NUREG-0760

# Investigation into Information Flow During the Accident at Three Mile Island

**U.S. Nuclear Regulatory Commission**

**Office of Inspection and Enforcement**

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# Investigation into Information Flow During the Accident at Three Mile Island

Manuscript Completed: January 1981
Date Published: January 1981

**Division of Program Development and Appraisal**
**Office of Inspection and Enforcement**
**U.S. Nuclear Regulatory Commission**
**Washington, D.C. 20555**

# INVESTIGATION INTO INFORMATION FLOW DURING THE ACCIDENT AT THREE MILE ISLAND

## I. Introduction

On October 25, 1979, Victor Stello, Director of the Office of Inspection and Enforcement (IE), sent a Notice of Violation to Metropolitan Edison (Met Ed) resulting from the IE investigation into the accident at Three Mile Island (TMI) that occurred on March 28, 1979. In the transmittal letter, Mr. Stello said, "Among other things, additional enforcement action is under review with regard to the reportability of several items of information following the onset of the accident, including specifically the calculated dose rate of 10-40 R/hr in Goldsboro, the elevated incore thermocouple indications and the pressure spike in the containment vessel."

Subsequently, the Commission concluded that the area of information transfer should be examined by the NRC Special Inquiry Group. At the conclusion of its review, the Special Inquiry Group reported that it found no direct evidence suggesting intentional withholding of information, but it did not reach conclusions on the questions of enforcement.

On March 21, 1980, NRC Chairman Ahearne requested that the Executive Director for Operations direct IE to resume its investigation regarding information transfer on the day of the accident at TMI. Accordingly, the IE investigation effort was initiated on April 1, 1980. The investigation examined information that did not adequately flow from TMI to NRC and to the Pennsylvania Bureau of Radiological Protection (BRP) on March 28, 1979.

This investigation examined the transfer of information and knowledge related to specific events, parameters, and systems. The summary, conclusions and recommendations of this investigation are presented in Section II. Section III of this report contains a description of the information flow and a summary of the knowledge of specific plant personnel for each of the key indicators examined during this investigation. The review of the information flow associated with the key indicators allowed a description to be developed for the onsite information flow (Section IV), information flow to the NRC (Section V), and information flow to the State (Section VI). This investigation concluded with an evaluation of enforcement considerations related to the transfer of information (Section VII).

The investigation team was composed of Norman C. Moseley (IE), Team Leader; Terry L. Harpster (IE); John W. Craig (IE); and William L. Fisher (IE). David H. Gamble participated in this investigation as a representative of the Office of the Inspector and Auditor, whose function is to protect the interest of the Department of Justice in any criminal matters that may arise. Richard K. Hoefling (ELD) provided legal advice and assistance to the team and participated in most of the interviews.

Victor Stello, Director (IE), participated in some of the interviews. Although Ronald C. Haynes (IE) was initially a member of the team, he was released to resume other pressing duties.

An early premise of the investigation was to make maximum use of the extensive records that had been already accumulated. The records used included NUREG-0600, IE interviews, tape recordings, logs, depositions taken by the NRC Special Inquiry Group, testimony and depositions taken by the Kemeny Commission, testimony and depositions taken by the Senate investigation, and testimony before the Subcommittee for Energy and The Environment.

The investigation was delayed when some persons to be interviewed contested the validity of NRC administrative subpoenas. After the court enforced the subpoenas, all interviews were conducted under oath with a court reporter providing a verbatim transcript. During the investigation, employees of Met Ed/General Public Utilities (GPU), Babcock & Wilcox (B&W), Pennsylvania Bureau of Radiological Protection (BRP), and NRC were interviewed. Copies of transcripts of the interviews will be available for inspection in the Public Document Room.

The following summary of events that occurred on March 28, 1979 was developed from NUREG-0600. This summary is intended to familiarize the reader with some operational aspects of the accident. It is not intended to ba all-inclusive. Detailed summaries are presented in NUREG-0600 and in the Special Inquiry Group's Report, NUREG/CR-1250. (The timing indicated is approximate.)

## SUMMARY OF EVENTS

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| 4:00 a.m. | The main feedwater pumps tripped resulting in an almost simultaneous trip of the turbine (actual time 04:00:37, March 28, 1979). Low feedwater pump suction pressure or loss of the condensate booster pumps, while in automatic, caused the feedwater pump turbines to trip. Tripping of both feedwater pumps caused the main turbine to trip. |
| +3-6 seconds | Reactor coolant system (RCS) pressure reached electromagnetic relief valve (EMOV) opening setpoint (2255 psig). |
| 8 seconds = | Reactor tripped from reactor high pressure (setpoint 2255 psig). Indicated reactor pressure on the wide range RCS pressure strip chart from the control room showed an increase to approximately 2435 psig, which would normally suggest that one of the two safety valves may have lifted. |

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ABSTRACT

This report was prepared in response to a request from NRC Chairman Ahearne that directed the Office of Inspection and Enforcement to resume its investigation of information flow during the accident at Three Mile Island (TMI) that occurred on March 28, 1979. This investigation was resumed on March 21, 1980. The transfer of information among individuals, agencies, and personnel from Metropolitan Edison was analyzed to ascertain what knowledge was held by various individuals of the specific events, parameters, and systems during the accident at TMI. Maximum use was made of existing records, and additional interviews were conducted to clarify areas that had not been pursued during earlier investigations. Although the passage of time between the accident and post-accident interviews hampered precise recollections of events and circumstances, the investigation revealed information was not intentionally withheld during the accident and that the systems for effective transfer of information were inadequate during the accident.

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

INVESTIGATION INTO INFORMATION FLOW DURING THE ACCIDENT AT THREE MILE ISLAND

Docket No. 50-320

License No. DPR-73 Category C

Licensee: Metropolitan Edison Company
P. O. Box 542
Reading, Pennsylvania 19640

Facility Name: Three Mile Island Nuclear Station Unit 2

Investigation conducted: March 1980 - January 1981

Investigators

| | | | |
|---|---|---|---|
| | | T L Harpster | 1/23/81 |
| Norman C. Moseley | Date | Terry L. Harpster | Date |
| William L. Fisher | 1/23/81 | John W. Craig | |
| William L. Fisher | Date | John W. Craig | Date |

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| ~13 seconds | RCS pressure reached setpoint for EMOV closure (2205 psig). However, later events showed that closure did not occur.<br><br><u>Plant Status</u>--TMI Unit 2 had just experienced a turbine/reactor trip. RCS pressure and pressurizer level were decreasing rapidly after reaching their peaks. Unknown to the plant operators, the EMOV was not shut and was passing reactor coolant from the steam space at the top of the reactor coolant system pressurizer. Based on control room indications, the RCS pressure and pressurizer level were trending together and decreasing as was expected after a reactor trip. The once-through steam generator (OTSG) water levels were at about 90 inches and decreasing at about 4 inches/second. The OTSG steam pressures were about 1030 psig and decreasing at 4 psi per second. The turbine bypass valves were open to relieve steam. The OTSG water levels had not yet reached the setpoint of 30 inches for the programmed opening of the emergency feedwater valves that would admit feedwater to the OTSG. |
| 14 minutes | The reactor coolant drain tank (RCDT) rupture disc blew at an RCDT indicated pressure of 192 psig, dropping RCDT pressure to approximately 10 psig in 36 seconds. Reactor building pressure appeared to jump one full psi. At this time, up to about 1.2 psig, pressure rise was evident in the reactor building. |
| 74 minutes | The reactor coolant pumps (RCP) in B loop were chosen to be tripped to be able to maintain maximum pressurizer spray capability which comes from A loop. RCP 1B and 2B tripped. |
| Prior to 101 minutes | Approximately 5-10 minutes after the trip of the B loop RCP source range monitor (SRM), count rate instability increased again as well as continued to trend upward. Intermediate range monitor (IRM) current also began to show an upward trend. Operators reported that loop flow instability was increasing again, and the indicated loop flow continued to show a decrease. Operators asserted during interviews that they were concerned about a "seal failure loss of coolant accident (LOCA)" and decided to go on natural circulation. An operator stated that he started "emergency boration" during this period, based on SRM increases and fear of a restart accident. |

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| 101 minutes | The loop A RCPs tripped. SRM count rate spiked upward to peak at least one decade over count rate expected following a normal reactor trip. All radiation monitors exhibited substantial ramp increases. Operators stated they did not believe that natural circulation had been established due to the differential temperature across the steam generator and the low steam generator pressure with minimum heat removal, if any.<br><br>The reactor coolant system (RCS) had no forced-flow cooling. All reactor coolant pumps (RCPs) were stopped. The RCS average temperature and pressure were approximately 520°F and 750 psig. Makeup pump 1A was operating. The operators were attempting to establish natural circulation flow to cool the reactor core. OTSG B was isolated because of a suspected leak to the reactor building. |
| 6 a.m. | Nuclear engineer called the site to gather information required for standard post-trip report. There was some question of whether the reactor had experienced a restart based on SRMs. The third boron sample indicated approximately 400 ppm. |
| 6 a.m. | A conference call was established among Unit 2 technical support (Unit 2 control room) and Station Manager, Vice-President of Generation, and B&W site representatives (at their homes) lasting approximately 38 minutes. They all knew that the trip was abnormal since RCPs were off and they were unable to draw pressurizer bubble. Having a blown rupture disc and water on the floor were not surprising since this had happened before. The condition of the EMOV block valve was questioned and reported to be shut. The group decided that a need existed to restart an RCP and all should report to TMI. (A conference call had been initiated by station support following discussion with Unit 2 technical support (on-call Duty Officer) around 1 hour 15 minutes into event. The Unit 2 technical support had been on the site since 50 minutes into the event, following his call to the site shortly following the initial trip.) |
| 6:18 a.m. | The operator requested computer printout of EMOV and code safety outlet temperatures (229°F, 190°F, and 194°F, respectively). The operator isolated the EMOV by closing the block valve. The operators had noted tail pipe temperature on relief valve 35°F higher than others and believed the valve to be leaking. |

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| | They noted a drop in reactor building pressure after closure of the block valve. The pressure change in the reactor building was more marked than when B OTSG was isolated. The plant operations group decided that the B OTSG did not have a leak from the shell into the reactor building. The B OTSG still had a water level. |
| 6:40 a.m. | An operator initiated emergency boration based on increasing nuclear instrument (NI) indicator, low boron sample results reported, and calculated shutdown margin of only 2.4% reactivity. |
| 7:00 a.m. | The RCS loop B hot leg temperature reached 800°F. |
| 7:16 a.m. | The answering service attempted to reach the Region I Duty Officer, but he had already left for the Region I Office. |
| 7:18 a.m. | Plant Status--After attempts to establish natural circulation had failed, the operator started RCP 2B. However, based on a no-flow indication, RCP 2B was stopped after 19 minutes. Superheated steam/gas was present in the reactor vessel head and RCS hot leg. Both reactor coolant system hot leg temperatures were offscale high (i.e., greater than 620°F). The RCS cold leg temperatures were about 375°F for loop A and 330°F for loop B. OTSG B was isolated due to a suspected RCS-to-OTSG leak. OTSG A pressure control was implemented by means of the power-operated emergency main steam dump valve A. An attempt was in progress to control pressurizer pressure and level with the EMOV. |
| 7:20 a.m. | The answering service signaled the Region I Duty Officer beeper, but the beeper reportedly did not alarm. |
| | The RCS loop A hot leg temperature dropped from 800°F to 710°F. Makeup pump 1B had been off since engineered safety features initiation (referred to as ES initiation) at 2 minutes after the start of the incident. The RCS loop A hot leg temperature varied between 680°F to 760°F over the next 6 hours. Loop B followed loop A, but it was about 60°F hotter. |
| 7:24 a.m. | A General Emergency was declared by the Station Manager. |
| 7:26 a.m. | The pressurizer level and pressure were dropping. The pressurizer high-level alarm cleared indicating 254 inches |

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| | and pressurizer pressure had dropped to 1500 psig. The pressurizer surge line temperature had returned to normal at 581°F. |
| 7:30 a.m. | The borated water storage tank low-level alarms were received at 53.03 and 53.06 feet. |
| 7:56 a.m. | The ES and reactor building isolation were initiated by high reactor building pressure (approximately 4 psig). Makeup pump 1B started automatically, joining makeup pump 1A in injecting through the wide-open valves. Intermediate closed-cooling pumps 1A and 1B tripped. |
| 8:00 a.m. | The ES and reactor building isolation was defeated by operator. The operator restarted the intermediate closed-cooling pumps to ensure RCP seal and letdown flow cooling.<br><br>By this time, the pressurizer level was approximately 380 inches with a reactor pressure of 1500 psig.<br><br>The detector, shielded with 2 inches of lead located in the containment dome, was reading 200 R/hr.<br><br>The Station Manager requested the B&W Site Operations Manager and other senior supervisors to caucus with him in the Shift Supervisor's office. It was decided to try another RCP start since pressure was high enough to satisfy net positive suction head (NPSH) requirements.<br><br>The nature of subsequent discussions was reported to consider the current situation and options available for return to normal conditions; discussions were not retrospective to determine what actions or conditions resulted in the plant reaching its current status.<br><br>The NRC Regional Director called the NRC IE Director to notify him of the activation of the Regional Emergency Center. |
| 8:22 a.m. | Technicians lifted the leads on RCS loop A hot leg resistance temperature detector (RTD) to take a reading (729°F). Initially, temperature readings were not believed due to their magnitude and the fact that the readings were outside the calibrated range of the instruments. |
| 8:00 a.m. to 9:00 a.m. | The Station Manager had requested verification of incore thermocouple (T/C) readings, which were |

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| | indicating off-scale temperatures. Technicians took incore T/C readings at terminal strips in the control building. The readings indicated temperatures from 80°F to 2620°F. |
| 9:15 a.m. | Convinced that steam was present in each loop, the licensee's staff decided to raise RCS pressure and collapse unwanted steam bubbles. They verified again that the EMOV was shut. (Recall that position "indication" shows valve position demand rather than actual position.) An increase in high-pressure injection flow was directed. |
| 11:30 a.m. | An operator opened both the EMOV and its block valve to depressurize the RCS. Reactor building pressure showed a rise from low point of 0.2 psig to 2.5 psig during this RCS depressurization. |
| 1:50 p.m. | ES was actuated on the reactor building isolation by high building pressure (4 psig). The building pressure experienced a spike to 28 psig (indicated), tripping the reactor building pressure switches (nominal 30 psig setpoint) some 6 seconds later. Building spray pumps started and the 30 psig actuation cleared within 4 seconds. The RCS pressure indication showed rapid 40 psi dip (probably due to increased pressure on RCS pressure detector reference leg) and recovery to 500 psig at the same time. Makeup pump 1C started (1B already operating and 1A in pull-to-lock). Decay heat pumps 1A and 1B started, intermediate closed-cooling pumps 1A and 1B tripped. |
| | Code safeties and RCP air temperatures alarmed high. Operator defeated building isolation and restarted intermediate closed-cooling pumps 1A and 1B to maintain RCP seal water and letdown cooling. |
| 1:55 p.m. | The Station Manager and Superintendent of Technical Support met with the Vice-President of Generation and proceeded to the Lt. Governor's office. |
| 1:56 p.m. | The reactor building spray pumps shut down and were placed in pull-to-lock position by operator to secure sodium hydroxide (NaOH) washdown of building when pressure drop indicated it was no longer needed. It appears these switches were returned to normal within minutes. |
| 3:32 p.m. | Operators indicated that method of cooldown at this time was using one high-pressure injection pump and the core flood tanks. |

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| 4:10 p.m. | The incore temperatures were reported to be unavailable. The Supervisor reported to NRC that the computers were all printing question marks, which indicated that either the computer point or the sensor was malfunctioning. The supervisor did not indicate that the same result occurred when the temperature exceeded the range of the software calibration for those points. These were the first thermocouple data or comments to the NRC. The first request had been made at approximately 8 hours 20 minutes into the accident. It was stated that core flood tanks were floating on the core, the Th was 590°F, and that the staff was convinced there was no boiling in the core. |
| 4:56 p.m. | An NRC inspector reported the following:<br>1. Licensee was concerned that current cooldown process was too slow and believed that it would be faster to cool down by steaming the OTSG.<br>2. Licensee was working to get rid of bubbles in loops, to establish bubble in pressurizer, and to go on natural circulation.<br>3. Licensee was concerned about further use of EMOV since water was dumped to the floor, and, with sources of clean water being exhausted, was concerned that they would be forced to use dirty sump water for recirculation.<br>4. Licensee concluded core was covered. Discussed and rejected further blowdown because this would ultimately entail recirculation of sump water. |
| 5:30 p.m. | Staff was repressurizing RCS to collapse voids and was prepared to start RC pump. Plant charges confirmed pressure increase. |
| 7:50 p.m. | RCP 1A was started and was allowed to run. Flow and amps looked good. The reactor coolant pressure dropped to 1123 psig. OTSG B indicated level dropped below 79% and recovered to above 85% within 8-second span. OTSG A indicated level dropped below 81% and recovered to above 82% within a 9-second span, 40 seconds after OTSG B transient. |
| 7:52 p.m. | Pressurizer level was still offscale high. |
| 8:00 p.m. | The RCP 1A was running with both RCS loop cold legs temperature at about 290°F. The pressurizer level was still full scale with RCS pressure at about |

| Time of Event, March 28, 1979 | Event Description |
|---|---|
| | 1350 psig. OTSG B was operating with about 97% level and 99 psig, whereas OTSG A was steaming to the main condenser at about 93% level and 76 psig. Makeup pump 1B was operating and supplying RCP seals and normal makeup, the latter at 95 gpm. Makeup pumps 1A and 1C were secured, as were the decay heat removal pumps 1A and 1B. Pressurizer temperature was at 150°F and operators were letting down in attempt to draw a bubble. |

## II. Summary, Conclusions, and Recommendations

### Summary

This investigation found that, although pertinent information was not intentionally withheld on March 28, 1979, information was not adequately transmitted to the Nuclear Regulatory Commission or the Bureau of Radiological Protection (BRP). The investigators concluded that two primary factors examined during this investigation caused the failure of station personnel to adequately inform the necessary organizations. The predominant factor was the absence of an effective onsite system to accumulate, evaluate and disseminate information. The second factor was the lack of comprehension by plant personnel of the behavior of the plant systems.

The investigators relied heavily on existing information, including data from the plant computer, reconstructions of recorded parameters, personal notes, and tapes to establish the time when information could have been known. Other information came from personal notes and transcripts of statements made to the various investigators during interviews were conducted to supplement the existing information. In some cases, the accumulated information contained apparent conflicts concerning the knowledge of individuals about specific information. The conflicts resulted from differences in an individual's testimony taken at different times, and differences in the testimony of different individuals with regard to the same subject.

To reconstruct what information was known, the investigators examined several of these apparent conflicts. This examination resulted in conclusions on the information known by various individuals. These conclusions are stated in the body of the report. One possible explanation for the apparent conflicts in knowledge of specific information is that one or more of the individuals involved has lied. Other possible explanations include poor recall, different statements by an individual on the same subject as a result of a slightly different question, the inability of an individual to differentiate between what was known on March 28, 1979 and knowledge gained later, and the effect of elapsed time. The investigators did not attempt to assign a specific cause for each of the apparent conflicts examined. They did, however, conclude that none of the conflicts examined were the result of lying.

Two potential items of noncompliance were examined related to the failure to report specific information (discussed in Section VI of the report). However, an additional citation of noncompliance is not recommended.

### Conclusions

1. There was significant information that did not adequately flow either on the site or to the necessary offsite groups on the day of the accident.

2. On the day of the accident, an effective system did not exist to ensure adequate information flow; i.e., to provide significant information for dissemination and evaluation within the onsite

organization or offsite within the Met Ed and GPU organizations as well as the NRC, Commonwealth of Pennsylvania, and other agencies.

3. Those individuals on site failed to understand the extent and significance of the problems confronting them on the day of the accident; this contributed to the inadequate flow of information.

4. Met Ed was not fully forthcoming on March 28, 1979 in that they did not appraise the Commonwealth of Pennsylvania of either the uncertainty concerning the adequacy of core cooling or the potential for degradation of plant conditions.

5. Information was not intentionally withheld from the State on the day of the accident.

6. Information was not intentionally withheld from the NRC on the day of the accident.

7. The NRC did not have an effective system to ensure that information was properly accumulated, evaluated, and disseminated.

8. Reporting requirements, both to NRC and to the State, were not sufficiently specific on March 28, 1979.

Recommendations

1. The investigators recommend that no citation for failure to report be issued against Metropolitan Edison. Even though the investigators are unanimous in this recommendation, the underlying reasons vary. These reasons include the following:

   a. The regulatory requirements in existence on March 28, 1979 with regard to reporting were not sufficiently specific to support such a citation;

   b. Sufficient information was transmitted by Metropolitan Edison on March 28, 1979 to conclude that the reporting requirements existing at that time were satisfied; and

   c. A belief that a citation of this type at this time for this licensee has no real meaning.

2. The investigators recommend that NRC require emergency plans and implementing procedures to specifically address, in detail, the following communications functions:

   a. Assignment of specific responsibilities to ensure that all pertinent information is accumulated, recorded, and displayed.

   b. Assignment of specific responsibilities to ensure that this information is disseminated to both those responsible for evaluation of the information and those responsible for communication of the information, including specification of how this information is to flow.

c. Assignment of specific responsibilities to ensure that all pertinent information is communicated to all offsite groups and agencies which require this information, including specification of how this information is to flow. This recommendation includes the communication of plant management's evaluation of the significance of the information.

3. The investigators recommend that NRC reporting requirements and related regulatory guidance be modified or revised to ensure that all pertinent information is provided. Those requirements and guidance should:

   a. Specify the nature of the subevent, occurrence, or indicator within an overall event that should be reportable in itself.

   b. Specify that, the evaluation or assessment of each reported subevent, occurrence, or indicator is reportable.

   c. Specify the responsibilities of the plant staff to promptly provide and continue to provide timely assessment of the plant conditions and the potential for deterioration.

   d. Specify the responsibilities of the plant staff to provide information related to anomalous plant behavior; i.e., information related to plant behavior which is not understood.

4. The investigators recommend augmentation of the present system of verbal/telephonic information flow with a real-time data link in order to provide offsite organizations and agencies sufficient information to permit timely independent evaluation of plant conditions and the timely initiation of the resulting recommendations or actions.

5. The investigators recommend that NRC review and revise, as necessary, the communications channels to be implemented in response to an accident.

6. The investigators recommend that the roles of those NRC personnel involved in responding to an accident be clearly defined. This includes those personnel to be on site, in the Regional Office, and at headquarters. These roles should also be discussed with and understood by licensees.

## III. Knowledge and Reporting to NRC of Key Indicators Related to the Accident

The investigators reviewed previous testimony, reports, and other source materials. Based on the results of this review, key indicators (events or key plant parameters) were identified as being particularly significant. Because these key indicators were significant, knowledge or lack of knowledge associated with them should have enabled the investigators to trace the flow of information among plant personnel on March 28, 1979. However, it was found that past testimony contained both incomplete answers and unasked questions that prevented the investigators from establishing knowledge of the key indicators for some personnel. Therefore, a series of interviews was conducted in an attempt to get complete answers and to ask previously unasked questions. This process allowed the investigators to reach conclusions concerning the extent of knowledge possessed by particular Metropolitan Edison employees related to each of the key indicators. A summary concerning this knowledge of key indicators is discussed in the following.

1. Primary Coolant System

a. HPI and Letdown Systems

A review of the status of the makeup pumps (MUPs) and the letdown system during the initial hours (prior to 8:00 a.m.) of the accident confirmed previous TMI operating staff testimony that the behavior of the plant was not understood. Approximately 2 minutes into the transient, reactor coolant system pressure decreased rapidly through the 1640 psig level, initiating both trains of the safety features actuation system (SFAS). During the next 6-8 minutes, pressure continued to decrease to saturation values for the corresponding hot leg temperatures. Contrary to the transient behavior of the plant for which they had been trained--that is, rapid pressure and level decrease during a loss-of-coolant accident (LOCA)--the pressurizer level increased rapidly to an offscale value and returned intermittently within the indicated range only when the operators throttled the high-pressure injection (HPI) flow and increased letdown to a value greater than 160 gpm. The plant appeared to stabilize in this anomalous condition, with the pressure essentially stable at saturation and pressurizer level offscale high, until the EMOV was closed after 2 hours and 19 minutes into the accident. At that point, pressure rapidly increased. In retrospect, it appears that, because the behavior of system pressure was essentially stable over much of this period, the operating staff became increasingly preoccupied with pressurizer level and a related concern over the possibility of operation with a solid primary coolant system (e.g., with the system completely filled with water). As a result, the operator actions of throttling the HPI and increasing letdown were directed toward restoring pressurizer level, thus contributing to the continual reduction of coolant inventory in the primary system.

This is significant because the incorrect analysis of the anomalous conditions not only resulted in detrimental operator actions but also delayed recognition of LOCA conditions and the potential severity of the accident. The resulting confusion was evidenced by the fact that some members of the key staff were aware of the prior status of these systems. However, post-accident testimony reveals that little discussion occurred early in the morning among key staff members regarding either the status of these systems (HPI and letdown) or the resulting implications with regard to the potential magnitude of the coolant inventory deficiency.

Knowledge of HPI and Letdown

George Kunder--Kunder was aware that HPI had been secured shortly after initiation of the transient and that letdown had been increased in an attempt to restore pressurizer level to a less-than-full indication (SIG, 9/18/79, pp. 32-35, 42-45). Kunder cannot remember if this information was discussed with any of the key staff (IE, 9/4/80, pp. 3-4).

Leland Rogers (B&W)--Rogers was unaware of the status of HPI and letdown prior to 8:00 a.m.; he did not recall any subsequent conversations with regard to its status prior to 8:00 a.m. (IE, 9/2/80, pp. 3-5).

William Zewe--On the morning of March 28, 1979, Zewe directed the reactor operators to throttle HPI and increase letdown in an attempt to restore pressurizer level. Zewe recalled briefing Kunder and Miller (separately) on what had happened prior to their arrivals and specifically recalled that the status of these systems was discussed (IE, 9/4/80, pp. 3-5).

Michael Ross--In testimony on September 18, 1979 to the SIG (pp. 11-12), Ross stated that he thought the fact that HPI had been off for some time or was throttled back was discussed prior to 11:00 a.m. When questioned on September 24, 1980 (IE, pp. 4-5), Ross stated that the discussion would have involved the "think tank" people.

Joseph Logan--Logan vaguely recalled (IE, 10/16/80, p. 5) that when he arrived in the control room he was told by Zewe that a safety injection had been automatically initiated and that it had been secured. Logan recalls no subsequent discussions of this subject.

Gary Miller--When asked, Miller did not recall knowing that HPI had been secured and/or throttled for some period of time prior to his arrival in the control room at approximately 7 a.m. (IE, 9/5/80, pp. 6-7 and IE, 11/10/80, pp. 140-146). Miller did not think Zewe's recollection of briefing him on the status of HPI and letdown was accurate.

The investigators conclude that Miller was briefed on the status of the HPI and letdown systems as they existed prior to his arrival. Zewe, who was present when the EMOV block valve was closed, probably did not recognize that a significant inventory loss had occurred. Thus, Zewe did not recognize the significance of the HPI system being secured and the letdown flow being increased for a period of time. Because of this, the investigators conclude that any information with regard to the status of the HPI and letdown systems was presented to Miller in the context of actions taken to restore an offscale high pressurizer level. Thus, Miller's attention was not directed to the length of time the HPI system had been secured.

b. Reactor Coolant Pumps

As reactor coolant system (RCS) inventory decreased due to the stuck open EMOV, the reactor coolant progressively changed to a circulating two-phase mixture with a continually increasing steam fraction. This condition was evidenced both by the increasing vibration of the RCPs and by the erratic and decreasing RCS flow rates. In response to these indications and the minimum net positive suction head limits, operators secured the loop B RCPs at 5:14 a.m. The loop A RCPs were tripped at 5:41 a.m., thus terminating the forced coolant circulation through the reactor core. At 6:54 a.m., RCP 2B was restarted. At 7:12 a.m., the indicated flow was zero and the motor running current was 100 amps; therefore, RCP 2B was tripped. At 8:09 a.m., RCP 1A was restarted to confirm the pump running conditions. At that point, the indicated pump current rapidly decreased to less than 100 amps with no flow being indicated. RCP 1A was tripped 37 seconds later.

This sequence was significant for two reasons. First, termination of forced flow resulted in separation of the two-phase mixture, thereby vapor-binding the loops. This effectively terminated an already degraded two-phase heat transfer mechanism, resulting in coolant boiloff and initiation of core uncovery. Second, a qualitative indication of the severity of loss of coolant could have been inferred from the extent of voiding as evidenced by the steam environment in the RCP volute (suction).

The investigators conclude that the inability to run the RCPs on the morning of March 28, 1979 did not lead the plant personnel to infer the extent of voiding in relation to core water level.

Knowledge of RCPs

George Kunder--Subsequent to the attempt at 8:09 a.m. to run RCP 1A, Kunder concluded that the RCP was spinning in a steam environment. At that point, Kunder was concerned that they could be uncovering the core (Senate, 8/22/79, pp. 17-18). Kunder recalls no specific conversation on March 28, 1979 regarding this concern (IE, 9/4/80, pp. 6-7).

Leland Rogers (B&W)--Subsequent to the attempt at 8:09 a.m. to run RCP 1A, Rogers concluded that the loop was filled with steam at least to the suction of the RCP (IE, 9/2/80, pp. 14-16).

Joseph Logan--Logan was aware of the inability of the RCPs to provide forced circulation on the morning of March 28, 1979 (IE, 5/9/79, pp. 6-7, 33).

William Zewe--After Miller and Rogers arrived, Zewe informed them of the actions he had taken with regard to securing the RCPs and the bases for his taking these actions (IE, 9/4/80, p. 9).

Michael Ross--Ross was convinced that the RCP was pumping steam. When asked about checking plant elevation drawings subsequent to the attempts to start the pump, Ross recalls some discussion within the think tank about levels and the probable problem. However, he does not think they ever related it to a core water level (IE, 9/24/80, pp. 11-12).

Gary Miller--From the time the reactor coolant pumps were restarted and indicated 100 amps, Miller was aware that there was a coolant inventory deficiency in the plant (IE, 9/5/80, pp. 37, 48-50). Miller's concern was related to the level of water in the hot leg. The investigators conclude that Miller did not recognize the magnitude of the inventory deficiency, and that he did not attempt to relate this inventory deficiency to core water level.

c. EMOV

Approximately 4 seconds after the turbine and generator trip, the EMOV opened as RCS pressure increased through the 2255 psig setpoint. When the pressurizer steam space was vented to the reactor coolant drain tank (RCDT), excess pressure, which was caused by the coolant expansion from the RCS into the pressurizer via the surge line reactor coolant was relieved. RCDT temperature and pressure began then to increase. At 2345 psig (approximately 8 seconds after turbine trip), the reactor tripped on high pressure and the coolant began to contract, thereby rapidly reducing system pressure and pressurizer level. Approximately 7 seconds after the reactor trip, pressure decreased through 2205 psig (the EMOV closure setpoint) and the EMOV did not close.

The EMOV solenoid deenergized and the EMOV control board position indicator (which was sensed from the electrical state of the solenoid) indicated closure of the EMOV. From this time (approximately 15 seconds from turbine trip) until the EMOV block valve was closed (2 hours and 19 minutes into the accident), an unrecognized loss of coolant continued to flow from the reactor coolant system.

The RCS pressure steadily decreased to the saturation pressure for the hot leg temperatures. The unavailability of feedwater to remove heat from the RCS and the low RCS pressure caused a rapid expansion of reactor coolant into the pressurizer. In fact, contrary to the expected transient behavior for loss-of-coolant accidents and contrary to the symptoms for which operators were trained to respond, pressurizer level was increasing rapidly within 1 minute of the reactor trip. A pressurizer high-level alarm (266 inches) was received at about 3 minutes and 28 seconds, and within 5 minutes and 30 seconds, the indicated pressurizer level was offscale high (maximum indicated range of 400 inches).

At 3 minutes and 15 seconds, the RCDT relief valve lifted (setpoint 122 psig), discharging coolant into the reactor building sump. The pressure and temperature in the reactor building began to increase as a result of the hot coolant expanding through the EMOV into the RCDT and out of the RCDT relief valve into the reactor building atmosphere (sump). At approximately 15 minutes into the accident, the RCDT rupture diaphragm burst (192 psig RCDT pressure) and released the contents of the RCDT into the reactor building atmosphere. This caused a rapid increase in reactor building pressure.

From this time until the EMOV was isolated, conditions remained essentially stable: RCS pressure remained at the saturation level for the corresponding hot leg temperatures, pressurizer level remained offscale high, and reactor coolant inventory continued to decrease as the coolant expanded through the EMOV into the RCDT and into the reactor building atmosphere.

The EMOV block valve was closed at 6:19 a.m. The reactor building pressure decreased rapidly, and the RCS pressure increased from 680 to 2120 psig during the next 41 minutes.

Knowledge of the EMOV

George Kunder--At some time on March 28, 1979 (he does not believe it was in the morning), Kunder became aware that the EMOV had been stuck open (IE, 9/4/80, p. 8-9). In earlier interviews (e.g., SIG 9/18/79, pp. 39-41), Kunder left the impression that it was earlier in the morning (perhaps shortly after the general emergency was declared) that he became aware that the EMOV had been stuck open.

Joseph Logan--Logan does not recall if he became aware on March 28, 1979 that the EMOV had stuck open (IE, 10/16/80, pp. 11-16).

Leland Rogers (B&W)--Rogers does not recall becoming aware that the EMOV had stuck open until March 29, 1979 when the reactimeter data was delogged (IE, 9/2/80, p. 7).

William Zewe--After the EMOV block valve was shut, Zewe recognized that the EMOV had been open for some period of time. Zewe was aware that some inventory had been lost and that, with closure of the block valve, the RCS pressure started increasing and the reactor building pressure started decreasing (SIG, 10/11/79, pp. 92, and Senate, 11/15/79, pp. 35-38). He recalled discussing this fact with several members of the plant staff, whom he believed included Kunder, Ross, and Logan. He also believed that it was discussed with Rogers and Miller some time on March 28, 1979 (IE, 9/4/80, pp. 11-12).

Michael Ross--Ross recalled arriving about the time the block valve was shut and Zewe saying that the reactor building pressure was decreasing with the EMOV closure (IE, 5/19/79, pp. 11-12). He also recalled discussion in the think tank regarding the EMOV having been open (IE, 9/24/80, pp. 17-20).

Gary Miller--Miller has stated that he was aware on March 28, 1979 that the EMOV had been open longer than it should have been because the RCDT rupture disc had blown. However, his perception of that time period was in terms of minutes rather than hours (IE, 11/10/80, pp. 61-78).

The investigators conclude that Miller was aware on March 28, 1979 that the EMOV had stuck open and that it was related to the abnormal indications in the early morning but that he did not perceive how much water had been lost from the RCS.

William Dornsife (BRP)--Dornsife recalled Miller briefing him at approximately 9:00 a.m. on March 28, 1979. He recalled Miller stating that the EMOV had been stuck open for a period of time and that the position indication had been faulty (IE, 10/1/80, p. 11).

James Higgins (NRC)--Higgins stated in an IE interview on October 7, 1980 (p. 31) that he was told by Marshall (on his arrival at about 10:15 a.m.) that the EMOV had been stuck open.

d. Th/Superheat/Incore Thermocouples

The loop B RCPs were secured at 5:14 a.m. Twenty-seven minutes later (5:41 a.m.), the loop A RCPs were secured. Loops A and B hot leg temperatures were approximately 535°F at that time. Within 9 minutes, the loop A hot leg temperature started to increase rapidly and within 30 minutes exceeded the wide-range console indication (maximum indicated 620°F). The loop B hot leg temperature did not increase immediately, but went off the scale 19 minutes after the loop A temperature indication. Both loops A and B hot leg temperatures increased to greater than 700°F and remained there for approximately 7 hours.

The significance of these temperatures is derived from the thermodynamic relationship of coolant temperature, pressure, and core water level. After the loop A RCPs were secured, coolant boiloff reduced the coolant level below the top of the fuel. Steam rising above the steam-water interface continued to be heated by the exposed fuel rods beyond the saturation temperature (i.e., the steam became superheated). The reduction in the heat transfer capacity of the superheated steam resulted in further degradation of heat removal from the exposed fuel. The overheating of the fuel rods resulted in a reaction of the zircalloy tubes with the steam, which produced free hydrogen.

Given the training of the plant personnel, it is questionable to believe that the extent of core damage during the accident should have been inferred from the indications present. However, recognition of the obvious superheated conditions should have led to a closer reexamination of some of the information present in the control room. In fact, when the loop A hot leg temperature exceeded the wide-range indication (620°F), RCS pressure was approximately 700 psig and decreasing, which was well below the saturation pressure for 620°F (1787 psig). The indicated temperatures were questioned by the plant staff, particularly with regard to the validity of the calibration of the hot leg temperature sensors in a steam environment. To verify the indicated temperatures, the plant staff checked these temperatures with other instrumentation. An attempt was made to read out the core exit thermocouples on the plant computer. Question marks were obtained from many locations, which indicated that these core exit themocouples were damaged or off scale (700°F). The plant staff then tried to read the thermocouples with test equipment in the cable spreading room. The range of data presented to the Station Manager (five readings that varied from a high of >2000°F to a low of <100°F) was characterized as unreliable; how-ever, they provided him with a gross indication that the core was hot and that this was why the computer read off the scale. It is important to note that these personnel had no experience, training, or procedures for the use of these core exit thermocouples. In retrospect, if all the readings had been available and had been examined in the light of other confirming temperature indications, it might have been recognized that the >2000°F temperature indicated that the core was within the range in which an autocatalytic exothermic zircalloy-steam reaction could occur. Confirmation of the magnitude of the hot leg temperatures was obtained (and believed) by connecting instrument bridges to the hot leg temperature sensors for the reactor protection system. These were read out in the control room and confirmed the hot leg temperatures in the range of 700-800°F (i.e., superheated).

The investigators conclude that the significance of superheated steam was not understood on March 28, 1979 by the people on site.

Knowledge of Th/Superheat/Incores

George Kunder--Kunder was aware that the hot leg temperatures were in the range of 700-800°F. Kunder inferred from these temperatures that there could be portions of the core that were being cooled by steam. Kunder believes that his concern was verbalized in the think tank meetings (SIG, 9/18/79, pp. 53-55, and IE, 9/4/80, pp. 11-17), but he does not recall any specific conversations relative to superheated steam.

Kunder, who was unfamiliar with the core exit T/Cs, briefly discussed these T/C readings with Porter. Kunder accepted Porter's analysis of unreliability. Kunder was not aware of any other discussions of these core exit T/Cs (IE, 7/11/79, pp. 12-14, and IE, 9/4/80, pp. 28-29).

James Seelinger--Seelinger concluded that the hot leg temperatures could have been hotter than indicated (maximum indication on meter was 620°F wide range).

Although Seelinger was aware that Porter went to get the core exit T/C readings, Seelinger did not know the results of those readings. Seelinger was aware of the question marks on the computer and concluded that they were probably out of range and that the hot leg temperatures were valid (IE, 10/14/80, pp. 77-78).

Leland Rogers (B&W)--When interviewed, Rogers stated (IE, 9/2/80, pp. 16-17) that, although he was aware of a temperature readout (hot leg temperature) greater than 700°F, he was never certain on March 28, 1979 that the correct hot leg temperatures were being indicated in the steam phase. Rogers was aware of the core exit thermocouple readings but he was not certain of their validity (IE, 9/2/80, pp. 26-27). Rogers recalled no discussions of superheated steam on March 28, 1979 (IE, 9/2/80, p. 18).

Joseph Logan--Logan did not recall knowing the magnitude of the hot leg temperatures on March 28, 1979. He recalled Porter's discussion of a range of core exit T/C readings with Miller and the remark that the readings were questionable. However, Logan was not aware of nor did he consider or discuss superheated steam conditions on March 28, 1979 (IE, 10/16/80, pp. 18-22).

William Zewe--Zewe was aware of the hot leg temperatures on the extended scale device connected by Porter. Zewe then became aware that the temperatures were in excess of the saturation values (IE, 9/4/80, p. 15).

Zewe has testified both that he was not aware of the core exit T/C readings taken by Porter (Senate, 10/18/79, p. 23) and that he does not recall whether he knew these readings were being taken (IE, 9/4/80, p. 30).

Michael Ross--Ross was aware of the hot leg temperatures; however, he related them to inadequate core cooling and did not connect them with an inventory deficiency (IE, 9/24/80, p. 26). Ross stated in the same interview that, although the term "superheat" was never discussed, the plant staff's analysis was that the hot leg temperatures were too hot for the existing pressure (p. 28).

Ross recalled being aware of the core exit T/C readings and the discussion between Miller and Porter that took place in the control room. However, he only recalled the core exit thermocouples being discussed in passing in the think tank (IE, 9/24/80, pp. 41-45).

Ivan Porter--Porter and four instrument technicians were involved in reading out the incore thermocouples in the cable spreading room. Based on the magnitude of the readings observed, some of the instrument technicians concluded that the core could be uncovered. Porter returned to the control room to pass on the initial readings. Porter advised Miller that some readings were high (>2000°F), some were low, and some did not read out. Porter felt that the thermocouples may have been damaged. Porter did not pass on the concerns of the instrument technicians. Although a complete set of readings were taken after Porter left, neither Miller nor other key staff members were aware of them on March 28, 1979.

Gary Miller--Miller was aware that hot leg temperatures were greater than 700°F. Even though there was a discussion of steam conditions and Miller was aware of the readings from the extended-scale hot leg readout, Miller said he made no connection between the existing steam conditions and core uncovery. Miller did state, however, that they might have believed there was some steam environment near the top of the fuel rods (IE, 9/5/80, pp. 21-56).

The investigators conclude that Miller did not believe that the core had been uncovered on March 28, 1979 and that Miller's concern, resulting in reinitiation of HPI at a less-than-maximum flow rate, was based predominantly on ensuring adequate core cooling (i.e., removing decay heat). The investigators also conclude that, prior to receiving the incore thermocouple data, Miller already believed the core was hot. This belief (Miller's belief) was based on the hot leg temperatures obtained from the instrument bridges hooked up to the reactor protection system (RPS) cabinets, the offscale computer indications, etc. Thus, when Porter advised Miller that the thermocouples could have melted and formed new junctions, Miller was concerned that the core was hot but he saw no further use for the incore thermocouple data.

e. Count Rate Behavior

Following the turbine and reactor trip, source range nuclear instrumentation readings decreased at a normal decay rate of approximately one-third decade per minute for the first 20 minutes. At that point, the count rate leveled off at about 5000 cps and then increased slowly until 5:41 a.m. when the loop A RCPs were secured. The count rate then abruptly dropped. Shortly thereafter, it increased again and continued to behave erratically over the next 2 hours. This behavior has been postulated to represent both changes in core configuration and changes in neutron leakage due to moderator conditions in the reactor vessel annulus.

Although the complexity of neutron transport mechanics could prevent a simple analysis of the count rate with changing plant thermal-hydraulic conditions, it is significant that the operators were presented with an unexpected and unexplained increase in source range count rates following the shutdown condition.

Boron concentration prior to the trip was in excess of 1000 ppm. At approximately 5:15 a.m., the shift supervisor received a boron analysis indicating that the concentration was approximately 700 ppm. A second sample taken at 5:45 a.m. yielded approximately 400 ppm boron in the RCS. Based on the count rate behavior and the boron concentration, there was a concern about recriticality as a result of moderator dilution. Emergency boration was initiated at about 6:10 a.m. and continued until 7:22 a.m.

Count rate behavior essentially stabilized after about 7:45 a.m. Later in the morning, a B&W employee postulated that this count rate behavior could have resulted from increased neutron leakage due to voiding. This conjecture, when combined with other information, suggested that the core may have been uncovered.

Knowledge of Count Rate Behavior

George Kunder--Kunder was concerned about the count rate behavior and low boron concentration. His concern, along with that of Ross and Zewe, resulted in initiation of emergency boration. Kunder had nuclear engineers looking at the count rate behavior; however, he did not remember any further discussions with either of them or with the think tank members regarding the count rate behavior. Kunder did not become aware of the implications (i.e., voiding and partial core uncovery) until he heard Flint's explanation late in the morning (IE, 4/25/79, pp. 26-34, and IE, 9/4/80, pp. 24-26).

Joseph Logan--On the morning of March 28, 1979, Logan was aware of the low boron concentration and the count rate behavior (IE, 5/9/79, pp. 8, 9). Logan did not believe that the reactor was returning to criticality; however, he could not explain the count rate behavior. Logan recalled discussing these indications with Kunder and the reference to possible moderator dilution. However, he did not recall knowing of Flint's explanation as discussed below (IE, 10/16/80, pp. 33-39).

William Zewe--Zewe did not believe that the reactor was going critical. However, he also could not explain the increase in count rate. Zewe recalled discussing with Miller, Kunder, Flint, and Chwastyk the reason for an increase in flux in the detectors. Zewe did not recall these discussions being concerned with core voiding (IE, 9/4/80, pp. 29-30).

Michael Ross--Ross was aware of the increasing count rate and believed that the reactor was returning to criticality. Ross recalled no discussions with regard to Flint's explanation of core voiding and increased neutron leakage (IE, 9/24/80, p. 37).

Gary Miller--Miller knew that emergency boration had been initiated, based on count rate behavior and boron concentration (IE, 5/7/79, p.76).

Miller did not recall being aware of Flint's explanation on March 28, 1979, nor did he recall any inferences related to inventory based on count rate behavior (IE, 9/5/79, pp. 57-59).

Leland Rogers (B&W)--Rogers recalled discussing with Zewe a concern about low boron concentration and recriticality. Rogers recalled no discussion, however, of count rate behavior. Rogers did not recall discussions with Flint regarding core voiding and neutron instrumentation behavior (IE, 9/2/80, pp. 22-24).

John Flint (B&W)--After reviewing plant instrumentation, Flint concluded that the increase in count rate had probably been caused by a change in the leakage flux from the core. Based on this and other instrumentation readings, Flint believed that the core had been uncovered earlier in the morning (Kemeny, 6/30/79, pp. 18-19 and IE, 4/23/79, pp. 4-5). Flint recalled discussing this information with Kunder, Zewe, and Rogers. Flint's recollection was that Rogers said he would discuss it with Met Ed management (IE, 9/2/80, pp. 18-19).

The investigators conclude that Miller, Logan, Seelinger and Ross were not aware of the implication of core uncovery based on the count rate behavior. They also conclude that Kunder did not learn of this explanation until late in the morning or early in the afternoon. By this time, the count rate had stabilized and Kunder dismissed this factor as not being priority information.

### 2. Containment Pressure Spike

Three aspects are pertinent to a discussion of the 28 psig containment pressure spike that occurred at 1:50 p.m. on March 28, 1979: (1) the containment and associated systems, (2) the hydrogen, and (3) the testimony of Chwastyk and Mehler.

The safety features actuation system (SFAS) is the instrumentation monitoring and actuation system for engineered safety features (ESF). SFAS receives input from reactor coolant pressure transmitters and containment pressure switches. On actuation, SFAS initiates emergency coolant injection, isolates the containment, starts the emergency containment cooling system, initiates the containment spray, and starts the emergency diesel generators.

Table 7.3-2 of the final safety analysis report (FSAR) for TMI-2 lists equipment associated with ESF actuation. Each of these components has component status indication in the control room (e.g., containment isolation, containment cooling equipment actuation, high-pressure injection valves position indication and high-pressure injection pump actuation, decay heat removal pump actuation, containment spray valve position indication, and diesel generator status).

The signals for the containment spray functions are provided by six containment pressure switches. These switches are arranged in two separate and independent actuation logic trains (three channels per train with two-out-of-three logic). Each pressure switch has a range of 0-100 psig and trips at a nominal 28 psig. There is control room panel status indication for each channel and train.

At 1:50 p.m. (9 hours and 50 minutes into the accident), the reactor building pressure rose abruptly from about 3 psig to about 28 psig and then decreased rapidly to less than 4 psig. Containment spray pumps automatically started. Coincident with these events, two 480 Vac busses were tripped, after which a "thump" or "thud" was heard by some personnel in the control room. Several members of the control room operations staff witnessed the reactor building pressure recorder respond to the pressure transient and the accompanying spray pump actuation. However, with the exception of two shift supervisors, it appears that the recorded pressure transient and spray pump actuation were generally attributed to electrical faults or instrument malfunctions.

It was not until late the next evening on Thursday, March 29, 1979, that the significance of the containment pressure spike was generally known, and it was not until early in the morning of Friday, March 30, 1979, that the Station Manager was aware that the pressure spike had been real. The investigators believe that, because the pressure spike was not generally recognized as being "real" on March 28, 1979, it was generally ignored. It is reasonable, however, to expect that, based on their licensing, training, and required knowledge of engineered safety feature (ESF) systems and associated instrumentation, personnel at TMI-2 should have deduced that the observed pressure spike did not result from instrument malfunction or an electrical fault. The recorded containment pressure transient was, in fact, a real pressure excursion and a potentially serious challenge to the containment integrity. The investigators conclude that licensed operators and operating supervisors in the Unit 2 control room should have recognized that the pressure spike was caused by a real pressure increase inside the containment. [Two shift supervisors (Chwastyk and Mehler) have testified that they thought the spike was real; however, the investigators conclude that they did not explain or discuss this belief with their supervisors on March 28, 1979. They appear to have diverted their attention away from the spike to other plant activities after a brief time period. See also the discussion of the third aspect in this section.]

The second aspect related to the pressure spike is the extent of knowledge of hydrogen as the cause of the spike. Two shift supervisors have stated beliefs concerning the symptoms of the pressure spike that are substantially different from the beliefs of other Met Ed personnel. In fact, they have testified that they were aware on March 28, 1979 that a real pressure transient had occurred and that a chemical reaction or hydrogen was the possible cause. Chwastyk also testified that an order not to restart electrical equipment was issued on March 28, 1979 (IE, 9/4/80, pp. 12-22).

