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, 80 CIV. 1683
: (R.O.)
-against-
:
THE BABCOCK & WILCOX COMPANY and
J. RAY McDERMOTT & CO., INC., :
:
Defendants. :

- -x

Continued deposition of GPU Nuclear Corporation by WILLIAM H. ZEWE, taken by Defendants, pursuant to adjournment, at the offices of Davis Polk & Wardwell, Esqs., One Chase Manhattan Plaza, New York, New York, on Monday, May 24, 1982 at 11:10 o'clock in the forenoon, before Harvey B. Kramer, R.P.R., a Certified Shorthand Reporter and Notary Public within and for the State of New York.

A p p e a r a n c e s:

KAYE, SCHOLER, FIERMAN, HAYS & HANDLER, ESQS.
Attorneys for Plaintiffs
425 Park Avenue
New York, New York

BY: DAVID KLINGSBERG, ESQ.,

of Counsel

DAVIS POLK & WARDWELL, ESQS.
Attorneys for Defendants
One Chase Manhattan Plaza
New York, New York

BY: ROBERT B. FISKE, ESQ.
-and-
WILLIAM E. WURTZ, ESQ.,

of Counsel

KILLIAN & GEPHART, ESQS.
Attorneys for the Witness
Box 886
Harrisburg, Pennsylvania 17108

BY: KEVIN WALSH, ESQ.,

of Counsel

Also Present:

JONATHAN QUINN
Law Assistant
Davis Polk & Wardwell, Esqs.

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W I L L I A M H. Z E W E, having been previously duly sworn, resumed and was examined and testified further as follows:

EXAMINATION (continued)

BY MR. FISKE:

Q Mr. Zewe, you have the pressurizer system failure procedure in front of you?

A Yes.

Q Looking at page 2, section B.2, it says "Immediate Action"? And under that there is a section that refers to "automatic action"?

A Yes.

Q You see in part 2 of that, for a failed open RC-R2 reactor will trip at 1900 psig or variable pressure/temperature and high-pressure injection would be actuated at 1600 psig?

A Yes.

Q What did you understand that section of this procedure meant?

A My understanding was that if the RC-R2 was open, that pressure would be reduced and that the reactor would trip on either low pressure or variable low pressure, and that if it continued, that high-pressure injection would automatically

actuate at 1600 pounds.

Q Going back to the section of this part of the procedure that is captioned "Symptoms," paragraph No. 3 says that "RC-R2 discharge line temperature is above 200-degree Fahrenheit alarm."

Do you remember we discussed that on Friday?

A Yes.

Q And that it was a symptom of an open PORV according to this procedure, that the RC-R2 discharge line temperature would be above 200 degrees Fahrenheit?

A We did discuss that it would be greater than 200 degrees Fahrenheit, and that it could also be caused by if it had lifted and had reseated or that the code valves RC-R1A and 1B had lifted.

Q You also testified that for some period of time before the accident, temperatures at this discharge line had been 190, in that vicinity?

A Yes.

Q At any time before the accident did it occur to you that the usefulness of this particular symptom of an open PORV had been affected in any way by the elevated temperatures?

THE WITNESS: Would you repeat that, please?

(Question read)

MR. KLINGSBERG: You mean did it occur to him before the accident that in the event of an accident or something like it, that the usefulness of the symptom would be affected?

MR. FISKE: Yes, that is fair enough.

A I don't recall.

BY MR. FISKE:

Q To your knowledge, were any steps taken by anyone at Met Ed to change the 200-degree Fahrenheit number in this procedure in light of the fact that elevated temperatures had been elevated?

MR. KLINGSBERG: There is something wrong with the end of that.

MR. FISKE: In light of the fact that temperatures had been elevated. Isn't that what I said?

MR. KLINGSBERG: You said "elevated temperatures had been elevated."

Q The question is, to your knowledge, did anyone at Met Ed take any action to increase the temperature in this particular paragraph in light of

the fact that the temperatures had been elevated?

A Not that I recall.

Q Now, there came a time, did there not, Mr.Zewe, when there was a transient at TMI-2 in which the PORV failed open?

A Was that "failed to open" or "failed open"?

Q Failed open.

A "Failed open."

MR. KLINGSBERG: Other than March 7, '79.

MR. FISKE: Yes.

THE WITNESS: May I have that reread again, please?

MR. FISKE: I can rephrase it.

Q There was a transient in March of 1978 in which the PORV --

A Okay.

Q -- failed open. Do you remember that?

A Yes, I do. There was an electrical malfunction that resulted in the PORV going open.

Q Following that transient, was there action taken at Met Ed to install some kind of a light in the control room relative to the position of the valve?

A Yes, there was. The transient in March of '78 was caused by a power failure going to a pressure bistable as I recall, which gave a false signal to the PORV. As a result of this, they had installed a new indicating light for the PORV that was energized whenever the solenoid was energized to activate the PORV.

Q According to the wiring, if there was power to the solenoid, was the valve supposed to be opened or shut?

A As I recall, the solenoid is energized for the valve to be open.

Q Were you a participant in any discussions at Met Ed concerning what type of instrumentation should be installed in the control room relative to the position of the valve?

THE WITNESS: Would you repeat that again, please?

(Question read)

A I don't recall taking an active role in those discussions, but I was involved in the day-to-day routine discussions between the shifts in what was going to be added, and how it would operate, and how it would result in the indication.

Q. You knew, did you not, that the light that was eventually installed was not a direct indication of the position of the valve?

A I knew that it came off of the energizing signal for the valve solenoid, and I knew that it was not a direct limit switch, yes.

Q In other words, in order for the valve to open, there had to be power that went to the solenoid; correct?

A Yes.

Q And if the valve functioned correctly, when the power went to the solenoid, the valve would open; right?

A Yes.

Q And when power went to the solenoid, the light would go on; correct?

A As I recall, yes.

Q And then as pressure fell below the point at which the valve was supposed to close, the power would go off to the solenoid; isn't that correct?

A Yes.

Q So you no longer at that point had electric power to the solenoid keeping the valve

open; right?

A Yes.

Q And at that point, the light on the panel would go off?

A Yes.

Q And isn't it correct that the only thing that the light off indicated was that power was no longer flowing to the solenoid?

A The light --

MR. KLINGSBERG: Indicated? You mean as a scientific matter? Or indicated to the operator?

MR. FISKE: Well, what it indicated to the operator is what I am asking Mr. Zewe.

Do you want to read the question, please?

(Question read)

A As an operator, it indicated to me that the light was on and read that the PORV was open. And if the light was out, that the PORV was shut. That was the only indicating device I had on it.

Q But you knew, didn't you, Mr. Zewe, before the accident, that in fact if the light was off, then the only thing that directly indicated was that there was no longer power going to the

solenoid?

A Not entirely true. I view it as an operator. I don't go through each and all of the console indications, going over in my mind, this is a limit switch, this is a demand indication.

I believe in taking stock in the indication I have for that particular component, and I don't recall thinking that the light is out, it could be failed open.

I believe my instrumentation and my training and experience has always been that when the light was on, the valve was open, and when the light was out, the valve was closed.

Q You were aware, were you not, before the accident, that there were a number of ways in which the PORV could fail to close or could stay open other than simply having power continue to flow to the solenoid?

A I don't recall having that information that I knew that there were various ways that the valve could fail open rather than not having power to the solenoid. I don't recall thinking about that or even having training in that area, that the valve would be anything other than the indicated position.

Q Nobody told you before the accident that there were things that could cause the valve to stick open and not shut, even after the power had gone off to the solenoid?

A I don't recall discussions on that particular point, no.

Q What kind of instrumentation was there on Unit 1 to indicate the condition of the PORV?

A There is a combination red and green light that is also demand position indicating the valve.

Q When the light was installed at Unit 2, was there already a light at Unit 1 at that time?

A Yes, there was.

Q Was the light that was installed at Unit 2 the same as the one that was installed at Unit 1?

A No, it wasn't.

Q What did you understand the difference was?

A As I recall, they were both off of the signal going to the solenoid, but that the light in Unit 1 was a combination red or green light, and when the valve was indicated shut, it would have a

green light, and if it was open, it would be red. And in Unit 2, it had a light that was on and it was red if it was open or it was just out if it was shut.

Q Apart from the fact that the Unit 1 operated with a red and a green light and Unit 2 operated with a red light that was either on or off, did you understand there was any difference in terms of what it was that actuated the light between the two units?

A No. It was still the energizing of the solenoid, and it was a parallel contact with that that was the actual indicator.

Q Do you remember discussions going on at Met Ed as to whether or not it would be desirable to have a direct indication of valve position at Unit 2 instead of the indication that you did have?

MR. KLINGSBERG: That is before the accident?

MR. FISKE: Yes.

A In relationship to the PORV indicating light?

Q Yes.

A I don't recall, no.

Q You never heard anybody at any time before the accident express the view that it would be better if we had a direct or positive indication of PORV position?

A I don't recall that discussion on that particular valve. But I think that I was aware of other discussions more on a generic basis, saying that it is always better to have more direct indication than indirect or demand indication.

Q And why did you understand that it was better to have direct indication than demand indication?

A It was my understanding that the direct indication would be more reliable.

Q And you did understand that the indication you had for Unit 2 was a demand indication?

A Yes, I did.

Q Now, to what extent did you understand that the demand indication was less reliable than a direct indication?

MR. KLINGSBERG: I object to the form of the question to the extent that you speak of a percentage.

Q Did you answer the question?

THE WITNESS: Would you read it again, please?

