PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

THIRD MEETING

PUBLIC HEARINGS

FIRST DAY, WEDNESDAY, MAY 30, 1979

EXECUTIVE OFFICE BUILDING, ROOM 2008
STREET & PENNSYLVANIA AVENUE, N.W.
WASHINGTON, D.C.

The Third Meeting of the President's Commission on the Accident at Three Mile Island convened pursuant to notice at 1:00 p.m., John G. Kemeny, Chairman, presiding.

Pages 1 through 210.

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COMMISSIONERS PRESENT, Wednesday, May 30, 1979

JOHN G. KEMENY, Chairman
President of Dartmouth College

BRUCE BABBITT
Governor of Arizona

PATRICK E. HAGGERTY
Retired President of Texas Instruments

CAROLYN LEWIS
Associate Professor of Journalism
Graduate School of Journalism, Columbia University

CORA B. MARRETT
Associate Professor of Sociology
University of Wisconsin

LLOYD McBRIDE
President of United Steelworkers of America

HARRY McPHERSON
Attorney

THOMAS PIGFORD
Professor and Chairman,
Department of Nuclear Engineering
University of California at Berkeley

THEODORE TAYLOR
Professor of Aerospace and Mechanical Science
Princeton University

ANNE TRUNK
Resident of Middletown, Pennsylvania

COMMISSIONERS ABSENT, Wednesday, May 30, 1979

RUSSELL PETERSON
President of Audubon Society

PAUL E. MARKS
Vice President for Health Sciences, Columbia Univ.

COMMISSION STAFF MEMBERS

BRUCE LUNDIN, Staff Director
RONALD B. NATALIE, Chief Counsel
BARBARA JORGENSON, Public Information Director

I N D E X

Wednesday Afternoon, May 30, 1979

Transcript consists of pages 1 through 210.

LIST OF EXHIBITS

Written testimony of Herman Dieckamp, GPU, dated May 18, 1979 before President's Commission

Written testimony of Herman Dieckamp, GPU, dated May 24, 1979, before the Subcommittee on Energy and Environment of the House Committee on Interior and Insular Affairs (Udall Committee)

General Public Utilities 1978 Annual Report

Met-Ed, GPU Annual Report 1978

Professional Biographies of Met-Ed and GPU Representatives Submitting prepared testimony before the President's Commission, May 30 and 31, 1979 (Dieckamp, Creitz, Herbein, Arnold, Miller)

Written testimony of Walter M. Creitz, dated May 18, 1979 on the Met-Ed Organization

Written Summary of testimony of John Herbein, Met-Ed, dated May 18, 1979

Written (full) testimony of John Herbein, Met-Ed, dated May 18, 1979

Written testimony of Robert C. Arnold, GPU Service Corp., dated May 30, 1979

Written summary of testimony of Gary Paul Miller, Station Manager of Three Mile Island, dated May 18, 1979

TMI Station March 28, 1979 Incident, Statement by G. P. Miller, Station Manager

REQUEST FOR INFORMATION

5/30/79

P R O C E E D I N G S

CHAIRMAN KEMENY: Will the Third Meeting of the President's Commission on the Accident on Three Mile Island please come to order.

This is our first meeting where the Commission will take testimony under oath. I call on our Legal Counsel, Chief Counsel Natalie, to call the first set of witnesses and to swear them in.

MR. NATALIE: Will Messrs. Dieckamp, Creitz, Herbein and Arnold please come forward and be sworn?

WHEREUPON,

PANEL I

HERMAN DIECKAMP
WALTER M. CREITZ
JOHN G. HERBEIN
ROBERT C. ARNOLD

were called as witnesses herein, and after having first been duly sworn, were examined and testified as follows.

CHAIRMAN KEMENY: Thank you. We have received written testimony from you and we have actually had a chance to see it because you prepared it for a previous meeting. That written testimony will be made part of the record of this meeting. It is hereby accepted.

Mr. Dieckamp, I understand you have an opening statement you wish to make. Is that correct?

MR. HERMAN DIECKAMP: Thank you, Chairman Kemeny, and Members of the President's Commission on the Accident at Three Mile Island. My name is Herman Dieckamp. I am President and Chief Operating Officer and Director of General Public Utilities (GPU). I'm also a Director of Metropolitan Edison and the other GPU subsidiaries.

We are pleased today to have the opportunity to appear before you, and we pledge our full and open support to the important task that you have undertaken. My objective is to provide a brief overview of the accident. We are hopeful that the panels of management and operating personnel will be helpful in allowing us to respond effectively to the full range of your questions.

Before proceeding, perhaps I should identify the other people more specifically and the material that we have provided.

On my far left is Walter M. Creitz, who is the president of Metropolitan Edison. Mr. Creitz has presented testimony which describes in brief Met Ed and his relationship to the management activities at Three Mile Island, as well as an annual report for Metropolitan Edison Company.

On my immediate left is Mr. John G. Herbein, Vice President of Generation for Metropolitan Edison, the officer directly responsible for the operations at Three Mile Island. Mr. Herbein has submitted a prepared statement which outlines the organizational structure of the Three Mile Island Plant and enumerates some of the specific mechanisms for safety review

of that plant operation.

Second from my left is Mr. Robert C. Arnold, Vice President of Generation for the General Public Utilities Service Corporation. Mr. Arnold was responsible during the final phases of the design and construction of Three Mile Island. Since the accident he has been senior person at the site in the post-accident recovery activities. Mr. Arnold has also provided a statement which describes both his responsibilities within the service company as well as the activities that he has been in charge of at the site.

For myself, as you are aware, I have submitted as background information a brief description of the GPU corporate structure and our involvement in nuclear power over the years, a copy of GPU's annual report, a copy of my testimony before the Udall Subcommittee on Public Works and Environment of the House Interior and Insular Affairs Committee.

We have also submitted for your information what is called an annotated sequence of events, a preliminary annotated sequence of events which should provide a time scale backbone for the discussion of the accident as well as some graphical presentations of plant response during the period of the accident.

If I may, I'd like to now proceed with a brief summary of the accident as we have seen it from the company's point of view, covering not only what we see as the critical pieces of the

accident, but also the organization response, the response to the emergency plan, the relationship between the company and the NRC and other items.

The accident at Three Mile Island on March 28, 1979 has had a profound and shocking impact on the residents of central Pennsylvania, Met-Ed and GPU, our customers and employees, and on the future of nuclear energy. While nuclear power plant systems and procedures have been designed to accommodate extreme malfunctions of both equipment and personnel, the reality of this accident has had a far greater impact that we could have ever projected.

We do not propose today to present a detailed description of the sequence of events. We are in general agreement with the NRC testimony on this subject previously given in other oforms. We may, however, differ somewhat on the relative importance of the various ingredients of the accident.

While extensive data and information have been made available, Met_Ed and GPU have not completed a detailed reconstruction of the accident or verified the relative importance of the many ingredients. The following appear to be the major causes of the severity of this accident.

(For those of you who may be trying to follow, I am using the testimony before the Udall Subcommittee and my outline, and I'm on page 2.)

The first of the major contributing factors to the

accident is the following:

(a) Shortly (4 sec.) after the turbine and reactor trip at about 4:00 a.m. on March 28, a reactor coolant system pressure relief valve opened to relieve the normal pressure excursion, but the valve failed to reclose after the pressure decreased. The operator was unaware the valve had not closed. An order for valve closure was signaled in the control room. The operator monitored temperatures near the valve to indicate valve position. However, these signals did not clearly confirm the continuing coolant flow through the valve.

(b) Secondly, when system pressure decreased to 1600 psi about 2 minutes into the accident, the High Pressure Injection (HPI) safety system was automatically initiated. Four to five minutes into the accident the operator reduced injection of water from the HPI system when pressurizer level indicated that the system was full.

(c) Thirdly, operator training and experience had emphasized the retention of a steam vapor space in the pressurizer. The operator apparently did not anticipate that continued depressurization could lead to steam void formation in hot regions of the system other than the pressurizer and that under these conditions his level or fullness indication was ambiguous or misleading.

(d) Fourth, because of the presence of steam voids in the primary system, indicated primary coolant flow decreased.

The operator turned off the main coolant pumps in order to prevent damage to the pumps. The plant staff expected cooling by natural circulation. Voiding prevented natural circulation and prevented reestablishment of pumping.

(e) Fifthly, an emergency feed system, designed to provide cooling to the steam generators in case of loss of the normal feed water system, was blocked because of two closed valves. The operator discovered this condition and initiated secondary system emergency cooling 8 minutes after the start of the plant transient. The plant safety system surveillance program had called for the placing of these valves into the closed position six times during the first three months of 1979. The last test of the emergency feed system was conducted on the morning of March 26, about 42 hours before the March 28 accident.

(f) Lastly, primary coolant initially vented through the pressurizer relief was pumped into the auxiliary building because the containment design did not require isolation until building pressure reached 4 psi. Continued plant operation required some transfer of fission products to the auxiliary building.

Performance of the plant operators has been the subject of much speculation. Their performance must be view in the context of:

1. Ambiguous and contradictory information relating to pressurizer level and relief valve closure.

2. The experience and training underlying the operators' emphasis on maintaining pressuriter level.

3. The operators' awareness of equipment limitations.

4. The time and opportunity to assimilate large quantities of data with varying degrees of physical and chronological availability.

In terms of the status of the plant today, the plant is stable and in a cold shutdown state. The fission product decay heat being liberated in the damaged reactor core is just slightly in excess of 1 Megawatt thermal (0.04% of full power). The core is being cooled by the natural circulation of primary reactor coolant. The heat from the reactor is being rejected through one steam generator and the plant condenser. The plant has been in the natural circulation mode since April 27, 1979. The plant's several and original emergency cooling capabilities are available to backup this cooling approach.

(I'm now on page 6.) I would like to comment a little bit about the time it took to fully develop an awareness of the extent of the accident. The accident certainly differed from the popular perception of common accidents because of the extended time necessary to achieve a full definition of its scope. The time required to develop a reasonably complete understanding of the accident and its result was approximately 2 to 3 days. It should be stressed that while the full impact of the accident was not fully evaluated initially, there was

sufficient understanding of system conditions to maintain plant cooling stability during this period.

During the first few minutes the plant staff attempted to recover from what they thought was a normal transient. Beyond this time, the plant behavior became increasingly abnormal. The loss of coolant via the reactor coolant system relief valve was identified and the valve was isolated around 6:20 a.m. At approximately 6:50 a.m. several radiation alarms alerted the staff to possible reactor core damage. In the earlier time period of 5:30 to 7:30 a.m. the reactor core became uncovered and suffered extensive damage, including significant zirconium-water reaction. During the next 12 hours, the operators attempted a number of strategies to establish dependable core cooling. This objective was achieved about 8:00 p.m. on March 28.

A preliminary sequence of events was being extracted from the various plant records by the afternoon of March 28. The data for the 16-hour accident became available in summary graphical form on the morning of March 29. The probable occurrence of a zirconium-water reaction and the presence of hydrogen gas in the reactor containment building was deduced during the evening of March 29 from containment pressure records that indicated a pressure spike during the accident. The size of the hydrogen gas bubble in the reactor coolant system was first measured from system data just after midnight,

March 30. The concentration of hydrogen gas in the containment building was determined from the analysis of the first containment gas sample taken about 4:00 a.m. on March 31. The first quantitative data with respect to fission produce release and degree of reactor fuel damage became available via analysis of a primary coolant sample taken at 5:00 p.m. on March 29.

The purpose of this enumeration is imply to indicate the time necessary to gain insight into the scope of the accident and, in turn, to provide the basis for a meaningful analysis and assessment.

A release of radioactive materials to the containment building occurred during the first forty-five minutes of the accident when water was released from the primary reactor coolant system through the pressuriter relief valve. This coolant collected in the containment building sump and was pumped into the auxiliary building sump. Operator action turned off the containment sump pumps approximately 40 minutes into the event.

Containment isolation automatically occurs in the TMI-2 plant upon a 4 psi pressure increase in the reactor building. In the accident this pressure building did not exist until 4 hours into the accident and thus containment was not isolated until 8:00 a.m.

High fuel cladding temperatures produced by inadequate core cooling during the accident resulted in the breach

of most of the fuel cladding in the core beginning about 90 minutes into the accident. This failure of the first level of fission product containment resulted in the release into the primary system of the gaseous fission products from the fuel-cladding gap and extended periods at high temperatures released a fraction of the fission products normally contained within the fuel pellets.

Continued operation of the primary reactor coolant letdown and makeup systems to remove gas from primary coolant circuit resulted in a buildup of hydrogen, iodine, and noble gases in the reactor makeup and letdown systems and in the waste gas decay tank in the auxiliary building. Steps necessary to restrict tank pressure levels, the taking of gas samples, and efforts to discharge these gases back into the primary reactor containment building resulted in a eries of radioactive gas releases. The largest of these occurred on Friday, March 30 at about 7:00 a.m.

NRC has calculated the highest integrated whole body dose possible to an unprotected individual off-site. This exposure is equivalent to about 2 to 3 chest x-rays.

In addition to the maximum integrated whole body dose measured from the accident, the total dose to the population within 50 miles has also been evaluated. A report of the Ad Hoc Interagency Dose Assessment Group, consisting of representatives of NRC, HEW, EPA, indicates that the total potential

additional cancer deaths associated with this accident are less than 1, in addition to the 300,000 cancer fatalities which would be normally expected to develop in the population of about 2,000,000 persons.

(Page 11.) With respect to the emergency plan, both Three Mile Island and the Commonwealth of Pennsylvania had formal written emergency plans in place before TMI-2 received its opeating license.

Under the emergency plans, there is a clear division of responsibility between Met-Ed and the state authorities. In terms of that division of functions, it is Met-Ed's duty to make an initial assessment to do whatever it can to terminate the event, to read the plant instruments and monitoring devices and give an indication of the level of releases from the palnt, to dispatch teams of technical personnal to areas outside the plant, to report these back to plant emergency control center by radio and keep the Pennsylvania Bureau of Radiological Protection informed of all these matters.

It is the responsibility of the Pennsylvania Bureau of Radiological Protection to make the decisions as to what measures of protection, including evacuation, should be undertaken.

In accordance with the site emergency plan procedures, a Site Emergency was declared at about 6:50 in the morning on March 28, and notification to authorities was initiated in

accordance to the plan.

Throughout the day of March 28, 1979, on-site and off-site radiological monitoring teams were providing a full flow of data to the Emergency Control Center at Three Mile Island. Constant communication existed through open lines from Unit 2-s Control Room to the State's Bureau of Radiation Protection and to NRC's offices at Region I in King of Prussia.

From our vantage point, the Three Mile Island radiation emergency plan and procedures, as defined, were effectively implemented. We must, however, expect that further review of this experience will identify numerous opportunities for improvement.

In the interest of time, I will pass over (the writte) "organization response" which I had planned to cover, and move on down to page 17--NRC interface. Let me only say that we felt an extremely bright aspect of the organizational response was the very open and immediate response of the entire nuclear industry to our call for assistance. Many of the country's best nuclear experts ended up in what became known as the "Industry Advisory Group" and provided us with significant added capability and independent assissment of some of the critical problems that we faced during the first few days.

NRC Interface. The role of the NRC and the relationship between the Company and the NRC has been the source of much speculation in the press. The Company's view of the

relationship is one of mutual respect and cooperation. The popular perception of the relationship may have been significantly colored by the Company's election to reserve comment on plant status and plans. The NRC spokesmen adequately covered this aspect of communications. It has been our judgment after the first few days and up to this time that the public interest was best served by minimizing the opportunities for media emphasis on minor nuances of expression. A serious side effect of this policy has been to create the public impression that the Company was not contributing to the management of the post accident efforts. We believe that Met-Ed and GPU fulfilled their licensee responsibilities and have effectively responded to the accident.

The question of who was in charge was not a critical factor. The Company has from the outset recognized the role of the NRC in this accident situation. The NRC's access to the control room provided direct and immediate access to the plant status from mid-morning of March 28 on. There were tense moments, but we must emphasize that it is the Company's view that the relationship with the NRC was constructive and effective. We were able to close ranks so as to effectively employ our joint resources.

With respect to the longer term outlook for repair and return to service at TMI-2, it is too early to be able to provide a definitive schedule or cost estimate. Experience with

the cleanup and recovery of other reactor incidents suggests that the problem is technically manageable. It will, however, be significantly influenced by the availability of financial resources, regulatory requirements, and public acceptance.

Despite the loss of this major block of capacity in the GPU system, there is adequate capacity in PJM to insure reliability of the supply of electricity. Under current planning and current capacity schedules, the interconnection will be able to supply energy into the mid-80's.

While ad adequate supply of energy for Met-Ed, Penelec and Jersey Central customers is likely to be available from PJM, the cost will be substantial. The cost of this accident, when concentrated on the 1.5 million customers and the 170,000 stockholders and other investors in TMI's parent and subsidiaries is extreme. The traditional constraints of the utility regulatory process impose significant impediments to the easy discussion of the ramifications of an accident of this type and a ready resolution of the proper sharing of the costs between the customers and the investors. To date, the industry has underestimated the importance of diversifying this financial risk and thus spreading the cost of the development of the technology over the total beneficiaries of nuclear power. The institutions charged with the responsibility to supply a secure, abundant, and economic source of electrical energy must be able to withstand the impact of an event like the accident at TMI-2.

The system must retain the ability to balance the social and economic costs of energy supply and energy availability.

In conclusion, I would urge that your Commission adopt a broad point of view with respect to the accident at Three Mile Island and that you look beyond the specifics of equipment and human performance into the underlying bases of nuclear plant design, operation, operator training, and regulation. While the accident was a traumatic experience to the local populace and continues to have an impact on the GPU companies and their customers, we must now turn our attention to a full understanding of the accident and ensure that we drive the maximum learning from this experience.

Thank you. We are now ready for your questions.

CHAIRMAN KEMENY: Commissioner Haggerty.

COMMISSIONER HAGGERTY: On page 3, paragraph (c) of your testimony, there is the following sentence: "The operator apparently did not anticipate that continued depressurization could lead to steam void formation in hot regions of the system other than the pressurizer and that under these conditions his level or fullness indication was ambiguous and misleading."

In the remaining discussions before the Udall Committee last week, the letter written by T. M. Novak of NRC, which practically reads on your accident in great detail, was discussed, and in the news stories, at least, you were reported as saying this was the first you had heard of this particular

report by Novak. Is that correct?

MR. DIECKAMP: The only thing that is incorrect about it is that I think it was Mr. Herbein who made the response rather than me. And Jack, would you like to comment on that questioning last week?

MR. HERBEIN: Yes, Sir. I believe the memorandum that you are speaking about is an internal memorandum that was circulated among members of the Nuclear Regulatory Commission. I was not aware of that memorandum prior to the Udall Committee hearings last week.

COMMISSIONER HAGGERTY: It appeared there were discussions or references to the McPherson original paper, however, that led to this letter by Novak on January 10, because I had seen them prior to mid-May, I believe, discussion in Science at least, and perhaps elsewhere. I'm puzzled if it had not been called to your attention because it is so basic to the entire accident.

MR. DIECKAMP: Mr. Haggerty, I think you are referring to the Michaelson Report.

COMMISSIONER HAGGERTY: Michaelson, yes.

MR. DIECKAMP: For myself, my first awareness of the Michaelson report was an article in the New York Times a few days after the accident. We might ask Mr. Herbein again whether he had become aware of it prior to the accident.

MR. HERBEIN: No, Sir, I was not aware of it prior to

the accident. But some days before the Udall Committee hearings, I was shown a copy of the writeup.

COMMISSIONER HAGGERTY: Were there ever discussions after the Davis-Bessy (ph) accident of the kind of problem that could develop in this sort of closed pressurizer loop operating as it was?

MR. DIECKAMP: I might just say in response to that that it is my understanding that we received a bulletin describing the Davis-Bessy accident on March 29, the day after the accident. Again, I would ask Mr. Herbein whether in any industry meetings or other communications what was our degree of awareness of that accident?

MR. HERBEIN: We were not specifically aware of the connotations associated with the Davis-Bessy accident--that of a loss of secondary cooling and subsequent expansion and release of primary coolant through the electromatic relief valve. We were, to some degree, aware that there had been an electromatic relief valve problem at Davis-Bessy, but I don't believe, I'm sure we were not aware of the full extent of the ramifications of the incident.

CHAIRMAN KEMENY: Mr. Dieckamp, I'd like to take you up on the Commission taking a broad point of view, and I know several of us will want to ask you broad questions. The area I'd like to explore is a suggestion that was made to us at our first set of meetings when we asked people what issues we

should look at. One of our witnesses suggested that the effect of regulation may be that companies are so hypnotized with having to follow regulations that they cannot concentrate on basic safety issues.

Let me first ask you in general: Do you or your associates feel that you have to spend so much time worrying about regulations that you cannot make your independent assessment or you do not make your independent assessment of safety?

MR. DIECKAMP: I don't think that I would want to say it that way, in a way that seemed as though our working with the NRC or our response to them was the item that prevented us from doing our own safety analysis. I think, though, that I would feel more comfortable saying that I think that over the years we probably grew up to make assumptions that the things that the NRC was asking of us and demanding of us were indicative of the full range of things that we needed to be looking at.

While I don't mean, again, to suggest that we do not feel a direct and personal responsibility for safety, I think we did perhaps make the assumption that the NRC's overview was defining for us an envelope of performance and an envelope of accident considerations within which our operation and our designs would be adequately safe.

Again, I think it's a difficult thing to try to be terribly specific about exactly that interplay between our own

initiative and our presumptions of the total effectiveness of the regulations that were being applied to us.

CHAIRMAN KEMENY: Perhaps it might be helpful if I brought up a concrete example of it which we might discuss it in terms of. We toured your plant which certainly has some extremely impressive and very modern engineering equipment in it, and then we came to the control room in Plant 2, and I must confess I personally was shocked by it. To put it very mildly, it does not employ modern technology that one is capable of in the age of computers. You have a rather spectacular display there. You were there when we were witnessing a few alarms going off and depending on blinking lights. I think you will remember on the third or fourth alarm nothing blinked, at which point operators had to pull off those little indicator panels one by one to find out which light bulb burned out. That struck me as strange.

I noticed that the recording computer was running more than an hour behind time and that occurred during the accident also.

All of these seem to me about twenty years out of date. I'm wondering why a plant this expensive and this sophisticated would have so unsophisticated a control room?

MR. DIECKAMP: Sir, I would not disagree with your characterization of the technology that is employed. I would rather say that the technology that you see there tends to be

a natural progression of that which we have used, both in the fossil plants and I think moving in a similar vein towards the nuclear plants.

I would only add one other thought and that is that I think as we think in terms of our operators and their past and other experiences, we sometimes may be overly concerned about making too rapid departure in technology in bringing in something that is unfamiliar and that people are uncomfortable about.

Perhaps one of my colleagues would like to comment further on this. Jack or Bob?

MR. HERBEIN: I think to the extent that things have progressed over the time it took to build the facility, we are not that outdated with the equipment that we have. Unit 1 is in many respects similar to Unit 2. And the equipment in both units is comparable. They are both the same vintage plant. It does take eight to ten years to build a plant like Three Mile-2; from the time of design until installation checkout and final operation, things do change. But I wouldn't state that Unit 2 is outdated or behind the technology as it existed at the time the plant was designed.

CHAIRMAN KEMENY: That surprises me. For example, you'd say even ten years ago that you would feel the technology did not exist or have a computer that has enough storage memory that it would not lose an hour or an hour and a half worth of

information, or that you can't have on-line indicators when an operator could from a central control point see what alarms are going off, rather than depending on blinking lights that could burn out.

MR. HERBEIN: The alarm indications are available through an alarm typewriter, if it doesn't run behind.

CHAIRMAN KEMENY: Or if the paper doesn't jam.

MR. HERBEIN: That's true.

MR. DIECKAMP: Jack, I wonder if I could add: I think your comments relate to what you would conceive of as conventional power plant technology and I would read Dr. Kemeny as referring to the technology that one has seen in the space program or in military display systems or things of that sort which --

CHAIRMAN KEMENY: Or in a fairly simple university computing center.

MR. DIECKAMP: All right.

CHAIRMAN KEMENY: That costs a great deal less than a billion dollars. Commissioner Lewis.

COMMISSIONER LEWIS: I'd like to go back to the stuff characterized as a relief valve, and the indications we are getting now that other people are having trouble with similar things. There was the Nicholson (ph) letter, and so on. In some of our staff interviews with some of the people that work for Met Ed, it was indicated that you had a similar

problem in the time before you went on line. Could one of you tell me whether you had problems with that particular relief valve during the early period, the year before you actually went commercial?

MR. HERBEIN: We had a problem the the electromatic relief valve on the second unit, approximately March 29, 1978. At that time there was a power loss during hot functional testing when we were using pump heat from the reactor cooling pumps. There was no core installed at this time. The valve on a loss of power failed to open and did blow down to some lower pressure, perhaps 1200 to 1500 pounds.

Subsequent investigation with regard to the details of that occurrence indicated a problem with the direction that the valve failed when the power was lost. Power supplies were subsequently made more reliable and I believe additional logic was incorporated to prevent that valve from failing open on loss of power.

To that extent we thought we had resolved the problem.

COMMISSIONER LEWIS: But at that time you became aware, according to this earlier testimony that we had, that there was no way for the control operator to know whether the valve was open or shut. Is that correct? Were you made aware of that particular problem at the time in that year earlier that you talked about?

MR. HERBEIN: To the best of my understanding, that

is the case, and it was at that time that we installed the light on the console which indicates the order to the valve. It does not actually indicate the valve position.

COMMISSIONER LEWIS: Okay. That's what I was getting at. When you made those changes you went half-way, but you didn't go all the way, which would have made it possible for the operator to know that even though he sent the signal, the signal didn't come back. Is that correct? You didn't really make a change such as to make it possible for the control operator to know that this has actually taken place?

MR. HERBEIN: That's correct.

COMMISSIONER LEWIS: Why not?

MR. HERBEIN: I don't know that there's a good answer for that. I personally believe that with the information we had at the time, our assessment of the conditions and the change or fix, if you will, to the problem and its subsequent review by our management and technical team, we felt it was an adequate solution to the problem at the time. In retrospect, now it appears that some additional indication may have been warranted.

COMMISSIONER LEWIS: Were you trying to save a little money at that point, perhaps?

MR. HERBEIN: No, I honestly don't feel that it was a dollar savings that motivated us. I think it was a feeling that we had analyzed correctly the cause of the problem and had

taken appropriate steps from a technical standpoint to keep the difficulty from occurring in the future.

CHAIRMAN KEMENY: Commissioner McPherson.