The ESF systems at TMI-2 were designed to prevent core meltdown, to maintain the integrity of the reactor containment building, and to ensure that the exposure of the public to radiation would be below the limits of 10 CFR 100 during LOCA conditions. The principal document discussing the ESF systems and post-accident hydrogen production, and with which the TMI-2 personnel would have been familiar, is the final safety analysis report (FSAR). The FSAR analyses show that post-accident radiolytic hydrogen plus hydrogen contributed by metal-water and aluminum-corrosion

reactions does not approach the generally accepted lower flammability limit of 4 volume percent for several months (4 months) after the LOCA (refer to Figure 6A-10, TMI-2 FSAR). Therefore, it is probable that, prior to the TMI-2 accident, it was beyond the range of credible operator knowledge to infer that amounts of hydrogen sufficient to reach a flammable concentration in a 2 x $10^6$ $ft^3$ containment might exist 10 hours after the initiation of the accident.
The investigators conclude that hydrogen was not believed to be the cause of the pressure spike. The testimony reviewed leads the investigators to further conclude that hydrogen was not discussed on March 28, 1979. This conclusion concerning hydrogen not being identified as the cause of the pressure spike on March 28, 1979, is based on the testimony of operators and a review of the engineered safety systems.

The third aspect of the containment pressure spike was developed from the testimony of Chwastyk and Mehler. The investigators examined a possible discussion of the pressure spike in the presence of an NRC inspector in the Unit 2 control room at the time of the spike. At this time, two NRC inspectors were in the area of the TMI-2 control room. They were James Higgins, a reactor operations inspector, and Don Neely, a health physics inspector. Two Med Ed employees, Joseph Chwastyk and Brian Mehler, have testified that an NRC inspector was present in the TMI-2 control room at the time of the spike.

Joseph Chwastyk stated that he told an NRC inspector that he (Chwastyk) believed that an explosion had taken place in the containment (IE, 9/4/80, p. 104). In testimony to the Special Inquiry Group (10/30/79, p. 18), Chwastyk stated "...and I know specifically there was at least one NRC inspector there. And I don't know who it was, I don't remember his name or what he looks like." [Although Chwastyk was interviewed on May 21, 1979 and October 11, 1979, the NRC inspector was not mentioned until October 30, 1979, even though the pressure spike was discussed.] In testimony before these investigators, Chwastyk stated that he later learned the NRC inspector's name. When asked by another NRC investigator, he remembered that Neely was the NRC inspector to whom he explained that the pressure spike was real. Chwastyk further stated that Neely saw the containment pressure recorder (IE, 9/4/80, pp. 104-109).

Brian Mehler testified (Senate, 8/22/79, p. 9) that he discussed the spray pump actuation that occurred as a result of the pressure spike with an NRC inspector. He stated that, "There were NRC people in there wandering around, and he asked me a question, so I explained it to him." Mehler then stated that he could not identify this NRC inspector (Senate, 8/22/79, p. 10). When asked about the identity of the NRC inspector, Mehler said that it was not Neely because he became acquainted with Neely after March 28, 1979 (SIG, 10/30/79, pp. 19, 20). Mehler also states that Donald Haverkamp was the only NRC inspector in the TMI-2 control room whom he recognized on March 28, 1979 (SIG, 10/30/79, p. 19). Haverkamp did not go to the site until Thursday, March 29, 1980.

Donald Neely testified that he was not aware of the pressure spike on March 28, 1979 and that he did not discuss the spike with Chwastyk or Mehler on March 28, 1979 (IE, 10/7/80, p. 10). He also testified that weeks after the accident (in April), a Met Ed employee told him that he (the Met Ed employee) had information relating to the spike. Neely turned this matter over to the IE investigation team, whose findings are contained in NUREG-0600 (IE, 10/7/80, pp. 10-13).

James Higgins also testified that he was not aware of the pressure spike on March 28, 1979 (IE, 10/7/80, p. 22). When asked how he could explain being in the control room during the time period of the spike and not be aware of the event, he stated: "I guess I can't really explain that. All I could say was that there was certainly a lot of activity going on at that time. I don't recall any thud of that type, and if it was a dull type of thud, similar to a main coolant pump check valve, when you start a main coolant pump on a submarine, which is what--when I discussed it with Gary Miller on Friday, the way he described it, and that is sort of a dull thud in the background. There are lots of noises at a plant that happen at various times, and if you are familiar with the plant, one that's a little bit different sticks out, if you're there all the time. If you're not, and you hear all these various noises, and there are lots of them at a plant--now if you're not familiar with the noises, what's common and what's not, they don't really register with you, and the odd ones that are not normal don't really stand out as they would to somebody that was very familiar with it and there on an every-day basis..." (IE, 10/7/80, p. 23).

Recognizing the apparent conflicts that exist between the testimony of Mehler and Chwastyk concerning the identity of the inspector, these investigators conclude that an NRC inspector was not informed that an actual pressure of about 28 psig had existed inside containment on the day of the accident. These investigators also conclude that the NRC inspectors in the control room at TMI-2 were aware of some of the symptoms associated with the rapid increase in containment pressure to 28 psig (indicated). The symptoms of the pressure spike included the SFAS actuation and containment spray actuation. However, the investigators conclude that they did not understand the symptoms or pursue an explanation of any symptoms they may have observed.

<u>Knowledge of Containment Pressure Spike and Hydrogen</u>

<u>Gary Miller</u>--Miller was in the Unit 2 control room at the time the pressure spike occurred when he heard a noise like a "thud." He did not observe the spike on the containment pressure recorder or recognize that the containment spray pumps had actuated (Kemeny, 5/31/79, p. 57; IE, 9/5/80, p. 112; Senate, 9/28/79, p. 25). Miller discussed the source of the noise with Ross and Marshall and requested an explanation. When the noise was attributed to the ventilation system changing modes, Miller did not question this explanation (Senate, 9/28/79, p. 25).

The investigators conclude that Miller was not aware of the 28 psig pressure spike on March 28, 1979, and also conclude that he did not believe or have discussions concerning the possibility that hydrogen was being generated and could become a problem on that date. Although the investigators conclude that it is possible that Miller was aware that the containment spray pumps actuated, they also conclude that he placed no significance on this actuation and accepted the explanation of the ventilation system to be the cause of the "thud."

Michael Ross--Ross was in the Unit 2 control room at the time of the pressure spike. He was aware that the containment spray pumps started, and that the containment pressure recorders showed the 28 psig spike (IE, 5/19/79, p. 3). He believed that an instrument failure caused the spray pumps to be actuated. The event itself, however, was not believed to be possible (i.e., the rapid increase and rapid decrease in containment pressure). Ross did not believe on the day of the accident that hydrogen buildup would happen in such a short period of time (IE, 9/24/80, pp. 47-56). Therefore, on March 28, 1979, he did not conclude that hydrogen had been or was a problem.

William Zewe--Zewe was in the Unit 2 control room at the time of the pressure spike. He was aware that the containment spray pumps actuated and that the containment pressure recorders showed the 28 psig spike (IE, 7/2/79, pp. 34-41). Zewe told Ross that the spray pumps had actuated, but he did not believe that the pressure spike was real on March 28, 1979. He could "not conceive how the building of over 2 million cubic feet could pressurize that rapidly, and then be depressurized that rapidly" (IE, 9/4/80, p. 44). On March 28, 1979, he did not conclude that hydrogen was or could become a problem.

Joseph Chwastyk--Chwastyk was in the Unit 2 control room at the time of the pressure spike (IE, 5/21/79, pp. 8-18). He has stated that he was aware that containment spray pumps had started and that the recorders showed a spike. After a few minutes, he ordered that the spray pumps be secured. He knew that a real pressure spike had occurred on March 28, 1979, but he did not hear the "thud." During this same interview, he was asked "...at that time as far as the cause was strictly a channel or pressure spike in the containment but [did you] not have any feeling for what would cause that kind of problem?" He responded, "No, I did not." However, when he later learned of the noise, he assumed that some kind of explosion had taken place. Chwastyk also testified (IE, 9/4/80, p. 24) that he reached the conclusion on March 28, 1979 that a zirconium-water reaction had been caused by heat generated in the reactor core and that this reaction resulted in hydrogen generation that was sufficient to cause an explosion. He also stated that shortly after the pressure spike he "related" to Gary Miller that a hydrogen explosion had probably taken place.

In an IE interview (5/21/79, p. 9), Chwastyk stated that he was hesitant to secure equipment because he did not know what caused the pressure spike. In this same interview, he stated that he reset the equipment, but he had no idea of the time frame after the spike in which this equipment was reset: "Oh, I have no idea. It was...there were a lot of things happening. I remember it was just an oh-by-the-way type thing. How, exactly long after the spike I don't know" (p. 12). However, less than 1 minute after the spike, operators began to take actions to defeat the ESF actuation signals that were caused by the spike; at about 6 minutes after the spike, the containment spray pumps were secured.

Chwastyk has testified that not very long after the spike he "...suggested to Gary Miller we no longer cycle the electromagnetic relief valve because it had...the explosion...or rapid rising pressure in the reactor building corresponded to opening the electromagnetic relief valve" (IE, 5/21/79, p. 18). Chwastyk also testified that, "It was right after the hydrogen explosion and I mentioned that I correlated the opening of the valve with the detonation period that I again went to Gary Miller and explained what I thought had happened as far as the hydrogen detonation and the simultaneous opening of the valve, and it was shortly after that, Gary Miller got back to me and said go ahead and draw the bubble" (SIG, 10/11/79, p. 18).

In an SIG interview (10/30/79, p. 17), Chwastyk was not sure that he told Miller of a hydrogen explosion; he stated, "my best recollection of that is that I did relate to Gary that we had some sort of an explosion. Whether I said it was hydrogen or not, I'm not sure. But I remember distinctly putting together the operation of the valve and the spike, and I think I relayed those thoughts to Gary." In this same interview, Chwastyk stated that he did not remember specifically discussing the possibility of an explosion with other control room personnel other than Mehler on March 28, 1979 (pp. 17, 18). He also stated (pp. 19, 20) in this interview (in response to a question about Miller's lack of knowledge of an explosion on March 28, 1979), "Well, that could very well be true. Again, I can't absolutely--if Gary said--I may not have told him what I thought at the time, because I really wasn't certain." In testimony conducted as part of this investigation (IE, 9/4/80, p. 11), Chwastyk responded to the following:

"Q. What about Mr. Miller, was he already aware before you discussed it with him that there had been a pressure spike?

A. I don't know that. To the best of my recollection, I think I asked someone to tell him that we had just had something happen in the building that caused a pressure spike. I don't remember who that was, and what they did, if they actually told Gary."

In contrast to Chwastyk's testimony is the testimony of the other think tank members who have testified that the spike was not believed to be real on March 28, 1979.

Chwastyk also stated (IE, 9/4/80, pp. 33-36) that he directed someone to inspect the containment to determine if containment integrity had been lost. He did not know that he ever got a report of the status of actions that he directed be taken. He stated, "I don't know that I ever got the report back on that outside, you know, check of the containment. I guess I don't remember because I think by the time they could make any kind of inspection I had come up with the idea, and quote if you will, of the hydrogen explosion. And I think after that I just sort of forgot about the containment check" (IE, 9/4/80, p. 36).

The investigators conclude that Chwastyk may have directed operators to make checks to help identify the cause of the spike. However, the investigators conclude that Chwastyk did not direct that the integrity of a containment (known to contain substantial amounts of radioactivity) be checked on March 28, 1979. It is also concluded that Miller did not give Chwastyk permission to establish a bubble in the pressurizer before he (Miller) returned from briefing the Lt. Governor. [Pressurizer heaters were turned off and on several times between 2:00 p.m. and 4:30 p.m. The actions being taken were attempts to maintain the plant status; i.e., continued efforts to collapse the bubble in the loops and cooldown by natural circulation using loop A and to make preparations to initiate the decay heat system.]

The investigators conclude that Chwastyk believed the pressure spike to be real (containment pressure reached 28 psig) and discussed it with Mehler on March 28, 1979. They conclude that Chwastyk's recollection of the cause of the spike is in error. The investigators conclude that hydrogen was not discussed as a cause for the pressure spike on March 28, 1979; there was no acknowledged cause for the spike on that date. It is concluded that the order not to restart electrical equipment was given on some day subsequent to March 28, 1979.

Brian Mehler--Mehler was in the Unit 2 shift supervisor's office at the time of the pressure spike. He was aware that the containment spray pumps had actuated and saw the spike on the containment pressure recorder (wide range) (IE, 5/17/79, pp. 29-33). Mehler discussed the symptoms associated with the pressure spike with Chwastyk. Part of this discussion concerned the cause of the spike as being "some kind of chemical reaction or something" (SIG, 10/11/79, pp. 14-15).

Mehler testified (SIG, 10/11/79, p. 15) that he did not connect the spike with the EMOV block valve operation.

"Q. Did you connect the spike with the fact that it [spike] just happened after the vent valve had been operated?

A. No, later on, yes. Two days later when everyone became concerned, yes."

Mehler also discussed an order not to start any pumps and "...not to do anything that could give an ignition" (SIG, 10/11/79, p. 15). When asked (SIG, 10/11/79, p. 16) about the time of the order or recommendations he may have made to Gary Miller in connection with the pressure spike, Mehler responded, "No. It's very hard. I would like to put the time together, but I can't. I can't. I do not know sometime after the pressure spike happened we were told not to start equipment because they assumed that it could happen again and they probably put it that there was hydrogen in there, but that was sometime after 1:50. Now how far past that, I don't know. And I do not, I said--well, to Gary Miller I said--he said don't start any more oil pumps and I said we don't have to, I already tested them all, because they were concerned--but how far into the afternoon at that time, I don't know whether it was 4:00, 2:00 or what, but it was sometime after."

The investigators conclude that Mehler recognized on March 28, 1979 that the pressure spike was real (containment pressure reached 28 psig), but its cause was not known. It is concluded that Mehler's recollection of hydrogen being discussed on March 28, 1979 and his recollection that an order not to start electrical equipment which could cause a spark was given on March 28, 1979 are in error. It is concluded that an order not to restart electrical equipment was given on some day subsequent to March 28, 1979.

Charles Mell--Mell arrived in the Unit 2 control room after the pressure spike occurred. He learned of the spike on the evening of March 28, 1979. Subsequent to March 28, 1979, Mell learned that a hydrogen explosion had possibly caused the spike (Senate, 8/22/79, pp. 14-17).

Theodore Illjes--Illjes arrived in the Unit 2 control room after the pressure spike (3:45 p.m.) and was briefed by Chwastyk. Illjes and Mell were told of the pressure spike and resulting containment isolation. Illjes testified that in this briefing there was a discussion of hydrogen having been the cause of the pressure spike (IE, 5/23/79, pp. 5-10). The investigators conclude that discussions concerning hydrogen and an order not to restart electrical equipment were learned by Illjes subsequent to March 28, 1979.

In a separate but related effort, the NRC Office of Inspector and Auditor (OIA) interviewed several of the inspectors who went to TMI on the day of the accident. During these interviews, Karl Plumlee, an NRC inspector, expressed several concerns related to this investigation. Copies of OIA summaries of their two interviews with Plumlee are attached as is an OIA summary of a followup interview with James Seelinger who was employed by Met Ed at the time of the accident.

Plumlee's concerns, as evidenced by the OIA interview summaries, may be condensed into the following:

(1) Knowledge by Region I personnel of elevated hydrogen concentration inside containment on the morning (~8:00 a.m.) of March 28, 1979;

(2) Performance of hydrogen monitoring by Met Ed before the containment spike (1:50 p.m.) as evidenced by specific concentration numbers about which he was told; and

(3) A perception that information may not have been freely supplied by NRC management to NRC inspectors or by Met Ed to its employees.

The investigators' review of these concerns included interviewing all of the inspectors who were sent to the TMI site with Plumlee as well as interviewing George Smith, reviewing notes and records of information received by Region I prior to the departure of the inspectors, and reviewing TMI records for evidence of containment air sample results. The results of the review are summarized in the following paragraphs.

Plumlee's belief that regional personnel had knowledge on the morning of March 28, 1979 of specific concentrations of hydrogen in the containment came from two sources. First, he believed that his Branch Chief, George Smith, said that there was 2.3% hydrogen in the containment when Smith briefed inspectors at about 8:15 a.m. prior to their leaving for the TMI site. Second, his own analysis of the other information he was provided led Plumlee to conclude that hydrogen levels could be expected in the containment building. Plumlee asked Smith at the time of the briefing about the hydrogen and Smith said he believed that he had said pressure rather than hydrogen composition but, if he had said it differently, that what he meant to say was pressure.

The review leads these investigators to conclude that the containment hydrogen composition was not known by anyone until the morning of March 31, 1979 when the first sample was analyzed at about 6:00 a.m. The investigators also conclude that Plumlee was and continues to be mistaken in his perception that elevated hydrogen levels could be expected from the information that was available in Region I prior to 8:45 a.m., some of which he was told on the morning of March 28, 1979. He stated that his conclusion on this perception was based on the containment dome monitor reading and the primary coolant sample result. The containment dome monitor was reported to Region I to be 200 R/hr at the time. Although there was a question as to whether this number was the shielded or unshielded value, lack of certainty about the value precluded Plumlee's certainty. A radiation rate of 200 R/hr on the containment is not evidence of core damage involving a zirconium-water reaction. The initial report of primary coolant activity was reported to Region I after Plumlee left for the site. Even if he had learned of the activity level reported to the regional office shortly after he left, he could not have properly concluded that the reported value was indicative of core damage involving a zirconium-water reaction.

Plumlee concluded that Met Ed had been monitoring the containment atmosphere for hydrogen before the pressure spike based on his conversation with Seelinger, which was followed very shortly by a discussion of the hydrogen analyses with Gallina. Originally, he believed that this conversation took place on Wednesday, March 28, 1979. On a subsequent day, a followup discussion with Gallina caused him (Plumlee) to think the conversation may have occurred on Thursday, March 29, 1979. Plumlee was certain that his conversation with Gallina immediately followed the discussion with Seelinger and that three sample analysis results were mentioned by Seelinger. Plumlee was also certain that, when he told Gallina of his conversation with Seelinger, Gallina told him that there was already general speculation that hydrogen burn had occurred. The investigators' review of this matter showed that the specific concentrations of hydrogen in the containment were not obtained until Saturday, March 31, 1979, at about 6:00 a.m. Gallina and Plumlee were not on the site simultaneously on Thursday, March 29, 1979, but they were there simultaneously on the afternoon of March 30 and 31, 1979 between 2:00 p.m. and 5:00 or 6:00 p.m. The records show that these containment air samples were analyzed at about 6:00 a.m., 2:00 p.m., 9:00 p.m., and 10:00 p.m. on March 31, 1979. Plumlee distinctly remembered three sample analyses being mentioned by Seelinger, and this information was not available until at least 9:00 p.m. on Friday March 31, 1979 after Plumlee had left the site. The investigators conclude that the discussion by Plumlee with Seelinger and Gallina of these data occurred on Saturday, March 31, 1979.

The investigators' pursuit of Plumlee's feeling that NRC management was less than forthcoming with the inspectors who were being sent to the site was hampered by lack of specificity in the basis for Plumlee's feeling. It is concluded that Smith could not have known specific hydrogen concentrations in the containment, and that he could therefore not have been holding back this information. Likewise, even though Smith and others must have had some conclusions of the severity of the accident, these conclusions would have been based in large measure on speculation. There is not a factual basis to conclude that failure to discuss speculation of specific severity was motivated by fear that the inspectors would be reluctant to go to the site. Conversely, the cause for incomplete briefing seems to have resulted from lack of information and a desire to get inspectors on site as promptly as possible.

Plumlee's feelings about Met Ed's failure to inform those who were on site were also based on nonspecific feelings and inferences that are hard to address directly. These investigators differ with Plumlee, as discussed elsewhere in this report, that Met Ed management had a clear understanding of how bad the situation really was. However, the investigators conclude that Met Ed was not fully forthcoming on March 28, 1979 in that the State was not appraised of either the uncertainty concerning the adequacy of core cooling or the potential for degradation of plant conditions.

During the course of the investigators' review of Plumlee's concerns, they learned that inspector Neely had a notation on a sheet of paper refering to hydrogen and a concentration of 4%. There was on this same sheet a reference to the date of March 29, 1979 noting when a filter was changed. On the basis of other events mentioned on the same page, it was concluded that the notes were taken on Sunday, April 1, 1979 and the reference to March 29, 1979 concerned something that had happened earlier rather than it being a contemporaneous note.

### 3. Goldsboro Radiation Dose Rate Projection

Upon arriving at the plant at 6:55 a.m. in time to hear the announcement of a Site Emergency, Howard Crawford, a nuclear engineer, proceeded to the Unit 2 control room. There, he gathered materials for predicting offsite exposure rates on the basis of the reactor building dome monitor reading, a task he had performed during drills for two years. Crawford recalls that his first calculation, which was completed soon after 7:00 a.m., showed an exposure rate of 40 R/hr in Goldsboro. Neither the time of day nor the result of this calculation has been substantiated by records or the recollection of others. However, a similar documented calculation (10 R/hr at the low population zone (LPZ) boundary) was performed before about 7:50 a.m. This calculation (10 R/hr at the LPZ) appears to have been performed by Crawford after 7:13 a.m., during the beginning of the massive release of radioactive material to the reactor building atmosphere. Both the time and magnitude of Crawford's dome monitor (HP-R-214) reading (300 R/hr) are uncertain. Accurate or not, the 300 R/hr reading formed the basis for the LPZ calculation. The time of 7:44 a.m. shown on the calculation sheet probably indicates either when the monitor was read or when the calculation was performed. Therefore, Crawford's calculation of 10 R/hr at the LPZ seems to have occurred between 7:13 a.m. and 7:44 a.m.

This prediction was reported to the Supervisor of Radiation Protection and Chemistry, Richard Dubiel. Although the projected dose rate of 10 R/hr was doubted because of conservative assumptions in the calculation, TMI management appears to have realized the need for a quick measurement in Goldsboro to confirm or deny Crawford's prediction. The containment dome monitor readings were questioned, but as a precaution the Station Manager, Gary Miller, requested that a State Police helicopter transport a survey team to Goldsboro for radiation monitoring. The helicopter did not arrive until 8:35 a.m., by which time Charlie Team had reported in from Goldsboro and Bravo Team had left by truck for Goldsboro. The helicopter was not used to transport a survey team to Goldsboro.

There was a common concern for getting onsite and offsite radiation measurements to supplement the Crawford prediction. Upon declaration of a Site Emergency at 6:55 a.m., efforts to organize and dispatch onsite and offsite monitoring teams began. An onsite team (Alpha) was instructed at about 7:30 a.m. to measure the radiation level west of the Unit 2 reactor building. During that survey, the wind was westward and very light with minute-to-minute variations of about 10 to 30 degrees. At 7:46 a.m., Alpha Team reported less than 1 mR/hr at Station GE-8 west of the Unit 2 reactor building. This measurement became the basis for discounting Crawford's prediction(s) of high exposure rates off site. At about 8:00 a.m. and 8:30 a.m., respectively, Charlie and Bravo Teams were dispatched by vehicle to Goldsboro. At about 8:30 a.m., Charlie Team reported less than 1 mR/hr in Goldsboro; Bravo Team reported similar results at about 9:40 a.m.

The calculation that resulted in the 10 R/hr projection in Goldsboro could also be used to indicate a prediction of 220 times the reportable level of xenon-133 at the LPZ established in 10 CFR 20.403(a). The reportable level of xenon-133 is $1.5 \times 10^{-3}$ μCi/ml ($5000 \times 3 \times 10^{-10}$ μCi/ml). The xenon-133 level calculated was 0.33 μCi/ml at the LPZ.

The licensee reported the 10 R/hr projected dose rate at Goldsboro to the BRP. The BRP notified the Pennsylvania Emergency Management Agency (PEMA) of this projection at 7:45 a.m. and suggested that it was advisable to make preparations for possible evacuations. However, Met Ed did not report the 10 R/hr projection to the NRC on the day of the accident. The licensee reported the accident to the NRC Region I office at 7:50 a.m. on March 28, 1979. The survey that was used to discount the 10 R/hr calculation was made at 7:46 a.m. Although this survey was not technically adequate to make a valid new calculation, it clearly demonstrated that the 10 R/hr calculation was predicting an excessively high radiation rate. It did not preclude the possibility that a lower but still significant offsite (LPZ) radiation release could occur.

Knowledge of 10 R/hr Dose Projection

Gary Miller--Miller was aware of the 10 R/hr dose rate projection for Goldsboro on the morning of March 28, 1979, prior to 7:50 a.m. Based on this prediction, action was initiated to get onsite readings that would be in the same direction of, if not actually in, the plume; in addition, he requested that a helicopter transport a monitoring team to Goldsboro. He was aware that onsite readings were less than 1 mR/hr.

Richard Dubiel--Dubiel was aware of the offsite dose projections because he reviewed the calculation results. However, he believed that the results were probably not accurate because the dome monitor had not responded properly and because the calculation was based on an assumed containment pressure of 55 psig. Containment pressure at that time was known to be less than 4 psig. He discussed the dose projection of 10 R/hr and the calculation assumptions with State officials. He believed that offsite readings were needed to back up and recalculate the dose projection; he did not believe that an immediate offsite hazard existed (IE, 4/24/79, pp. 7-8).

Howard Crawford--Crawford made the calculations associated with offsite dose projections on the morning of March 28, 1979. He was involved in discussions that questioned the validity of the dose projection (IE, 6/6/79, p. 18).

## IV. Onsite Information Flow

The flow of information within the Unit 2 control room on March 28, 1979 has been examined in previously published reports; i.e., the "Rogovin" (SIG) and "Hart" (Senate) reports. The scope of the present investigation in this area was limited to trying to understand the flow of information with regard to certain key indicators or events that occurred on March 28, 1979. These key indicators are discussed in Section III of this report. An attempt was made to establish the recognition of key indicators and then to understand the subsequent flow of related information within the control room organization. The purpose of this attempt was to evaluate this information and identify the resulting conclusions and recommendations or actions taken to mitigate the accident.

The flow of information was directly influenced by the organizational structure that existed at various times throughout the day. Key staff members, who were important to understanding the information flow, arrived at (or left) the Unit 2 control room at various times during the accident; e.g., Kunder (Unit 2 Superintendent Technical Support) arrived at approximately 4:50 a.m.; Logan (Unit 2 Superintendent) arrived at approximately 5:45 a.m.; Mehler (oncoming Shift Supervisor) arrived at approximately 6 a.m.; Seelinger (Unit 1 Superintendent) arrived at approximately 6:50 a.m.; Ross (Unit 1 Operations Supervisor) arrived at approximately 7 a.m.; Rogers (B&W Site Operations Manager) arrived at approximately 7 a.m.; Miller (Station Manager) arrived at approximately 7:05 a.m.; Flint (B&W Startup Engineer) arrived at approximately 9 a.m.; and Chwastyk (Unit 2 Shift Supervisor) arrived around noon. Because there was not an effective system for accumulating and passing on information, many of the key staff members did not become aware of important information related to events that occurred prior to their arrival. The best example of this is the EMOV (refer to Section III.1.c.).

At 6:19 a.m., the EMOV block valve was closed. Reactor building pressure decreased rapidly and RCS pressure increased from 680 to 2120 psig during the next 41 minutes. The recovery of plant conditions with block valve closure was known to three shift supervisors (Zewe, Mehler and Bryan), a shift foreman (Scheimann), and two control room operators. However, the investigators were unable to establish that Miller, Logan, Seelinger, or Rogers (the four principal members of the "think tank" or "command team") connected the closure of the EMOV block valve with the subsequent RCS pressure increase and reactor containment pressure decrease. Subsequent actions taken that morning are indicative of a lack of understanding that a significant inventory loss had occurred through the stuck-open EMOV. It was concluded that Miller's order at around 8:00 a.m. to keep the HPI on unless he personally approved a change was motivated by the need for decay heat removal rather than making up for primary coolant inventory losses. If the order was based on a concern for primary coolant inventory, then the investigators conclude that Miller would have given more specific instructions on maximizing net input of water into the system.

A second example of inadequate information flow was that associated with the apparent recriticality (refer to Section III.1.e.). Because of the concern of Kunder, Ross, and Zewe over what appeared to be an uncontrolled approach to criticality (they concluded that a moderator dilution was in progress), the primary system was emergency borated from 6:10 a.m. until 7:25 a.m. The count rate behavior stabilized after 7:45 a.m. and attention was directed to other problems. Three engineers (Wilkerson, Benson, and Crawford), who were attempting to resolve the unexplained behavior, discussed the indications with Flint, B&W startup engineer, after his arrival in the control room around 9:00 a.m. Flint postulated that these indications, along with others he checked shortly after his arrival, were results of voids forming in the core. Flint believed the core may have been uncovered. Both Kunder and Zewe, as well as other control room operators, were aware of Flint's explanation. Flint has testified that he also discussed these conclusions with Rogers. In spite of the number of people who were aware of Flint's explanation (Crawford, Wilkerson, Benson, and Rogers), the investigators conclude that Miller, Logan, Seelinger, and Ross did not become aware of Flint's explanation of core uncovery on March 28, 1979.

In each of the preceding two examples, at least one think tank member was aware of information that was not discussed in the think tank. An additional example is that Seelinger, Unit 1 Superintendent, testified that on the morning of March 28, 1979 he believed (based solely on radiation levels) that the core was uncovered. Seelinger further testified that he discussed this important belief with no one else. The investigators conclude that the think tank did not exist as a group that held periodic formal meetings. This is supported not only by the testimony of Miller but also by the record, or lack thereof, of discussions/evaluations, conclusions, or resulting actions relating to significant knowledge of key indicators. The investigators' perception of how the think tank actually functioned is this: Miller would converse with different staff members at different times depending on the subject, but usually with only one or two individuals at a time. Further support for this perception is provided by the testimony of the think tank members themselves; e.g., Seelinger has testified that his primary involvement was overseeing the implementation of the emergency plan and Logan's role was ensuring that individual steps were performed (as in a quality control check). For almost every key indicator, the record contains recognition by at least one key staff member. However, the same record demonstrates a lack of discussion/evaluation of these indicators within the think tank itself. Finally, there is no record of actions taken that would indicate an understanding of the implications of these indicators.

A final example of inadequate information flow is that of the pressure spike on the afternoon of March 28, 1979 (refer to Section III.2). Two shift supervisors (Chwastyk and Mehler) believed the pressure spike to be real. Numerous others in the control room (e.g., Ross and Zewe) were aware of one or more of the indications. The investigators conclude that this knowledge was not passed on to other members of the organization who would have been responsible for evaluating this information on March 28, 1979. It is therefore concluded that on March 28, 1979 Miller, Logan, Kunder, Seelinger, Ross, Rogers and Zewe did not have knowledge that the pressure spike was real on March 28, 1979.

## V. NRC Information Flow

At 7:10 a.m. on March 28, 1979, a TMI-2 engineer left a message with the NRC Region I office that a Site Emergency had been declared. The answering service was unable to contact the Duty Officer. At 7:37 a.m. a second message was left and at 7:40 a.m. a final message was left. A General Emergency had been declared at 7:20 a.m. at TMI-2, there was a primary to secondary leak in steam generator B, and there had been an offsite release. At 7:45 a.m., the Region I Reactor Operations and Nuclear Support Branch Chief received the messages and returned the calls to the site.

The following gives a limited reconstruction of the information flow to the NRC during certain periods on March 28, 1979. This reconstruction is based on the (1) IRACT tapes; (2) transcriptions of the Region I tapes; (3) Region I incident center message forms; (4) interviews with NRC and Met Ed employees; and (5) reports by the Senate, Special Inquiry Group, and IE investigation group. Only information important to characterize the severity of the accident has been identified. It is important to note that this is only part of the information that flowed to NRC on March 28, 1979.

In the first 10 minutes following the notification of the General Emergency (prior to 7:55 a.m.), the following information was passed on to Region I:

- Reactor trip and safety features actuation had occurred
- Fuel had failed
- Bubble was located in reactor vessel
- Measurements of 1500 psi and 571°F recorded
- All containment radiation monitors were in high alarm
- Measurement of 1 to 2 psi in containment recorded
- EMOV had lifted and blown the RCDT rupture disc
- Site and General Emergencies declared

Based on these early communications, Region I declared a level 1 severity incident and assembled a 5-member team to send to the site. George

Smith, the Region I Fuel Facilities and Materials Safety Branch Chief, when interviewed by the investigators, said that it was his impression of the first calls that it was an extremely serious accident and that it could get significantly worse. He further stated that, based on the information Region I was receiving, he felt that the potential for further deterioration existed throughout the afternoon.

The Regional Director notified NRC headquarters and at 8:05 a.m. the headquarters Incident Response Center was manned. At 8:23 a.m., headquarters returned the call to the Region I Incident Response Center and, from this time on, most of the information transferred to headquarters from Region I was taped. The first call (8:23 a.m.) was a discussion of the initial information received in the regional office. At 8:34 a.m., the first containment dome monitor reading of 200 R/hr was reported to headquarters. The reported temperature of 571°F was an average of the hot and cold leg temperatures that were already out of the indicated range. [Regional personnel were not aware that this was an erroneous temperature when they received this information from the site and passed it on to headquarters.]

Shortly after 8:30 a.m., based on the initial information, John Davis, the Acting Director, Office of Inspection and Enforcement, informed Lee Gossick, the NRC Executive Director for Operations, and Edson Case, the Deputy Director, Office of Nuclear Reactor Regulation, of the accident. He stated, "It looks like there's some loss of coolant." At 8:59 a.m., Kunder informed Region I that he was concerned the core was not being cooled. Kunder thought they were not getting proper flow to the core. Kunder thought the loops were vapor locked.

At about this time, headquarters asked how the core was being cooled. Region I reports the following:

- Core was not being cooled
- RCPs were off
- Primary system was vapor bound
- There was no indication of primary temperature (no flow)
- Containment pressure had been to at least 4 psi

Between 8:30 a.m. and 9:15 a.m., NRC headquarters perception of the accident was that an earlier inventory deficiency probably resulted in partial core uncovery, and had caused damage to the fuel. However, in this time frame, the core was thought to be covered even though an inventory problem still existed, as evidenced by the voids in the primary system.

By 9:15 a.m., the NRC had notified the U.S. Senate and House of Representatives as well as the White House of the problems at TMI.

At 9:21 a.m., Region I reported that the core was being cooled by natural circulation only minutes after Region I had reported that the core was not being cooled. At 10:04 a.m., Region I told headquarters that there was no natural circulation. Headquarters was now thoroughly confused and could not establish either how the reactor was being cooled or where the water was going. Finally, at 10:06 a.m., headquarters was told that they

[site] were pumping in 500 gpm and using the EMOV to control pressure. This was also the only means of cooling.

At about 9:25 a.m., Region I was preparing a press release and a preliminary notification (PN). They requested to speak to Kunder to establish the information and times accurately. In the following exchange, Kunder was attempting to explain the steam conditions in the core and loops, and why it appeared that the HPI system was not adequately cooling the core. Region I, however, moved on to get additional information for the PN. Kunder then attempted to explain the anomalous plant conditions (level, pressure, and temperatures) and why they were not understood. Region I again interrupted Kunder and asked him to get Dubiel so that they could get the health physics (HP) information.

Region I: "This is Don Haverkamp. I would like to go through the scenario with George Kunder--is he available. Or with someone familiar with it because I am going to try and get some times...."

Kunder: "Once the operators recovered from that, and pressurizer level went up and the thing I have not gotten from the operators yet--still debriefing on--because they are all pretty much tied up with the plant activities--but it looks like the pressurizer level went up and went virtually solid and that apparently through the letdown activity and so forth--you lost your bubble--apparently pushed it right through the relief valves into the drain tank which subsequently ruptured the ruptured disc--when the level came down then you don't have that steam bubble--you put too much cold water into the pressurizer and now the heaters are on but you are not really drawing a bubble--the pressure came down at that point, all the way down to about 10 hundred pounds and that was over roughly a 15-minute span. I think it was during that condition that we possibly lost the--we got a bubble--steam bubbles or some such--through apparently the heating in the core up in the loops and the--it apparently had an effect of vapor-locking--you know--the coolant system such that we were not getting good flow--we did not have any RC pumps running for awhile--but once the pressure got down below their NPSH for the temperature we were at and then the flow dropped off. We secured the pumps--the indications were very confusing but now that we are looking at the thing now--it looks to me like we had that vapor locking effect being fed by the heat in the core--and we reinitiated HP injection, of course, to get the coolant flow in but it didn't appear to have the effect that we wanted--okay--and we did try to run another coolant pump to turn it on again but it didn't give you any flow--so it was still apparently vapor locked. The problem is trying to get the pressure down low enough so we are sure that the flow is going into the--is going down--in the reactor vessel annulus and up into the core. The vapor-lock apparently is preventing that from occurring--and that is apparently what led to failed fuel."

Region I: "Okay...Let me go on, George, with a couple of things--to get your confirmation...."

KUNDER: "That's right, the pressurizer level being pegged, then the pressure was drifting down, temperature staying about where it was, around [545°] or so, in that range--plus or minus 5 degrees. That's the thing I think that baffled people the most, and it was--we did have RC flow at the time--I think it was close to full flow."

Region I: "Just a minute, George, we have a couple of questions I think you can answer for us...."

Region I: "The HP related questions, if Dick Dubiel is handy, you might have him answer them...."

At 9:39 a.m., Boyce Grier, Regional Director, and Karl Abraham, Region I Public Affairs Officer, discussed a draft press release with John Davis, Acting Director, Office of Inspection and Enforcement, and with Joe Fouchard, NRC Director of Public Affairs. The following statement was read: "They apparently have a vapor lock in the primary system so that they're not able to circulate coolant and get as cool as they would like to...."

Kunder's concerns were not passed on to headquarters. Headquarters was not aware of the concerns over steaming in the core and the inability to get adequate HPI flow into the core. The following exhcange between headquarters and Region I took place at 10:21 a.m.

Headquarters: "We still don't know the status of the core."

Region I: "They are still injecting."

Headquarters: "Where is it going?"

Region I: "I don't know."

Accurate temperature information had still not flowed either to Region I or headquarters at that time. Region I requested the primary system temperature and pressure at about 9:55 a.m. Kunder reported a pressure of 2000 psi and temperature of 571°F $T_{ave}$. He cautioned the region that this was not a representative temperature. Kunder told Region I that Ross (Operations Supervisor) was sure the core was covered, but the hot leg temperatures were still high and that these were bothering them.

Shortly after 10:00 a.m., the 5-member team arrived on the site. They started reporting to Region I from the Unit 1 control room at 10:23 a.m. Bubba Marshall, a Met Ed Operations engineer, had just been evacuated to the Unit I control room from the Unit 2 control room. Marshall briefed Higgins (Region I reactor operations inspector) on the status of Unit 2 prior to his departure (Unit 2 conditions up to approximately 9:30 a.m.).

Higgins testified that, as a result of this briefing, it was his understanding that the EMOV had stuck open causing a loss-of-coolant accident. Marshall did not know how long the valve had been stuck open or how much inventory had been lost. Higgins testified that he was sure that he passed on this information to Region I prior to proceeding to the Unit 2 control room. This information, however, was not recorded on the Region I incident message forms with other information transmitted to the region by Higgins in his first update at 10:55 a.m. The following information was reported to headquarters as a result of these exchanges: 142,800 gallons were injected from the borated water storage tank (BWST), containment sump level was pegged high (6 ft max.), containment pressure was 2 psi and decreasing, pressurizer level was pegged high, they were trying to draw a bubble with heaters, they were using atmospheric dumps and steam generator A, cold leg temperature was 220°F, pressure was 1950 psi, and reactor coolant pumps were off. Region I inspectors Higgins and Neely proceeded to the Unit 2 control room. They arrived in the Unit 2 control room around 11:15 a.m. From that time throughout the afternoon, Higgins and/or Neely participated in most of the caucuses in the shift supervisor's office.

At 11:41 a.m., Region I reported that the hot leg temperature was believed to be 620°F, cold leg temperature was 220°F, and pressurizer temperature was 359°F; they were maintaining 2000 psi by cycling the EMOV. In fact, Miller had just instructed that the EMOV block valve be opened to rapidly depressurize the plant and allow core flood tank injection. This decision was the result of discussions that were primarily concerned with the assessment of core coverage and core cooling. Although the NRC inspectors were present for these discussions, the considerations that led to this action were not passed on to either Region I or headquarters.

At 12:17 p.m., headquarters requested the core exit thermocouple readings. This request went unanswered. (The readings were requested again at 4:00 p.m. This investigation did not attempt to determine why this data was not provided). At 12:33 p.m., headquarters was informed by Region I that pressure was 1100 psi, the hot leg temperature was 565°F, and that there were bubbles some place in the system, maybe in the core. At 12:49 p.m., three-way communications were established between the Unit 1 control room, Region I, and headquarters.

Throughout the early afternoon, the information flow was mainly through the Unit 1 control room to Region I and headquarters. Some of the information received by both Region I and headquarters was erroneous. Region I had a direct line into Unit 2; however, it received only a minimum of operating information. An example of this is an accurate hot leg temperature that was not reported to headquarters until 2:20 p.m. Headquarters repeatedly requested operational information until headquarters finally requested a three-way telephone call into Unit 2 at 3:56 p.m. At 4:35 p.m., headquarters established three-way communications with both the Unit 2 control room and Region I, at which time operational information began to flow directly to headquarters.

The NRC inspectors located on the site and at Region I had a better understanding of the accident than headquarters. The role of each of the NRC components was vague. This resulted in a degree of confusion concerning the flow of information within the NRC. The investigators conclude that, on the day of the accident, an effective system did not exist within NRC to ensure that information was properly accumulated, evaluated, and disseminated.

## VI. Operating Information Supplied to the State

### Scope

This portion of the investigation addressed the reporting of certain key operating events by Metropolitan Edison to the Pennsylvania Bureau of

Radiological Protection (BRP) during the day of the accident. The key events were the same ones discussed in Section III of this report. The three principal members of the BRP were interviewed to evaluate the operating information that was provided to BRP in contrast to information that was supplied to NRC. The operating information supplied to the BRP was also reviewed with the objective of identifying improvements that could be made.

TMI Emergency Plan

Several of the TMI Emergency Plan implementing procedures make reference to an Emergency Status Board and contain as an enclosure a format for the information that is contained on the Board. A list of the questions contained in the enclosure under the title "Penna. Bureau of Rad. Health Questions" is excerpted below:

1. What type accident has occurred:

2. Has the reactor tripped?

3. Did the Emergency Safeguards Systems actuate? If so, which ones?

| | | | |
|---|---|---|---|
| a. | High Pressure Injection | Yes_____ | No______ |
| b. | Low Pressure Injection | Yes_____ | No______ |
| c. | Core Flood | Yes_____ | No______ |
| d. | Reactor Building Isolation | Yes_____ | No______ |
| e. | Reactor Building Cooling | Yes_____ | No______ |

4. What is the status of the Plant?

   a. At Power
   b. Hot Standby
   c. Hot Shutdown
   d. Cooling Down
   e. Cold Shutdown

5. Is offsite power available?

6. Are diesels operable?"

The above operating information questions are followed by questions pertaining to radiology and other areas.

Emergency Plan Implementing Procedure 1670.2 (Rev. 1), "Site Emergency Plan Procedure," specifies that the plant nuclear engineer is to relay data of plant status as defined in the enclosure to the procedure, the Plant Status Board format. (Note that the procedure actually refers to Enclosure 2, whereas the Status Board format is labeled Figure 2, but the format sheet pagination is correct for an Enclosure 2). The procedure does not specify to whom the nuclear engineer is to relay the status information. However, the format identifies the particular questions as "Penna. Bureau of Rad. Health Questions," leaving little doubt that the information is to be passed on to the BRP.

Emergency Plan Implementation Procedure 1670.3 (Rev. 1), "General Emergency Procedure," states in Note (1), page 4, that "It shall be the responsibility of all of the above to provide maximum assistance and information possible to the various offsite groups; i.e., AEC, State of Pa., Bureau of Radiological Health...." This note is the first of three that conclude the procedure section entitled "General Emergency Immediate Action." It immediately follows a statement that says the duties of listed personnel during a General Emergency are outlined in a specified procedure. The personnel listed are shift supervisor, control room operator, supervisor of operations, station engineer, supervisor of maintenance, nuclear engineer, radiation protection supervisor, chemical supervisor, radiation monitoring teams, emergency repair party, and security guards.

Operating Information Supplied

Based on the investigators' interviews and other interviews, the three principal BRP staff members (Gerusky, Dornsife and Riley) say that on March 28, 1979 the following operating information related to the key events previously identified was passed on or reported to the State:

(1) Dornsife knew of the low boron sample analysis (IE, 10/1/80, pp. 2-3).

(2) All of them knew that the reactor coolant pumps were not running (Dornsife, IE, 10/1/80, pp. 9-10; Gerusky, IE, 10/1/80, pp. 9-10; Riley, IE, 10/1/80, pp. 5-7).

(3) Only Dornsife recalled knowledge that the EMOV had been open for a period of time that was longer than normal (IE, 10/1/80, pp. 11-14).

(4) Both Dornsife and Gerusky knew that there was some voiding in the primary coolant system (Dornsife, IE, 10/1/80, pp. 13, 11, 28; Gerusky, IE, 10/1/80, pp. 5, 29, 41-43).

(5) Gerusky and Riley knew of the early-morning calculated projected dose rate of 10 R/hr at Goldsboro and that this projection was believed to be high (Gerusky, IE, 10/1/80, p. 33; Riley, IE, 10/1/80, pp. 19)

(6) Dornsife believed that, although the plant was not in the desired mode, the plant was stable and that the core was being cooled through a feed-and-bleed process using HPI for feed and bleed through the electromagnetic relief valve/block valve (IE, 10/1/80, pp. 10, 14-15).

(7) The pertinent data from the Status Board "Penna. Bureau of Rad. Health Questions" was passed on during a telephone conversation between Miller and Dornsife at about 9 a.m. (Dornsife's "Recollections").

(8) It could not be established that Gerusky, Dornsife, or Riley received specific knowledge on March 28, 1979 of hot leg or core exit thermocouple temperatures.

## BRP Perception of Adequacy of Operating Information Supplied

In general, the BRP expressed satisfaction with the information supplied to them by Met Ed on the day of the accident. Dornsife and Gerusky described previous drills as not having detailed operational information relayed and, in cases where information was relayed, the State relied on Met Ed to assess it. Gerusky said that they were not expecting much more information from the site than that received. He and Dornsife said that personnel at BRP were not thinking about the hardware as much as their major responsibility, offsite consequences. The key BRP personnel believed that the questions they asked of Met Ed were adequately answered. Both Gerusky and Riley said that the BRP personnel did not pursue sufficient additional questions with Met Ed. (Note that some specific questions, which are keyed to an identification of the specific accident under way, are contained in the State Annex to the TMI Emergency Plan. Although the Annex is not specific, the implication is that the State will initiate the questions.)

Notwithstanding BRP's apparent satisfaction with the communication of operational information described above, when the investigators asked BRP staff if a number of specific operational data or parameters should have been passed on by Met Ed on the day of the accident, each of the key BRP personnel were of the opinion (September 1980) that many of these parameters should have been passed on.

The loss of confidence in Met Ed, which Pennsylvania officials developed as a result of the mid-afternoon briefing of the Lt. Governor, has been covered by other investigators and was not pursued in this investigation. The effect of the meeting on Gerusky was opposite to that which he had as a result of direct telephone contacts. During the interview with Gerusky, he attributed his loss of confidence to Met Ed's failure during the briefing to admit offsite releases of which the BRP was aware. This was reinforced by Gerusky's perception of an attitude conveying that the accident was over and all that remained was cleanup.

## NRC Assessment of Operating Information Supplied by Met Ed to the State

The BRP staff with whom the IE investigators talked seemed to have concluded in hindsight that there was a need for the specific operational data that was not received. Although the BRP Emergency Plan Annex indicates that they have an interest in more specific operating data, BRP staff believed that they should have pursued these data through further questioning. Operating information was provided by Miller in the telephone conversation (about 9:00 A.M.) he had with Dornsife in preparation for Dornsife's briefing of the Lt. Governor. There is a correlation between the operating information supplied to Dornsife and that supplied to Floyd. Although the correlation is not exact, the operating information supplied to Dornsife is similar to that supplied to Floyd in his conversation with Bryan in the Unit 1 control room at about 9:00 a.m. (Floyd was the Unit 2 Operations Supervisor who was in Lynchburg, Virginia, on the day of the accident.) The similiarity in the information supplied is substantiated by comparing Dorsife's notes and his written recollections with what Floyd said he received, which was verified by the March 28, 1979 B&W log (Wandling notes). (Floyd was told among other things that there was a natural circulation cooldown, the RCDT rupture disc had blown, the EMOV block valve had been closed, there was high radiation in the reactor building, and the reactor coolant pumps were not running.) Although the information supplied to both Dornsife and Floyd was not indicative of the concern the investigators now believe should have been conveyed, it is believed to be representative of the assessment of the conditions prevailing in the Unit 2 control room at that time.

Shortly after Miller's telephone conversation with Dornsife, Miller had a telephone conversation with several people in Reading, Pennsylvania, in which he talked about the Dornsife conversation. A tape recording of this conversation was made at the Reading office. This recording has become known as the "Troffer tape" because the principal person talking from Reading was George Troffer, a QA Manager. If the Troffer tape transcript is read without relating it with what the investigators believe to be Miller's lack of understanding and, without relating it to what Floyd has been told, it can be inferred that Miller is describing a better situation than he believed existed. Contrary to this inference, the investigators conclude that Miller was describing how the accident was assessed at that time in the morning. A complication to this conclusion is the information that Kunder was providing to the Region about one-half hour later. The investigators conclude that, although Kunder had a more accurate perception of the accident, Miller and others did not share Kunder's concerns at that time.