MR. KLINGSBERG: Answer it if you can.

(Question read)

A As I recall, I always related direct indication to a limit switch that would be actuated by the actual valve position itself, either going open or closed, and that the demand indication would not actually show the valve movement physically, and I felt that there was more room for error in the demand indication versus the actual.

Q And the room for error would consist of anything that might cause the valve to stick open other than the continued flow of power to the solenoid; right?

A Could you rephrase that, please? I didn't quite understand what you were saying.

Q Well, is it correct that the room for error that you just referred to in your preceding answer between a direct indicator and a demand indicator would consist of all of the reasons why the PORV might stick open other than by reason of a continued flow of power to the solenoid?

MR. KLINGSBERG: Are you asking him an abstract question or are you asking him for his recollection of what was in his mind at some point before the accident?

MR. FISKE: I am asking him what he understood before the accident this greater room for error between a demand indicator and direct indicator consisted of.

BY MR. FISKE:

Q And I am asking, isn't it true that this greater room for error between the two types of indicators would consist of all of the reasons why a PORV might stick open other than by reason of continued flow of power to the solenoid?

A As I recall, I believed that since it was demand indication, that more things could go wrong to inaccurately show them the valve position. But even the direct valve position does have problems also, so it is one versus the other. Limit switch moves. Limit switch break. Light indicating device from the limit switches even on the direct kind all have their particular problems, and I don't recall in my own mind thinking what are the various failure modes of the PORV because it only has the

demand indication.

Q Is it your testimony, Mr. Zewe, that it was not any part of the training that you received at Met Ed after this light was installed that anyone explained to you the different ways in which the valve could be stuck open even though the light was off?

MR. KLINGSBERG: When he asks "is it your testimony," he means is it a fact, not suggesting that you previously testified one way or the other.

You might want to have it back.

(Question read)

A I don't recall receiving any training pointing that out, that there were other ways that the valve would fail.

It was only pointed out that the particular case of the March 29, '78 transient was that this light should correct that problem from happening again, plus they made some other wiring changes to the pressure switches that weren't involved from their electrical source so that that should not reoccur, and I felt that we now had a better position indication device for the PORV because

of it.

MR. FISKE: Could I hear that answer again?

(Answer read)

Q I am not sure I completely understand that answer, Mr. Zewe. Let me just put a couple more questions.

When you said that action was taken after the March '78 transient which you thought might correct that problem from happening again, were you referring to action that was taken to prevent the PORV from failing open as it had on that day?

A Yes.

Q And what was that action?

A As I recall, they revised the wiring going to the pressure switch that actuated the PORV that day.

Q And the installation of the light itself had nothing to do with that, did it?

A As I recall, in looking at the transient that they had, they realized that a better indicating light was needed. And at that same time they installed a light.

Q Did you learn, between the March '78

incident and the accident in 1979, that the open PORV in March '78 had been diagnosed by reason of an increase in pressure in the drain tank?

S I don't recall that.

Q Let me show you a document, Mr. Zewe, which has been previously marked as part of B&W Exhibit 456. It is a document prepared after the accident which lists 26 separate ways in which the PORV --

MR. KLINGSBERG: Have you got a copy?

Q It lists 26 potential failures of the PORV to close.

Do you have that in front of you?

A Yes, I do.

Q At any time before the Three Mile Island accident, as part of the training program at Met Ed, did anyone make you aware of those 26 separate potential failures?

A No.

Q Were you in fact aware of any of those potential failures of the PORV to close, before the accident?

A I believe that I was aware of some of these items on the list, yes, as possible potential

failures.

Q Could you tell us which ones?

A Only from a general standpoint, that I felt that it was possible for something to go wrong with the pilot-operated portion of the valve. I felt that it was possible for things like high-pressure switch contacts to stick closed, and also that there could be a wiring or an electrical malfunction with the solenoid.

Q Just so we understand what we are all talking about here, when you said you were aware that it was possible for something go wrong with the pilot-operated portion of the valve, you were referring to something that might cause the valve to stay open even after power had gone off to the solenoid; correct?

A I guess I believed that it was possible, though I am not sure if I separated it in my own mind to differentiate one part from the other part or actually what the failure mechanism would be; only that I realized or I thought that it was possible for it to fail in one means or another.

Q Including a means other than power staying on to the solenoid?

MR. KLINGSBERG: I think he has answered the question.

MR. FISKE: Yes, okay.

Q Did you become aware at any time before the Three Mile Island accident of any other situation in which a pilot-operated relief valve had stuck open or failed open?

A I don't recall that, no.

Q Was there ever an incident at TMI Unit 1 where a PORV stuck open, failed open?

A Are you referring to failed open over some period of time or just momentarily lifted and then reseat?

Q Well, I am referring to a situation where the PORV was open at a time when it wasn't supposed to be open.

A I do recall at least one instance where the valve cycled open and then shut when it was not supposed to.

Q And what was the cause of that?

A As I recall, the cause was opening up and reclosing the DC power supply to the valve solenoid.

Q Do you recall any other situation at TMI-1 where the PORV was open when it wasn't supposed

to be?

A Yes, I do.

There was another case where maintenance testing was going on and the valve had inadvertently opened and then reclosed again.

Q And what was the cause of it opening?

A As I recall, the cause was the instrument and control technician either misread the procedure that he was following or the procedure was wrong, I don't remember which that was.

Q And then what did he do that caused the valve to open?

A As I recall, he was checking the calibration of an RCS pressure switch, and in the course of that test he inadvertently caused the valve to lift and reset based on what it thought was high pressure.

Q All right. Any other situations at TMI-1 where the PORV was open when it wasn't supposed to be?

A Those are the only two that I can remember at this time.

Q Was there any incident at TMI-2, before the accident, other than the March '78 incident,

where the PORV was open when it wasn't supposed to be?

A Not that I can recall.

Q Did you at any time before the Three Mile Island accident hear of any incident at any plant other than at TMI where a pilot-operated relief valve had stuck open or failed open?

A Not that I remember.

Q Specifically, did you ever hear of an incident in which a pilot-operated relief valve failed open or stuck open at Toledo Edison's Davis-Besse plant?

A No.

Q Did anyone bring to your attention an incident in which a pilot-operated relief valve failed to open or stuck open at one of Duke Power's Oconee plants?

A No, not that I remember.

Q Now, at Met Ed Unit 2 there was an incident in April 1978 where some steam relief valves stuck open?

A Yes, there was.

Q And that caused a fairly major transient, did it not?

A Yes, it did.

Q Were you aware of any situation, before the accident in 1979, in which other valves, at either Unit 1 or Unit 2, had stuck open, failed open?

A Yes, there were.

Q Can you tell us about those?

A Are you referring to where they open up automatically and then they fail or if they were opened up by hand and then they failed or --

Q Either way.

A -- or they would respond out of position in a manual mode or anything like that?

Q Times when they were supposed to be closed but were in fact open.

A I can recall one case where the atmospheric relief valve in Unit 1 had failed open. And I can recall where the heater drain control valve HD-V-3A had failed open.

Another case was a Unit 2 turbine bypass valve had failed partially open.

There were other cases where valves had failed partially open or open or failed shut due to various surrounding circumstances, which I don't recall actually what valves they were, but there were

others.

Q In the President's Commission deposition, Mr. Frederick testified at page 165. I will read one sentence.

"In the system, relief valves are notorious for sticking open."

Do you have that testimony in front of you, Mr. Zewe?

A Yes, I do.

Q Have you had a chance to read whatever you would like to read on either side of it?

A Yes, I would like to look at it briefly.

Q Sure.

(Witness examining document)

A I have looked it over.

Q Did you have the view, before the accident, that it was common for relief valves to stick?

A It was my feeling that it was not common, no.

Q Is it fair to say that it was not unusual?

MR. KLINGSBERG: Are you asking him fact or what his recollection is before the

accident?

MR. FISKE: His understanding before the accident.

Q Is it fair to say it was your understanding before the accident that it would not be unusual for relief valves to stick?

A No, I wouldn't say that. I would say, as I recall, that it would still be unusual.

Q So I take it that you would not say that relief valves were notorious for sticking?

MR. KLINGSBERG: I object to the form of that question.

A As I recall, I don't remember thinking that safety or relief valves were notorious for sticking open.

Q Going back to the pressurizer system failure procedure, Mr. Zewe, at any time after the March '78 incident, did anyone at Met Ed tell you that the symptoms of an open PORV in the pressurizer system failure procedure were not reliable?

THE WITNESS: Would you read that back, please?

(Question read)

A Do you mean between there and the March

29th accident or 28th accident?

Q Yes.

A No, I don't really remember that happening.

Q It is a fact, is it not, that at no time between the March '78 incident and the March '79 accident was the pressurizer system failure procedure changes to reflect the light?

A After reviewing the procedure, I concluded that it was not changed to reflect the light, though in most of our emergency procedures the normal indicating light on the console for that particular component would not necessarily be changed.

MR. FISKE: Can I hear that answer?

(Answer read)

Q Are you saying, Mr. Zewe, that in the case of other emergency procedures designed to deal with a particular problem, that if there is a normal indicating light for that problem, the light is not referred to in the procedure?

A Yes, that's true. The normal indicating status of the component, whether it be on or off, open or shut, in most cases in the actions of the

procedure itself is not addressed, because the operators use these in determining whether the component is in the correct state or not, and it is not really addressed further in the procedure.

The exception to that is whenever you have an ES actuation, you verify the status lights for the actuated components on the ES panel itself, but you do not go over to the main console and verify it.