COMMISSIONER McPHERSON: Let me ask either one of you again to go back to Mr. Haggerty's question. Did you all know about the problem that the Michaelson report addresses itself to--leaving aside the Michaelson report or the Novak memo or whatever, had you heard about the problem at the Davis-Bessy plant, the problem that is identified, as I understand it, giving you an inadequate reading on how much water there is in the reactor? Did you know about that problem that had been experienced at Davis-Bessy?

MR. HERBEIN: No, we did not; not specifically. I subsequently checked into our state of knowledge of that particular occurrence and found the Nuclear Regulatory Commission Clearinghouse document which summarites typical industry experience in power reactors. That document was circulated among the Three Mile Island staff and among the Redding corporate support staff. I guess because of the way the Davis-Bessy incident was written up in the report, it was missed by those who are assigned to review the report for experience that would be applicable either in our training program or to our technical people.

COMMISSIONER McPHERSON: You mean it was there but you couldn't pick it out of that. Is that right?

MR. HERBEIN: The information was there but we did not pick it out.

CHAIRMAN KEMENY: May I just ask Mr. Arnold: Were you in the same position that you were not aware of this problem?

MR. ARNOLD: That's correct, Mr. Chairman. I was not familiar with either the Davis-Bessy transient nor the Michaelson report until after the accident.

COMMISSIONER McPHERSON: May I ask generally, what is the practice in the Nuclear Regulatory Commission with respect to its licensees? When somebody has an experience such as they had at Davis-Bessy, how is that circulated around among the licensees and when they think it may be a serious problem, as apparently this one was, how do they go about underlining that and calling it to your attention?

MR. HERBEIN: The three principal ways that the Nuclear Regulatory Commission communicates with power reactor operators: Basically the bulletin, circular, and notice of occurrences at power plants are the mechanism by which they communicate information to various utilities. The bulletin is the strongest in the hierarchy of communication devices. Specific action is required and feedback report to the Nuclear Regulatory Commission must be given in a set time frame.

COMMISSIONER McPHERSON: This was not included in a bulletin, then?

MR. HERBEIN: No, this was not, prior to the March 28 incident, included in a bulletin.

The next communication device that is used by NRC is that of a circular. In that particular communication action is required but no formal feedback is required. However, the NRC does, on inspection, verify that action required has been in fact accomplished.

COMMISSIONER McPHERSON: It is a desirable but not necessary step?

MR. HERBEIN: No, it's action that is required but no formal verification with regard to completion is required back to the NRC.

The final device is a notice, and that is put out by the NRC to convey general information--information of interest and possibly information on which we should take action. In some instances an event will initially be noticed and then a circular will come out and then finally a bulletin, as the NRC's understanding of the incident or occurrence becomes more detailed and they get a more indepth and breadth of understanding.

CHAIRMAN KEMENY: Mr. Herbein, Did you say earlier that you heard about this on the 29th, is that right? Did I hear you correctly, that you did not hear about this problem until after the 28th? I thought somebody said the 29th.

MR. HERBEIN: I think Mr. Dieckamp mentioned --

CHAIRMAN KEMENY: Mr. Dieckamp mentioned the 29th.

MR. HERBEIN: -- that the NRC's --

CHAIRMAN KEMENY: In what form did that come on the 29th? Was that a notice or a circular?

MR. HERBEIN: I believe, Sir, that that was Bulletin 79-05.

COMMISSONER McPHERSON: That would be the bulletin, but you had an earlier notification of this which you just didn't pick up?

MR. HERBEIN: It was not formal notification. This is the Nuclear Regulatory Commission Clearinghouse document, a publication to which we subscribe because it does contain pertinent industry information. Our technical people do look through that and do review that.

COMMISSIONER McPHERSON: Is that put out by the government?

MR. HERBEIN: I'm not sure.

COMMISSIONER McPHERSON: Is that the Nuclear Regulatory Commission Clearinghouse document?

MR. HERBEIN: We believe that's a commercial document. The Atomic Energy Clearinghouse.

COMMISSIONER McPHERSON: I see. So to go back and clear it up, the NRC itself had never told you in anything before sent to you before March 28, 1979, about the Davis-Besse pressurizer problem, the problem on the B&W reactors with the

pressurizer. Is that correct?

MR. HERBEIN: To the best of my knowledge, that is correct.

COMMISSIONER McPHERSON: They had never written you anything to allert you to that problem?

MR. HERBEIN: As I understand it, that's correct, Sir.

COMMISSIONER McPHERSON: And the only place you had seen it was in a commercial document and you had simply not paid that much attention to it when it came through in that form. Is that correct?

MR. HERBEIN: We had not paid attention to it. I'm not sure that anyone saw it.

COMMISSIONER McPHERSON: What is the typical industry practice here? Don't you people get together and talk about the kind of problems you have on occasion in trade associations or in technicians meetings?

MR. HERBEIN: Yes, we certainly do.

COMMISSIONER McPHERSON: That problem never surfaced in some of those meetings?

MR. HERBEIN: Not to the extent that we remembered it and we took it home and acted upon it.

COMMISSIONER McPHERSON: What about your plant, as you say in your testimony here: You have a Plant Operations Review Committee and you have a Nuclear Plant Managemenet Review and all these are supposed to be addressed to safety.

Would they ordinarily pick up information of this kind? It has to do with your kind of plant; it has to do with, obviously, a very important safety feature which practically melted your plant down. Wouldn't that come to their attention?

MR. HERBEIN: That kind of information is fed into the plant in one method by the General Office Review Board where we have consultants and members of Babcock & Wilcox staff periodically meet to advise our company president on broad issues of nuclear safety and radiation protection for our personnel. We do through that group learn of industry experience in particular items that we should take action on.

However, the Davis-Bessy transient was not mentioned by that group to the plant staff. Also that Plant Operations Review Committee, the review committee backing the Corporate Technical Support Staff, also act on the kind of information that you mentioned. However, the Davis-Bessy incident was not picked up by either of those groups and conveyed to the plant staff or to myself as an item requiring further action.

COMMISSIONER McPHERSON: What would you have done had it been?

MR. HERBEIN: Certainly (we) would have reviewed the recommendations, examined the potential implementation and if, in my judgment and in the judgment of those that advise me, felt that it was appropriate, we would have proceeded to take some action. To speculate on just what we would have done

is just that--pure speculation.

CHAIRMAN KEMENY: Professor Pigford.

COMMISSIONER PIGFORD: Mr. Herbein, I think you, with regard to this Davis-Bessy information, you received that on March 29 in Bulletin 79-05. Is that correct?

MR. HERBEIN: To the best of my knowledge, that is correct.

COMMISSIONER PIGFORD: Now wasn't there attached to that bulletin attachment what they call A, B, or C, which in fact was a communication sent out by NRC some time earlier, in either January of 1979 or '78, I'm not sure, concerning the Davis-Bessy incident of over maybe a two-page memo also giving some interpretation of it, sent out by NRC to the licensees? Is that correct?

MR. HERBEIN: Sir, I couldn't speak directly to that. I would have to look at 79-05 to examine the attachment about which you are speaking.

COMMISSIONER PIGFORD: Yes. Of course, I'm not sure I'm always correct in my understanding, but let me assume that it might have come in January of one of those years, at least prior to the accident. Then where would it have gone to within your organization?

MR. HERBEIN: This bulletin?

COMMISSIONER PIGFORD: Yes. Not 79-05; the attachment to it.

MR. HERBEIN: Any bulletin would come in to my licensing staff in Redding. It would also go to the plant staff. The document would be read very carefully for specific action required, and that action would subsequently be assigned and would be put into the tickler file and the commitment dates would be met.

COMMISSIONER PIGFORD: Yes, and I gather maybe the point is, just assuming for a moment it actually was sent out at the date I'm suggesting, that NRC didn't request any specific response to it. I gather that's the point you're making, isn't it?

MR. HERBEIN: Again, of the three kinds of documents, there is one that requires a response: That's a bulletin. A circular and notice require no response.

COMMISSIONER PIGFORD: Yes. With regard to the Michaelson report, I'm going to again recite my understanding of the dates and if I'm incorrect, please correct me. It said that he first wrote this as a rough draft in 1977 while working for TVA.

MR. HERBEIN: I believe that's correct, Sir.

COMMISSIONER PIGFORD: And then he sent some kind of copy, I don't know if a draft or formal, to the ACRS in early 1978. Do you know about that?

MR. HERBEIN: I know that there was an exchange of communications. I wasn't aware that he sent it to the ACRS.

COMMISSIONER PIGFORD: Well, and he sent a copy to B&W. Do you know about that?

MR. HERBEIN: I was subsequently made aware that his report was sent to B&W.

COMMISSIONER PIGFORD: Recently made aware of that?

MR. HERBEIN: Yes, Sir.

COMMISSIONER PIGFORD: B&W then, to your knowledge, did not forward that information directly to the people who own their plants?

MR. HERBEIN: Not that I saw it, Sir.

COMMISSIONER PIGFORD: And it is also suggested that it was sent, perhaps informally, to some people within the Nuclear Regulatory Commission in 1978. Are you aware of that?

MR. HERBEIN: Just generally, Sir.

COMMISSIONER PIGFORD: Now, let's take the ACRS. When such a subject comes up, and apparently this document was directed towards specifically the B&W reactors, does your organization have some way of keeping in touch with what the ACRS is considering? At least I'm assuming that the ACRS had some meeting to discuss that Michaelson document; I may be wrong. If there were such a meeting, would your company have a way of knowing about it?

MR. HERBEIN: We would have a way, but I'm not so sure that it would be a formal method. I know that the company does receive, at least I believe we receive, notices of ACRS

meetings and the subject matter. To the extent that we would need to be aware or take action, we would rely on some of our consultants and some of the legal firms who do keep an eye on the ACRS proceedings.

MR. ARNOLD: Dr. Pigford, I might just add a little bit to that. Within my organization within the GPU Service Corporation we have a licensing section that does routinely follow issues that are before the ACRS.

COMMISSIONER PIGFORD: Do you know, Mr. Arnold, if this one then if the Michaelson report came up during 1978 and then that information was forwarded to your company?

MR. ARNOLD: I do not know. I frankly doubt it because I think had there been significant discussion on it I would have been made aware of it.

COMMISSIONER PIGFORD: Do you have a copy of the Michaelson report now?

MR. ARNOLD: Yes, Sir, I do.

COMMISSIONER PIGFORD: And does it address any other issues besides this one of the interpretation of the pressurizer level? That's too broad. Does it address any other issues that are pertinent to the safety and to the Three Mile Island accident, besides the pressurizer level?

MR. ARNOLD: I think I'd be inclined to characterize the Michaelson report which I've read, but I can't really claim to have studied it, but I would characterize it as looking at

the problems a plant of the B&W design may get into in the event of a small loss of coolant accident from the steam space of the pressuriter. And it assumes loss of one train of high pressure injection, as I recall. And it identifies the difficulty with the remaining train of high pressure injection to provide sufficient makeup to the plant with a pressure that remains as a result of the size of the break and the location of the break, and the possibility that there may be difficulty encountered in continuing to utilize the steam generator for removal of heat.

So, to that extent, I think there are a number of issues that are raised within that report.

CHAIRMAN KEMENY: Professor Taylor.

COMMISSIONER TAYLOR: Mr. Dieckamp, I'd like to ask you or one of your colleagues to summarize for us what you believe to be the present state of the fuel in the TMI core inside the pressure vessel. If you can tell us what you believe to be the fraction of the core that has had the uranium oxide fuel exposed directly to the water, in other words, losses cladding completely, and, to the extent you can do this in a summary way, sort of quantitatively tell us what your picture is and what's out there right now.

MR. DIECKAMP: Dr. Taylor, I should start off by saying that our staff has not done any analysis of the specifics of the core heat apra (ph), the zirconium water reaction, or

what state it might be in. We had depended I think almost totally on work that has been done by B&W, members of the Industry Advisory Group, specifically some participants from EPRI, and EG&G and I think we also have seen some of the results of the NRC attempts to characterize the state of the core.

From those pieces of work, the ones that I am familiar with as of three or four weeks ago, it is my impression that there is a general feeling that of the order of 50 to 60 percent or so of zirconium cladding was involved in the zirconium water reaction. I'm not sure that there is any way to be specific about the degree to which that reacted cladding or the resulting zirconium oxide is all fractured or spawled off or to the extent some of it still exists as a cladding hull, but in the oxide rather than in the metal form.

There are some postulates that the fuel pellets from a significant number of assemblies may, as a result of losing the mechanical integrity of the cladding, have kind of fallen out on to the grid spacers of the fuel assemblies themselves. Some people think in terms of models that involve layers of beds of pellets, things of that sort. Some of those kinds of things were attempted to be deduced from looking at the temperature differences of some of the end core thermocouples under various cooling conditions.

One of the things we did find, I think, on the

transition from the forced convection with just one pump operating down to the natural circulation condition, we find that the temperature distributions are more uniform than what seemed to be the case under forced convection. It certainly indicated to us that the forced convection was imposing a non-uniform flow distribution through the core.

Again, I think that the ability to reconstruct, recreate or visualize the exact state of the fuel elements is very limited on the basis of the physical data that are available to us.

But what I've just said, I think, represents my understanding from the reports that were available a few weeks ago.

COMMISSIONER TAYLOR: Now, presumably, this information developed by B&W and the other organization you referred to, EPRI and possibly NRC, was reconstructed or was constructed from data that some of which were observed during the course of, let's say, the several days of the accident, the early stages of the accident also. In connection with those data, what is the highest temperature that you know of that has been measured in that core any time? I mean measured, not incurred.

MR. DIECKAMP: I am not positive of that. There are information available from Mr. Miller of our staff who is scheduled to testify tomorrow, but it is my understanding that during the course of the morning on the 28th he asked a member

of the staff to go down into the cable spreading room and attempt to measure the millivolt readings in some thermocouples that were terminated there. If one takes those millivolt readings and if one converts those to temperature, whatever thermocouple they are, and makes no assumption that theres any kind of a malfunction, other kind of millivolt source or shorts or shunts, then one implies temperatures of the order of 2400 degrees Fahrenheit. I think at the same time those readings showed an adjacent channel slightly in excess of 200 degrees at the time people were quite suspect of the meaning of that measurement, whatever it was measuring.

COMMISSIONER TAYLOR: Roughly, when were those measurements made; that is, when millivoltmeters were put on to the thermocouple terminal, roughly?

MR. DIECKAMP: Let me ask whether Herbein knows. Again, I think your best witness on this will be Gary Miller tomorrow morning. Jack, do you know when?

MR. HERBEIN: No, I don't know specifically.

COMMISSIONER TAYLOR: I guess we'll ask tomorrow. I'd like to ask now, when did you become aware of at least the high likelihood that a large fraction, not one percent but at least 10 or 20 or perhaps 30 or 40 percent, of the core had lost its cladding and therefore the barrier, the first barrier between the fission products and the cooling water running through the reactor, when did you first come to believe that

that had happened?

MR. DIECKAMP: I can trace my own awareness in a few steps. When I first talked to Mr. Arnold and to Mr. Creitz on Wednesday morning in the time period of 9:00 to 10:00 a.m., they made mention to me that there was the likelihood or the probability of fuel damage. My immediate reaction to them was that I felt that we should be careful about that observation because it was my understanding that the emergency cooling system was supposed to prevent that from happening.

My next level of awareness came on Thursday, the day after the accident, when from Mr. Herbein there was general description of the state of the thing as involving significant fuel damage.

I think to get to the next level of understanding of converting significant fuel damage into 50 or 60 percent of the cladding being reacted, I think we have to go to the time period of Friday or Saturday at which time there was an ability to estimate the amount of hydrogen that might have been reacted in the containment building and also the amount of hydrogen in the primary coolant system, the bubble, hydorgen bubble that was present, and from back calculating that amount of hydrogen to infer 50 or 60 percent of the cladding having reacted.

COMMISSIONER TAYLOR: On this first --

CHAIRMAN KEMENY: One moment, please. Mr. Arnold, I gather you were one of the people who told Mr. Dieckamp on

Wednesday morning of the possibility of damage to the core. Did I understand that correctly?

MR. ARNOLD: Yes, Sir.

CHAIRMAN KEMENY: And that Mr. Dieckamp responded that his understanding was that high pressure injection system should prevent that. Did you tell Mr. Dieckamp at the time that the high pressure injection system was hardly used at all during the accident?

MR. ARNOLD: No, I certainly didn't. I was not aware of the details of the operation of the high pressure injection system.

CHAIRMAN KEMENY: I see.

COMMISSIONER TAYLOR: Going back to your first hint, let's say, that there may have been fuel damage, I guess you said Wednesday morning at 9:00 o'clock or something like that, what was thought to be the possible character of that damage and the cause, other than simply just overheating? Specifically, was it already at that time being speculated, suggested possibly, that temperatures might have reached the point at which the zirconium cladding in water or steam might have reacted? Was there any suggestion of that possibility Wednesday morning?

MR. DIECKAMP: No suggestion of that kind came to my attention. It was simply, I think, a characterization that fuel damage had to have occurred in order to account for the kind of radiation releases that were observed in the plant. To

my knowledge, there were no inferences of how much damage or what mechanism. None were conveyed to me. If I tried to recreate my own presumptions, they probably would have thought in terms of local overheating and some swelling and cracking of cladding.

I don't think the possibilities of hydrogen or zirconium water reaction entered my mind on that first day.

COMMISSIONER TAYLOR: Now, on the matter of, which I guess was on lots of peoples' minds certainly by Friday or Saturday, the question of whether there had been any actual melting of the core, I'd like to ask two questions. First of all, are you aware of the existence of a mixture, a eutectic of uranium oxide and zirconium or zirconium oxide which has a substantially lower melting point than uranium oxide itself? As I understand it, this eutectic, when it exists, would involve uranium oxide fuel material if it had formed, that this melts at a temperature about 1,000 degrees Fahrenheit below the melting temperature of the uranium oxide.

Has this been discussed with you, suggested to you, is it in your consciousness at all, let's say, that the possibility of the formation of something that did in fact melt? Has that come to your attention?

MR. DIECKAMP: I certainly had no prior awareness of --

COMMISSIONER TAYLOR: Let me say, as of right now.

MR. DIECKAMP: I recall one occasion during discussions with the Industry Advisory Group personnel of some mention of a zirconium uranium oxide eutectic and the reason I recall is because my own reaction was one of surprise that there would be such a thing. My own reaction was: doesn't the oxide form of the uranium prevent significant reaction with the zirconium? That's the extent of that and the discussion did not go to the point of the details of the reduction and the melting point or things of that sort.

COMMISSIONER TAYLOR: Well, let me ask this, then. Have any of you or are any of you aware of a preliminary set of calculations by the NRC Reactor Safety part--I don't know whether it's the Office of Reactor Safety--to the effect that this may well have happened? Were you aware of a written memorandum to that effect?

Let me say the reason that I'm asking this is that I became aware of this about 10 days ago, and it was the first I had ever heard of this eutectic. I was very surprised and it put in my mind a rather different picture on how one would have felt if one knew this might happen during the time at which you began to have a handle on the quantitative core damage. I think one might have felt somewhat differently.

Have any of you seen a written account of this attempt to muddle the situation in the core that has led to--I don't think it's fair to NRC to say a conclusion to this effect--

but at least a possibility that this may have happened?

MR. DIECKAMP: If we can indulege the word "awareness," my awareness, again, is not of the specifics of that and I have not seen the memorandum myself, but I was told of an analytical attempt or effort on the part of either the NRC or some supporting national lab to attempt to add together all of the energy contributing phenomena and the specific one mentioned to me at the time was, I gather, that the zirconium water reaction is exothermic and therefore could also have added some energy to the system and might have brought things closer to melting.

I don't recall, though, that there was a specific conclusion or credible conclusion relative to melting. I don't recall any conversation to that effect.

CHAIRMAN KEMENY: Commissioner Lewis.

COMMISSIONER LEWIS: I'd like to address this to Mr. Creitz, we haven't heard from him today. From what we have been able to see, there are a lot of things that normally are just not working in that plant, and maybe this is so in other plants. We found that gauges were leaking and therefore the operators didn't believe what they were seeing. We found that valves that were supposed to be open were closed; that other switches were hidden by tags, and so on.

What I would like to find out is what is your attitude toward the running of the plant, a nuclear plant? In

other words, is your priority first of all, keep it going so we can make money; and second, make sure the equipment is running; and then third, maybe we'll worry about the possibility of reactor damage and radiation? What is the philosophy that is passed down from your office down to the people who work there?

MR. CREITZ: Our philosophy, number one, is that safety is on top of the list; it has to be. We would not want to operate the plant if we didn't think it could be done safely. I'm sure as a result of this accident we certainly are going to learn many things and we would feel that from this learning experience that the plant should be in a safer condition. But safety has to be a number one priority.

COMMISSIONER LEWIS: Well, if that has been your priority, why were so many things not functioning or considered unreliable by the operators? In other words, is there a line at which you say it's okay to let certain pieces of equipment not be in an operative condition? Because that is really one reason why the operators were confused at the time of this accident, is that they saw a guage and they said "that's been leaking; we're not going to believe that." They tried to turn on a pump and it didn't work. Something was shut that should have been open.

I mean, it gives the impression to someone coming into this industry that you really didn't care enough to make

sure that those things were working. Then when you had an accident, you couldn't handle it.

MR. CREITZ: It does give that impression when you look at the collection of items that you are referring to, and yet in looking back during the test year, the year before the unit was put up to 100 percent of power, looking back over the testing procedures that had occurred, I believe we would agree that it is a fairly extensive testing program which is used before the unit is taken up to that level.

I would like to say one thing. I don't believe that it's a truly fair representation to say that the operators felt that a lot of their indications were unreliable and that much of their equipment was inoperative. I believe, in retrospect, it does appear now that the pressurizer level indication was ambiguous and misleading. I don't believe that the operators felt that that was the case at the time this accident occurred. I feel that they did believe their instruments and one of the difficulties they had was trying to resolve this increased level in the pressurizer, this solid water indication with the decreasing pressure. That was an experience they had not been put through before, one that they had not necessarily been trained on.

CHAIRMAN KEMENY: Mr. Herbein, as an example, when they were asked about the tests which were going out of that famous PORV valve, they said well, they weren't paying any

attention to that because that valve leaked normally.

MR. HERBEIN: Well, there has been with Unit 1 and with Unit 2 some history of leakage past the electromatic relief disconceit. To the extent that they viewed the tail pipe thermocouple indications and saw that they were on the order of 220 or 230 degrees and attributed that to valve leakage, I can understand that. I'm not sure that I agree, certainly in retrospect, that that was a proper assumption. But I can understand why they thought that.

But I don't believe that their misinterpretation of information indicates they felt that the indications available to them were unreliable.

MR. DIECKAMP: Ms. Lewis, I wonder if we could return to the dollar incentive, because it is one that comes up many times. The point that I would like to make is certainly the management, and I think the operators, too, take great pride in trying to run the plant efficiently in order to serve the customers with the low-cost energy that it makes available.

The key point that I would want to make to you is that if the plant operates half of the time or three-quarters of the time--50 percent capacity factor or 75 or 80 (percent)--it makes no difference to the bottom line income statement of the company. All the differential in terms of produced energy flows directly to the customers in terms of lower cost available energy. There is no profit impact on the company under

utility regulations.

CHAIRMAN KEMENY: Commissioner McBride.

COMMISSIONER McBRIDE: I'd like to ask a question as to when Unit 2 was put on line and acting commercially?

MR. DIECKAMP: We declared the plant commercial on December 30 of 1978 and I should point out, though, that that is a word of art. I'm sure you are aware the plant received its operating license on February 8, 1978; went critical, that is, first chain reaction, on March 28, and produced net electrical power a few weeks thereafter.

When I refer to the commercial date being a word of art, what that really is is a time at which we changed the bookkeeping so that we are no longer capitalizing the operating expenses or the financing charges and we begin to charge those directly and begin to reflect, hopefully though regulation, that the costs of the plant are now being prorated over the customers who are enjoying the output from that plant.

But it has nothing to do with the plant's operability or the plant's safety. Sure, it has to do with operability in the sense that you don't want to begin that before you feel that the plant is an effective producer of electricity.

COMMISSIONER McBRIDE: Was the date December 30 selected because of any particular monetary consideration that might be coming towards the company? What was the circumstances, then, that said December 30 is the day, instead of a

month later, 60 days later, or whatever?

MR. DIECKAMP: December 30 tended to be a significant date in terms of having the plant in service during what, under utility regulation, is called the "test year." That is the time period during which costs and expenses and investment are all normalized in order to determine the rates that will be used in charging to the customers. The test year tends to be significant because of things that occur outside of the test year, it offers a legal opportunity to exclude those costs.

But, again, in terms of the plant's operability and its testing, there was no impact of that date.

COMMISSIONER McBRIDE: It has been stated that one of the considerations for that date was a $40 million tax write-off and participation in a $49 million rate increase. Was that any consideration?

MR. DIECKAMP: The $49 million rate increase is the one that I was making mention of in terms of the concepts of the defined period being a test year that the regulators use. With respect to the other $40 million, which I presume is the investment tax credit, again, that item flows all to the consumer and provides no net benefit to the company and would be available to the consumer irrespective of December 30 or January 1 or the like.

COMMISSIONER McBRIDE: If I may ask this question: There has been some discussion as to the number of days that

the plant had been closed, from March 28, 1978 up to December 30 because of repairs. Do you recall the number of days that it had been closed for repairs during that period?

MR. DIECKAMP: I don't recall the specific days but the plant did encounter some very definite problems during the startup program and I think it might be appropriate for Mr. Arnold to enumerate what those major time blocks were associated with.

MR. ARNOLD: I haven't reviewed those recently, but let me see if I can recall.

COMMISSIONER McBRIDE: Was it 195 days closed for repairs.

MR. ARNOLD: As far as how many days we were down for repairs. April 25, I believe, through September 18 would be close. It depends on all the days that were included. But I wouldn't be surprised at the number of days which the plant was down subsequent to receiving the license prior to commercial was anywhere to 195 days. I think the important perspective within which to place that, though, is that the plant had, prior to even receiving its operating license, a carefully thought-through and very detailed test program defined for the eventual startup of the plant. That test program was carried through to its completion. And the results of that test program were reviewed, not only internally by us but in many cases by the NRC. There certainly was no

reservation in my mind as to the readiness of the plant to operate. In fact, had it not been declared commercial, we would have then done nothing differently from an operational standpoint. The plant would have been placed on the line; it would have delivered power into the grid, and from the plant viewpoint, they would not have known the difference; in fact, did not know the difference.

CHAIRMAN KEMENY: Mr. Lundin.

MR. LUNDIN: Mr. Dieckamp, you stated earlier in your testimony, I believe, that Mr. Arnold was responsible for plant design. Is that correct.

MR. DIECKAMP: Yes.