Near the end of the Troffer transcript, there is a specific passage that could be interpreted to mean that Miller believed the situation to be more severe than he had told Dornsife. It says, "We've been assessing* the plant, we don't know where the plant is going. See, the situation we're in is a delicate one because we actually have plant integrity. If we had a leak we'd be all right--as far as we'd have a lot more economic consequences. We've been trying to figure out how to cool down in the most expeditious fashion without releasing and without damage too much." The investigators conclude that this passage means that the situation was not understood at that time, but it does not mean that Miller believed that the situation was continuing to deterioriate. The phrase, "If we had a leak we'd be all right," seems to reinforce the conclusion of a lack of understanding because procedures for handling a leak existed. However, the conditions being experienced were not anticipated and were not covered by procedures. Conversely, the phrase "we'd have a lot more economic consequences" if there was a leak seems to indicate that further deterioration was not expected. Another complication comes from Miller's statement to IE investigators on April 11, 1979 when he said, "I didn't feel I got...could get any help from anybody because I felt I didn't think anybody believed where I was...." Miller stated in an interview with the investigators that he did not intend in this statement to convey hesitancy to pass on information. The investigators conclude that Miller was not withholding information from the State (BRP) in his telephone conversations with them. Although it is not concluded that Miller believed

*The transcript says "testing" but the tape itself says "assessing."

that conditions were going to deteriorate, he could not preclude this possibility.

The afternoon briefing of the Lt. Governor left a number of the State people with a belief that Met Ed (Herbein was the principal spokesman) was downplaying the accident, and that "everybody was making a big deal out of nothing" (Gerusky, IE, 10/1/80, p. 23). The investigators' review of the Lt. Governor's briefing from the perspective of the State people was limited to their interview with Gerusky. Based on the information received, the investigators accepted the fact that some of the State people believed they had been misled and attempted to assess whether this happened deliberately on the part of Met Ed. On the one hand, there could be motives for Met Ed to describe conditions as being better than they believed them to be. On the other hand, although Met Ed knew the plant was outside known operating parameters, they also believed that conditions were improving. It was concluded that Miller and Herbein were encouraged by indications showing that the hot leg temperatures were decreasing and that the cold leg temperatures were increasing. The notes of IE Inspector Higgins show that those located on site believed that the situation was improving. Miller and Herbein would not have wanted to unduly alarm the State people. Not knowing exactly how much detail or background information the people present for this briefing wanted or needed, Miller and Herbein could have expected to be guided by questioning as to how much information was wanted. Nevertheless, based on a belief that information was omitted about their concerns earlier in the day and their lack of assurance that the situation would not deteriorate, the investigators conclude that the Met Ed representatives were not completely forthcoming during the briefing.

Miller was asked by Congressman Cheney during hearings by the House Subcommittee on Energy and the Environment (Transcript 5/11/79, pp. 203-204) about criteria for recommendations to the State for evacuation. In response, Miller referred to EPA Protective Action Guides (PAG) that recommend threshhold radiation exposures for which protective action should be taken. He pointed out that the measured offsite dose rates on the day of the accident did not indicate exposures near the PAG values. Miller said that he had to use judgment about plant status to give the State input as to whether he thought "the consequences in the plant is going to get severely worse quickly."

The judgment that a plant may get "severely worse quickly" is purely subjective. Nevertheless, the effectiveness of offsite protective actions is enhanced by as much notice and preparation as possible. A lack of certainty about the assessment of plant conditions and the adequacy of core cooling should be communicated promptly and clearly to offsite agencies to enable contingency planning. As discussed in the following paragraph, this lack of certainty was not communicated by Met Ed to the State on the day of the accident.

For much of the day on March 28, 1979 prior to the Governor's briefing, TMI management personnel were primarily concerned with a continuing assessment of core cooling. They were unable to obtain a previously analyzed or known configuration of system components for which they could be confident that the core was being adequately cooled (Ross, IE, 9/24/80, p. 34; Miller, IE, 9/5/80, pp. 31, 43). Because of the extensive voiding, both natural circulation and forced circulation were precluded. This left a feed-and-bleed method for which there were no direct indicators of the adequacy of cooling. Without a procedure to specify an adequate flow rate or a means for direct verification of the adequacy of cooling, those located on site were left with uncertainty (Miller, IE, 9/5/80, pp. 41, 43), This lack of certainty led to depressurization of the plant before the noon hour in an attempt to assure core coverage with the core flood tanks and to go into the decay heat removal mode, a known cooling configuration.

In this section, aspects of the lack of full communications with the State have been discussed. These aspects involved a failure of Met Ed to be fully forthcoming in that information was not volunteered concerning the potential for degradation of plant conditions or concerning the uncertainty of the method being used to cool the core. The investigators conclude that the responsible Met Ed personnel did not perceive the situation to be as bad as it really was. However, it is concluded that their concern was sufficient to have made the receipt of this information important to the State. Finally, the investigators conclude that failure to pass on the information was not willful withholding, but rather it resulted from a lack of perception of the severity of the accident coupled with a perception that, unless PAG guidelines were approached, it was not necessary to discuss plant operational uncertainties with the State. In the time frame of the accident, the investigators believe that it would not have been uncommon for other utilities to have been similarly influenced by offsite releases so far below PAG levels.

## VII. Enforcement Considerations

The reportability of three specific items of information was a central issue that led to this investigation. Consideration of these three items plus other possible noncompliance with reporting requirements is discussed in this section of the report following a discussion of two other enforcement issues that are related to the investigation.

### 1. Potential Material False Statement

On May 9, 1979, Herman Dieckamp, President of General Public Utilities (GPU), forwarded to NRC Commissioner Victor Gilinsky a copy of a mailgram which he had sent to Congressman Udall. The mailgram contained the statement, "There is no evidence that anyone interpreted the 'Pressure Spike' and the spray initiation in terms of reactor core damage at the time of the spike nor that anyone withheld any information." In view of the testimony of Chwastyk and Mehler about their knowledge and conclusions on the pressure spike, the investigators reviewed the record to determine if a material false statement had been made in the mailgram.

The investigators have concluded that, for a statement to be considered a false statement under Section 186 of the Atomic Energy Act of 1954 as amended, the statement must be made in a license application or it must be a statement of fact required under Section 182 of the Act. The Dieckamp mailgram was neither of the above. Therefore, it does not constitute a potential material false statement under the Act.

2. License Modification Related to Gary Miller

Gary Miller--In the course of assessing the flow of information on March 28, 1979, the investigators identified common or focal points for the flow of information. The Emergency Director, Gary Miller, was identified as a key focal point through which critical onsite information flowed. It is from the Emergency Director, as the manager of the think tank, that decisions flowed based on the assessment of information. The final phase of this investigation was a consideration of enforcement action to be taken with respect to Gary Miller. This involved an evaluation of Miller's performance on March 28, 1979.

This evaluation was complicated by the absence of specific criteria on which an objective assessment could be based. Another factor complicating the evaluation was the brevity of the record concerning Miller's individual actions. However, the investigators attempted to evaluate Miller's performance based on the record established during this and previous investigations. This led to two conclusions:

- Miller's decision to leave the site to brief the Lt. Governor (regardless of Met Ed management influences) was not in the best interest of plant safety.

- Miller could have more effectively utilized offsite technical resources known to be available on March 28, 1979 (i.e., GPU and B&W).

The investigators reviewed the need for enforcement action with respect to Gary Miller. These investigators reviewed the existing record, including the conclusions of this report. Based on this review, three investigators conclude that enforcement action directed to Miller is not warranted. One of these investigators based his conclusion on his review of the 10 R/hr projected dose rate as this was the sole area examined by this investigator.

The fourth investigator recommended that, although the record does not strongly support such a conclusion, Met Ed be required to show cause why Gary Miller should be allowed to continue to be involved in the licensee's nuclear activities in a supervisory capacity. This investigator's recommendation was based on Miller's performance on the day of the accident as summarized below:

- Miller's decision to leave the site to brief the Lt. Governor (regardless of Met Ed management influences) was not in the best interest of plant safety.

- Miller could have more effectively utilized offsite technical resources known to be available on March 28, 1979 (i.e., GPU and B&W).

- Miller failed to effectively utilize onsite resources in that he assumed the detailed decisionmaking role for a broad spectrum of activities. This diluted his own ability to overview these activities.

- The failure of knowledgeable plant personnel to put together symptoms, to review previous assessments in the light of later information, and to more thoroughly understand the accident is considered to be a supervisory or management deficiency in Miller's performance on the day of the accident. His role should have been to cause those under his direction to be more thorough and complete in their analyses. He should have questioned explanations that were given to him (for example, the explanation about the core exit thermocouples and the containment pressure spike indications).

3. Reporting

a. Regulatory Requirement to Report

The potentially applicable requirements to report information to the NRC on the day of the accident are contained in the following:

(1) Code of Federal Regulations,

(2) Facility Technical Specifications, and

(3) Procedures implementing the Emergency Plan.

The specific requirements of each are discussed in the following paragraphs.

Paragraph 403(a) of 10 CFR 20 requires immediate notification by telephone and telegraph, mailgram, or facsimile to the Director of the appropriate NRC Regional Office of any incident involving byproduct, source, or special nuclear material that may have caused or threatens to cause a whole-body exposure of 25 rems or more, release of radioactive materials in concentrations exceeding 5000 times the specified limits, loss of one working week or more in facility operations, or damage to property in excess of $200,000. Paragraph 403(b) of 10 CFR 20 requires notification within 24 hours of incidents of less severity.

Section 6.8 of the technical specifications states that written procedures shall be established, implemented, and maintained for stated activities, including emergency plan implementation. Emergency Plan Implementing Procedure 1670.3, page 4, Note (1), following a list of key people for General Emergency, says, "It shall be the responsibility of all the above to provide maximum assistance and information possible to the various offsite groups; i.e., AEC, State of Pa., Bureau of Radiological Health...."

Section 6.9 of the facility technical specifications requires reporting within 24 hours by telephone and confirmed by telegraph, mailgram, or facsimile to the Regional Director, or his designee, certain events, including "abnormal degradation discovered in fuel cladding, reactor coolant pressure boundary or primary containment;...personnel error or procedural inadequacy which prevents or could prevent, by itself, the fulfillment of the functional requirements of systems required to cope with accidents analyzed in the SAR."

A broad concept of an "implicit reporting requirement" has been suggested. Although it is clear that both NRC and the State need pertinent information in order to discharge their responsibility to protect public health and safety, expanding this need to include an "implicit reporting requirement" implies that failure to report such information is a violation of a requirement, and, as such, can be the basis for specific enforcement action. Although NRC is justified in criticizing Met Ed for failure to provide pertinent information, enforcement action based directly on an implied requirement does not appear to be valid. This conclusion is supported by the Statement of Considerations associated with promulgation of 10 CFR 50.72. Since the TMI accident, NRC issued 10 CFR 50.72 requiring nuclear power plant licensees to report listed events as soon as possible and in all cases within one hour. As a part of the same action, 10 CFR 20.403 was modified to make incidents included therein also reportable pursuant to 10 CFR 50.72. The Statement of Considerations for these regulation modifications says, "most of these events are not required presently to be reported immediately to NRC." If the "implicit reporting requirement" concept is applied, such a statement could not have been used as one of the justifications for waiving the normal public comment period prior to making the rule change effective.

b. Knowledge of Reportable Events

The knowledge of key members of the TMI staff on March 28, 1979 about a number of operating parameters and data is contained in the knowledge of key indicators section (Section III) of this report. Even though the Emergency Director/Station Superintendent Gary Miller says he does not recall knowing of some of these key indicators, knowledge by any responsible licensee personnel on duty is all that is required to establish knowledge by the licensee.

c. Failure to Report

The facts concerning reporting or passing on of specific important individual events or pieces of data to the NRC by Met Ed on March 28, 1979 are contained elsewhere in this report. Although some key indicators were reported, a question exists on the timeliness of the reporting. For those cases where timeliness is a factor, this aspect is discussed later as a part of the consideration of whether or not to cite Met Ed for noncompliance.

d. What Constitutes Reporting

On the day of the accident, the licensee communicated various times by telephone directly with NRC Region I, with NRC Region I and headquarters on a conference telephone line,and with NRC inspectors located on site. In the circumstances of these various communications, the question is raised as to what constitutes reporting.

One of the items of potential noncompliance considered refers to 10 CFR 20.403. This regulation states that the "...licensee shall immediately notify by telephone and telegraph, mailgram, or facsimile, the Director of the appropriate Regional Office...." As a matter of informal practice in the past, NRC has accepted telephone notification of the regionally based principal inspector, or his supervisor, as meeting the requirement to notify the Regional Director. From the time Region I returned the initial Met Ed telephone notification on the day of the accident, either the principal inspector or his supervisor was a party to the conversation. Therefore, any report made over this telephone is considered to be adequate in this instance.

It is less clear whether information passed on to an onsite inspector is acceptable. On the one hand, the onsite inspector may be considered a responsible NRC representative. Otherwise he would not be sent to the site. On the other hand, many inspectors are specialists in one particular discipline and cannot be expected to understand the significance of each item of information they receive if it is outside their area of specialty. Licensee representatives cannot be expected to know the limits of each inspector's expertise. A further complication is the danger of miscommunications if simple mention of a subject by a licensee representative to an onsite inspector is taken to satisfy reporting requirements. This could put an unduly large burden on the inspector and could thwart the purpose of reporting. An acceptable resolution of this dilemma is that licensees should be expected to notify the regional office by telephone unless it is assured that the onsite inspector understands the significance of what he is told. Telephone notification to the regional office minimizes concern that information will not be understood because this communication automatically alerts the recipient that the licensee considers the information to be important.

The other area of potential noncompliance relates to failure to inform NRC and the State based on the emergency plan implementing procedure. The procedure contains no guidance on which to base a conclusion as to how the passing on of the information is to be accomplished. For the purposes of this report, the investigators will use the same criteria as previously described for 10 CFR 20.403.

e. Assessment of this Case

Appendix A is a citation containing two specific items of noncompliance that were considered by these investigators. The citation includes the three items that were put aside last year plus an additional item related to the EMOV. The other key indicators were dropped from consideration because they were reported in a timely manner or they were not events.

The requirements and facts in this situation can be argued to a conclusion that further enforcement is either justified or that it is not justified. In this section of the report, a rationale for both sides is presented.

Basis for Citations

In the assessment of potential citations, the use of Section 6.9 of the technical specifications for failure to report information on March 28, 1979 was found to be inappropriate. The requirement was not applicable to the projected dose rate calculation. In relation to core temperatures, it was potentially applicable to the fuel degradation reporting requirement; however, a belief that fuel damage had occurred was reported early in the morning. Lack of knowledge by those on site of the extent of core damage precluded this meeting the requirements for a citation for failure to report. It was not applicable to the pressure spike because, even though the containment was challenged, it was not degraded. It was potentially applicable to the EMOV both as a degradation of the primary coolant boundary and as a personnel error (failure to recognize the open EMOV). It was, however, reported to the onsite inspector within the time specified by the requirement. It was concluded, therefore, that a case could not be made for citation against Section 6.9 of the technical specifications.

The use of 10 CFR 20.403(a) as a basis for a citation must rest on there having been an incident in addition to the incident reported by Met Ed (once communications were established with NRC Region I early in the morning). The containment pressure spike is the only potential item of noncompliance for which a clear argument can be made that a separate incident occurred. This event represents a unique challenge to the containment that was known to have a large inventory of radioactive material, the release of which could have caused consequences of the magnitude of those contained in 10 CFR 20.403(a). Such an argument is not believed to be sustainable for the other items cited.

A calculation (the radiation prediction in Goldsboro) cannot be successfully argued to be an incident. The other items in the citation are believed to be sufficiently related to the information that was reported to preclude classifying them as individual incidents. Two members of the TMI crew on duty at the time the containment pressure spike occurred stated that they talked about the event with an NRC inspector who was also in the control room at the time. One of the Met Ed employees identified the inspector by name. Neither of the two NRC inspectors who were in the Unit 2 control room area at the time have any recollection that they had knowledge of the event on March 28, 1979. Conversely, considerable evidence points to a general knowledge in the control room and shift supervisor's office that something significant happened at that time. Alarms sounded, equipment changed operational state, and operators took actions in resetting and shutting down equipment. Notwithstanding their belief now that they were not aware of the pressure spike on the day of the accident, these investigators believe that it is likely that one or both of the inspectors were aware of some of the symptoms of this event. If this be the case, it is believed that either they did not understand the symptoms to be indicative of the problem or they accepted an incorrect explanation of the symptoms. One of the Met Ed crew who stated he talked about the spike with an NRC inspector said that the inspector did not appear to understand what he was told.

Knowledge and understanding of information by onsite NRC inspectors can be accepted as a substitute for a required immediate verbal report to the regional office. However, some knowledge without an understanding cannot be accepted as a substitute for a verbal report. Even though there is conflicting information on what the NRC inspectors on site were or were not told about the pressure spike, the necessary elements to satisfy reporting requirements were not met.

The emergency plan implementing procedure was used as a basis for the other item of noncompliance. As was discussed earlier, because of the wording of the requirement, it was concluded that 10 CFR 20.403(a) was not applicable for these examples, but the broad language in the implementing procedure does not present such constraint. It can be argued that the information contained in the examples was not supplied in a timely manner, so this constitutes failure to comply with Technical Specification Section 6.8. In the context of the statement in the implementing procedure, to be timely the information is to be provided promptly or at the first available opportunity. In the examples contained in Enclosure 1, it can be argued that the information either was not provided or that it was not provided at the first available opportunity.

Discussion of Whether or Not to Cite

At this juncture, it can be asked, "Why should further citations be considered in response to the TMI accident?" There are two apparent principal reasons that can serve as motivations for citation: (1) a citation can deter a licensee from future failure to follow regulatory requirements, and (2) a citation can "send a message" to other licensees as well.

With regard to deterence for this licensee in this case, no further civil penalty may be assessed because the legal limit has already been imposed. The licensee is already facing a hearing to justify restarting Unit 1 (much less Unit 2) so that license suspension is not a main deterent. Licensee revocation would subject the licensee to a different sanction; however, it is not believed that the factual basis surrounding the events on the day of the accident would support license revocation. Use of a "failure to report" citation as a mechanism for deterence for this licensee could then be viewed as unrealistic. The motive to "send a message" may be characterized as "tough but not fair." The changes already made in reporting requirements through the issuance of 10 CFR 50.72 and the revision of 10 CFR 20.403 have improved the specificity of NRC reporting requirements. This report recommends further modification to the regulations. This action is needed regardless of whether or not Met Ed is cited in this case. It is not clear that what is in effect a "pro forma" citation against Met Ed will provide any meaningful remedial action for other licensees. Ample opportunity for any needed remedial action against Met Ed is already open before either unit is allowed to start up.

The applicability of 10 CFR 20.403 may be challenged on the basis of the historical development of the regulation. The precedent of prior citations against 10 CFR 20.403 is that in the past it has only been used to cite power reactor licensees for overexposure of people to radiation. The existence in reactor technical specifications of explicit reporting requirements that are related to operational events adds weight to a conclusion that it is inappropriate to use 10 CFR 20.403 for operating events.

The failure to specifically report the calculation of a projected dose rate in Goldsboro and the related implications of the technically inaccurate early discounting of the calculation may be questioned on the basis of information that was supplied. Met Ed did report to NRC that the dome monitor was reading 200 R/hr and that the containment pressure was 1 psig. Although this information alone does not enable a direct inference of potential offsite dose rates, it is a clear indication that significant releases could occur. It is true that, if the calculation had been accurate, minutes were important. Nevertheless, the Pennsylvania BRP was notified and it was the logical agency to have initiated action if the need to do so had been confirmed.

The citation against the Emergency Plan Implementing Procedure rests on a very general statement that can be characterized as more of a philosophy statement than a procedural step. This is exemplified by the fact that the statement admonishes all of the listed people to supply information. Taken literally, this would have each of these individuals personally calling the agencies to assure that they received the information. Furthermore, responsibility that is assigned to everyone may be responsibility that is assigned to no one. The lack of specific assignment of responsibility to one person with a systematic flow of information to that person was concluded elsewhere in this report to be the principal deterrent to full reporting. Citation against such a general statement as that referenced in the potential citation could have the effect of drawing attention to the wrong problem. In conclusion, it is recommended that citations not be made against Met Ed for failure to report.

## APPENDIX A

## NONCOMPLIANCE CITATION CONSIDERED BY THE INVESTIGATION TEAM

A. 10 CFR 20.403(a) requires that each licensee immediately notify by telephone and telegraph, mailgram, or facsimile, the Director of the appropriate NRC Regional Office of any incident involving byproduct, source, or special nuclear material possessed by him and which may have caused or threatens to cause the release of radioactive material in concentrations that, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in Appendix B, Table II.

Contrary to the above, on the afternoon of March 28, 1979, at about 1:50 p.m., two on-duty shift supervisors of the licensee recognized that a pressure spike (approximately 30 psig) had occurred inside the containment building of Three Mile Island Unit 2. Because the containment building contained radioactive material which, if released and averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such material in Appendix B, Table II, this incident threatened to cause a release of such material. The incident was not immediately reported to the NRC by telephone and telegraph, mailgram or facsimile.

B. Section 6.8 of Three Mile Island Unit 2 Technical Specifications states that written procedures shall be established, implemented and maintained covering Emergency Plan Implementation. Radiation Emergency Procedure 1670.3, which implements the Three Mile Island Unit 2 Emergency Plan, states that, in a General Emergency, it shall be the responsibility of licensee personnel "...to provide maximum assistance and information possible..." to the NRC (among others).

Contrary to the above, following the declaration of a General Emergency at Unit 2 at 7:25 a.m., on March 28, 1979:

(1) The licensee failed to provide maximum information possible to the NRC in that a projected dose rate of 10 R/hr in Goldsboro, Pa., calculated at approximately 7:44 a.m., was not reported to the NRC.

(2) The licensee failed to provide maximum information possible to the NRC in that the core exit thermocouple readings, taken at approximately 9:00 a.m., were not reported to the NRC.

(3) The licensee failed to provide maximum information possible to the NRC in that the conclusion by an on-duty shift supervisor at approximately 6:30 a.m. that the open EMOV was the cause of abnormal plant conditions was not reported to the NRC.

APPENDIX B
Report References

List of Attachments

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conversation with Gary. That would have been some time after 6:00 o'clock. I think in previous testimony the times are a little bit more accurate.

Q You arranged the conference call?

A No, Gary Miller did.

Q You testified that you had no basis to disbelieve what you were seeing in the control room?

A Right.

Q Did there come a time when you began to disbelieve?

A No. The whole time I questioned it and I don't think that there was any one time when I disbelieved it.

BY MR. FRAMPTON:

Q Mr. Kunder, I believe you said at some point shortly after you came in you asked the operator how long high pressure injection had been on and they said, "Not very long"?

A Right.

Q What did you understand that to mean? That the actuation had been recent and not at the beginning of the transient?

A No. I perceive that as meaning when the reactor cooling system pressure decreased to the actuation point the high pressure injection came on and that the reactor cooling system level -- they had pressurized level recovery and they secured it within a brief period of time.

It would not be consistent with a high level.

In other words, if you were to leave the high pressure injection, in effect, for the full flow, that it develops for a long enough time, I would expect to see the pressurized level increase and in fact, the reactor cooling system would go solid.

Q So they were telling you that the HPI had only been on for a short period of time at the beginning of the transient before it was throttled or turned off, is that right?

A That is my perception.

Q Was high pressure injection secured when you came in at about 5:15?

A I did not look. Again, it is more a matter of nonfamiliarity with the controls. In Unit 1 I am used to going in and I can look at everything and I know exactly what the status is and I can get that quicker than by asking people. Unit 2 was not merely as obvious to me.

Q Just to jump to two other points on the same issue, when you then had a conference call beginning at about 6:00 or 6:15 a.m., was there any discussion during the conference call, that you remember, about whether high pressure injection was on?

A I really don't remember anymore. I don't think I would have thought it was on based on that question I asked the operators.

Q Was there any decision at that time that you better turn it on, manually?

A No.

Q I think you testified before that at some point after you began to get radiation alarms you and Mike Ross made a decision that you should attempt to -- that you should start high pressure injection?

A I remember becoming real concerned over another issue but I think that occurred before we got the radiation alarms.

Q What was that other issue? Was that hot leg temperature?

A No. I was misled into believing that we may have a deboration event occurring. The indications of the boron concentration and the indication of the intermediate range, how to core detectors, were beginning to combine to suggest that we had a moderated delusion accident occurring.

We had just initiated boration into the makeup tank, the emergency boration system. Bill Zewe initiated that when I received the phone call from Dick Dubiel saying that the concentration of boron in the system is 400 pp, and so as a precaution he initiated that right away.

I was extremely concerned that that was not going to be enough. At that point in time I was worried that inaction was leading to a greater problem than if we were to take a safe action of initiating high pressure injection. At least we could be getting water from the boron water storage tank, which I was hoping it was borated the way it is supposed to be and get that into the reactor cooling system to turn this, in effect, around.

I think it was largely on that basis and whatever else I may have been responsive to at that point, that I yelled to get the high pressure injection back on.

BY MR. DIENELT:

Q Did you order a state police helicopter?

A Yes.

Q When did you do that?

A That was after we had made contact with virtually all the agencies required to be contacted per the emergency plan. It would have been roughly 8:00 o'clock or something like that, quarter of 8:00. It wasn't too long after the general emergency was declared.

Q Were you directed to order the helicopter?

A The direction to order the helicopter was made by someone, either Gary or probably Dick Dubiel in the control room.

A few minutes later we got a call back from the state police asking what services we wanted from them. I the pressurizer be full or to have overfilled the system and yet to have the pressure continue to be low?

A Yes. I can't remember how I perceived it precisely in my own mind at the time.

Q Did you perceive how that could happen? Is there any explanation of why the pressure --

A At that time I couldn't put it all together. It is perfectly obvious now but at that time, as I recall my perceptions at that time, somehow we had overfilled the system and we lost the steam bubble, the bubble that was giving us the pressure.

It just did not occur to me and I did not go through the thought process that would have allowed me to conclude at that point in time that we had voiding in the other portion of the system and that the core itself or the fluid in the region of the core actually took over pressure control of the reactor cooling system.

Q As you understood it from the period of 5:00 a.m. to let's say 7:00 a.m. or 7:30 when Mr. Miller arrived and the emergencies were declared, what was the strategy for trying to bring the plant to a more stable or more understandable status? What was it primarily that you understood that the operators and Mr. Logan and yourself were trying to do with the plant during that time?

A It is a variety of things. Relative to the reactor cooling system per se, the operators were letting down some water. I understand from subsequent testimony, I guess, that they did have some high pressure injection water going into the reactor cooling system. We were trying to let down in order to bring the pressurizer level back into range.

Q So you were basically trying to reduce inventory in the system in order to get the pressurizer bubble back?

A In effect that was what was happening.

There were a lot of other activities that were ongoing at the time. The fact that the containment pressure was up around 2 PSI was at one point thought to have been a steam leak from the 1 steam generator and that was believed to be so because of the disparity in the pressure which is classically something that would indicate a potential steam leak out of the lower pressure steam generator.

The steam generator, I believe, at one point was secured, isolated, on both the feed water and the steam side in order to bottle up that generator and ultimately stop the suspected steam leak into the building.

Later on when the reactor building pressure did not decrease as expected, the operators felt that that wasn't the problem and they reestablished normal feed water and steam removal from the steam generator.

Q Didn't emergency boration using the high pressure injection system go counter to the strategy of trying to get the bubble back? That was putting more water into the system, was it not?

A Yes. At the time I was not aware that they had a high pressure injection continuing in the reactor cooling system.

At that time, I am pretty certain I perceived that they were just letting down.

Q But you said you and Mike Ross wanted to get some high pressure injection --

A That was later.

Again, you have to realize that we were traveling along at like 90 miles an hour and things were whizzing by and you are making decisions. I don't think I could ever reconstruct the feedback that I was getting and using to make decisions upon at this point in time.

By the time that we made that decision to initiate high pressure injection a lot of things had transpired by the time I got in the control room. There were phone calls, a lot of developments, minor things that didn't make sense or that caused me to believe that something other than what was really occurring was transpiring.

By the time we made that decision to initiate high pressure injection it was apparent that we were dealing with something an awful lot bigger or more consequential than I had recognized when I first arrived at the plant. It had developed a lot further by that time.

Q You still believe that the cooling system was solid, the primary system was solid, when you were ready for emergency boration, I take it?

A I guess that would be true to say that.

Q But you made a choice that the most important thing was to prevent renew criticality at that point?

A That I think was the overriding idea that I had.

Q Let me ask you a question about the conference call with Gary Miller and Mr. Herbein and yourself.

During that call there was some conversation about whether the EMOV was closed or the block valve was closed. Do you recall the substance of that conversation about that subject?

A The thing that I recall and is pretty much what I said in the past, in past interviews, and that is, I think I was asked whether or not the electromatic release valve was opened. I think that was true because I seem to recall having gone out to the control room for a moment and asking someone out there if the valve was opened or if it was closed.

The response that I think I recall getting -- the response that I would have gotten is that it was closed.

I just remember going out and asking that question.

Whereupon,

GEORGE A. KUNDER

was called for interview and, having first been duly sworn, was examined and testified as follows:

EXAMINATION

BY MR. HARPSTER:

Q George, a review of your testimony before the Special Inquiry Group has indicated that shortly after your arrival in the control room on the morning of March 28, 1979, it was your perception that following the reactor and turbine trip high pressure injection had been secured, and let down had been increased in an attempt to restore the pressurizer level to normal.

Was the status of these systems discussed in the telephone conference call with Messrs. Miller, Rogers and Herbein at approximately 6:00 a.m.

A I don't recall specifically what parameters I discussed with them, other than I am pretty sure I discussed the fact that the pressurizer level indication was high, that stands out in my mind, and that the pressure was low. Beyond that, I cannot recollect for sure any more.

Q Did you at any time on March 28, 1979, discuss the status of these system as they existed prior to approximately 8:30 a.m., that is the high pressure injection secured, and the let down increased?

A Would you repeat that again?

Q Did you at any time on the day of the accident discuss the status of the high pressure injection system, and the let down system as they existed prior to 8:30 a.m., that morning with Messrs Miller, Rogers, Zewe, Herbein, Mehler, Chwastyk?

A It is possible, but I cannot remember.

Q To the best of your knowledge, was this information pass on to the NRC on March 28, 1979?

A Do you mean specifically that the high pressure injection was secure, and that the let down was increased?

Q Yes.

A I don't recall, nor do I recall in the communication I had with the NRC from reviewing the taped conversations with Region I, that that was in there either. That communication is certain one where the record could be reviewed to see if I said anything relative to those two parameters.

Q In your opinion, should this information have been passed to the NRC on that morning, that is, the high pressure injection was secured, and the let down flow increased?

A Do you mean, what was my opinion at that time?

Q What is your opinion today.

A Obviously, all that information should have been given to the NRC

BY MR. MOSELEY:

Q What would you have said then?

P R O C E E D I N G S

MR. GAMBLE: Could we go on the record.

This interview is being conducted as a portion of the NRC's investigation into the exchange of information between the Metropolitan Edison Company and the NRC on March 28th, 1979.

Mr. Roger, we have counsel for B&W present here. Do you have any objections to their being present during the interview of you?

MR. ROGERS: No.

Whereupon,

LELAND C. ROGERS

having been first duly sworn by Mr. Gamble, was examined and testified as follows:

EXAMINATION

BY MR. CRAIG:

Q Lee, on the morning of 3/28/79 were you aware that high pressure injection flow had been throttled and the let-down flow had been increased to a high value, higher than normal value?

A No, not directly. I didn't follow that.

Q Were you aware that operators were taking actions to try and restore pressurizer level?

A That is a little strange question really. Pressurizer level was one of the things that we had and we were trying to restore it.

Q It was pegged high, and were you aware of the actions that they were taking to try to get it back down to the indicating range?

A Oh, yes, yes.

Q What were they trying to do?

A Well, what was being done that I observed at least was that we were trying to get the heaters operable and with the normal plant systems type operations to get that level back down in the operating range.

Q Aside from the heaters, what plant systems?

A Well, I couldn't really tell you what they were doing because I wasn't observing them in that way. I was just observing the indiciation as I saw it from further back in the control room. I knew that they were having apparent trouble with the heaters and ~~it~~ I was following in that particular vein because it was easier to follow in conversations, but as far as other actions, no, I wasn't directly following those.

Q Besides the information concerning pressurizer level being pegged were any other actions, the heaters, discussed on the confernce call at approximately 6 a.m. that morning?

A I don't recall. At this time I don't recall much of that conversation at all.

Q Did you at any time that day discuss the status of high pressure injection and let-down as it existed prior to 8 a.m. with Messrs. Miller, Kunder, Zewe, ~~Urbine~~ or Chwastyk?

A Not that I recall, no.

Q Our review of your testimony to IE investigators indicates that during the 8 o'clock thinktank meeting in order to restart a reactor coolant pump that system pressure was raised by increasing HPI flow. However, in testimony before the Special Inquiry Group in response to a question about HPI discussions during the a.m. thinktank meeting you state that you didn't recall the discussion of HPI occurring.

In your statement of 6/12/79, the statement that you prepared you state that "The group impression was that HPI must be keeping the core cool." Would you clarify your knowledge of the status of the high pressure injection system before the 8 a.m. meeting?

A I have no recollection of ever inquiring on my own part of what the flow was or what they were doing to it. I just don't ever recall that I was in a conversation about that. I know we had the conversation as you stated there in your reading to get the pressure up. We increased the HPI, but that makes an assumption that you have some at that point to me. So I guess I wouldn't try to speculate on anything else because I don't remember any discussions of what the flow may have been.

Q After the primary system pressure was increased to approximately 2,000 pounds in the 10 o'clock to 11:30 time frame, would you clarify your knowledge about the high pressure injection system from that point on?

A Well, I think I have already stated at other times that

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PROCEEDINGS

MR. GAMBLE: We will go on the record.

This interview is being conducted as a portion of the Nuclear Regulatory Commission's investigation into the exchange of information between the Metropolitan-Edison Company and the NRC on March 28th, 1979.

Mr. Zewe, will you please state your full name for the record?

MR. ZEWE: William H. Zewe.

MR. GAMBLE: Counsel present, would you please identify yourselves for the record.

MR. McBRIDE: My name is Michael F. McBride of the law firm of LeBoeuf, Lamb, Leiby & MacRae, counsel for Mr. Zewe.

MS. BOAST: Molly S. Boast.

MR. GEPHART: Smith B. Gephart, Killian & Gephart.

MR. GAMBLE: Mr. Fidell will be joining us later?

MR. McBRIDE: That is correct.

MR. GAMBLE: Norman Leslie is also out of the room and will be joining us later.

Whereupon,

WILLIAM H. ZEWE

having been first duly sworn by Mr. Gamble, was examined and testified as follows:

MR. GAMBLE: Thank you.

EXAMINATION

BY MR. CRAIG:

Q Bill, our review of your testimony indicates that on the morning of 3/28/79 you instructed the shift foreman to reduce and maintain pressurizer level, and these actions were that high pressure injection would be reduced and let-down flow would be increased to recover pressurizer level. Did you at any time that day discuss the status of the high pressure injection and let-down systems with Mr. Miller?

A Yes.

Q Would you tell us what the substance of those conversations were?

A Well, throughout the day we had discussed the status of the high pressure injection system and the status of the let-down system throughout the whole day at various intervals.

Q Did you discuss the status of these two systems as they existed prior to 8:30 a.m. in that let-down had been increased and high pressure injection had been stopped for a while and then throttled?

A Yes, we did discuss that.

Q Would you tell us the context of those discussions?

A When Mr. Miller arrived I was briefing him on what had taken place to that point until he arrived. As I recall, I described the actions that we took up to that point which include increasing the let-down at various times and also verifying high pressure injection flow and then further reducing it.

Q Did you have a similar conversation with Lee Rogers concerning the status of the system as it existed prior to approximately 8:30 in the morning?

A I really can't remember because Mr. Rogers was there for a period of time and I am not certain when he arrived. He was involved in most of the conversations that I had with Mr. Miller after he arrived. So I don't recall exactly if I addressed them to him and Mr. Miller together along with Mr. Ross and so forth, whoever was with Mr. Miller at that particular time.

Q Did you have any kind of a discussion concerning the fact that HPI had been reduced and let-down increased prior to 8:30 a.m., the status and not the conversation with George Kunder?

A Yes, I did discuss that with George after he had arrived. We had talked about that.

Q What about with Jack [illegible] ~~Urbine~~?

A I do not recall any direct conversations with Mr. [illegible] ~~Urbin~~ concerning those two items on that particular day.

MR. FIDELL: Before we go on, may I ask for the record, please, to which of the three subjects listed on the subpoena these questions relate?

MR. CRAIG: They relate both to the radiation levels and to the pressure spike and to the core temperature.

concerned you?

A Nothing right that minute. Later on we started receiving radiation alarms and at that time we became very concerned.

Q When you said you asked Bill Zewe if he was injecting and he assured you that he was, did you ask him that because you would have to be using high pressure injection to get the maximum amount of borated water into the system or was that a question that related to core cooling?

A It was both. It was a question relating to both.

Q Was there any discussion between you and anyone else the first hour or so after you had come into the Unit 2 control room as to whether high pressure injection had in fact been on for a very long period after 4:00 a.m.?

A I did not ask that question. I didn't have time to go back and look at what happened between 4:00 and 6:00 or whatever time it was that I got there.

Q Was there subsequently any conversation about that whether you asked the question or not? What I am getting at is whether, at some point in the time period before 11:00 o'clock in the morning, it was generally discussed that a combination of the EMOV being opened and high pressure injection being off could have resulted in a substantial loss of inventory?

A I think we discussed the fact that high pressure injection had been off for some time or throttled back. I don't think we ever related it to fully uncovering the core that early.

We were concerned that the possibility existed. In our own minds we had a concern that we had to do something. We knew we had some problem. We had radiation monitor alarms. We knew we had fail fuel of some sort, and the seriousness of it was not known, of course.

Q In your own mind, did you entertain the possibility that the core had been partially uncovered for a period of time?

A No, I guess I really didn't. I was kind of concerned about it particularly as the day went on but I don't think I ever said, "Hey, that thing could have been uncovered," definitely.

Q What were the things that kept you from considering that as a realistic possibility? Was it anything other than the pressurizer level continuing to be high, if you can recall?

A Being honest, we just never had full time to sit back and analyze the whole situation very closely and very methodically. I think that is the only thing that prevented us from making that look-see effort.

Q I want to ask you a question about that but maybe his presence during the interview?

THE WITNESS: I do not.

MR. GAMBLE: Thank you.

EXAMINATION

BY MR. MOSELEY:

Q Mr. Ross, during your questions I will make reference to prior interviews and statements that you have made. I have those available for reference, and if at any time you would like to view the statement, just say so and I will be happy to show it to you; but I had not planned to show you each of them as we go along. But if at any time you want to see them, just say so and I will be happy to let you see them.

A Okay.

Q In testimony to the Special Inquiry Group in September, in response to a question relating to the time period prior to 11:00 a.m., you responded -- and this is a quote: "I think we discussed the fact that high pressure injection hsd been off for some time, or throttled back. I don't think we ever related it to fully uncovering the core that early."

Now in the first sentence of this quote, who do you specifically mean when you use the pronoun "we"?

A As I recall, "we" would be the people in the back of the room in the think tank. That would be our group. That would be Miller, Rogers, people like that participated in that that morning.

Q It would be specifically the think tank people?

A It would be the think tank people.

Q Now let me ask you some specific names, because they may or may not have been part of the think tank at that period in time.

Did it include Kunder?

A I can't definitely say he was there, but he was in there, in the room and part of that most of the time. I can't say he was there for that particular conversation.

Q Okay, but let's relate it back to the sentence that said, "I think we discussed the fact that high pressure injection had been off for some time, or throttled back."

Now let me ask you: Do you think Kunder participated in that discussion?

A My recollection is "yes," but that's just what it is, "my recollection."

Q Okay. Fine. Do you recall Zewe participating in this?

A Yes.

Q Chwastyk?

(Pause.)

A You gave me the timetable, and --

Q Let me interrupt you there. I was making reference there where -- HPCI was not the first thing that was of concern, then; rather the fact that we were having radiation alarms. And to me that was more -- would have been more important, I believe, rather than discussing whether they had secured or started the high pressure injection. That's what I am saying now.

Of course, trying to remember what actually went on, I have no recollection.

BY MR. CRAIG:

Q. On page 21 of the same interview, May 9, 1979, in response to a question about high pressure injection you state, and I quote, "I don't recall being informed. I don't think -- let me rephrase that. At the time I got there, they were not injecting. I recall vaguely that Zewe told me that we had had an injection and that they had secured it."

During the course of any of the think tank meetings, was the fact that high pressure injection had been secured in the morning discussed?

A. Would you define think tank?

Q. This group of supervisors that Gary Miller was calling into the shift supervisor's office periodically.

A. Okay. Are you asking did they discuss the fact that it had previously been secured?

Q. Yes.

A. I don't know. I remember Gary ordering high

mind. He was discussing the release, the ventilation systems, that type of technical type conversation because of his awareness of the plant. That occurred throughout the day and I can't begin to place times and subject matter any more.

Q Moving on to another subject, we were told yesterday in an interview by Mr. Zewe that he had briefed you when you arrived on March 28th in the morning that the HPI had been throttled and the let-down had been increased in an effort to control the level in the pressurizer. In a May 7th interview with the IE investigators you said that you perceived the operators were still tending to use the pressurizer level as their indicator of a full system and they were still tending to throttle HIP injection and trying to recover pressurizer level.

From this can we conclude that you were aware in the morning of the fact that the HIPSI had been throttled and the let-down had been increased in an effort to regain or to control the pressurizer level?

A I can recall discussions on HPI throttling but not specific flow rates. In our procedures HPI throttling was a recognized item that you had to do. I think in the May thing I was trying to conclude in my mind what they were thinking more than being sure of what they were thinking. That was my perception. The only thing that stands out strong in my mind is that somewhere in the early morning, and I got there at 7 or 7:05, somewhere in the first hour to hour and a half it was throttled beyond the point where I wanted it to be and I very strongly told Zewe and Ross personally that it wouldn't be secured without me personally. That is the one strong conversation that I can remember.

Q Yes.

A The let-down, I can't recall today as specifically I can the HPI securing, say, at 8:15 or 8:20 in the morning.

Q Okay. Was the status of HPI in the let-down system discussed in the telephone conference call that you Rogers, Kunder and Herbein participated in at about 5 o'clock?

A I can't recall any better today than what I have said previously to questions that were asked like was the block valve shut. Those kinds of things I have said before and I can't remember.

Q I don't believe this is mentioned in that. That is why we were interested in whether or not this was.

A I can't recall. The status of the plant was the discussion, and I can't recall all the questions that came up. The result of the conversation was that, you know, my day was changed from another activity to go to the plant, the reasoning being that the status of the plant wasn't

THE WITNESS: Is that question relative to the period of time of quarter to seven in the morning? That is an encompassing question when you ask it about the day.

MR. MOSELEY: Would you like tl respond to it in terms of quarter to seven? We will start with that.

THE WITNESS: I don't remember being told about throttling of the HPI in the period of time at quarter to seven in the morning.

MR. MOSELEY: I am asking in terms of water flow into the system whether it is the pumps in the HPCI mode or in the make-up mode?

THE WITNESS: I don't remember being told of a reduction in flow. Is that what you are asking me?

MR. MOSELEY: Yes.

THE WITNESS: I don't remember being told about that.

MR. MOSELEY: Mr. Miller, I am going to read to you from Sewe's testimony to us on Setpember 1908.

MR. MAUPIN: What page?

MR. MOSELEY: Page 4.

"Question. Bill, our review of your testimony indicates on the morning of 3-28-79 you instructed the shift foreman to reduce and maintain pressurizer level, and these actions were that high pressure injection would be reduced and let-down flow would be increased to recover pressurizer level. Did you at any time that day discuss the status of the high pressure injection and let-down systems with Mr. Miller?

"Answer. Yes.

"Question. Would you tell us what the substance of those conversations were?

"Answer, Well, throughout the day we had discussed the status of the high pressure injection system and status of the let-down system through the whole day at various intervals.

"Question. Did you discuss the status of these two systems as they existed prior to 8:30 a.m. if that let-down had been increased and high pressure injection had stopped for a while and then throttled?

"Answer. Yes, we did discuss that.

"Question. Will you tell us the context of those discussions?

"Answer. When Mr. Miller arrived I was briefing him on what had taken place to that point until he arrived. As I recall I described the actions we took up to that point which included increasing the let-down at various times and also verifying high pressure injection flow and then further reducing it."

Mr. Miller, do you have any recollection of these conversations which Mr. Zewe is describing?

THE WITNESS: I don't today have a recollection of those conversations.

MR. MOSELEY: Given Zewe's clear recollection which I have just read to you, isn't it likely you knew on March 29 that water flow on the coolant system had been throttled more than the ordinary amount?

THE WITNESS: In earlier testimony and earlier dis-cusssion where I had been involved we discussed in detail the status of the HPI system four in the morning on, analyzed it, looked at it. We thought HPI was on a lot more gallons per min-ute than you guys calculate it was on. It is as simple as that. You look at the flow rate in your 0600 report at seven in the morning and it comes like 60 gallongs a minute.

MR. MOSELEY: That is the net.

THE WITNESS: That is the net but that says there wasn't much HPI. Bill does not remember it that way. I have been involved in conversations. On the May 25th tape you will find that. I don't remember that discussion and Bill's recollection being vivid in September of 1980 is hard because we have gone through an awful lot of discussion on HPI for this whole process within the last year, year and a half.

MR. MOSELEY: I don't believe Mr. Zewe's recollection is all that new. I believe his recollection has been very similar to that from the very beginning. That is my recollection of his testimony throughout.

THE WITNESS: I am aware that when you initiate HPI and pressurizer level goes up, the procedure says to throttle it. I have been aware of that ever since we have been in Unit I, to get on the discharge valve and get ready to throttle them to prevent damage to the pumps and that sort of thing. I don't have a recollection of Bill's exact conversation that is referen here. That would have been very soon after the transient started.

MR. MOSELEY: What I am talking about is something in excess of what would be normal. In the quote that I have just read Mr. Zewe is clearly talking about throttling in excess of what would be normally expected by your procedures and by your previous experience.

THE WITNESS: You know, if you go back to what my testimony has been earlier, you will see that at five in the mornin when I was on the phone with Kunder and he told me the pressuriz was low, I didn't understand it. I am not sure that Bill Zewe and I talked about this item at seven a.m. in the morning.

MR. MOSELEY: What I am trying to get at is the same thing you were referring to earlier. Given Mr. Zewe's clear recollection and your recollection or lack of recollection that that you were aware of that, shouldn't we conclude that Mr. Zewe indeed was right, that there is something you were aware of that morning?

THE WITNESS: I am having trouble with what you are trying to get me to conclude and concluding that HPI had been cu back for three hours?

MR. MOSELEY: My question is related to the total input to the system.

THE WITNESS: And I had no recollection to that. I had no recollection or conclusion of what he had done with HPI from four to seven in the morning at that time.

MR. MOSELEY: Given your lack of recollection, is there a reason that we should not conclude that given Mr. Zewe's clear recollection, that you probably were aware of it?

THE WITNESS: I don't conclude the same thing you do from that. I don't think that was discussed with me.

MR. MOSELEY: Moving on to another subject, in your interview with the I.E. investigaors in May 1979 relative to the core ---

MR. STELLO: Wait a minute. I want to get back to somethi that is not resting easy with me.

Gary, I am trying to understand whether or not you are saying you were not briefed throughout the day on the status of the total amount of flow going into the reactor. Is that what I am to understand?

THE WITNESS: At periods throughout the day I would have had that status. I was asking the question how much do we need in the early part of the morning. I depended on Ross to have HPI on and my interpretation would have been that it would have been both pumps. I didn't give him a flow rate. I have been asked that before.

MR. STELLO: The fact that you were searching for what ought the flow rate be, you have said a number of time a concern over running out of water and having to go piggyback to supply water, I have just got to believe that throughout the day this was a popular discussion. Are you telling me that I shouldn't? I mean you personally since you were the decisionmaker?

THE WITNESS: No, I am not telling you that. I am interpreting the things that Zewe is talking about to being historical before seven in the morning. There was a lot of talk about HPI after seven in the morning. The questions asked today relate to me being told what was done at seven in the morning with HPI. I am saying I have no recollection of that fact being given to me that HPI had been this way for this many hours. I don't think Bill Zewe remembers exactly because he was not in the control room most of that time.

MR. STELLO: The issue of how much water was going in the primary system is one that I would think had considerable discussion throughout the day.

THE WITNESS: Yes.

MR. STELLO: With you?

THE WITNESS: Yes.

MR. STELLO: Whom did you discuss it with?

THE WITNESS: Discussed it with the think tank.

MR. STELLO: Ross?

THE WITNESS: Yes.

MR. STELLO: Kunder?

THE WITNESS: Yes.

MR. STELLO: Rogers?

THE WITNESS: Yes.

MR. STELLO: Did you ever talk to Zewe about it?

THE WITNESS: He was not in most of the ---

MR. STELLO: Outside of the think tank, Zewe?

THE WITNESS: I don't believe so. I recall one instance clearly and that is when he came in the office around 8:15 and he said they were going to secure it. I said no. That is the one instance I can recall. I can recall one instance when we were going on core flood. I said we would not terminate it while we were oncore flood, because people in the room had discussed terminating it.

MR. STELLO: The first was with Zewe?

THE WITNESS: The first was with Zewe. He walked out of the room before I said anything. He told Ross it wouldn't be secure without me personally knowing it, my direction being that I had to know that.

MR. STELLO: So, you now have a recollection of a discussion of throttling HPCI and how much water was going in the primary system throughout the day?

THE WITNESS: Throughout the day.

MR. STELLO: You have specific recollection in the think tank it came up?

THE WITNESS: Yes.

MR. STELLO: With Zewe there is no doubt in your mind,

radiation level in the sample lines rose very sharply. Dick came back on the phone and called for myself on line 1 and indicated this, that we had big problems. Just knowing the fact we were upset, I knew it had to be coming from the core, and it was within either seconds, or just a few minutes at the most, that we received the alarms --

Mr. Blush. Radiation alarms?

Mr. Kunder. The radiation alarms on the back panel. It progressed too rapidly to really discern values on the meters. We got alert alarms. They went into the full alarm status very quickly and a large majority of the alarms were coming in almost simultaneously. I know I turned to Joe Logan and told him, we've got big problems.

Mr. Blush. Did you say we have failed fuel?

Mr. Kunder. I said it in terms I don't want to repeat here, we're failing fuel.

Mr. Arena. What did you attribute that fuel failure to?

Mr. Kunder. I don't know that I conceptualized the precise nature of the failed fuel in any other way than we are leaking radiation out of the core. We are apparently damaging some cladding to some extent, pleats or thermally, something is happening that is releasing some of the activity.