So that is something that the operator does in the course of operating the plant, whether it be normally or in a transient condition.

Q Were you aware of any incident in which, before the Three Mile Island accident, the PORV had failed to open when it was supposed to?

A I don't recall.

Q One way or the other?

A No.

MR. KLINGSBERG: What one way or the other?

MR. FISKE: Whether there was one or not.

MR. KLINGSBERG: All right.

A I don't recall whether there was one or

not.

Q Specifically, did anyone make you aware, at any time before the accident, of the situation in October 1978 where the light went on, indicating power to the solenoid, but the PORV failed to open?

MR. KLINGSBERG: Failed to open?

MR. FISKE: Yes.

Q In other words, a situation where the light was on but the valve was shut.

A I don't remember that.

Q Going back to the transient on March 29, 1978, Mr. Zewe, were you on duty when that transient occurred?

A March 29, 1978?

Q Yes. The failed-open PORV.

A I was not.

Q How soon after the incident occurred did you learn about it?

A I don't remember.

Q Was the March 29, 1978 incident included in the training that you received at Met Ed as part of your requalification training?

A As I remember, it was.

Q Did you learn, in the course of that

training, that high-pressure injection had come on in the course of that transient as a result of the PORV having failed open?

A As I recall, yes.

Q And did you learn in the course of your training on that incident how long the PORV had remained open?

A I believe I knew that at the time, yes.

Q You don't remember now?

A I am not certain about the time element now, no.

Q Did you learn in your training how the open PORV had been diagnosed?

A I don't recall exactly, no.

Q It is correct, isn't it, Mr. Zewe, that the pressurizer system failure procedure that we have been talking about in the last couple of days was in effect on March 29, 1978?

A Yes, it was.

Q In the course of your training at Met Ed on this incident, did you learn how high the temperatures had gone on the discharge line while the PORV was open and how quickly they had come down after the PORV closed?

MR. KLINGSBERG: Will you take them one at a time?

MR. FISKE: Yes.

Q If you would like to take that question in two parts, you can.

A I don't recall receiving any training on what the temperatures went up to or how long they took to cool down.

Q Was there any discussion in the Met Ed training on this incident what the consequences might be of failing to diagnose an open PORV? In other words, what would be bad about having a PORV stay open?

THE WITNESS: Would you read that back again, please, and the previous one?

(Pending question read)

MR. KLINGSBERG: You are asking now specifically about Metropolitan Edison training and requalification dealing with the March '78 and not B&W training.

MR. FISKE: Well, yes. I am asking him about training that he received at Met Ed about this particular transient, and I won't limit it to requalification training, although

I am not sure that Mr. Zewe received any training other than requalification training at this time.

BY MR. FISKE:

Q But my question, Mr. Zewe, is directed at training you received at Met Ed on this transient.

A I don't recall receiving training on that particular subject and if the valve had failed open what would be the consequences of it in those terms. I realized then I believe that if you had a PORV stick open, that you have a loss of inventory from the reactor coolant system itself.

Q Did you have any training, Mr. Zewe, before the accident, on this pressurizer system failure procedure with respect to symptoms 3 and 4?

A What page are you on?

Q Page 2.

A Page 2?

Q As to how you could tell, if you saw either one of those symptoms or both, whether those symptoms resulted from a normal opening and closing of the PORV as opposed to a PORV that had stuck open?

A I don't recall receiving any training that would differentiate between these two symptoms,

if the valve had lifted and remained open or if it had just cycled.

Q Prior to the Three Mile Island accident, would you have expected a normal opening and closing of the PORV to produce a drop in pressure which would cause HPI to be automatically actuated?

MR. KLINGSBERG: Could we have that again?

(Question read)

A I would not.

Q Were you aware of situations before the Three Mile Island accident in which the PORV had opened and then closed as it was supposed to?

A Yes.

Q And in the course of your training at Met Ed before the Three Mile Island accident, did anyone make you aware of the temperatures or the discharge line of the PORV during those normal openings and closings of the PORV?

MR. KLINGSBERG: You keep saying "training at Met Ed," assuming that was his only training, contrary to the fact. Do you really mean to exclude all of his B&W training in these questions?

MR. FISKE: I am asking him about

training, Mr. Klingsberg, that he received at Met Ed on specific transients or incidents that had occurred at Met Ed on Unit 2. I don't know that if there is any difference, that B&W is aware of them.

MR. KLINGSBERG: The question is not so limited.

BY MR. FISKE:

Q Just to make this clear, Mr. Zewe, there were a number of situations, were there not, at Unit 2 where in the course of various transients the PORV opened on high pressure and then closed again when pressure dropped below the point at which the PORV was supposed to close?

A Yes.

Q Okay. And what I am asking you is, in the course of the training that you received at Met Ed before the accident, did anyone at Met Ed ever make available to you information concerning the temperatures on the discharge line for the PORV during those normal openings and closings of the valve?

A Not that I recall.

Q Did anyone make available to you

information as to how quickly the temperatures at the discharge line dropped after the valve had closed?

A Not that I recall.

Q And with respect to those same transients or incidents, Mr. Zewe, did anyone at Met Ed make available to you information concerning the extent to which there had been an increase in either pressure or temperature at the reactor coolant drain tank?

A That information may be available. I don't recall.

Q In other words, you don't recall whether or not anybody gave you that information as part of your Met Ed training?

A That is true. I don't recall.

Q Specifically, Mr. Zewe, going back for a moment to the March 29, '78 transient where the PORV failed open, did you learn as part of your training on that transient that the rupture disk on the drain tank had not blown?

THE WITNESS: Read that back again, please.

(Question read)

A I don't recall the training saying that the rupture disk had not blown. There was more the fact that if it had, that it would have been pointed out that the rupture disk had blown, but in this case it had not. So I don't recall them mentioning that particular.

Q Do you remember also learning, as part of your training, that in that transient the relief valve in the drain tank did not lift?

A I don't recall if the training stated whether it had or had not lifted.

MR. FISKE: This is a good time for lunch.

(Lunch recess taken at 12:30 p.m.)

Afternoon Session

1:50 o'clock p.m.

W I L L I A M H. Z E W E, resumed;

BY MR. FISKE:

Q Mr. Zewe, we had been talking before lunch about the March 29, 1978 transient where there was a failed open PORV and where high pressure injection had come on automatically. Do you recall that discussion?

A Yes, I do.

Q Now, it is correct, is it not, that before the accident it was your understanding that you would not expect to see an automatic actuation of HPI every time you had a reactor trip?

A That is true.

Q And it is a fact, is it not, that prior to the Three Mile Island accident, there had been four situations at Unit 2 where HPI had come on automatically after a reactor trip?

A Three or four, yes.

Q And it is correct, isn't it, that the approximate one-year period between start-up and the day of the accident, there had been approximately 20 reactor trips at Unit 2?

A I would have to research that to say 20 is the right number. But there were several, yes.

Q Well, let me show you a document which we marked previously as B&W Exhibit 658, which is a portion of the report written by the so-called Rogovin Commission, and I refer you specifically to page 110 of that report, which is captioned "Chronology of TMI-2 Operating Experience."

A I have that document, yes.

Q Do you see where it says in the third item "3/29/78 Initial Criticality"?

A Yes, I do.

Q I just ask you to read through that page and the following page and ask you whether reading that document refreshes your recollection that there were approximately 20 reactor trips at Unit 2 during that one-year period.

MR. KLINGSBERG: Do you have a copy of that?

MR. FISKE: Sure.

MR. KLINGSBERG: Can I hear the question?

(Question read)

A After reviewing this page 110 and 111, I will agree there were approximately 20 reactor trips during that period in question.

MR. KLINGSBERG: Excuse me. I only counted 17. If I missed them --

MR. FISKE: There are 20.

THE WITNESS: Yes.

Q Looking at this list, Mr. Zewe, the fourth item down refers to "3/29/78 reactor trip. Pressurizer relief valve opened ECCS actuation."

Do you see that?

A Yes, I do.

Q That is the transient we have previously discussed, correct?

A Yes, it is.

Q Now, the chronology indicates three other transients in which ECCS was actuated, one on April 23, one on November 7, and one on December 2. Do you see those on this list?

A November 7? O.K. And December 2. Yes.

Q Did you receive training at Met Ed after these transients occurred on the circumstances leading to each transient?

A Yes, I did.

Q Let's start with the April 23 transient.

That is the transient, is it not, in which five main steamline safety valves opened and then stuck

open?

A They failed to close as designed, but they did close at a lower pressure later.

Q You mean they closed later than they were supposed to close?

A Right.

Q As a result of that failure to close, there was a drop in pressure, was there not, in the steam generators?

A Yes, there was.

Q Am I correct that the drop in pressure in the steam generators produced a drop in temperature in the reactor coolant system?

A Yes. The oversteaming of the steam generators resulted in an overcooling event for the RCS.

Q And is it correct, then, that in that kind of situation, the drop in temperature in the reactor coolant system produces a shrinking in the volume of water in the reactor coolant system?

A Yes, it does.

Q And the shrinking of the water causes a drop in reactor coolant system pressure; is that correct?

A It results in low pressure and also low

pressurizer level as a result of the shrinking, yes.

Q In other words, the shrinking produces two things. It produces a drop in pressure and as the water shrinks the level of the pressurizer goes down; both those things happen, right?

A I think that it would be more correct to say that the cooldown effect of oversteaming causes the RCS to cool, which causes the pressurizer to shrink.