MR. LUNDIN: Then, Mr. Arnold, could you describe for us briefly the rationale that is used for sealing or isolating containment on the basis of internal building pressure rather than some other signal such as radiation level or actuation of the emergency cooling system?

MR. ARNOLD: I think in a general sense, Mr. Lundin, that the selection of the four pound signal for building isolation provides assurance that the need for, and that signal is used in conjunction with a low pressure signal, and it identifies the need for building isolation within our analyses in the event of the loss of coolant into containment. In other words, I believe the analyses showed that if we were not at the four pound in containment pressure, then there

probably was not a significant, at least, release into the containment building.

MR. LUNDIN: Do you feel today in retrospect that looking back on the accident that isolating on a 4 psig pressure is the right way to continue?

MR. ARNOLD: That's a subject that we're reviewing right now. I think it's very important to realize that the containment isolation does put the plant in a condition where many of the normal systems or the systems that normally provide support for the reactor would be in a off normal condition and I think that needs to be fully analyzed.

We are looking at the advisability of changing the design criteria for isolation. But I don't think the answer is that obvious.

MR. LUNDIN: Thank you. What is your view today about how radioactive substances did actually escape from a nuclear system that is supposed to provide containment in an emergency?

MR. ARNOLD: I'm sorry, Sir. I didn't hear.

MR. LUNDIN: How do you view today or postulate the method of release of radioactive substances from a plant under emergency conditions? How did the radioactivity get out into the biosphere during this accident?

MR. ARNOLD: I think the major pathway was, and let me just preface my remark by saying that this is still a matter

that we're investigating--we are not confident that we have eliminated all the possible pathways as being sources for transfer of radioactivity from the containment to the auxiliary building.

But quite clearly, substantial amounts of radioactive coolant were let down from the reactor coolant system into tanks in the auxiliary building during the several hours subsequent to the failure of fuel. I think that a major part of the radioactive transport can probably attributed to that pathway.

MR. LUNDIN: And then it had to get from the ausiliary building out into the surrounding atmosphere. Have you speculated on that at this time?

MR. ARNOLD: Well, once it was in the auxiliary building, there was the potential for it to release the volatile radioactive materials from the liquids, either through packing leaks, pump seal leak-off, those types of pathways. That would have been collected in the ventilation system of the auxiliary building and in the fuel handling building, and subsequently vented out through the exhaust staff. The iodine was initially almost completely removed, but the noble gas releases during the first couple days were substantial.

MR. LUNDIN: Thank you. We also noticed, Mr. Arnold, that there are several possibly significant differences in the design between the Unit 1 and Unit 2 of your plants. For

example, the feed water by-pass around the polishers occurs automatically in Unit 1 and requires a manual human intervention, as I understand it, in Unit 2. With that as an example, could you comment on how differences in your plant such as this are resolved or rationalized from a safety point of view?

MR. ARNOLD: I don't think that we specifically compare the design of Unit 2 against the design of Unit 1 to rationalize safety issues. I think, as in the licensing of any plant, the safety evaluation of the design is based upon comparison with NRC regulations, the safety review plan that the NRC has, the codes to which the systems must comply with. I think that that process proceeds independently of the particular design of another unit.

MR. LUNDIN: The design of each plant is sort of laid up against regulation and licensing requirements rather than prior experiences in other plants or engineering and operational evaluations of different plants independent of the regulatory requirements?

MR. ARNOLD: I would suggest that the regulatory requirements encompass those experiences.

CHAIRMAN KEMENY: Mr. Arnold, sticking to that specific example, why was it decided to make the by-pass of the polishers not automatic?

MR. ARNOLD: I'm sorry, Dr. Kemeny, but I can't answer that specifically.

CHAIRMAN KEMENY: Several Commissioners have asked for the floor, and I saw Commissioner Pigford first.

COMMISSIONER PIGFORD: This is directed to Mr. Arnold. I want to return to the issue of the earlier indications from Davis-Bessy of possible problems in interpreting pressuriter level, and also on failure of relief valves, I finally located what I thought existed in the NRC Inspection Enforcement Bulleting 79-05, dated April 1, actually. What they are presenting to the people to whom they sent this is in fact what is entitled "excerpt from memorandum entitled 'conveying new information to licensing boards' concerning Davis-Bessy units 2 and 3 and Midland units 1 and 2." And it is dated January 8, 1979. So that, indeed, says it went to licensing boards and my memory was incorrect.

However, in that document it does refer to an inspection and enforcement report 50-3467806, which I suppose is a 1978 report. Don't inspection enforcement reports go out to the licensees?

MR. ARNOLD: The inspection and enforcement reports go into the public document room and I believe that they are sometimes summarized, or portions of them, at least, are presented in the Clearinghouse publication that Mr. Herbein referred to earlier. They are not routinely circulated to all licensees as far as I know.

COMMISSIONER PIGFORD: Mr. Chairman, I would like to

suggest one thing as follow-up, if it's permissible, to ask these people to determine from their records if they received that inspection and enforcement report, when, and what its history was through the review organization.

CHAIRMAN KEMENY: Mr. Arnold, I do request that from you.

MR. ARNOLD: We will certainly attempt to do that.

CHAIRMAN KEMENY: Thank you. Next, Commissioner Haggerty.

COMMISSIONER HAGGERTY: On March 28 Unit 2 was operating at 97 percent power. What kind of events with respect to that, for example, would determine whether you could declare a unit commercial or not on the previous December 30? What were the criteria that would make you say on December 30 the unit was commercial?

MR. DIECKAMP: There are not specific criteria that are set forth in any kind of document. There are Federal Power Commission rules, however, that say that within 120 days of the first power operation of a plant it must be declared commercial, and by that I mean the bookkeeping changed; or one must provide to the Federal Power Commission specific explanation of why not.

Since this was a matter, though, in our rate proceeding of considerable interest, we set forth to the Pennsylvania Public Utility Commission some time I think in

the middle of 1978 a very detailed plan for the test program that we said that we would accomplish prior to declaring the plant commercial. So, in effect, we asserted our own set of criterian, and in general, those criteria were to adopt the groundrules or the test requirements that had been set forth in the plant's license as items that had to be completed precedent to operation at full power.

So then when we had completed those tests, we were in a position to declare that plant commercial.

COMMISSIONER HAGGERTY: Were you operating at full power in December?

MR. DIECKAMP: We operated for a very brief time at 100 percent of power. This, again, gets to be a very narrow technical detail. We had a detail problem in terms of flow instrumentation and specific limitations in the technical specifications relative to that flow, and I think Bob Arnold or Jack Herbein would be able to comment on that in more detail.

MR. ARNOLD: If it is desired. But the effect of it was to limit us to about 97 or 98 percent flow and we had operated at that higher level in December prior to going commercial.

COMMISSIONER HAGGERTY: So from an operational standpoint, there was no real substantial change from December 28 to March 28?

MR. ARNOLD: No, Sir; that's correct.

CHAIRMAN KEMENY: Professor Marrett.

COMMISSIONER MARRETT: I'd like to return to a comment of Chairman Kemeny's earlier question dealing with the control room. I believe in response to his question you indicated that the control rooms in both TMI 1 and 2 are highly competitive, or they are equivalent to what you would find in other utility plants, is that right, other primarily fossil fuel plants, so that there's little difference in terms of the state of the art?

MR. HERBEIN: Nuclear or fossil; I would say they are comparable.

COMMISSIONER MARRETT: But that these are not comparable to plants that are found in the other settings he mentioned--the Navy reactor program, other university research settings; is that -- ?

MR. HERBEIN: I couldn't speak to the research program settings. And the analogy between commercial nuclear plant and a Naval propulsion plant, in some respects, might be valid, but in general I don't believe it is.

COMMISSIONER MARRETT: But you were suggesting that there probably are advances in computing that your plants have not kept up with, if I could put it that way.

MR. DIECKAMP: Ms. Marrett, I certainly was willing to accept the thesis that there are technologies available that

relate to data simulation and data display that could be used to advantage in these plants that we are generally not using today.

COMMISSIONER MARRETT: I'd like to ask, what becomes the relevant basis for comparison? Are you saying primarily that for the nuclear plants it is really what's going on in the fossil fuel plants and it's a matter of asking how far ahead are we of the fossil plants in some matters of design? Is that the kind of comparison?

MR. HERBEIN: No, I wouldn't say that. I would say it's what has been the experience in the nuclear plants that have gone on before the one we are about to operate or are currently operating.

COMMISSIONER MARRETT: Let me ask more specifically having to do with the structure of GPU and the nuclear plants within GPU. As I understand it, most of your plants are fossil fuel plants, that most of the electricity is generated by coal and oil and that nuclear energy represents about 34 percent, I believe that's what your report indicates. Is that --

MR. DIECKAMP: I think that's probably correct for 1978. We probably had close to 60 percent coal and slightly more than 30 percent nuclear. In 1979 on a forecast basis, had TMI been in service, we would have been expecting about 40 percent of the energy to come from nuclear.

COMMISSIONER MARRETT: Suppose I said that some might

speculate that perhaps GPU is better equipped technically, that is, in terms of staff, to handle questions of safety that might arise in the fossil plants than in the nuclear plants. That's a question in a sense, but I guess I'd like to know more concretely how do you handle safety questions that might arise in those plants differently from the kinds of things that might occur in your other plants?

You mentioned, for example, in your testimony the existence of a nuclear plant management review. Are managerial issues different for that management review team than might occur for your other plants?

MR. DIECKAMP: Well, of course, you understand that we completely lack the equivalent of a Nuclear Regulatory Commission in the fossil area. In that case our prime safety regulations relate to the Occupational Safety and Health Administration (OSHA) and to meeting the various and sundry aspects of the pressure vessel and boiler code that are required for high pressure and fired vessels.

We just have a completely different total structure in relationship to safety in the nuclear business than we do in the fossil area.

COMMISSIONER MARRETT: I understand there would be differences, but I guess that leads me to the questions of you're not responding only to the regulatory agencies, are you? That is, aren't there safety concerns beyond what NRC might

raise with reference to the nuclear plants, or that OSHA may raise with reference to the other plants? Are there routine kinds of matters that you undertake in your plants that go beyond having to meet the regulations?

MR. DIECKAMP: Jack, would you like to comment?

MR. HERBEIN: Well, I think that there certainly are. We've got a general office review board which is composed of consultants and people with a wide array of experience who do come in and review plant operations and activities and advise our company president on matters related to nuclear safety and radiation protection for personnel. We do have the nuclear management review committee which Herman mentioned, which consists of the operating company presidents and vice presidents of generation and Mr. Dieckamp, and they do come to the nuclear stations on an annual basis and review indepth and in detail plant operational specifics and certainly safety is one of the areas that they probe and examine.

So I would say that we do certainly go beyond the mere letter of the law.

CHAIRMAN KEMENY: Commissioner Trunk.

COMMISSIONER TRUNK: I'd like to address my question to Mr. Dieckamp and Mr. Creitz. United Engineers built Unit 1 and I'm under the impression they started Unit 2. Why did you change construction companies mid-stream?

MR. DIECKAMP: United Engineers was the constructor,

that's the brick and mortar and pipe welding people, and they constructed all of Unit 1 and I would just off-hand say somewhere between 95 and 99 percent of Unit 2. It was only towards the very concluding stages of Unit 2 that we felt that it would be beneficial to the timely completion of the job to make a transition from UEC who were not planning to have a continuing role on the site to the organization that we did expect to be there in a continuing maintenance role. So we felt that by making the phasing in the latter stages of the construction, we would bring into play that organization that would be there on a continuing basis to assist us in plant maintenance.

COMMISSIONER MARRETT: But they were so close to finishing. Do you think it was wise to bring in another construction company and say here are the welds, you weld to what was welded there already, you know. Each company works a different way. Do you think they did as good a job as United Engineers would have done had they finished?

MR. DIECKAMP: I know of no reason to say they did not do as good a job, and Mrs. Trunk, certainly there are some management subjective judgments that are made in a case like that, and as I say, the trade-off becomes the one of phasing out the organization who has everything to lose through completion versus bringing in the organization who needs to gain familiarity in order to be there on a continuing basis. The exact timing of that transition certainly is one of judgment

and I couldn't prove to you that our approach on Unit 2 was absolutely right. On the other hand, I don't feel that it was wrong. I don't know; Bob, do you have any comments?

MR. ARNOLD: I'll just mention a couple of subjective items on it. For one thing, the new organization has a great deal of interest in doing a better job than the one that was there before. I think also pertinent to that decision is that the final 1 to 2 percent, which is really what we're talking about as far as how much construction work had to be completed, was much more the nature of maintenance work. It was completion of what we would call punch list items predominantly, which is much more akin to and lends itself to working as maintenance work is manageed as opposed to major construction effort.

COMMISSIONER MARRETT: It is just that Unit 2 has the problem; Unit 1 has been working fine, you know.

MR. ARNOLD: Well, we did the same thing on Unit 1. UEC stayed on the site, though, because they were working on Unit 2. But prior to completion of the construction 100 percent, we phased in the maintenance contractor.

CHAIRMAN KEMENY: Professor Taylor.

COMMISSIONER TAYLOR: As I understand from your testimony, by some time Thursday evening, certainly by Friday morning after the accident, you had a pretty clear picture that you had high temperatures in the core, had probably lost

a considerable amount of cladding, had a hydrogen bubble inside the pressure vessel, and my question is, given that picture that I gather was qualitatively in all your minds, did you then have any discussions, formal or otherwise, with either members of NRC or among yourselves of the question of whether or not to make that information public?

Let me add one point, and that is that my impression, trying to follow closely what was being said publicly at that time, made no mention of zirconium, the zirconium water reaction of any temperatures in excess of about 700-800 degrees Fahrenheit, and I have no indication that the media were directly or indirectly informed of what I gather was then knowledge about the situation as far as the fuel was concerned in the reactor.

So I want to go back to my two questions. Did you have any discussions among yourselves about what to do about making those facts public, or judgments public, either among yourselves or among NRC?

MR. DIECKAMP: In that time period of Friday to Saturday, Jack, if I recall, the company was still meeting with the press and reviewing the situation. I'm not sure exactly when it was that the NRC took over formally in the business of communicating to the public. I suspect it was in the Saturday-Sunday time period where that occurred. I will state for myself that I know of no discussion with the NRC relative

to "let's not talk about that." Jack, you were doing a lot of talking on Friday.

MR. HERBEIN: Yes, there were no discussions between myself, Mr. Dieckamp, Mr. Arnold concerning what do we tell the public and what don't we tell the public, or any further discussions between Met-Ed and the Nuclear Regulatory Commission on the same subject.

I primarily handled communications with the media and can say with sincerity and honesty that I conveyed to them the knowledge and understanding of plant conditions and events that I had at the time. To the extent that that later turned out to be non-factual or inaccurate in retrospect, I can only say that we did the best we could with the information and circumstances as we understood them at the time.

COMMISSIONER TAYLOR: Did you believe that there had been extensive core damage at any time before the Sunday following the accident, April 1? Did you believe there had been extensive core damage before then?

MR. HERBEIN: It depends on what you mean by extensive. I knew that we certainly had --

COMMISSIONER TAYLOR: More than 10 percent of the cladding lost.

MR. HERBEIN: I couldn't really speak to a percentage. I didn't become aware of the 40-50 percent kinds of numbers that have been discussed here in this meeting until many days

after the event.

COMMISSIONER TAYLOR: Could you recall roughly how long after the event you did become aware of these numbers more like 40 or 50 percent than a few percent?

MR. HERBEIN: Well, I would say it was well into the second week when we had analysis back on our coolant sample and Industry Advisory Group had made calculations based on information that they were able to glean from the records. So I can't speak with any certainty, but it was -- My perception of the conditions in the core did change as the incident progressed. Certainly by Saturday I was aware that we'd had fuel damage of a significant amount.

COMMISSIONER TAYLOR: What would you say was significant at that time? What did that mean to you?

MR. HERBEIN: I think any time that we have fuel failure that is over one percent, I think that's significant.

COMMISSIONER TAYLOR: So you thought it was over one percent, then?

MR. HERBEIN: I thought it was over one percent, yes, Sir.

COMMISSIONER TAYLOR: Did you tell the media anything about this that weekend?

MR. HERBEIN: I believe I may have conveyed to the media as early as Wednesday afternoon that we had failed fuel. I'm not sure if I gave them a percentage. I may have indicated

that I felt that it was on the order of 1 percent. But I don't specifically remember attempting to quantify based on the information I had exactly how much fuel had failed at a given point in time.

COMMISSIONER TAYLOR: Okay. Thank you.

CHAIRMAN KEMENY: May I suggest to the Commission that we might limit this portion to not more than ten more minutes. Commissioner McBride.

COMMISSIONER McBRIDE: In the light of what you know now as management, is there anything that you would do differently based upon this experience?

MR. DIECKAMP: That covers an extreme amount of ground, Commissioner. Were you referring to things that we would do in order to better prevent such an occurrence or things that we would do in terms of a response to it?

COMMISSIONER McBRIDE: The question, of course, runs to prevention, and I guess more directly, did management make any mistakes that it would not make again?

MR. DIECKAMP: Let me put it this way, that I think in thinking about what has happened and what some of the contributing factors are, we certainly have a number of items in our mind that we think we're going to need to make improvements on. And I would list in that area firstly, more extensive and more detailed operator training which would include more simulator time on more events of this sort, coupled with

more emphasis on training the operators in the fundamentals of reactor safety and the heat transfer and cooling demands of reactor safety.

I think that we will want to go back and look at procedures that control the surveillance program and see what we can do to inject into that kind of a program a greater feeling of personal accountability, or perhaps the other way to say it is to diminish the extent to which a program like that takes on the feeling of being an administrative burden.

I think that we're going to be giving serious thought to the concept of having more senior experienced people available at the plant at all times.

We certainly have become more aware of some of the inadequacies of our plant instrumentation and we'll be looking for opportunities to improve the dependability of that instrumentation. I think there's just a whole host of these kinds of things that we will be turning our attention to, both in the short end and the longer range.

I'm sure I've not touched on all of them at all.

CHAIRMAN KEMENY: Commissioner McPherson.

COMMISSIONER McPHERSON: Let me go back to what Mr. Herbein said earlier was speculative, which is what you would have done if you had determined for yourself that the pressurizer was a problem. How would you have gone about looking at that memorandum if you had seen it, the Michaelson

report or the Novak memorandum? Do you have the in-house capability, the engineering horsepower to look at these matters or would you have to bring in somebody from the outside?

MR. HERBEIN: With regard to the question on how we would have looked at it, that would have been dependent on how it came to us. Again, if it came to us from the Nuclear Regulatory Commission with specific action required, there is a chance that we may have had to go for outside assistance and probably would initially have turned to the service company engineering group, which Mr. Arnold is in charge of.

MR. DIECKAMP: Jack, in terms of analyting the significance of that kind of a failure and the blow down and the system response to it, perhaps Bob could comment on our capabilities there, and of course, we don't have an infinite capability; at the same time we do have some.

MR. ARNOLD: I think, Commissioner McPherson, our response probably would have been in two areas. One would have been a review of the Michaelson report, assuming that was available; or review of the Davis-Bessy report if the details of that incident were available to us or we were aware of them.

As to the impact that that would have on operator training, I do think that we routinely and normally do pick up items that occur at other plants that need to be flagged to our operators. It is a part of our formal plan for training.

With regard to the analytical capability, we do

presently have available computer codes which I believe could give considerable insight into the type of transient and the type of system conditions that would exist in the event of a scenario a; described by Michaelson.

I think undoubtedly we would also have asked B&W to do some analytical work in conjunction with that. Depending upon what our own and the B&W results showed, we may request assistance from other organizations as well.

COMMISSIONER McPHERSON: I know it's a hard thing for any company to say we don't have adequate engineering capability. It has been reported in the press that you don't, that other utilities that operate nuclear power plants, that some others do have an adequate engineering capability, and that small ones such as Metropolitan Edison, relatively small ones, don't. Would you care to comment on that?

MR. DIECKAMP: I'd like to comment on that. Certainly we do not have the scope of capabilities that a large organization that does its own engineering and construction on an in-house basis, for example, at TVA or a Duke Power or an American Electric Power; we don't have the same breadth and depth of capabilities that those kinds of organizations have.

I think, though, that we are intermediate with respect to the range of capabilities that nuclear plant operators have, and I think that in some recent NRC testimony I have seen reference to one of the Commissioners referring to

the GPU system as being middle ground in terms of capability. I would also want to say that we do think of ourselves not just in terms of a compartmentalized Med-Ed, but rather in terms of the total scope of capability that we have in the two operating companies with nuclear plants and in the service company.

As I point out in my submitted testimony for the record, across the GPU system we have about 1100 people involved in nuclear activities. Indeed, in response to this accident, a significant fraction of the available people, maybe not use the word significant, but a good number of people were brought to bear on the problem outside the resources of Metropolitan Edison.

CHAIRMAN KEMENY: Last question to Commissioner Trunk.

COMMISSIONER TRUNK: I'm going to go to public relations. The communications between Met Ed and the surrounding areas has been criticized a lot. I see on your chain of people on staff that you have Mr. Tropher (phonetic) working for you. What is his title and what was he doing every morning during the crisis? Do you know?

MR. HERBEIN: Mr. Tropher is our manager of quality assurance. He also heads up the areas of security, training and licensing with the various regulatory agencies. With regard to specifically what he was doing each morning of the incident, those few days after the 28th, I can't speak directly to that. I can state that Mr. Tropher is not directly in

charge of public relations for Metropolitan Edison. He occasionally does assist the public relations communications services group in the preparation of routine press releases. I think he may have been on one or two occasions assigned to answer press inquiries and phone calls that perhaps came in during those early days of the incident.

MR. CREITZ: May I supplement those comments? One of the difficulties we had in our communications division was having the ability to talk to the people who had the technical know-how on what was going on. They were busy with the accident. We were able to identify George Tropher to assist our PR people for periods of time each day.

COMMISSIONER TRUNK: The reason I ask is that I was informed that he was briefing local officials. He invited local officials to Crawford Station and there he was giving them the rundown on what was happening at the plant. I was just wondering if Middletown and Lancaster and Harrisburg were all invited to this meeting.

MR. CREITZ: I believe the officials that he was primarily talking to were those in the close area--Middletown, Goldsboro Township, etc.

COMMISSIONER TRUNK: But Middletown says that they weren't being informed. This is why I'm asking. I know Lois Whittauer (phonetic) was going to these briefings. I would like to know if Middletown was invited.

MR. CREITZ: In retrospect, certainly our communications organization wasn't prepared to handle this type of event. I know in the very beginning there were many communities that were shocked, surprised and angered that they were not notified. We recognize this deficiency and in addition to some of the things that we'll be looking at from a technical aspect what we've learned from this accident, certainly our communications plan will have to be modified, too, because there is nothing more important than having effective communications. We tried but we weren't successful.

CHAIRMAN KEMENY: Questions may come up as we ask other employees of your company this afternoon and tomorrow morning. So we would like to excuse you subject to recall in case questions should come up this afternoon or tomorrow morning.

MR. CREITZ: Thank you.

(Messrs. Dieckamp, Creitz, Herbein, and Arnold were excused.)

MR. NATALIE: Do you want to go to Panel II?

CHAIRMAN KEMENY: Yes, please.

MR. NATALIE: Would Messrs. Lionarons, Gutherie, Hemmila, and Cooper please come forward?

WHEREUPON,

PANEL II

JOHN KEVIN LIONARONS
CARL L. GUTHERIE
EARL D. HEMMILA
MARTIN V. COOPER

were called as witnesses herein, and after having first been duly sworn, were examined and testified as follows:

CHAIRMAN KEMENY: Mr. Gutherie, I believe you are a shift foreman working at Three Mile Island Unit 2; is that correct?

MR. GUTHERIE: That is correct.

CHAIRMAN KEMENY: And I believe the four of you, if our information is correct, were performing certain surveillance tests on the morning of March 28?

MR. GUTHERIE: That is correct.

CHAIRMAN KEMENY: Would you be willing to describe in your own words what the surveillance test was and roughly how it is conducted?

MR. GUTHERIE: One of the surveillance tests we've done was the test on the emergency feedwater system.

CHAIRMAN KEMENY: Yes. That's the one we'd like to hear about.

MR. GUTHERIE: That test is done using an approved

plant operation review committee procedures, using a computer printout schedule. It was brought to my attention that this test was required to be done within a certain length of time, that we had available manpower to do it and plant conditions would permit us to do that.

I assigned a control room operator the job of getting the necessary people, the necessary equipment and to oversee the performance of the test.

CHAIRMAN KEMENY: Who was that control room operator?

MR. GUTHERIE: The control room operator was Earl Hemmila. I believe he assigned Kevin Lionarons and another auxiliary operator to do the test.

CHAIRMAN KEMENY: Mr. Hemmila, would you like to tell us about what happened?

MR. HEMMILA: Okay. Carl, would you pass me the procedure? Kevin and I sat down with this, checked out what steps we had to do. This one called for us to do both feed pumps. There were Sections 6.1 on page 4 and Section 6.2 on page 7.

What we do in a case like this is I sit down with the operator, talk about what we have to do, and then we do it. Now, I don't suppose you have this in your hands, do you? A copy of the procedure?

CHAIRMAN KEMENY: We do not. We would ask for it.

MR. HEMMILA: Yes, you may. Kevin has one of these

copies that I have for him. He takes the certain steps and signs them off as we go. I also have one of these with me upstairs and follow all the steps involved.

CHAIRMAN KEMENY: During this process, does the process call on closing certain valves, I believe they are number 12 on the emergency feed system?

MR. HEMMILA: Yes, it does.

CHAIRMAN KEMENY: How were these closed? Were these closed manually or were these closed from the control room?

MR. HEMMILA: They were closed from upstairs.

CHAIRMAN KEMENY: Who did the actual closing?

MR. HEMMILA: I checked the valves closed.

CHAIRMAN KEMENY: Now, for what period of time were these supposed to stay closed?

MR. HEMMILA: The actual testing of the pumps probably took around three hours.

CHAIRMAN KEMENY: I am reminded by one of the Commissioners that perhaps I have not made it clear. I did say March 26. That I should have emphasized in my opening question that these are events that happened two days before the accident that we are talking about.

So you checked and they were closed during this period. Sorry, I didn't hear the answer. How long should they stay closed?

MR. HEMMILA: They were probably closed for a period

of three hours.

CHAIRMAN KEMENY: Three hours. Now, who makes the decision to reopen them under this procedure?

MR. HEMMILA: I did.

CHAIRMAN KEMENY: You did. Did you actually reopen them?

MR. HEMMILA: Those valves were opened. Three of us stood up at the panel and checked out the lights. The final steps tells us to open those valves.

MR. COOPER: Mr. Chairman, I actually opened the valves myself. I was the control room operator on duty. I had the responsibility and I was assisting Earl and Kevin in the surveillance.