Mr. Arena. When, can you recall, did you first start worrying about the core being uncovered?

Mr. Kunder. I guess it was within maybe the next 15 minutes half an hour, when I, along with everybody else, recognized that we had significant steam void inside the reactor coolant system and we had observed the fact the reactor coolant pumps, the pump that was attempted to be started again did not produce any flow and the amps on the motor went up to very low value and the pump ran for quite a few moments without producing any flow, and it's apparent that it was just spinning in a steam environment which we were concerned at that point that we might be uncovering the core.

We had no indications to show what the water level is, of course. We had the high-pressure injection, I understood to be going in based on the direction that we had given previously. There was no indication to suspect that it was not being pumped into the reactor coolant system.

I was concerned, however, that with the vapor lock, I just wasn't sure in my own mind that all the flow was going in through the core. Maybe somehow there was some phenomenon existing that was causing some of that water to flash the steam, perhaps, or to bypass the core in some fashion. So, I think we were concerned for some indefinite time which may have been an hour or two that the core was, indeed, covered. I guess intuitively after somewhere around 9 or 10 o'clock, just roughly, we felt that the core was covered, but we had no concrete proof of that.

Mr. Arena. What, if you can remember, changed that perception? Here you are saying that you were aware of the of the high pressure injection and the let down systems?

A No, not to my knowledge.

Q A review of your testimony, and this is Office of Inspection report of July 1979, has indicated that on the morning of March 28, 1979, it was your perception that the reactor coolant pumps were pumping steam. Was this discussed in the telephone conference call with Messrs. Miller, Rogers, and Herbein at approximately 6:00 a.m.

A To the best of my recollection, that would not have been discussed with Miller and Herbein, and Rogers, i- the telephone conversation because I believe that I reached that perception later on, after that phone call was terminated.

Q What would you have discussed or what do you recall discussing with regard to the reactor coolant pumps that morning and their inability to pump water?

A Do you mean during the phone conversation?

Q Yes.

A I don't really recall.

Q What discussions were subsequently held on March 28, 1979, regarding the inability of the reactor coolant pumps to pump water with anyone that you were involved with?

A Do you mean days and weeks after the accident?

Q No, just on March 28 in trying to analyze why the reactor coolant pumps could not pump water?

A I would estimate that within about an hour or two after the phone conversation, it was evident to myself as well as generally to the management team, I will call it, that the coolant pumps were unsuccessful in establishing any kind of coolant flow. We reached the conclusion that we were steam-bound. I think that that is the terminology that I used. The behavior of the coolant pumps when we attempted to start them was consistent with that perception.

I cannot remember any specific conversation with anyone, but I do remember that general perception that I had.

Q Let me ask you if you can expand on that just a little for us. When you say that the reactor coolant pumps were steam-bound, are you saying that you envisioned them as the hot loops being void down to the pump section itself?

Can you explain what you mean by steam-bound?

A Yes. I had the perception that we had steam in the system. I don't think -- I don't remember quantifying, or being able to quantify how much steam and just where, but that the pumps were sitting there rotating in a steam void.

So by implication, I guess you could say that that was my perception.

Q In testimony before the special inquiry group on September 18, 1979, you participated in the following exchange with regard to the status of the electromagnetic relief valve. Let me quote to you.

The question was, "I have been focusing those questions

A Well, a generalization is probably the best way I can put it, and that would be just to what actions can we now suggest to be taken towards getting this plant in a stable condition.

Q The sequence of events surrounding the accident up until that time, were they discussed at all?

A No.

MR. HARPSTER: Before we go on let me ask Lee another question.

Before you had the first thinktank session I believe the operators had attempted to restart the coolant pumps. What did you attribute to the fact that the reactor coolant pumps just sat there and ran at a low current, at essentially a low current? Not necessarily you personally, but what was the discussion about with regard to that? You were running I think if I recall at a hundred amps or something on a reactor coolant pump.

THE WITNESS: Yes.

MR. HARPSTER: What was that attributed to?

THE WITNESS: I don't know that the operators or Zewe or anyone else gave me their feelings about that sort of thing and I wouldn't guess that they would. In soliciting some information from Zewe about the fact had you attempted to run the pump, and he gives me the facts, yes, we did. I tried to run all four of them and only got one of them to start. Then he says they had little or ~~not~~ no current on it and they weren't getting any flow indication.

I have trouble trying to even put together things here that really took place that day. It would seem reasonable that that was another piece of information that I needed or was trying to digest. I didn't reach a conclusion then. When we had our first meeting together as a group, one of the things I wanted to do was try to start it again so I could see what was going on. I know that was the kind of thought I had, that I would like to see that myself. The result of that conference was that we attempted to run the pump. Then I saw that and concluded myself at that point that there was no sense in running the reactor coolant pumps now and the loops had filled with steam ~~oversteamed~~. That was quite obvious to me. With all the things I had been told before and now I had seen it myself, that was my conclusion. I don't believe I attempted to reach a conclusion until after I had seen that next attempt at 8:15 or something.

MR. HARPSTER: Once you get to the point where the loops are steam bound were you able to draw any inferences then as to what the extent of voiding was?

THE WITNESS: Yes. I think one of my testimonies makes a statement to the effect that I told Miller you have got steam as far down in the loop as the reactor coolant pump itself which would given an indication in my mind at least of how much voiding there was I am sure. The whole hot leg was steam bound down through the steam generators and down to the suction of the pump.

MR. HARPSTER: Down over the pump lift?

THE WITNESS: Yes, which would to me just give an amount of voiding conclusion I guess at that point.

MR. HARPSTER: Did anyone go to the isometrics to try and equate this with where you might be at in the core?

THE WITNESS: No.

BY MR. CRAIG:

Q Our review of your testimony indicates that you were aware that hot-leg temperatures were above 700 degrees and that instrumentation bridges had been hooked up so that resistance readings could be used to determine the approximate hot-leg temperatures on 3/28.

Was a record kept of the data indicated by this extended scale read-out for the hot-leg temperatures?

A A recorded record, a log-keeping book?

Q Any kind of a record.

A None that I know of, no. I would like to rephrase your statement of my earlier testimony. I was aware of a read-out of over 700 degrees. I wasn't aware that that was a correct temperature. I never agreed that that was a correct temperature at that time.

Q You didn't agree with the hot-leg temperature?

A I didn't agree that we knew that that was what the temperature was.

MR. MOSELEY: With any of the instrumentation even after

Hunter: At that time were there any radiation alarms that you recall seeing or were there any brought to your attention?

Logan: Not at that time as I recall. I know I didn't at that time I didn't anticipate that we had a leak I mean that we had a problem other than perhaps a primary to secondary leak in the steam generator but as I recall Bill Zewe didn't indicate that he had picked up an alarm it was a pressure differential in the steam generators that I believe gave him the indication that we had a leak in the steam generator.

Hunter: Okay, Joe. The pressurizer level being full and the pressure being down can you give us a little information what that meant to you at that time?

Logan: Well, it was somewhat it's not a normal situation when we have a plant that is hot. To have that high a level and not have a high pressure also because you would anticipate with a bubble up there that the pressure would be high. At the time something you know didn't ring a bell. There was something that was wrong there at the time and I didn't, I couldn't identify what it was. The fact that the pumps were off certainly was you know abnormal. The shift supervisor was busy trying to get the plant squared away that's why I went to ask George Kunder you know what had happened, what was his assessment of this problem because he had been there for sometime and perhaps he could fill me in on some of the information. As I recall the information he gave me concerning the pumps was that they had fluctuation in the discharge flow or flow indication on the discharge of the pump and I believe he also said that the amperage had dropped on the pumps indicating that they were not pumping water.

Hunter: You at this time had personally were talking with George Kunder in the shift supervisor's office?

Logan: Yes.

Hunter: And you had discussed the pumps. Did you discuss the pressurizer pressure and level problem?

Logan: I don't, I can't recall that I did. I think the thing that really hit me was the fact that the pumps were off and we were still hot you know and that to me you want to maintain flow and that's the thing that stuck in my mind. There's a tremendous problem I am real serious ....

Hunter: You are saying Joe that the pumps were off. Ah, two pumps or all four pumps?

Logan: I don't recall right now how many were off.

Hunter: Okay.

Logan: We were doing something, I'm trying to remember just what.

Hunter: Was there any discussion continuing and trying to put in core flood tanks or was at that time your understanding that you were stable on the core flood tanks and that that's, that was as far as you, as far as you, as far as you end up, was there any discussion of going down to the decay heat at that time?

Martin: Something like opening an eltromatic relief at that point.

Logan: It was further down here I believe, down here wasn't it.

Hunter: This is the, that spike is concurrent with the, yeah 8 hours, 9 hours, 10 hours, this is the spike almost, well it turned out right at 13, 50 whatever, this spike occurred but the power operated relief valve in fact, in the pressurize heaters which has very little probably, it could of been that but the power fail operated valve appears to it open at that moment.

Logan: Your right it was, something that could of caused the you know a spark in there and I think it was the pump, now refreshing my memory I believe we did operate that, I'm trying to, I don't recall right now why.

Hunter: Ok, you don't have any reason, you don't remember why it was being operated at that time?

THE WITNESS: I do not know that information.

BY MR. CRAIG:

Q To your knowledge, was the information withheld from the NRC?

A To my knowledge, no information was withheld.

Q Our review of your testimony indicates that two reactor coolant pumps were secured based on net positive suction head limits and about 20 minutes later the remaining two coolant pumps were secured due to deteriorated flow. With whom did you discuss the inability of the reactor coolant pumps to pump water other than George Kunder?

A The other members of my shift that were present there, the shift foreman and control room operators Ken Bryan ~~Brian~~, the other shift supervisor who I had called from Unit I to Unit II.

Q Later on after Gary Miller and Lee Rogers arrived, did you have a conversation with them about the inability of the coolant pumps to provide forced flow through the core?

A I informed them of the actions that I had taken and why I had taken them.

Q What was their reaction to that?

A As I remember, their reaction was that we should proceed and try to start one of the reactor coolant pumps as soon as we could.

Q During the conference call early in the morning, was it your understanding that there was a direction during that phone

Q In your interview with the IE investigators back in May, you stated in part, and again I quote: "Some people stated the pump didn't run, and we were pretty well convinced that it pumped steam, I think." And "the pump" here refers to the primary coolant pump.

Again, to whom specifically does the "we" apply?

A Again I think the "we" applies to the people that were in the think tank and the people in the control room.

Q Both the think tank and the control room?

A Oh, yes.

Q Does this statement mean that you believe that each member of the think tank was convinced that the pump was pumping steam?

A I think at least I could say that they had indication that it wasn't pumping water. Whether or not it was pumping steam, everybody could draw their own conclusions.

Q Someone has testified -- and I don't recall who right off the top of my head -- that isometric drawings were checked in relation to this. Were you involved -- were you personally involved -- in the checks of isometric drawings?

A I recall something about that, okay; but I don't think I was personally involved. It's been a long time. I've never been asked that particular question before.

MR. HARPSTER: Gary Miller told us that after you ran the pump and saw the steam ~~down~~ around the valute that it would either be yourself or Seelinger that he would rely on to check those drawings to try and relate that to the level of water.

THE WITNESS: I did not do that specifically myself. I do remember some discussion within the tank about levels, possible levels, what the problem was. I don't think we ever related it yet to a core level, or I think our actions would have been slightly different at the time; slightly different.

BY MR. HARPSTER:

Q Let me ask you -- excuse me -- why would you get out the isometrics if you weren't trying to relate it to the inlet nozzle levels and the core level?

A Why we did a lot of things that day, quite honestly, is something that's hard for us to defend right now. It's easy for me to sit in this room and say I'd do things differently now --

Q No, I think it's a very reasonable thing to do, don't misunderstand me. I would have gotten out the drawings in a hurry, too.

A I don't specifically remember relating it to the core level; but I do remember a discussion about isometric drawings.

(Pause.)

are many methods of determining primary system inventory.

Q I am asking you what did you do on that day? What was done, to your knowledge.

A But you stated there were many methods. I am saying that I don't agree with that.

Q The question that I asked you was what efforts did you exert on that day to determine this?

A From the time we got there and started the reactor coolant pumps and saw them pump a hundred amps we were convinced we didn't have a water level fully in that whole plant. The efforts we had were to assure that the inventory which we couldn't see didn't degrade. I can't remember efforts in the research over how low it had gotten or how deficiency the inventory had been. Today I can't recall discussions along those lines.

Q I understand that there were isometric drawings taken out on the basis of the pump performance.

A To look at elevations of the plant, where the hot-legs are, where the top of the nozzles are and where the HPI comes in.

Q Wouldn't the core exit thermocouples be an indication of core level? Wouldn't the water level be indicated by the nuclear instrumentation and other factors?

A Core exit thermocouples weren't even wired out except by a quirk of design. I called for a set of those

A Yes.

Q Okay. The only thing you could thing you could think of is turn on the pumps and put more water in, right, as an engineer?

A As an engineer with some knowledge of the plant that was the only method I knew available.

Q As an engineering then wouldn't the next question be how do I find out if that was effective? Did that thought enter you mind?

A The thought that entered my mind is how do we determine how much heat removal we need versus much we are putting in, yes.

Q What did you consider to be indicators of whether you were being successful or not?

A I think we have gone through that. We looked at temperatures in the RCS, we looked at the steam generator pressure and we put an indicator or an a test instrument on the RPS on the hot legs if I remember right. We put that on there because the on-scale meter was off.

Q Slow down.

A Okay.

Q You wanted to look at that temperature. What were you expected it to do?

A At the initial stages of looking at it, Vic, there was no high temperature on scale available, so the initial idea was to get some reading in addition to the other information.

Q You had a reading then. What were you expecting that reading to do as you added more and more water?

A As we added more and more water throughout the day we were expecting that reading to come down.

Q So it if stayed superheat it was clear then, was it not, that it wasn't covered with water? Those RTDs took the drawings out and you looked at them, should you not have concluded they weren't covered with water?

A Hot-leg RTDs I think are located up above the coolant.

Q Yes, the are in that straight run area.

A I think that even early in the morning when the pumps started and we looked at the level we knew there was water missing out of the hot legs, yes.

Q But my point being that as you kept adding water you knew you never got those thermocouples covered?

A I think we knew that those were in a steam condition of some type because I think there was some discussion at some point during the day about how accurate were they in a steam environment versus their qualification which was in a water environment, that type of thing. I mean, I think there was that kind of recognition.

A That means you had that part of the system empty of water. So you should add more water. What is another thing that ought to come in your mind? Is there any other indicator? You had this Navy training with the in-core thermocouples. Were you thinking they might tell you if you covered the core back up?

A Either me or Lee asked for those initially because that was a part of the initial getting of some indication.

Q Indication of what, Gary?

A Of temperature. You know, when you go in and you look at the panel on TH which is off scale high we began to look for an instrument on the high end. That is my memory of their initial, you know, why we started looking for, you know, some indicator. And once we had at least an indicator, I don't believe the in-cores were really a point of our discussion any more.

Q You never thought of the in-cores as an indicator of water level, that they weren't covered with water?

A I don't believe I did, no. I asked for them, and then by the time I got information on them they seemed useless to me because the conversation indicated they weren't reliable. At the same time we got the RTD hooked up to a bridge and that was giving some information.

Q On the hot leg?

A That is right. But you are asking about heat removal, and I am saying that that was one. There was steam on the period between 5:00 and 6:00 in establishing a time frame, and your answer is, yes. The question, when subsequent to that time, if at all, did you become involved in any discussions of the release valve." I believe what was meant there was a relief valve."

Your answer was: "That would be after the general emergency was declared, and it was recognized that voiding had occurred. At that time, I presumed someone had determined that the relief valve had, in fact, opened, and that is how we lost the inventory of water. It pretty much became common knowledge what had happened."

How did you find out that the relief valve had been stuck open?

A I don't really remember if anyone specifically told me. Obviously, someone obviously told me. I cannot remember when.

Could I read that?

Q Sure. If you don't mind my notebook, I have put everything in a notebook. They are indexed, and if you will go to IE, but maybe I can find it much faster for you.

A All right.

(Document was handed to the witness.)

A That testimony, I did not have any specific time frame. It was sometime after the general emergency, and I can't tell whether it was minutes, hours, or just when that I gained the perception or the knowledge that the relief valve had been stuck open. I cannot remember any specific conversations, or how I became aware that specifically we had a problem with the valve.

Q Can you recall exactly what it is that became common knowledge, is it the fact that it became common knowledge in the control room that the relief valve had been stuck open for some period of time?

A When I say that it became common knowledge, I think I was referring to the fact that when bits and pieces of the accident scenario became known, as part of the general development of information and disseminating that to the staff, it just became known by the rest of the staff, and that was just my perception at the time. But I cannot tell you for sure if that was in the morning, in the afternoon, or later.

Q Do you recall that you at any time that day discussed the fact that the electromagnetic relief valve had been stuck open with Messrs. Miller, Rogers, Herbein, Zewe, Mehler, or Chwastyk?

A I don't recall any specific conversations, but it is certainly possible that later in the morning, or later that day, whenever I became aware of the fact that the relief valve was stuck open, or was believed to have been stuck open, we certainly could have had conversations.

I do know that I was not really aware of that in the morning, and it was a piece of information that I would have learned from someone else.

patterns for radiological releases. In that sense I was responsible to make sure all those things happened if any area was not being taken care of.

Once those functions were carried out by individuals I was available to assist in other matters. Most of the time, just due to the involvement in the control room, I wasn't in a very good position to relay information or perceiving certain needs, I would go ahead and take care of requesting those needs.

For instance, trying to get in touch with someone at the observation center and letting them know that we have a problem and directing those kinds of activities. Talking to security and trying to find out where the Muster Sheets are so we can account for everyone and then I would report to Joe Logan or Gary Miller, whoever the emergency director was, I would directly report to that individual.

Q Prior to the time that Mr. Logan arrived on the morning of the 28th, had you been involved with or were you aware of any consideration of whether the EMOV was opened?

A No, except from the standpoint of when I first arrived, Ken Brian, who was the Unit 1 shift supervisor at the time, had indicated to me that the relief valve temperatures had looked like they were coming down. As a result, qualitatively, I dismissed that we had a problem in that area. I don't think, at that time, I was thinking in terms of a stuck open valve. It was just another piece of information that made sense to me and I don't think I ever questioned it in my mind. The fact that we had a problem with the release valve stuck open or a misoperation of the release valve. It sounded to me like somehow they had the release lift and the amount of steam that was discharging into the drain tank was more than it was able to handle for that particular discharge.

The fact that the release monitoring temperatures were high made sense. The fact that they were coming down made sense and I didn't question it any further.

Q Were you aware of any additional readings of the temperatures that were made?

A I don't believe I was -- not after my conversation with Ken Brian.

Q Were you involved in any discussions of any possible leaks?

A I don't believe I was.

Q I have been focusing those questions on the period between 5:00 and 6:00.

A Yes.

Q When, subsequent to that time, if at all, did you become involved in any discussions of the release valve?

A That would have been after the general emergency was declared and it was recognized that voiding had occurred.

At that time I presumed someone else had determined that the release valve had in fact stuck open and that is how we lost the inventory of water. It pretty much became common knowledge of what had happened.

Q Would it be fair to say that the next time you gave any thought to the stuck open release valve it was after you had learned from some other source that it was assumed to have been stuck open?

A That is correct.

BY MR. FRAMPTON:

Q Mr. Kunder, can you recall what kind of a situation you perceived that you were facing the first hour or two in the control room, if there were inflicting indications of what was happening in the plant, what were they and what was, in your mind, or what did you discuss with others about what might be happening?

A The thing that was foremost in my mind at that time was that somehow we had overfilled the reactor cooling system. In doing so we lost the pressurizer steam bubble, which allowed the pressure to be low.

I guess most of the activities that I tried to -- most of the indications that I tried to look at and assess was relative to that concern. It was an anomaly that I had never seen before and it did not make sense.

Q When you say it was an anomaly, you mean to have the pressurizer be full or to have overfilled the system and yet to have the pressure continue to be low?

A Yes. I can't remember how I perceived it precisely in my own mind at the time.

Q Did you perceive how that could happen? Is there any explanation of why the pressure --

A At that time I couldn't put it all together. It is perfectly obvious now but at that time, as I recall my perceptions at that time, somehow we had overfilled the system and we lost the steam bubble, the bubble that was giving us the pressure.

It just did not occur to me and I did not go through the thought process that would have allowed me to conclude at that point in time that we had voiding in the other portion of the system and that the core itself or the fluid in the region of the core actually took over pressure control of the reactor cooling system.

Q As you understood it from the period of 5:00 a.m. to let's say 7:00 a.m. or 7:30 when Mr. Miller arrived and the emergencies were declared, what was the strategy for trying to bring the plant to a more stable or more understandable status? What was it primarily that you understood that the operators and Mr. Logan and yourself were trying to do with the plant during that time?

A It is a variety of things. Relative to the reactor cooling system per se, the operators were letting down some water. I understand from subsequent testimony, I guess, that they did have some high pressure injection water going into the reactor cooling system. We were trying to let down in order to bring the pressurizer level back into range.

Q So you were basically trying to reduce inventory in the system in order to get the pressurizer bubble back?

A In effect that was what was happening.

There were a lot of other activities that were ongoing at the time. The fact that the containment pressure was up around 2 PSI was at one point thought to have been a steam leak from the 1 steam generator and that was believed to be so because of the disparity in the pressure which is classically something that would indicate a potential steam leak out of the lower pressure steam generator.

The steam generator, I believe, at one point was secured, isolated, on both the feed water and the steam side in order to bottle up that generator and ultimately stop the suspected steam leak into the building.

Later on when the reactor building pressure did not decrease as expected, the operators felt that that wasn't the problem and they reestablished normal feed water and steam removal from the steam generator.

Q Didn't emergency boration using the high pressure injection system go counter to the strategy of trying to get the bubble back? That was putting more water into the system, was it not?

A Yes. At the time I was not aware that they had a high pressure injection continuing in the reactor cooling system.

At that time, I am pretty certain I perceived that they were just letting down.

Q But you said you and Mike Ross wanted to get some high pressure injection --

A That was later.

Again, you have to realize that we were traveling along at like 90 miles an hour and things were whizzing by and you are making decisions. I don't think I could ever reconstruct the feedback that I was getting and using to make decisions upon at this point in time.

By the time that we made that decision to initiate high pressure injection a lot of things had transpired by the time I got in the control room. There were phone calls, a lot of developments, minor things that didn't make sense or that caused me to believe that something other than what was really occurring was transpiring.

By the time we made that decision to initiate high pressure injection it was apparent that we were dealing with something an awful lot bigger or more consequential than I had recognized when I first arrived at the plant. It had developed a lot further by that time.

Q You still believe that the cooling system was solid, the primary system was solid, when you were ready for emergency boration, I take it?

A I guess that would be true to say that.

Q But you made a choice that the most important thing was to prevent renew criticality at that point?

A That I think was the overriding idea that I had.

Q Let me ask you a question about the conference call with Gary Miller and Mr. Herbein and yourself.

During that call there was some conversation about whether the EMOV was closed or the block valve was closed. Do you recall the substance of that conversation about that subject?

A The thing that I recall and is pretty much what I said in the past, in past interviews, and that is, I think I was asked whether or not the electromatic release valve was opened. I think that was true because I seem to recall having gone out to the control room for a moment and asking someone out there if the valve was opened or if it was closed.

The response that I think I recall getting -- the respor e that I would have gotten is that it was closed.

I just remember going out and asking that question.

That is what I seem to recall.

Q Subsequently, it turns out that the block valve was apparently closed during that conversation --

A I am not sure of that.

Q -- whether as a result of your asking about whether the release valve was opened or perhaps as a result of somebody else coming in and suggesting that. Do you recall that happening?

A No.

Q Do you recall learning shortly after the conversation that the block valve had been closed and some indication that this was having an impact on the system that the pressure was going back up?

A I believe that I wasn't there.

Again, after we had declared the general emergency and I had been told that we were trying to figure out what happened to the water and I think it became apparent to the group after that time that that is what had transpired.

Whoever closed the block valve relayed that information and it eventually filtered back to myself. I am certain that I didn't know that until after we declared a general emergency and we had pieced together, very quickly, what we believe had occurred.

Q And that might have been an hour later or more?

A It might have been.

MR. FRAMPTON: I believe this would be a good time for a short recess.

(Short recess.)

BY MR. FRAMPTON:

Q Mr. Kunder, do you recall when you learned that the ruptured disk on the reactor cooling draining tank had burst?

A That I had assumed occurred when I first got into the plant and the pressure in the reactor building was up.

Q You learned that right away?

A Yes. It was based on a presumption. It made sense that that had occurred. There is no indication that the upper disk blew other than by looking at other parameters in making that indication.

It was based upon previous experience in Unit 1 that that information made sense. I have seen Unit 1's ruptured disk blow during -- it was a transient, I think, involving some instrumentation problems during the start of programming Unit 1, during the hot functional test program of Unit 1.

Q Had you ever seen a ruptured disk blow in either unit simply as a result of the pressurizer release valves opening and then shutting again?

A The one in Unit 1 was the one I was familiar with.

That was due to an electronic problem.

Q Do you know whether Unit 1 has a much smaller reactor cooling draining tank?

A My understanding is that it is smaller in terms of cooling capacity. The tank size itself, I don't believe is all that much different.

Q But the pressure would build up faster because the cooling capacity of the tanks cooling system was much smaller, is that correct?

A No. The statement I am trying to make is that the tank and its quenching capability are probably the same order of magnitude, they are about the same size.

However, the Unit 2 system has the ability of cooling down that water after the relief has occurred and the quenching function has occurred. It has the capability of cooling it down much faster than the Unit 1 situation.

Q How would that affect the speed with which the ruptured disk might blow?

A The only way that would have an effect is if you had significant leakage into the drain tanks prior to that event which allowed the contents to remain at an elevated temperature in Unit 1 vs. Unit 2. Unit 2 could keep that temperature down where the full quenching capability is maintained.

Q Was there any discussion about whether the ruptured disk might suggest that there was continuing leakage through the relief valve? Do you remember that being considered or discussed in the time period before 7:00 a.m.?

A No. I think the fact that it was recognized by Ken Brian that the relief temperatures were coming down allowed me, in my own mind, to say that made sense and pretty much dismissed, you know, what had occurred there as relating to our current problem in the pressurizer.

Q I think you testified before that after the emergencies were declared and notifications made and Mr. Miller had taken over command of the unit that basic strategy was put into effect to try to repressurize the reactor cooling system. What was the purpose of that strategy? Was that because you perceived that you had Voids and you were trying to collapse them?

A I think that would have been the basic strategy, although I can't remember any more what our discussions centered around at that time.

For instance, I can't remember any more whether we deliberately closed the block valve in order to pressurize or whether it had been closed by the operator who first recognized that it may be the cause of our basic problem and then left closed. Do you see what I mean?

Q Yes.

just don't recall them shutting the PORV block valve.

BY MR. MOSELEY:

Q. This is the time when Zewe made some comment to the effect, gee, this was the cause of the thing, the valve was open. And some other comment which I don't recall offhand.

And here we have the principal problems that were concerning people are going away. The low pressure, high pressurizer indications, which were analogous, were going away. And what we are trying to get at is were you involved in discussions of this ~~having~~ been the problem?

A. No, not at that particular time.

As I say, there were several other things going on, as you will recall. We had a steam generator that was isolated with a leak, evidence of a leak in there. We had the coolant pumps off also, which was an abnormal situation, certainly. And, as I say, I tend to think that I was, at this particular instant, probably in with Kunder trying to find out -- because he had arrived before -- from him the sequence of events that had caused the trip, and also I suppose trying to help him in answering questions that Miller and Herbein --

Q. Were you in the room during the telephone conversation?

A. In and out, yes.

Q. It just seems strange that this is, you know, the thing that apparently has turned around the problem, and we are trying to get at what discussions you had concerning this. Do you recall any?

A. No, I don't recall -- in fact, I'm almost positive that I didn't really find out that that PORV had been the culprit until quite sometime later, and I don't even remember if it was the same day, with everything else that was going on.

You have to put yourself in the atmosphere that existed in that control room at this particular time, with all the other problems that were attendant with the accident, to appreciate that.

Q. Because this was before the radiation alarms were coming on?

A. Yeah, but the radiation alarms, as I recall, came on about 6:30.

MR. CRAIG: Closer to 6:50.

THE WITNESS: Okay. Sometime in that time frame. It's surprising how fast time goes when you are in those situations.

BY MR. CRAIG:

Q. This is also about the time Zewe realized that the steam generator was probably not leaking, and they were watching the reactor building pressure, and he showed a decrease at this point in time.

A. Not leaking into containment.

Q. Right.

A. But there was still -- we knew that there was a primary -- secondary leak in the steam generator.

Q. You state in your IE testimony of May 9, page 31, you were aware the reactor building sump pumps had been secured and that you wouldn't have expected the reactor coolant drain tank disk to rupture.

And you state, "Well, it" -- referring to the fact that the disk had ruptured -- "was unusual, to me, for it to occur. I would not have anticipated that it would rupture. It's designed, of course, to protect the tank, but under normal circumstances I wouldn't expect it to rupture."

And Hunter asks you a question, "How did -- what did you get the impression -- what kind of impression did you get from Bill when he's telling you about it and that it did rupture?"

Your response was, "He was very vague. I'll have to summarize that it was when we were probably discussing the electromagnetic relief valve operation. If it sticks open, you know, and you can't get the steam into it, it's not designed for that, I don't believe."

BY MR. MOSELEY:

Q. Does that quote refresh your memory of any discussion you had with Zewe on this?

A. When I first arrived, Zewe give me a quick run-down on the status at that particular time, and as I recall in that conversation, he had mentioned the water in the containment and the fact that he had secured the pumps, sump pumps.

Now, the discussion of the rupture of the tank, the rupture disk going on the tank, I don't really remember whether that occurred at that particular time or whether during the day or even days after that that that discussion took place.

BY MR. CRAIG:

Q. Can you remember any more specifics concerning this discussion between Mr. Zewe and yourself about the EMOV having been stuck open?

A. No. As I say, I don't recall any conversation with him, at least on that day, about the EMOV being, you know, stuck open.

When I got there, there was no mention of the EMOV being stuck open, because we didn't realize it, of course, at that time. And when that information became apparent to me, as I say, I just honestly can't remember.

BY MR. MOSELEY:

Q. It just seems to us this would have been discussed with people coming in, Rodgers, Miller, as sort of bringing them up to what we know about where we are.

A. I agree. That's why I say I didn't know about it, at least when Miller got there. I had no -- I still, when he arrived, could not have explained the situation, why it existed, because I wasn't aware of it. And, as I say, I do not remember now when I became aware that the EMOV had been found to be stuck.

BY MR. CRAIG:

Q. Was the possibility that the EMOV had been stuck open discussed in the think tank meeting on the day of the accident?

A. I do not recall any conversation concerning the EMOV, but I would assume that it was discussed. Certainly if Zewe was aware of it, I'm sure it would have come out on some of those think tank meetings.

Q. Well --

A. Let me clarify one thing. When you say think tank meetings, this isn't what you might assume to be a group of people that are remote from the problem that get together in a little corner and talk about things. This is Miller sitting in there and calling individuals in at times, or a couple of people in, or as many as he can get in there, and people going out and doing things.

You have to appreciate the atmosphere that existed of trying to control that accident, rather than trying to rehash what caused it. What caused it was not material to the problem at this particular time. That's what I'm trying to get across.

BY MR. MOSELEY:

Q. You don't really believe that, do you?

A. Yes, I do.

Q. You've got to know how you got into a situation in order to know how to get out.

A. Let me give a similar situation. You're aboard a ship and you have a fire. Your object is to put the fire out, not to find out what caused it.

Q. But I don't think this situation is quite analogous to that. You had a situation that no one understood with the low pressure and high pressurizer level, and this was when the valve was finally closed, things begin to come back, and it seems to me if you are in a position where you don't know what caused it, that it is quite relevant and important to say, well, how did we get here?

A. I don't disagree with that. I'm saying you have to get the priority of what's important. At the time that all of this was taking place, the main thing was to stop any releases of radiation, right?

Q. Well, certainly.

A. Just like putting out the fire is what you want to do first; then you look at what caused it.

Q. Well, go ahead.

and what were the plans and what we were going to decide to recommend what the further actions were. I don't believe there were any explanations or statements of surprise or any other reaction, if you will, to the fact that the pumps were off. It were merely stated as a plant condition.

Q Was there a discussion about what it meant?

A No, not that I recall.

Q On March 28th of 1979 when did you become aware of the continuous relief path through the EMOV and block valve which we have learned existed for approximately two hours?

A You mean prior relief path, prior to the time that I was in there and prior to the knowledge of what time it was shut. I did not know until the next day or the day after, I think it was the next day, when we delogged the data from the reactimeter what time it was shut. My only knowledge of it being opened at the time that I was there was when we were using it as a pressure control device, a mechanical pressure control device by operating the block valve. I didn't know until some time later. I am sure, as I recall now, it was the next day when the data was reduced that it had been open for that period of time.

MR. MOSELEY: If the EMOV was operating properly, why was the block valve used do you suppose?

THE WITNESS: I think we are digressing here a little bit because in the conference call when I asked was the block valve shut and got the answer that the block value was shut, then

WITNESS ZEWE: Up until the site emergency and everything else, I didn't thing of a problem reaching people at all with any information I requested of them or I gave them. I didn't have any problem in that respect.

MR. FRAMPTON: What about after the EMOV block valve was closed off? Did you then realize very shortly that that had been the main leak?

WITNESS ZEWE: Yes.

WITNESS SHEIMANN: Yes.

MR. FRAMPTON: Then you realized that in essense you had a small break LOCA; right?

WITNESS ZEWE: True.

MR. FRAMPTON: Thereafter, didn't you continue to face a situation in terms of the plant parameters that it was very difficult to understand why the plant was behaving that way?

WITNESS ZEWE: No. As soon as we closed the electromatic valve the pressure in the reactor building startec to go down. The pressure in the coolant stem started to come up. So we knew then that we once again had a tight stem, which we didn't have before but didn't preceive we didn't have a tight stem. So from then on we knew that that was the leak and we were already on our maximum capability of high pressure injection and just coutinued on that path to pressurize up.

Mr. Zewe. Yes.

Mr. Recktenwald. And why wasn't that done prior to the March 28th accident?

Mr. Zewe. Well, the temperatures that we monitored every day on the discharge pipes of all three of the relief valves were inconclusive where, which one was the leaky valve, and it was accepted generally, I think, that we really did not have any reason to believe that it was more one valve than another valve. That the one code valve had been consistenly, at least a few degrees higher than the other valves.

So, I don't know why we didn't isolate it, and just count it from that point. I really can't say that the logic wasn't there to do that, just to eliminate it.

Mr. Recktenwald. Could you have done this on a shift yourself?

Mr. Zewe. Yes, very easily.

Mr. Recktenwald. Was there any concern that if you did that, the isolation valve might stick?

Mr. Zewe. Yes, there was, but that wouldn't have prohibited us from doing it if we thought that it was a problem, but the concern always is in a high-temperature fluid system, in a high-temperature atmosphere that the valve could remain shut and we would lose the inability of having that relief valve.

We have had other valves on the pressurizer that were motor operated isolation valves similar to that one that have had failure modes in that direction.

Mr. Recktenwald. During the first two hours of the March 28 accident, do you recall explicitly considering the possibility that the PORV could fail?

Mr. Zewe. No, I did not.

Ms. Giannelli. I've got sort of a follow-up question. ID a previous interview with our staff, you stated that you realized the existence of superheated steam on Wednesday, the 28th. What time did you first realize that?

Mr. Zewe. Sometime later that morning and I'm not sure of the time frame, 8, 9 o'clock, I'm not sure, certainly not within the first one or two hours.

Ms. Giannelli. So, 8, 9 o'clock is your recollection?

Mr. Zewe. It's probably as close as I could remember now. I really couldn't say. It may have been later than that, I really couldn't recall, but that would probably be the earliest.

Mr. Recktenwald. Going back again to the first two hours, do you recall what you thought was going on; what kind of accident you thought you had prior to the time that the block valve was closed on the PORV?

Mr. Zewe. Well, all kinds of items went through my mind. we had, of course, the low pressure coolant system and the high pressurizer level, and I could not conclusively come up with one single failure that would cause all the indications that we had. We had thought that we had a secondary steam generator leak that was contributing to the pressure increase in the building, and also --

Mr. Recktenwald. A steam line rupture?

Mr. Zewe. Some secondary side leak from the steam generator. Either being feedwater or steam. We suspect it's steam, and that contributed to the higher temperature and the increasing pressure. And I felt that we did have a hole of some type in the RC drain tank because of the low pressure, low level in the elevated temperature.

I felt that the loss of feedwater transient, as rapidly as it was initiated, in that the pressure spike was high enough to possibly lift the code safety valves. And I though that while maybe that the valves blew and it ruptured something in the tank, not thinking that it was the rupture disc or the relief valve, but it could have been something else in the tank.

So, that would account for the high temperature and the low pressure, but I felt that the relief valves had lifted and that they had receded, I did not realize that it was an ongoing --

Mr. Recktenwald. Can I ask. What prior to the accident would you have said, how would the reactor coolant drain tank look after a normal reactor trip and turbine trip?

Mr. Zewe. It would have an elevated temperature, elevated pressure, and an elevated level.

Mr. Recktenwald. And when you went back to look at it this time -- and how would you have expected it to look? Had the PORV stuck open?

Mr. Zewe. As it did.

Mr. Recktenwald. Did you think during the accident that you might have had a LOCA, were you considering the possibility?

Mr. Zewe. I never really considered that we had a LOCA. The automatic actuation of the engineering safety feature system I felt at the time was because of feedwater initiation. And I really didn't realize that we actually had a hole in the reactor coolant system until we shut the block valve for the electromatic relief valve.

Mr. Recktenwald. Do you recall what radiation alarms you got in during the first two hours of the accident?

Mr. Zewe. During the first two hours, the only alarms that I recall are the intermediate monitors that monitor each of the letdown coolers. Those were the only two that I can recall that were in alarm.

Mr. Recktenwald. And if you had gotten an alarm on the HPR 227, alarm, what would that have told you about the accident?

Mr. Zewe. That would have told me that we had activity in the atmosphere of the building.

Mr. Recktenwald. In terms of diagnosing the accident?

Mr. Zewe. Yes, because one of the things that you look for if you do have a LOCA is that you have activity indicated on the atmospheric monitor in the building, so that certainly would have been a key. And I know that Ed Frederick and I for some period of time longer than the period that you would have expected?

A Would you restate the beginning, please there? Are you saying that containment pressure was going down?

Q You were aware that containment pressure decreased after the block valve was shut.

MR. FIDELL: That is a question?

MR. CRAIG: No, a statement.

BY MR. CRAIG:

Q And that the EMOV valve being opened as caused the plant status, high pressurizer level and low primary system pressure. Did you conclude that the EMOV had been opened for a period of time?

A At that point, yes.

Q With whom did you discuss this conclusion?

A At that time there were several people present in the control room and it was more of a collective type conclusion once we had shut the block valve ~~from~~ for the electromatic and the pressure changed dramatically. We just concluded that it had been opened, but I really didn't have a feel for exactly how long.

Q Would you identify those people for us?

A My control room operators were still present, the shift foreman was still present, Brian Mehler was present, George Kunder was present, I believe Mike Ross was present at that point and Ken ~~Brian~~ and I am not sure of all of the others involved. I believe that Mr. Logan was also present at that point in time.

Q Concerning the shutting of the block valve, decreasing containment pressure and increasing primary system pressure, did you discuss that with Gary Miller on 3/28/79?

A I am certain that we talked about it, but I am not sure exactly what time frame it actually took place. Like I have stated before, I tried to cover everything that we had done and what had happened whenever he came and took charge and that should have been among them.

Q What about Lee Rogers, did you discuss that with him?

A Here again I can only reiterate that I believe that I did, but I can't recall the exact conversation.

Q How about Brian Mehler or Jack Herbein ~~Urbine~~?

A Brian was present when we shut the block valve so he was aware of the change in the pressure whenever we shut the block valve and the repressurization of the reactor coolant itself. Mr. Herbein ~~Urbine~~, I would say no, I did not have direct communication with him on that subject.

Q Do you remember any of the conversation that you had with Brian Mehler about the response to shutting the block valve?

A I don't recall exactly, but something to the effect that that was it, that that was the reason for the low pressure.

Q Did you discuss this with George Kunder?

A In the same light, yes.

HUNTER: Okay.

ROSS: At that time we I kind of decided that we kind of left Unit 1 hanging with a problem going so we ought to have someone go back up. So we sent Brian back up in that he had the shift up there prior to this starting and he was most current on information.

HUNTER: Did the readings... does readings on the power operated relief valve and the safety valve discharges in the range of 200 to 230 even as high as maybe 250? Was that unusual if you have a leaking valve?

ROSS: No, I don't think they're unusual if you have a leaking valve. I think readings on the order of 2200 would indicate a leaking valve.

HUNTER: But not a valve that was discharging for instance.?

ROSS: That is correct.

HUNTER: The valve was apparently looked at that temperature and even though they were above 200 in some cases. By looking at the computer data, they finally ended up with, well Brian Mehler ended up, picking the temperatures off at a specific time. I don't have any reason why it changed right now, but it was like 260 above the relief valve so he... somebody said, close the power failure relief valve, block valve and it was closed and it turned out that was in fact the problem. In the previous tape and I want to clarify something. At the time the power operated relief valve, block valve was closed, okay, which occurs at 2.2 hours in that range, do you recall the pressure transient or the events that occurred or the things that you do recall seeing when the valve was closed?

ROSS: Yeah I basically just got there when that particular thing happened. I was still trying to digest what was going on around me. A pretty frightening sight walking into something like this. I am sure you can understand. Right after it was closed, Zewe turned around and said, "Geeze, that was it, the reactor building pressure is going down." So he figured he had found where it was going at that time.

HUNTER: Okay, do you recall looking at the reactor coolant pressure at that time yourself or was...?

ROSS: Yeah, it was when I first got there it was like oh, well, I don't know 1,300 or 1,400 pounds maybe in that area. It was not high. It was not extremely low. It was lower than we would like to see it, of course.

HUNTER: Okay. And in your previous statement we had gone through you did not note the steam generator primaries you were actually concentrating to the left side of the control board and you had discussions concerning getting a reactor coolant pump started. Can you characterize those discussions, the reason for getting the pump back on?

the oncoming people at that time in the morning. I think right after I got there, about the time I got there the PORV was shut, and that is information I kind of picked up from there.

Q Let's see if we can identify people related to this particular thing. Is the time now about 6:00, 6:30 a.m.? What time are we talking about?

A Yes, to the best of my recollection it is somewhere around 6:30 in the morning.

Q And this would include yourself, Kunder, Zewe, who else?

A Oh, there were a lot of people there by that time, a lot of staff engineers. Logan was there. Maylor. In fact, I think he's the guy who shut it, or had it shut. Ken Bryant. There were a lot of people there, an awful lot of people there at that time in the morning.

Q Rogers?

A That, I don't remember. I don't remember him distinctly at 6:30 in the morning, but I do remember him around right after 7:00 or so, in that area. I don't remember him distinctly at 6:30.

Q Do you recall discussing this -- that is, the fact that it was recognized that the valve had been open for some period of time and that this had contributed to the problem that you were then in -- was this discussed with Miller when he arrived?

A I didn't take part in what he got turned over from Zewe when he arrived. I don't know what Zewe told him about it. In the think tank, it was brushed across that the PORV was a part of the problem and it's now shut; but at that time they were looking at so many other problems that had kind of mushroomed secondarily and they had a lot of confusing information by then.

Q But didn't that information indeed contribute to a belief that this was the cause of the problem? This is why you were where you were? The pressurized level was high, your pressure in the system is low?

A Well, I don't think anybody ever jumped up and said: We got here because the PORV is open. I don't think anybody ever pounded on the table and said that. I'm sure it was discussed.

Q Didn't this statement that I just read in effect say: This is why we are where we are? Would you like to refer to it?

A Would you reread it?

(Handing document to the witness.)

Q It starts about line 12 on page 9, and I am referring to the Special Inquiry Deposition on September 18.

(Pause.)

A I think that particular statement refers to the information we heard as we came into the control room I think is what that particular statement refers to.

Q Is the interpretation that I just gave you the one that is correct? Is my interpretation correct, that this says that this is how we got here?

A I don't think that says that. I think it's a statement of the fact of what happened at the time. The conclusion we draw from that is sometimes hard to defend later on.

Q I'll refer you to another quote from testimony of yours to IE in May, and this quote says: "Right after it was closed, Zewe came around and said, geez, that was it. The reactor building pressure was going down, so we figured he'd found out what was going on at the time."

Isn't that saying that there was a realization by Zewe, and he's making this statement to others, that: Hey, this is why we got here.

A I think you'd have to ask Bill that, but that's what that would mean to me, yes.

Q And was this discussed with Miller when he arrived, or at sometime later? I believe I asked you whether it was discussed.

A Again, I didn't take part in what he was briefed on when he came in. In the think tank, I'm sure it was known knowledge that the PORV was open and had been shut.

Q And that it was open for some period of time, not just for a couple of minutes?

A. Yes, it was open for some period of time; but I don't know what the conclusion we at the time drew from that. I think that information was known. The conclusion was not.

end #5
JWB

a significant item from the other end of the phone at that time.

MR. MOSELEY: What about later?

THE WITNESS: Eight thirty in the morning I am saying; I have said that I don't recall. He is asking me, I believe, could that have occurred in there, and you don't recall it, and that could have occurred in there. I am saying at 7:15 I wouldn't have had any discussions. I would not allow any because of what I was supposed to do. At 8:30 that could have occurred, in that session and I don't recall it.

None of the other people recall it either, because the April 14th tape that I made with that same group -- Ross, Seelinger, Kunder, Zewe, Logan -- did not, that I remember, have that in it. If it did, it would have been in my testimony which was derived from that. I am trying to go back to where we were and not get contaminated with the knowledge that we all have since.

MR. STELLO: It would be easier if we moved a little further down and pick this up sometime later, because there are a couple of other related issues.

MR. MAUPIN: Let us take a break for a minute.

(Brief recess.)

MR. HARPSTER: Judge Higgins said in the October, 1980, interview -- our inspector referred to notes he made while on site, TMI, on March 28th -- said that at 10:30 a.m. he was briefed by Bubba Marshall on Unit II status as of 9:30 a.m., when Marshall left the Unit II control room. Higgins said that Marshall and he understood that EMOV had been stuck open longer than it should have been.

Higgins also said to us that while he was in Unit II there was concern about cycling the block valve and there was a general recognition that the EMOV had failed open.

Ross has testified to us on September 24 -- and I will repeat what Ross said:

"Question: Then it was open for some period of time, not just a couple of minutes?

"Answer: It was open for some period of time, but I don't know what conclusion we at the time drew from that. I think that information was known. The conclusion was not. When you agreed with me, with my assessment, that this is what was said, is that in agreement today and in agreement that that is what was being said on March 28th?

"Answer: It is an agreement. That is my testimony to the best of my recollection. I don't have a distinct knowledge of that right now, that particular scene at this time. I do remember that PROV scene.

"Question: Let me make sure I understand what you said. Have you said that the fact that the PROV was open for a period of time much in excess of what you would expect it to have been open, and that this was discussed by members of the think tank and members of the supervision on watch, or in the control room in the early morning of March 28th, is that what you have said?

"Answer: I am saying to my recollecton we did have knowledge that it was open for a period, a long period of time. I can't testify that is the conclusion we drew from that at this time."

Zewe testified to us on September 4th, 1980:

"Question: And that the EMOV valve being open has caused the plant status, high pressurizer level and low primary system pressure. Did you conclude that the EMOV had been open for a period of time?

"Answer: At that point, yes.

"Question: With whom did you discuss this conclusion?

"Answer: At that time there were several people present in the control room, and it was more of a collective-type conclusion. Once we had shut the block valve to the electromatic and the pressure changed dramatically, we just concluded it had been opened; but I really didn't have a feel for exactly how long.

"Question: Would you identify those people for us?

"Answer: My control room operators were still present, the shift foreman was still present, Brian Mehler, was present; George Kunder was present; I believe Mike Ross was present at that point; and Ken Brian; and I am not sure of all of the others involved. I believe that Mr. Logan was also present at that point in time.

"Question: Concerning the shutting of the block valve, decreasing containment pressure and increasing primary system pressure, did you discuss that with Gary Miller on March 28, 1979?

"Answer: I am certain that we talked about it, but I am not sure exactly what time-frame it actually took place. Like I have stated before, I tried to cover everything that we had done and what had happened whenever he came and took charge, and that should have been among them."

After all that, let me ask you the question: Were you aware that the EMOV had been stuck open for a period of time longer than it should have been?

THE WITNESS: Was I aware in the time period of what, Terry, at 8:30 in the morning, 8:00 in the morining? Is he talking 7:00 o'clock in the morning? Can you tell?

MR. HARPSTER: He is talking of the initial briefing when you came in. He testified that he briefed you for about ten minutes after you arrived in the control room.

THE WITNESS: I can't recall, but I don't believe the significance of that valve being open was discussed at that time.

MR. HARPSTER: Given the testimony --

MR. MOSELEY: Let us not restrict it to the time when he arrived.

THE WITNESS: I am saying at 8:15 in the morning, if everybody had attached the significance to it, I don't understand why I had to provide the direction to keep HPI on. I am trying to go back and pin myself on things I know happened on the 28th. I know that happened and nobody disputes that. HIP was directed to be secured and I said no one, without me, personally. If that had that significance, why would that have occurred?

MR. STELLO: You recall it was said each of them had a reservation on conclusions drawn therefrom. We are trying to deal with only the issue of the stuck-open valve, not the conclusions drawn therefrom. Don't bring the two together, if that is what is causing your reservation.

Let us see if we can strictly deal with the issue of the EMOV stuck open for a period of time longer than it should have been.

MR. MOSELEY: I guess he is waiting for the question.

Were you aware that EMOV had been stuck oven for a period of time longer than it should have been on March 28th?

THE WITNESS: I cannot recall that piece of information exactly today.

MR. MOSELEY: Is the problem the use of the word "stuck"? Because you seem to be willing to agree that you were aware that it had ben opened for a period longer than it should have earlier. Is the word "stuck" sticking in your mind and is that a problem, and why we are not somehow able to nail this down?