It does not shrink due to the pressure reduction. It is related strictly to the cooldown effect. And colder, denser water occupies less space so the pressurizer level goes down as a result of the temperature change, not the pressure change.

Q I think that was the thrust of my prior question.

It is correct, isn't it, that the cooldown effect causes a drop in pressure and the cooldown effect also causes a drop in pressurizer?

A Yes. Most significant is the effect on pressurizer level.

Q When you say "most significant," why do you say "most significant"?

A From the fact that the pressurizer is the device used to try to maintain pressure at a desired

point in the reactor coolant system, and it uses the saturation of the steam and water in the pressurizer and the pressurizer heaters and the spray valve to control that pressure.

So if you lose level from the pressurizer, you are going to lose that pressure control.

Q Is it correct that this situation where a drop in temperature produces a drop in pressurizer level and a drop in pressure in the reactor coolant system is commonly referred to as a cooldown?

A Yes. Any time that you reduce the reactor coolant system temperature, you are in effect cooling down, and you will see the reduced level. And if it is fast enough, you will see the reduced pressure.

Q And is it correct that it is that kind of a cooldown effect which produced the drop in pressure sufficient to actuate high-pressure injection in the April 23 transient?

A The resultant cooldown that the RCS had undergone because of the oversteaming resulted in cooling it down sufficiently to drop pressurizer level enough, and it also reduced the pressure when you lost pressurizer level sufficiently enough to get down to the high-pressure injection ECCS actuation setpoint, yes.

Q Is it correct that as a result of this transient on April 23, the plant was shut down until September 17, 1978?

A It is true that it was shut down for a considerable length of time. Whether September 17 is an accurate date or not, I am not sure.

Q Well, several months, in any event?

A That is correct.

Q And there were fairly extensive investigations that were conducted after this transient, both by Met Ed and By GPUSC, were there not?

A Yes, there was.

Q I would like to show you a document previously marked as B&W Exhibit 246. Do you have a copy of Exhibit 246 in front of you, Mr. Zewe?

A I do.

Q Do you see your name listed on the front page as one of the many people who received a copy of this document?

A I do.

Q Did you, in fact, receive a copy of this report by Mr. Seelinger sometime in or about May 1978?

A As I recall, yes.

Q I would like you to direct your attention

to the sequence of events which occurs at page 7, and to graph D, which appears as part of this report, and which is referenced in the sequence of events.

A What page is that?

Q 22, I believe.

A Okay, I have it. I have it. Thanks.

Q Now directing your attention to page 7, Mr. Zewe, that indicates that at one minute and 11 seconds into the accident, safety injection A and B came on due to low pressure; is that correct?

A Yes.

Q And two items down it says at one minute and 17 seconds safety injection was bypassed.

Do you see that?

A Yes, I do.

Q And both of those points, that is, the time at which it came on and the time at which it is bypassed, are indicated on graph D, are they not, at point 14 and point 17 respectively?

A Yes.

Q What does the term "bypass" mean in this sequence of events?

A "Bypass" is a term used to describe what the operator does after a safety injection actuation, where he takes manual control of the equipment.

Nothing really changes. All he does is he presses a series of manual push buttons which, after that occurs, would allow him to take individual component control if he would like to do that. But by just going to bypass, nothing really changes. Nothing stops, nothing starts, nothing changes position at all.

Q So if HPI comes on automatically at 1,000 gallons a minute, pressing the bypass button doesn't reduce that flow?

A It does not. It would require manual operation of the particular components, either off or on or shut or open or what have you, in order to change any of the status.

Q What did you understand were the criteria by which an operator was supposed to determine whether or not to bypass automatic HPI?

A As I recall, the criteria was one where, once you had verified that all the components had actuated properly, you would then bypass it.

Q As what did you mean by the word "components" in that last answer?

A Whenever you have an engineering safety feature actuation, certain components reposition. Some go shut. Some come open. Some start. Some stop.

We have a status board to that effect, for all the components.

The operator must verify that all the components are in the desired engineering safety feature position.

After he has done that, then he would normally bypass the actuation. And then if he needed to take any manual control, that would allow him to do so.

Q Are there any particular components which would cause him to not bypass automatic HPI if those components had not been automatically actuated?

A If after the actuation the operator verified and all of the components had not actuated, the operator would have to further evaluate why that component was not in its desired position and try to do so.

Q So is it correct that until he had satisfied himself then that every single one of the components had either actuated or there was a good reason for it not actuating, he has to leave HPI on in its automatic form?

A Not totally true, no. If there were components that didn't actuate but that if he had to

bypass it in order to take action based on its indication, he would still have to do that.

For instance, if one of the containment isolation valves had failed to position, but that the high-pressure injection flow was exceeding pump runout, he would then have to manually bypass and throttle the flow to insure that he protected his equipment.

So it was really varying type circumstances, based on the information that the operator had, based on his knowledge and plant conditions themselves.

Q All right.

Now looking further at this sequence of events, Mr. Zewe, it indicates two items further down, doesn't it, that at one minute and 40 seconds there were HPI flows as indicated, 130 GPM for A, 160 for B, 300 for C, and 240 for D? Does it indicate that?

A Oh, yes. Yes.

Q I'm sorry. And does that indicate that by one minutes 40 seconds into the transient, the HPI flow had been cut back?

A I could not conclude that from this.

Q Is there anything in this sequence of events, recognizing that page 8 and 9 seem to be out of order, which tells you how much, if at all, HPI was cut

back after it had been automatically bypassed -- after its automatic action had been bypassed?

THE WITNESS: Could you read that back? I didn't follow that.

MR. FISKE: Let me put it again.

Q Looking at page 9 of the chronology, which I believe is supposed to follow page 7, is there anything in that sequence of events on page 9 which indicates at what time there was a throttling of HPI, and if so, in what amount?

A The only throttling that I can see or at least the first throttling occurs at 2:30 where they throttle the C and D high-pressure injection legs.

Q Have you answered the question? I didn't know whether you planned to go on or not.

A No. I had stated that the only throttling or the first signs of throttling that I could see that the operator did was at two minutes 30 seconds, he throttled the C and D high-pressure injection legs.

Q Looking at graph C, which is referenced at that two minute and 30 second point, do you see the number 29 on that graph?

A Graph C, point 29?

Q Yes.

A No, I don't.

Q Right on the bottom, right above where it says "Time in minutes," isn't that 29?

A I see a 22 and what appears to be a 27.

Q Going back to the sequence of events which refers to a time of two minutes 30 seconds, does that help you determine that that is a "29"?

A From looking at graph C and D and denoting the time of 2-1/2 minutes, I would conclude that that is the time period that we are referring to and pressurizer level is above zero at that point.

Q Do you remember any discussion after this transient about whether the operator's action in throttling -- in bypassing and throttling back HPI was proper?

MR. KLINGSBERG: Could I have that?

MR. FISKE: If you want me to make that two questions, I would be happy to.

(Question read)

A As I recall, there was not any comments that the operator's action was not correct in throttling HPI. The only thing that there was mention about the operator was about the main feed pump, I believe, that was in hand at a higher speed at that point.

MR. KLINGBERG: You had asked separately about the bypassing.

Q Was there any discussion of whether the operator's action in bypassing HPI was proper?

A I don't recall any mention that it was improper.

Q Looking at graph D again, Mr. Zewe, do you note that that contains a graph which shows pressurizer level and also another graph which shows reactor coolant system pressure?

MR. KLINGSBERG: I am sorry. I lost that.

MR. FISKE: I will start over.

Q Do you notice that on graph D there is a line which reflects pressurizer level, and there is also a line which reflects reactor coolant system pressure?

MR. KLINGSBERG: Well --

A Yes.

MR. KLINGSBERG: -- one is actually the column on the side of the table and the other is a line in the body of the table.

Q Isn't it correct, Mr. Zewe, that both pressurizer level and reactor coolant system pressure are reflected on this graph?

A Yes. They are, along with pressurizer temperature also.

Q Fine.

Now, directing your attention to the period of time beginning at what appears to be a little bit after one minute, do you notice that the line for pressurizer level is right at the zero point?

A At approximately 1-1/4 minutes, yes.

Q And it continues at the zero point until about two minutes, and then begins to increase?

A Two and -- yes, yes.

(Continued on next page)

Q Do you notice that during that period of time, while the pressurizer level was at zero, that is, about 3/4 of a minute, that the reactor coolant system pressure was dropping from approximately 1650 down to about 1,000?

MR. KLINGSBERG: It was not 3/4 of a minute. It was after a minute.

MR. FISKE: I said during that period of time of approximately 3/4 of a minute --

MR. KLINGSBERG: Oh, I see.

MR. FISKE: -- between 1:15 and 2:00.

A Almost a full minute.

(Witness examining document)

Q Did you answer, Mr. Zewe?

MR. KLINGSBERG: Is there a question?

MR. FISKE: Yes.

A During that time period, it looks to me like RCS pressure was about 1620 to about 1,000 pounds.

Q All right. And then do you notice that for approximately the next minute -- that is, from about two minutes -- for the next minute and a half, from about two minutes to about 3-1/2 minutes, the pressurizer level rises while the pressure continues

to go down?

A For the next minute.

Q Right.

A Yes. Between 2 and 3, pressurizer level begins to recover and pressure bottoms out at 3 minutes.

Q In any of the postaccident discussions which occurred with respect to this particular transient, were you ever present at any discussion of why it was that during that period of time pressurizer level had been rising while pressure was going down?

THE WITNESS: Would you read that back, please?