CHAIRMAN KEMENY: And Mr. Cooper, you are certain that you did actually open those two valves on the 26th?

MR. COOPER: Yes, Sir.

MR. LUNDIN: May I ask a question?

CHAIRMAN KEMENY: Yes.

MR. LUNDIN: As I understand, Mr. Cooper, you opened the valves from the control room?

MR. COOPER: Yes, Sir.

MR. LUNDIN: And was the valve position verified at the valve at that time? Did the valves actually respond to your command?

MR. COOPER: No, Sir. We used the position indication

in the control room. We have a green and red light indication. Red indicates open. When you go to open on the switch on the valves, you get intermediate indication a green and red light and then when they are full open you have a red light.

MR. LUNDIN: That's your method of checking whether they are open or not rather than a physical inspection of the valves at the valve site?

MR. COOPER: Yes, Sir.

MR. LUNDIN: Is there an existing record or document or written sign-off certifying this action?

MR. COOPER: When the procedure is performed we have a written checkoff list. We follow the procedure. When the surveillance procedures are completed we fill out the data sheets with the data that is required and file the technical specifications and that is the only thing that is checked. The other checkoff sheets are thrown in the trash can.

MR. LUNDIN: So you verify and sign off on valve open position following completion of the surveillance?

MR. COOPER: Yes, Sir.

MR. LUNDIN: And that document exists some place today?

MR. COOPER: No, Sir. It is thrown in the trash can.

MR. LUNDIN: It's just filled out and signed and and verified and thrown away?

MR. COOPER: Yes, Sir. That is the way we do our

surveillance procedures. Only the data sheets are kept. The actual steps of the procedure, once it is completed, are discarded and all we keep is the information on the pump vibration and discharge pressures.

CHAIRMAN KEMENY: Mr. Cooper, may I ask you a question on this? You personally saw the lights change from green to red, as I understand that's the right sequence when you reopen the valves, on both valves?

MR. COOPER: Yes, Sir.

CHAIRMAN KEMENY: Would you happen to know if this is one of those lights partially obstructed by a tag?

MR. COOPER: No, Sir.

CHAIRMAN KEMENY: It was not obstructed at that time? Let me ask a different kind of question. Certainly during your shift, let me ask first of all, on the 26th, was there any occasion that any of you would have closed those valves again?

MR. COOPER: No, Sir. We closed them while doing the lineup for the surveillance procedure and we performed the test on both the emergency cool water and motor driven pumps and at the completion of the second pump we reopened it. And after that there was no reason to reclose them.

CHAIRMAN KEMENY: May I ask then the following question? What was the next time you, say, Mr. Gutherie, when were you next on duty after the 26th?

MR. GUTHERIE: I was on duty the 27th.

CHAIRMAN KEMENY: Yes. Would you have been on duty with these same gentlemen?

MR. GUTHERIE: Would you repeat that?

CHAIRMAN KEMENY: Were you on duty with the same team on the 27th? As I understand, teams usually stay together.

MR. GUTHERIE: On the 26th I was in the status of the active duty shift foreman and also as covering surveillance. On the 26th I was also the duty shift foreman and the people I was working with was a different crew.

CHAIRMAN KEMENY: How about on the 27th? The 27th you said -- Did you have a different crew on the 27th?

MR. GUTHERIE: It was a different crew. The relief crew actually has a shift on that day and they would not be doing surveillances normally on that day.

CHAIRMAN KEMENY: How about you, Mr. Hemmila? Were you on on the 27th?

MR. HEMMILA: Yes, I was on duty that day.

CHAIRMAN KEMENY: With that same shift?

MR. HEMMILA: The same shift; day shift.

CHAIRMAN KEMENY: May I ask. Is it part of the procedure when a new shift comes on to check the status of certain lights?

MR. HEMMILA: Not it's not, Sir.

CHAIRMAN KEMENY: There is no standard sign-on

procedure when a new shift comes on to check the status of various kinds of valves?

MR. HEMMILA: We do not check all the lights on the valves, no.

CHAIRMAN KEMENY: May I ask each of you when you were next on duty, did any of you happen to check the green or red light status of those two valves the next time you were on, Mr. Hemmila?

MR. HEMMILA: I was on duty the next day and I cannot say right now that I checked the status of those valves.

CHAIRMAN KEMENY: Mr. Lionarons?

MR. LIONARONS: No, Sir, I wouldn't. I'm an auxiliary operator and I'm not that familiar with the controls.

CHAIRMAN KEMENY: Yes. Mr. Cooper?

MR. COOPER: The 26th was my last day on shift and was off until, I didn't come into work until Thursday, the 29th.

CHAIRMAN KEMENY: The 29th. How about you, Mr. Gutherie? Did you have occasion to check those?

MR. GUTHERIE: No. I as much as possible do check things in the control room for plant status, but I do not remember checking those valves.

CHAIRMAN KEMENY: Mr. Gutherie, as a shift foreman, do you know of any other procedure that could have happened between then and the 28th that would have led to those valves being closed? I may understand it is required as part of this

surveillance procedure, but any other procedure that would lead to the closing of those valves?

MR. GUTHERIE: No procedure that I know of.

CHAIRMAN KEMENY: No procedure that you know of. Thank you.

MR. LUNDIN: Mr. Gutherie, I understand that you approved the fact that the surveillance test was completed.

MR. GUTHERIE: That is correct.

MR. LUNDIN: Can you tell us what you do to base that approval on? What facts do you verify or what physical inspections do you make or upon what do you base that approval?

MR. GUTHERIE: I base that approval looking at the procedure at the sets of criteria and at the data entered on the surveillance data sheet that meets that criteria.

MR. LUNDIN: And this is the data sheet, Mr. Hemmila, that you mentioned as signing, or Mr. Cooper?

MR. COOPER: Yes, Sir.

MR. GUTHERIE: There is no spot on that data sheet to verify that these valves are open. That's a different part of the procedure.

MR. LUNDIN: You essentially, then, approve the paper, the data sheet? You approve the data sheet?

MR. GUTHERIE: That's correct.

MR. LUNDIN: Thank you.

CHAIRMAN KEMENY: Any other questions, Mr. Lundin?

MR. LUNDIN: No.

CHAIRMAN KEMENY: Do any of you have any idea as to how those valves could have been closed on the morning of the 28th?

MR. COOPER: No, Sir.

MR. HEMMILA: I don't.

CHAIRMAN KEMENY: Mr. Lionarons? Mr. Gutherie?

MR. GUTHERIE: No, I don't.

MR. LIONARONS: No.

CHAIRMAN KEMENY: Commissioner McPherson.

COMMISSIONER McPHERSON: Would you mind going back over this? Can the valves be opened and closed manually at the valves or can they only be opened and closed from the control room?

MR. COOPER: They can be closed outside the control room.

COMMISSIONER McPHERSON: They could have been closed by turning a wheel?

MR. LIONARONS: They can be operated from three different places. They can be operated from the control room; they can be operated from extension controls out in the plant; and they can be operated right at the valve by engaging a clutch and turning the hammer on it.

CHAIRMAN KEMENY: Okay, that is a key question. Can I just follow up on that, Commissioner McPherson. Suppose we

have been operating from some other site and the valves would have been closed, not from the control room. Would the lights have turned from red to green in that case in the control room?

MR. COOPER: Yes, Sir.

CHAIRMAN KEMENY: Thank you. Commissioner McPherson.

COMMISSIONER McPHERSON: I don't think of anything more. But there are three places: the control room, the valve itself, and what was the third?

MR. LIONARONS: We have an extension control out in the plant by our emergency switch gear. We have a row that our switches are located for operating certain valves and there is a pushbutton there.

CHAIRMAN KEMENY: I didn't hear.

MR. LIONARONS: It is in a switch gear room that we have for emergency switch gear.

MR. LUNDIN: Operator error of some sort in that switch gear room could have inadvertently operated the valve, then, I would assume?

MR. LIONARONS: Yes, but that is highly unlikely.

MR. LUNDIN: Why is it unlikely?

MR. LIONARONS: Because there is a row of about, there must be 15 or 20 valves that can be operated. And there are 12-A's and 12-B's are in different rooms. So that type of thing happening would be highly unlikely.

COMMISSIONER McPHERSON: Is there any other reason besides surveillance for which the valves would be closed, any other purpose?

MR. COOPER: None that I can think of. They are not supposed to be closed except by procedure. Those valves are specifically required to be opened by specifications and not just operated haphazardly. They have to be operated usually from the control room. We hardly ever would send an operator out to operate them locally because we do have a control in the control room, and the control room operator would have to do it.

COMMISSIONER McPHERSON: But there's no reason other than a checkout, unless you had some kind of an emergency situation in which there might be -- Well in that case they would be open, but there is no reason to close them except during this surveillance. Is that correct?

MR. COOPER: That is correct.

CHAIRMAN KEMENY: Commissioner Haggerty.

COMMISSIONER HAGGERTY: Is there just one valve in each case actuated manually or automatically from two locations and is the same valve actuated? Just one valve?

MR. COOPER: No, Sir. It is two separate valves, two separate switches.

COMMISSIONER HAGGERTY: I know one in each circuit, but I mean as far as that one valve or any one of the two valves

is concerned, when you actuate it manually with a wheel and then you deactuate it from one of the other two locations, what happens? Does the same valve open and close? Or is the manual valve separate?

MR. LIONARONS: No. It's a one-valve unit.

COMMISSIONER HAGGERTY: One valve.

MR. LIONARONS: It's a limit torque valve that can be operated right there. It's the same valve that you are closing and opening with the electric pushbutton.

CHAIRMAN KEMENY: Commissionrr Lewis.

COMMISSIONER LEWIS: Who has access to the emergency gear room? Who normally --

MR. LIONARONS: Everybody.

COMMISSIONER LEWIS: Anybody in the plant can get in?

MR. LIONARONS: Just about, within reason. The construction workers, operators, rad chem techs, general people that work in the plant.

COMMISSIONER LEWIS: So anybody could have gone in and out after the 26th into that room and advertently or inadvertently turned these valves off?

MR. LIONARONS: That's right.

COMMISSIONER McPHERSON: But if that had been done, again, as Mr. Kemeny asked, that would show up on the panel wouldn't it?

MR. COOPER: Yes, Sir. The lights would be green on

the panel if those valves were to be shut from outside the control room.

COMMISSIONER LEWIS: You say you don't normally look at those lights, that you are not conscious --

MR. COOPER: We don't have a normal checkoff list that requires us to verify the position of the valves. The operators do come in and they do look over their panels to see if they can find anything out of normal.

COMMISSIONER LEWIS: But you said that--Mr. Hemmila, you were there on the 27th, am I correct?

MR. HEMMILA: That is correct.

COMMISSIONER LEWIS: And you didn't notice that those lights had been changed?

MR. HEMMILA: No, I didn't notice them at all that day.

COMMISSIONER McPHERSON: Would it be possible for you all to show where those lights are on that mock-up back there? Could you show where the --

Is this in the first --

MR. COOPER: It is on the first console.

COMMISSIONER McPHERSON: On the front console. And it is down there, and it should be red if it is open. Is that correct?

MR. COOPER: Yes, Sir. They are both indicated red on this picture.

CHAIRMAN KEMENY: Mr. Cooper, as a control room operator, how much experience do you have as a control room operator?

MR. COOPER: I've been a control room operator at Metropolitan Edison for about one year now.

CHAIRMAN KEMENY: Fine. So as an experienced control room operator, suppose someone had somewhere at a remote location closed these valves, which means these lights go from red to green, can you conceive that you can be the operator and not notice those lights changing?

MR. COOPER: Yes, Sir. It would have to be, you know, catch it while it was actually traveling to see the dual indication of red and green and see a blink or something moving out of the corner of your eye. Once they turn green, it is possible I wouldn't see it at all.

CHAIRMAN KEMENY: That gives me a chance to ask you a question that has nothing to do with this event but something a couple of us were talking about after our visit to the control room. I gather on the normal operations some valves have to be open and some have to be closed, which means that the normal position on some them is green and some of them is red. Don't you as operators find that confusing?

MR. COOPER: It is not confusing as far as knowing the position of the valve. But it might help to have a normal position indicated in one color so that you could look at the

board and see.

CHAIRMAN KEMENY: That is what occurred to some of us. In other words, there is no way you can just glance at that and see something is in a non-normal position because say roughly half of them are red and half of them are green in normal operation.

MR. COOPER: That's right.

CHAIRMAN KEMENY: Okay. Professor Taylor.

COMMISSIONER TAYLOR: Are there sensors, wires or whatever, right on the valve itself that then transmit a signal to the control room and say whether it is red or green , and if so, are those wires visible to someone who would manually then be able to open or close those valves? In other words, could the signal in the control room be falsified by manipulating some wires at or near the valves?

MR. GUTHERIE: Let me answer the question. That is not easy to do because those switches that control that position indication are internal to that motor operator, and it is all a conduit type connection to the motor operator and you know someone would have to have first of all some experience; you know, you have to know what connections and so forth, and that is very highly unlikely.

COMMISSIONER TAYLOR: So they would have to cut through some kind of metal cable outside to get at the conduit?

MR. GUTHERIE: That's correct.

COMMISSIONER TAYLOR: Is there any possibility of being able to simply pull them off and reverse the terminals?

MR. GUTHERIE: No. There is no plug type disconnect. That's all hard wire.

COMMISSIONER TAYLOR: Thank you.

CHAIRMAN KEMENY: Commissioner McPherson.

COMMISSIONER McPHERSON: When you come into one of these control rooms and you look at these two panels, this is a front console, the lower one there, and there's the back. What are the areas of greatest concern? What are the things that you've got to see looking all right to make you confident that the plant is in good shape, and what are the things that would give you a start if you saw that the wrong signal was up there? What are the main areas on that enormously complicated double panel there that are of main concern to a control room operator? Could you point them out?

MR. COOPER: Okay, for a normal operation, the main concern we would start off with would be our ICS stations along here on the front console on the diamond panels to see whether they are on automatic and if they are controlling correctly. Then we would be checking our --

COMMISSIONER McPHERSON: Excuse me. What is the ICS station?

MR. COOPER: That is our integrated control system. That is what we use to control the plant. It is supposed to

do it automatically based on the signal that the operator feeds in through -- power.

COMMISSIONER McPHERSON: What essentially is that telling you?

MR. COOPER: Well, I want to know if it's on automatic and if for some reason it is not automatic, there are certain situations where a station in the ICS control will go to hand operation; in other words, not working automatic anymore, so it wouldn't be doing its job and we want to check and make sure that it is still on automatic. We would also be checking our primary system pressure and our pressurizer heat and spray valving switch light up to see if we've got proper pressurizer level indication.

We would also look up here on our radiation monitoring system to see if we had any radiation monitoring alarms, to see if there's any indication --

COMMISSIONER McPHERSON: That's the radiation alarm up there?

MR. COOPER: Radiation monitoring system for --

COMMISSIONER McPHERSON: Monitoring system. All right.

MR. COOPER: -- for different buildings and cooling water systems throughout the plant.

COMMISSIONER McPHERSON: Go ahead.

MR. COOPER: Okay. And also we want to check our

makeup system lineup to see what our makeup pump lineup to see if we have them normally operating. We have the B pump running with the A pump standby. We see what our makeup tank level is, the normal makeup supplied to the reactor coolant system.

We check our seal injection flow to the reactor coolant. And also we look at all of our alarms all along the back to see if there are any alarms that are up there that shouldn't be there and ask questions about why they are in.

COMMISSIONER McPHERSON: Those alarms would register pressure drops or rises or --

MR. COOPER: Indicate a number of things: pump trips, pressures out of specification levels, and tanks --

COMMISSIONER McPHERSON: Okay. Now, these two lights that you pointed out, the valves we've been talking about, are down there in the lower righthand side. And those valves should have been opened when this incident started and the pump went out, the condensate pump went out, then the emergency feed water pump kicked on and the steam generator was beginning to go dry. At any rate, it was losing water. And the emergency feed water pump should have been pumping water into the steam generator to prevent that from happening and therefore to prevent the primary system from overheating.

But those two valves were closed, even though two days before you all had inspected them in the course of this

surveillance and you had seen to it that they had been opened. And that was 42 hours before. So that when this event started and the emergency feed water pumps were unable to put water into the steam generator and this super heating event took place, no one noticed that for about eight minutes; isn't that correct? That seems to be what happened?

MR. COOPER: That's what I heard is what happened.

COMMISSIONER McPHERSON: Yes. I know that you were not there and therefore I shouldn't ask you that question. But nevertheless, those lights did show that they were closed; isn't that -- at the time the event took place?

MR. COOPER: That's right.

CHAIRMAN KEMENY: We should ask that of the next panel.

COMMISSIONER McPHERSON: We should ask that of the next. I apologize, Mr. Chairman. All right.

CHAIRMAN KEMENY: Professor Taylor.

COMMISSIONER TAYLOR: In this general surveillance work -- did you check out any of the emergency core cooling system valves; in particular, any valves that need to be open to allow the high pressure injection system to feed water into the reactor? Did you do any checking of the ECCS system during this period of two days before the accident?

MR. COOPER: You mean as part of the procedure or just normal looking around the panel?

COMMISSIONER TAYLOR: In either way. Was it on your agenda of things to look at, first of all?

MR. GUTHERIE: Let me answer that, since I scheduled the surveillance. None of the high pressure injection surveillances was dominant that day.

COMMISSIONER TAYLOR: So you have no knowledge from direct observation of the state of valves associated with the high pressure injection system, or the ECCS system in general at that time?

MR. GUTHERIE: No, not on surveillance basis. If there was a valve out of position, it should have been reflected in our lock valve book.

COMMISSIONER TAYLOR: A valve out of position?

MR. GUTHERIE: If it was a lock valve, it would have been in a lock valve book logged as being out of position and the reason why.

COMMISSIONER TAYLOR: Is this something you just sort of noticed in passing or what?

MR. GUTHERIE: No. I saying we didn't do any surveillances on high pressure injection, you know; to my knowledge, none of the valves were closed or out of position.

COMMISSIONER TAYLOR: Okay. I misunderstood you. Thank you.

CHAIRMAN KEMENY: Commissioner McBride.

COMMISSIONER McBRIDE: I wonder, Mr. Cooper, if you

would describe what the relief arrangements are at the time of the changing of a shift? Is there any procedure, any requirements, any obligation on the part of the shift going off in terms of reporting or remaining on the job, or just what exactly is the arrangement for being relieved from your post to go home?

MR. COOPER: As control room operators, you can't leave until you've got an operator, another control room operator comes in to relieve you. A control room operator is relieving the man on the desk. The man who has the duty keeps a log book. Before he relieves, he has to review the log book back until the last time he had the shift to see if any changes were made in the plant status or changes to operating procedures that he should know about.

We also write up an informal turnover sheet anything that hasn't been put in the log or something that we feel the relief should know about, things that may be coming up, procedures that we're going to be performing, or something that occurred during the shift that he might want to watch out for. We write that on just a piece of paper and he will get that and then he will pass it on to his relief like that.

But, as far as shift relief goes, we just alternate each day between the two or three control room operators on a shift as to who takes the desk.

COMMISSIONER McBRIDE: Are you required to stay on

and both the person who is about to be relieved and the person who is coming on shift, do they have any requirement to communicate personally with each other and to stay at their particular post jointly until such time as the relief has officially been given?

MR. COOPER: Yes, Sir. Until the log book is signed by the operator going off shift, he has the duty. The operator coming on shift doesn't have it yet; he is still looking over plant status and until he feels comfortable that he knows what is going on and he is ready to take the shift. Then the outgoing operator signs the book and the on-coming operator signs in the log book.

COMMISSIONER McBRIDE: What is your schedule hours per shift?

MR. COOPER: We work eight-hour shifts.

COMMISSIONER McBRIDE: How is the overlapping compensated for? As I understand what you've said that there is a period of time in which the on-shift operator and the relief operator must carry out certain functions and certain duties, and therefore both of them are working and that would indicate to me that one is there early or one is staying late. How is that compensated for?

MR. GUTHERIE: Let me clarify that.

COMMISSIONER McBRIDE: I'm asking Mr. Cooper.

MR. COOPER: In general, it is not compensated for.

We can put in for the 10 or 15 minutes that we stay extra or come in early to perform shift turnover, but just as a rule people don't do it.

COMMISSIONER McBRIDE: So that you then are in a position of having completed your shift and staying on duty in terms of being required to complete certain communications to your relief. I would ask you then, what happens if your relief comes in early? Are you allowed to leave early?

MR. COOPER: Yes, Sir. Once he has been properly relieved, we can leave early.

COMMISSIONER McBRIDE: So that it is kind of informal?

MR. COOPER: Yes, Sir.

COMMISSIONER McBRIDE: You can actually in some circumstances be on the job less than eight hours and on other occasions over eight hours?

MR. COOPER: Yes, Sir.

COMMISSIONER McBRIDE: In the event that your relief comes in late, is there any -- As I understand it, you said you are obligated to stay over and wait until he comes?

MR. COOPER: Yes, Sir. That is what having our reactor operators license means.

COMMISSIONER McBRIDE: And under those circumstances if it is an appreciable amount of time you would be paid overtime?

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COMMISSIONER McBRIDE: And under those circumstances if it is an appreciable amount of time you would be paid overtime?

MR. COOPER: Yes, Sir. Time and a half.

COMMISSIONER McBRIDE: What would be the line of demarkation?

MR. COOPER: It would pretty much be up to the operator whether he wanted to put in for the overtime or not.

CHAIRMAN KEMENY: Governor Babbitt.

COMMISSIONER BABBITT: I would like to ask each of whether you recall part of the incident we have been discussing. Any other occasion upon which any of you have encountered the feedwater pumps closed outside of the three-hour maintenance period or outside of the period when you knew there was somebody actually assigned to some sort of function that required that they be closed?

MR. COOPER: You mean to come up to those valves and find them closed at another time?

COMMISSIONER BABBITT: Have you ever encountered the kind of occurrence that we are discussing; that is, the valves out of position with no apparent reason for them to be out at that time? Out of position.

MR. HEMMILA: Thinking back, I can say no that I have not found them out of position.

MR. LUNDIN: May I broaden that question?

COMMISSIONER BABBITT: Bruce, if I may, let me finish this and just ask for each one of them and then ask the next question.

MR. COOPER: I can't remember any time when I found those valves out of position.

MR. LIONARONS: No.

COMMISSIONER BABBITT: Mr. Gutherie?

MR. GUTHERIE: Yes, sometimes on start-up you'll find them closed until system pressure gets sufficient to back check the check valves. We have a leakage problem in those valves and I believe it is in the start-up procedure. At a certain system steam pressure you unisolate them.

CHAIRMAN KEMENY: Excuse me. I didn't quite understand that. Did you say that then they are closed manually or they close by themselves?

MR. GUTHERIE: They are closed manually.

COMMISSIONER BABBITT: You are inferring then that that is not detected until start-up begins, if they are out of position prior to startup?

MR. GUTHERIE: That is one of the start-up checks in the start-up procedure. To ensure at a certain steam pressure these valves are open.

COMMISSIONER BABBITT: But am I correct that you are saying that you have then encountered, at least during start-up, valves which were out of position, out of proper position?

MR. GUTHERIE: Let me clarify that. They are not out of position. They are in the correct position as dictated

by the procedure.

COMMISSIONER BABBITT: Okay. My next question to all four of you would then be: Have you at any time during your operation of this plant encountered valves out of their correct position with no apparent explanation; that is, out of position at a time when you would not expect them to be?

MR. HEMMILA: To that I would have to answer yes.

COMMISSIONER BABBITT: If I could follow that up, could you explain to me those kinds of circumstances that you have encountered?

MR. HEMMILA: I have been on shift at various times and I can't specifically say which one of the valves they are, but I have found valves that should have been open or shut or shut or open.

CHAIRMAN KEMENY: Could you give us an example, perhaps?

MR. HEMMILA: Right offhand I can't give an example.

COMMISSIONER BABBITT: What do you normally do when you find that kind of occurrence?

MR. HEMMILA: I speak to somebody about it to find out why it is like that.

COMMISSIONER BABBITT: Have you on all previous occasions found an explanation?

MR. HEMMILA: No, I haven't.

COMMISSIONER BABBITT: On how many occasions have you

not found an explanation?

MR. HEMMILA: I could guess and probably say one or two but I'm not sure about that answer.

COMMISSIONER BABBITT: On those occasions when you couldn't find an explanation, how did you pursue the matter?

MR. HEMMILA: I spoke to the supervisor about it, the foreman about it, and we checked in from there.

COMMISSIONER BABBITT: Would there be any written record of that kind of incident?

MR. HEMMILA: I do not believe there would be a written record of that.

CHAIRMAN KEMENY: Would you like to ask the same question of Mr. Cooper and Mr. Gutherie?

COMMISSIONER BABBITT: Let me make just one final observation. What is the best inference you can make as to the causes of those unexplained occurrences?

MR. COOPER: Of the valves being shut?

COMMISSIONER BABBITT: I just want to get Mr. Hemmila's response to those he could not explain.

MR. HEMMILA: Right now I couldn't say why a valve was shut when it should have been open, or vise-versa.

COMMISSIONER BABBITT: You wouldn't venture an opinion, for example, as to why that was --

MR. HEMMILA: No, I wouldn't venture an opinion.

COMMISSIONER BABBITT: -- more likely due to operator

error or more likely due to instrument malfunction?

MR. HEMMILA: I can't say.

COMMISSIONER BABBITT: Mr. Cooper, have you had some of those experiences?

MR. COOPER: Yes. There was a time when emergency core cooling water supply valves to the high pressure injection pumps were found shut. The reason it was shut is because it was shut for some kind of test, I don't recall what, and then in returning the lineup to normal the procedure wasn't followed. So the valves weren't reopened when they were supposed to be. I think the plant was in operation at the time, but the procedure wasn't followed and that is why the valves were shut. Also, the lock valve book wasn't kept up. The particular valves normally have a chain and lock on them so that nobody can operate them manually, and when a lock valve is moved its position has to be recorded in our lock valve book, and when it is returned to normal the position has to be recorded. It is also supposed to be recorded in the control room operator's log.

COMMISSIONER BABBITT: Did you personally discover that incident?

MR. COOPER: No, Sir.

COMMISSIONER BABBITT: But you were involved in ascertaining what had gone wrong?

MR. COOPER: I believe I was on shift, I think.

COMMISSIONER BABBITT: Okay. And you were able to ascertain that that was due to operator error; is that correct?

MR. COOPER: Yes, Sir.

COMMISSIONER BABBITT: And that consisted of manually putting the valve in the wrong position and locking it and failing to report it?

MR. COOPER: Yes, Sir.

COMMISSIONER BABBITT: Do you know what corrective measures were taken with respect to the employee who did it?