THE WITNESS: You are asking me specifically if I was aware the valve was open longer than normal on the 28th, period, the whole day, anytime during the day; is that right?

MR. MOSELEY: Yes.

THE WITNESS: Not restricting it at all?

MR. MOSELEY: Yes.

THE WITNESS: I cannot today remember exactly. I can't remember today any discussion of that.

MR. STELLO: You are confusing me. You and I had a discussion just a few moments ago, when I was trying to use your exact words, and I thought that you agreed that the valve was opened longer than it should have been?

THE WITNESS: That is true.

MR. STELLO: If I don't use the word "stuck" you agree with the statement?

THE WITNESS: I agree with the statement.

MR. STELLO: So it is the word "stuck" that is stopping you from answering this question?

THE WITNESS: The word "stuck" is -- eliminating the word "stuck" does make the question different to me, I guess.

MR. STELLO: Can you tell me why?

THE WITNESS: Because the valve opened longer than normal would rupture that disk and close, that is, has opened before as opposed to sticking open for a very long period of time.

MR. STELLO: What would be the reason that the valve would be open for a longer period of time, in your mind, longer than normal?

THE WITNESS: It would have to be electro or mechanical, in my mind; either the valve didn't get the signal to shut or it didn't shut; but it could have been open for a period of time longer than normal and then shut. During that period of time it would have been open either due to being stuck or due to an electrical problem.

MR. STELLO: That is the distinction? "Stuck" to you means mechanical, not electrical? If it did not close because of an electrical problem, youw would not describe that as stuck?

THE WITNESS: I would not describe that as stuck, right. When you say "stuck", to me it means the valve electrically has been told to move and it stuck, as opposed to an electrical problem or loss of power, which would have occurred and that valve would have failed open, as opposed to being stuck open.

I realize that the fail open part had been corrected earlier in this plant. That is the difference between your distinction and mine.

MR. STELLO: I guess maybe what we ought to do is talk about is being open for a longer period of time. If we don't use the word "stuck", it might be easier to communicate. Why don't you try that for a while?

MR. MOSELEY: You testified that on March 28th you were aware that EMOV was open for a period of time longer than it should have been; is that correct?

THE WITNESS: Today's testimony?

MR. MOSELEY: Yes.

THE WITNESS: Yes, I have said that.

MR. HARPSTER: In fairness to him, it is characterized as having been opened for a short period of time, as opposed to longer.

MR. STELLO: He agreed it was open for a longer period of time than normal

If you can try to relate some of the things that have been said to decide on what that means --

MR. HARPSTER: Gary, when you say "longer than it should have been," are you talking of seconds, minutes, hours? Would you characterize for us what you mean?

THE WITNESS: As opposed to hours--not hours; seconds or minutes, but not hours.

MR. HARPSTER: A relatively short period of time?

THE WITNESS: Yes.

MR. HARPSTER: Opposed to a longer period?

THE WITNESS: Yes.

MR. STELLO: What was your basis for making the statement that it was irrelevant, a shorter period of time? What information do you recall on the 28th that made you answer that way?

THE WITNESS: I am saying that during the six o'clock phone call, Vic, when I knew the tank disk was ruptured, I would have know the valve would have been opened longer than I would have expected on plant trip, period; and that longer than expected is a short period of time.

I am saying I would have had knowledge of that in the back of my mind from experience.

MR. STELLO: What did you glean from the plant condition that made you conclude it was relatively short, a few minutes, rather than hours?

THE WITNESS: Probably because the answer came back the block valve was shut. When we asked the next logical qeustion -- you can't see that valve's position; we all know that -- so you don't have an actual position availability for that valve. You don't have a position indicator. So the question that Lee Rogers asked on that call was, "Is the valve behind it shut?" Which you do have a position indicator for. The answer was, "We will check." The answer came back "It is shut," and that stopped me from thinking about the EMOV for a while.

MR. STELLO: The fact that they told you the block valve was shut is when you concluded in your mind that it doesn't matter about the PROV, that path is isolated?

THE WITNESS: That is right.

MR. STELLO: So you identified in your mind block valve shut, path isolated, right?

THE WITNESS: And identified we didn't understand what we had based on it.

MR. STELLO: That is how you decided that the path was isolated?

THE WITNESS: That is right, didn't think about the EMOV; that is the though process.

MR. STELLO: You asked that at 6:15. Would it have been reasonable to conclude it was open until the block valve was closed?

THE WITNESS: It would have been reasonable to conclude that now?

MR. STELLO: No, then.

THE WITNESS: I don't think so. We didn't know that they had just shut it.

MR. STELLO: Excuse me. I didn't ask you when they shut it, because you did not know the position on the PROV. You did know the position on the block valve, that when the block valve was shut at that time that is when the path was isolated?

THE WITNESS: Right. I think that we in the phone call made the assumption from the answer we got that the valve had been shut previously, and here we are; we didn't know that at that instant the valve had been shut. There had not been any time lapse. If you look at the times that are documented, right at that period it must have been right after, they must have looked right after we acted.

The answer came back, "It is shut." We didn't go back and say anything about that. We said, "Oh, that is not the cause of the problem." We said, "What the hell is it?" That is when we went in and tried to figure it out. George had gone through the discussion on the phone about the ruptured disk and all that. He knew that. That question that came out was the one that should have been asked: We didn't pursue the answer and say, you know, "how long has it been shut?" The answer that came back gave no indication of its not being shut, and you would have expected possibly that it was shut earlier in the transient.

MR. STELLO: At what time did you have your first briefing?

THE WITNESS: 7:05.

MR. STELLO: What did they discuss then at that first briefing?

THE WITNESS: I didn't have a briefing. Bill Zewe talked to me over the cabinets about what he had. He was at that time, he ended up as the emergency director, because he had sighted the emergency at ten to 7:00. I don't remember the plant conversation.

MR. STELLO: He remembers telling you about the valve being stuck open for a long time.

THE WITNESS: I am not agreeing or disagreeing.

MR. MOSELEY: That is not correct. He does not recall what he said to Gary.

Going back to our discussion earlier, you don't recall being told of this dramatic rise in prssure, what caused that; the problem you had been concerned with when you left home no longer existed in terms of pressure, that wasn't discussed?

THE WITNESS: I don't recall that being discussed. I was also trying to get across to you that if everybody realized what you are saying, then I don't understand why at 8:15 I had to be the one to say, "Turn the water on." I am not trying to dispute anybody's testimony, but I am trying to say if that was transmitted to me in the context you are saying, then why did that occur? It should not have; and that did occur and it is on that chart.

MR. MOSELEY: Were you aware that the block valve was being opened and closed to both control pressure and to let water out of the system during the morning?

THE WITNESS: During the morning, yes.

MR. MOSELEY: Unless the EMOV was opened, the block valve would not have let the water out, would it?

THE WITNESS: No; I did not know which valve Mike was using. He would have had to use both to get water out of that path.

MR. MOSELEY: Unless the EMOV was stuck open?

THE WITNESS: But he would not have know that; he would have given the valve a command signal. If the valve was stuck open, he would never have know that the valve was not cycling. The valve does not have anything but a command signal.

MR. STELLO: Zewe didn't say he told you that. I am going to read the question and answer:

"Question: Concerning the shutting of the block valve, decreasing containment pressure and increasing primary system pressure, did you discuss that with Gary Miller on 3-28-79?

"Answer: I am certin that we talked about it, but I am not sure exactly what time-frame it actually took place."

What I was trying to get at is, when did he talk to you about it? He is certin that he did. There are many times an answer starts out in discussing Three Mile Island where nobodys says anything about being certain. The reason it stuck so plainly in my memory is because it is one of the few times he said he is certain he talked to you about it; but he does not remember exactly when.

MR. MAUPIN: Aren't you first asking if he recalls Zewe talking to him?

MR. STELLO: That was not my question.

MR. MAUPIN: The most recent one was when?

MR. STELLO: I am aying Zewe said he is certain about talking to him about it, but he is not --

MR. MAUPIN: You are asking him when?

MR. STELLO: Starting at 7:00 o'clock, when he got there, did he mention it then?

THE WITNESS: I don't recall.

MR. STELLO: Can you recall any time on the 28th Zewe speaking about the block valve, decreasing containment pressure and increasing primary system pressure, any time at all on the 28th?

THE WITNESS: Vic, I can't recall. I have said in respose to Terry that in that first think tank meeting that could havbe been disucssed and I don't recall it.

MR. MOSELEY: Does the computer pick up command signals to the EMOV?

MR. MAUPIN: Before you go on, I know that the testimony does speak for itself. I take it you are tying to get something from which you can draw some inference among other things about the extent to which Zewe might have talked about the length of time when the valve was open.

We have been addressing two questions: whether he knew it was open at all, and if he did, whether he had any reason to form some conclusion as to how long it had been open. Zewe said that he had no feel for exactly how long it had been open based on the same information Zewe seems to think he told Miller.

MR. MOSELEY: Do you recall the outstanding question?

MR. STELLO: What is the thrust of what you have just said?

MR. MAUPIN: The impression I have, for better or for worse, is that for the last two hours you have been exploring fundamentally two questions: (a) to what extent Mr. Miller believed that sometime on the morning of March 28th that the EMOV had been cepn for longer than normal.

MR. STELLO: We have clarified that.

MR. MAUPIN: The second is, what basis he had for forming a judgment, if any, as to how long the valve had been open.

I was simply afriad that in using the Zewe testimony you were tyring to provide the basis for drawing an inference about whether Zewe might have told Miller about how long the EMOV had been open.

I simply want to point out that on the previous page of his testimony, Zewe said he did not have a feel for exactly how long the EMOV had been open.

MR. STELLO: You ought to read the whole thing. He said, "At that time there were several people present in the control room and it was more of a collective type of conclusion once we had shut the block valve from the electromatic and pressure changed dramatically, we just concluded it had been opened."

Then he added, "But I really don't have a feel for exactly how long."

Knowing, I think reasonably from that statement, that the valve had been open when they closed the block valve because it was the system changes they saw that allowed them to conclude at that time the valve was open, that is what we are trying to establish. This is very important information and whether or not that was known and by whom is important.

What I am trying to understand for myself is when someone starts a question with he is confident of something that is unusual, very rarely do we get anybody saying he is confident of anything. In this case, he did.

THE WITNESS: Did you ask me if the command signal as on the computer?

MR. MOSELEY: Yes.

THE WITNESS: I think it is. I believe it is. I believe the computer gets an input where it can tell. I don't know that it is a command signal. It could be the pressure sensing signal. I think it is probably a command signal.

MR. MOSELEY: Our review of the computer data does not indicate that this valve was being coperated, that the only valve that was being operated was the block valve. Is it your statement that you weren't aware whether or not both valves were being operated?

THE WITNESS: That is right; that is my statement. I am also saying if you look at the NSAC printout, doesn't that say the valve had an open command signal starting at 7:30, the valve being the EMOV?

MR. MOSELEY: This is entitled, "EMOV Block Valve".

THE WITNESS: I am saying Mike Ross would have done that, and I would not have needed to know that. The operation of those two valves plus the other one which goes to the drain tank, I would not have necessarly known which valves they were doing specific manipulations with.

MR. MOSELEY: Let me go on to something else for a moment: We may come back to this.

Your testimony to us in September related to the EMOV or rather the block valve. You said, "Certainly I would have been concerned about the other valve, but my history of failure of the block valve, it was a gate valve, I believe, and it tends to stick sometimes open or shut."

What was the failure history you had experienced with the block valve?

THE WITNESS: The valve was a gate valve and the history I had experienced was in Unit I, because my response in the testimony was that the block valve had a tendency to stick open and shut.

MR. MOSELEY: Do you real how many? Was it less than a half dozen or more than a half dozen?

THE WITNESS: I vividly recall Unit I being five or six times. I don't have as good a recall on Unit I because I wasn't as close to the test program.

MR. MOSELEY: Your statement refers to some performance related to Unit I's block valve; is that correct?

THE WITNESS: My statement refers to the fact that the valves on top of the pressurizer in either unit in an odd environment is inside the building and it has the potential to stick, and that has happened.

That was only one of a couple of concerns that I

this is something he should have told you?

A Yes.

Q Okay. Or they should have told you.

A Yes.

Q Again I would like to ask you why you feel this information was not passed on to you.

A Again probably the same reasons I gave for the other.

Q Okay. And then I will ask you -- I won't go through the list of questions again, but could I ask you whether you feel that other organizations within the state may have been given this information?

A I don't believe so, not to my knowledge.

Q Another fact, the electromatic relief valve had been stuck open for a period in excess of two hours. To your knowledge on March 28th, was this information passed on?

A Yes, it was, in conversation with Gary Miller, he told me the valve had been stuck open. The indication was faulty, and it wasn't indicating the proper position on the indicator, and the valve was now closed. But this was again at 9:00 a.m.

Q Did he tell you how long the valve had been open? Maybe not two hours, but a long time? Or do you recall a period of time?

A I think he indicated it was open for a fairly long period of time, I believe.

Q Okay. Before we started the interview, you gave us

9:30, the conditions in Unit 2 were, and I have a readout of the plant status.

Q Is that the --

A Actually this is not really the plant status. Well, it's a plant status, plus it's a rundown of what had happened in the initial accident.

BY MR. HOEFLING:

Q Jim, I think you just referred to the time of your arrival as 10:20. Did you want to say that?

A In Unit 1, not Unit 2. It took about an hour to get over to Unit 2.

Q Okay.

BY MR. MOSELEY:

Q Now is this time -- I guess I'm confused on that.

A This is the status I got in Unit 1 at around 10 -- probably by the time I got this from Bubba Marshall, I had been in Unit 1 for maybe a half hour, so it may have been 10:45 by the time I got this particular status. Bubba Marshall had been in Unit 2, had evacuated over to Unit 1 control room, and the last time he had been in Unit 2 was about 9:30, so he told me as of 9:30, this was his understanding of what had happened.

Q Okay. So you got this at around 10:30, but it was his reporting to you of his knowledge at about 9:30 when he left?

A Right.

Q Now is that the place where you have the notation of

in the system. I know one of my pet concerns, which I think was a more serious concern on my part than any of the other concerns that were being considered, was the fact that we could be concentrating boric acid in the core, because any water that is getting in, if it is getting in, it is flashing to steam and that is a cooling mode at that point in time.

Of course, we didn't have any level indication so you couldn't be certain what the level of coolant would be in the core. I assumed that there is a significant possibility that this boiling action that could be occurring would be concentrating the boric acide in the core. I was becoming worried that after some period of time, which quantitatively I couldn't define, we could actually form a slurry boric acid which possibly could impede per the cooling.

I guess in the morning that was -- that issue along with the issue of how do I assure that I am indeed cooling the core were the major ones in my mind.

Q Was there ever anxiety about the core actually being uncovered during this period of time?

A I believe it would be safe to say that there was some anxiety along that line, but intuitively I believe I always felt the core was covered or at least being cooled sufficiently to stop any increase in core temperatures or increase in the voiding that we may have experienced. We couldn't prove it. There were no indications to prove that we were cooling the core effectively.

In that regard there was anxiety about guaranteein that if we had the core cooled and verifying something that we intuitively felt was occurring, either through direct cooling with water or by some steaming that was, of course, removing heat.

Q How did the high hot leg temperatures figure in this evaluation?

A We were looking desperately for those temperatures to show a decrease and that would point towards an improvement in our condition.

Throughout a good portion of the morning and I guess into the afternoon, those temperatures were not responding as we were hoping them to respond in order to use those as a basis for suggesting core cooling was improving.

Q Were the hot leg temperatures disbelieved?

A No, I never disbelieved the hot leg temperatures. I thought they were about 800 degrees, in that range.

I think that we had believed in those because we had more than one RTD telling us the same information.

Q So what you are saying is the hot leg temperatures showed you that you might not be getting out of the core

CRESWELL: What did the information mean to you?

KUNDER: Well, since I wasn't that familiar with the Unit 2 instrumentation particularly in the area of the thermocouples, he said he wasn't sure if there's anything that could be derived from it or anything reliable that we could get from it at that point I guess I just dismissed it.

CRESWELL: Discounted the information.

KUNDER: Well, yeah I guess discounted might be one word. I didn't place any concrete faith in that information you know I wasn't sure what it was telling me and I think we were all looking for something that we could identify with really pretty clearly in terms of meaningful instrumentation to tell us what the conditions were in the core and since that was...you know you can only speculate on what it was telling you at least that's what we thought it was telling us at that point I didn't put a whole lot of meaningful restored at that point.

SHACKLETON: Jim we are almost ready to run off our cassette and we'll change the tape at this time. The time is 2:03 p.m. and we'll discontinue until we come back on tape again.

SHACKLETON: The time is now 2:06 p.m. eastern daylight and this is a continuation of the interview of Mr. George A. Kunder. Please continue Mr. Creswell.

cooling with this particular mode of cooling?

A At the time I viewed the hot leg temperatures of being representative of voiding steam in the core, I visualized the reactor cooling system as being steam bound in the upper section of the core and hot legs themselves. Since we were relieving steam through the electromatic relief valve at various portions of time in the morning and afternoon, that we were removing some heat. We could not confirm from those indications whether that removal of heat was adequate to keep the core safely cooled or improve the cooling of the core. We did not have indications that would conclusively confirm that the core was covered in its entirety.

I believe that there was some possibility that we were having steaming in the core which was contributing to some voiding and I guess in a technical sense you could say the core was not fully covered but it was being cooled to some extent. That is the way I think I perceived things at that time.

Q Late in the morning a decision was made to depressurize the system and to blow down to try to go on decayed heat and to try to get the core flood tanks into the core. Why was that decision made? Was that made simply because you couldn't satisfy yourself that the strategy you had employed during the morning was definitely working?

situation.

I think that it is unfair to task anybody with this sort of Monday morning quarterbacking with the perfect vision that we all have after an event.

MR. HARPSTER: I think one thing you should understand, and one of the reason that we repeat this question and asks these gentlemen for their opinion, is that we are tasked with the problem of trying to write better reporting requirements, and determine how better to get this information. So it is necessary to have these gentlemen's opinion. We find it necessary to ask it.

BY MR. HARPSTER:

Q George, you have previously testified that on the morning of March 28, 1979, after the reactor coolant pumps were shut off, the hot-leg temperatures sreamed up. You were impressed by the magnitude of 700 to 800 degrees of the hot-leg temperatures. You perceived the core as being cooled by over-heated steam. That is, you were considerably in excess of the saturation temperature.

And, you never disbelieved the hot-leg temperatures because you had more than one RTD telling you the same information.

Did you at any time on March 28, 1979, discuss this information or its implications with Messrs. Miller, Rogers, Flint, Herbein, Zewe, Mehler, or Chwastyk?

A I would have been engaged in various strategy discussions with Mr. Miller, and Mr. Rogers, throughout the morning, and that information was a parameter that was a factor in those discussions. But I don't remember any specific discussions. I just remember that at various times we assembled in the shift supervisor's office, and perhaps out in the control room, and discussed what we were going to do next because we recognized that we did have a need to establish cooling that we could identify with, and conclusively say was a situation that was under control.

I really cannot remember any specifics, though.

Q Was a record kept of the data indicated by the extended scale read-out device connected to the hot-leg RTD?

A I can't remember any specific records, but there could be records of that information. If it is available, it would have been retained by the data reduction group, and it would certainly be available today.

Q On March 28, 1979, what was your evaluation of the hot-leg temperatures when they sharply increased after the reactor coolant pumps were shut down?

A My general recollection is that they indicated that we had an abnormal situation in the plant. I think that those conditions were beyond the bounds of plant conditions that I was used to dealing with.

My general perception of the reactor coolant system was that it was indicative of the voiding that we had. I cannot recall specifically when I reached that general feeling, or that conclusion. It was sometime, of course, after the temperatures went up, and after many discussions with different people. You gradually reached that perception.

I cannot remember any specific time frame for me to draw that conclusion.

Q John Flint of B&W testified that he advised several people, including Lee Rogers and Gary Miller, that the magnitude of the temperature of the super-heated steam would preclude the ability to collapse the bubble.

Were you aware, on March 28, 1979, or did you take part in, or overhear any discussions of these concerns?

A I can't remember specific discussions, but John was part of the management team, so to speak. He certainly had input. I had specific discussions with him that I recall relative to the indications of the source and intermediate range detectors, but I don't remember any specific discussions that we had relative to the high temperatures and the process you discussed.

Q Do you recall a concern of your inability to pressurize the plant because of the release set points to a point where you could collpase the bubbles?

A We had a lot of concerns that day, but looking at it from the point of view you have expressed, I really can't remember. I will have to say that I just don't recall reviewing it specifically the way you have mentioned it.

Q You previously testified that on March 28, 1979, your interpretation of the super-heated temperatures indicates that the core had been uncovered and that it was being cooled by the super-heated steam. Was this information discussed at any time on March 28, 1979, with Messrs. Miller, Rogers, Flint, Herbein, Zewe, Mahler, or Chwastyk?

A Again, I think the perception I had was similar or the same as the general perception of the rest of the management team. A large part of our discussions was directed toward what strategy we would take to try and assure that the core was covered. It meant what strategy we would take to get enough water into the system and achieve plant status that we could guarantee that we had the core covered.

I think intuitively we all hoped, or believed that we had the core covered, at least I did. But there was not enough positive information to say without a doubt that that was the condition, and to relax, so to speak. Thus, we continued to define our goals, and I am speaking of general goals, and come up with a strategy that got ourselves in a condition where we could say for sure that the plant was back under total control.

Q George, let me ask you a question which is similar. As I have reviewed your previous testimony, and your conversations with Don Haverkamp on that morning, I had the impression that you were very seriously concerned that the core was uncovered at some time, and in fact that it was being cooled through this superheated steam mechanism.

Did you express these concerns in this think tank meeting, or meetings, as they were held throughout the morning?

A I remember one specific feeling that I had relative to cooling of the core, and that relates to the fact that if we were getting water into the core and it was evaporating, and that is the mechanism I was thinking of, removing heat through the evaporation of the water. Then, of course, as that steam would contact other hot material, it would become super-heated, that would achieve some cooling.

But I remember being concerned about the precipitation of boron, and by this time, by the way, it would have been sometime around the middle of the morning, and I believe that it was after my conversation with Don Haverkamp. I don't recall any more as to what terminated that conversation, but that thought and concern was in the back of my mind.

Basically, I think my feeling was that I was hoping that that was not going to be a real problem, and I had no way of knowing whether that was going to be an eventual problem or not, but the only way of avoiding that problem was to keep water chugging into the core, and keep it there.

We did have high pressure injection established at that point, and it seemed to me to be about the only thing that we could do. There were no other alternatives that were obvious to us, or I am sure that we would have perhaps taken a different course of action, a different strategy.

Q Let me ask you, did you discuss these concerns on how you perceived the core as being cold with the other members of the management team?

A We had discussions throughout the morning. I am fairly certain I verbalized that specific concern, and everybody else verbalized the concerns they had. We all came to reach an agreement on the course of action which seemed to be the best course of action to take at that point.

Q Do you feel that people were in agreement with your understanding of the way the core was being cooled that morning?

A My perception was that we all shared the same general understanding, although I would have to say that it was more of a qualitative feel for what was going on, rather than a quantitative understanding because we did not have knowledge of actual level in the core. We did not know how much water we had in the system. We believed we had enough, but at least, I think on my part, it was more of an intuitive feel for the conditions in the system.

Q Did you discuss or did you overhear or learn of any conversations with regard to the implications of this superheated temperatures that morning?

A I don't recall any specific conversations relative to that. Most of the time we were focusing on how to get to the basic plant in a control mode of cooling, one that we understood and one that we had experience in through our training, and so forth, and that was either to try and achieve decay heat removal operation, using the decay heat removal pumps. Ultimately it was, as I recall, our goal, and we tried a number of strategies toward achieving that goal, and we did try to keep in mind what we would do if those individual strategies would fail, and have some back up plan.

But I don't recall either taking the opportunity, or being able to really sit back and think, and focus on some of the academic aspects, shall we say, of parameters that we were seeing. I think what pretty much motivated me personally was my desire to see the plant in a controlled mode that I could identify with as being safe, and my background in operations which I think tended to make me react in that way.

Q How did you account, or what was your feeling toward the continued extremely hot temperatures over the duration of the day?

Did this generate a concern about whether or not you were achieving your objectives, as the temperatures stayed up over the course of the day?

A Certainly, it was a very frustrating experience to not be able to restore the plant to a status that I was comfortable with. To the best of my recollection, my belief was that there was a lot more water loss than could be made up in a very short period of time by the high pressure injection system. So that it would take some period of time to regain control.

know it was sometime in the middle of the morning when we were meeting with Gary and Lee Rodgers and so forth. The thing that was scaring me was the thought that we were putting water in the core from high pressure injection and it was boiling off and concentrating boric acid and I was really scared that we would end up blocking flow lanes and stuff you know with the boric acid unless we'd get enough cooling water near to really get some sort of circulation and the only circulation that we could conceive of getting was to blow fluid out the electromatic relief valve which was the only place that we could find any kind of venting path and hopefully carry over whatever other mechanism would exist would at least minimize any kind of buildup of boric acid and... but...I know the feeling that I had was that we were cooling the core but at a elevated temperature in through the steaming process because we I don't think I thought in terms of the supercritical steam point I don't think that thought went through my mind but at that point I'm not sure I was prepared to think of that sort of thing but I knew that we probably had a bubble in there, a steam bubble, so to avoid and I couldn't define it in my own mind or really get a feel for what it was like but as long as we were pumping in the high pressure injection that was the only thing we could do other than try and start a pump and that had been tried by others and it was apparently unsuccessful at that point.

CRESWELL: George the implementation you had some technicians hook up a thermocouple reader and digital volt meters to the thermocouples. Were you aware of the evolution?

KUNDER: I was aware of that evolution, the extent of that evolution I believe, that's quite a few weeks after the incident, but I was aware that he had gotten thermocouple data that morning and he had reported his findings to Gary and I also discussed it with him briefly that the data was irratic and he didn't know what kind of reliability to place on it cause he had numbers that ranged all over the place. You see up to that time I was unaware that Unit 2 had their thermocouples tied into the computer. Unit 1 doesn't they don't use them so I didn't even...I wasn't even aware of the ability to get that kind of information and the data since it was so scattered there was some questions marks there was temperature...I think he had converted...I learned this after the fact...he had converted the DVM data from all 52 thermocouples he took four of those or five of them, something like that it was a very small number, and he converted the data to temperatures just to see what kind of a range he was getting there was some I guess a couple of points that weren't giving him any information at all. One temperature was down around...either under 100 or just over 100°, another one 20... around 2300 or somewhere in that range, another one high question, another question mark they get four data points that I had learned when I was down at the presidential hearings that he had actually converted at that time and given to Gary and mentioned to me and they you know kind of going along here at 90 miles an hour and that just... he wasn't sure what kind of reliability to derive from the information so that was pretty much the extent of you know any kind of involvement analysis that I can recall.

to me. It was a voltage reading, and Ivan just indicated ---

Q Would it help to change your testimony from IE on 7-11? Let me find that page for you.

A I think that it will refresh my memory.

Q Did your evaluation of this information, that is the information you have just read in the IE transcript, change after your discussions with John Flint regarding the explanation of the re-criticality?

A I cannot remember which came first. I tend to think that my conversation with John Flint came first, but to the best of my recollection, I am just not sure.

Q Okay.

MR. MOSELEY: The question remains the same, did you tie the two together?

THE WITNESS: I don't think that I tied the two together no matter in which order it came.

BY MR. HARPSTER:

Q To the best of your knowledge, was the core exit thermocouple information reported to the NRC on March 28, 1979?

A To the best of my recollection, it was not.

Q Can you recall why?

A Well, I am fairly certain that I was not aware of that when I was talking to Don Haverkamp. Again, I am not sure in my own mind if I ever really knew that information in terms of temperature, or if I knew it in terms of DVM values. There was a number of them that just raced all over the place, and therefore you could not put any specific reliability into what they are telling you.

My recollection is that it was something that did not give you a whole lot to work with, and I don't recall really thinking about it, or dealing with that information much further for the rest of the day.

Q At any time on March 28, 1979, did you monitor, or were you aware of anyone else monitoring the south power neutron detectors?

A I don't remember anyone taking a look at that.

MR. FISHER: Would this be an appropriate place to take a five minute break?

MR. HARPSTER: Sure.

(Whereupon, a short recess was taken.)

Hson ends
Sims fols.

BY MR. HARPSTER:

Q I quote page 73, line 6: "One of the early conversations was to try to get a readout from the incore thermocouples to determine the temperature conditions inside the core" -- end of quote.

In your I. E. interview on May 8th, 1979, -- and I refer you to page 101 -- you state in reference to your participation in the first Think Tank session after arriving in the Unit 2 control room -- and, I quote: "I do remember, in the first discussion we had, bringing up the incore thermocouples to look at for temperature, and we immediately went up to take a look at those and got them back with question marks on them out of the computer, which really didn't give us any information other than it was perhaps outside the program, so we probably really did have the hot condition in the core.

"In other words, the fact that T hot" -- and, I believe the transcript reflects: Th -- "was offscale was probably valid from the basis of what we saw on the computer" -- end of quote.

On page 153 of this same interview, you state -- and, I quote: "Because of the incore thermocouples had question marks, and that T hot was in excess of six twenty, and we knew what our pressure was, and we knew that we had temperature in excess of the saturation temperature for that pressure" -- end of quote.

Given that information that you have testified to in these quotes, what then was your evaluation of the thermocouple data taken by Ivan Porter in the cable spreading room, which included a reading greater than two thousand degrees Fahrenheit?

A Sir, I, on that day, did not hear the reading, any of the readings, to the best of my recollection, from Ivan Porter, taken in the cable spreading room.

Q Were you aware on March 28th, 1979, that they were taking readings locally in the cable spreading room?

A I knew on March 28th, 1979, that Ivan Porter had been sent out of the room to try to get readings somehow.

I do not believe that I ever heard the results of any of those readings.

Mike Ross, in his Special Inquiry Group deposition, has testified that the incore thermocouples were discussed in the Think Tank at least twice, and maybe four times.

Others have testified that there was

MR. HARPSTER: Down over the pump lift?

THE WITNESS: Yes, which would to me just give an amount of voiding conclusion I guess at that point.

MR. HARPSTER: Did anyone go to the isometrics to try and equate this with where you might be at in the core?

THE WITNESS: No.

BY MR. CRAIG:

Q Our review of your testimony indicates that you were aware that hot-leg temperatures were above 700 degrees and that instrumentation bridges had been hooked up so that resistance readings could be used to determine the approximate hot-leg temperatures on 3/28.

Was a record kept of the data indicated by this extended scale read-out for the hot-leg temperatures?

A A recorded record, a log-keeping book?

Q Any kind of a record.

A None that I know of, no. I would like to rephrase your statement of my earlier testimony. I was aware of a read-out of over 700 degrees. I wasn't aware that that was a correct temperature. I never agreed that that was a correct temperature at that time.

Q You didn't agree with the hot-leg temperature?

A I didn't agree that we knew that that was what the temperature was.

MR. MOSELEY: With any of the instrumentation even after this bridge was hooked up?

THE WITNESS: That is correct. There was speculation and discussions to the effect do we know that those are really going to indicate the correct temperature in the steam ~~side~~. If we had all sat down and remembered everything maybe that we had known earlier maybe we wouldn't have arrived at that speculation, but the question was put forth and that made me as an individual not sure that those were the real temperatures at that point in time.

MR. HARPSTER: At what point did you believe them?

THE WITNESS: After we had gone up in pressure. That was a fairly obvious conclusion that those temperatures were too high for the 2,000 pounds there.

MR. MOSLEY: At this time here (Indicating)?

THE WITNESS: Yes.

MR. MOSELEY: That is approximately ---

THE WITNESS: Nine or ten o'clock.

MR. MOSLEY: --- at the 9:30 time.

BY MR. CRAIG:

Q On 3/28/79 what was your evaluation of the hot-leg temperatures when they sharply increased after the reactor coolant pumps had been shut down?

A We didn't know that. We didn't have that piece of information.

Q Our review of your testimony before the inspection -- the Office of Inspection and Enforcement, indicates that you were aware that the core exit thermocouples were being monitored, and that some were reading, and I quote, "pretty high and some were reading 600 and some degrees. A lot of them are not reading or indicating."

You also testified that you were aware that millivolt readings of the core exit thermocouples were being taken, and that these readings were as high as approximately 2400 on some thermocouples.

What was your evaluation and meaning of the core exit thermocouple temperatures?

A I don't believe I would try to correlate it at all at that point, merely as a piece of information that we were getting as a group or individual, depending on the -- if it were part of the conversation at the time, and that is probably because they didn't tie into the safety system, or part of the normal operating condition. It was just an auxiliary piece of information for use of anyone.

I know very well that the discussion of the temperatures that we were getting again, just like we did on the RTDs, how do we know that these are good, is the conversational pieces that came out, are these really reading correctly? Are they the real temperatures, or do we know that? Do we know we can rely on them?

And I know that in that kind of an atmosphere, once you're not sure that the people that are telling you they are right, they are not sure that the information is really correct, you discount it as being information that you don't want to use.

Q Did you discuss these temperature readings with John Flint?

A I'm not sure that I recall any conversation with John on the temperatures. I'm not sure I can recall that.

Q The core exit or the hotleg temperatures either?

A Well, John and I, during the course of the day, were discussing hotleg temperatures because we were both reading them trying to see that the actions being taken in the plant would result in getting an indication back in a normal range, and I'm sure we had discussions on the RTDs.

Q Did you discuss any time that day the core exit thermocouple readings with the exception of can we really believe them, with Miller, Kunder, Flint, Herbein or Chwastyk?

A That's hard to recall at all. The answer to that has to be I don't recall those kind of conversations, no.

Q Did you have a conversation with John Flint with respect to the hotleg temperatures that he felt that the temperature indication, both the core exit thermocouples and the hotleg temperatures, sort of backed each other up?

A Not that I remember, no.

Q Based on your discussions with John Flint, did you

Q On the morning of 3/28, were you aware that hotleg temperatures were in excess of the saturation pressures to the corresponding coolant system pressures?

A As I stated, not until we got up to pressure.

Q And that's again approximately 9:30?

A Uh-huh.

Q At that point, did you recognize the temperatures in excess of 705 degrees were above the critical temperature for steam and, in fact, meant that the system had contained superheated steam?

A I don't believe I put it all together like that, no. I really didn't arrive at any conclusions from an analysis point of view, no.

Q Was superheated steam discussed with you or in your presence on 3/28?

A Not that I recall, no.

BY MR. MOSELEY:

Q Excuse me. Did Rogers -- I mean Flint, talk to you about his conclusions on superheated steam on the morning of March 28th?

A I don't remember anybody talking about superheated steam at all during that whole day.

BY MR. CRAIG:

Q You testified on 3/28 that you were aware that the reactor coolant pumps had been shut off because they were not

which I just don't.

MR. MOSELEY: I can appreciate that problem.

BY MR. CRAIG:

Q. Was the fact that the RC drain tank disk had ruptured discussed with Gary Miller? Did you discuss that with him?

A. I can't recall whether I discussed it with him or not. If I was aware that it had ruptured at that time, yes, I did tell him, I'm sure.

By this I mean if he had told me he was aware that it had ruptured, and again I can't remember when he told me this, whether it was after Miller was there or before, but I'm sure I would have told him.

Q. Was information passed on to the NRC, to the best of your knowledge, concerning the fact that the EMOV had been stuck open or that the RC drain tank rupture disk had, in fact, ruptured on the day of the accident?

A. Again, I did not have a conversation with them concerning this, and I wouldn't participate in that conversation with him on it, so I don't really remember.

Q. To your knowledge, was this information withheld from the NRC on 3-28-79?

A. Not to my knowledge.

Q. Were you aware that the hot leg temperature was 2700 and 800 degrees as measured by Ivan Porter on the digital volt meters and on the multi-point recorder in the control room on 3-28-79?

A. I don't remember the readings that Ivan had mentioned. Ivan came through the control room at some point in the accident or in the --

BY MR. MOSELEY:

Q. I believe you are talking about the core exit thermocouple. He's asking about hot leg temperatures.

A. I don't remember any readings on the hot leg temperature that he had hooked up. At the time that Ivan was making his measurements and things, both thermocouples -- I was running the emergency plan for Miller, and as far as the operation of the plant and particularly the parameters affecting the plant, I wasn't really involved in those. Those are things that I heard from being in there.

Yes, I can recall those, but some of the things that went on I did not get involved in just because I was doing other things.

BY MR. CRAIG:

Q. Well, were you aware on the morning of 3-28 that the temperatures were above 620 degrees Fahrenheit, which I believe is the maximum indicated on the front panel?

A. At sometime during the day I was, and that was when I mentioned that Ivan came up, because he went down to measure thermocouple temperatures.

MR. MOSELEY: Core exit.

THE WITNESS: Yes. Because obviously we didn't have any pumps running or stuff like that. It would have been more accurate to get them off the thermocouples core exit.

I remember him coming through the control room and mentioning to Miller -- I think it was Miller. Yeah, I'm sure it was -- that he had some awfully high readings and very low readings, the inference being that they were questionable, the readings were questionable. Some of them were very low, some very high, so what did you believe.

In that context, I feel I knew that the hot leg temperatures were unreliable up there. They were probably off scale or he wouldn't have taken those.

BY MR. MOSELEY:

Q. You don't recall either personally seeing or being told that the meter indications of hot leg temperature, which pegged at 620 degrees, were either 620 degrees or the meters were pegged?

A. No, I don't. I can't recall that.

Q. Do you recall having any knowledge of the hot leg temperatures, the fact they were high, or some indication other than the reference that you made to the core exit thermocouples?

A. I don't recall that right now. Now, at the time I may have. I just don't recall right now of seeing that.

My big concern at that particular time — now, when I first got there, and the period shortly thereafterwards, I was interested in trying to re-establish flow. That was my main concern, was to re-establish flow. Now, whether I looked at the hot leg/cold leg temperatures or not, I don't remember.

Walking across that board, you remember the number of gauges and dials that you have on there. And I was concerned with trying to get the flow back.

Also, I must say there were some people that were in front of it. I was trying to stay out of their way, so I was actually behind them.

Q. Why were you concerned about getting flow back if you had no feel for temperature?

A. Decay heat is there. We have been operating, and a philosophy that had been bred into me, if you try to sustain flow -- I have never been -- natural circulations was a new concept to me, as far as actually observing it or having a lot of confidence in it. To me, the more desirable situations have forced circulation.

BY MR. CRAIG:

Q. What was your evaluation of the meaning of super heated steam in the system on 3-28-79?

A. My evaluation of it? I never discussed that with anybody. I didn't evaluate it, is what I'm saying. I never considered it, at the time.

Q. Did you believe that the loops were steam-bound?

A. I don't recall even considering that. I must have. When they said that the pumps weren't pumping water, something was preventing them from pumping it. I would have assumed that I felt there was something in there that was preventing them from pumping. Naturally, something would be steam.

But I don't recall -- certainly I didn't discuss that with anybody, nor do I recall it going through my mind, as far as super heating.

BY MR. MOSELEY:

Q. But there is a difference, I think, between pump cavitation limits that one sees on pumps and a pump that is operating in a steam environment. Did you have the impression that this pump was operating in a steam environment?

A. I didn't have any impression because, of course, when I got there the pumps had been secured, or were secured shortly after I got there. And I did not observe their operation.

There are different things that can cause a pump to cavitate, as you say. Pressure, low pressure, or steam environment, or whatever. And I did not witness the fluctuation of the current or the flow on the generator, so I

BY MR. CRAIG:

Q Our review of your testimony indicates that you were aware of hot-leg temperatures in the neighborhood of 740 to 800 degrees and that you verified these temperature readings in the 740 to 800 degree range by the instrument, the bridge, by comparing it to a graph. Was a record kept of the data indicated by this extended scale readout device which was connected to the hot-leg RTD?

A I don't remember whether there was a record kept of that or not. We have an I&C engineer that was involved in that, and I am not sure whether he did, but I certainly did not.

Q On 3/28/79 what was your evaluation of the hot-leg temperatures when they increased sharply after the reactor coolant pumps were shut down?

A What time was that again? I am sorry.

Q In the morning when you secured the reactor coolant pumps, and I am looking at a graph that was part of the Rogovin Report, and I will show you a copy of it.

MR. FIDELL: Let the record show that the witness is looking at a copy of a graph or a series of graphs from the Rogovin Special Inquiry Group Color Plate III.

THE WITNESS: I believe that if memory serves me the final pair of reactor coolant pumps were secured at approximately 5:41 in the morning.

MR. CRAIG: It is four or five down.

situation and tried to get ideas as to what to do next as far as the core being cooled for sure was concerned, what certainty we had, et cetera. But I don't recall any direct correlation between that and something to require this action level. We didn't feel we were anywhere near the situation that we would affect the off-site population.

Mr. Carlson. In the morning there were actual measurements taken of the incore thermocouple readings besides the question marks that were being printed out by the computer. Were you aware of these measurements?

Mr. Zewe. No. I was unaware of those measurements until I believe sometime the next day. Certainly not that day.

Mr. Carlson. Were you aware of the containment pressure spike when it occurred that afternoon?

Mr. Zewe. Yes. I was. Because I was directly in front of the reactor building core, and I directed the operator at that point to operate the electromatic block valve to open up to further vent down the reactor coolant system because we were into the depressurization point at that time, and we wanted to try and limit the reactor building isolation four point signal, so I was losing a point in time in the pressure where we should open up the vents, and I was directing him to do so, looking at the recorder, and I directed him to open it up and as soon as we did that, we had a pressure spike.

Mr. Carlson. Did you hear a thump when that happened?

system for core uncovery, which would give you the increase in flux at the outer detectors?

A Not that I can remember, no.

Q In your opinion today, should this increase in count rate and potential for recriticality have been passed on to the NRC on the day of the accident?

A Yes.

Q To the best of your knowledge, what were the core exit thermocouples used for during normal operation?

A Prior to the accident, we did not really use them. They were unavailable in Unit 1, and they were available in Unit and to my knowledge, there were not any existing procedures that really had you use them at all.

Q To the best of your knowledge, who would have used the core exit thermocouples?

MR. MC BRIDE: On the day of the accident?

MR. CRAIG: Previous to the day of the accident.

MR. MC BRIDE: Well, that question strikes me as a little odd, because he's just testified that they weren't used.

MR. CRAIG: No, he testified that he wasn't aware that they were used. I'll be a little more specific.

MR. MC BRIDE: Okay.

BY MR. CRAIG:

Q I interpreted the response that you didn't believe that they were used, is that Metropolitan Edison personnel didn't

temperatures which were measured by the digital voltmeter set up by Mr. Porter were known by Think Tank members and discussed in the meetings.

Were you aware that this instruments indicated temperatures of 700 to 800 degrees Fahrenheit?

A I was aware they indicated temperatures around 700 degrees.

Q What was your assessment of these temperatures? What did they mean to you?

A They meant to me that I didn't have a cooling method for the core, is what it meant at the time. Today it means something different to me, as it does to any operator. But at the time it meant to me that I didn't have an adequate cooling method in the core.

Q And you related it to method rather than coolant available?

A I don't think I ever said, oh, I've got a low level. I think I said, hey, I'm not removing the heat.

Q Did you at any time on March 28th discuss the implications that you drew of these temperatures with Mr. Miller

A I think we did discuss them in the Think Tank. One of the things we discussed was to establish the cooling method. As you gentlemen know, no place in any procedure in any B&W plant was there an alternate cooling method thought of, like th PORV. That's why we started pushing water through the PORV. I

Q Okay. You have told us what your assessment of these temperatures were, in the range of 700 to 800. Was the assessment of any of the members of the Think Tank different from your own?

A That I can't really say. I can say in our discussions, no one jumped up and down and said the core is uncovered. A couple of times the question was raised, are we sure it's covered. But no one related the temperature at that time to either superheat or anything, any of the things we would do today.

Q Zewe stated to us a couple of weeks ago that after the DVM was set up, that -- I'm quoting him now -- "We were aware that we were in excess of saturation temperature for the existing pressure."

He also goes on to say that he believes that superheated steam conditions were discussed by the Think Tank.

Did you participate in or overhear any discussions about superheating conditions on the morning of 3/28?

A I don't recall that we got superheated steam ever being passed. We did discuss and we did look, or have B&W look at some steam tables, and what their analysis was, I don't know. Our analysis was we were too darn hot for where we were for existing pressure.

Q Does the term superheat -- maybe that term wasn't used, but the implications that the temperature is beyond what

A. Somewhat, yes, sir.

Q. Did you have reason to recall this prior experience and the use of these on March 28th?

A. No, I did not.

Q. Do you know why these thermocouples or alarms are in the computer?

A. No, I do not.

Q. To the best of your knowledge, is there any procedure -- Met Ed procedure -- for these thermocouples?

A. Prior to March 28th, on Unit 1, there definitely is none; on Unit 2, to my knowledge, none.

Q. Were you aware of anyone monitoring the computer printout of in-core thermocouples during the day of March 28th?

A. No, sir.

Q. You were not aware that Flint, for instance, was doing this?

A. (Nodding in the negative.)

Q. Your response is "no"?

A. "No."

Q. You stated to the Special Inquiry Group that you were in the vicinity when Porter reported to Miller the core exit thermocouple readings which had been taken down below the terminal. Later in the same interview, you say: "They were discussed a couple of times" -- and I'm quoting you. "They were discussed a couple of times, and I can't remember

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whether it was just the two times that I remember, or four times, but they were discussed. And each time in the discussion, they were discounted."

Did the existence of the high temperatures at least imply to you that the core was or had been uncovered?

A. At the time, they did not.

Q. Did you discuss or overhear discussions with other think tank members the possibility that these readings could indicate that the core was uncovered?

A. As I stated before, I was aware of the readings, sir. The span of the readings. I don't remember anybody drawing any analogy to the core coverage based on the thermocouples.

Q. Do you recall the reasons discussed on March 28th for discounting these thermocouple readings?

A. Yes. The span was very wide. There were some anywhere from 200 degrees up. It was just a fan. Basically they were discounted because of their span. There were some that were 0, 200°, 40°, it was -- what I got out of what I heard was it was just a real wide area, and no conclusion could be drawn from it.

Q. Do you recall a discussion that new junctions may have been formed? Do you recall that statement on March 28th?

A. No, sir. No new junctions. I've heard since March 28th, but not that day; I don't recall.

Q You stated to the Special Inquiry Group that you think, or you recall hearing additional thermocouple readings which I, in reading your statement, take that to mean reference to additional readings taken down below at the terminals. And you go on to say that the additional numbers were pretty much the same.

A Yes. I don't remember that today, but I remember something vaguely with another set of readings coming in, and they discounted them the same way, and we just went on.

Q Can you give me some -- Can you relate that in any way, those additional discussions, to something else that was going on at the time? Or can you enlarge on the statement that you have already made?

A No, sir; you've got to remember the time span we're involved in here. I cannot.

BY MR. GAMBLE:

Q Do you recall if it was a large quantity of readings?

A I recall it was not a large quantity of readings -- and this is a feel for how the thing flowed. I recall a small sampling of readings, is how I put it.

BY MR. MOSELEY:

Q Do you believe the other discussions were somehow referring to the same set of readings? Or did you have the impression they were additional readings?

A. My impression was they were additional readings, but I can't say. I know now some things I didn't know then and that's the problem, as you guys know. My impression at the time is that they were additional readings; but where they were taken, I can't nail down because I have some other knowledge now.

Q. Do you at that time have knowledge that the instrument was left hooked up down below such that it could be read at various times during the day?

A. No, sir, not down below. We had an instrument hooked up upstairs, but not on the thermocouple.

Q. And you don't have any knowledge of who may have discussed these readings, or any recollection whatsoever as to who was discussing it and in what context they were discussing it?

A. The first discussion, Ivan made the discussion and I heard a part of that. Subsequent discussions are kind of like a flowing blur, and I am sure Ivan was part of it.

BY MR. GAMBLE:

Q. In the context of a think tank meeting?

A. All I remember about the first one, it was out in the control room. That's my best recollection, but you've got to remember that it's 18 months old.

Q. Right. The first one you believe might have been out in the control room?

out in the control room?

A. That's my first belief. I don't know why I say that; I just say that from something I remember and I don't know what it is. It seems to me it was right out in the control room.

Q. How about the second one? Do you have any feel for that?

A. I think they were mentioned just in passing, perhaps, in the think tank.

BY MR. MOSELEY:

Q. You indicated that you have knowledge now, improved knowledge, of what may have gone on in terms of the thermocouple readings, the ones that were taken down below. What is that? Do you have knowledge that additional readings were taken?

A. I hear rumors that a lot of things went on downstairs. I've heard people say that -- I've heard a lot of information that thermocouples were applied, and I've heard a lot of things. I had heard that a complete set was taken, but that's all hearsay information.

Q. Have you seen the record that was made of a complete set on March 28th, which was subsequently I believe placed on the console and its whereabouts was unknown for some period of time?

A. I did not.

Q. You are now aware of this?

status of the EMOV?

A The discussions I recall in the think-tank involved the use of the block valve and the EMOV for venting off for the plant conditions we were in then and not the plant conditions that had progressed us to that point.

Q Your 30-page prepared statement stated that you knew that the hot-leg temperatures were greater than 700 degrees after about 8:30 a.m., and that you knew even earlier that the console TH instruments were pegged high.

Did you observe or were you told that the expanded scale multipoint recorder printout showed a sharp increase beginning shortly after the pumps were shut down?

A Which scale is that?

Q That is depicted here (Indicating on chart) during the time period again from 6 to 7 a.m.

A Is that the black recorder on the back panel?

MR. HARPSTER: It is the one on the back panel, Gary.

THE WITNESS: The one that is not necessarily the qualified grade instrument. It is not normally used that much. It has got a lot of points on it. It is hard to read

MR. HARPSTER: On the left-side of the console.

THE WITNESS: My recollection that I have of that time frame was that we were hooked up on TH with the test instrument. We were using that. There may have been a discussion with me that I don't recall on that black panel recorder. I always thought that the operators had a problem reading that black panel recorder. I knew it was there, but I don't think the RTDs are hooked to the RPSs where we were taking voltage readings that I remember and getting similar data, you know, in the range.