(Question read)

A I don't recall.

Q During any of the postaccident discussions that went on at which you were present, was there any discussion of why it was that during the period of approximately 45 seconds while pressure was dropping from 1620 down to approximately 1,000, pressurizer level apparently stayed the same? By "accident," I meant this particular accident.

A And prior to --

Q The other accident.

A Okay.

I recall a discussion about the pressurizer level went off-scale low. All right. That is, the range of the indication is down to zero and it doesn't go any further. All right? So the range of pressurizer was off-scale low.

I don't believe that a point was made that pressure had dropped to such a value when pressurizer level was off-scale low because the operator doesn't have any known way of knowing what the actual pressurizer level is, because it is below his indicated level.

Q It is generally considered to be bad, isn't it, if the water goes right on out the bottom of the pressurizer?

A Yes. I think my testimony is quite clear that I felt that pressurizer level and maintaining pressurizer level was very important.

Q And how much margin is there between the zero reading on the pressurizer level instrument and the point at which in fact water goes out the bottom of the pressurizer?

A I don't have that information. I would

have to view a drawing of the pressurizer and its scale and its exact relationship to the lower-level tap and the relationship of the level of the surge line to the reactor coolant system piping.

Q After this incident, Mr. Zewe, was there any discussion between you and the other operators to the effect that, "Once the pressurizer level instrument gets down to zero, how much margin do we have before we have actually lost the bubble?"

A I don't recall any discussions of that type, about losing pressurizer level and losing the bubble. This was only an even that occurred over one minute, that they lost lovel, and I am not sure I even remember thinking about that they had lost the bubble for any long period of time, though.

Q Let's put it this way. You understood when you were running the reactor that it was important that you didn't lose the bubble; correct?

A I understood it was important not to lose pressurizer level and lose the pressure level that the pressurizer provided.

Q You knew that losing the bubble would occur at some point after the indicator indicated zero; is that correct?

MR. KLINGSBERG: I am not sure about that.

Q Is that correct?

THE WITNESS: Read that again, please.

(Question read)

A As I recall, I never considered shifting the bubble except in a case where you had a loss of system inventory in a LOCA. Any other case, you were solely concerned with trying to regain pressurizer level and regain the pressure control that the pressurizer could provide, not really in terms of shifting the bubble, watching the bubble. A concern and training, particularly the transient response training that I had, was always on trying to recover the pressurizer, not thinking in terms of watch for the bubble shift, watch when you do this.

It is always: put enough inventory in to recover pressurizer level, and not in terms of moving the bubble, as you put it.

Q You did know it was important not to let the bubble escape from the pressurizer into the hot legs?

A I am trying to give you my understanding

of it.

And it wasn't that I am shifting the bubble or I am doing anything in those terms. It is just trying to maintain pressurizer level, in that term. All right. Not that I worried about shifting the bubble.

I never worried about shifting the bubble. I worried about losing pressurizer level and the pressure control.

The only time I can ever recall thinking about, worrying about shifting the bubble or having boiling any other place except in the pressurizer and the RCS was where I had a loss of inventory and a loss of coolant accident where I could not make up enough water to overcome the leakage.

Q Didn't you understand sometime before the Three Mile Island accident that if the bubble left the pressurizer and went into the hot legs, there was a risk of core uncovery?

A I don't ever recall in my training at Met Ed or at B&W in transient response ever being trained that if I should shift the bubble, I would have uncovering of the core.

The only time that I would have uncovery

of the core or boiling in the hot legs or having the bubble anywhere other than the pressurizer would be strictly on a loss of inventory which would be reflected in pressurizer level and I couldn't make up the water fast enough that was losing out the break that I had. And that is the only time.

Q Isn't it a fact that a specific analysis was made at Met Ed after this transient to determine whether or not the bubble had been transferred from the pressurizer to the hot legs and, as a result, the core may have been uncovered?

A I recall both Met Ed and B&W doing analysis of this event. And I remember that their analysis wasn't exactly the same in relationship to how low pressurizer level had actually gotten. But I don't recall the fine details of that.

Q Without getting for the moment to the results of the investigation, didn't you understand that there was an investigation conducted at Met Ed to determine whether or not the core may have been uncovered by reason of the fact that the bubble may have been transferred from the pressurizer to the hot legs?

A That is not my understanding or belief

at all, no.

Q Let me refer you to page 3 of Mr. Seelinger's report. I direct your attention to the paragraph second from the bottom. It says, "Calculations performed immediately after the event and subsequent chemistry analyses showed that the core remained covered at all times. Although the bubble left the pressurizer and went into one or both hot legs, the hot leg with the bubble if only one had it was at least still filled with water halfway up the height of the leg. If both hot legs had a bubble, then the legs would have been filled three-quarters of the way up the legs."

Did you read that paragraph in this report, Mr. Zewe?

A Did I read it then --

Q Yes.

A -- or am I reading it now?

Q No, did you read it sometime in or about May 1978 when you received this report?

A As I recall, I did, yes.

Q Did you also see a copy of a report that was written at GPUSC with respect to this same transient which has been previously marked as B&W

186?

A I have that document before me.

Q Did you have it before you at some time in or about May of 1978?

A I cannot differentiate between the reports right now, but I can only recollect that I should have seen it at that particular time, though I cannot recall with any certainty.

Q All right. Were you aware, after this transient, of a discussion of the question of whether or not the pressurizer level had been held up to any degree by reason of the fact that flashing may have occurred at some point in the reactor coolant system?

A I do not remember that.

Q Directing your attention to page 25 of Exhibit 186 --

A I am sorry, what page?

Q Page 25 of Exhibit 186, which is the GPUSC report -- would you take a moment to read the section G, captioned "Pressurizer Performance"?

Have you read that?

A Yes, I have.

Q Directing your attention to the first

two sentences in the third paragraph, it reads, "Calculations by the plant staff indicate that the pressurizer contains insufficient volume below the zero level reference to provide the required contraction for the temperature change experienced even when HPI flow is accounted for. It is expected that the additional fluid volume was supplied from the reactor vessel."

One more sentence. "This large, hot, relatively stagnant volume has been shown to flash and to control system pressure during other rapid cooldown events."

Were you aware of that analysis at any time after the April 23 transient?

A In your reading of it, I believe that you skipped two very important words here.

Q I didn't mean to.

A After "reactor vessel," "upper head."

The way you read it is that it came from the reactor vessel itself. And to me that is where the core is, but it actually states "upper head."

Q Fair enough. You are absolutely right.

A Could you reiterate your question?

Q Yes.

A Regardless of the words here that I read?

Q Yes. Referring now to what is written in the first three --

MR. KLINGSBERG: Any chance that we can get a copy of this?

MR. FISKE: Don't you have one?

MR. KLINGSBERG: No.

(Document handed to Mr. Klingsberg)

Q Let me read it again, Mr. Zewe.

From page 25, and so there is no mistake about what I am asking you --

A The upper head in the reactor vessel is quite different and significant.

Q "Calculations by the plant staff indicate that the pressurizer contains insufficient volume below the zero level reference to provide the required contraction for the temperature change experienced even when HPI flow is accounted for. It is expected that the additional fluid volume was supplied from the reactor vessel upper head. This large, relatively stagnant volume has been shown to flash and to control system pressure during other rapid cooldown events."

Were you aware of that analysis at any time in or about May of 1978?

MR. KLINGSBERG: I don't know if it is important, but between the parenthetical references you skipped "This large, hot, relatively stagant."

MR. FISKE: Right.

Q In any event, Mr. Zewe, rather than me trying to read it again, were you familiar with the analysis that is reflected in the first three sentences of this paragraph at any time up to the date of the Three Mile Island accident?

A I don't recall the results of the analysis as presented here.

Q Directing your attention to the last paragraph of this section, which is on page 26, it says, "In summary, it is concluded that a bubble was not drawn in the hot legs, a bubble was drawn in the reactor vessel upper head, the core remained covered during the transient and the pressurizer probably did not empty."

Did you see that sentence anytime before the Three Mile Island accident?

A Not that I recall.

Q Were you aware of those conclusions with respect to the April 23 transient any time before the Three Mile Island accident?

A Not that I recall.

Q I would like to read one other sentence from this same section, Mr. Zewe, the first sentence. "Pressurizer level was off-scale (low) for about one minute during the transient. Leading to the question of whether any part of the reactor core had been uncovered."

Do you see that?

A Yes, I do.

Q Were you aware of that question having been raised anytime prior to the Three Mile Island accident?

A I do not recall that question ever being raised in relationship to this transient.

Q Is it correct, Mr. Zewe, then that at no time after this transient, up to and including the Three Mile Island accident, were you made aware by anyone at Met Ed that if the bubble were transferred to the reactor coolant system, that that might cause core uncovery?

A That is true, that I don't recall any

training by Met Ed or B&W that would conclude that if we would shift the bubble, that we would have core uncovery during a transient like this.

Q And is it also correct, Mr. Zewe, that at no time before the Three Mile Island accident did anyone at Met Ed make you aware, as a result of this transient, that the existence of flashing or steam in the reactor vessel hot legs or upper head could have an effect on pressurizer level?

MR. KLINGSBERG: Could we have separate parts for that, the hot legs and the head?

MR. FISKE: I don't think it should be separate.

Q Do you want to listen to it, Mr. Zewe, and bear in mind if you can that it is two questions and if you would rather have me break it up, I will break it up.

THE WITNESS: Read it again, please.