MR. COOPER: No, Sir. I don't recall who was involved at the time. It was a long time ago on those particular valves. But immediately thereafter we did institute a stricter control on locked valves, making sure that their position was recorded and that everybody was aware and nobody just would open a locked valve chain without permission.

CHAIRMAN KEMENY: Will you permit one question? I happen to see Mr. Lionarons nodding. Were you present also when these locked valves were discovered?

MR. LIONARONS: Not at that particular time, no.

CHAIRMAN KEMENY: You just had similar experiences?

MR. LIONARONS: That's right.

COMMISSIONER BABBITT: Just one last question, Mr. Cooper. Would there be a written record of the incident that you described?

MR. COOPER: I believe there were entries made in

the log about it. I'm not sure--in the control room operators log and the shift foreman's log.

CHAIRMAN KEMENY: May I ask who was the operator in charge who discovered it at the time, do you remember?

MR. COOPER: No, I don't remember.

COMMISSIONER BABBITT: Mr. Lionarons, you I take it have encountered similar examples of valves out of position with no apparent explanation?

MR. LIONARONS: Yes, I have.

COMMISSIONER BABBITT: About how many such occasions have you encountered?

MR. LIONARONS: One that I can think of right off-hand.

COMMISSIONER BABBITT: Could you describe it?

MR. LIONARONS: It pertains to a valve. Yes, I found DHV-102-A shut and it is a suction valve to our DK-8 mobiles (phonetic) pumps and it is normally open with the breaker open and I had found it shut with the breaker shut--or open, excuse me; the breaker was open.

COMMISSIONER BABBITT: How did you happen to discover that?

MR. LIONARONS: Auxiliary operators take a tour of the auxiliary building and the secondary buildings and upon my tour, this is one of the check points on our mode check list that we are required to check. Upon descending upon the

valve, I noticed that it was shut and notified the control room.

MR. COOPER: That particular valve is on the auxiliary operator's log sheet on every night when he makes his tour on every shift, he has to check the position of that valve and check the position of that breaker for that valve and the log sheet lists the required position. So on that particular valve it is checked every shift.

COMMISSIONER BABBITT: What kind of action did you take after you discovered that?

MR. LIONARONS: I notified the controller, the control room operator. Then we went and closed the breaker and repositioned the valve and opened the breaker again.

COMMISSIONER BABBITT: Do you know whether there was any follow-up to ascertain why it was out of position?

MR. LIONARONS: No, I do not.

COMMISSIONER BABBITT: Who would we ask that question of?

MR. GUTHERIE: Maybe I could answer that question. When it is brought to my attention that the valves were in the wrong position. I notified the shift supervisor and we make an entry into the log and we try, I don't have the time to try, but generally a shift supervisor makes an attempt to find out who is involved and why the valve was left in the wrong position. He generally takes it from there. I don't get into

the ramifications from that.

COMMISSIONER BABBITT: So the shift supervisor would be the proper person to ask those questions?

MR. GUTHERIE: That is correct.

COMMISSIONER BABBITT: Mr. Gutherie, you suggest that whenever this is discovered, a log entry is made. Is that correct?

MR. GUTHERIE: Yes, if he's a good operator, he certainly does.

COMMISSIONER BABBITT: So it would be fair for me to infer that if we did a check of the right kinds of logs we would be able to ascertain how often this kind of misposition valve event occurred?

MR. GUTHERIE: That is probably a safe assumption, although I don't think it is as common as you may think.

COMMISSIONER BABBITT: Have you encountered this kind of event, other than the incidents described by your associates?

MR. GUTHERIE: Very, very rarely; maybe on one or two occasions.

COMMISSIONER BABBITT: Could you remember specifically what those occasions were?

MR. GUTHERIE: No. The past eight years I've worked at the Island, it is very difficult to remember one or two occasions in eight years.

CHAIRMAN KEMENY: Commissioner McPherson.

COMMISSIONER McPHERSON: I'm not sure to whom to address this question, but how often do the emergency feed water pumps come on? That is, in the course of a year, how many times would the emergency feed water pumps have to come on?

MR. COOPER: Well, surveillance has to be run --

COMMISSIONER McPHERSON: Leaving aside surveillance, leaving aside times when they are planned to come on, how many times do they kick on because they are needed to?

MR. HEMMILA: During the course of a year they should not kick on at all.

COMMISSIONER McPHERSON: They should not do so at all?

MR. HEMMILA: No, they should not.

COMMISSIONER McPHERSON: Have the emergency feed water pumps, to your knowledge, ever kicked on in TMI-2 before?

MR. COOPER: Yes, Sir.

COMMISSIONER McPHERSON: They have done so?

MR. COOPER: We've had plant trips due to loss of feed water which causes the emergency feed water pumps to start before and we've had them come on.

COMMISSIONER McPHERSON: How many times has that happened?

MR. COOPER: I couldn't give you a number. I know that I've had it happen on my shift at least twice.

COMMISSIONER McPHERSON: So it has happened on your shift twice, that you've had a loss of coolant and so the emergency feed water pumps have come on?

MR. COOPER: Yes, Sir. We also had at another time on my shift they came on because there was a leak on a pressure switch which was involved in the starting circuitry for the emergency feed pumps, and an operator was trying to stop the leak and he got near the pressure switch and bumped it and the emergency feedwater pump started in that case, too.

COMMISSIONER McPHERSON: In either of those cases or any of the ones you know about, were the valves closed?

MR. COOPER: No, Sir.

COMMISSIONER McPHERSON: They were always open?

MR. COOPER: Yes, Sir.

COMMISSIONER McPHERSON: Has anybody else had an experience, had a shift in which the emergency feed water pumps went on? Mr. Gutherie?

MR. GUTHERIE: Yes, I have on one or two occasions, loss of feed and back to problems with the condensate polishing system and loss of feed and trip of the feed pumps and booster pumps and left with strictly emergency feed for feeding the steam generation.

CHAIRMAN KEMENY: In those cases did the turbine trip?

MR. GUTHERIE: Yes, definitely.

CHAIRMAN KEMENY: Did the reactor trip?

MR. GUTHERIE: Yes.

CHAIRMAN KEMENY: Mr. Cooper, in your cases, did the turbine trip?

MR. COOPER: Yes, Sir.

CHAIRMAN KEMENY: And the reactor tripped?

MR. COOPER: Yes, Sir.

COMMISSIONER McPHERSON: So the frequency of it -- It is frequent enough to make it critical that those valves are opened, else there will be very harsh consequences. Isn't that such as happened here? The must be opened.

MR. COOPER: They must be open.

COMMISSIONER McPHERSON: Sure.

CHAIRMAN KEMENY: Commissioner Haggerty.

COMMISSIONER HAGGERTY: The sensor on the emergency feedwater block valve, since it functions when the valve is operated manually, presumably then it is associated with the physical position of the valve rather than with power? The sensor --

MR. COOPER: You have to have power supply to the valve for the position indication to work. But the position indication is based on the valve position.

COMMISSIONER HAGGERTY: Actual closed or open?

MR. COOPER: Yes, Sir.

CHAIRMAN KEMENY: Commissioner McBride.

COMMISSIONER McBRIDE: Mr. Cooper, from a control room operator's point of view, is the crew size adequate to cope with the emergency situations that you have experienced?

MR. COOPER: In my experience with emergency situations at the Island, the crew size has been adequate. We have been able to handle it with the people we had available.

COMMISSIONER McBRIDE: Is that true so far as your point of view, Mr. Hemmila?

MR. HEMMILA: Yes, it is.

COMMISSIONER McBRIDE: Mr. Lionarons?

MR. LIONARONS: I don't dispatch the men so I wouldn't know.

COMMISSIONER McBRIDE: You are a member of the crew in times of emergency, though, are you not?

MR. LIONARONS: That is right.

COMMISSIONER McBRIDE: Do you feel under those circumstances that the crew size is adequate to cope with it?

MR. LIONARONS: I couldn't tell you for sure because I don't dispatch the men. I go to a job and I've always been sent to a job. I've never had to stand around in any type of emergency.

COMMISSIONER McBRIDE: So you really don't have an opinion then?

MR. LIONARONS: That is right.

CHAIRMAN KEMENY: I see no further questions. Thank you; the witnesses are excused.

(Chair declared a 5-minute recess before calling Panel III witnesses)

Dorothy Eberth 1
Pres Comm on Three Mile Island 5/30/79

MR. NATALIE: Would Mr. Zewe, Mr. Scheimann, Frederick and Mr. Faust please come forward and be sworn?

Whereupon,

PANEL III

WILLIAM ZEWE, FRED SCHEIMANN, EDWARD FREDERICK, and CRAIG C. FAUST

having been duly sworn, were called as witnesses herein and were examined and testified as follows:

CHAIRMAN KEMENY: Could you please be seated. Before we ask the main questions, I would like to establish continuity with the testimony we have just heard, therefore let me take something out of sequence.

Mr. Faust, if my reading of the record was correct, were you the operator who discovered that the valve number 12 and the emergency feed system were closed?

MR. FAUST: That is true.

CHAIRMAN KEMENY: Let me ask the same question we asked the earlier shift, when you came on shift did you or Mr.Frederick check whether anything was out of position or is that not a normal part of your operation?

MR. FAUST: The man who turns over the shift, that takes the shift, usually scans the panel. It is usually up to him as to what he is looking at, what would be of any significance to him in the turn over.

CHAIRMAN KEMENY: Yes.

MR. FAUST: At the time I took shift switching and tagging and I didn't scan the panel at that time. I took

dc-2

readings later on that caused me to go around the panels and look at different indications that I had to log down.

CHAIRMAN KEMENY: Yes, but you did not notice that these two switches were showing red?

MR. FAUST: No I did not, not at that time.

CHAIRMAN KEMENY: You did not notice that they were showing green at that time?

MR. FAUST: No.

CHAIRMAN KEMENY: Mr. Frederick you did not notice that either, is that correct?

MR. FREDERICK: That is correct.

CHAIRMAN KEMENY: Now,Mr. Faust, how did you happen to discover -- I know you were working on the secondary system, we have read the chronology, how did you happen to notice that these switches were closed?

MR. FAUST: When I noticed those switches were closed was actually during several moves I made after the initial onset of the accident and what I would be doing, if you looked on the panels where I was at, I was monitoring steam generator levels. I saw that it was low. I think I voiced at that time that it was generators are indicating 10 inches and that they were dry, possibly.

And at the same time I was looking at valve indicator lights which, once again, now this is a while ago, and from what I can best remember they were indicating

de-3

shut at that time to me.

One of my immediate actions was to take manual control with the Bailey controller for the 11 valves, 11A, 11 A and B, at which time I started driving them open, not fully. I cracked them initially to see if I could get a response because at that time I didn't know exactly how long the generators -- I thought that was a problem in other words, that the ICS for some reason didn't open up those valves.

So I was going to do it manually and try to throttle it initially. That took time because the way we tell if we get feed indication into the generator is we have to monitor for a steam generator level change and that is what I was looking for.

So I waited and another thing that is out of-- I don't think has been brought up right now is that this happened pretty fast. And the fact that this whole thing until the time I discovered those valves open at that time, I thought a period of time of only like 60 seconds passed when actually it turned out to be eight minutes from the time I finally discovered them open.

CHAIRMAN KEMENY: How quick you discovered them closed and you opened them?

MR. FAUST: I opened, yes. Excuse me.

CHAIRMAN KEMENY: You do not have any idea of

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how they could have gotten closed, do you Mr. Faust?

MR. FAUST: I don't have any factual knowledge of how they got closed.

CHAIRMAN KEMENY: Do you have a guess?

MR. FAUST: Like we have been saying before, possibly an oversight on somebody's part.

CHAIRMAN KEMENY: Yes. Mr. Frederick, do you have any idea on how they were closed?

MR.FREDERICK: No sir, I don't.

CHAIRMAN KEMENY: Mr. Zewe?

MR. ZEWE: I do not.

CHAIRMAN KEMENY: Mr. Scheimann?

MR. SCHEIMANN: No sir.

CHAIRMAN KEMENY: Okay, thank you. Professor Pigford?

COMMISSIONER PIGFORD: Mr. Frederick, I would like to follow up to some fo the questions that were raised in your testimony to the -- for the Udall task force, the Udall Committee Task Force. I am referring to the questioning of May 11th.

Now I found interesting there your comment that the relief valve on the pressurizer had stuck open once before and you mentioned that there was some repair work going on and they -- the purpose of the repair work was so that in the future, if it were to stick open, you would

de-5

be able to tell that it is open. Can you tell us the repair work that was done for that purpose?

MR. FREDERICK: The time that it stuck open previously was not on my shift. I just found out about it through reading the reports. The maintenance I was referring to was installing a valve indication that would tell the operator that the valve was open. It is the red light that exists on the panel now which, as we have said before, is simply a command signal indicator. It does not actually indicate valve position. That is the installation I was referring to.

COMMISSIONER PIGFORD: So it indicates command and not whether it is really open or not?

MR. FREDERICK: That is correct.

COMMISSIONER PIGFORD: You see, I raised the question because before the Udall Subcommittee you said, "the purpose of the repair was so that if it were to stick open you could tell if it were really open." I am inserting an adjective here or there. Maybe I am misconstruing what you had in mind.

MR. FREDERICK: The purpose of the installation, assuming that if it stuck open it would be because the command signal was calling for the valve to be open and that command signal was not taken away.

COMMISSIONER PIGFORD: Do you feel now that it

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accomplished that purpose?

MR. FREDERICK: No, it did not. It would have been better to install an absolute valve indication that told whether the sequence was covered by the dischron --

COMMISSIONER PIGFORD: But, I gather you are telling us what you understand in terms of maintenance carried out by someone else?

MR. FREDERICK: That is correct.

COMMISSIONER PIGFORD: Is there some log that you know of that would show this record?

MR. FREDERICK: That the maintenance was performed?

COMMISSIONER PIGFORD: Yes.

MR. FREDERICK: I am not familiar with the documents, but the job certainly would have been logged somewhere.

COMMISSIONER PIGFORD: Is it in your log?

MR. FREDERICK: The log that I maintain pertains only to operation of the plant and out of service equipment not in the repair of that equipment.

COMMISSIONER PIGFORD: Yes. Have you had a chance to look over the record of the testimony before the Udall Subcommittee?

MR. FREDERICK: I have read it once, yes.

COMMISSIONER PIGFORD: Then who was it who finally decided that maybe that valve was open and we had better investigate and then close it? Is there some person that you can identify?

de-1

MR. FREDERICK: As far as I know the action to close the valve was out of -- somewhat out of desperation. In other words, there seemed to be no other possible cause for the low pressure and it just seemed like something that we could try to see if that would isolate the problem. It is not at all a recommended procedure to isolate a relief valve. It is a last ditch effort.

COMMISSIONER PIGFORD: I understand, Mr. Frederick. Who was that who decided that maybe it was open and they should now close it, do you know?

MR. FREDERICK: I believe Fred Scheimann closed it. I think it was at the suggestion of Brian Mehler.

COMMISSIONER PIGFORD: Could you give me that name once more? Mehler?

MR. FREDERICK: Brian Mehler, M-e-h-l-e-r.

COMMISSIONER PIGFORD: Now, is he an operator also?

MR. FREDERICK: He is Shift Supervisor, Senior Reactor Operator.

COMMISSIONER PIGFORD: I see. Now, was he there during your shift?

MR. FREDERICK: He was there in the latter part of my shift. He came in several hours after the initiation of the accident.

COMMISSIONER PIGFORD: Yes. Would he normally have

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been on a shift to replace your shift?

MR. FREDERICK: Was he on the oncoming shift?

MR. ZEWE: Yes, he was the oncoming Shift Supervisor for the day shift to relieve myself.

COMMISSIONER PIGFORD: Did he come on early by any chance?

MR. ZEWE: I don't know.

COMMISSIONER PIGFORD: And apparently it was he who recognized the possibility that the valve was open? Were you there when that happened when he deduced this?

MR. FREDERICK: Yes sir.

COMMISSIONER PIGFORD: Do you know what he did then?

MR. FREDERICK: He suggested to the Supervisor and the Foreman that we try isolating the valve.

COMMISSIONER PIGFORD: Yes. Did you -- and apparently then it was isolated as a result of that, is that correct?

MR. FREDERICK: Yes, I believe so.

COMMISSIONER PIGFORD: How long had it been open?

MR. FREDERICK: According to the sequence that I read it was two and a half hours, approximately.

COMMISSIONER PIGFORD: Now, I gather from your

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testimony that first -- was there some alarm which was triggered off by the thermal couple reading the temperature in the tail pipe from the valve?

MR. FREDERICK: I have been told that, that alarm was on the alarm printout , yes.

COMMISSIONER PIGFORD: It was a printout rather than an audible alarm?

MR. FREDERICK: That is correct.

COMMISSIONER PIGFORD: About when did that alarm occur?

MR. FREDERICK: I don't know.

COMMISSIONER PIGFORD: Did it occur during your shift?

MR.FREDERICK: I think so. In the alarm printout which was delayed some hour and a half or so, it would have been during my shift sometime, yes.

COMMISSIONER PIGFORD: I see. So it was not available until about an hour and a half after the beginning of the event?

MR. FREDERICK: I am just guessing. I don't know at what time it appeared on the computer, or if it appeared on the computer at all.

COMMISSIONER PIGFORD: Mr. Faust, do you happen to know? You were on duty also at that time, weren't you?

MR. FAUST: At that time, why yes, I was on duty.

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I was on the secondary side of the plant during while they were trying to determine what I believe what you are asking. In other words, I wasn't involved in looking at that at the time.

COMMISSIONER PIGFORD: Yes. Mr. Zewe, do you have information? I am speaking of the alarm,in whatever form, that was initiated as a result of the temperature in the tail pipe?

MR. ZEWE: I am not sure of the exact time that the alarm came in, but it should have happened within seconds of lifting of the relief valve.

COMMISSIONER PIGFORD: Yes. Now, and then the question is, was that alaram known to anyone at that time?

MR. ZEWE: I did not see it on the computer alarm printout at the time because of the activity that was taking place at the control room at that time. But I would assume that it should have been in and it would not have been abnormal for that alarm to be in at this time knowing that the electromatic valve had opened because of the high pressure in the reactor coolant system.

CHAIRMAN KEMENY: I would like to just ask a couple of questions for clarification. I am a little confused. Could you give, Mr. Frederick, could you give me some idea of how many alarms might have gone off during the first five to 10 minutes? Was it like two or 200?

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MR. FREDERICK: In the first few seconds of the accident there were probably several 100.

CHAIRMAN KEMENY: Several 100. So clearly you couldn't personally have checked all of those. Mr. Zewe, am I pronouncing your name correctly? We had a debate on the correct pronounciation.

MR. ZEWE: Zewe.

CHAIRMAN KEMENY: Zewe. Thank you. Mr. Zewe, did at any time let's say during the first half hour , any of have a chance to look at the alarm center, or were you so busy you had no chance to look at it?

MR. ZEWE: Quite sone after we had the event I had called the Unit I Shift Supervisor to come over and assist me. And when he came over I asked his aid in looking at the computer printout to try to help us along with the casualty that we had before us. And he was evaluating the alarm typewriter and the printing of the computer.

And I did ask him to check for any discharge temperature sometime after that.

CHAIRMAN KEMENY: At what point did the alarm printer start printing out? We gather there was some sort of major delay there or a paper feed problem?

MR. ZEWE: If I remember correctly, sometime about 12 minutes after 4 or so the computer alarm function

d1a-12

became inoperable and for approximately an hour and 20 minutes after that until we re-initialized the computer and again gained the function of the alarm status of the computer.

COMMISSIONER KEMENY: While it was functioning, was it printing real time or is there a delay when an awful lot of alarms go off?

MR. ZEWE: On the alarm printer it prints out and it keeps a running backlog of what the actual time was for the alarm. It is not real time and it becomes very backlogged just because of the mechanics of the typewriter. It physically takes a certain amount of time to print up each alarm, and it scans so many functions that it physically becomes further and further behind as you receive more and more alarms.

COMMISSIONER KEMENY: Does it have a buffer that keeps that information that is not yet printed out, do you know?

MR. ZEWE: Normally it does, yes.

COMMISSIONER KEMENY: So why was the information lost in that case after 5:00 o'clock?

MR. ZEWE: This is just conjecture on may part, but it was so far behind we had problems with the paper jamming up and we had a technician working on the computer and I believe that he just re-established the time on the computer which would preclude the memory that hadn't

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printed out to that point and started again at time zero once he re-initialized the computer.

CHAIRMAN KEMENY: I see, thank you.

COMMISSIONER PIGFORD: Someplace in one of the sequences of events there is a statement that at a certain time there was an alarm from this thermal couple, and I would still like to know was it actually possible for any of you to know that or not when that alarm came in?

MR. ZEWE: It was possible for us to go over. Whenever the computer has an alarm function on it, all right, there is a computer sound that sounds and it flashes saying that we have an alarm on the computer. You will go over and read the alarm printer to find out what value the particular parameter is at and if the alarm condition prints out what the condition is. All right?

So if we had checked the alarm printer at that particular time we would have seen the alarm come in. However, that alarm typewriter itself, if you were to get in an alarm at any point where you had a mess of other alarms in, it would go all of the way back to the back of the backlog. So, it might be some time period before that actual alarm came out to your visible presence.

COMMISSIONER PIGFORD: Then, are you saying that the time it actually came out was not the time that it was indicated in the sequence of events?

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MR. SCHEIMANN: I am saying that is quite possible.

COMMISSIONER PIGFORD: I see. Has anyone sought to examine the records to see that, do you happen to know?

MR. ZEWE: I have looked at the alarm responses and I can't remember finding the actual place at which an alarm and at the temperatures that we had indicated.

COMMISSIONER PIGFORD: However, it was testified that at 25 minutes and again at 80 minutes into the accident, someone did call up the temperature and found it to be what, about 280-285 degrees?

MR. ZEWE: The highest reading that I had received after I had requested to have it checked was approximately 232 degrees was the highest I had ever received information on.

I physically did not ask for it from the computer but I had other people do it for me and that was the word that I had from them that it was about 229 to 232 was the highest reading I had received.

COMMISSIONER PIGFORD: Do you remember what it was on both instances? There were two times it was called up, apparently.

MR. ZEWE: They were pretty much in the same ball park within about five degrees.

COMMISSIONER PIGFORD: Mr. Zewe, do you have an emergency procedure that tells you what to do if that

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temperature is -- if there is an alarm on the computer from that thermal couple?

MR. ZEWE: We do have an emergency procedure that addresses the electromatic relief valve and the discharge temperatures on the tail pipe downstream of the relief valve.

COMMISSIONER PIGFORD: And what does it tell you to do with regard to the temperature that is read?

MR. ZEWE: It has you isolate the suspected leaky relief valve.

COMMISSIONER PIGFORD: What temperature does it say you must go into isolation?

MR. ZEWE: I believe it says approximately 130 degrees.

COMMISSIONER PIGFORD: I have trouble remembering these two and I am sorry I lead you into this without telling you what I have before me. This is a procedure that is dated June, 1977 concerning the possible leaking of the pilot operated relief valve and it says, "Syptoms," which I presume are instructions to you to know if something is possibly leaking or open.

Number one says,"Relief valve discharge line temperature exceeding the normal 130 degree fahrenheit. Alarms on computer at 200 degrees fahrenheit." Now I am assuming that this is the applicable emergency procedure that

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I am quoting from. Is that reasonable?

MR. ZEWE: If we had been aware that the relief valve in fact was stuck open, we would use that procedure. But at this point in time we did not suspect that we had the relief valve -- had failed to close. All right? But if I may add, all right, prior to this we have had readings that have been greater than 130 degrees normally, all right, because either the electromatic valve or the code safety valves do have some leakage passed them.

CHAIRMAN KEMENY: What is the highest you have had?

MR. ZEWE: The highest reading that I have seen?

CHAIRMAN KEMENY: Previously.

MR. ZEWE: In the neighborhood of 200 degrees. I have seen,in reviewing logs since the accident, approximately 198 degrees. But I can remember instances before that which I don't have before me, somewhere just over 200 degrees, 203, 203.

COMMISSIONER PIGFORD: But during this accident you read it two times at 20 minutes, 25 minutes and 80 minutes and I think you told us 230 degrees, is that correct?

MR. ZEWE: Yes sir.

COMMISSIONER PIGFORD: And so that is greater than the temperature in your specs that says there should be an alarm indicating a leak.

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MR. ZEWE: Yes sir, but knowing that the relief valve had lifted,the downstream temperature I would expect to be high and that it would take some time for that pipe to cool down below the 200 degree set point. So that alarm by itself was normal.

COMMISSIONER PIGFORD: Would you expect it to stay at that temperature for 55 minutes, which seems to be the elapsed time between these two times you called for the temperature?

MR. ZEWE: I really don't have very good feel for how long that it would stay hot, but it would not be too hard for me to conceive that it would take at least that long for this to cool down after being open.

COMMISSIONER PIGFORD: But now getting back to the logic and the applicability of your emergency procedure, what I am getting is the temperatures you finally learned about higher than the maximum in your procedure. Now I think what you have told us is that the procedure is applicable if you know the valve is leaking? Yes?

MR. ZEWE: The procedure is applicable if I know the valve is leaking?

COMMISSIONER PIGFORD: Yes, I thought you said a moment ago that this is the procedure you are to follow if you know that the valve is leaking?

MR. ZEWE: Yes.

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COMMISSIONER PIGFORD: It does raise a difficulty in my mind as it does appear that maybe this number one item on the procedure is to give you a symptom that the valve is leaking so that you would then follow the procedure because it says, it alarms symptom number one, it alarms at 200 degrees Fahrenheit under the subject "Leaking Relief Valve."

MR. ZEWE: I agree, but normally ever since we have started up Unit II, the relief valve temperatures have always been greater than 130 degrees. They have been in the neighborhood normally of 175 to 195 degrees normally because we knew that we had a certain amount of small leakage passed that valve or either one of the code valves which have their calm and downstream of the discharge point of the relief valve.

So we could have had some of the high temperature caused from the other valves leaking by causing the high temperature to be reflected in the other two valves.

COMMISSIONER PIGFORD: So apparently you felt that this emergency procedure just wasn't applicable at that time? Is that correct?

MR. ZEWE: Yes sir.

COMMISSIONER PIGFORD: Mr. Frederick, did you also feel that?

MR. FREDERICK: Yes sir.

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CHAIRMAN KEMENY: Could I ask one follow up question on that Professor Pigford? Do you know what other symptoms you would look for to see whether the valves were stuck open?

MR. FREDERICK: I would have suspected that we would receive a much higher temperature in the tail pipe. 230 degrees does not indicate to me that the valve is blowing by.

CHAIRMAN KEMENY: But where else would you look for a reading to find out if it is stuck open?

MR. FREDERICK: You would look at the valve indication to see if it indicated open.