BY MR. MOSELEY:

Q Did you inquire, or were you told as to what had happened or how the sharp divergence between TH and TC had developed and when it had developed?

A I don't recall a discussion of that. I did recall in my testimony I think in that earlier time frame, 7 to 8 or 8 to 9 in the morning, a discussion of an evaluation of some heat removal. The TC we would have thought was low because HPI physically comes into the systems, I remember being told, and we would have expected that to respond to that colder water. TH would be on scale. That is one of the reasons we were looking for a temperature device. Plus I think we were using a steam generator pressure or temperature recording instrument. That kind of discussion remember in the early time frame as far as trying to determine some heat removal capability while we were pumpin the HPI in.

Q Early on you asked for a instrument to be set up to expand the scale of the TH indications on the console.

Was a record kept of the data from these instruments?
A I had a requested that a record be kept. I can't tell you where that is at or whether that was fully implemented, but I had requested that, yes.
Q Were you aware on March 28th that it was being kept? Let me go on to say that what I am getting at is was this record looked at or trends or movements or changes in these temperature indications?
A There were points during the day when I recall discussions with Ross I believe and some of the group about trending on temperatures, the differences in temperatures and differences in the loops in the temperatures. I can't recall specifics of the discussions, but I think that was a part of some of our think-tank meetings.
Q Was Ross or someone else assigned the responsibility for trending these data?
A I can't recall who would have been assigned.
Q Do you recall that someone was assigned?
A I can't recall a specific assignment other than that was a part of the discussions. I can't recall a specific set of words saying you do that trending. I guess I am saying it was implied in the kind of meetings I was having every hour or every two hours to discuss that, to trend it. The assignment could have come from some other level than mine.

Q Just to clarify, did you direct or request Mr. Ross to have someone do this?

A I can't recall giving a specific direction today.

Q In your statement during the Met-Ed group interview, and this was a recording that was made on April 12th, you said, and I quote:

"Our major concern was that the fuel didn't degrade any more than it had degraded from there on and to somehow figure out how to prevent that and how to stop this. I didn't really feel that we were stopping at the initial stages. I was scared of running out of water. The outside pressure that I was getting indicated that you could just pump this thing solid and I couldn't get it solid. You could have pumped all day, but I am convinced that without pumping water into the hot leg because you had to collapse those bubbles we didn't have a 4,000 pound system."

You also stated in your testimony to the Senate investigators on September 28th:

"We were pumping at that time or close to that time as high a pressure as we had decided to go, and the water level not changing or not charging the system solid. In fact, we were losing water to the reactor building floor, in other words, very hot superheated conditions."

Further in your statement to the Senate investigators on October 29th you stated, and I quote:

"Somewhere in the morning, maybe because of Lee Rogers' thrust, there must have been discussion of a superheated condition, but as of today I can't remember that."

Later in the same interview you said in another quote:

"I think sometime later in the morning we may have discussed steam conditions when we got into the core flood type discussion because we were aware we weren't getting anywhere by charging the plant."

You were then asked if you think that perhaps later in the morning the steam conditions were discussed and you responded, and I quote:

"I think that is true, and I base that on the fact that I think Lee Rogers and his people may have brought that up. I don't think that that made much difference from an action standpoint. I think we talked about going against the code release, but that is very hard to remember."

Now, a final reference. Zewe has stated to us that everyone was aware of superheat after the bridge was set up in on the RPS.

Now, my question is, weren't you aware on the morning of March 28th that hot-leg temperatures were in excess of saturation temperature for the corresponding reactor system pressure?

A I don't think I can add any more to the quotes that you have given me from what I have said previously. The essence of that was it is hard to remember at which time the steam conditions were exactly discussed, and from an action standpoint the concern was to keep putting water in.

Q Does that mean that in the morning of March 18th you were aware that the temperature was in excess of saturation; in other words, there was superheat conditions existing?

A I don't understand the question relative to everything you have read back to me. I don't know what I can answer to amplify it any better.

Q Would you like to refer to the records?

MR. BLAKE: Could we have the question repeated or have him read through it again.

THE WITNESS: Please do that.

MR. MOSELEY: I apologize for the length of it, but I was trying to capture the essence of several different things.

In your statement during the Met-Ed interview on April 12th you stated and I quote:

"Our major concern was that the fuel didn't degrade any more than it had degraded from there on, and to somehow figure how to prevent that and how to stop this. I didn't really feel that we were stopping at the initial stage. I was scared of running out of water. The outside pressure that I was getting indicated that you could just pump this thing solid and I couldn't get it solid. You could have pumped all day, but I am convinced without pumping water in the hot legs because you had to collapse those bubbles we didn't have a 4,000 pound systems."

You also stated in your testimony to the Senate investigators in September, and I quote:

"We were pumping at that time or close to that time as high a pressure as we had decided to go and the water level not changing or not charging the system solid, and in fact we were losing water to the reactor building floor; in other words, very hot superheated conditions."

In your statement to the Senate investigators on October 29 you stated:

"Somewhere in the morning maybe based on Lee Rogers thrust there must have been a discussion of a superheated condition, but as of today I can't remember that."

Later in the same interview you said:

"I think sometime later in the morning we may have discussed steam conditions when we got into the core flood type discussion because we were aware we weren't getting anywhere by charging the plant."

You were then asked if you think that perhaps later in the morning the steam conditions were discussed and you respond:

"I think that is true, and I base that on the fact that I think Lee Rogers and his people may have brought that up. I don't think that made much difference from an action standpoint. I think we talked about going against the code release but that is very hard to remember."

Then I referred to Zewe's statement that everyone in his view was aware of superheat after the bridge was set up on the RPS system.

THE WITNESS: The initial think you read me was out of what interview?

MR. MOSELEY: The initial one was out of your group interview with various Met-Ed employees on 4/12.

THE WITNESS: Is that the tape that I made?

MR. MOSELEY: Yes.

THE WITNESS: That tape was made amongst Ross and Zewe and the whole group I believe, right? Was that the tape we are referring to?

THE MOSELEY: Let me make sure.

THE WITNESS: Because I thought that was the 14th.

(Short pause.)

MR. MOSELEY: The reference there begins on page 28 and 29.

THE WITNESS: Bill Zewe's statement of everybody being aware, I am not sure I understand that. From the standpoint of my recollection on April 12th it was certainly better than September or October. I am sure that comes through with some of the statements you have read. I don't believe there was a discussion of superheat in the early hours. I am saying steam conditions were most certainly discussed as a part of the plant conditions in those think-tank sessions, and I can't specifically remember at what point in time that discussion point would have been a strong one.

BY MR. MOSELEY:

Q Again referring to this, would you conclude that it must have been sometime before the repressurization which occurred between 9 and 10 o'clock?

A It could have been that time frame or the time frame of the advertent depressurization which we went through with the thought about the core flood and all. You know, I couldn't pinpoint the exact point quite honestly.

Q Is it your statement that you were aware of superheat but you don't know at what time you came to that conclusion? Is that your statement?

A I can't remember at what time that point was discussed in the conversations?

Q But you were aware of superheat?

A Sometime in the morning I think we discussed steam conditions. I don't believe it was at 7:45 or 8:15 in the morning because of the number of other activities that had to take place to implement all the other things that had to occur. At some point in that think-tank Ross or Sellinger or somebody could have discussed that and I wouldn't remember.

Q But it was during the morning to the best of your recollection?

A I am concluding it was at sometime in the morning because of the conditions we went through in the plant moves we made. That is why.

Q Did you on March 28th recognize that temperatures in excess of 705 degrees were above the critical temperature of steam and in fact meant that the system had to contain superheat?

A Please ask that again.

Q On March 28th did you recognize that temperatures in excess of 705 degrees were above the critical temperature for steam and in fact meant that the system had to contain superheated steam?

A I was aware of that, but not as a heavy point of discussion as opposed to the action status and action recommendations and implementation. The conclusion was we had to keep the core cool, and that was the thrust of the pumping of water and looking at heat removal. It was a part of that kind of discussion, yes.

Q What was your evaluation of the meaning of superheated steam in the system?

A It is very hard to not be clouded by what I have read in the last year or so. I just don't recall discussions of that in those concise terms because the cooling method we were in wasn't recognized anywhere that had ever been studied.

The fact that you come in and all the indicators are off scale high wasn't a recognized condition for this reactor plant and it is hard to recall what that meaning was of something that hadn't had much training or discussion in the years of operation. So from a standpoint of what I know today and methods and means of countering this type of problem are different than they were on March 28th. The discussion involved how to cool the core from a condition that we didn't have recognized in any formalized training or implemented document.

Q I guess what I am asking, Mr. Miller, is what your evaluation of the meaning of superheat in the system is. Having concluded that there was superheat, and certainly this isn't something that you would have expected, but what was your assessment of this superheat? Did you relate it to core coverage?

A I can't today remember in our think-tank discussions the details of those kind of discussions. I just can't remember the evaluation or the conclusions that were reached other than trying to come up with action recommendations from the conditions that existed.

Q But I am asking what did you think?

A I can't remember what I thought on March 28th any more than what I have said.

Q What did you conclude was the source of the superheat, if it wasn't core uncoverage? Again, I am asking what you think.

A You know, it is very hard to specifically remember what I thought that day. From the time we got there and started the reactor coolant pumps we knew there wasn't water in the hot legs. Where was the water level at? There was no recognition or instrumentation to tell you that.

So what I was thinking was that we had to keep water moving into the core. Where was the level at? We had to make sure we took every precaution through the whole fabric of the thing to keep water moving on to the core, and I can't remember any more of what I thought that day other than the fact that there was recognition that there wasn't a full system. That is why the concern about water. That is why the concern about keeping the water on occurred to me in the early hours. It was the only know method I knew of of assuring core coverage.

If you look at the testimony somewhere we were aware that steam pressure was low in the steam generator and therefore natural circulation wasn't very effective. That was aware to us. For the conditions we were in we were no where near saturation pressure in the steam generator. That kind of discussion and conclusion was what I thought on March 28th.

To say we had this temperature and therefore we had "X" fuel degredation, I just don't think we had that discussion. We were very clear on the fact that we didn't have a full system, and the recommendations and the thoughts and the conclusions of the think-tank, including my own, were to maintain heat removal and water flow. It was the only thing we knew to do and we were looking at any other action that could be taken to bring the plant to stability.

Q But you did not attempt to relate the superheat conditions to what was the cause of this superheat? Am I correct in what you have told me?

A I just don't feel we had the evaluation time in the control room to very carefully and calculatingly deduce this is how the plant got to this point. We were concerned about getting it to a recognized point before we discussed how we got it to where it was and what caused it to get there.

Everything we did was to try and bring the plant to a stable condition so you could discuss what had happened to the plant. If you had taken the time and critiqued the hours of four to seven in the morning, you wouldn't have been able to perform the emergency plan or handle the plant conditions. We were not in a mode of stability yet.

Q It was my impression that that was the purpose of the think-tank was to assess what needed to be done and to assure that that was done, and it is also my impression that one needs to know how you got there in order to know how to get out of it. Do you have a different impression?

A I don't have a different impression, but I am saying that the ability to go back in time is somewhat restricted when you are still in a serious condition. So, yes, that is a part of the think-tank purpose, but the other part of the purpose was to figure out what to do the next your or the next two hours. There was a lot of focus on the requirements of an emergency plan that had to be met with as much importance at that time that the plant had.

I am not disagreeing with you, but it is a matter of time and availability of information and the availability of more technical talent. It was, you know, communication with a lot of people who I felt were going to help analyze and to make the next recommendation. That was one of the reasons that the think-tank included the people it did. That is one of the reasons it included the technical people. It included Lee Rogers from B&W. That was the whole purpose of it.

Q Do you believe that a very important part of assessing where you go is assessment of how you got there?

A I don't disagree with that. I think full assessment while you are in the crisis is hard to arrive at when you are looking at a hundred indications or forty indications and you can come back at a subsequent time and pick the right priority of information to display exactly what happened. I am just saying that the amount of exactness that you can deduce during the crisis is not at the level where you are at today with this chart you have in front of me. The chart took six months to make and I went through a lot of questions and had people in other places for weeks at a time. I am just saying that type of analysis can't be done during a crisis. Yes, I agree with you, but under those conditions.

Q Well, we have talked about so far the fact that there was knowledge that the HPISI flow and the problem of let-down flow was increased, the reactor coolant pumps were shut off because they weren't pumping water, the MOV had been opened for some extended period of time, the hot-leg temperatures were significantly higher than one would expect, and in fact were in the superheat condition.

Did you infer from these that there was an inventory problem and that the core may be in trouble?

A We inferred that there as an inventory problem, and we were certainly aware of some fuel damage because of the readings in the building. But to infer that the core had, say, been empty, we didn't arrive at that point in our minds. I had never discussed that in my whole life prior to March 28th. Therefore I was concerned and action was taken to ensure water went on the core. As to whether the core coverage was of a certain amount based on those things, I can't recall that lucid a discussion of that, other than assurance that the core was kept covered.

Q Given these indications, isn't there reason to suspect that it might not be?

A There is reason to suspect that it might not be, yes.

Q What efforts we made to determine the extent of inventory deficiency on the morning of March 28th?

A I guess I don't understand the question.

Q There are various ways of inventorying the primary coolant system and from that inferring or calculating the deficiency.

A How do you determine the primary coolant system?

Q How do you normally do it?

A The pressurizer level. We knew that was no good. What else is there? You said that. I don't know that there are many methods of determining primary system inventory.

Q I am asking you what did you do on that day? What was done, to your knowledge.

A But you stated there were many methods. I am saying that I don't agree with that.

Q The question that I asked you was what efforts did you exert on that day to determine this?

A From the time we got there and started the reactor coolant pumps and saw them pump a hundred amps we were convinced we didn't have a water level fully in that whole plant. The efforts we had were to assure that the inventory which we couldn't see didn't degrade. I can't remember efforts in the research over how low it had gotten or how deficiency the inventory had been. Today I can't recall discussions along those lines.

Q I understand that there were isometric drawings taken out on the basis of the pump performance.

A To look at elevations of the plant, where the hot-legs are, where the top of the nozzles are and where the HPI comes in.

Q Wouldn't the core exit thermocouples be an indication of core level? Wouldn't the water level be indicated by the nuclear instrumentation and other factors?

A Core exit thermocouples weren't even wired out except by a quirk of design. I called for a set of those readings because of my experience in test programs in naval reactors where we used them. They weren't recognized, they weren't in the procedures, their accuracy was in doubt and they were never used to my knowledge in that plant for a core condition.

Yes, to day I can very quickly conclude that that is true. I don't believe that was a very rapid conclusin on that morning. We looked more towards recognized indicators. That is why we went to the test equipment on the RPS temperatures because they were qualified environmental instruments. The core thermocouples were recognized that I know of. They weren't even wired out in Unit I.

MR. STELLO: Norm, I notice you are getting away from the superheated steam. I wonder if we could just chat for a moment, Gary.

BY MR. STELLO:

Q Normally when you are operating a plant there is a fairly easy way in which to look at where are the hot temperatures, where approximately they are. So if you ask yourself the question do I have superheated steam, given you have talked about it, what do you think about it? You are an engineer. What is going through your mind?

A We have overheated something.

Q Good. How? What is there in the plant that was capable of generating that high a temperature? Let's try to go through it. You certainly can't do it in the steam generators, right?

A You certainly can't.

Q There isn't anywhere in the plant where the metal can be hot enough to do it, right? It is higher than any metal temperature we have ever been, true?

A True.

Q What is left, the core?

A The core was the heat source.

Q Is it not clear that as an engineer you have to say if I am going to get this steam hotter than saturation I have got to raise metal higher than saturation heat to steam, true?

A Or I have got to limit cooling to the core which is normally at a pretty high temperature anyway, the fuel elements themselves.

Q That will do it, because you have got water.

A We didn't have heat removal. We knew we didn't have good heat removal. We knew that.

Q No, no. If you have water and you know you are not going to get superheated steam, if you are transferring heat to water, true? Thermodynamically you can't do it that way. Isn't that true? If the core is covered with water, even if you have poor heat removal, if the heat is going to the water you can't see 700 degree temperatures.

A I don't disagree with you. I am not sure of the condition you are in when you have, say, some partial uncoverage and at what point you could end up with hot fuel elements and that type of thing and the exact steam water conditions that would have occurred.

Q Okay. But are you saying that in order for you to get superheated steam you really concluded you had to have at some time core uncoverage? The core had to be uncovered?

A I guess I am having trouble with -- you know, the plant normally operates with superheated steam coming off the steam generators.

Q Out of the steam generators.

A Coming out of there with water boiling in there and going up through phases. Now, I am not sure, and never was made that familiar with the conditions that would occur if you start to have conditions in the core where there is superheated regions and ~~nuclear~~ boiling regions or what would have occurrd in that kind of transition. I am relating it to what I know about a B&W plant.

Q But as an engineer you knew in the steam generators the only way you superheat is to have steam in contact with the hot tubes, right?

A That is right.

Q An analogy then, you have to have steam in contact with the hot fuel elements.

A On steam generator you have some level indicators.

Q I understand. But I am trying to understand did that analogy allow you to conclude the core is uncovered?

A And I can't recall that analogy in discussions on March 28th. You know, I am sure that our discussions were in terms of the inventory deficiency, but I am not sure how far the discussion went relative to the technical terms we are talking of now as far as superheat and lack of superheat, you know what the temperature was and what the degredation of inventory was.

Q A few minutes ago you said you clearly knew you busted up fuel.

A I said we knew there were some degregation of fuel.

Q You busted fuel and you got fission products. I inferred from that that you knew you had poor cooling and the core overheated and busted some fual, true?

A We knew we had some fuel degredation, Vic, and we knew we had insufficient heat removal.

Q But I am trying to make certain that you coupled the two. The degradation of the fuel was a result of core cooling.

A And I can't remember how close that coupling was on March 28th is what I am trying to say as far as the actual discussion.

Q Give me any other intrepretationd that comes to your mind even now. How do you degrade the core without it being the result of core cooling? Even today can you think of a way?

A Of degrading the core without having a lack of core cooling?

Q Yes.

A No. Unless you are talking of, you know, of some other mechanical damage.

Q Oh, yes.

A Other than that, right.

Q I am talking about the core staying in the fuel without being physically damaged.

A Yes.

Q So the degredation of the fuel you did couple that morning as a result of the core cooling?

A I am saying I can't remember the coupling of that in the discussions of that morning. I can't honestly remember the nice tie we have just discussed.

Q I am not looking for nice ties. I am looking for can you conclude anything other than that you knew you had busted fuel somehow, that that was a result of poor cooling? Is it reasonable to conclude that that was understood by the people that were analyzing the problem then?

A At some point in the morning that was certainly understood and it is one of the reasons we asked for flow rate from B&W for decay heat, the same reason. How much heat removal do I need for what we are at.

Q Good. Now, let me try again looking at the superheat. What do you think was the nature of the core cooling? Describe for me how can you get core cooling in the reactor some two hours after shutdown? What does it mean to you. What does core cooling mean?

A Well, core cooling to me means that we knew natural circulation was adequate for the design of the plant and we weren't getting adequate natural circulation. Beyond that point on March 28th I don't believe there was any information available other than the stuff you knew you had, to pump water in it at the flow rates you had available.

Q Yes, but I am trying to get you to help me understand poor cooling of the core. What does that mean to you?

A And I am saying that what it means is that we were out of a recognized cooling mode and therefore we knew that we had to have more cooling. We didn't know how much more.

Q Gary, we are passing each other in the night. Core cooling, let me give you some things that come to my mind. The flow rate in the core was lower than it should be. There was not enough water. I had steam in the core with water. I had steam blanketed fuel. These to me are concepts of inadequate cooling. Are they the kinds of things that you think are inadequate for cooling?

A Those are kinds of things that I would connect with that, yes.

Q Was any of that connection made during the day, core uncovery, steam there?

A And I am having a hard time recognizing whether we discussed that specifically or at what point in the day it coupled the way you have, Vic.

Q You had a lot of people in the control room.

A We didn't have a lot of people in the think-tank though.

Q No, but in the control room who hopefully were feeding information to the people there, or I hope that was the management concept you were working under.

A That was the management concept.

Q Good. Of all of those people that somebody didn't say, hey, if you have got superheated steam there ain't but one way to get it. The core has got to be uncovered. That kind of conclusion never popped up all morning?

A In the think-tank meetings, hey, the core is uncovered was not, you know, wasn't brought out to that degree.

Q Was it brought out to any degree?

A The amount of core uncoverage was not, to my knowledge, discussed specifically as much as how do we maintain water in there.

Q Gary, not amount, because I can't tell you that even today, how much. Not degree; concept. Core uncovery caused superheated steam. Did anybody hint at, suggest at, and then you would quickly come to the conclusion I have got to get more water in, right, which you did come to?

A As far as the conclusion to get more water in, you know, the recognition early in the morning of inadequate natural circulation left you only one way of doing anything. That was arrived at without even having to have the other discussion you are talking about. We had to put water in. There was nothing else available. It doesn't matter what the conditions were. At 8:30 in the morning I said put water on now even though people were saying don't put water on.

Q Because you needed natural circulation.

A People that were out in the control room. That is right.

Q That is what I am trying to say. That is clear to me.

A And it was clear to me, not even needing to know temperatures, just needing to know the steam pressure.

Q I understand that, but did you also know that you weren't at that time getting enough water, there wasn't enough water because of superheat?

A I didn't know how much water I needed.

Q I understand that, too. Do you understand my question? Was there anyone coupling the only way to get superheat was core uncovery? Did anybody suggest it?

A And I can't remember that. As of today I can't remember that being suggested clearly at any point at least in the early hours in the morning.

Q Forget the early hours. At any time that day. Don't put time contraints on it.

A I can't remember. You are right, I shouldn't put time constraints. I can't remember it in the afternoon either. You are right.

Q I find that very hard to understand that here you are stuck with temperatures that the only way to get them is to have a metal, a heat source beyond anything you ever had in normal operation. You know, the coupling, at least the question is the core uncovered.

A Or the question we were asking is is the core covered now. That is the question. We weren't asking has the core been uncovered in the early hours. We were asking how do you keep the core covered now.

Q Right.

A That is what we were asking ourselves.

Q Right.

A Using the only systems and methods we had. That is where we were at.

Q And how do you know if it is covered?

A How do you know?

Q Right. If there is superheated steam you should have a question about it. Today you know that for sure.

A Today there is a whole wealth of ways of handling this based on this.

Q Agreed, but that is not a very sophisticated concept. With all the people there I am trying to understanding how it would be that nobody brings it up. To day that you had superheated steam and then drop it doesn't seem rationale to us. All of us bureaucrats sitting on our duffs in Washington, that is what we were fussing about.

A And I think at the time of the crisis, Vic, I really believe we were trying to look for anything that would tell us any other method of arriving at stability more than the coupling you are talking about. Do you know what I am saying? We are saying what else can be done in the plant and what else do we need to do in the plant.

Q Let me try one more way. You had a concern and you wanted to put water in. You knew you had busted up some fuel and you knew you weren't getting enough coolant. Those were things you clearly understood that morning, right?

A Yes.

Q Okay. The only thing you could thing you could think of is turn on the pumps and put more water in, right, as an engineer?

A As an engineer with some knowledge of the plant that was the only method I knew available.

Q As an engineering then wouldn't the next question be how do I find out if that was effective? Did that thought enter you mind?

A The thought that entered my mind is how do we determine how much heat removal we need versus much we are putting in, yes.

Q What did you consider to be indicators of whether you were being successful or not?

A I think we have gone through that. We locked at temperatures in the RCS, we locked at the steam generator pressure and we put an indicator or an a test instrument on the RPS on the hot legs if I remember right. We put that on there because the on-scale meter was off.

Q Slow down.

A Okay.

Q You wanted to look at that temperature. What were you expected it to do?

A At the initial stages of looking at it, Vic, there was no high temperature on scale available, so the initial idea was to get some reading in addition to the other information.

Q You had a reading then. What were you expecting that reading to do as you added more and more water?

A As we added more and more water throughout the day we were expecting that reading to come down.

Q So it if stayed superheat it was clear then, was it not, that it wasn't covered with water? Those RTDs took the drawings out and you looked at them, should you not have concluded they weren't covered with water?

A Hot-leg RTDs I think are located up above the coolant.

Q Yes, the are in that straight run area.

A I think that even early in the morning when the pumps started and we looked at the level we knew there was water missing out of the hot legs, yes.

Q But my point being that as you kept adding water you knew you never got those thermocouples covered?

A I think we knew that those were in a steam condition of some type because I think there was some discussion at some point during the day about how accurate were they in a steam environment versus their qualification which was in a water environment, that type of thing. I mean, I think there was that kind of recognition.

A That means you had that part of the system empty of water. So you should add more water. What is another thing that ought to come in your mind? Is there any other indicator? You had this Navy training with the in-core thermocouples. Were you thinking they might tell you if you covered the core back up?

A Either me or Lee asked for those initially because that was a part of the initial getting of some indication.

Q Indication of what, Gary?

A Of temperature. You know, when you go in and you look at the panel on TH which is off scale high we began to look for an instrument on the high end. That is my memory of their initial, you know, why we started looking for, you know, some indicator. And once we had at least an indicator, I don't believe the in-cores were really a point of our discussion any more.

Q You never thought of the in-cores as an indicator of water level, that they weren't covered with water?

A I don't believe I did, no. I asked for them, and then by the time I got information on them they seemed useless to me because the conversation indicated they weren't reliable. At the same time we got the RTD hooked up to a bridge and that was giving some information.

Q On the hot leg?

A That is right. But you are asking about heat removal, and I am saying that that was one. There was steam generator down cover we were using, there was steam generator pressure we were using and we were looking at heat removal determination, yes.

Q But you looked at the RTDs and concluded that that was also a level indicator, that they were in a steam environment.

A I didn't say we concluded it was a level indicator. I am saying that just starting the pumps before that instrument was available I think told us that we weren't going to have a water environment on those RTDs because they are up in the hot leg.

Q Okay, so they were in steam. That is what I mean.

A And there was even discussion I think of the accuracy of gross versus fine, you know. That is a qualified instrument.

Q But you didn't have that same thought with the ---

A Didn't even consider them qualified. I mean, in my mind. Had they come back with a consistent set of readings on them that I was aware of then I might have changed my thought process on the in-cores. But I have said before when they came back, you know, there was nothing at all that I could see from them. What came back to me said there is one here, there is one zero, there is one there. It would have been tough to pick the one I was going to use to believe.

Q It could have been another connection to superheated steam.

A It could have been another connection for superheated steam.

Q But that was not made?

A It was not made.

Q By anyone?

A By anyone that I am aware of.

Q It could have been an indication of core uncovery. That was also not made.

A To my knowledge, it was not made. They do sit above the active core though. You mean from the standpoint of the steam ---

Q That those thermocouples were uncovered, that was never brought up?

A That I don't remember being brought up. We were aware that the RTD was uncovered because we knew where they were at and we knew when we got the elevation drawings out and we knew when the pumps didn't run and we knew the hot legs were not full of water.

Q But you made no analysis?

A We didn't make an anlaysis. We didn't go back and discuss the in-cores. That is exactly what I remember. We did not go back on the think-tank or myself even, my inputus for them didn't come back to me. I got those things and I was told they were unreliable and I guess I did not pursue and question the in-cores further once I got the initial shot from one of the people that they were not reliable.

Q Okay. Let me ask you now without trying to recall a specific conversation with anyone or anything else. In your mind as you search back now, was there ever a time in the day when you believed the core was uncovered?

A As I search back, Vic, I can't honestly remember what point of level I thought the system was at, including the core.

Q I am not talking about the degree. Did you ever believe the core to be uncovered? By that I mean the water level, two phase, dropped into the core somewhere? That is the top to the middle, I could care less. Just the fact that it was uncovered. Did that enter your mind?

A And I can recall specifically the thoughts of that day.

Q That is what I am trying to tell you. Don't try to get specific, just your general impression of how you felt.

A I think the general impression was that there was a possiblity of some level near the top or maybe partially -- you know, I am saying I think there was thought of some minimum uncoverage as opposed to an empty core.

Q The degree is not ---

A But the degree is where we were at as far as heat removal.

Q Not the degree to which it was uncovered, but whether or not it was uncovered.

A I don't believe we felt that if it was uncovered that it was of any magnitude is what I am trying to say, Vic. We might have believed that there was some steam envirnment on the top of the fuel rods, is what I am saying as opposed to, you know, is the core uncovered. We didn't believe that we were doing anything that was going to put us any further than we were, and that is the best I can do.

MR. STELLO: Okay.

MR. HARPSTER: Gary, help me out a little bit. One of the things in looking back at this and reviewing the testimony we got into some confusion. When you got down to the trying to start the reactor coolant pumps and obviously you had the low steam pressure in the hot leg, and you saw the hundred amps and from that you tried to draw some conclusion about what the state of your system was. I believe you said was you got out the isometrics now and were trying to draw some inference from that. Do you recall who checked the isometrics?

THE WITNESS: I think Ross and Sellinger. That menas they were probably out by the computer console and there could have been Zewe and other people there, but I am pretty sure Ross and Sellinger would have been technically the two that were talking to me. That is what I think, Terry.

BY MR. HARPSTER:

Q George Kunder in his testimony ---

A And he could have been another one. It is just the name slipped me.

Q George has expressed the concern many times that that morning his belief was that the core was being cooled by steam. In fact he was concerned about building up a boron slurry down there because of the steam.

A He was there in the early, early hours. At five in the morning he was there. And he has said that at the point of time of 6:30, somewhere in there.

Q But he goes on in his testimony to say he has had this concern throughout the morning and he can never assure himself that he not cooling the core by steam, and in fact when he talks with us at 9:30 in the morning he describes the core as being cooled by superheated steam, some superheated steam mechanism. Did he discuss that in the think-tank that day?

A I don't believe so.

MR. BLAKE: If there is a question about the time here, Terry, it might help to pull out these Kunder statements that you are referring to.

MR. HARPSTER: We have conflicts in the testimony and I am trying to understand what concerns were raised with the think-tank. We have Mr. Kunder with the concern in his testimony that the core is being cooled by steam and is uncovered.

MR. BLAKE: To the extent there is a time difference in what he recalls, if we have George's statement here maybe we could take a look at it and sort that out.

MR. HARPSTER: I do have George's statement.

MR. BLAKE: Maybe we could take a break and look at it.

MR. MOSELEY: We are almost ready to go into another subject so I think it would be a convenient time to take a break.

MR. HARPSTER: I was just trying to see if Gary recalls George expressing his concern.

THE WITNESS: I do not.

MR. MOSELEY: Let's take about 10 minutes.

(Whereupon, a short recess was taken.)

KUNDER: I had thought yeah, I think it was the B loop pumps, because I recalled the flow went down in the B-loop pumps. I believe that they secured the B-loops so that we could still have adequate spray flow and the A-loop gives you more pressure and you get better spray flow, gives you better pressurizer spray control. But at any rate, we finally ended the conversation and Gary and Lee Rogers said they were coming. Joe Logan I think was the first Senior person to come into the Control Room. Best to my recollection we had already secured one set of pumps by the time Joe came in and it was about the same time frame that when, it was either about the time he came in or shortly thereafter that we secured the second set of pumps, because the flow was starting to degrade on the console flow indicator I seem to recall that it was the flow in the A-loop, two pumps running was up above 60% on the indicator and the flow was degrading and had degraded somewhere I think in the region around 30% so it was clear to me that flow was decreasing and that it was thought we were cavitating. So, the Shift-supervisor secured that set of pumps expecting to go on natural circulation because the pressure was low and we didn't want run into cavitation problems with the pumps. I guess prior to that point I started to get into a different thought process, I had a, Bubba Marshall had come into the control room, and Scott Wilkerson was still there and I had asked to have a shutdown margin calculation performed and I wanted to get the boron concentration from the system. I had asked Bubba Marshall to call the lab and get a boron pretty quick. Again I was sort of concern where this water was coming from but at that point I still felt, it still appeared to me that somehow we other water in the system and I didn't know where it had come from. Cause the operators had indicated to me that they didn't have high-pressure injection on for that long that it would have filled the system up and we would have gone solid. I didn't understand that. I had a, let me think. Dick Dubiel had arrived and I told him that I had asked for that boron sample and asked if he'd go down and coordinate and make sure we get the boron sample, get the results of them and I guess it was an interim period of perhaps 15-20 minutes or 30 minutes before Dick got back to me. This was probably close to, when I asked Dick to go down and check on getting the sample I believe it was around between 6:00 and 6:15 that sort of thing, so it would have taken them a certain period of time and by that technicians may have been getting a sample cause that had been asked for a little bit earlier. Dick had called up to me, and I believe it was around 6:35 or so maybe 6:40 and he called up the result, and he said the first, I think he said the first two samples indicated 700 ppm boron and he said the next sample he didn't think that was right so they had another sample that was 400 or something, I don't recall the exact numbers but that change all of a sudden really frightened me, because I thought I hope that's a bad sample analysis because I couldn't at that point I started to think my God, maybe were getting demineral water in through some flowpath, I just don't understand.

<u>KIRKPATRICK</u>: This was really only a few minutes after the second set of pumps were cut off, probably around 6:30?

KUNDER: It was to far from that time frame. I didn't know what initial boron was I walked over to the status board and it was a little over a 1000 ppms that was the boron concentration that we should have been at at that point in time, then the thought went through my mind, Oh my God, were deboring the system and I told them you got to get another sample and tell me whats wrong, at that point I asked Bubba Bubba Marshall, that is to start looking at the Unit 2 system and see if there's anyway possible we could be getting demineralized water into the system. Then again the primary side I just was not familiar enough with over in Unit 2 and although the basic B&W system is the same, the interconnections and rad waste system are totally different between Unit 1 and Unit 2 and I had very little feel for the various system the configurations and soforth and how we could be getting demineralized water so I went through my head, maybe we had demineralized water in BWST and somehow we may have this in our sample analysis, but nonetheless Bill Zewe initiated emergency boration at that as a precaution. At that point, I knew something was really, really wrong and at some point in time in that same timeframe I was alerted or I even noticed or somebody mentioned that the NIs were kind of high, I went over a looked at sources ranges instrumentation and the source ranges were reading in the range of about $10^5$ counts, intermediate range had come onscale and it was about half a decade to almost a decade onscale. The only thing that was going through mind at that point, is that the reactor had gone critical again. I didn't understand what was really happening, I think I understand now, we think we understood after the fact we seen, but at that point in time I thought my God we've been deboring the system, somehow that's how we've been getting all the water in the system and we taken the reactor critical, so I started to urge, we got to get high-pressure injection back on, we got to get some borated water, what we thought was borated water back into the system and Mike Ross was in the Control Room at the time. I remember him commenting to me George we got to do something because, there was a, the guys just set there at console and I guess Joe Logan just weren't sure of what the next step was and all I could think of was get that damn high-pressure injection on, that was the only thing I could think of. There was nothing else to do except to get some borated water into the system until we understand what was going on. And so we did initiate high-pressure injection and I seem to recall I even yelled it out, get it on, I don't care, we got to get that thing initiated and now. So that was done, immediately after we asked for it and continued thereafter. Dick called up very shortly thereafter and I heard him screaming over the page George Kunder, George Kunder, line one and I answered. Dick said, George the sample line had just went up up to 600 mR/hr, and at that point I realize oh my god were failing fuel and I yelled at Joe, I said Joe were failing fuel, Dick gots 600 mR/hr at the sample lines and that was right around 6:45 in that region and I said hey were into site emergency, its the real thing and site emergency was declared. I turned around and told Ron Warren and Dick Bensil and who had been in the Control Room, .. oh I think just before that Ivan Porter who's my lead I&C engineer had come into the Control Room and I briefed him on what had happended, on what the plant was doing and I seem to recall, I may have mentioned something about failed fuel, we were getting high activity in the system and that was all pretty much around the same time frame, but I do recall telling Ron Warren who had been in there and Dick Bensil to get on the phone and start making the phones calls and we went into the emergency procedures and began the emergency response and I don't know, at that time I really started to just starting reacting to the condition and really getting it clear in mind, we were in a real emergency situation and we got to initiate the emergency plan and you know from that point on I was, I don't know how to put it, just keyed up to carry out those emergency plans and keeping the plant in a safe condition. Bill Zewe as I recall pretty much directed his attention to the console and it was around the same time frame that Gary Miller came in, I think he came in, he definately came in after the site emergency was declared, Joe Logan was the Senior guy at the time the site emergency was declared and Gary came in I would estimate 15 minutes or so after the site emergency was initiated and Gary took charge of the emergency as Emergency Director and the emergency teams were formulated. I basically was responsible at that point to work for Joe Logan, carry out any technical activities he needed, make sure communications was established with the State, that was my first concern, to get hold of the Civil Defense and I did put two engineers on it, because through previous emergency drills it just takes a long time to make all the phone calls. The first one of course is to the Civil Defense Duty Officer and maintenance times that goes to get them notified so they could notify the Bureau of Radiological Health and get that part of the plan moving.

<u>SHACKLETON</u>: At this time we'll end this tape, its 9:02 p.m., April 24, 1979 and we come on other tape.

SHACKLETON: This is a continuation of the interview of Mr. George A. Kunder. Time is now 9:05 p.m., April 25, 1979.

KIRKPATRICK: George you were, you had just commented that you had starting making the appropriate calls, Joe Logan was the Senior man on site at that time. Does that make him the Site Emergency Director? And shortly, then, Gary Miller came in. At that time does he assume the ...?

KUNDER: He did. Gary first appraised himself of the plant conditions and what we had and Gary, I thought, very forcefully took over as the Emergency Director. He announced it, and he indicated that he, myself, Logan, I think he said Ross, and I know he said Dediel were the guys that talked to him, to try and establish good clear communications paths with the people in the Control Room. And there was the... communications were being established by someone else between the control room and the emergency control station. In otherwords, between ECC and ECS. I was pretty much making sure that the calls were being made to the offsite people and we got someone... I can't remember who it was anymore... to keep the emergency status board and I wanted to make darn sure that we go the information from the callers, Ron Warren and Dick Bensel, out to the emergency board. That worked fairly well. We had clearly identified who was called at what time. In fact, there was a photograph made of that, so we wouldn't lose that information. That part of the drill got started fairly well.

KIRKPATRICK: Step back a minute, I want to keep the emergency in mind, I want to ask you earlier about the conference call between yourself and Jack Herbein and Gary. Did you keep a log of that or is there a record of your call ...?

KUNDER: No. I did not keep a record, Jack or someone on their end may have kept some notes.

KIRKPATRICK: We're down to the point were the emergency has been declared now. If my sequence is correct, the emergency occurred, you saw radiation increase when Mr. Debiel was down in the lab.

KUNDER: Dick saw the increase down there. When he told me what his problem was, it was within seconds that the alarms in the back panels of the RMS starting coming in. At this time in my training, I'm not familiar with which alarms go to which area, but I saw the alert and the alarm lights coming in and they all started coming in very, very quickly. I knew that there was probably a dome monitor in each unit. I was not aware that there was other monitors in the reactor building. I'm not sure what they did, but the alarms for the area monitors or the atmospheric monitors in the Auxiliary Building or fuel handling building were apparently going off. A lot of alarms were coming in.

KIRKPATRICK: Were you aware they started the reactor coolant pump at that time, or do you recall that?

KUNDER: I was aware that the coolant pump was attempted to be started. I thought it was only started one time. But I learned a little later that they had tried to start one and it didn't work out, but I observed when they started the--let me think, I think it was the 2B pump, if I'm not mistaken. There was one control switch in the far right. They started the pump, the indicating light was red. I looked at the flow indicator, it read zero. And I seem to recall Mike Ross and Zewe wondering if it was really running. They called for someone to go down to the switchgear and check to see if the breaker was closed. And you know they said it was, and they recognized it probably was running, but you know it was just pumping steam up. There was just no water in the pump and that is why we didn't see the flow indication. About this same time by the way, the intermediate range counts dropped off.

KIRKPATRICK: Did that give you any kinda--did somebody report that to you, for instance, or were you watching your intermediate range?

KUNDER: I wasn't watching. I looked at it just after it went down, just to verify that it was going down?

KIRKPATRICK: What does that mean to you? At the time, I mean?

KUNDER: At the time I was sort of relieved, but I still didn't fully understand what we were seeing. I think it was later on when John Kenna, of B&W, had been in the control room that he mentioned that probably was due to the fact that we had the core uncovered, and that the the neutron leakage output to the out-of-core detectors was greater, and we were seeing the higher count rate. And that all correlated. You know, after the fact you start thinking about this, and then it fowls up your memory a little bit, because you know--I wasn't--you almost think you recognized it at the time but I don't think I really did. I did not recognize why the counts went down.

KIRKPATRICK: During the period the pump was off, somebody...

KUNDER: Excuse me. I think probably what's going through my mind is the high pressure injection was having some effect, but I just can't recall exactly.

KIRKPATRICK: During the time you had the high pressure injection going in at the normal rate, 200 and some gallons per leg.

KUNDER: 250.

KIRKPATRICK: 250, ok. So you felt that would be boron water? Cooling water?

KUNDER: Right, it would be 2270 ppm.

that called for site emergency.

I don't recall exactly what they were doing at that point. Our gears shifted into responding to the emergency condition, and I became involved with assuring that our emergency plan was implemented at that point.

I do remember the conversation with John Flint, but that was after we had achieved the general perception that we were having steam voiding in the system, and his explanation or his conclusion as to why we saw the indications we did made sense. They were consistent with what we felt existed in the system.

We felt that we had steam and then we did not have the moderation that we normally would have for the neutrons.

Q Did you at any time on March 28, 1979, discuss the apparent return to criticality with the subsequent inferences of core uncovery or voding with Messrs. Miller, Rogers, Herbein, Zewe, or Chwastyk?

A I don't remember any discussions.

Q To the best of your knowledge, was the count rate behavior or apparent re-criticality reported to the NRC on March 28?

A I don't remember if that was reported or not. Again, it would be in the tape if I did. If I didn't, it didn't represent a significant item at the time that I had the conversation because the rate count did come down.

I don't remember if I associated the increase in the count rate with the voiding prior to my conversation with the NRC or if that came afterwards. But, the time frame was that it woul have been just after John Flint came in the control room that I became aware of the connection between the two.

Q In your opinion today, should the information regardin the count rate behavior have been passed along to the NRC or the inferences from it?

A All the information that was available should have bee passed along to the NRC. At the time, I believed that I had passed on all the information that was available and pertinent within the time frame that I had to discuss it over the phone.

BY MR. MOSELEY:

Q Let's go back a little to the discussion of Flint's conclusion of the voiding. You were asked if you discussed with some named individuals, was that discussed in the think tank with the management group, to the best of your knowledge?

A I don't remember it being discussed. I suspect that by the time we really got into the management team environment tha that was a parameter that was passed, and not of immediate concern It may have been because by that time I had linked the two together in my own mind. I cannot be sure.

BY MR. HARPSTER:

Q Let me ask you some questions about the in-core instrumentation, George.

To the best of your knowledge, what are the core exis thermocouples used for during normal operations?

MR. McBRIDE: At Unit I, at Unit II, or in power plants in general?

BY MR. HARPSTER:

Q At Unit II.

A Now, I am aware that they are used, if anything, for diagnostic reasons.

Q I am sorry, prior to the accident.

A I don't remember thinking about them prior to the accident.

Q Had you had any training on in-core thermocouples at all?

A Just the fact that they existed. I was aware of that. But at their termination, they don't go anywhere.

Q Are you aware of any other station personnel who would have had training on the in-core thermocouples?

A Well, when you say, training on in-core thermocouples, do you mean were there other people who were aware that they existed?

Q I was thinking more of training in their use, what they might be used for.

A The instrumentation engineers that I became responsible to supervise when I came over to Unit II, of course, were familiar with the fact that they were installed and presumably they knew that they were hooked up.

Logan: Abnormal pump configuration and normally you would want to maintain as much flow as you could through the core to remove the heat.

Hunter: I understand that. I tried to ascertain can you recall then after coming in and maybe talking with Bill with looking the charts over in the control room and then talking with George Kunder do you recall the two more pumps being secured while you were there within the first few minutes?

Logan: Right now I can't recall whether that happened before or after I got there.

Hunter: Did you spend some time Joe with Bill Zewe that morning you know when he came in discussing the plant conditions?

Logan: I didn't have much of an opportunity because when this... My first intention was to see that the calls had been made this was an abnormal situation and I wanted to make sure that one, Miller had been called and informed of the situation. I walked back out Zewe was having problems trying to get this thing under control because of the abnormal indications and my mind is kind of hazey right now as to what went on at that particular time you know trying to decide what we should do. I do recall we tried to start a pump. I can't remember if it was shortly after I got there or not but we had received a report sometime shortly after I got there of a boron sample which indicated a low boron content and as I recall we were concerned whether we were getting an acçurate sample. The results were I think were around 700 dpm when we were running at that time around slightly over 1000 dpm so the concern here was that an accurate sample or not. As I recall we also had an indication about that time of an increase on our source and intermediate range meters. George Kunder I know had was concerned that we might actually that could perhaps have been an accurate indication and as I recall I believe we reinitiated, or we initiated emergency injection they had initiated this before and secured it. I might point out in previous reactor trips we had initiated high pressure injection and subsequently corresponding with that high pressure injection we have the you know sodium hydroxide injection also and this has caused us considerable problems of course in removing the sodium from the plant and they secured the high pressure injection ... I'm getting this ... from .... Talks that I had with them after this occurred of course, they had secure that when the pressurizer started filling up you know. That indicated that they certainly had enough water in there and they didn't want to put anymore sodium hydroxide in the plant and they secured both the sodium hydroxide and the BWST, the high pressure injection.

Hunter: Okay. When you had discussed with George Kunder earlier you indicated you had discussed the reactor coolant pumps, the problem with the pumps, do you recall any other specific areas that you and George had talked about? net potitive suction pressure curve pin compression limits I'm trying to key on anything that you may have discussed. It's looks like at 5:45 you logged in at the gate. It's looks like at 5:45 that all the pumps had been secured.

A. Well, I guess eventually, yes, you know. Certainly I wouldn't have expected to get the high radiation alarm in the reactor compartment, no, and that may have been the thing that triggered my mind that we had a very serious problem.

Q. Did that lead you to conclude the core had been at least partially uncovered?

A. What, the one in the high range?

Q. Yes.

A. I don't know, at this particular time, what I thought about what had caused it, except we had one hell of a problem, or were going to have one.

Trying to -- you know, sitting back with 20/20 hindsight and knowing everything we know today, you say, why didn't you recognize that. Again, you have to experience it to appreciate it. You can sit up here and go through the testimony and everything and Monday night quarterback and say, gee, you should have recognized that. You can't. No way. You can't. You can't take people down and fight a fire in the same situation that existed in the actual conditions.

BY MR. CRAIG:

Q. Concerning your early morning increase in this source range nuclear instrumentation and intermedial nuclear instrumentation, you told the IE investigators again in your May 9, '79, testimony that the source range indication really bothered George Kunder.

Did you observe the nuclear instrumentation between six and 5:45? Now, referring to this NSAC chart again, we are looking here at these high levels and the source, which is the blue.

A. I can't recall actually looking at them. As I recall the situation, we had had a spike or an increase at the same time that we had received a report of a low boron from the primary coolant, an analysis that we had running. Those two, I think, corresponded about the same time, if I'm not mistaken.

The concern at that time, of course, was that we had diluted the primary coolant. In retrospect we hadn't, but that was the inference then; that we had diluted the primary coolant boron concentration.

Q. Did you believe that the reactor was or could return to criticality?

A. At that particular time, I can't tell you what I thought. I don't believe I thought that we were going critical. We had -- first of all, we had several abnormalities that were going on. The thing was generating heat obviously because it was -- the pumps were secured, so the decay heat was coming in there.

The low boron condensation I didn't understand. I didn't see how we could have diluted it, in my own mind, pertaining to the RWST, which was borated around two thousand epm. The facts just didn't jive. It was an abnormal sampling situation because you didn't have stuff being circulated. I don't know what I thought right at the moment, you know.

But we started injecting, I believe, at that time, just because that was the indication we had; had a low boron, so we took the precautionary measures.

I don't think, at that time, I felt we were going critical, however.

Q. In your interview before the subcommittee of the Nuclear Regulatory Commission on Environment and Public Works, October 15, 1979, you state on page ten, and I'll quote, "The count rate coming up was because we were — in fact, we had a bubble in the — what we were seeing was leaking neutrons."

Were you aware, on 3-28-79, that you were seeing leakage neutrons?

A. No. That is 20/20 hindsight, trying to explain that.

Q. In Mr. Flint's testimony on June 30, 1979, he states that he drew the conclusion that the nuclear instrumentation indications were not a criticality but were a change in the leakage fluxion resulting from a portion of uncovery of the core. He says he discussed this with Mr. Rodgers, and Mr. Rodgers told him he would discuss this with Met Ed management.

Did you discuss John Flint's conclusion with Lee Rodgers on the day of the accident?

A. No, I didn't.

BY MR. MOSELEY:

Q. Or with anyone?

A. No. I don't remember when John showed up, frankly.
Do you remember?

BY MR. CRAIG:

Q. It was --

MR. MOSELEY: About ten.

BY MR. CRAIG:

Q. Nine to 10 time frame.

A. This occurred back around six or seven.

Q. That's right.

A. I did not -- I don't recall having any conversation with John that day. In fact, I don't really recall seeing John that day now. I may have.

Lee Rodgers was in there, I remember seeing him. But Lee was, again, mostly talking with Gary Miller. I had no conversation on that particular subject with Lee.

Q. You have stated that you didn't have any discussions concerning the apparent return to criticality or increase in count rates with respect to voiding on the day of the accident.

A. Restate that, please.

Q. I believe you have just told us that you didn't have any discussions which related the increase in count rates and the nuclear instrumentation with the possibility of voiding in the core; is that correct?

A. I don't know if I had any conversations. I don't recall discussing it with John Flint. Kunder, I think, raised the issue when we had the count rate increase, combined with this low boron concentration. Whether I discussed anything with him at this particular time, I can't recall.

I don't think, as I say, in my own mind, I felt we were critical, however.

Q. Do you recall any discussions with Miller, Zewe, Herbein, Chwastyk, or anyone else, at any time, on the day of the accident, concerning the nuclear instrumentation behavior in the morning?

A. Right now I don't recall. I may have, when Miller showed up, told him that -- I don't know. Just in telling him what events, as I remembered them, when he arrived, I may have mentioned it. I don't know.