(Question read)

A As I have stated earlier, there has been training in respect to pressurizer level and the flashing of the upper head or the hot legs, but only in relationship to if you had a loss of inventory and you lost pressurizer level during an

accident where you could not make up sufficient volume; that then you would have flashing in the RCS, which includes the legs or the upper head. But only during an accident condition where you had a loss of inventory in a LOCA when you would have drained the pressurizer.

So in that relationship between flashing and pressurizer level, yes, I would have to lose the level before I would ever have the flashing.

Q Is it correct that after the April 23 transient, no one at Met Ed told you that if you had flashing in the reactor coolant system, that that could have an impact on pressurizer level?

MR. KLINGSBERG: I think he has answered it.

MR. FISKE: He answered it the other way around.

Q Just so we understand each other, Mr. Zewe, you said that you were trained that if you lost pressurizer level to the point where you lost the bubble, that could cause flashing in the reactor coolant system.

A That is correct.

Q Now I am asking you the other way around.

Did anyone tell you, as part of your training at Met Ed after the April 23 transient, that if by reason of a drop in pressure, flashing occurred in the reactor coolant system, that that could have an impact on pressurizer level?

A No.

As I stated, the reverse was covered. But what you have asked, there was no training on reflected in pressurizer level. It was from pressurizer level back to the flashing.

Q Now, page 17 of this Exhibit 246, which is Mr. Seelinger's report --

A 17, did you say?

Q Yes.

A All right.

MR. KLINGSBERG: Was this other document an exhibit?

MR. FISKE: 186.

MR. KLINGSBERG: The one we just finished is?

THE WITNESS: 186.

MR. FISKE: 186.

MR. WURTZ: Off the record.

(Discussion off the record)

BY MR. FISKE;

Q In Exhibit 246 there is a section beginning at page 14 captioned "Recommendation/ Action Items." On page 16 there is a section captioned "Training." Paragraph 5 in that section appears on page 17. It says, "Simulator training is a definite asset in helping the operator recognize and respond to this type of incident."

Do you see that sentence?

A Yes, I do.

Q To your knowledge, Mr. Zewe, did anyone at Met Ed request B&W to incorporate this transient in the simulator training at Lynchburg?

A I don't recall.

Q When you went to B&W in January of 1979 for simulator training, did you see this transient simulated?

A I don't recall.

Q Did you ever tell anyone at Met Ed that you personally would like to see this transient simulated at B&W?

A I don't recall asking to have it done, though we have had other related-type transients that would have led to similar circumstances.

Because here all you are dealing with is a steam leak as such, because you have a failure of the relief valves 3-C. And I had had that training at B&W, Lynchburg with a cooldown that was induced from a steam line break or rupture. And I am not sure at this particular time that I could have gained any more out of this one than out of another steam break as such.

And I sort of remember that was in my mind about, well, you try and look at the event. And if you could really gain anything more from that particular event more than any others, you would ask for it.

Q Do you know whether anybody at Met Ed asked B&W to simulate the March 29, 1978 open PORV transient on the B&W simulator?

MR. KLINGSBERG: Which?

MR. FISKE: The March 29, '78 failed-open PORV transient on the simulator.

MR. KLINGSBERG: '78, okay.

A Not that I can recall.

Q Did you yourself have the view that it would have been desirable to have that transient simulated by B&W?

MR. KLINGSBERG: This is before the accident?

MR. FISKE: Yes.

A As I recall, it would have fallen into I believe the same category as I viewed the main steam valves that failed to close. In this case, a failed-open PORV would have only resulted in a LOCA, of which we typically had a lot of LOCAs at B&W, Lynchburg for training, and I wouldn't have thought that it would have been any more different than any of the other LOCAs.

Q Didn't B&W in fact include in its simulator training an open PORV?

A I do not recall that particular plant upset as part of their training, but I was aware of that they could simulate a loss of coolant accident, of which they could control the magnitude of it and the rate of change of magnitude, but that they could not dictate the location of the break.

Because I remember asking them to simulate a cold leg break versus a hot leg break. And I remember being told that as far as the computer knows, it really doesn't know the difference. It will initiate a break size and a

break rate from the RCS, but not as to location.

So the symptoms were always the same, whether it was in the reactor vessel, hot leg, cold leg, letdown line, pump seal. It didn't make any difference what the location was. The response was the same.

Q Didn't they have specific training, Mr. Zewe, on how to diagnose an open PORV?

A As I recall, they did. Because they have a light indicator for the PORV. They have a quench tank high-temperature alarm. And they have a quench tank pressure alarm, as I recall, also.

Q Is it your testimony, Mr. Zewe, that at the B&W simulator there is a light indicator for an open PORV?

A As I remember, yes.

Q Isn't it a fact, Mr. Zewe, that the training on an open PORV at B&W was that you diagnosed whether or not the PORV had failed open by looking for a drop in pressure, by looking at the thermocouple readings on the discharge line, and by looking at the drain tank pressure?

A As I remember, that is not true. As I remember, we would look at it for the LOCA-type

symptoms where you have pressurizer level going down, pressure going down, quench tank alarms, and as I remember the PORV light, I do not ever remember reading the tailpipe temperatures at B&W, Lynchburg simulator.

Q Let me read to you some testimony, Mr. Zewe, that Mr. Faust gave in a deposition in this case in August 1981. Let me read it to you and then I will give you the transcript so you can look at it yourself.

"Question: Was one of those transients that you experienced on the simulator an open pilot operated relief valve?

"Answer: I believe so.

"Question: Were you instructed as part of the training that if you diagnosed that a pilot operated relief valve was open, you should shut the block valve?

"Answer: In reference to a failed open pilot operated relief valve, that was the mode to take, to shut the block valve for it.

"Question: Were you instructed that you could diagnose whether or not the PORV had failed open by looking for a drop in pressure by looking at

the thermocouple readings on the trunk line and by looking at the drain tank pressure?

"Answer: You have the procedure? I could review it.

"Question: I am asking you for your recollection.

"Answer: My recollection right now would be towards those parameters, yes, but I don't recall everything in the procedure anymore.

"Question: You would need to see the procedure that was being used at B&W in that course for that transient?

"Answer: Now?

"Question: In other words, that is what you are asking?

"Answer: At this point in time, I would like to look it over to make sure. It has been a while since I have had the need to remember that.

"Question: I believe you told us your recollection is that the parameters that I described were the parameters that you were given while you were on the simulator analyzing that transient. Isn't that correct? That is your best present recollection subject to looking at the procedure?

"Answer: Yes."

That is from pages 195, 196, 197 of Mr. Faust's deposition in this case.

MR. KLINGSBERG: Pretty wishy-washy stuff.

MR. FISKE: That was Mr. Faust's best recollection. We had to settle for that whenever we could get it.

A I have it here. But it really doesn't make any difference to me. Because what I recall is what I recall, and what he may recall may be exactly alike or it may differ quite a bit. But reading his statement won't necessarily change my statement.

Q Do you recall being trained at B&W on the pressurizer system failure procedure that we have spent some time here going over in the last couple of days?

A I recall having instances where the PORV valve had opened and we had had all the indications that the valve in fact had opened. The light, drain tank pressure. Drain tank temperature alarms, level going down and pressure coming down.

But I do not recall training exactly on that. That may have been part of a transient that

had started, and that may have been part of it. But to deal with that by itself, I just don't remember that.

Q With regard to this training that you referred to a moment ago, that in the case of a LOCA, you would see pressure going down and pressurizer level going down, it is correct, isn't it, that you said earlier that you received that training with respect to all LOCAs?

A That is correct.

Q And that the computer couldn't distinguish between a break in one place in the system and a break in any other part of the system?

A That is as I remember, yes.

MR. KLINGSBERG: Is this a good time for a break?

MR. FISKE: Sure.

(Recess taken)

(Continued on next page)

BY MR. FISKE:

Q Mr. Zewe, going back to this April 22 transient for a second, it is a fact, is it not, that in that transient there was a very sharp decrease in steam generator pressure?

A Without looking, yes, there should have been.

Q Well, the chronology, at page 7, indicates at the bottom that at one minute 48 seconds, pressure in the B generator was down to 560 psig, right?

A Yes.

Q And that is a level at which the water latch should occur?

A The actual actuation point is less than 600 pounds.

Q It is also correct, is it not, that there was a rapid decrease in reactor coolant system temperature?

A There was, yes.

Q Page 2 of this report indicates that that drop was from 583 degrees Fahrenheit to 464 degrees Fahrenheit in three minutes.

A Yes, that is true.

Q Going back for one minute to page 16, the

recommendation action item section, under "Training," item 1 says, "Review this transient and all other trips and transients to date with all operating shifts. Such review should be conducted when feasible in front of the controls to get maximum benefit from the situation. Floyd-May 10."

Following this transient, was there training on this incident conducted in front of the controls?

A Yes, there was.

My particular shift, excluding myself, was on for that event. And I remember asking them to show me exactly what they did and what had happened.

Q By your shift, do you mean Mr. Scheimann, Mr. Frederick and Mr. Faust?

A No. As I remember, Mr. Lydon was the shift foreman. Mr. Faust and Mr. Frederick were the control room operators.

Q Following this April 23 transient, were other trips and transients that had occurred at Unit 2 reviewed in front of the controls?

A We typically discussed the transients in the control room in front of the controls. We would do whatever we felt was necessary in order to gain a better understanding of the transient, which included

standing at the controls and discussing it.

Q Did you have such a discussion in front of the controls on the March 29, '78 open PORV transient?

A I don't recall that particular event being discussed like that.