CHAIRMAN KEMENY: Mr. Zewe, would you look anywhere else?

MR. ZEWE: Yes sir, the discharge point of the valve, which would be the reactor coolant drain tank.

CHAIRMAN KEMENY: Did you at any time look as to what was happening to that drain tank?

MR. ZEWE: We did look. I am not sure of the exact time that we first went to look at it. It was probably 25 minutes after the event.

CHAIRMAN KEMENY: Is that something easily visible on your control panel?

MR. ZEWE: It is easily accessible, but not really visible from te main portion of the control room. It is

de-20

acutally, you have to walk out around the panel and go behind panels that face the control room to actually read this adjacent panel.

CHAIRMAN KEMENY: Commissioner Haggerty and then Professor Pigford.

COMMISSIONER HAGGERTY: I am confused in terms of the report which was submitted to the NRC on the event at 25 minutes says: " The operator requested the computer print the electromatic relief valve outlet temperature. A value of 285.4 was indicated."The operator attributed the temperature level to the normal cool down of the discharge head, et cetera, pretty much as you have said, but that is 50 degrees higher than you have indicated.

Than at 12031 the operator requested the computer print the electromatic relieve valve out a temperature. A value of 283 was indicated, substantially the same. Then at 2:17, the third time, the operator requested that the computer print the electromatic relieve valve outlet temperature. A vale of 228.7 was indicated. That was the first time the roughly 230 that you remember is indicated in this report and it is five minutes after that, that the valve was shut and the thing began to get under control.

Now this 283 doesn't seem, and this 285 doesn't seem to agree with your memory of it never being over 230.

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MR. ZEWE: Sir, I did not have the input into that report that you have before you. Once I was able to review the information there I made comments to the effect that I had never seen temperatures greater than 232 at any time, including 283 or whatever you have there before you. I had not seen a temperature that high and it is correct that my temperature, that as I recall, was 232 at the highest point, which in fact is 50 degrees less than what is indicated there.

s-8

COMMISSIONER HAGGERTY: Would you have been the operator who requested the three printouts?

MR. ZEWE: I did request two of them, yes. I didn't-- I really didn't request a printout. All right? I just requested it to be called up from the computer. You could do that on the display window which wouldn't be recorded in the typewriter, either.

COMMISSIONER HAGGERTY: Well, these temperatures of 285 and 283 had to come from somewhere though.

MR. ZEWE: I have not seen the computer printout where these temperatures were made available from for the report.

COMMISSIONER HAGGERTY: Would you have considered that an excessive temperature, 285, since that is well above the 190?

MR. ZEWE: It would have concerned me to a larger

de-22

degree.

COMMISSIONER PIGFORD: Mr. Frederick, Mr.Rice of the Task Force asked you about this and he quoted to 285 as the reading and you said that would not be abnormal. Is it meaning that you thought -- was your recollection that 285 was the temperature that was called out?

MR. FREDERICK: No sir. He asked me I thought that was abnormal at that time and I said no, I did not.

COMMISSIONER PIGFORD: I see. What is your recollection of the temperature that was called out at these two instances?

MR. FREDERICK: I don't remember that temperature or that information being relayed to me at that time. Whoever was calling up the information did not feel it was abnormal and did not relate it to me.

COMMISSIONER PIGFORD: Mr.Faust, before the Task Force you said we have a procedure that covers a leaking relief valve if we suspect it. And my question is, what then would normally lead you to suspect it so this procedure can be implemented?

MR. FAUST: Well, at the time we were more concerned, or I was concerned about a steam generator leak. As far as-- temperatures would have to be above 200 degrees before I would consider them, or at least on the tail pipe, being other than just normal leakage that we had been having up

de-23

to this time. We knew that the electromatic had lifted earlier so I don't -- depending on when this thing fits in the sequence of time, I don't have a feel for how fast it had cooled down. But saying that it was at a normal temperature up around 190-200 degrees, seems like it would take quite a while for a pipe like that to cool off.

COMMISSIONER PIGFORD: Is it your understanding, Mr. Faust, that this is reading the temperature of the steam that is flowing through the tail pipe?

MR. FAUST: This is indicating pipe temperature.

COMMISSIONER PIGFORD: But what is the answer to the question? Does it indicate the temperature of the fluid that is flowing through the tail pipe?

MR. FAUST: It is an indication of it. It is indicating whatever the water heats the pipe up to.

COMMISSIONER PIGFORD: Mr. Zewe, I think you said you expected a much higher temperature than 230. If the relief valve were really stuck open, why?

MR. ZEWE: I would expect to see over 300 degrees, at least, for the relief valve temperature there on the downstream side, because you have a steam space and pressurizer that is approximately 650 degrees steam that is relieving through the relief valve and I would suspect that the discharge pipe would be a lot higher temperature indication than the 230 degrees.

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COMMISSIONER PIGFORD: I suppose it depends upon whether there is insulation on top of the thermal couple on the outer surface of the pipe, doesn't it?

MR. ZEWE: Yes, sir.

COMMISSIONER PIGFORD: Do you know if there -- I am sorry. Did you know at this time if there were insulation there or not?

MR. ZEWE: Sir, I did not know for sure if the -- where the insulation was. But it wouldn't do us any value at all at any time if the insulation was between the pipe and the thermal couple itself.

COMMISSIONER PIGFORD: Are these emergency procedures something that all of the operators are supposed to be familiar with?

MR. ZEWE: Yes, sir.

COMMISSIONER PIGFORD: And is the one I quoted from,to your knowledge, the procedure that was in effect at the time of the accident?

MR. ZEWE: We did not specifically pull out that procedure until later because we did not suspect that we had the relief valve problem.

COMMISSIONER PIGFORD: To your knowledge, is the procedure that I quoted from , the one that was in effect at the time of the accident?

MR. ZEWE: It was in effect, yes sir.

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COMMISSIONER PIGFORD: And I find that this procedure also suggests, among symptoms, that the reactor coolant drain tank pressure and temperature, if above normal, would give some indication. I am paraphrasing what it says. Do you recall that?

MR. ZEWE: Yes sir.

COMMISSIONER PIGFORD: Yes. Was the recognition that the relief valve was probably open reached in the telephone conference call involving Mr. Miller, to your knowledge?

MR. ZEWE: No sir.

COMMISSIONER PIGFORD: Mr. Frederick, as we find in the Task Force questioning proceeding with you through the accident, you mentioned securing the pumps and you were in the process of raising the steam generator level and you stated, quote ,"we established natural circulation," unquote. Do you remember that part of the questioning?

MR. FREDERICK: Not specifically.

COMMISSIONER PIGFORD: Well, have I given you enough to know the place in the time sequence where we are?

MR. FREDERICK: Yes, sir.

COMMISSIONER PIGFORD: Do you believe that natural circulation was established?

MR. FREDERICK: No sir. We were attempting to establish natural circulation.

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COMMISSIONER PIGFORD: I see. The quote is really not what you intended to say then?

MR. FREDERICK: Probably.

COMMISSIONER PIGFORD: Was natural circulation ever established?

MR. FREDERICK: At the time I was not -- I was not fully aware of all of the indications that we would get when natural circulation was established. I was carefully monitoring the board indications of RCS temperature and trying to evaluave whether natural circulation was developing, but I was relying on the senior personnel and the representatives from the service company as to whether or not natural circulation was occuring.

COMMISSIONER PIGFORD: Who was the senior person present in the con rol room at this time when you were trying to establish natural circulation?

MR. FREDERICK: There were others in the room. The person I dealt with directly was Mr. Lewe.

COMMISSIONER PIGFORD: And --

MR. FREDERICK: However, he was conferring with all of these other people I am referring to.

COMMISSIONER PIGFORD: At that time was there some more senior person present also?

MR. LEWE: I am not sure of the time frame here when the Unit Superintendent, Mr. Logan, was there. But a

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discussion that we were into were between myself and the operators and George Sounder, our Unit Superintendent for Technical Support.

COMMISSIONER PIGFORD: In your opinion, Mr. Zewe, was natural circulation established?

MR. ZEWE: No it was not.

COMMISSIONER PIGFORD: Now tell me, I haven't had a chance to read your technical specifications, is that a requirement when you go into a shutdown mode like this?

MR. ZEWE: To go on natural circulation sir?

COMMISSIONER PIGFORD: Yes.

MR. ZEWE: No, it is not.

COMMISSIONER PIGFORD: Is it --

MR. ZEWE: Normally we always have flow through the core either by way of the normal reactor coolant pumps of the long term cooling D.K. heat pumps. And we always establish D.K. heat flow before we secure reactor coolant pumps. So normally there is always forced flow through the coolant system and through the core.

COMMISSIONER PIGFORD: Well normally.

MR. ZEWE: Yes, sir.

COMMISSIONER PIGFORD: But I am speaking of now then, let's get into emergency procedures. Is establishing natural circulation an objective in your emergency procedures?

MR. ZEWE: I am not -- are you saying is there

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a certain procedure that says for natural circulation this is what you use? All right. Our blackout procedure, or loss of offsite power where we lose the availability of running our reactor coolant pumps, all right, is the point at which we would go into a natural circulation in an emergency situation because we lost the available power source to run the reactor coolant pumps.

We were still too high in pressure yet to use the normal D.K. heat pumps for flow. That is the point at which we would go into withdrawal of natural circulation.

COMMISSIONER PIGFORD: Is it reasonable --

CHAIRMAN KEMENY: Professor Pigford, one question I think we are getting confused about the word normal here, at least I am. So I will just ask two quick questions and then back to you.

Mr. Zewe and Mr. Frederick, have you experienced previous reactor trips?

MR. ZEWE: Yes sir.

MR. FREDERICK: Yes, we both have.

CHAIRMAN KEMENY: In those cases did you try to establish normal flow or did you stay with the high pressure injection system?

MR. ZEWE: We always stayed on with our normal reactor coolant pump flow.

CHAIRMAN KEMENY: So therefore, when you say normal

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here, it is normal after the reactor trip?

MR. ZEWE: Right. Normal is normal forced flow by the reactor coolant pumps.

CHAIRMAN KEMENY: Yes, so you are saying you did something different here from what you had done in previous reactor trips?

MR. ZEWE: Yes, sir.

CHAIRMAN KEMENY: I am sorry. Professor Pigford?

COMMISSIONER HAGGERTY: Again, this same report of May 15th says that reactor building sump pump A started on a high reactor building sump level, but that the -- this normally happens about once per shift and for this reason the pump stark was not considered extraordinary by the operator.

But then later at 38 minutes, operator stopped reactor building sump pump A to prevent overflowing the auxillary building sump tank. At 3811 operator stopped reactor building sump pump B to prevent overflowing the auxillary building sump tank. Where did you think all of the water was coming from?

MR. FAUST: At the time, the steam generator.

COMMISSIONER HAGGERTY: Into the reactor containment?

MR. FAUST: Into the reactor containment building, yes.

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COMMISSIONER HAGGERTY: How?

MR. FAUST: That could have been a feed line break, and as it was we were experiencing problems with indication of a steam generator decreasing, which was another indication of a leak in the generator.

COMMISSIONER HAGGERTY: But you were having coolant pump problems? You were getting a hammer and --

MR. FAUST: Well, I understand it was one of the things we were looking at and we had reason to believe that our problem was in the steam generator because when I initially cut in feed water to that generator, I put it through quite a transient, a cycle, thermal cycle, as I admitted it would be on the order of about 60 degree water into that hot generator.

COMMISSIONER HAGGERTY: So you thought you had some damage there?

MR. FAUST: Possibley, yes.

COMMISSIONER HAGGERTY: I am curious, with all of the water though, and with the inability to get your coolant pumps to operate indicating that you had voids, that the two didn't go together somewhere and --

MR. FAUST: Part of this could have probably been attributed to this. I might have cooled it down in excess of the way, lead into a pressure problem.

MR. FREDERICK: The indications were of a secondary

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leak, not of a primary leak, because there was no radiation alarm.

COMMISSIONER HAGGERTY: I beg your pardon?

MR. FREDERICK: The indications were of a secondary leak rather than a primary because there were no radiation alarms. These symptoms are identical with that exception.

COMMISSIONER TAYLOR: Do you have any reason to believe now that there couldn't have been any serious leakage from the steam generators? In other words, your original reason for your original explanation for the water in the sump tank, or in the sump, is it possible that that could have been at least partly right? That in addition to the pressurizer relief valve releasing water into the sump tank and then that flowing, that there could have been significant water loss from the steam generator?

MR. FAUST: There could have been , yes. Well, that would depend --

COMMISSIONER TAYLOR: Is there anything that would indicate --

MR. FAUST: Because we hadn't isolated the generator.

COMMISSIONER TAYLOR: Is there anyway of looking back that occurs to you to try to find out whether you were at least partly right?

MR. FAUST: Well, the fact that we have been

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maintaining an inventory in the B generator, which is our suspected leak. In other words, we haven't been losing water.

CHAIRMAN KEMENY: Excuse me, Mr. Frederick, You said the difference is -- the reason you suspected the secondary system was that there was no radiation alarm. Didn't at 25 minutes something called a high radiation alarm go off? Were you aware of this?

MR. FREDERICK: He is referring to the letdown.

CHAIRMAN KEMENY: From the sump pump.

MR.FAUST: It is the ITS letdown, radiation detectors.

CHAIRMAN KEMENY: Are you aware that there was a significant radiation indication in the sump pump?

MR. FREDERICK: The only earlier radiation I am aware of is in the intermediate closed cooling water system, and that would not be particularly significant on a reactor trip.

CHAIRMAN KEMENY: So you were not aware of the radiation coming out of the sump pump area?

MR. ZEWE: If I may interject at this point. There may be some confusion on the time that we are referring to here, all right, As I remember we actually thought that we had a problem with the steam generator a little bit later than when we had isolated the reactor building sump pumps.

All right? And that this was sometime after

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whenever we had looked at the RC drain tank. All right? And we then had zero pressure and a rather high temperature and off scale low on level. All right?

So the water could have come from the RC drain tank. All right? The relief valve could have lifted which caused a leak on the RC drain tank to be transmitted to the sump. And at this point the only alarm that we had as far as radiation goes, are the intermediate cooling lines to the letdown coolants,which are right along side the RB sump.

And these are very susceptible to background radiation and they have a very, very low set point. Yes?

MR. LUNDIN: Did I understand you to say earlier, Mr. Zewe, that you were monitoring within the first hour after the event the drain tank temperature and pressure?

MR.ZEWE: I am not sure exactly when we did look at the drain tank pressure level. All right?

MR. LUNDIN: Were you aware at the time that it occured that the ruptured disk in the drain tank had gone?

MR. ZEWE: I did not know that, no.

COMMISSIONER PIGFORD: Mr. Zewe -- I am sorry, Mr. Frederick, I gather from your testimony elsewhere that you were the one who requested the sump pumps to be turned off, is that correct?

MR. FREDERICK: Yes, sir.

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COMMISSIONER PIGFORD: And please tell us again, on what signal, what information?

MR. FREDERICK: An auxillary operator called me on the page phone from the auxillary building. He has a remote indication of the reactor building sump level on is panel there in the auxillary building. He called me to tell me that his indication of level was off scale high, greater than six feet.

I went to the computer and requested the sump in the reactor building manually to see if my indication agreed with his, and it did. Mine read at six feet or greater.

Since I didn't know where the water was coming from, since I only suspected it was from the drain tank, and it was very unusual to have both pumps running and a high level at the same time. I suggested to the Supervisor, Mr. Daley, that we turn off the pumps.

COMMISSIONER PIGFORD: Why?

MR. FREDERICK: Rather than transfer water of an unknown origin into the auxillary building.

COMMISSIONER PIGFORD: You were then concerned with what possible consequence if you didn't turn them off?

MR. FREDERICK: First in my mind was overflowing the auxillary building tank which contained radioactive water.

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COMMISSIONER PIGFORD: I see. Was the radioactive water,that you were worried about,getting from the containment building to the auxillary building?

MR. FREDERICK: Yes sir.

COMMISSIONER PIGFORD: And possibly overflowing the tanks?

MR. FREDERICK: Yes.

COMMISSIONER PIGFORD: Now, when you turned the sump pumps off, does that isolate the sump from the auxillary building? Is it possible for water still to flow through to that line, that pipe?

MR. FREDERICK: I believe it is possible, yes. However, I thought that the auxillary operator isolated the lines at that time.

COMMISSIONER PIGFORD: You that you did?

MR. FREDERICK: Yes.

COMMISSIONER PIGFORD: What information led you to think that?

MR. FREDERICK: No, it was just an assumption on my part.

COMMISSIONER PIGFORD: From your narrow hindsight, was it in fact isolated at that time?

MR. FREDERICK: I do not know.

COMMISSIONER PIGFORD: Mr. Dewe, do you know?

MR. DEWE: Yes. From the information that I could

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gather from talking with the operator right at the panel and what indication he had that day when he secured both his sump pumps, it was in fact lined up to the miscellaneous waste hold up tank,which is on a higher elevation than the RB sump. So it would have been, and I am just speaking from a gravity flow type standpoint or siphon effect, that it should have precluded letting the water from the reactor building sump go into this miscellaneous waste hold up tank by a siphon effect. All right?

The valves were lined up in that fashion. But the valves from the auxillary building to the reactor building were not physically isolated from the building. But it is just a question of where the water would have been directed to.

CHAIRMAN KEMENY: Would you just say that again? Which tank were the valves lined up into?

MR. ZEWE: From talking to the auxillary operator who was there at the time, the reactor building sump pumps were lined up to the miscellaneous waste hold up tank.

CHAIRMAN KEMENY: That is not the same as the one radiation waste tank that --

MR. ZEWE: The -- you might be confused between the nomanclature that we used for various tanks in the auxillary building, all right. All of these tanks, the miscellaneous waste hold up tank, the aux building sump

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tank and the aux building sump are all in the auxillary building, but there are different elevations in the auxillary building and we have the pathways available for us to line it up to either one of these three tanks.

CHAIRMAN KEMENY: Is this miscellaneous, the one that it was going into, was this a huge tank?

MR. ZEWE: Yes, it is. It holds approximately 20,000 gallons.

CHAIRMAN KEMENY: Did you have evidence as to whether the level rose in that tank?

MR. ZEWE: I do not.

CHAIRMAN KEMENY: Mr. Lundin, do we have any evidence on that subject that you believe?

MR. LUNDIN: Yes, we have some evidence that indicated to us that the liquid level in the waste tank did not increase during this period of time. Can you comment on that?

MR. ZEWE: Yes. I have seen that same report that the level in that tank had approximately been 7.4 feet, if I remember right, and that it hadn't changed signficantly enough to contain the water that was pumped over for the time that the sump pumps were on.

Now, I am just going by the operator that was at the panel at the time. And it was further checked by another operator. All right?

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We did have an increase in level in the aux building sump tank and the aux building sump which, in turn, did overflow. But the fact remains that the operators do specifically remember and did check the valve line ups. And I am going on that information from my operators.

CHAIRMAN KEMENY: From the other statement you made, would you infer that they were wrong?

MR. ZEWE: No. I really don't know the final conclusion on if the level instrumentation on the miscellaneous waste hold up tank was true and accurate at that point in time. I don't have any knowledge either way saying that we have found since then that the instrumentation was valid or that it was invalid at this point in time.

CHAIRMAN KEMENY: Well now, I am just asking something very simple. You think the operators are sure it is going into one tank? There is no indication that the level goes up. It is not a tank that overflows to the floor? Isn't there some suspicion that it may have been going to the other tank?

MR. ZEWE: Yes, sir. You could believe that, but there is also other sources of water that could cause those tanks to overflow.

MR. LUNDIN: Was the valve line affected?

MR. ZEWE: Yes, it was.

MR. LUNDIN: And what was found?

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MR. ZEWE: It was found to be lined up to the miscellaneous waste hold up tank. This was -- I am not sure of the exact date, but it was within two or three days after the accident.

COMMISSIONER TAYLOR: Which is the tank that finally overflowed?

MR. ZEWE: Aux building sump tank and the aux building sump also.

COMMISSIONER TAYLOR: Well, how did the water ever get to the aux building sump tank then if the valves were lined up to take it to the hold up tank?

MR. ZEWE: We are still investigating at this time what the exact mode was in order to solve the confliction between what the operator saw and did and what we actually had occur. All right?

And we haven't fully determined yet, to a large extent, exactly what the pathways were of the water from the reactor building to the auxillary building in great detail. There is several possibilities, but they are still being explored and evaluated and the final conclusions have yet to be drawn.

COMMISSIONER PIGFORD: Is that valve line up known in the control room?

MR. ZEWE: Is it known in the control room?

COMMISSIONER PIGFORD: Yes.

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Does the operator in the control room have a means of knowing what the valve line up is?

MR. ZEWE: He does not physically, no.

CHAIRMAN KEMENY: I know Professor Taylor has some questions. Could I sneak in two quick ones because I know you have a number of questions? I forgot to ask you one thing, Mr. Faust. Do I remember in one of your testimonies you said that one problem of seeing those two famous number 12 valves, that they were on green, that the problem was some sort of tag was hanging over it, is that correct?

MR. FAUST: Right. It was a yellow caution tag.

CHAIRMAN KEMENY: Where was that hanging from?

MR. FAUST: It was hanging from UFG 16B, which is an emergency -- it is our feed pump resurge valve.

CHAIRMAN KEMENY: Feed pump resurge valve. You don't happen to know what the date was when that was attached do you?

MR. FAUST: It was probably put on when we had -- it was put on from two runbacks we had due to that valve coming open inadvertantly causing one of the feed pumps to trip off. It was geared to that date.

CHAIRMAN KEMENY: What would the date of that had been, very approximately? I mean, is it anywhere near to March 28th, or would it have had been--

MR. FAUST: I think that was about a month and a

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month and a half earlier, maybe a month.

CHAIRMAN KEMENY: Because we just heard testimony that said that no tag obscured those particular lights.

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MR. FAUST: That tag, I don't know how it would get over the one valve. It didn't get over both of them. It was just hanging down. It could be moved around on the panel.

CHAIRMAN KEMENY: Mr.Frederick, I have one question for you before I turn it over to Professor Taylor. Do you happen to remember what the date was when TMI 2 went critical?

MR. FREDERICK: Yes sir, it is March 28th, 1978.

CHAIRMAN KEMENY: Do I remember that in one of your statements you said you were part of the shift that was there when it went critical?

MR. FREDERICK: Yes sir.

CHAIRMAN KEMENY: On March 28, 1979, do you happen to remember that it was an anniversary date ?

MR. FREDERICK: No sir.

CHAIRMAN KEMENY: You did not?

MR. FREDERICK: Not for several days, no sir.

CHAIRMAN KEMENY: And Mr. Faust, you did not remember it was an anniversary?

MR. FAUST: No, I didn't.

CHAIRMAN KEMENY: I hate to ask this, but we have

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ask all questions. There wasn't a party going on celebrating the anniversary, was there?

MR. FREDERICK: No.

MR. FAUST: No sir.

CHAIRMAN KEMENY: No. Mr. Zewe, there was not?

MR. ZEWE: There was not.

CHAIRMAN KEMENY: Thank you. Professor Taylor? Do you see why we had to ask that? The coincidence is just an enormous coincidence.

MR. FREDERICAK: It certainly is.

COMMISSIONER TAYLOR: During the time from about half an hour after the reactor trip, for about the next couple of hours, when I gather the post mortem is seeing most of the fuel damage was done, Mr. Zewe what were you focusing on the most in terms of all of the components that were being recorded , measurements which were being recorded on the control panel? Which item were you most concerned about giving the most attention to among all of the main components, or was there any single one that you looked at the most?

MR. ZEWE: One of the very first things that I had done was as soon as Mr. Scheimann came back to the control room, which was approximately two minutes after the trip, I assigned him specific duties along with the control room operator to take charge of and to control any

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primary plant pressure and prassurizer level. And I devoted most of my time to helping them, helping the other operator with the -- looking at the emergency feed and so forth and the hot well level in the overall plant.

But the main thing that I was concerned with was naturally the high pressurizer level. It shouldn't have been high, and the pressure which was low, but it had stablized somewhat, and then the emergency feed initiation and the high hot well level and the overall scope of the problem that we had.

COMMISSIONER TAYLOR: Was your reason for concern, particularly about the pressurizer level, that you thought that was a direct indication of the level of water in the core, an indication of whether or not you might be uncovering some of the core? Is that the reason for focusing on the pressurizer level?

MR. ZEWE: No it wasn't. I didn't have any idea at that point that we were going to, or have uncovered the core.

COMMISSIONER TAYLOR: Were you concerned about that possibility? Was that entering your mind at that stage, or did you think it had not gotten that far?

MR. ZEWE: It had not. It had not entered my mind at that point.

COMMISSIONER TAYLOR: Now we have heard that the

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thermal couples, the readings went off scale during this period. The computer printout at least was printing question marks, but that at least one measurement was made by taking a millivolt meter and putting it across the terminals in one of the in core thermal couples and at that point a temperature was registered of about 2500, 2600 units Fahrenheit.

Was that brought to your attention as soon as it was measured? Is that something that was a big event to you during that period? Did you know this temperature was being measured?

MR. ZEWE: I did not know that we had readings from these thermal couples down in the cable spreading room which you are referring to the 2400 degrees. I didn't learn of that number until the afternoon of the 29th.

COMMISSIONER TAYLOR: What is known of that number? In other words, who would have measured?

MR. ZEWE: I know now in retrospect who did do it specifically, but it would have been an instrument and control technician or foreman who would have gotten those readings for us.

COMMISSIONER TAYLOR: And have you talked to him to find out who you relayed that number to, if anybody, during the time when -- immediately after he observed it?

MR. ZEWE: I have not approached the individual and

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asked him who he told that day because I didn't learn about it until the next day to ask him that question.

CHAIRMAN KEMENY: And who was that individual?

MR. ZEWE: I learned later that the man had been requested to take those readings from Gary Miller, the station Superintendent and he had given the readings back to Mr. Miller.

COMMISSIONER TAYLOR: Do you know approximately when that was?

MR. ZEWE: I do not know.

COMMISSIONER TAYLOR: But do you know the name of the person, could you tell us who it was?

MR. ZEWE: I believe that it was Ivan Porter, was the individual. And he is an instrument and control Supervisor.

COMMISSIONER TAYLOR: Okay. So, I gather that the reason you were focusing on the pressurizer was that -- well is this correct that you wanted to make sure that you had control over the pressure, you didn't want it to go solid in the pressurizer, you wanted to make sure you had some way of controlling the pressure in the reactor coolant? Is that the main reason?

MR. ZEWE: That is correct, sir.

COMMISSIONER TAYLOR: So you were not really concerned about very big scale overheating of the core at

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that point?

MR. ZEWE: All of our instrumentation at this point, all right, really did not show excessive core temperatures.