BY MR. MOSELEY:

Q. I'm a little bit confused. What did you and Kunder discuss in regard to --

A. As I recall, we received, at about the time of the count rate increase, a report from a boron concentration that had been run earlier, had been drawn earlier, from the primary coolant. And that report was a low boron concentration. I don't know what the value was, but it was significantly lower than what it should have been.

Q. And that was what you discussed with Kunder?

A. I remember that coming up, but I can't remember what we said except that, as I recall, if we were not injecting, then we reinitiated injection.

Q. And your conclusions, even though you weren't concerned that the reactor was going critical, was that you were having a boron dilution?

A. No, that was the inference, because I think George felt that. I couldn't quite agree with that, but the safest thing is to go ahead and inject.

Q. What did you believe was happening?

A. At this particular time, I don't know. As I say, there was a lot of abnormalities going on, as far as the plant was not in a normal configuration. At that particular time, I don't know what I thought. I'm sure I did not feel we were going critical.

BY MR. CRAIG:

Q. There was a subsequent boron sample which is even lower than the first one, as I recall.

A. I think that's true. I believe there was.

Q. Did you draw any conclusion --

A. Well, you have to realize we were not circulating water. So the sample that you get can be suspect.

BY MR. MOSELEY:

Q. But the nuclear instrumentation is not subject to the same problem.

A. No, but the nuclear instrumentation that it's subject to, to a lot of heat or other things, can give you some erroneous indications.

Q. Did you believe there was that much heat in the area of that instrumentation?

A. I don't know what I believed at this particular time, frankly.

BY MR. CRAIG:

Q. Was the count range behavior passed on to the NRC on 3-28-79?

A. I did not pass it on. I don't know if it was or not.

Q. In your opinion, should it have been, on the day of the accident, reported to the NRC?

A. I think they should have been told everything that went on when they got there.

BY MR. MOSELEY:

Q. What about before they arrived?

A. Certainly if -- I'm trying to remember when we actually established communications on a continuous basis with them.

Q. It was near eight o'clock.

A. Yeah. Anything that went on, I think we should have,

A Yes.

BY MR. CRAIG:

Q On the morning of the day of the accident, did you believe that the reactor was going recritical after the scram?

A I did not believe that it was going recritical, but I did not have a good answer for why the increase in count rate.

Q Did you at any time on the day of the accident discuss this increase in count rate with Mr. Miller, Kunder, Flint, Herbein or Chwastyk?

A Any time that day? With Mr. Miller, Mr. Chwastyk. Not Mr. Herbein. And who else did you say? I'm sorry.

Q Mr. Kunder.

A Mr. Kunder, yes.

Q And John Flint?

A Yes, I recall discussing that with Mr. Flint later in the day, yes.

Q Can you tell us the reaction to this increase in count rates for any of these people? Mr. Miller, Kunder, Flint or Chwastyk?

A I really can't recall exactly what each of the gentlemen expressed to me, other than some way the out-of-core detectors were seeing an increase in flux, and I don't recall exactly what each of them had to say about it at the time.

Q At any time on the day of the accident, were these conversations held with respect to voiding in the primary system for core uncovery, which would give you the increase in flux at the outer detectors?

A Not that I can remember, no.

Q In your opinion today, should this increase in count rate and potential for recriticality have been passed on to the NRC on the day of the accident?

A Yes.

Q To the best of your knowledge, what were the core exit thermocouples used for during normal operation?

A Prior to the accident, we did not really use them. They were unavailable in Unit 1, and they were available in Unit 2, and to my knowledge, there were not any existing procedures that really had you use them at all.

Q To the best of your knowledge, who would have used the core exit thermocouples?

MR. MC BRIDE: On the day of the accident?

MR. CRAIG: Previous to the day of the accident.

MR. MC BRIDE: Well, that question strikes me as a little odd, because he's just testified that they weren't used.

MR. CRAIG: No, he testified that he wasn't aware that they were used. I'll be a little more specific.

MR. MC BRIDE: Okay.

BY MR. CRAIG:

Q I interpreted the response that you didn't believe that they were used, is that Metropolitan Edison personnel didn't that I didn't like right after I walked in." That's the end of the quote.

You also said that you asked Bill Zewe if he was injecting, and was he emergency borating. At the time you were watching the nuclear instrumentation, did you believe that the reactor was actually returning to criticality?

A I don't know what conclusions I drew. My gut feeling was something was wrong, was the conclusion I drew. I just walked in, and the only conclusion I could draw, she is going to go critical on us for some reason. I remember that's one of the things we looked at. Whether I just walked in or whether it was an -- times were real tough after something like this. But it did bother me very much, and the conclusion the draw, the only thing I could draw, she is starting to go critical, reason or not.

Q In Flint's testimony to the Kemeny Commission, he says that he drew the conclusion that the nuclear instrument indications were not a recriticality, but were a change in leakage flux on the core. He says that he discussed this with Rogers, and Rogers told him that he would discuss with Met Ed management.

Did Rogers inform you of Flint's conclusion?

A No, sir.

Q Did you participate in any discussion on March 28th in which Mr. Flint's conclusion or anyone else's similar

MILLER: That was discussed plus the excores. We watched both of those. Early in the morning that was discussed if some thing had occurred. You know, we did not see, that I remember, after seven in the morning any kind of an upward response on those. We were looking at those. They had showed an upward response earlier in the morning. In fact early in the morning they probably emergency borated it...things based on the excores going up. And you know they had low boron samples early in the morning and they thought they were getting a low boron when they were probably taking water of the damn core.

HUNTER: I understand. I don't have any further questions at this time, Gary. I appreciate your time and would also like to indicate that after I review this conversation and would also like to review your transcript. I would like to indicate that I would be getting back and try to cover some of the specific decisions at that time.

MILLER: I don't have any problem with further interviews. I think you got to remember the further we get the harder it is to become honestly specific and I'll give you the answer as honestly as I can. Testimony gives my logic as best as I can present it and I, also, might say that the level of stress that I felt under that day was almost intolerable because, I think the situation as I've said was one I wasn't schooled in, secondly, the amount of communications I was trying to accomplish were almost intolerable and that I actually removed myself at times

MR. MOSELEY: We are back on the record.

BY MR. MOSELEY:

Q Mr. Miller, I would like to go to another subject area now.

In your transcript of your discussion with the I&E investigator on May 7, you were asked if the SPND were used or discussed during the accident. Your response in part was, and I quote: "That was discussed plus the ex-cores. We watched both of these. Early in the morning that was discussed. If something had occurred, you know, we did not see, that I remember after 7:00 a.m., in the morning any kind of an upward response on these. We were looking at these. They had shown an upward response earlier in the morning. In fact, earlier in the morning they probably borated it, things based on the ex cores going up, and you know they took low boron samples early in the morning and they thought they were getting a low boron when they were probably taking water off the damn core."

On the morning of March 28, what did you believe based on what you saw or were told about the nuclear instrument indications?

A I think the samples were pertinent. I have it in my mind because of the samples and the way that I got into this thing. I got a phone call saying that the sample lines in unit I were hot, because the unit sample lines went into unit I.

As far as further memory on the use of the ex-cores and the in-cores, we looked at those as an instrument of indication of criticality or recriticality. That is all would think of discussing.

Q Was the count rate behavior discussed in the telephone conference call between yourself, Kunder, Rogers and Herbein at approximately 6:00?

A I can't recall specifically.

Q I am not sure if you asked this question, so I will ask it again.

Did you, at any time during the day on March 28, reach any inferences on core uncovery from the nuclear instrumentation indications?

A Not that I recall. I also believe that the boron boost in mid-morning was a recriticality as opposed to level.

Q I am aware that that was the initial determination.

A I don't believe that the conversation went any furter than that during the day as far as an indication.

Q You don't recall any conversations of that as an indication of core uncovery by anyone during the day on March 28?

A Today I don't recall.

Q In Flint's testimony to the Kemmeny investigators on June 30, Flint says that he drew the conclusion that the instrument indications were not of a recriticality but were a change in liquid flux.

He says that he discussed this with Rogers, and that Rogers told him that he would discuss this with Met Ed management. Did Rogers inform you or discuss it with you?

A I can't recall a conversation of that context. I don't believe I recalled it in the past either.

Q Mr. Kunder has indicated to us, in fact yesterday, that he believed this was discussed in the think-tank meetings. This does not help you to recall this in any way?

A No.

Q To the best of your knowledge, what are the core exist thermocouples used for, or how are they used in normal operations?

A To the best of my knowledge, in fact on March 28 I don't remember them being in the procedures.

Q There was no procedure at that time?

A There may have been a procedure for use of them on the computer as a computer procedure, but I don't believe any of the procedures for ECCS safety systems recognized or utilized them that I remember.

Q What were they routinely used for in non-accident situations?

A I personally today cannot recall their being

things together, and we know there were discussions about some people were concerned that the core wasn't covered, wasn't being adequately covered, despite all these, and inventory deficiency was not specifically discussed.

Am I capturing you correctly?

A That's fair to say, to characterize the conversation, yeah.

BY MR. CRAIG:

Q Our review of your testimony before the Senate indicates that you were aware there was a concern over recriticality before 8:00 a.m. on the morning of 3/28.

A I was aware of some of the operators' concerns because they told me about it, yes.

Q Did you believe on the morning of 3/28 that the reactor had gone recritical after it scrammed?

A No.

Q Was the count rate behavior discussed during this 6:00 a.m. conference call?

A Not that I recall.

Q Did you at any time during the day discuss the concern over recriticality with the count rate behavior with Miller, Kunder, Zewe, Herbein or Chwastyk?

A Yes, I talked to Bill Zewe about it, when he and I had a discussion. I think that was probably before 8:00 o'clock. Told me they thought they had been going recritical when some of the boron sample analyses had come back low numbers, and maybe this was shortly after 8:00 o'clock. I'm not sure now of the timeframes, but it probably was, because we concluded that we had steam in the system, and I said to him something to the effect that it's reasonable to assume that you're getting steam coming out through your sampling lines, and it's really just flushing your boron out, you're not getting representative fluid samples of boron. Therefore, you're getting low numbers. And it explained it away for me in that case.

I don't recall that Zewe ever mentioned anything about count rate at all in that discussion, ~~or any~~ of the boron sample number results.

Q Did you ever discuss this with -- the boron samples with Miller, Kunder, Herbein, Chwastyk or John Flint?

A I think I did with John when he came in and tried to catch him up with what I had known, what I had been able to find out from either the discussions or the conference call, or plant conditions as I saw them.

I think I told him there had been some discussions towards probably the recriticality was a concern, and gave him my conclusions from the sampling results of the piping steam, and those are the only conversations that I recall having with John.

Q Did you discuss at any time the neutron instrumentation behavior with respect to voids or core uncovery?

A Not that I recall, no.

BY MR. MOSELEY:

Q You don't recall such a discussion with Flint?

A No, I do not.

BY MR. CRAIG:

Q To the best of your knowledge, what are the core exit thermocouples used for during normal operations?

A Most of the information from that was accumulated in what we call the ~~PDQ~~ PDC runoff from the computer for the analysis to be performed at Lynchburg on core performance, and it would then be forwarded down as a computer runoff, and the people in Lynchburg in the fuels section would take that information, and then calculate the different performance characteristics of the core overall and come back and form a report, which I think usually only came out about once a year, but, no, those reports were not a required periodic frequency, as I recall, except for the ~~PDQ~~ PDC information being sent down at, I believe, the first time we get to 100 percent power in each start-up, and then some periodic point in time during any ~~one~~ [illegible] at power, we sent a ~~PDQ~~ PDC runoff down to Lynchburg.

BY MR. MOSELEY:

Q This would just be a --

A It would be an encoded computer system, digital numbering system, and as far as reading it in the runoff, it had nothing but a series of numbers that needed to be decoded

information that was available from the computer relatively promptly?

A Yes, I was.

Q And were you consulting with anyone else as you reviewed that material and analyzed it?

A With Bill Zawe, shift supervisor, and Ed Fredricks, control room operator.

Q Were you reviewing the computer printout together, or did you review it yourself and then talk to them?

A I reviewed it myself and then talked with them.

Q What conclusions did you arrive at, based on the information you acquired from the computer?

A I decided that at that point in time, I would have to have discussions with Lee Rogers and with the operators to obtain more information.

Q And what information did they give you?

A They provided the fact that there had been a turbine reactor tripped and that they had the impression they had recriticality or an approach to recriticality.

I looked at the charts and informed them that in all probability it was not a recriticality but a change in the leakage flux from the core.

Q A change in the leakage flux?

A Yes, from the core.

Q What was their response?

A Just that they had apparently not thought of this possibility.

Q Did they appear to accept your conclusion?

A To the best of my knowledge, yes.

Q In retrospect, was your conclusion accurate?

A Yes.

Q Once you had analyzed the computer information, and once you had acquired additional information from Zewe and Fredricks, and once you had given them your analysis, did you do anything more?

A Well, of course, during the time I had reviewed the other strip chart recorders in the control room and talked with Lee Rogers about my findings.

Q And what did you tell Rogers? Was it the same thing you told them?

A Essentially the same thing I told them at that that time, yes, and advised him that we needed to induce natural circulation or run a reactor coolant pump.

Q What was his response?

A He said that he would discuss it with Met Ed management.

At approximately 0830 on the 20th of March, I arrived at the North gate to the Island only to be stopped due to security personnel restricting anyone from coming on the Island. It took me approximately 20 minutes to a half hour to have the security guards call in and contact the control room to find out if my services were required.

At approximately 0900 I was granted permission to go on the Island; immediately went to the Unit 2 turbine area where we have the entrance for Unit 2 and went directly to the control room. On entering the control room, I noticed that the normal alarms were lit and that the typers were printing out as normally occurs following a turbine/reactor trip. Ah, I also noticed that the Emergency Team for radiation type emergency was in attendance in the control room at this time. I talked with the Control Room personnel and this is primarily with (ah) Bill Zaywee, the Shift Supervisor, Ed Fredricks, the Control Room Operator, and Lee Rogers, Babcock and Wilcox Site Representative, and learned that the conditions were abnormal for this type of a transient. In talking with these personnel and looking at the console indications and the computer printouts, I noted that the hot lake temperatures for the primary system were in excess of 620°F, cold leg temperatures were significantly lower than this, which would be unusual in this condition, pressure was low in the reactor coolant system, all control rods were on the bottom. Indications for the source and intermediate range appeared to be normal, for this period of time following a shutdown condition. I did notice however that there were several blips on the recorder for source/intermediate range and in conversation with Ed Fredricks he informed me that they thought at the time that they were going critical and that they had added additional boron into the system. At this time, I informed them that in all probability this was not the case, that there had been a change in leakage flux path from the reactor core to the detectors and it was not in fact the reactor going critical again. Looking at the recorder that prints out the steam generator and reactor coolant temperatures on wide range which runs from approximately 0 to 800°F, there were 2 temperatures that were printing up scale on the hot leg temperatures; one approximately 770 degress, the other approximately 800 degrees. Now these thermocouples are not normally used in this range so I was not certain that they would give an accurate temperature, only indications of approximate ranges. Ivan Porter, Metropolitan Edison I&C engineer, showed me a setup where he had set up a bridge and was reading out a temperature in the back of the control room that was (ah) converting instances was above the normal Rosemont Calibration scale, came out to be approximately 725°F, which tended to back up the indications we'd seen on the other recorder. Talked to various personnel in the Control Room, Gary Miller, the rest of the Operations personnel such as George Kunder, informed me of sequence of events that led up to this position. At this time I again talked with Ed Fredricks and both he and I were convinced that we had in fact a solid steam bubble in both loops of the hot legs. At the time, I attempted to initiate the filling of the steam generator to induce natural circulation or at least remove enough that they had seen super-heated steam in the loops before. When was that occurrence?

A It was during some hot functional testing, as I remember.

Q You got super-heat without a core?

A I don't remember all the details, but they did have that condition where the temperature remained elevated and were steam-bound for an extended period of time in the top of the hot-leg.

BY MR. HAPSTER:

Q Was there any discussion with regard to this, John?

A Not on that day, no.

Q You testified that you talked with Lee Rogers on the morning of March 28, 1979, with regard to your analysis of the behavior of the nuclear instrumentation. That is, the apparent re-criticality was caused by a change in the leakage flux with a result of a voiding in the core. What was Lee's reaction?

A This refers to the previous answer, where he was on his way to a meeting. I think he understood that it had not actually gone critical again. I am certain that he correctly interpreted the reason for it.

Q You further testified that Lee Rogers said that he would discuss your inferences with Met-Ed management. Did you have any discussions on March 28, 1979, with Miller, Herbein, Kunder, Zewe, Mehler or Chwastyk with regard to those inferences?

A I remember speaking with Bill Zewe, George Kunder.

Again, this goes back to the previous answer, with Ed Fredericks and the nuclear engineers about what I thought the condition was.

Q Could you tell us a little bit about the discussions with Kunder and Zewe?

A I can only paraphrase it now to the fact that it was not a re-criticality. Basically, it was a change in the leakage flux either due to voiding of the core, or steam blanketing, uncovering, or whatever. I don't know exactly what words I used with which individuals at this time.

Q What was Kunder's reaction to this?

A I think, basically, his was the reaction the same as the rest of them. I don't know that he really believed what I was telling him.

Q Did you have any subsequent discussions with Rogers on that day with regard to the inferences you were drawing?

A Not that I can remember.

BY MR. HOEFLING:

Q At what time did you talk with Kunder, do you recall?

A I know that it was sometime between 10:00 and 12:00 or 13:00, in that time frame, but I could not pin it down any closer than that.

Q It would have been around 10:30?

A yes, somewhere around that time.

BY MR. HAPSTER:

Q John, to the best of your knowledge what are the

A I ordered monitoring of everything in the building. I don't remember specifically temperatures, but I remember seeing generator pressures that we checked. Other than just a general check of parameters and equipment in the building, that is all I can stand by. The specifics are a little fuzzy.

BY MR. MOSELEY:

Q Would that have been to get further confirmation of the reality of the pressure spike that you asked these other parameters to be checked?

A Not primarily. I think that primarily it was to check everything to find out if we could explain that. If we had problems that could be explained by that pressure spike, a steam rupture or something of that nature.

I think that after the first few seconds, I knew it was not a steam rupture because the pressure dropped back. It was in that vein, in trying to determine what the hell had gone on.

BY MR. CRAIG:

Q Did you, or anyone else, to your knowledge, monitor the alarm printer during the pressure spike?

A I don't remember specifically assigning anyone to monitor. I don't even remember whatthe status of the alarm printer was at that time, but if it was real time, it had been caught up, someone was monitoring it. I had either assigned them, or else there was just someone standing around.looking at it. I remember there was a bunch of people there.

Q Was this information passed on to the NRC, to the best of your knowledge?

A Okay, first of all, the NRC was present at the time of the spike. I remember an NRC inspector being, I don't want to say involved because that is not the right word, but he was present at the time Mehler and I were discussing the spike.

BY MR. MOSELEY:

Q Did you discuss the spike and its ramifications with this NRC inspector?

A I did later. We had sort of a general discussion at that time, and the NRC inspector was standing there. Again, I don't remember if he took part in the discussion, or if he just sort of listened to it.

After I had talked to Miller, and after in my own mind I was pretty sure that we had gone through a pressure transient in the building, I remember essentially telling that NRC inspector that. The words that come to my mind are: "That explosion was real." It was real. I don't know if I said, explosion, but I said that the pressure spike, or whatever it was, was real. It had actually happened in the building. I remember passing that to him.

BY MR. GAMBLE:

Q That was after you had spoken with Mr. Miller?

A Yes.

You have to remember, or at least when it dawned on me what I thought had happened, the first thing I did was to go back to Gary Miller and tell him that there was trouble.

Q That is the same conclusion that you passed to Mr. Miller, that you thought that it was real?

A Yes.

BY MR. CRAIG:

Q I don't know how to phrase this properly, but if the NRC inspector had not been there to tell, is this the kind of information that was reportable to the NRC?

A Let me say this, during normal circumstances, yes. Even during those circumstances, it was something that would have been. The mode of communication would have assumed that.

I am not sure, but if the NRC inspector was not there, we had telephone communication to communicate that to the NRC. I definitely think that it would be reportable in the sense that if it happened during normal power operations or at some other time, other than right in the middle of an accident, it would be properly reportable, the whole bit from the tech specs.

I am not sure how the reporting requirements fall during that time period.

Q At what time and what logic caused you to conclude that the spike was caused by hydrogen?

A The time, I have to say, the time really did not have much meaning on the 28th. I don't think that it was very long simply because it did not take us long to -- It did not take the spike long. The spike was not there very long. Mehler and I did not go into a two-hour or three-hour discussion. It was just a matter of exchanging ideas.

It was shortly thereafter that someone related to me that they heard a noise of some type. Again, Idon't remember who related that to me. Somehow, the noise, the pressure spike, the operation of the valve which was being operated all came together and it scared the hell out of me. That is when I assumed that we had had some kind of explosion, a hydrogen explosion.

Q Your best recollection is that it was on 3-28?

A Yes.

Q On testified on 5-21-79 that you recommended to Gary Miller that the EMOV should not be cycled. What was the basis for your recommendation not to cycle the EMOV?

A The basis for the recommendation was what I have just related. The operation of that valve with the pressure spike, I therefore assumed that there was something wrong with the operator motor, or some kind of connection there that was causing a spark.

Q Was your concern based on the failure of the motor for the block valve?

A No, I will be quite frank with you, my first concern was, Holy Christ, we had an explosion in there, and if we operate that valve we may have a bigger one. Of course, you know, I did not think it through and the fact that the first burn should have burned anything that was there.

Q Were you concerned about localized concentrations of hydrogen?

A Well, yes. I will state also that I assumed that the explosion was localized in the pressurizer area. One of my concerns was that there may be other pockets around there, and that would be dangerous.

Q Why didn't your concern or recommendation include other equipment inside containment?

A At that time, we were not operating any other equipment in the containment. Our mode of cooling was cycling the valves.

Q If other equipment was to have been energized, would you have recommended to Gary Miller that that not be energized also?

A I will be quite frank with you, I did not think in those terms. As a matter of fact, there was word put out not to operate ~~in~~ any of the equipment, and I sort of kicked myself for not thinking about that myself.

BY MR. HOEFLING:

Q When was that word put out, do you recall?

A To the best of my recollection, it was on the 28th.

Q Who put it out?

A I assume that it came from Gary Miller, but I cannot say that Gary Miller told me specifically.

Q You mean that it might have been passed along from someone else?

A Yes, and I am not sure of that.

BY MR. MOSELEY:

Q You don't recall who gave you that order or instruction?

A I am just trying to think about it.

I will be quite frank. Again, I don't remember, but I think Gary Miller was there, but whether he actually said it or not, I don't remember.

BY MR. HOEFLING:

Q But your best recollection is that it came out on the 28th?

A Yes.

BY MR. MOSELEY:

Q Following up on the same thing, do you recall any reason for the order or instruction not to operate equipment? Was any reason for this order or instruction?

A I don't remember now if it was stated, or I just assumed that it was so that we did not cause any more sparking.

Q You don't recall which?

A Can I talk to my lawyer?

MR. MOSELEY: We will go off the record.

(Discussion was held off the record.)

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MR. MOSELEY: We are back on the record.

THE WITNESS: May we have the question asked again?

BY MR. MOSELEY:

Q The question was, do you recall at the time that the order was given whether or not there was a statement as to why the equipment was not to be operated?

A Again, I don't remember specifically that the reason was given or that I just assumed it that this was to prevent sparking in the building.

I do remember the circumstances and who was present. Essentially Gary Miller had mentioned, and Brian Mehler was there. Mehler said something to the effect that it was too late, and that he had just started some piece of equipment in the building.

I remember some comment of mine to the effect, and this was sometime later, "Don't worry about it because we have burned up ~~that~~ what was in there anyway."

Q That was your comment?

A That was my comment.

BY MR. GAMBLE:

Q To Mr. Mehler?

A Yes.

Q And Mr. Miller?

A To whoever was there.

BY MR. MOSELEY:

Q Mr. Miller, to your recollection was there?

A Yes, to my recollection he was.

BY MR. CRAIG:

Q How was that order transmitted?

A Again, I don't remember specifically Gary Miller giving that order specifically to me. I do remember that soon after it was given, Gary Miller and myself were discussing something when Mehler walked in. How the order was actually transmitted, I don't know.

Q It was not somebody saying to you in a calm voice, "Don't restart any electrical equipment," as opposed to somebody standing back and saying in a loud voice, so that other people could hear, "Don't restart any electrical equipment in the containment."

A It was not a general announcement made in the control room. I remember that definitely.

BY MR. HOEFLING:

Q Would that kind of order or direction be recorded in a log?

I am not familiar with plant operation, but normally would something like that be recorded or logged?

A It is difficult to answer because Icannot think of an analogy to use during normal operations for an order like that.

Q So it is unclear.

A Yes.

Q So you don't have a feel for one way or the other.

A Let me say this. During normal operations, or right now, for that matter, there are a number of ways that we would prevent operation of equipment if we did not want it operated, and that would be tagging it out, which involves a lot of time to get instituted.

Prior to that time, it would have been a verbal type of communication to whoever was in charge of the shift. Right now, presently,the shift foreman. If I had a piece of equipment that I did not want run, I would institute the proper tagging, whether it be safety tagging, or a caution tag, or something of that nature, but until the time that the tags were placed, I would give a verbal order by way of the shift foreman not to operate that equipment. But I don't think that they would log it.

BY MR. MOSELEY:

Q In this circumstance, wouldn't that be sort of well publicized to all the operators in the control room because each of them may have had some reason to operate some equipment?

A Normally it would, except for the fact that at the time the word was put out, it started a piece of equipment and nothing happened. So I am not too sure how far we carried it out. I don't think that we did at all because that ~~it~~ is about the time we were starting the reactor cooling pump.

Q This would have beenabout six o'clock in the afternoon?

A Between 4:00 and 10:00, I guess.

Q The pump was bumped at about 7:30.

A I remember, to the best of my recollection, that it was about that time that we were getting ready to run the reactor cooling pump that all of this happened.

Q Could you tell me from your knowledge what precipitated at this point in time, some six hours or five hours after the time of the explosion? Had there been discussion of this? What caused the long time period?

A I don't know, to tell you the truth. All I can relate is what I remember, and my first impression was, "Oh hell, why didn't I think of that."

After I thought about it a little more, I thought, Oh hell, we have already burned it up in there. We have not been recycling the valves, so we have not been putting any more hydrogen in the building."

How the order came about, I just don't know.

Q I just wondered if you overheard or knew of any conversations in the interim in which this was being discussed?

A No, I didn't, or at least I don't remember any.

BY MR. GAMBLE:

Q Do you recall hearing any comments from any of the personnel who received this order, operators or anyone, indicating that they understood the order was to prevent any sparks?

A I don't really remember that the order got out to the control room operators. As I think about it now, there would be no reason to because we had just started some equipment in the building.

Whether the word got out to them prior to my knowing what happened, Idon't know.

Q Was there any discussion amongst the personnel, aside from Mr. Mehler, Mr. Miller and yourself, which you have talked about earlier?

Was there any discussion along the lines, "Well, we don't have to worry about this problem because we just started these pumps and nothing happened," any discussions along that line?

A The one between Mehler, myself and Miller, I definitely know about.

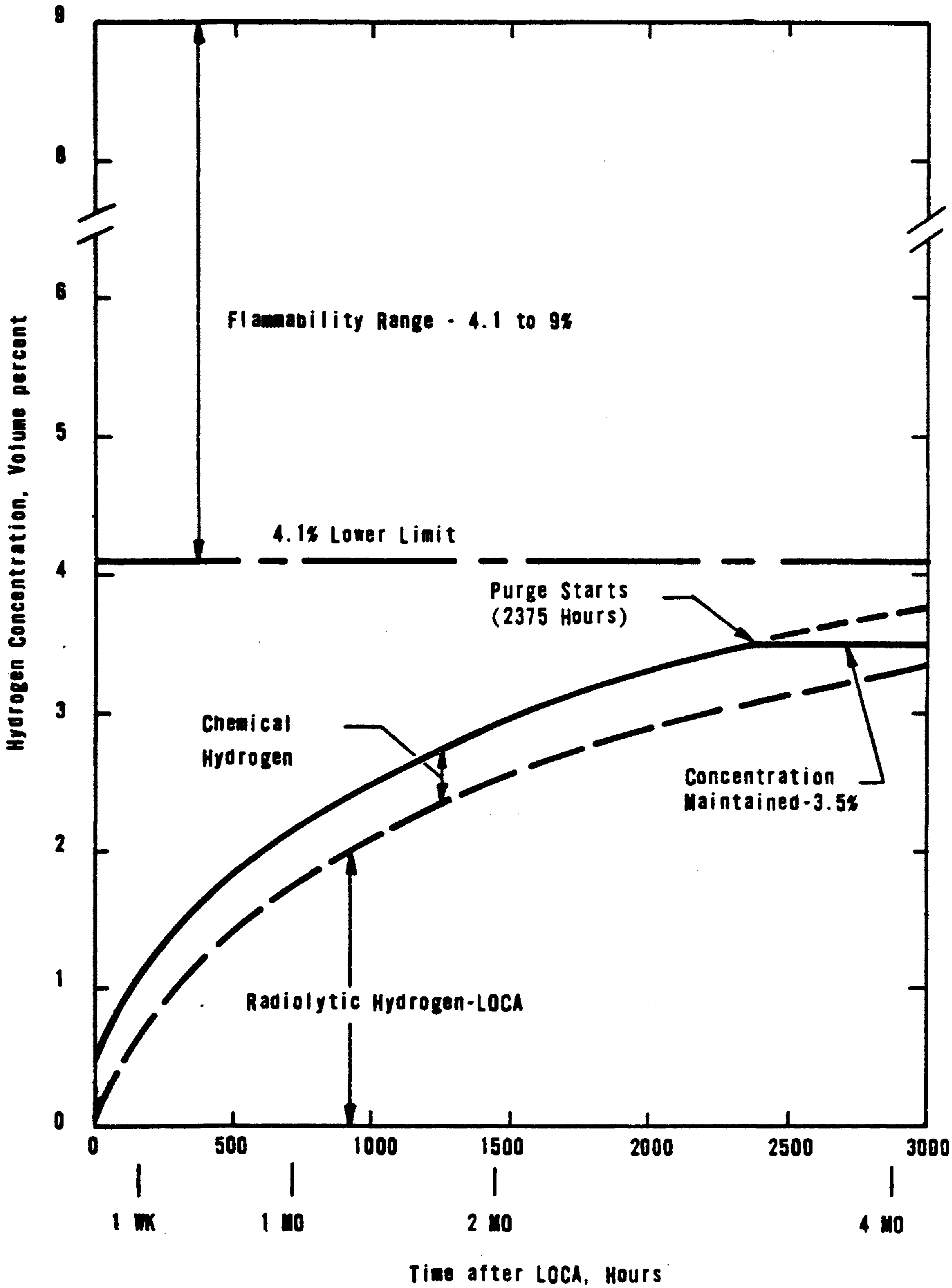
Q Did you hear any of the other people, the operators, talking along these lines?

A I don't remember specifically that they did. I vaguely seem to remember, and I don't know if I am remembering this now from the 28th or not, but I seem to vaguely remember someone saying to me in the control room, after I left Miller and the shift supervisor's office, that "We just started a piece of equipment," or something in that general vein.

I don't remember who it was, and I am not even sure that it did happen. I am not sure if that was a carry-on of the conversation. I remember carrying a conversation with Mehler.

BY MR. CRAIG:

Q With respect to your recommendation that the EMOV




58-1

REACTOR BUILDING HYDROGEN CONCENTRATIO
FOLLOWING LOCA

THREE MILE ISLAND NUCLEAR STATION UNIT 2

FIGURE 6A-1

pressures affecting decisions to report items to the NRC?

A Would you restate that question again I am not sure that I understood the question.

Q I want to know, on 3-28-79 what pressures or influences that you felt which would impact on your decision to either report an item or not report an item to the NRC?

A There was none that I was aware of. The NRC inspector was there with me in the control room, and we were exchanging viewpoints.

MR. CRAIG: Now, if you want to ask your questions.

MR. McBRIDE: Mr. Chwastyk, do you recall having testified previously that subsequent to the pressure spike that occurred in the reactor containment building, you advised the NRC inspector in the control room that you believed that an explosion had taken place in the containment?

THE WITNESS: Yes.

MR. McBRIDE: Do you also recall testifying that you could not identify at the time of the earlier testimony who that NRC inspector was?

THE WITNESS: Yes.

MR. McBRIDE: Didthere come a time subsequent to that testimony when you learned the identify of that NRC inspector?

THE WITNESS: There was a time afterwards that I saw the inspector again, and at that time I learned his name.

MR. McBRIDE: What is his name?

March 28th?

A I don't remember specifically, but I'm sure I must have. I was not trying to keep it a secret or anything. There were all kind of fellow shift supervisors and people I worked with there, I'm sure I must have related it to someone. I don't remember specifically.

Q It doesn't seem to have been general knowledge or it doesn't seem to have been generally appreciated that there had been a great deal of hydrogen in the system and a hydrogen explosion until Thursday afternoon or even Friday morning among many people here. Yet you seem to have put this together in your own mind on Wednesday afternoon.

A There were people in that control room that knew it happened, and I know specifically there was at least one NRC inspector there. And I don't know who it was, I don't remember his name or what he looks like. But I do know there was an NRC inspector, because I remember him standing behind Mehler when we shut down the spray pumps.

Q I want to ask you about that in just a minute, but what I was trying to ask you is whether you can shed any light on why so many people around here didn't seem to really put all this together until Thursday or Thursday night or Friday morning?

A I am not sure I understand that. You've got to remember that -- I'm not sure I know what you're getting at.

I remember sunshine. What else was happening, I don't remember.

BY MR. MOSELEY:

Q Can we eliminate this summer, and it would have been last summer?

A I really can't. I know that I would know him again if I saw him. I am terrib~~ly~~e on names, I really am. I have always been that way.

BY MR. CRAIG:

Q Let's go back for a minute. I have a couple more questions about that.

The day you recognized that it was Ne~~a~~ely, did you see him walkingat a distance? I am not going to get into a quarter mile, but did you go up and look at his badge to get his name; how did you learn that his name was Ne~~a~~ely.

A I don't remember the specifics behind the first time seeing him, and I was in the control room at the time, and it triggered in my mind that that was the guy.

Q Did you walk up to him and say, "Do you remember talking to me the day of the accident"?

A No.

Q You did not talk to him at all?

A No. The only reason I brought it up is because when I talked to the investigator, afterwards he asked me specifically if I remember, and I said, yes, I remembered it was Ne~~a~~ely because I saw Ne~~a~~ely subsequent to that.

BY MR. CRAIG:

Q I have three names, maybe you will recognize one of them. Robert Martin, Darwin Hunter, or Owen Shackelton.

A I think that I could recognize him again.

BY MR. HOFELING:

Q Do you know at what time this exchange took place?

A What time of the day?

Q Yes.

MR. FIDELL: Which exchange are you referring to?

MR. HOEFLING: The exchange between Joe and the investigator where he informed him that he recognized Ne~~x~~ely as the individual.

MR. FIDELL: Are you talking of the day of the accident?

MR. HOEFLING: No. I am talking about the exchange between Joe and the NRC investigator, where he told the investigator that he recalled who the individual was that he spoke to on the day of the accident. Apparently, that exchange took place on site.

THE WITNESS: I can remember exactly where it took place, by the ~~terminal~~ turbine building in unit two, but I don't remember whether it was fall or summer, or what his name was.

BY MR. HOEFLING:

Q Do you recall whether it was summer or fall?

A It was summer because it was warm. It was a warm day, THE WITNESS: I don't think so.

MRL FIDELL: Let me also mention, for the record, that the term employed in the subpoena is "pressure spike."

BY MR. CRAIG:

Q When did you see Mr. Neely and recognized him, that you believed that he was the NRC inspector that you had talked to?

A I don't even remember. I have no idea. It was sometime after the interview. I remember one of the inspectors -- I remember one of the first investigators that I gave an interview to, Idon't remember the circumstances, but he and I somehow were walking through the plant one day, and he asked me the same question. I told him then that I remembered that it was Neely, and I remembered afterwards. I don't remember who the investigator was.

MR. FIDELL: May we have a moment please?

BY MR. GAMBLE:

Q Did you finish your explanation. You were talking about the time that one of the other investigators interviewed you.

A It was at that time that I notified him that I had see Neely and recognized him as the man in the control room.

Q That was after the interviews had been completed that you talked to this investigator?

A Yes, and I don't know his name.

earlier.

When it dawned on me what had happened, the first person that I went to was Gary Miller.

Q In your discussions with, we will assume it was Mr. Nealy, did you have the perception that he understood what you were telling him?

A I assumed that he understood what I told him, that the pressure spike or the explosion, whatever word I used, was real. I assumed that he knew what that meant. I am not sure that that answered your question.

Q I am not sure it did either.

What I am looking for is whether you felt he perceived the significance of this, either by the questions he asked, or by comments that he made, or by any other actions that you saw him take.

A I assumed that he knew what I was talking about, and when he left I just assumed that he went back to notify his chain, whoever it was at that time, which I don't know. That is the only thing that I assumed at that time.

BY MR. GAMBLE:

Q He did not, in fact, indicate to you what he was going to do when he left?

A No. He just walked away.

MR. FIDELL: May I ask a question.

Did you know Mr. Nealy from before?

THE WITNESS: It is Neely.

MR. McBRIDE: Do you recall anything about your discussions with Mr. Neely on March 28, 1979, subsequent to the pressure spike?

THE WITNESS: The only thing I remember, I related to him that it was a real pressure spike or explosion.

MR. McBRIDE: How is it that you came to learn his identity?

THE WITNESS: Like I said, I saw him later at the site, and when I saw him I ~~spoke to~~ recognized him.

MR. McBRIDE: Another question is, after your conversation with Mr. Miller about the pressure spike, the fact that you believed that an explosion had taken place,did you make any assumption with respect to whether Mr. Miller had passed along that information either to his superiors or to the NRC?

THE WITNESS: I assumed -- He was their emergency director, and he would pass that information along up our chain, and also making the necessary NRC notification.

BY MR. MOSELEY:

Q Let me ask a couple of questions related to that. In answer to the question, you used the term explosion. Was the term explosion used on March 28?

A I don't know that. I remember the word "real," that the pressure spike, or the explosion was real, because in the previous discussions I had, there was some doubt like I mentioned pressures affecting decisions to report items to the NRC?

A Would you restate that question again I am not sure that I understood the question.

Q I want to know, on 3-28-79 what pressures or influences that you felt which would impact on your decision to either report an item or not report an item to the NRC?

A There was none that I was aware of. The NRC inspector was there with me in the control room, and we were exchanging viewpoints.

MR. CRAIG: Now, if you want to ask your questions.

MR. McBRIDE: Mr. Chwastyk, do you recall having testified previously that subsequent to the pressure spike that occurred in the reactor containment building, you advised the NRC inspector in the control room that you believed that an explosion had taken place in the containment?

THE WITNESS: Yes.

MR. McBRIDE: Do you also recall testifying that you could not identify at the time of the earlier testimony who that NRC inspector was?

THE WITNESS: Yes.

MR. McBRIDE: Didthere come a time subsequent to that testimony when you learned the identify of that NRC inspector?

THE WITNESS: There was a time afterwards that I saw the inspector again, and at that time I learned his name.

MR. McBRIDE: What is his name?

Mr. Mehler. Yes, I did.

Mr. Blush. When did that sort of fall out of consideration? You saw it?

Mr. Mehler. Yes.

Mr. Blush. You discussed it?

Mr. Mehler. Yes. The pressure spike came in -- I was actually in the shift supervisor's office at that particular time. What I noticed is the people started to move a little faster, they were securing pumps. So, essentially, I thought we had an ES again, which is an emergency safeguard, but I didn't know whether it was low pressure or reactor buildup pressure. I have never seen reactor buildup pressure go that high. We went out to see what was going on. I don't know if it was me or the other individuals, but the spray pumps were running. To start spray pumps you need 30 pounds of pressure, two out of three, and they were running. I couldn't believe that, I looked at them. I walked over and looked at the charts and that's when I saw the line straight up and straight down. It looked like somebody played with the transmitter. It couldn't have been that or we wouldn't have gotten the spray pumps. I kept -- who was the individual from NRC. I explained it to him. I can't give you his name. He did ask why the spray pumps were running. I explained why they were running and I also pointed the chart out to him.

Mr. Blush. It was one of the NRC people in the control room

.. the time?

Mr. Mehler. There were a multitude of NRC people in there wandering around, and he asked me a question, so I explained it to him.

Mr. Blush. If you saw him again, would you know who he was?

Mr. Mehler. No.

Mr. Blush. You have been asked that question again, "Would you know him?"

Mr. Mehler. No. I am sure the individual would never remember I explained it to him.

Mr. Blush. What did you explain to him?

Mr. Mehler. He asked me why I was concerned because the spray pumps were running. I told him they would only start at 30 pounds. I said it is impossible to get 30 pounds. I walked over to the chart and looked at it, we got up to 28, according to this chart; 31, it was straight up. I looked at it and said, "That's impossible." I showed it to him.

Mr. Blush. What did he say?

Mr. Mehler. He didn't say anything. He didn't know what was going on. All he did was write down what we told him.

Mr. Blush. And then he walked away?

Mr. Mehler. Basically. Then we went back in the office after we secured from all that. The pressure was down so there was nothing else to do. Someone did make a comment they thought

Q I think Mr. Higgins is well over six feet and rather thin, sharp face. You don't think it would have been him?

A No. And Neely I know.

Q How did you -- strike that. Do you recall whether people in the control room were in respirators at the time that happened?

A The time of the discussion, no, we weren't in respirators.

Q Do you remember how you identified him as an NRC person?

A I seen him earlier in the day in the supervisor's office over on the one side, and when he did come into the office, he had an NRC hat on.

Q U.S. NRC, white hard hat?

A Yes.

Q Were you introduced to him?

A No, I wasn't.

Q You had conversations with him there in the shift supervisor's office?

A The only individual I knew that particular day that was from the NRC by name was Don Haverkamp. All the other gentlemen there, even Mr. Neely, which I know now, I did not know that particular day.

Q This is on March 28?

A That's correct.

Q You recognized Mr. Haverkamp in the control room?

A I seen him there in the control room. That was only periodically.

Q He was not the one that you recall speaking to?

A I definitely would have known if it was him.

Q Was there anybody else standing there or listening, a party to this conversation that you had with the inspector?

A I wouldn't want to say definitely yes. There's some people I could ask.

Q But as you sit here now, you don't recall another person being a party to the conversation?

A No, and the conversation, like I said, could have only lasted a minute or two, because we were quite concerned with what was going on.

Q Do you remember whether there was a control room operator standing there in front of you, for example?

A I think we did have a control room operator over there that secured the pumps, but whether he listened to the conversation, I couldn't tell you that.

Q You mentioned that you thought that you had given an instruction to secure the spray pumps?

A Yes, and I know other people that say they gave the instruction also.

Q You were not the shift supervisor in charge at that point, were you? Or were you, in fact?

Q I think Mr. Higgins is well over six feet and rather thin, sharp face. You don't think it would have been him?

A No. And Neely I know.

Q How did you -- strike that. Do you recall whether people in the control room were in respirators at the time that happened?

A The time of the discussion, no, we weren't in respirators.

Q Do you remember how you identified him as an NRC person?

A I seen him earlier in the day in the supervisor's office over on the one side, and when he did come into the office, he had an NRC hat on.

Q U.S. NRC, white hard hat?

A Yes.

Q Were you introduced to him?

A No, I wasn't.

Q You had conversations with him there in the shift supervisor's office?

A The only individual I knew that particular day that was from the NRC by name was Don Haverkamp. All the other gentlemen there, even Mr. Neely, which I know now, I did not know that particular day.

Q This is on March 28?

A That's correct.

suggestion being made not to start electrical equipment inside containment?

A The only time that I recall was after the hydrogen problem had been surfaced, and then the concern was about starting electrical equipment.

Q Which day would this have been, do you know?

A It was when -- it was after the NRC was put on alert that they hydrogen bubbles had increased and were increasing in the containment.

Q During interviews conducted after the incident, the Metropolitan Edison employees have stated that the 28 psi pressure spike was explained to an NRC inspector. Did you have any discussions with Mehler or Chwastyk on 3/28/79, the day of the accident?

A I did not. First of all, I did not know those individuals, who they were, or by name. I did not discuss anything of that sort.

Q Do you believe that you could have been told of the 28 pound pressure spike that was due to an electrical problem or any other reason, and dismissed it?

A I don't think so. I -- again at that point my primary mission was the radiological control of things. Afterwards I had to go out and find out where that particular console was.

BY MR. MOSELEY:

Q Had you been told, do you think you would have recalled

suggestion being made not to start electrical equipment inside containment?

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BY MR. MOSELEY:

Q Had you been told, do you think you would have recalled it?

A Yes.

BY MR. CRAIG:

Q Did you see the containment pressure increases indicated by the chart recorder at approximately 2:00 p.m. in the afternoon on 3/28?

A Could you repeat that?

Q Did you see the spike on the chart recorder?

A No, I did not. As I've said, I don't even know where that recorder is located at the time.

Q Were you aware on 3/28 at about 2:00 p.m. that the containment spray pumps came on?

A No, I did not.

MR. CRAIG: Let's go off the record just a second.

(Discussion off the record.)

BY MR. CRAIG:

Q Are you aware that you have been identified as the inspector who received an explanation concerning this pressure spike by Brian Mehler?

A I was informed by an individual many, many weeks after the accident -- and I don't know if it was Mehler or not, and I turned that over to the investigating group.

Q It was Chwastyk, I believe. Which group? The Rogovin group?

A No, the special investigating group.

BY MR. MOSELEY:

Q I'm sorry, I missed something here. When did you say you were told?

A Several weeks after the accident, the -- and I'm not -- I think it was Mehler, said he had information about the spike, and I turned it over to the IE investigating group at that point.

Q Several weeks? That would have been in April?

A Yeah, it could have been April. It was when we had -- we were in our site coverage at that point.

BY MR. HOEFLING:

Q What kind of information did he indicate he had?

A I can't remember now, something -- he indicated at that point he had talked to people regarding the spike.

Q NRC people?

A Yes. And so I knew -- we had our investigating team on site, so at that point I turned it over to -- it was Tony Faisano, who is the special investigator.

BY MR. MOSELEY:

Q Would this have been some time before this information was in the newspaper, which would have been early May, I believe?

A This was after.

Q It would have been after that?

A (Witness nodding.)

In fact, I was in the control room one day and he brought up that point.

Q To you?

A Yes. And I pointed it out to the investigators, that this individual had some concerns and had this information. Again it wasn't my area of expertise. That's why I passed it along.

BY MR. CRAIG:

Q Were you aware that he believed -- I think it was Chwastyk believed that you were the inspector who was at the recorder during the time of the spike, and that they turned around to you and said, in effect, "We have just had a 28 pound pressure spike inside containment"?

A No. I don't even know who he is. I mean now I do, but then I didn't. My main areas in the control room would have been at the instrument panel, for the process monitors and area monitors.

BY MR. MOSELEY:

Q Isn't that in the near vicinity of the --

A It's up in front.

Q -- of the containment pressure?

BY MR. HARPSTER:

Q Let me ask you a question, to help clear this up. You had the operator's console, and then the vertical rods in back. Here is the radiation monitors. Were you in this part here?

A No. Up on the panel, in the back, the tall panel in

Miller's absence?

A Not really, no.

Q Nothing perceptible changed while Miller was gone, in terms of how things were run?

A No.

BY MR. CRAIG:

Q Who was in charge when Miller left?

A I'm not really sure now, to tell you the truth.

Q Do you remember, if you aren't sure, then, who the guy was?

A I probably wasn't.

Q In previous testimony before the Hart subcommittee, you stated that you were not present during discussions concerning the containment pressure spike which occurred at approximately 1:50 on 3/28, and that you did not know of the pressure spike until Friday. Is that still your recollection?

A Yes.

Q How can you explain the fact that you are present in the control room or the shift supervisor's office during the pressure spike, and the people in the control room and people in the shift super's office have testified that the pressure spike or thud was common knowledge at the time it occurred? In fact, virtually everyone in the Unit 2 control room and/or the shift supervisor's office who was present on 3/28 at about 1:50 has testified that they either knew of the

spike or heard the thud?

A I guess I can't really explain that. All I could say was that there was certainly a lot of activity going on at that time. I don't recall any thud of that type, and if it was a dull type of thud, similar to a main coolant pump check valve, when you start a main coolant pump on a submarine, which is what -- when I discussed it with Gary Miller on Friday, the way he described it, and that is sort of a dull thud in the background.

There are lots of noises at a plant that happen at various times, and if you are familiar with the plant, one that's a little bit different sticks out, if you're there all the time. If you're not, and you hear all these various noises, and there are lots of them at a plant -- now if you're not familiar with the noises, what's common and what's not, they don't really register with you, and the odd ones that are not normal don't really stand out as they would to somebody that was very familiar with it and there on an every-day basis.

I really think that your characterization of it from the different people that you have talked to isn't correct, because I know that when I discussed it with Gary Miller on Friday, the impression I got from him at that time was that, okay, now that we understand what it is -- Friday, I'm saying now -- now on Friday, March the 30th, we looked back and we got a feel that it was a hydrogen burn or explosion, and tied

introduced just in our calculation or our analytical technique and I don't think that we were able, at least I know I was not able, to pin point whether we were talking about ten percent or ninety percent.

MR. TAYLOR: Yes, I understand.

MR. DUBIEL: But it was definitely beyond the one percent, I think there's the part we were at.

MR. TAYLOR: Now, about a little before two o'clock, according to the sequence of events, there was a larger pressure spike which has been reported as 28 psi. How did that come to your attention, Mr. Miller? That that had happened. Did you see this yourself, or did -- (interrupted).

MR. MILLER: At the time, I was not aware that we had the spike on the chart, or that the safe guard system had re-initiated. It does so happen that I heard a noise. And I did mention to Mike that I heard a noise. But I think that there are, the ventilation makes a noise that's similar. I heard a noise.

MR. TAYLOR: Could you characterize that noise. I mean was it a loud bang, or what?

MR. MILLER: A thud.