Q This list of reactor trips that we looked at earlier, Mr. Zewe, refers to a trip on November 7, 1978 --

A One moment, please, and I will see if I can find it.

I have it.

Q -- in which ECCS was actuated. Do you see that?

A Yes, I do.

MR. KLINGSBERG: What date is that?

THE WITNESS: November 7.

MR. FISKE: November 7, 1978.

Q Let me show you a document that has been marked B&W Exhibit 191, which has your name among others as a person who received a copy of a report on that trip. I ask you whether or not you received a copy of this report in or about November 1978.

A As I recall, yes, I did.

Q Is it correct that this was a variable

pressure, variable pressure/temperature trip resulting from a loss of feedwater?

A No, that isn't correct.

Q What did cause -- well, first of all, was it a variable pressure/temperature reactor trip?

A Yes, it was.

Q And what was the initiating event?

A Give me a minute. I may have confused this with another transient.

Q Do you want to take a minute to look at this report? Why don't you do that.

A Yes, I will.

It is true that this trip was a variable low pressure trip and that it was caused by loss of feedwater.

Q What you have just been looking at, Mr. Zewe, is a report prepared by Met Ed; is that correct?

A Yes.

Q Let me show you another document which has been marked as B&W Exhibit 192 and ask you if you recognize that as a report on the same transient prepared by GPUSC.

A Yes, it is.

Q Was it part of a regular procedure at Met

Ed, when investigations were conducted by GPUSC and reports written on particular transients, to have those reports made available to the operators of Unit 2?

A That was the standard practice.

Q And with respect to this particular report, did you receive or did you see a copy of this in or about November of '78?

A As I recall, yes.

Q Now, is it correct, Mr. Zewe, that following the reactor trip in this transient, that T-Av decreased, dropped from about 594 degrees to about 553 degrees in the first minute? And I would refer you to page 7 of Exhibit 192.

MR. KLINGSBERG: It says in the first minute, the report says, in the first minute following the scram.

MR. FISKE: Yes, following the trip.

MR. KLINGSBERG: I guess we didn't have it on there.

A Which paragraph are you in?

Q I am in the second paragraph on page 7. I' is the first two paragraphs, actually.

(Witness examining document)

MR. FISKE: Was there an answer?

MR. WURTZ: He is reviewing the document.

THE WITNESS: What was the last question, please?

(Question read)

A Yes.

Q And looking at figure 1, which appears on page 12 of this same document, that indicates, does it not, in the third paragraph, that within the first minute after the scram, that pressure dropped to the point where HPI came on automatically and pressurizer level went down below the zero reading on the scale?

A Yes.

Q And these are all facts that you learned about this transient sometime in or about November 1978?

A As I recall, I was aware of this report and the substance of the report, though I don't remember these numbers now.

Q But it is correct that you learned sometime in or about November 1978 that this depressurization leading to actuation of HPI had resulted from a cooldown, as we have more or less used the term earlier?

A It was an overcooling transient after the trip, yes.

Q Page 1, I guess, of Exhibit 191 states,

"The decreased RC system volume due to the cooldown and depressurization caused the pressurizer volume to decrease below zero indicated level for approximately 30 seconds."

Do you see that sentence?

A Yes, I do.

Q Do you remember any discussions in connection with this transient, as to whether or not the bubble in the pressurizer had been lost?

A I do not recall any discussion about the bubble being lost in relationship to this event.

Q Did you learn what it was that had caused the cooldown?

A Steam leak.

Q And as a consequence of that steam leak, there was, was there not, a sharp drop in steam generator pressure?

A Yes, there was.

Q Page 9 of Exhibit 192 indicates that there was a drop in steam generator pressure -- Exhibit 192.

A Page 9?

Q Right.

MR. KLINGSBERG: It would be faster if you could direct us to that paragraph.

MR. FISKE: I am. Paragraph 1.

Q Will you read that?

I will start again.

Paragraph 1 on page 9, Exhibit 192, indicates, does it not, that steam generator pressure dropped to 600 psi?

A Yes, it does.

Q And that feedwater latch occurred?

A Yes, on the A generator.

Q Back earlier in your testimony when we were talking about valve failures, you said that you had learned sometime before the Three Mile Island accident about a situation in which a turbine bypass valve had failed to close.

A Yes.

Q Was there such an event in this transient?

A As stated in paragraph 4 there on page 9, it says that, "After the event, a turbine bypass valve was found to have a damaged yoke, and it is likely that this malfunction was the cause of the excessive steam demand after the scram. The valve has been repaired."

Q And it is the open turbine bypass valve that was the cause of the steam leak that produced the cooldown?

A As I remember, it was, yes.

Q Did you understand, when you received this report, what a damaged yoke was?

A I had come down and physically examined the valve, yes.

Q So you personally observed whatever it was that was wrong with this valve?

A I had looked at the valve and the broken yoke, yes.

Q And what is the yoke of the valve?

A The yoke of the valve is a collar arrangement between the valve body and the valve stem. The packing gland is just above that with the lantern ring.

Q Did you determine what it was that had caused the damage?

A I viewed the valve after the fact. And as I recall, I drew no conclusions on what caused it to fail, if it was the operator or if it was just overstressed or just what the actual cause of the failure was. I don't recall exactly what that was.

Q In what respect did this damage to the yoke keep the valve from closing?

A Physical binding prevented the valve from full travel.

Q Was there any discussion, Mr. Zewe, after this transient about the actions of the operators in the way they handled high-pressure injection?

A I don't recall any discussions stating that the operators had made any errors in their handling of high-pressure injection.

Q On page 3 of Exhibit 192, in the sixth paragraph -- I am sorry, the seventh paragraph -- it says, "Since it may not be possible to prevent safety injections as a result of some primary cooldowns, action is required to insure that spurious sodium hydroxide injections are prevented."

Do you remember any discussion of that problem after this particular transient?

A Yes, I do.

Q What was the problem with having sodium hydroxide injected into the system?

A Sodium hydroxide is designed to be used following loss of coolant accidents. It is not designed to be put into the reactor coolant system. The sodium becomes activated in the reactor coolant system and results in high radiation levels because of the sodium activation, and it also results in crud traps and hot spots because of this radiation, and it also is

detrimental to the primary good chemistry control.

Q Why was it felt desirable to inject sodium hydroxide into the system during a loss of coolant accident?

A On a loss of coolant accident, you have the engineering safety feature actuation, which has high-pressure injection and low-pressure injection, and possibly core flood and building spray actuation, putting in a high amount of highly borated water into the reactor coolant system and ultimately into the reactor building, either directly by building spray or indirectly out of the break in the RCS.

In order to keep the general corrosion down from the very low acidic water in the RCS and in the RB, you add sodium hydroxide to counteract this.

Also, it helps to keep the iodine levels low and keeps it in solution after an accident.

Q Where did the sodium hydroxide come from then that is injected into the system by HPI?

A We have a sodium hydroxide tank that has two motor-operated outlet valves, 8A and 8B. And they did open up on an ES actuation, which allowed the water to come from the tank into the suction of the pumps and put it into the RCS.

Q So am I correct in understanding that up until at least the time of this transient we have been talking about here, every time HPI came on automatically, sodium hydroxide would go into the system?

A No, that isn't correct.

There were reset buttons for these actuation valves.

Normally they would not open up until you had four-pound actuation, which is another engineering safety feature setpoint.

If you reached four-pound reactor building pressure, then you would have the sodium hydroxide initiated into the system by opening up the valves. If you only had high-pressure injection actuation, you would not have that go in. But in this particular case, as I remember, there is a logic to resetting the valves, and this logic was not reset properly and it resulted in the sodium hydroxide actuation.

Q Let me just make sure I understand this.

Is what you have told us up to now that as of November '78, the system was designed so that if HPI comes on automatically, as a result of reactor building pressure reaching four pounds, then sodium hydroxide would go into the system, but that if HPI

is automatically actuated by a drop in pressure to 1640 without an increase in reactor building pressure to four pounds, sodium hydroxide was not supposed to go into the system?

A That is as I remember, yes.

Q And, in fact, did sodium hydroxide go into the system in the course of the November '78 transient?

A As I remember, it had. But I would have to review the entire event to make sure that I was not confusing this event with another event.

Q Well, let's go back to the paragraph on page 3. It says, "Since it may not be possible to prevent safety injections as a result of some primary cooldowns, action is required to insure that spurious sodium hydroxide injections are prevented."

The next sentence, "The temporary measures being implemented by the plant staff should be replaced promptly by permanent measures."

What were the temporary measures that were being implemented by the plant staff to prevent spurious sodium hydroxide injections?

A Without reviewing it in detail, I don't remember.

I do remember that we were going to

permanently insure that sodium hydroxide valves would not open up unless we actually had a low level in the borated water storage tank was one of the action items, as I recall. I don't recall what the temporary action was, except insuring that the level switches were reset. Other than that and the permanent fix of insuring that the BWST was at low level, and also I recall installing some indicating lights that indicated the position of the limit switches also as a permanent fix.

Q Had those permanent fixes been put in place by the time of the accident of March of '79?

A As I recall, yes.

Q All of the ones that you have just described?

A To be absolutely sure, I would have to review, but I believe that, yes, the low levels in the BWST and also the indicating lights, as I recall, were installed prior to the accident.

Q What were the indicating lights supposed to indicate?

A Status of the level switches for the sodium hydroxide tank.

Q Directing your attention, Mr. Zewe, to B&W 192, page 7, do you have that in front of you?

A Yes, I do.