COMMISSIONER TAYLOR: When did you first begin to suspect that you might be getting, or had extensive core damage? Was that during your shift, during that shift before whenever it was, 7:00 o'clock in the morning?

MR. ZEWE: I was physically in the control room up until about 6:00 p.m. that evening of the 28th.

COMMISSIONER TAYLOR: Well, when during that period did you begin to, or did you during that period until about 6:00 p.m. on Wednesday, begin to have reason to believe that extensive core damage had been done?

MR. ZEWE: I did not realize at all that day that we had extensive core damage. I felt at that point that we really didn't know if we had a crud burst due to the shock of the core, or that we did have some fuel damage or clad failure, some but not a significant amount or extensive damage at all, no. I didn't realize that.

COMMISSIONER TAYLOR: That was not then through 6:00 o'clock Wednesday evening. When did you become aware of the fact that there probably was, or at least of the estimate that there probably was a lot of core damage consisting of cladding failure?

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MR. ZEWE: A lot of damage? Probably not for three or four days later that we had a lot. And I am not even sure of that time frame, but it was certainly not that day or the next, or the next after that; sometime further on down the line.

COMMISSIONER TAYLOR: Do you remember whether you began to have this feeling at a time when there was still a large,significantly large hydrogen bubble inside of the pressure vessel? In other words, what I am trying to get at is whether at the time when it was presumed that there was a large hydrogen bubble inside the pressure vessel, did you by that time begin to have reason to believe that there had been a lot of extensive core damage?

MR. ZEWE: At that point I was -- I am not sure how to put it. I was aware that the possibility existed, but just how much there was varied at that point in time from who actually you were talking to at that moment.

We had speculations from very, very, little damage to a lot of damage, and I really didn't have a grasp of how much hydrogen I would have and how much damage that much hydrogen would relate to.

COMMISSIONER TAYLOR: Had you asked yourself where the hydrogen would come from?

MR. ZEWE: Well, at this point now and it is several days later, we had learned that we had had 24 degrees

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in the core and that it would have come from the Zirk water reaction.

COMMISSIONER TAYLOR: I see.

MR. ZEWE: Earlier than that the highest reading that I had seen was about 780 degrees which is nowhere near high enough for Zirk water reaction to liberate the hydrogen.

COMMISSIONER TAYLOR: Now, I want to go back to the question about the closure of the two pairs of reactor coolant pumps A and B that were then closed, I guess, 20 minutes or so apart. First of all, why were they closed?

MR. ZEWE: They were turned off or secured to preclude damage to the pumps themselves.

COMMISSIONER TAYLOR: Was that because there were -- was there anything more than indications from the pressure readings or was there any noise, was there any shaking, any visible sign of what people with experience with big pumps cavitating could have said might be a cavitating pump? Was the control room actually shaking significantly?

MR. ZEWE: It was not.

COMMISSIONER TAYLOR: Was there a loud noise that you could attribute to the pump?

MR. ZEWE: I could not, no.

COMMISSIONER TAYLOR: I want to ask a question, it may sound totally irrelevant, but that is, did any of you who

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were in the control room, among you four, I don't want you to speak for other people, had any of you seen the movie "The China Syndrome" before the accident, any of the four of you?

MR. ZEWE: I have not.

MR. FREDERICK: I have not.

MR. SCHEIMANN: I have not.

MR. FAUST: I have not either.

COMMISSIONER TAYLOR: So none of you had seen the movie before. Let me tell you why I asked the question. I was trying to get some idea whether that might have affected your state of mind at all when the accident took place and in particular facing the possibility of cavitating pump.

MR. ZEWE: As far as the pump indication goes, we did have some oscillating flow indication and high vibration on the pumps.

MR. FAUST: I wouldn't say some. We had quite a bit.

MR.ZEWE: We had a lot, right.

COMMISSIONER TAYLOR: Were you alarmed by this that the pumps might just plain go?

MR. ZEWE: Yes.

MR. FAUST: My impression up to that time, and now I have learned differently, was I was always under the

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impression when you went above three mi stan vibration, you stood the chance of damage to the pipe. That was my impression at the time. Now I am told differently. And we had up around eight to 10.

COMMISSIONER TAYLOR: Thank you.

CHAIRMAN KEMENY: Commissioner Marrett?

COMMISSIONER MARRETT: This goes on a different tack, but given the two of you, Mr. Frederick and Mr. Faust, were in the control room as operators in an event that now has attracted a great deal of attention, I would like to know what has been the affect on you rather personally. Has it produced any changes in your own plans, goals, or anything else?

MR. FAUST: Of course it has affected us.

COMMISSIONER MARRETT: Could you say a little bit more about that? Does that mean that you probably are making plans to leave the organization, or in what way --

MR. FREDERICK: No, I don't plan to leave the organization.

MR. FAUST: We don't have any plans to leave unless I am forced to leave.

COMMISSIONER MARRETT: Do you raise that as a possibility?

MR. FAUST: I don't know. I guess that is what we are here for.

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COMMISSIONER MARRETT: You are asking from our angle? There is nothing internally that might have raised that as a question in your minds, is it?

MR. FAUST: No.

COMMISSIONER MARRETT: Well, if in fact you do plan to stay with the plant, I would assume that you would not want a repeat of these events. But from your angle, what would you as control room operators, and let's say now there are other operators whom you are representing, if you were undertaking an investigation to act, how should something of this nature be prevented? Where would you give your attention?

We have been talking about a number of possibilities ranging from operator training including more simulator training, engineering, more engineering information. We talked about matters of design. Are there ways for better instrumentation? We have talked as well, or at least we have implied, that there may be some matters that deal with organization and management. Where would you give your attention if you were undertaking a look at these kinds of issues and to follow up why would you choose those?

MR. FAUST: I guess I would hit on engine instrumentation for one of the major points as well as operator training and multiple drills, multiple casualties.

COMMISSION MARRETT: Would you follow up on

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instrumentation? What kind of instrumentation changes?

MR. FAUST: Direct indication of what we are looking at, as close as we can get to the core. There is on the diagram behind us, for instance, the thermal couples that monitor in core temperature. That was not up there during the accident. That was put up later. That is that white panel that looks like the outline of the core on it.

COMMISSIONER MARRETT: What about with reference to training, what kinds of changes, what would you propose for training?

MR. FAUST: Well, like I said, we would get into dual situations where we wouldn't have more than just one failure.

COMMISSIONER MARRETT: Mr. Frederick?

MR. FREDERICK: I agree that there should be some method of determining valve position as an absolute. In other words, inferred indication would be unsatisfactory. You must know that there is no valve as a fact.

COMMISSIONER MARRETT: That is on instrumentation. What about training?

MR. FREDERICK: On training, perhaps the -- as Craig said, the basic assumption that we don't train on multiple failures. That should be updated.

COMMISSIONER MARRETT: Are there no managerial issues you would include in your roster of items?

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MR. FREDERICK: Yes. I guess we ought to have a shift turn over written checklist.

COMMISSIONER MARRETT: A checklist for -- there is no such checklist now?

MR. FREDERICK: I am talking about a rather lengthy system by system check of the line ups as they appear on the control panel. And an evaluation should be made as to whether or not the indications on the panel actually depict the status of the system.

COMMISSIONER MARRETT: I would like to return the first question I was raising and I am sure it is awkward, but given the kinds of responses that we got at least from some of the public at our last hearing, it is obvious that some people were making a lot of response to what had gone on, and of course they were not in the operating room.

I guess I would like to return to the question of have the stresses been like, what have they been like subsequent to the event? Mr. Faust?

MR. FAUST: I changed my phone number.

COMMISSIONER MARRETT: I guess that answers it.

MR. FREDERICK: There have been -- during the first few weeks there was rather concentrated attack on the two of us by the press as far as they wanted interviews. They wanted to talk to us about what happened. And I thought we were fairly successful at fending that off.

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I thought it was important, personally, that I did not speak to the press because what I had to say about the accident was extremely technical, and it was easily misunderstood. And mainly the words I would have used to explain what happened could have been completely misconstrued.

MR. FAUST: We attempted this one.

MR. FREDERICK: That is why I didn't say anything to the press.

MR. FAUST: And the way it came out, quotes were made out of context from what we said and what we were explaining and they were fit in with whatever the editor, or whoever puts this stuff together, looks best I guess.

COMMISSIONER MARRETT: How was that done? Did you set up the-- did you agree to the interview? Were they set up in the company or how?

MR. FAUST: No this was -- we were just walking around one dayand happened to run into somebody.

CHAIRMAN KEMENY: Commissioner McPherson?

COMMISSIONER MCPHERSON: Was there any previous indication that that pressurizer valve to stick open? Had there ever been any indication in the history of TMI 2 that that valve could stick?

MR. ZEWE: That it could stick open?

COMMISSIONER MCPHERSON: Yes.

MR. ZEWE: Other than the one that was mentioned

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previously that were we had it fail open on an electrical transient, no. I think the only time that I can remember that we had the valve either fail or --

COMMISSIONER MCPHERSON: I am sorry, I missed that. When was that, when did that happen?

MR. ZEWE: If I remember right, that happened just about a year prior to that on March 29, 1978. That was discussed earlier, at an earlier --

COMMISSIONER MCPHERSON : We were told that. What is the , Mr. Frederick and Mr.Faust, what is the shift that you are on? Is it from 11 to 7?

MR. FREDERICK: 11:00 p.m. to 7:00 a.m.

COMMISSIONER MCPHERSON: 11:00 p.m. to 7:00 a.m. As you develop seniority in the plant, would you be eligible to bid on the day time shift?

MR. FREDERICK: We normally rotate shifts.

COMMISSIONER MCPHERSON: You rotate shifts. So that you have day time sometimes and sometimes nights?

MR. ZEWE: Yes sir.

COMMISSIONER MCPHERSON: How many nights have you been on this particular shift, 11 to 7? I mean, in a row until before this happened?

MR. ZEWE: Five.

MR. FREDERICK: This was our fifth night.

COMMISSIONER MCPHERSON: Fifth night from 11 to 7.

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We earlier asked some earlier -- some of your colleagues to show us what they looked at on that control panel. What were the most important areas that you were looking at, where the really hot areas -- and they did show it and they said, among other things as I recall, that the two -- that the lights that show that the valve on the emergency feed water pump water are not areas that you ordinarily look at.

I found that when I was up in that room a couple of weeks ago with my colleagues here and with the press and with the loudspeaker system going on, that even without anything blinking it was an intimidating dazzling experience. I would ask you to describe, in your own minds, what the state of your emotions were and the state of your sense of competence to control this event were at say 4:30 or 5:00 o'clock on the morning of March 28th while these 200 alarms were flashing and other lights were on?

MR. FAUST: I would have liked to have thrown away the alarm panel.

COMMISSIONER MCPHERSON: You would have liked to have thrown away the alarm panel.

MR.FAUST: It wasn't giving us any useful information.

COMMISSIONER MCPHERSON: What about the state of your -- what about your sense that you could run this thing or that it had run away from you?

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MR. FREDERICK: I felt that we were stablized.

COMMISSIONER MCPHERSON: That you were stable.

MR. FREDERICK: Prior to the problems we started to seal the reactor coolant pumps.

COMMISSIONER MCPHERSON: When did they begin?

MR. FREDERICK: That was shortly -- a little bit more than an hour, I believe.

MR. ZEWE: About a quarter after five or something.

COMMISSIONER MCPHERSON: And then what was your sense of your capacity to control it?

MR. FAUST: Well, during this time we had just begun trying to get back our normal feed path which we didn't succeed at. What we did succeed at least in doing was was getting rejects re-established so that we got the hot well level back down. This was occuring during that time. We just took a part of the supervisor's time.

MR.FREDERICK: At that point I felt it was increasingly difficult to determine the actual condition of the reactor coolant system from the indications that were present on the panel.

COMMISSIONER MCPHERSON: Do you think that a different kind of panel or more men, more control room operators in there could have managed that, or if there are only the two of you there with Mr. Zewe --

MR.ZEWE: And Mr. Scheimann.

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COMMISSIONER MCPHERSON: And Mr. Scheimann. Now there are four of you. Is that enough?

MR. ZEWE: We also had, at this point, George Clender, our Unit Superintendent Technical Support and also the Shift Supervisor that was within Unit I was in Unit II from about seven minutes after the trip until somewhere around 6:30 or quarter of seven. So we were all in at that time.

MR. FAUST: When we were in there this morning, like I said, we were also concentrating on -- I had a problem with the steam generators maintaining the B level which indicated a primary or secondary leak off from that point and then we were also getting into where we started losing steam pressure on the B generator which was another procedure we are into now, as well as just starting off with the reactor, turbine reactor trip down into a possible loss of hot well, trying to get a normal feed re-established and into a steam leak which was a little hard to pick which one you were going to go through.

COMMISSIONER MCPHERSON: So there were a lot of contradictory signals that you were getting?

MR. FAUST: That is what we are trying to get across. It wasn't exactly as clear as these -- or what you have in front of you there is indicating, as to what we were looking at, what we had available.

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CHAIRMAN KEMENY: I am seeing an awful lot of alarm hands going up. I saw Commissioner Haggerty first.

COMMISSIONER HAGGERTY: On steam generator B, when did you begin to think that perhaps you had a leak from the generator into the reactor coolant system?

MR. FAUST: That came about, I would put it about 15 minutes into it because I was having trouble, problems with controlling the initial feeding of the generator up to where I had actually isolated the B generator again and the level was still drifting up.

COMMISSIONER HAGGERTY: When did you isolate? It says here that you isolated B at one hour and 26 minutes.

MR. FAUST: During that time from the different steps I was taking and I waited once again --

COMMISSIONER HAGGERTY: It took 15 minutes to an hour and 26 minutes to see --

MR. FAUST: To see if what I did was going to terminate it or not.

COMMISSIONER HAGGERTY: Did you actually know, Mr. Zewe, that the reactor building sump pump A and sump pump B had been turned off?

MR. ZEWE: Yes, I did. The control room operator, Mr. Frederick, informed me that the sump pumps were on and that he suggested that we secure them and that he told me once the operator informed him that the pumps , in fact,

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had been secured. I did receive that information.

COMMISSIONER HAGGERTY: And you did think that water was coming from a secondary system, or did you just not think at all as to --

MR. ZEWE: I did not know specifically, at that point, where all of the water was from. All right, at that point in time I did not suspect any one thing more so than another. I knew that our water levels in the auxillary building were quite high and that we really didn't have a large volume of inventory.

So, I would just as soon keep the water that was in the reactor building containment in the reactor building and not transfer it over to the auxillary building.

CHAIRMAN KEMENY: Commissioner Lewis?

COMMISSIONER LEWIS: You said earlier that the temperature gauge had basically been leaking and therefore you tended to discount the information that you were getting from that gauge. Am I correct in that?

MR. ZEWE: The temperature indicated on the relief valve?

COMMISSIONER LEWIS: Right. Is that correct?

MR. ZEWE: That is correct.

COMMISSIONER LEWIS: All right. This leads me --

MR. ZEWE: At this point.

COMMISSIONER LEWIS: The valve was leaking, but it

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gave you a faulty indication so you tended to discount it, am I correct sir?

MR. ZEWE: Not really. Really, the temperature indication that we had we suspected was probably real because the valve had lifted and the temperature should be higher than what it should have been prior to the event.

COMMISSIONER LEWIS: Okay. What I am trying to get at is, how many other things were not working as they should have been working at the time of the event? In other words, I think Mr. Frederick you said that there were all sorts of things that were not operating and you were going to say, tomorrow I am going to put out a work order for them. Can you run down the list of some of the things that were not really what an average person would call in working order the night of the incident? There were a lot of them from the look on your face.

MR. FREDERICK: The relief valve, actually the relief valve was suspected of leaking or one of the codes. It was not determined which one was leaking and because of that we were maintaining a chemical inventory balance by operating the pressurizer systems in manual. That was one abnormal situation.

I think I testified at some other interview that I had received an alarm earlier in the evening on the auxiliary transformer voltage low. And I was investigating

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that prior to the accident by reading the alarm response and trying to figure out what gave me the alarm. And I had planned to submit a work request but never got around to it. I can't think of any other specific instance.

MR. FAUST: One thing about it was that we had a reject valve,which normally returns water to our condensate storage tank, was throttled downstream because of problems received earlier. The valve, when it receives a signal would go open wide and what this would end up again would be -- ended up tripping off one of our feed pumps on it and had given us a run back. So that had been throttled manually to limit the rate of return to the condensate storage tank.

COMMISSIONER LEWIS: Let me ask you, is it normal for so many things to be just not working, not in working order? Is it just the way a nuclear reactor works that --

MR. FAUST: I think this is any plant you are talking about now. You are not just talking about nuclear power plants?

COMMISSIONER LEWIS: Okay, I was just trying --

MR. FREDERICK: I believe that where so many systems interface and you have so many different components it wouldn't be unusual to assume that some small percentage of them are not working fully.

COMMISSIONER LEWIS: How long does it normally take to get these sorts of things repaired?

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MR. FREDERICK: It would depend on their importance in the system as a whole. It takes a lot longer to get a chair repaired than it does a relief valve.

CHAIRMAN KEMENY: Commissioner Haggerty?

COMMISSIONER HAGGERTY: Earlier you heard the question about the letter from Novak at NRC and the description of the pressurizer problem that they have a speci problem and so forth. Have any of you ever heard of such a pressurizer loop problem before?

MR. ZEWE: I learned about the problem in David and Bassey after the accident. Prior to that I didn't have any knowledge of that particular event.

COMMISSIONER HAGGERTY: Obviously knowledge of it might have had some considerable difference in your reaction to what was happening.

MR. ZEWE: It might have, yes.

CHAIRMAN KEMENY: Commissioner McBride?

COMMISSIONER MCBRIDE: Yes. Mr. Zewe, you indicated that there were several hundred alarms went off within a few seconds of the event and I am curious as to whether this--

MR. ZEWE: Mr. Frederick said that.

COMMISSIONER MCBRIDE: Oh, is that so. Does that happen frequently?

MR. FREDERICK: In a reactor trip or a tramcr trip, any automatic shutdown like that, you do receive

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quite a few alarms.

COMMISSIONER MCBRIDE: Is it in the same proportion that they were received here? Several hundred alarms went off within a few seconds of the event I think is something that you said.

MR. FREDERICK: Loss of feed, yes.

COMMISSIONER MCBRIDE: That happens often enough that it was not considered a very dramatic thing other than it indicated a problem that you had before?

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MR. FREDERICK: Since it was loss of feed and there are so many components involved, I would expect that many alarms. However, the information which have been related to me by the alarms was just not there. In other words, there were so many alarms that we had to go to other indications to determine the status of the of the plant.

CHAIRMAN KEMENY: I have one question on that. You said you have gone through a reactor trip before. Did that, on previous times,quite as many alarms go off also or was this an unusual number?

MR. FREDERICK: This was an unusual number.

CHAIRMAN KEMENY: Okay, thank you.

COMMISSIONER MCBRIDE: With respect to the pressurizer valve being stuck, somewhere I think someone indicated that an accumulation of resin might have had a

bearing on that being stuck. Is that a reasonable, or has that been established as a fact or not?

CHAIRMAN KEMENY: Perhaps you should first ask Mr. Scheimann if he had firsthand knowledge of that, and we have been neglecting him.

COMMISSIONER McBRIDE: Could someone answer that?

MR. SCHEIMANN: To my knowledge, I never heard anything about that resin buildup in that valve being a possible difficulty.

COMMISSIONER McBRIDE: Is there a resin buildup in any other valves as as --

MR. SCHEIMANN: Are you talking now about the transfer of the resin that was going on?

That was in the condensate polisher system where we had the resin bound up. That was nothing to do with the primary system.

CHAIRMAN KEMENY: Mr. Scheimann, if I may ask, you were working on the polishers at 4:00 a.m. I believe.

MR. SCHEIMANN: That is true.

CHAIRMAN KEMENY: Are those anywhere near the condensate pump that tripped?

MR. SCHEIMANN: Yes, they are. They are right in the discharge line.

CHAIRMAN KEMENY: As far as we know, we don't yet know what tripped it. Is there anything that you or your

colleagues could have been doing that might have tripped that condensate pump?

MR. ZEWE: If I may add something here, we do have further determination now that you may not be aware of on why we did have the loss of feed water transient that day. We have determined that because of water getting into our air system, and this is just knowledge now as we see it today, all right, is that we had water that got into our air systems which caused our condensate polisher valves to go shut which reduced the condensate flow to another set of pumps, the condensate booster pumps, and they secure themselves on low suction pressure. That pump tripped and caused the condensate pump to also trip, which ensued the loss of feed.

CHAIRMAN KEMENY: Mr. Zewe, how do you know that now?

MR. ZEWE: Well, we have done extensive investigation of why we had the loss of feed water flow that day because judging from the computer alarms and the computer printout, it really didn't clarify why we should have a loss of feed water flow that we saw. So in the course of this investigation last week or so we determined that this one check valve which should preclude getting water into the air system in fact was faulty and it would allow water to go into the air system and it would cause the air operated valves on the outlet of the condensate polisher system to fail shut, which would isolate the suction to the condensate booster pumps which supply

suction to the feed pumps which feed into the steam generator. And it is loss of these feed pumps that result in a turbine trip and ensued into the reactor trip.

CHAIRMAN KEMENY: Just one more question. Have you actually examined this valve?

MR. ZEWE: Yes, we did, Sir.

CHAIRMAN KEMENY: But this is in a part of the building you can get into?

MR. ZEWE: It is in the turbine building, yes, Sir.

CHAIRMAN KEMENY: Mr. Lundin.

MR. LUNDIN: I understand that following the previous difficulty with the water getting into the air lines, that some traps were installed to preclude that from happening. Is that so?

MR. ZEWE: This is not my own information but from talking with the people that installed the traps, there were, I believe, six traps installed. But these traps will remove water moisture from the air lines. They will not remove large quantities of water from getting back into the air lines. It isn't designed to remove a slug of water or an appreciable amount of water.

MR. LUNDIN: And it is the feeling then that what you call large amounts of water could have gotten past the traps and into the air lines during the work on the polisher?

MR. ZEWE: Yes, because that morning after we had

the event, we did drain a considerable amount of water from our air system, meaning that a considerable amount of water had gotten into the air system. This test that we did just last week, we went into the same sort of lineup that we had that evening to see if we could get water out through a drain downstream of this check valve that we suspected that was bad, and we estimate that it leaked in the order of five gallons per minute or greater.

So then we removed the valve from the line and examined it and found out that the valve in fact was hanging open and not receding properly.

MR. LUNDIN: Let me make sure that I understand, quickly. Did I understand you to say that following the accident you opened up the air lines and found water in them?

MR. ZEWE: Right. The air receivers and traps from our air system, we have valves that we could drain any of the water or condensate that we have that is in the air lines. And we did pursue that that day of the accident and we found that there was a lot of water in the air lines which should not have been there.

CHAIRMAN KEMENY: Professor Pigford.

COMMISSIONER PIGFORD: I would like to pose a question to each of the witnesses. Do you currently hold an operator's license? Mr. Scheimann?

MR. SCHEIMANN: Yes. I hold a senior operator's

license.

COMMISSIONER PIGFORD: Mr. Zewe?

MR. ZEWE: Yes, I do, Sir.

COMMISSIONER PIGFORD: Senior?

MR. ZEWE: Yes, Sir. On 1 and 2.

COMMISSIONER PIGFORD: Mr. Frederick?

MR. FREDERICK: Yes, I hold a regular operator's license.

COMMISSIONER PIGFORD: It is not a senior operator's license, but a regular operator's license? Is that it?

MR. FREDERICK: That's correct.

COMMISSIONER PIGFORD: And Mr. Faust?

MR. FAUST: I hold the same, an RO license.

COMMISSIONER PIGFORD: Now, Mr. Zewe, does this license require you to have periodic experience with a simulator?

MR. ZEWE: Yes, it does, Sir.

COMMISSIONER PIGFORD: Where do you go to get that?

MR. ZEWE: We go to the B&W simulator at Lynchburg, Virginia.

COMMISSIONER PIGFORD: Yes. And is that simulator capable of simulating loss of coolant accident?

MR. ZEWE: In various forms, yes.

COMMISSIONER PIGFORD: Do you run such an accident on that simulator?

MR. ZEWE: We do.

COMMISSIONER PIGFORD: Is that simulator capable of simulating the effects of loss of off-site power?

MR. ZEWE: Yes, it is; to a certain degree, Sir, yes it is.

COMMISSIONER PIGFORD: And this means that your reactor coolant pumps are not operating?

MR. ZEWE: Yes.

COMMISSIONER PIGFORD: Does it simulate -- Do you run that case, the loss of off-site power when you go down there?

MR. ZEWE: We have on occasion, yes, Sir.

COMMISSIONER PIGFORD: Tell me what you actually do and are required to do when you take this yearly test on the simulator.

MR. ZEWE: Well, we go down there for a period of one week and during that week we approximately spend 20 hours out of the 40 hour week actually manipulating the controls under casualty situations of all types; and the other 20 hours we receive further training to keep up our proficiency in operating the plant by questions, lectures, and so forth.

COMMISSIONER PIGFORD: Training by whom?

MR. ZEWE: By the B&W personnel there at the training facility.

COMMISSIONER PIGFORD: Who gives the examination, or

do you have one?

MR. ZEWE: At the simulator we don't really have an examination as such except that they keep track of who participates in what casualties, how many of them you have, and then they go over them with you to make sure that your proficiency in the particular casualty is sufficient.

COMMISSIONER PIGFORD: And then you are also given some test for the Nuclear Regulatory Commission concerning your operator's license, are you?

MR. ZEWE: On a yearly basis we are given an oral examination and a written examination at the Island itself, at Three Mile Island, administered by our training department.

COMMISSIONER PIGFORD: Does it get into these casualty conditions?

MR. ZEWE: The orals and written tests, yes, Sir.

COMMISSIONER PIGFORD: On the simulator, have you experienced what some people call a small break accident?

MR. ZEWE: Yes, we have.

COMMISSIONER PIGFORD: One equivalent to the size of the open pressurizer relief valve?

MR. ZEWE: I'm not sure of the magnitude of the simulation in relationship to how much actual flow we had from this valve, Sir. I don't know that for a fact.

COMMISSIONER PIGFORD: Do they specify how large a break you are simulating, how big an opening?

MR. ZEWE: Well, I believe, and I'm certain that they could vary the range of the break from various sizes.

COMMISSIONER PIGFORD: Does it include the size, in your opinion, of an open pressurizer relief valve?

MR. ZEWE: As far as I know, they could simulate that size of a break, yes.

COMMISSIONER PIGFORD: But do they?

MR. ZEWE: I'm afraid I really don't know that size. I am not really certain what the actual size or how far open the relief valve was that we had during the event that we had on the 28th.