Q Do you see the references in the last four, or five, paragraphs to discussion of pressurizer level?

A I have read those last five paragraphs on page 7.

Q The last paragraph on the page says, "For a cooldown of 4 degrees (estimated pressurizer level change of 300 inches) a pressure reduction of 550 psi was observed. It is likely that some flashing in the reactor vessel upper head had occurred."

Do you see that sentence?

A Yes, I do.

Q Do you remember any discussion at Met Ed after this transient about whether or not the flashing in the reactor vessel upper head in this transient had any effect on pressurizer level?

A I do not recall any discussion of that nature.

Q Do you remember a discussion as to whether or not there had been any flashing in the reactor coolant vessel upper head?

THE WITNESS: Read that back again, please.

(Question read)

A I don't recall any discussion like that.

Q Directing your attention, Mr. Zewe, to B&W 191, appendix A, do you see the page -- I think it is page 30 -- which is captioned "Pressurizer Level Calculations"?

A Yes, I do.

Q Did you review those papers after this transient?

A Since it is included in the overall report, I believe that I did, yes.

Q When you read this, what did you understand was the relationship between pressurizer level and the extent of steam bubble formation in the RCS?

A What I thought then when I read it?

Q Yes.

A I don't remember reading it. I said that since it was in this report, I must have read it, but I don't remember the item itself.

Q In addition to your own private reading of this report, in the course of the training that was done at Met Ed after this transient on its significance, was there any information given to you or to your knowledge any of the other operators concerning the possible effect of a steam bubble formation in the RCS on pressurizer level?

A As I can remember, the time period as it is here that pressurizer level was zero was for 67 seconds. As I remember, that time period was so short that I didn't hold any significant -- significance of the fact that it was contained in here.

Q I guess that isn't quite my question.

My question was whether, after this transient in November of 1978, in the course of whatever training was done for the operators by Met Ed on this transient, was any information given to the operators as to the possible effect of a steam bubble formation in the reactor coolant system on pressurizer level?

A Not that I can remember.

Q Is it correct, Mr. Zewe, that following this transient you obtained no further understanding of the relationship between a steam bubble in the reactor coolant system and pressurizer level than you had before that transient?

MR. KLINGSBERG: I will object to the form of the question.

THE WITNESS: Would you read it back, please?

(Question read)

A As I recall, I did not gain any new

significant information based on the pressurizer level and the steam bubble formation.

Q Now, Mr. Zewe, the last reactor trip before the accident which produced ECCS actuation according to the Rogovin analysis was a reactor trip on December 2, 1978.

Do you see that trip referred to on B&W Exhibit 658?

A Yes, I do.

Q Let me show you a document that we will mark as the next B&W exhibit.

(Report written by Met Ed on December 2, 1978 transient marked B&W Exhibit 741 for identification, as of this date.)

Q Do you have B&W Exhibit 741?

A Yes, I do.

Q Do you see your name listed as one of several individuals who were to receive a copy of this document?

A Yes.

Q Do you recognize this document as a report written by Met Ed on this December 2, 1978 transient?

A Yes, I do.

Q And you received a copy of that in or about

December 1978?

A Yes, I did.

Q Is it correct, Mr. Zewe, that this reactor trip occurred on low pressure as a result of overfeeding the steam generator?

I refer you to page 1.

A Yes, it was.

Q Is it correct, Mr. Zewe, that overfeeding of the steam generators causes a drop in RCS temperature?

A Yes.

Q And that that drop in temperatures produces a drop in pressure as part of the cooldown effect that we have discussed earlier?

A Yes. The excess of feed causes the reactor coolant system temperature to be reduced, which causes the primary to contract and pressurizer level to go down and pressure to come down.

Q Looking, Mr. Zewe, at the graphs which appear starting in the section of the report which is Section 7, do you see that there are graphs there for pressurizer level, for reactor coolant system pressure and for reactor coolant system temperature?

A Yes.

(Continued on next page)

Q Is it correct, looking at the graphs for reactor coolant system pressure, pressurizer level, and temperature, that in the case of this transient, there was a sharp drop in reactor coolant system temperature and in pressurizer level, and in reactor coolant system pressure, to the point where HPI became automatically initiated?

A From the graph of RC pressure wide range versus time, it does not indicate to me that the high-pressure injection actuation point was reached. It looks like the pressure went down to 1675.

Q And it went down to 1675 within a few minutes after the trip?

A From the graph, it is very hard to read it. It looks like within a three-minute time period.

Q Within that same time period, reactor coolant system temperature was going down to 520 degrees?

A Yes.

Q And pressurizer level was going down almost to the zero indication?

A Down to about 5 inches or so.

Q Going back to page 1, Mr. Zewe, the

fourth paragraph, in the small print, do you see the sentence that says, "The overfeeding of the steam generators resulted in a reactor trip on low RCS pressure followed by safety injection two and a half minutes later"?

A Yes, I see that. It is just that the graph that you pointed out to the actuation setpoint does not bear that out.

Q But you did learn it is a fact, did you not, after this transient, that high-pressure injection had been actuated?

A As I recall, yes. But I am not sure if it was automatically or if it was manually actuated by the operator. I don't remember. Unless the graph is inaccurate or it was actuated above setpoint by the operator or it went automatically above setpoint. I don't remember.

Q There is a requirement, is there not, Mr. Zewe, that when ECCS comes on automatically, that some sort of a report has to be filed with the Nuclear Regulatory Commission?

A That is standard procedure, yes.

Q It is not necessary to file such a report if high-pressure injection is manually initiated;

isn't that correct?

A As I remember, we would still file the report, whether it was automatically or manually initiated.

Q You would do that every time if the high-pressure injection was manually initiated at full flow?

A Certainly at full flow, or any high-pressure injection actuation, either partially or full flow.

Q Just to make sure we understand each other, the same pumps that control high-pressure injection flow can also be used for ordinary makeup flow; right?

A They are used.

Q Right.

A They are the only ones with that capability.

Q Okay. And in a case where after a transient an operator increases the makeup flow, let's say by another 50 gallons a minute, that is not considered manually initating high-pressure injection, is it?

A In this case here, where they are saying

safety injection was initiated, I assume that the operator pushed a manual actuation button if it did not actuate automatically.

Q And pressing the manual actuation button has the same effect in terms of the amount of water that goes into the system as if it had come on automatically; is that correct?

A If he had full manual actuation. He has an A system and a B system.

If he actuated both the A and the B system, then it would be the same.

Q Going back to these reports that have to be filed with the Nuclear Regulatory Commission, if high-pressure injection coes on automatically, then a report has to be filed; correct?

A As I recall, yes.

Q If the operator manually actuates only the A pump but not the B pump, does a report have to be filed?

A I am not sure if the requirement is a "must" report, but I feel we would, yes.

Q I guess I am not quite clear yet on whether there is a difference between manually actuating, let's say, the A pump and increasing

makeup flow.

A When I read the words here, it is "safety injection." I only assume from my understanding that the operator initiates HPI by going to the manual actuation buttons, not just increasing makeup flow.

Q Well, let's just finish with this particular transient. I think it might be helpful to look at Appendix A. Do you have Appendix A in front of you?

A Yes, I do.

Q That is entitled "Performance of Safety Injection Equipment"; right?

A Say that again.

Q That is entitled "Performance of Safety Injection Equipment." Right?

A Yes, it is.

Q Would you just look at the first paragraph and see whether that refreshes your recollection that high-pressure injection was automatically actuated in this case.

A That states that it had occurred automatically. I don't know why the graph on low pressure does not support that.

Q Just one last thing before we adjourn

for the day.

Going back to this question of the circumstances under which a report would be filed with the NRC on the actuation of high-pressure injection, is it correct, do I correctly understand you that such a report would be filed if the operator pressed the button to actuate either the A or the B pumps, but it would not be filed if he simply increased the makeup flow?

A A or B actuation. Not just the A or B pumps. All right?

The A actuation would actuate the A pump. The B actuation would actuate the C pump, not A and B pump.

Q With that modification of my question --

A I believe that the company would still file a report. I do not remember what the exact requirements are -- all right -- for manually initiating it. I do not believe they would initiate a report based on an operator increasing normal makeup flow. All those requirements have been changed over the last three years, and I don't recall exactly how they were stated three years ago.

Q I am only interested obviously in what

happened --

A Right.

Q -- before the accident.

A And it is my recollection that we would report it.

Q You would report an automatic --

A Automatic --

Q -- an automatic A or B actuation, but not an increase in makeup flow.

A Right. And we would also report a manual initiation of A or B.

(Time noted: 4:40 p.m.)

WILLIAM H. ZEWE

Subscribed and sworn to
before me this day of
1982.

CERTIFICATE

STATE OF NEW YORK)
: ss.:
COUNTY OF NEW YORK)

I, HARVEY B. KRAMER, RPR, CSR, a Notary Public of the State of New York, do hereby certify that the continued deposition of WILLIAM H. ZEWE was taken before me on MONDAY, MAY 24, 1982 consisting of pages 249 through 348;

I further certify that the witness had been previously sworn and that the within transcript is a true record of said testimony;

That I am not connected by blood or marriage with any of the said parties nor interested directly or indirectly in the matter in controversy, nor am I in the employ of any of the counsel.

IN WITNESS WHEREOF, I have hereunto set my hand this 7th day of June 1982.

Harvey B Kramer

HARVEY B. KRAMER, RPR, CSR

WITNESS

William H. Zewe (resumed)

E X H I B I T S

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E X H I B I T S

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