COMMISSIONER PIGFORD: I should say, in your experience, has a break of the size equivalent, say, to a fully open relief valve been simulated?

MR. ZEWE: I would think yes, but --

COMMISSIONER PIGFORD: In your experience.

MR. ZEWE: Yes.

COMMISSIONER PIGFORD: Tell me, have you then also simulated, in your experience, a break, small pipe break, and also loss of off-site electrical power at the same time?

MR. ZEWE: I cannot remember that, no.

COMMISSIONER PIGFORD: Mr. Frederick, do you happen to recall?

MR. FREDERICK: No. I have not done a simulator for a small break.

COMMISSIONER PIGFORD: At all?

MR. FREDERICK: Not for a multi-casualty like that.

COMMISSIONER PIGFORD: You've not done a small break simulation?

MR. FREDERICK: I don't believe so.

COMMISSIONER PIGFORD: Mr. Faust?

MR. FAUST: I think what small break we've done, a leak, a small leak that is within the capacity of the makeup system we've done.

CHAIRMAN KEMENY: Professor Pigford, I just think I heard something that I wanted to verify. Mr. Frederick, did you say you have not simulated a multiple problem, something to that effect?

MR. FREDERICK: He inferred that there was a loss of off-site power concurrent with a loss of coolant accident of a small break size, and I have not experienced that.

CHAIRMAN KEMENY: Have you ever had a simulation exercise where two things went wrong in the simulation?

MR. FREDERICK: Not what I would consider a multiple casualty, no.

CHAIRMAN KEMENY: Not the multiple casualty. Sorry, Professor.

COMMISSIONER PIGFORD: Mr. Frederick, you mentioned in your testimony to the Task Force that you found these indications of pressurizer level and system pressure to be

conflicting. Could you please explain what you mean by that or what you meant by that?

MR. FREDERICK: Yes, Sir. The way I see it, if the pressurizer is full and high pressure injection system is injecting water, then the system pressure should increase. And that was not occurring.

COMMISSIONER PIGFORD: In your experience on the simulator, did you ever run into a case where the pressurizer level was going up and the pressure going down?

MR. FAUST: Are you asking me?

COMMISSIONER PIGFORD: Right now Mr. Frederick; I'll ask you in a moment, Mr. Faust.

MR. FREDERICK: I don't believe so. I don't think the simulator is capable of simulating a solid pressurizer.

COMMISSIONER PIGFORD: Of simulating what?

MR. FREDERICK: The full solid pressurizer.

COMMISSIONER PIGFORD: I'm not speaking of a solid pressurizer, one completely filled with water. I just mean the pressurizer level going up and the pressure in the primary system going down. That's not occurred on the similator, in your experience?

MR. FREDERICK: Not that I remember.

COMMISSIONER PIGFORD: Mr. Faust?

MR. FAUST: Same answer; I don't remember that ever happening.

COMMISSONER PIGFORD: Mr. Zewe?

MR. ZEWE: No, it hasn't.

COMMISSIONER PIGFORD: Mr. Scheimann?

MR. SCHEIMANN: I don't recall seeing that either.

CHAIRMAN KEMENY: Are all four of you saying that you were confronted with a combination of events here you had never experienced during your training?

MR. ZEWE: I believe so; that's true.

COMMISSIONER PIGFORD: Mr. Zewe, did you find these two indications--the pressurizer level rising, the pressure going down--to be conflicting at the time of the accident?

MR. ZEWE: Yes.

COMMISSIONER PIGFORD: Now, you've also mentioned in your testimony previously that you are aware that it was very important to be sure that the temperature of the liquid in the primary system was below the saturation temperature or the boiling point. Is that correct? That you were aware that that would be a requirement?

MR. ZEWE: I'm afraid I don't follow. This is from a previous testimony that I made?

COMMISSIONER PIGFORD: Yes. You were asked, are you aware that the temperature -- I'm sorry. Let me paraphrase it because I wouldn't ask it that way. Were you aware that it was necessary for the temperature of the water in the primary system during the transient to be below the boiling

point?

MR. ZEWE: Yes.

COMMISSIONER PIGFORD: Okay. Now, were there any indicators on the front panel available to you that would tell you whether that condition existed or not?

MR. ZEWE: Yes, there are.

COMMISSIONER PIGFORD: You didn't have to go to the computer readout for that purpose, did you?

MR. ZEWE: No. All the normal console indication are available.

COMMISSIONER PIGFORD: Now, how did they -- tell me specifically, which instruments that would tell you whether the temperature is greater or less than the boiling point? Which ones would you look at?

MR. ZEWE: I could look at the temperature of the hot leg and the pressure.

COMMISSIONER PIGFORD: Did you do that during the accident?

MR. ZEWE: I did look at the temperature and the pressure, but I really didn't correlate that to the saturation pressure for that temperature.

COMMISSIONER PIGFORD: Was it a problem that things were going too fast to make that correlation, because I gather you would have to convert from pressure to boiling point? Is that the problem?

MR. ZEWE: Yes, I would have to do that because I don't really know the saturation pressure for the particular temperature that I had at that point in time.

COMMISSIONER TAYLOR: During the accident, did you have any steam tables handy in the control room that you could look at to correlate saturation temperature pressure?

MR. ZEWE: I have a set of steam tables in my office in my desk and I believe that there were steam tables available in the operator's desk, but not readily available. This is only from, I believe they were there.

COMMISSIONER TAYLOR: Were you or anyone else that you know of asking anyone for numbers that would require looking things up in the steam table? Were you trying to correlate things? Were you asking questions and not getting answers because there weren't steam tables available? Or did you send someone off to try to get the steam tables?

MR. ZEWE: I did not send anyone off for steam tables or try to correlate that. We were reacting to what we had and trying to put together and formulate what we were going to do.

COMMISSONER PIGFORD: In your accident procedures, I suppose you have some drills. Do you never use this as a tool to guide you in what to do, mainly compare the temperature with the boiling point?

MR. ZEWE: We do not on our drills, no.

COMMISSIONER PIGFORD: In your simulation at B&W, does that occur?

MR. ZEWE: We do not.

COMMISSIONER PIGFORD: Do you read temperatures during that simulation?

MR. ZEWE: Do we read temperatures?

COMMISSIONER PIGFORD: Yes. Do you look at temperatures during that simulation?

MR. ZEWE: We use the normal console indication. The simulator is made like a smaller normal control room that has the normal primary plant and secondary plant indications. We would use the same relative type of indication there as we do at the plant itself.

COMMISSIONER PIGFORD: Are you responsible for the training of the operators under you?

MR. ZEWE: Yes, I am.

COMMISSIONER PIGFORD: As a result of this experience, do you have any recommendations for any modification in the training program?

MR. ZEWE: There's always need for improvement and obviously we have uncovered an area where there could be further improvement done. So, yes, I would certainly increase the operator training program and increase the various problems that we encountered that day, and also in all the research and everything that has ensued since then.

COMMISSIONER PIGFORD: Now, I gather then the simulation and in your instructions emphasize never let that level in the pressurizer get way down. Is that also correct? You don't want it to either get full or to get empty. Is that correct?

MR. ZEWE: That is true.

COMMISSIONER PIGFORD: In your simulations have you run across a transient in which it does empty, the water leaves the pressurizer?

MR. ZEWE: A particular transient that would cause that?

COMMISSIOENR PIGFORD: Yes.

MR. ZEWE: Probably the transient that comes close to doing that is if you have a reactor trip with your feed water in manual and you over-cool the primary plant by not reducing your feed input, that causes the primary plant to cool down a lot faster and a lot further than it normally would. I would say that that is probably the most common transient that we would do at the simulator that results in the lowest pressurizer level.

COMMISSIONER PIGFORD: And that is what you referred to as a shrink, isn't it?

MR. ZEWE: That's right, yes.

COMMISSIONER PIGFORD: And if it shrinks too much then I suppose the steam bubble and the pressurizer expands

out of the pressurizer, doesn't it?

MR. ZEWE: And into the loops, yes.

COMMISSIONER PIGFORD: And have you experienced that in the simulation?

MR. ZEWE: I have not. I've come very close to it but not actually can I remember actually experiencing having a steam bubble anywhere other than in the pressurizer with an indicated water level.

COMMISSIONER PIGFORD: Mr. Frederick, have you?

MR. FREDERICK: In the transients that I have observed in the simulator, it has never been specifically pointed out to me that a bubble shift took place, or what the indications were of a shifting bubble.

COMMISSIONER PIGFORD: If the bubble expands out of the pressurizer, Mr. Zewe, where do you expect it to appear next?

MR. ZEWE: To the highest point in the reactor coolant system loop.

COMMISSIONER PIGFORD: So you apparently have, even before this accident, thought about that possibility or is this something that you have considered since the accident?

MR. ZEWE: I had considered this prior to the accident, yes.

CHAIRMAN KEMENY: Professor Taylor.

COMMISSIONER TAYLOR: Given the hindsight that all

four of you have now of a lot of understanding of what was actually going on that you didn't know at that time, I'd like to follow up on a question that Chairman Kemeny asked before, and that is, a little more specifically could each one of you tell us whether or not, with what you know now, there is any significant thing that you did, whether it was under your own responsibility or someone else's, that in retrospect at least looks as though it contributed substantially to the severity of the accident?

Do you understand my question? Mr. Faust, could we start with you? Is there anything that --

MR. FAUST: Well, I'm the one that turned off the reactor coolant pumps initially. So from that point, I would say that probably helped it along.

COMMISSIONER TAYLOR: Are you convinced in your own mind that something worse might not have happened if you had not turned them off?

MR. FAUST: At the time, I --

COMMISSIONER TAYLOR: In retrospect.

MR. FAUST: In restrospect now if I had not turned them off?

COMMISSIONER TAYLOR: Yes.

MR. FAUST: Without knowing that now, they're telling me that I can run those pumps no matter what?

COMMISSIONER TAYLOR: So you're being told there is

really no major worry about cavitation, but that was after the fact?

MR. FAUST: Yes.

COMMISSIONER TAYLOR: Mr. Frederick?

MR. FREDERICK: Well, I was in on securing reactor coolant pumps as well. I also throttled the high pressure injection which is still a point of debate. I'd like to see a simulation in which it was not throttled.

COMMISSIONER TAYLOR: Will you tell us again why it was that you turned off the high pressure injection?

MR. FREDERICK: I did not turn it off; I throttled it.

COMMISSONER TAYLOR: Pardon me?

MR. FREDERICK: In other words, when high pressure injection is automatically initiated, the flow rate in excess of a thousand gallons per minute is initiated--somewhere between 1000 and 1300 gpm. The rapidly increasing pressurizer level at the onset of the accident led me to believe that the high pressure injection was excessive, and that we were soon going to have a solid system.

COMMISSIONER TAYLOR: I see.

MR. FREDERICK: In response to that I throttled the high pressure injection to approximately 500 gpm.

COMMISSIONER TAYLOR: Mr. Zewe?

MR. ZEWE: Your original question then was about what

events that we took now that if we looked back were significant?

COMMISSIONER TAYLOR: You are now convinced did contribute significantly to the severity of the accident, let's say, to the core damage, if you want to put it that way.

MR. ZEWE: Well, in my own mind, just the failure to recognize that we had a relief valve that was still partially open or open was probably the biggest event.

COMMISSIONER TAYLOR: This is semantics, but would you call that an operator error or an instrument design deficiency?

MR. ZEWE: I would have to say it is a combination of the two and it is very hard to separate it, looking at the circumstances that led us to not isolate it or isolate it, all right, were purely, we just used the indication that we had and reacted to what we had, and in looking further or harder or less harder or just by a different perspective, maybe we could have determined that it was open at that point, or maybe if we had better instruments to begin with it would have been more obvious to us. So in either case, it would certainly have been an aid to us.

But I'm not sure -- One contributed to the other, so that one thing, you know, sort of supported the other one, so to speak.

COMMISSIONER TAYLOR: Mr. Scheimann.

MR. SCHEIMANN: I would have to go along with

Mr. Lewe on our major problem being that not being able to recognite the fact that the relief valve was open, as well as the fact that for a while we did not have feed going to the steam generators. I think if either one or the other of those cases might have been not there we might have had fairly good success at riding it out without damage.

COMMISSIONER TAYOR: That was the next question I wanted to ask you, that if you had known all the time exactly what the state of the pressurizer relief valve was, can you, in going back through the accident sequence, can you imagine a set of events such that there probably would have been no core damage at all? In other words, if that had not stuck open; if the pressurizer relief valve had always come down when pressure got back down to the pressure at which it is not supposed to be activated, do you think there would have been any -- Would we be sitting here? Is there any chance -- Is that really a central part of the accident.

MR. SCHEIMANN: I believe it was.

COMMISSIONER TAYLOR: Okay.

CHAIRMAN KEMENY: May I ask just one follow-up question on that? It occurred to me, since you pointed out obviously, digging out steam tables in the middle of the mess you were in is hardly a reasonable thing to expect. Suppose there had been a single little computer that simply correlated temperature with pressure in the control room and an alarm had

gone off that you had passed the saturation point. Would you have known what to do, Mr. Zewe?

MR. ZEWE: Yes, Sir, I would have.

CHAIRMAN KEMENY: What would you have done?

MR. ZEWE: Left on high pressure injection at full flow.

CHAIRMAN KEMENY: Okay So that might be an interesting example of a different kind of computer that might be nice to have in the control room.

MR. ZEWE: Yes, it would.

MR. FREDERICK: I might want to point out that another alarm would not have been helpful at that time.

(Laughter)

CHAIRMAN KEMENY: No, but Mr. Frederick, that's a point very well taken, but I'd like to suggest that that particular alarm, presumably, should be one louder than any others because that means you are in very serious trouble.

(Laughter)

Commissioner McPherson.

COMMISSIONER McPHERSON: Gentlemen, I would like to ask each one of you. When was the last time you went to the Babcock and Wilcox simulator, went for training there? Mr. Faust, what about you?

MR. FAUST: I think it was when I -- prior to getting my license.

COMMISSIONER McPHERSON: When was that?

MR. FAUST: Let me think.

COMMISSIONER McPHERSON: Couldn't we look this up in the record? What would you guess? A year ago? Two years ago?

MR. FAUST: No. It wasn't that long ago.

MR. ZEWE: I believe that for the operators it was probably around July of '77 or so. I last went in January of this year.

COMMISSIONER McPHERSON: You went in January of this year?

MR. ZEWE: January of 1979. Yes.

COMMISSIONER McPHERSON: Did you hear the questions and testimony this morning about the so-called Michaelson report, about this is the TVA engineer's report about a possible problem in the B&W pressurizer in that it would give an indication of a higher water level in the reactor than actually existed?

MR. ZEWE: Up to this point the only thing that I've heard is the name, the Michaelson report, but I have not heard any of the details of the report at all yet.

COMMISSIONER McPHERSON: This apparently, the report was written on the basis of an accident at Davis-Bessy plant back in 1977. And Mr. Michaelson wrote and said that it appears that the pressurizer may give an untrue picture of the

water level in the reactor in the Babcock & Wilcox plant. This was brought up before the Udall Committee the other day and Congressman Udall said if that information had been known by the operators it might have been that this would have been a two-bit incident and not a serious one.

But when you were there at the Babcock & Wilcox simulator, you were not told anything about that by the company, I take it, that they suspected they might have a problem that would give an inadequate reading?

MR. ZEWE: I was unaware of that at all. Just to bring up another point, the operators and myself were scheduled to go down to the B&W simulator in April of this year.

MR. SCHEIMANN: Two weeks after the accident we would have gone down.

MR. ZEWE: Yes, for our normal cycle through there. I went down in January with my Unit I operators.

CHAIRMAN KEMENY: Professor Pigford.

COMMISSIONER PIGFORD: What is the required frequency for your operators to have training on the simulator?

MR. ZEWE: I believe that the requirement is every two years. But we had started to go down every year. We were instituting that to go down every year.

COMMISSIONER PIGFORD: Mr. Frederick, at the time of the accident were you also aware of the importance that the temperature be kept below the boiling point?

MR. FREDERICK: Yes.

CHAIRMAN KEMENY: Commissioner Trunk.

COMMISSIONER TRUNK: I'm going to refer to Mr. Frederick and Mr. Faust. Working in the control room could become very tedious and boring. Could you give us a rundown of what a normal day is like? What do you do during the day?

MR. FAUST: Normally, it depends on what part you are at in the control room, if you are on the panel, or like I was switching and tagging. There is a switching and tagging CRO where you would be taking readings around the plant that are required to be taken, as well as doing shift and daily surveillance that are tech spec requirements. Other things you might be doing is writing up safety tags. As a piece of equipment had to be taken out of service for somebody to work on, to isolate it properly.

Also you might get involved in doing surveillance on pieces of equipment, as switching and tagging. Or you might get involved in being the CRO on the panel.

COMMISSIONER TRUNK: So it could get very monotonous. How do you keep alert? What do you do to keep alert?

MR. FAUST: It is hard to fall asleep when you are taking readings, if that's what you mean.

COMMISSIONER TRUNK: Well, I don't expect you to fall asleep. But I would like to know what keeps you active.

The control room is full of green and red lights. I would get tired of looking at those lights after a while.

MR. FREDERICK: In normal routine, the operator usually picks out the systems or the parameters that he feels are most important to monitor and those would be monitored on a regular basis--maybe every few minutes. This is on a scan and it is possible to get familiar enough with the instrumentation to just scan it in a few seconds and absorb quite a bit of information.

Other than doing that periodic scan, there's enough administrative material to keep one busy for an eight-hour shift, as far as following changes to procedures, initiating work requests on out-of-service equipment, or reviewing maintenance procedures that may be in effect.

On a back shift, basically that's all they do. On a day shift you would definitely be involved in on-going maintenance and that is enough to keep a person quite busy.

COMMISSIONER TRUNK: How did you feel when you finally realized that this wasn't a routine trip; you know, that this was going to be something a lot more to handle?

MR. FREDERICK: Some of the comments I've heard is that it should be a situation of panic. But with the people that I work with, these four guys, it became a situation in which everyone became more intense in their --

COMMISSIONER TRUNK: Weren't you scared?

MR. FREDERICK: No. We were concentrating more deeply on what was occurring and trying to reason which malfunction it was that was causing the root of the problem. Although we were unsuccessful, we were trying very hard to do that.

COMMISSIONER TRUNK: I'm glad you weren't scared, because I was.

MR. FAUST: Well, you heard the news media.

MR. FREDERICK: The only time we felt safe was when we were in the plant. To turn on the TV was enough to panic anybody.

COMMISSIONER TRUNK: Then why weren't the people in Middletown getting this information? I mean --

MR. FAUST: Sounds like they were getting information.

COMMISSIONER TRUNK: I also was informed that a lot of people from Met Ed told their families to leave.

MR. FAUST: What people? Are you talking about operators?

COMMISSIONER TRUNK: The people who - Oh, I really don't know what their jobs are, but I've heard that --

MR. FAUST: There are a lot of people at that plant that don't know really what goes on in the plant itself. I'm talking like support people as far as stores who are supplying material to it, maintenance people, janitors, you name it.

COMMISSIONER TRUNK: Well, these were the people

that were not allowed to leave the plant during this time. I gather that you were told to stay at your jobs.

MR. FAUST: We didn't have to be told.

COMMISSIONER TRUNK: I know, but you didn't leave. They expected their workers to stay. I'm not talking about the vendors or the other fellows who just walk in and out. I meant the workers. They work at Met Ed. I don't know if it is a secretary or an office clerk, but they told their families to pack up and leave.

MR. FREDERICK: It is possible that the only information they were receiving was through the news media.

MR. FAUST: That sounded like that is what it was, from people I'm talking to now. Because even people on our snift -- not our shift, but people on other shifts, operators, weren't getting the full story of what we know had happened during that time period. All they were getting was what was from the news media or what they were picking up at random, and that can paint quite a scary picture.

CHAIRMAN KEMENY: Commissioner Lewis.

COMMISSIONER LEWIS: As a former member of the news media, I thought I ought to ask a question about this. Do you think that the public had a right to know what was going on in that control room and what was going on in that reactor?

MR. FAUST: At that time?

COMMISSIONER LEWIS: Yes.

MR. FAUST: If it needed to be put out. In other words, I don't think I can really answer that question. All I can say is I was rather upset when I went home. I wanted to get back into the plant. In fact, we called in and we came back. That's how much what we were hearing was scaring us.

COMMISSIONER LEWIS: Well, what I'm trying to get to is do you think there should have been a lid on what was going on there or do you think the people had a right to know what was going on?

MR. FAUST: I think the people have a right to know what is going on, but I think it should be put out in a better manner.

CHAIRMAN KEMENY: Mr. Faust, could I ask, from an earlier remark, was the implication of it that you went home and found that what you read in the newspapers or saw on TV was not an accurate representation of what was going on?

MR. FAUST: Well, we're still sitting here; it didn't blow up, you know. Nobody got over radiated by any means.

COMMISSIONER TRUNK: But it might have.

MR. FAUST: Anybody can say that. I can drag this out to the worst case. I don't know what I would have done if I had been sitting somewhere and received information that I was to direct people to leave.

MR. FREDERICK: There was a great deal of speculation by the press as to what could happen. There was very little

actual presentation of the facts as they existed moment to moment.

COMMISSIONER TRUNK: Well, from what we've been able to find out, you didn't know what was going on either. So you really didn't know what was going on and isn't it likely that that confusion was transmitted to the news media? Would you allow that?

MR. FREDERICK: I doubt that the news media was confused because of what we were seeing on the panel. They were confused because perhaps their source of information was not providing them with enough to fill up a column, or whatever. Okay?

COMMISSIONER TRUNK: Well, the source of information was Met Ed.

MR. FREDERICK: I'm sure it was. Either that or the NRC. There is only so much you can tell a person who does not understand what you are talking about.

MR. FAUST: It is very hard to be able to talk about this plant when nobody is interested in it, and now all of a sudden now they are.

COMMISSIONER TRUNK: Well, the presumption is then that the public really wouldn't understand what's going on inside a nuclear reactor and really shouldn't bother its head about it. Am I reading you right? Is that?

MR. FAUST: No.

COMMISSIONER TRUNK: No? Okay.

MR. FREDERICK: If an indepth study by the public were actually a point of interest, if they did want to learn about it and they approached the company with some interest as far as classes or some basic tours of the plant, etcetera, I'm sure that the company would provide an interested public with that information.

COMMISSIONER TRUNK: But at a time of crisis, you will agree that the public had a right to be informed?

MR. FREDERICK: I certainly do.

CHAIRMAN KEMENY: Professor Pigford.

COMMISSIONER PIGFORD: Mr. Zewe, I gather from your testimonay that among all the other things, there was another thing that was troubling you and your staff during the accident--the boron concentration. Could you explain what you were concerned about?

MR. ZEWE: On a normal reactor trip or any such larger thing like that we do get a let down sample of the reactor coolant to determine the boron concentration, for one, among other things. In the first results that I got back from the initial sample was that we had a boron concentration in the reactor coolant system of around 720 ppm. And we had had a boron concentration of about 1,030 ppm prior to the event. Since we had put in rather high boron concentration of water into the system, the boron concentration should have been

greater than what we initially started out with. But in fact the samples came back at 720, followed by a subsequent sample that was around 400 ppm, which would indicate to me that somehow we had diluted the boron concentration in the reactor coolant system.

COMMISSIONER PIGFORD: Is this some requirement of your emergency procedures that in such an accident or in a bad accident the boron concentration be kept above some minimum level?

MR. ZEWE: Yes, it is. We have, in order to ensure that the reactor is shut down sufficiently, we do what's called a shutdown margin calculation to determine how far the reactor is sub-critical. And in order to determine this value we need to have the boron concentration for the reactor coolant system, which is an input into this shutdown margin calculation. I had two nuclear engineers who were there at the time do a shutdown margin calculation. From that calculation before we had that boron sample returned showed that the reactor was very sub-critical.

COMMISSIONER PIGFORD: Did that calculation show that in fact there would be a problem if no boron were there?

MR. ZEWE: Not at that point, no.

COMMISSONER PIGFORD: You say there would be a problem if the boron were not there. Is that right?

MR. ZEWE: No. We should have still been shut down

sufficiently without the boron because we had other sources to shut down the reactor with.

COMMISSIONER PIGFORD: So why were you concerned about the boron?

MR. ZEWE: Because the boron is part of that shutdown margin and it is the boron samples were just the reverse of what they should have been. Eventually the boron concentration would become a factor. But if it went from 1,000 down to 700, at that point we still had sufficient shutdown margin where the reactor was still sufficiently sub-critical.

COMMISSIONER PIGFORD: Since it is possible my awkward question has confused it, let me ask it again. If the boron were not there at all, would you have had sufficient shutdown margin?

MR. ZEWE: Initially, yes.

COMMISSIONER PIGFORD: What does it mean, initially?

MR. ZEWE: Well, you have other poisons or other things in the core that attribute to keeping the reactor sub-critical. But these change.

COMMISSIONER PIGFORD: What, for example?

MR. ZEWE: You have a fission product poison which is xenon, which is just like, it's a neutron absorber which attributes to the shutdown condition of the reactor. But this decays with time. Initially we had quite a bit of shutdown margin attributed by the fission product poison that we

had in the core.

CHAIRMAN KEMENY: What was diluting the boron, in your opinion, at that time?

MR. ZEWE: At that point, my first reaction was that somehow we were putting demineralized water or pure water, if you will, without boron in it into the reactor coolant system by some means. I was unaware of how we could do that but we had people go out to try and check the various ways in which we could add this pure water to the reactor coolant system.

CHAIRMAN KEMENY: Professor Taylor.

COMMISSIONER TAYLOR: From what you, Mr. Zewe, from what you know now of the accident, do you believe that you specifically could, if you wanted to or had to, in that reactor or an exact duplicate of that reactor, starting from a full power condition, take action in the control room alone that would cause an essentially total core melt? That is, cause the temperature of the fuel to rise well above the melting point of the fuel on purpose. I'm not suggesting you tell us how. I just really am trying to find out whether you believe that is a possibility.

MR. ZEWE: I would have to agree it is a possibility, but I've never really thought about it in that light or even gave it consideration.

COMMISSIONER TAYLOR: Thank you.

CHAIRMAN KEMENY: This is perhaps a good time to

excuse our witnesses. We have had them under the hot lights and we have been under the hot lights for a long time, satisfactory. Thank you.

The witnesses are excused.

(Witnesses William Lewe, Fred Scheimann, Edward Frederick, and Craig C. Faust were excused.)

CHAIRMAN KEMENY: We will convene here at 9:00 a.m. in the same room to hear the next set of witnesses. Until then, this meeting is recessed.

(WHEREUPON, at approximately 6:00 p.m. the meeting recessed, to reconvene at 9:00 a.m. on Thursday, May 31, 1979.)

- end -