MR. TAYLOR: A thud?

MR. MILLER: It was a thud.

MR. TAYLOR: Did it occur to you when you heard that that it might have been an explosion?

MR. MILLER: No sir. It didn't at the time. I didn't

as conflicting and you could explain any apparent conflicts and we could approach it that way. I think that might be the preferable way of approaching it.

MR. BLAKE: Do you want to take an opportunity, Gary, to review your prior statements or do you just want to tell him whatever it is that you recall right now and then we will go that way?

THE WITNESS: I will go right now.

MR. BLAKE: Okay, why don't we do that then.

At the time that the spike occurred, you know, my thrust was to be leaving the site, like, you know, making last-minute preparations to go to the Lt. Governor's office. I believe I was out in the control room. I don't remember looking at any instruments relative to that incident. I do remember hearing a noise. I do remember that Mike Ross, and I think William Marshal Bubba Marshall is his name, nickname, was standing near me and I think I asked what the noise was. I think I was told that it was the ventilation system.

I think I had at that time no awareness of the spray pumping starting that I can remember today or of the spike itself And I feel that is accurate because when I came in in the days after the accident. I came back early Thursday morning because there were only two emergency directors, Jim Seelinger and myself. Then I believe I came back again either at 6 o'clock or 7 o'clock Friday morning.

were made of?

Mr. Miller. I knew they were alumelcromel. I would not say I had an intimate familiarity with those particular thermocouples. I am aware of what a thermocouple is and the type of junctions they are, that is the familiarity I have with it.

Mr. Arena. You wouldn't know the melting point of alumelcromel?

Mr. Miller. I don't believe so off the top of my head.

Mr. Arena. Did you personally know it off the top of your head on the morning of the 28th?

Mr. Miller. No.

Mr. Arena. On the afternoon of the 28th, did you become aware of the occurrence of a pressure spike in the containment in Unit 2?

Mr. Miller. In the afternoon of the 28th on that day I was aware of a noise at some point just prior to my leaving the site, and in fact, I believe I asked what was that in fairly strong language. I did not closely evaluate that the 28th, because I was told, I believe, that it was a ventilation system which was changing modes and did make a thud-type noise, and I, based on -- from the standpoint of getting ready to go to the governor's office, I did not come back and evaluate some of the data and events that I was aware of, say, on the 30th.

Mr. Arena. Do you remember who told you they thought it was

HUNTER: All right. Let us pick up another general item as we go along. In the afternoon at approximately,... after 12, 1300, there was a pressure spike in the containment. Were you present and recall that particular event?

ROSS: Yes.

HUNTER: Now can you give us your location at that time and what you recall seeing or hearing or discussing at that time?

ROSS: Yes. I was near the console at that time and if we are talking about the same time was around 2:00, sometime in that area. And at that time we got a an ES signal and some of the components restarted, decay heat, what have you. We got building isolation again and we took care of that and we looked back and the control room operator said "Jeese the spray pumps are running" and we looked back at the charts at that time. We saw a fairly large spike on the chart and the exact pressure at this time I don't know, ...it was around 30 pounds. My thought at the time and Miller was out there with us and he questioned he said, "jeese you know I thought I heard something, too." We are moving down the road there 100 miles an hour and we looked at it and we said "Jeese the spike was so short it must have been an instrument." That was our reasoning at the time. We reached over and we said you can shut the spray pumps off now because the pressure came right back to 0,... almost very, very rapid return and we shut the spray pumps off. I now know the spray pumps were on about five minutes when

don't mean you necessarily have some specific questions that we've asked about your belief on reportability -- but I would like to ask you: To your knowledge, was this information withheld from the NRC?

A. Again, no information that day was withheld from anybody.

Q. You stated to the IE Investigators in May that you were aware of the containment pressure spike. You looked at the charts showing the spike, and you said you knew that the containment pumps started. You also said you associated the event with an instrument problem.

You were a licensed SRO at the time, Mr. Ross. Didn't you know of the redundancy which would have to be set aside for the building spray pumps to come on?

A. Very definitely.

Q. And you then knew that an instrument or power malfunction couldn't have caused the spray pumps to come on?

A. You say "knew." We still associated it with some kind of a failure and proceeded. We didn't say: Hey, that couldn't have happened, but we want to write this off. I'm saying that what we concluded was that it couldn't have happened, based on our previous training; therefore, it was an instrument failure -- be that logically right or wrong, that's what we concluded.

BY MR. CRAIG:

Q You concluded that what couldn't happen, specifically?

A Any kind of a spike. It couldn't have been there based on that rapid of a change. We seen a change that was "bang, bang," and I said it had to be an instrument failure. and went on.

BY MR. MOSELEY:

Q And you didn't question that the downside, the return to normal, may have been caused by some failure of the containment vessel?

A Definitely not.

Q Chwastyk has told us that after the spike he had a survey made of the containment building because he thought the spike was real, and because the pressure had dropped so quickly that the containment could have failed. He also said that he had temperatures and pressures checked as a result of his belief that the spike was real.

Were you aware of these actions?

A I was not. I'm sure we had temperatures and pressures checked because we were doing that. We were looking at things -- what's the temperature? What's your pressure in the building? We had pressure in the building; we had the building bottled up and we were looking at it. The inspection I have no knowledge of; nor do I have any knowledge that it was done.

Q Do you have knowledge particularly that the containment building temperature was checked as a result of the spike?

A As a result of the spike?

Q Yes.

A No, I have no knowledge of that.

Q What particular temperatures are you aware of that were made specifically as a result of the spike?

A I'm aware of nothing specific as a result of the spike. I am aware that we were looking at pressure, and we were looking at temperature in the building. We wanted to make sure that the emergency core cooling, or the building cooling was keeping the pressure down for any reason, so we kept the pressure low in the building. We wanted to keep what was in the building in the building.

Q And Chwastyk didn't discuss any of these actions or their results with you?

A No, not at that time. At subsequent times, days later, we inspected the reactor building and we took radiation surveys on top of the dome with a meter and things like that, but at that time I have no knowledge of anything at the time of the spike. We went on to something else.

Q But, Mr. Ross, you were the man in charge of operations on that date.

A. That's correct.

Q. Here's Mr. Chwastyk taking actions. He has some concern that this was a real pressure spike. He has people take certain actions and he didn't tell you?

A. Or he didn't take them that day.

Q. How was information flowing to you as the Director of Operations on that day?

A. I was coming out to the control room -- I wasn't spending full time out there -- periodically; receiving information; looking at certain parameters and coming back to the think tank. That's what we were doing that day.

Q. With whom would you discuss this, any status --.

A. The shift supervisor.

Q. Do you feel that that information flow was working on March 28th?

A. As well as it could under the conditions that we had; yes, sir.

Q. Even when people say they had various concerns and had actions taken, and you say that you weren't aware of them, and you still conclude that that information flow was working?

A. I still conclude the information flow was working. I still question whether or not they say things now that we did then, or things we did days later. I've had that problem myself.

Q Your statement to the I&E Investigators in May about Miller's interaction with you at the time of the spike says, and I quote: "My thought at the time -- and Miller was out there with us, and he questioned, he said: Geez, you know, I thought I heard something too. We were moving down the road there 100 miles an hour, and we looked at it, and we said: Gee, the spike was so short, it must have been an instrument." That's the end of the quote.

Doesn't that quote of Miller, "you know, I thought I heard something, too," say that he was saying, in addition to the other evidence of a spike, that he thought he heard something?

A He did say he thought he heard something. That's what his quote says. We didn't associate it with anything -- a ventilation fan shift, dampers go shut -- we just never associated it with anything other than an instrument failure. We had never been trained to say that a hydrogen buildup would happen in that short a period of time. All our training said 60 days, not to worry.

Q Well, you're a little ahead of me. I'm trying to -- before we get to relating it to hydrogen -- I'm trying to understand knowledge that there was a pressure spike.

A We had knowledge that there was a spike indicated.

Q And you and Mr. Miller were standing there, and someone is saying the spray pumps come on, and people are taking actions, and it's your belief that Mr. Miller is aware of these things the same as you were aware of these things? Is that correct?

MR. BLAKE: Could we go back and read the first question?

MR. MOSELEY: Sure. Did you want the five-minute thing?

MR. BLAKE: No, just the question which you started with.

MR. MOSELEY: Would you reread the question?

MR. BLAKE: I thought you asked half of a question and he answered the second half. I'm not sure what the answer was.

THE REPORTER: "Q Your statement to the I&E Investigators in May about Miller's interaction with you at the time of the spike says, and I quote: "My thought at the time" --

MR. BLAKE: Could we stop just for a second? You're quoting now Ross' statement from your statement?

MR. MOSELEY: Yes.

THE REPORTER: " -- and Miller was out there with us, and he questioned, he said: Geez, you know, I thought I heard something, too. We were moving down the road there 100 miles an hour. We looked at it and we said: Gee, the spike was so short, it must have been an instrument." That's the end of the quote.

"Doesn't that quote of Miller, 'you know, I thought I heard something, too,' say that he was saying, in addition to the other evidence of a spike, that he thought he heard something?

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"A We had knowledge there was a pressure spike indicated.

"Q And you and Mr. Miller were standing there, and someone is saying the spray pumps come on, and people are taking actions, and it's your belief that Mr. Miller is aware of these things the same as you were aware of these things? Is that correct?"

BY MR. MOSELEY:

Q Would you answer that question, then, the last one?

A I'm convinced Miller was aware of the spike.

Whether or not he was aware of all the ES equipment functions, I can't say. Zewe turned around and said, "Hey, the spray pump's started." That's how I knew it happened.

Q And Miller is standing next to you, and one might conclude from that that he must have heard it. Is that correct?

A. That would be my conclusion. You've got to remember there was a lot of information being passed in that control room at that time.

Q I understand.

BY MR. CRAIG:

Q What about the spike itself as indicated on the recorder? Did you see that?

A. I looked it. It was long enough. It was from here to there (indicating). I did look at it and seen the spike go up, and I seen it clear right away. They turned to me and said: Can we secure the spray pumps? We looked at the pressure and said: Yes, secure them; no use spraying the building.

Q Is it your belief that Gary Miller also saw that chart recording?

A. I can't say. Gary was in the area. I stepped away and talked to Bill, and we were all kind of in the same area, but I can't conclusively say he knew it and saw the spike. He was in the area.

MR. CRAIG: Can we go off the record for a second?

(Recess.)

MR. HARPSTER: Back on the record.

BY MR. HARPSTER:

Q Mike, could you tell us what you did see in terms of other indications and things like the containment isolation valves and this, what did happen when you got the pressure spike in terms of other indications that were available?

A Well, the primary indication you have of course is the pressure recorder in the reactor building. The thing you do get is a four-pound building isolation signal that causes the valves to reclose anything you've had open, any building isolation valve. At 30 pounds, it causes the building spray pumps to start. If those actions take place, operators are talking saying the building spray pumps started; you hear those kind of things and that would be your indication.

Q Do you have announciation on your vertical boards of your SFAS logic?

A Yes, "building spray start," a couple of different announciators you would have. I don't know them all.

Q Things which might be more apparent to people that perhaps didn't have visual perspective, those little reactor building recorders sitting there, "loss of intermediate cooling," things like that?

A Things like that, but it would be a number of alarms coming in and out at that time, whether someone in the back could pick it up and say: Geez, that alarm was caused by this? It's hard for me to say. For the operators, yes, we could pick that up.

Q But the SFAS logic would put the big announciators up there?

A Yes.

Q That's something that would get your attention. That's not one of the alarms you would lose track of?

A It would get your attention; but whether you'd get it in addition to all the other alarms flashing around the control room, I can't say for somebody else.

BY MR. HOEFLING:

Q Why do you say, Mike, that you were convinced that Gary Miller was aware of the pressure spike?

A Because he asked me, "What was that?" And we were in the area, and I guess I probably said something to the effect that we had a spike. And he says, well — I don't recall ever saying to him, "Hey, Gary, all the spray pumps started, and all the building isolation isolated." I don't recall ever saying that. I don't know what I said on the record, testimony-wise, but I guess my basic reason for saying that is he was in there when it happened; he heard what went on in the control room, basically.

Q Do you recall saying to him: We've had a pressure

What's the reactor coolant pumps?

I mean, when we cycled the electromatic relief valve, rather. I'm sorry. And it wasn't until the next morning that I came in, that we were still trying to find out why we had that pressure surge. So we were talking with the electical engineers on how we could possibly go from that DC operated valve over and trip the pressure switches, which are set at 30 pounds for the building spray pumps and their on a logic of 2 out of 3, before you'll start a pump. So, at least we had picked up 4 of those, plus both of the pressure recorders showed an increase. So, he looked at it, and he said, "Bill, there's no way that the, that cycling the electromatic could cause an electrical fault to cause the pressure switches in the building spray to come up." So then we thought, I wonder if the real reason was a hydrogen explosion, because in order to pressurize a volume that large so quickly, it was almost like an explosion. But at first, then I thought, no, 2.1 million cubic feet like that - no way. But then I guess we have determined now, pretty well, that it probably was a hydrogen explosion inside the building.

Did you hear anything in the Control Room when that happened?

I did not. No.

O.K.

I learned later that at least two other people did.

How did they hear it? I mean -

Well,

How did they hear it? Do you have noise monitors or something? Or -

We do have noise monitors that are in the Reactor Building, loose parts and noise monitoring system. I don't recall hearing on that. But the person in question, who I first learned it, they had heard something. Pardon me, it was Gary Miller, who is the Manager of the Island. And he said that the had heard something. And that he had mentioned it to whoever was beside him at that time. And they thought that it was dampers in the ventilation system which sit directly above the Control Room. And he didn't think anything more of it, at that time. But then as he looked back on it, that's what he feels it was the same time.

Bill, did these pressure spikes were proceeded by the operation of the EMOB?

Well, maybe I should clarify that. The one that I was there for was from the electromatic, alright.

O.K.

I assume that the other one was too. Though I'm not sure of that. It may have been from operating something else from inside the containment. I don't know that for sure.

Hunter: We're interested in, in you know the - it's important - you saw the - you had the electromatic cycle, Fred opened the valve?

Right at that instant.

And at that instant you had the pressure spike. You saw the pressure spike?

I'm positive. Because he was waiting for my direction on when to open it up.

O.K.

Alright. And I said, "Alright Fred, open it up now." As soon as I said now, you know within a fraction of a second, the spike went boom.

Alright, you saw the spike. You saw it come back down?

Yes. It came up and came right back down.

Then it leveled out?

Yes.

O.K. And so then having the operators disappear in the containment spray pumps - the operator. You - did you - what was your basis for securing the pumps?

Well, at the - I thought then that it was just a faulty indication and the pressure had come back down to

Do you have - how many channels of pressure do you have in front of you narrow range and wide range?

For the Reactor Building itself?

Right.

Two. Two separate recorders.

O.K. then. So you were sure then the pressure was back down?

Yes, I was.

O.K.

I was convinced at that time that it was just a false electrical type signal.

O.K.

It never entered my mind that it was a hydrogen explosion, at that time at all.

I - can I - can I - I'll ask you the cuestion of hydrogen analyzers on the containment building - on the Reactor Building. Do you -you apparently do not have that type of

We need a sample for hydrogen.

You, I'm sorry go ahead.

We sample for the hydrogen, alright.

Later on?

We did later, yes, but I mean normally that's the only way we can determine what the hydrogen concentration is in the Reactor Building. Is through sampling. Or if we run the hydrogen recombiner, we can take - there's a formula for figuring out, based on the reaction chamber temperatures and the heater chamber temperatures. You just take the Delta T and divide it by a constant. You can come out with a relative percentage of hydrogen based on the reaction volume of the chamber, knowing the flow rate through it and everything else.

O.K. Had you ever had to take a hydrogen sample of the containment before that your aware of? Had you yeah - did you ever, before?

I'm sure that we have. And, well, the only time that I can remember actually doing that is anytime that we have the building closed for any period of time, alright. We normally go in an take an air sample for the quality of the air. And then they get the results and the shift supervisor reviews the results, to make sure you have the least enough oxygen to support life and that you don't have any combustible vapors in the Reactor Building before you send people in.

And that would include hydrogen in an analysis?

I think it's just combustible vapors. There's oxygen on it and I believe the other one is just combustible vapors. Like

O.K.

If you'll excuse me at this minute, but hydrogen being a combustible, it would be considered in that.

Creswell: What would the radiation levels have been in the area of where you could have drawn a hydrogen sample?

Well, our normal sample point for the building, alright, is a monitor that is right down on the 305 elevation of the Aux Building. Right near the intermediate CRD filters. Right next to the seal return filters and the seal return coolant from the coolant pumps. And at this point in time, I'm not sure of the radiation levels, but throughout the building. They were - I had heard numbers and not just certain areas, but pretty well generally in the 50 R range, at this point.

So from that information, what would your decision be about drawing a sample or asking for a sample?

Alright. Your referring to - I seen the pressure spike and did I think about drawing an air sample, at this point or what?

What things entered your - what sort of things did you have on your mind at point of time regarding that?

I didn't. I totally thought that it was just an electrical problem.

O.K.

I didn't even pursue it any further than that.

O.K.

I - I just didn't.

O.K. Lets assume that you had thought of drawing a sample, would it have been practical to have drawn a sample?

No. Because at that point, I had learned - and I'm not sure if it was before that or after that, but that the - I believe that it was the Health Physics technician had said that we had had water blowing from the Reactor Building containment monitor.

That was very early on in the morning though. That was four or five o'clock apparently. Say five a.m. in the morning, wasn't it?

I'm not sure of the exact time of that. But that stuck in my mind - like now that your asking it, alright. But at that time, I didn't even consider sampling. But just looking back on it, I did recall that they did report that it was blowing some water and we knew that the building was hotter ar2-19

Did you conclude on March 28th that the pressure spike was real?

A I did not.

Q For whatever reason?

A I thought that it was a false indication. I could not conceive how the building of over 2 million cubic feet could pressurize that rapidly, and then be depressurized that rapidly. I had not conceived of that before.

BY MR. CRAIG:

Q On the day of the accident, did you -- are you aware of anyone else who monitored any parameters such as containment temperatures, reactor coolant pump, air inlet temperatures, steam generator pressures, during or following the spike, pressure spike of 28 pounds?

A We had various operators monitoring all portions of the plant, but I was not specifically aware that we were monitoring them at particular times or noted any changes at that particular time because of the spike.

Q And specifically with respect to containment building temperatures?

A No.

Q Did you or anyone else, to your knowledge, monitor the alarm printer during or after the spike on the day of the accident?

A I don't remember if anyone was monitoring the alarm

CHWASTYK: I don't really remember. It may have been.

HUNTER: Was the spray valve being used as a flow path?

CHWASTYK: No.

HUNTER: You were going to say something I didn't mean to cut you off. These flow paths then being into the reactor coolant drain tank and then out the flooded tank and out the tank at the time of the reactor building sump and the water then was standing in the reactor building. Okay?

CHWASTYK: Yes.

HUNTER: Shortly thereafter, there was a reactor building pressure spike and as I understand you had the panel at that time.

CHWASTYK: Yes, I did.

HUNTER: Were you aware of that spike at that time?

CHWASTYK: Yes, I was.

HUNTER: Can you describe your reaction, your feelings what you thought it was at that time?

CHWASTYK: My reactions, I actually saw the recorder, the pressure recorder on the building, spike upward. I didn't know what caused it but the fact that the spray valves started indicated to me that we actually had some kind of pressure spike, either on the sensors on in the building itself. I was not sure. The spike of course started all the building spray pumps, decay heat pumps, etc. The pressure spiked up and it was only up very briefly, as a matter of fact, a couple of heart beats. I know because I missed those heart beats. It came right back down again. I still did not know what caused it so I sort of hesitated on securing all the equipment that started until I thought I had a better feel for what was going on. Of course, I never did because the pressure came down and stayed down, and then I ordered them the building spray pumps and the DHV8s and everything closed. Stopped.

HUNTER: What was the -- the pressure came back to what level Joe?

CHWASTYK: It came back to somewhere around zero where I am not sure. It came back to just about where it started from as a matter of fact, I remember that.

HUNTER: Okay, we...it looks like the system had run about four or five minutes when it was finally secured. Would you consider that amount of time, the time it took you to evaluate the situation and see what was going on?

CHWASTYK: Well, no that is -- I saw what was going on. I did not know why. That is why I hesitated on shutting the emergency equipment off.

HUNTER: Okay.

CHWASTYK: Until I could be absolutely sure that I did not need it.

HUNTER: When you shut the containment spray pumps off, you had gone up to the 30 lb. trip point or 28 lbs.

CHWASTYK: Yes.

HUNTER: You had gone back to two lbs. or close to where it was when you started. You ended up shutting that system off. Can you describe that process for shutting that system down, reset, and the position of the pumps and the valves?

CHWASTYK: Okay, in this case, after I had come to the conclusion that I did not need the emergency equipment I had asked the, I believe it was Chuck Adams, the shift foreman, who was in the back of the panel, I asked him to shut the DHV8s. About that time Bryan Miller another shift supervisor came over to the panel and asked why the building spray pumps were running. I told them to shut 'em down by going full lock because of course at that time I decided that we did not really need them. And essentially, we did not reset the high pressure injection. We went to the whole lock position on all the emergency valves. Now when the man was going to close DHV8s of course we still had the -- but I am not sure of this...I think one of the CROs reset the high pressure...the building... channels for reactor building pressure.

HUNTER: If you did not reset those, the 108 valves would come back open as soon as you let go of the switch.

CHWASTYK: That is right and I think after we tried to close the 8s the started to go back open and that is when I had to zero...reset them.

HUNTER: And the containment spray pumps were in full lock?

CHWASTYK: Right. We put those directly in full lock so that we did not have any problem.

HUNTER: Joe, did you take them back out of full lock as soon as everything was reset?

CHWASTYK: After everything was reset yes I did take them out of full lock. I remember taking all the equipment out of full lock just in case something else did happen and we would have it in standby.

HUNTER: Do you have any feel for that, the time frame?

CHWASTYK: Oh, I have no idea. It was...there was a lot of things happening. I remember it was just an oh-by-the-way type thing. How, exactly how long after the spike I don't know.

HUNTER: Do you -- who turned off the containment spray pumps? Specifically.

CHWASTYK: Bryan ~~Miller~~ Mehler.

HUNTER: Bryan ~~Miller~~, okay. All right, at that time as far as the cause was strictly a channel or pressure spike in the containment but you did not have any feeling for what would cause that kind of problem?

CHWASTYK: No, I did not.

HUNTER: We have indications that some electrical buses tripped and that same time, during that the same time frame possibly do you recall that event?

CHWASTYK: Yes. I recall something about it but I think at the time I just dismissed it as having anything to do with the reactor building.

HUNTER: Okay, I just wanted to make sure that we clarify that. You sat there at low pressure for a period of time okay, on the core flood tanks, and you had the console?

CHWASTYK: Yes.

HUNTER: And you were receiving your orders from who at that time?

CHWASTYK: For any changes I had to go through Gary Miller who was essentially the man in charge of the control room.

HUNTER: How did Mike Ross fit in at that time?

CHWASTYK: Mike Ross apparently had been called in because Jim Floyd, our normal Unit 2 shift supervisor operations, was down in Lynchburg, VA at simulator training, and Mike had been called in. Apparently Mike and Gary...Gary was running this, was totally in charge of it but Mike had been running the control room, and, I guess I am not sure because I wasn't there, was giving suggestions to Gary on what should be done.

HUNTER: Was Gary giving you the instructions and then you were instructing the changes in the control room?

CHWASTYK: Well, yes. Any changes that would come up, now. At this time we were still just maintaining this flow rate through the vessel, the core flood tanks, floating on the vessel.

HUNTER: Okay Joe, did you recall any specific instructions for maintaining a certain level high pressure injection flow?

CHWASTYK: Yes, I think 80 gallons a minute seems to be whatever I remember.

HUNTER: Eighty gallons a minute? Total or ---

CHWASTYK: If I remember correctly it was eighty gallons a minute. Maintain 80 gallons a minute flow through the vessel. I don't think it was any further instructions than that.

HUNTER: Again you had the makeup panel. I want to make sure that that was your particular position.

CHWASTYK: Yes.

HUNTER: Again, we are talking in the time frame when we were down on the core flood tanks and they had been depressurized. You were floating on the core flood tanks and they were there. We can see this is 11:30 -

12:00 o'clock, 1300 right in that time frame. Apparently it went on for quite a while...there is a building spike by the way...and then the time frame that the pressure is sitting barely fairly stable. Do you recall maintaining that high pressure injection flow rate for a substantial period of time or at any time during that day did you receive word from somewhere from like Unit 1 or Gary Miller or a source to increase high pressure injection flow?

CHWASTYK: Well, later on of course, when we went to go solid but that was afterwards somewhere in the neighborhood of 3 or 4 hours later. Prior to that I suggested to Gary Miller that we continue the high pressure injection but stop venting through the pressurizer so we car get the heaters on to establish a bubble back in the pressurizer and sometime later Gary came back to me and told me go ahead and do that, to maintain your flow through the vessel but stop venting and get the pressurizer, get a bubble back in the pressurizer.

HUNTER: And at time Joe, you closed which valve?

CHWASTYK: We closed the electromagnetic and the isolation valve I believe.

HUNTER: So you stopped the flow using both valves? Put the heat, did you put the heaters on at that time?

CHWASTYK: Yes. I know one thing I don't remember. The heaters were actually on at that time I think they were off, and we turned them on.

HUNTER: We have a printout on the heater breakers so we may be able to put that together. Okay. So they were either on or you put them on at that time?

CHWASTYK: That is true.

HUNTER: Did you in fact verify the pressurizer temperature was increasing?

CHWASTYK: Yes, we did.

HUNTER: And where would you verify that, would you watch it on the computer or where would you read it?

CHWASTYK: I read it on the console temperature indicator.

HUNTER: Right on the console?

CHWASTYK: Right.

HUNTER: Then there was, do you recall when that particular...when that particular change in velocity occurred generally? I am trying to get...maybe there was an event...?

CHWASTYK: It was not very long after the spike. Okay, and the reason was I saw the spike of course and it had correlated with Fred Scheimann, who was the shift foreman who was on the console at the time, had just opened the electromagnetic relief valve and the spike occurred.

HUNTER: Question, Joe. The electromagnetic valve and/or the block valve?

CHWASTYK: No. The block valve at that time was still open.

HUNTER: It had been opened from early this morning so you fellows were, in fact, using the electromatic valve itself?

CHWASTYK: Yes.

HUNTER: So it corresponded with that particular activity?

CHWASTYK: That is right, it corresponded with that particular activity and it was some time after the event...someone mentioned that they had heard a loud noise.

HUNTER: Did you hear the noise?

CHWASTYK: No, I did not hear the noise. But that was the point at which I had assumed that we did have some kind of explosion in the building. And that is when I suggested to Gary Miller we no longer cycle the electromagnetic relief valve because it had...the explosion...or rapid rising pressure in the reactor building corresponded to opening the electromagnetic relief valve.

HUNTER: Okay, did it cross your mind at that time Joe that...that...was fuel damaged? I assume that during your turnover that you realized that you had damaged the core to some degree or did you have any idea?

CHWASTYK: At the time I wasn't aware of how much damage, like there was not a very good turnover. It was like I said, everybody was pretty busy and I didn't want to stop anybody from what they were doing so I just tried to get a feel for what was happening by looking around and asking the operators at the panel what they were doing. Up until the time or sometime after the explosion and it dawned on me what it was, I didn't know how much core damage we had. Of course, that plus later on when we did start to draw the bubble in the pressurizer at about 100 and...as the pressurizer level was coming down due to the increased temperature in the pressurizer, at about 150 inches I had instructed the control room operators to open up some of the 16s further, okay so that we...it looked like our pressure was dropping so rapidly that essentially I thought at the time we were short some water in the reactor coolant

or not there was core damage. It was only after the explosion that it dawned on me that we did, in fact, have some core damage in there because the Zirc water reaction created the hydrogen. That is where I got nervous.

Until that time, I did not really know what the status of the plant was. I only knew what I was told. But when I put together the explosion and the hydrogen, I knew then that we had suffered at least some core damage. I did not know how to quantify it simply because, you know, it could have been a localized explosion, like I mentioned earlier, or it could have been a mininal amount of hydrogen.

That was about the time that I understood that we did have core damage.

BY MR. MOSELEY:

Q Did you conclude this Zirc water reaction on March 28th?

A In my mind, you know, when I put the explosion together and it was hydrogen, you know, it came from Zirc water, it was just an assumption I made.

Q So you did conclude that the core had heated up sufficiently to cause the Zirc water reaction.

A Yes.

Q You reached that conclusion in the afternoon of March 28?

A Yes.

CHWASTYK: My reactions, I actually saw the recorder, the pressure recorder on the building, spike upward. I didn't know what caused it but the fact that the spray valves started indicated to me that we actually had some kind of pressure spike, either on the sensors on in the building itself. I was not sure. The spike of course started all the building spray pumps, decay heat pumps, etc. The pressure spiked up and it was only up very briefly, as a matter of fact, a couple of heart beats. I know because I missed those heart beats. It came right back down again. I still did not know what caused it so I sort of hesitated on securing all the equipment that started until I thought I had a better feel for what was going on. Of course, I never did because the pressure came down and stayed down, and then I ordered them the building spray pumps and the DHV8s and everything closed. Stopped.

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Stop



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Q Do you think you definitely had made this recommendation to Gary Miller by the time we reached shortly after the hydrogen detonation?

A Yes, I had made the recommendation earlier. I had -- the recommendation to allow me to fill the system -- at that time I didn't say to fill the system, to inject and draw a bubble in the pressurizer. And I assume that was under advisement of Gary Miller and Jack Herbein, who was at the observation center at that time. It was right after the hydrogen explosion and I mentioned that I correlated the opening of the valve with the detonation period that I again went to Gary Miller and explained what I thought had happened as far as the hydrogen detonation and the simultaneous opening of the valve, and it was shortly after that, Gary Miller got back to me and said go ahead and draw the bubble.

BY MR. JOHNSTON:

Q What was it that you thought had happened that you communicated to Gary?

MR. ALLISON: I have a line of questions.

MR. JOHNSTON: Okay, I understand.

MR. ALLISON: Well, go ahead.

BY MR. JOHNSTON:

Q Okay. I was just going to ask you, you just stated that when you were aware of the pressure spiked, you went to Gary and said something to him about what you thought it was?

PORV in the vent valve and try to lower the pressure as much as you can. And a third one that can go with either one, is the max the HPI flow.

Did you think at the time that you would have a better chance of cooling the core with some combination of those strategies?

A. Yes, I did. My initial reaction was of course to let the reactor coolant system fill and that was what I suggested, not long after I took the console and then getting -- it was some time after the hydrogen explosion that I insisted to Gary Miller on what I wanted to do and I requested permission to do it.

Remember at this time I could not do anything on that console without prior approval from Gary Miller.

Q. So what was it that you wanted to do then?

A. I wanted to fill the system going to at some higher flow rate than we were going whether it was 80 gallons a minute or not, I don't remember. But close up the pressurizer, continue with the let-down and increase makeup flow, which we did do eventually.

Q. So this was your recommendation shortly after you took charge of the control room?

A. I think it was shortly after, but again, time during that time frame had no meaning because it could have been an hour, it could have been five hours, I don't remember.

March 28th?

A I don't remember specifically, but I'm sure I must have I was not trying to keep it a secret or anything. There were all kind of fellow shift supervisors and people I worked with there, I'm sure I must have related it to someone. I don't remember specifically.

Q It doesn't seem to have been general knowledge or it doesn't seem to have been generally appreciated that there had been a great deal of hydrogen in the system and a hydrogen explosion until Thursday afternoon or even Friday morning among many people here. Yet you seem to have put this together in your own mind on Wednesday afternoon.

A There were people in that control room that knew it happened, and I know specifically there was at least one NRC inspector there. And I don't know who it was, I don't remember his name or what he looks like. But I do know there was an NRC inspector, because I remember him standing behind Mehler when we shut down the spray pumps.

Q I want to ask you about that in just a minute, but what I was trying to ask you is whether you can shed any light on why so many people around here didn't seem to really put all this together until Thursday or Thursday night or Friday morning?

A I am not sure I understand that. You've got to remember that -- I'm not sure I know what you're getting at.

Should we have made a press release or something?

Q No, I'm really talking about internally, there are quite a few people from Met Ed who have told us and other groups in interviews and depositions that they really didn't appreciate the fact that there had been a possible hydrogen explosion until Thursday or even in some cases Friday morning. Yet, you seem to have figured it out fairly quickly, and you say that there were other people around who probably did or could have or might have.

I wondered whether you can recall this being discussed Thursday morning or Wednesday night with other people? Whether you knew if this was common knowledge?

A I'm sure that when I was relieved the next morning, I passed that on, and I'm sure, I know that I must have talked to people in the control room. Who specifically, I don't know. Mehler is probably one. I'm trying to think of who else was there. Kunder -- well, no, I didn't talk to Mr. Kunder that day. Mike Ross is a possibility, I guess.

I'm fairly certain -- and again, I can't be absolutely certain, but I'm fairly certain I reported it to Gary. I guess my question is, who else was supposed to have known?

Q Well, Gary Miller says he doesn't recall himself learning or realizing that there was a hydrogen explosion till Friday morning; that's his best recollection.

Q Well, that could very well be true. Again, I can't absolutely -- if Gary said -- I may not have told him what I thought at the time, because I really wasn't certain.

Q We can only ask you your best recollection.

A I can only give you my best recollection.

Q I understand. Let me ask you this: Was there any -- strike that. Let me start it a different way: When you saw this and then it together what you thought had happened, that must have been something that gave you some cause for concern?

A Yes. It scared the hell out of me.

Q Did you think that this was something that better ought not to be generally broadcast around the control room and outside? Was there any reason to keep this fairly close among the people who were there in light of the fact that it was fairly alarming?

A I'll say this: I didn't go out in the control room and broadcast it, no. It did scare me, therefore, I'm sure I didn't just make it general knowledge to everybody in that control room. I'm sure I did pick out specific individuals that, my counterpart types of people, and talked to them about it.

Q You said you think that you probably discussed it with Brian Mehler, and your best recollection is that you discussed it with Gary Miller. Do you have a pretty specific recollection of who else you may have actually discussed it

at the spray pump, he probably looked at the pressure indications also. I don't really remember.

BY MR. GAMBLE:

Q What about Mr. Miller, was he already aware before you discussed it with him that there had been a pressure spike?

A I don't know that. To the best of my recollection, I think I asked someone to tell him that we had just had something happen in the building that caused a pressure spike. I don't remember who that was, and what they did, if they actually told Gary.

MR. MOSELEY:

Q When you talked to him, he was already aware that the pressure spike had already occurred?

A I assume he was, but again I make that assumption because I did ask someone, I don't know who it was, to tell him what had happened here, and "I am not sure what the hell ~~I am doing.~~ is happening"

Q He was back in the shift supervisor's office at the time, as far as you know?

A Yes.

BY MR. CRAIG:

Q Did you, or are you aware of anyone else on the 3-28-79 monitoring any parameters such as containment temperatures, reactor coolant pump inlet temperatures, or steam generator pressures during or following the spike?

or was it throughout the whole building. You know, I had no means of knowing those things.

Q On 3/28 or even 3/29 was the possibility of containment integrity ever being breeched ever discussed?

A I am not sure "discussed" would be the proper word. You know, it entered my mind that it may have been breeched. As a matter of fact, the pressure dropping, you know, as fast as it did, one of the things that came through my mind was that possibly it did have some kind of pressure increase in the building, and I think I mentioned this earlier, a steam leak, and simultaneously containment was breeched and we are therefore relieving the pressure. You know, we checked everything we possibly could and found that wasn't the case.

MR. MOSELEY: What specifically did you check and whom did you ask to check this?

THE WITNESS: Well, things like the steam generator pressures, the containment isolation, you know, the valves to ensure that the valves were closed, that were supposed to be closed were closed, I think, and I don't really remember, you know, I can't say, and this doesn't stand out in my mind, but I think I had someone get the procedure for loss of coolant which describes containment isolation and verify that, you know, what was supposed to be isolated was in fact isolated. You know, reactor coolant pressure, of course. There were a number of things that we did check just to verify the fact that we did still have containment, and not only to verify that we did still have containment but also to try to determine what caused it, you know, did we have either a loss of coolant or a steam leak or something that caused pressure to go up and simultaneously lost containment. We checked everything we could and didn't find anything.

MR. MOSELEY: Did you specifically ask for the radiation monitoring people to make a quick survey around the building to see if there was activity leading out?

THE WITNESS: I remember directing someone to make an inspection of the containment. I think it was an operator type person. It wasn't a health, physics or radiation control person,, and it was probably a shift foreman, a senior CRO, or something of that nature, because you must understand how, you know, the chain of command there is. Essentially the shift foreman directs the operators, the control room operators primarily, and the control room operators direct the auxiliary operators who work out in the plant.

I asked and directed someone to make an inspection. Now, I don't remember who, you know. It was just a possibility that came into my mind, you know, that something in containment or some part of the structure itself had possibly broken or fell apart. I didn't really believe it but I thought it was something that I had to check anyway.

MR. MOSELEY: Did you discuss with Miller, Kunder, Ross or others that you were having these checks made?

MR. McBRIDE: Maybe the problem with the question is could you explain who you mean the others to be?

THE WITNESS: Let me say, normally I would as part of the report, you know, to the chain, in other words, Gary Miller, I would not only explain what had happened but what I am doing about it. Whether I did that in this case or not, I don't remember.

MR. MOSELEY: What about to Ross or Kunder and maybe Zewe? Zewe was the nominal shift supervisor at that time, right?

THE WITNESS: It is possible, but I really can't remember. Again, you know, the way I work I would have under normal conditions, and whether or not I did in this case I just can't remember.

MR. MOSELEY: You just don't recall.

THE WITNESS: I just don't recall.

MR. MOSELEY: Do you recall whether you discussed the results of these checks, some statement of confirmation that everything is okay, we have checked the containment and it is still good?

THE WITNESS: Again, no, I don't recall, but, again, knowing the way I operate, I assume I would have. I don't recall that I did.

BY MR. CRAIG:

Q Do you remember how long it took before you got a report back on that check of the containment?

A I don't know that I ever got the report back on that outside, you know, check of the containment. I guess I don't remember because I think by the time they could make any kind of inspection I had come up with the idea, and quote if you will, of the hydrogen explosion. And I think after that I just sort of forgot about the containment check.

BY MR. HOEFLING:

Q Joe, let me go back to something we have already talked about. This is the instruction not to start electrical equipment that we talked about earlier. What you basically said was that the instruction was given on March 28th by Miller not to start any electrical equipment in the containment.

Now, we have talked to Brian Mehler on this same subject, about the instruction and when it was given. This is how that spun out. On October 11th, '79 Brian testified on this subject and he said basically what you have said that he recalled the instruction having been given by Miller on the 28th. After that he had some doubts, reconsideration, what-have-you, and he later testified that he wasn't sure when the instruction was given. He wasn't sure if it was given on the 28th or the 29th. He still recalls such an instruction being given, but he didn't know when it had been given.

We talked to Brian about this yesterday and asked him what prompted him to think about this and begin to doubt the time. He indicated that he had some conversations. Specifically

HUNTER: After the K-3 relay was jumpered the pump started without.

MEHLER: We bumped the pump, yes.

HUNTER: Okay. Let's move on a little further in the day.

MEHLER: I didn't realize it was that early in the morning we bumped it.

HUNTER: Yeah, it may be ... it's a little suprising. I have two sheets and the two sheets take us from the four o'clock trip out to where we're going out to 16 hour ... the point where you get the pump back on and then we consider in our investigation or in our program as being from then on its recovery...that you're stable. I just use that as a key.

MEHLER: Okay.

HUNTER: Okay. There was a discussion about -- in the afternoon approximately 1:50 or so -- there was a spike in the containment to a high pressure.

MEHLER: The spike in the containment occurred about 10 of 2. Somewhere around 10 of 2 or 2:00.

HUNTER: Were you in the area when that occurred?

MEHLER: When that occurred I was in the shift supervisor's office. What alerted me to it is I noticed the CROs moving over towards the makeup pumps and starting to secure them, and that indicated that we had probably another ES. And there's two conditions that could have caused it. Either low pressure, which we were already at, or a high reactor building pressure of four pounds.

HUNTER: Okay, Brian, did you notice that the containment spray pumps were on at that time?

MEHLER: Yes I did, I walked out and I went to the left side of the console where the building spray pumps are. Previous to that I glanced over the RP pressure indication and it was reading roughly in the neighborhood of one to two pounds. At that particular point I looked at the spray pump and they were running and I didn't know why, because they should start at 30 pounds. So we secured the spray pumps because there was no need to put the sodium hydroxide into the containment all over the equipment.

HUNTER: Okay, Brian. Did you have the wide range pressure trench recorder available to you for reactor pressure?

MEHLER: Oh yes.

HUNTER: Did you look at that?

MEHLER: Yes, after we secured the spray pumps I went back and checked the recorders. And definitely there was a spike aligned straight up. It went up to approximately 32 to 33 pounds and it came down in the same line.

HUNTER: What did this mean to you? Did it mean anything at that time?

MEHLER: First thought in my mind that someone was screwing with the transmitter.

HUNTER: Do you know what activity the shift was involved in at the time that today ignition or explosion occurred?

MEHLER: I didn't know at that particular moment what activities were involved. Later on I found out.

HUNTER: Okay. And what did you find out later?

MEHLER: Well, later the only activity that could have caused the explosion was some kind of spark because they opened the block valve --

no, no it was not the block valve. It was the vent valve from the pressurizer to relieve some water. And that was the only thing that could have given us detonation of the hydrogen.

<u>HUNTER:</u> Were they using the vent valve and the block valve on the pressurizer? At different times?

<u>MEHLER:</u> At different times, yes.

<u>HUNTER:</u> What's the difference between using a vent valve and a block valve for that activity? Is is a smaller line?

<u>MEHLER:</u> Maybe I screwed up.

<u>HUNTER:</u> Is it a smaller line?

<u>MEHLER:</u> The vent valve is 137 and that is smaller. I could be wrong in that, it might have been the block. But I know it was one or the other that they did open at that specific moment when...

<u>HUNTER:</u> Does the vent valve or block valve are those -- is that a limitorque type motor on it? Is that electrical motor drive, that type of a motor?

MEHLER: Yes. An electromatic has a pilot valve on top of it, which causes that to open. The pilot valve actuates first.

HUNTER: Okay. There was some discussion that the ventilation reactor building, refueling building and auxiliary building ventilation was restarted at nine o'clock. Do you recall any discussion about that?

MEHLER: I don't know when it was restarted. I do know it was running later in the day. I do remember seeing the control switches taped to the "on" position.

HUNTER: Okay. You don't know when it was turned off or when it was started?

MEHLER: It would have automatically tripped on the high radiation levels.

HUNTER: Okay. Which high radiation levels automatically trip it?

MEHLER: Both the reactor buildings. I am sorry, not the reactor building. Fuel handling buildings, aux building, and probably it would have also tripped on the stack monitor, probably.

HUNTER: To restart that do you have to reset the actual radiation monitor?

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Q Which meant that there had been a pressure signal that went through and started the building spray pumps?

A Right.

Q Then I think in your I & E interview you said later you told Gary Miller --

A No, I don't believe I did say that. I did say that I told an NRC man standing right along side of me and I pointed out the pressure spike to him and told him that it happened and why the building spray pumps came on because he wanted to know.

Now you're going to ask me his name.

Q No, I'm not interested in that strangely enough.

A Well, I don't know it.

MR. ALLISON: Give me just a second to look at my notes.

(Discussion off the record.)

BY MR. ALLISON:

Q Now, after looking at it in that initial dismissal, did you later realize that there had been pressure in the containment that caused that spike on the instrument?

A Yes.

Q Do you have any idea what could cause that kind of a rapid pressure spike?

A I know Joe and I talked about it later on that day, about what could have caused it and I don't think hydrogen

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entered into it. We thought maybe some kind of chemical reaction or something happened because it was up and down so quick.

Q That is Joe Chwastyk?

A Yes.

Q So you really didn't have a good diagnosis?

A I personally didn't think hydrogen could form that quick in the building to that concentration to cause it in that period of time.

Q Did you connect the spike with the fact that it just happened after the vent valve had been opened?

A No, later on, yes. Two days later when everyone became concerned, yes.

Q But not on the 28th?

A We were told, someone must have connected it, because we were told not to start any pumps, not to do anything that could give an ignition.

Q Were you told that on the 28th?

A Yes, in a supervisor's office. I forget who told us that, so it was someone who was honed in on something.

Q It sounded like somebody made a connection with hydrogen?

A Who, I don't know. I would have to make an assumption and I don't want to do that.

Q Did you make any recommendations to Gary Miller --

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Q Did you make any recommendations to Gary Miller --

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with regard to that pressure spot either immediately after it happened or later on on the 28th?

A No. It's very hard. I would like to put the time together, but I can't. I can't. I do know sometime after the pressure spike happened we were told not to start equipment because they assumed that it could happen again and they probably put it that there was hydrogen in there, but that was sometime after 1:50. Now how far past that, I don't know. And I do not, I said -- well, to Gary Miller I said -- he said don't start any more oil pumps and I said we don't have to, I already tested them all, because they were concerned -- but how far into the afternoon at that time, I don't know whether it was 4:00, 2:00 or what, but it was sometime after.

Q Now basically this was a site involvement in the plant operation when you went out to see what happened, was it not? When the radiation alarms came in, did you become involved in emergency plan business?

A Basically I became involved in setting up -- I sent somebody downstairs to the control room down there to establish communications and we were making notifications immediately. I went through the procedures to make sure we were doing them all and sometime in that medium -- oh boy, Jim Schielinger showed up and took control of that. I then, sometime along the line that day, we broke vacuum and we were going through the atmospherics and the State of Pennsylvania said no and I got

Wednesday or 6 Thursday?

Mr. Mell. I came to the plant about 6 o'clock Wednesday, and I worked through until the following morning, until 7 or 8 o'clock in the morning.

Mr. Arena. During that time in the control room, did things quiet down a little in terms of the number of people there and all of that during the duration of the shift from that night until the next morning?

Mr. Mell. What do you mean by quiet down?

Mr. Arena. The impression we have gotten is at least, certainly during the afternoon of Wednesday, there were lots of people in the control room, there were plant people, NRC people, B&W people -- maybe to back up, when you got to the control room at 6, how many people were there?

Mr. Mell. The control room was full, but the people were -- like we have a roped-off area up there in the front.

Mr. Arena. The lines around the floor?

Mr. Mell. Most of the people were behind that line to where the operator could get up there and operate. Our bosses were there suggesting different things, talking to us, allowing us to essentially -- I didn't have any problem to operate up there. There were a lot of people there, but even when I got there at 6 o'clock it wasn't that excitable. People were quiet and doing their job.

Mr. Arena. But did the control room stay full during the night?

Mr. Mell. I really couldn't tell you. We were so busy all night. I never kept track.

Mr. Arena. During that night, what do you recall being --

Mr. Blush. Before you go on to that night, I have a questic about the 28th. Was there any discussion when you came on about whether or not the core coverage was being maintained? Were people concerned as to whether or not the core was covered at that point?

Mr. Mell. Well, when I first came on, or there shortly afterwards, we were worried about getting the reactor coolant pumps started. Because we were worried about getting them started, I would say, yes, they were concerned about coverage to the core because you start the reactor coolant pump, you have got water in there.

Mr. Blush. But I mean, do you remember that being factored into the consideration of starting the reactor coolant pump, that they were not certain that the core was covered?

Mr. Mell. Nothing was said to me, if that's what you are asking.

Mr. Blush. That's what I am asking.

Mr. Mell. Although they were concerned about starting the reactor coolant pump. To me that would mean they were concerned about getting water into the core.

Mr. Arena. And when did they finally get that pump started, do you remember?

Mr. Mell. A time?

Mr. Arena. Yes. About 8 o'clock?

Mr. Mell. I really couldn't tell you the time frame because that was quite some night.

Mr. Blush. Early on in the shift?

Mr. Mell. Early on in the shift, yes.

Mr. Arena. Did they try to start more than one and were only able to get one going, do you recall? Was it a cautionary thing of trying to get one going and see if it would be advisable to start the others?

Mr. Mell. We started the one. In order to start that, we had to jump routes and different relays, starting interlocks. As far as I know, we were going to start another one, but that was cancelled for some reason. I really couldn't tell you why. Discussions were going back and forth all night trying to figure out what would be the best way to take care of it. I believe they were discussing starting the second one.

Mr. Arena. While you were on shift, did they go ahead and get any other reactor pumps going?

Mr. Mell. Did we start one?

Mr. Arena. You got one started?

Mr. Mell. Right.

Mr. Arena. And subsequent to that one, did you start any others?

Mr. Mell. Not to my knowledge.

Mr. Arena. Back to the evening. The control room was full about 6. Did it stay full until the next morning or did it thin out a little bit behind the line, people were going home?

Mr. Mell. I can't tell you.

Mr. Arena. Do you remember hearing during that time frame any discussions about the existence or the presence of hydrogen either in containment or in the system itself?

Mr. Mell. Hydrogen itself, no. That we did have a bubble, yes, we talked about that after we started the reactor coolant pump. The way the plant was responding it wasn't responding normally and one of my co-workers suggested we had a bubble somewhere.

Mr. Blush. Who was that?

Mr. Mell. Ted Elljes. He suggested as soon as we started the pump, that reacted sluggishly and there probably was a bubble somewhere. He suggested it was in the steam generator, being a higher point.

Mr. Arena. During the evening, do you remember anybody looking at or discussing the reactor building containment pressure strip chart?

Mr. Mell. That was shown to me when I came in on the afternoon. The man I relieved showed that to me. He said today they both went up and the pumps came on. So he said they looked at it, the pressure went back down, they turned the pumps off.

RADIATION EMERGENCY PROCEDURE 1670.3

## GENERAL EMERGENCY PROCEDURE

1.0 Discussion

A General Emergency is an incident which involves areas external to the site boundary and will require assistance from off-site support groups. A General Emergency is declared when:

a. The Reactor Building high range gamma monitor indicates 8R/hr.

OR

b. The radiation level at the site boundary is 125 mr/hr.

OR

c. The liquid effluent radiation monitor (RML-7) indicates greater than $6.8X10^{-3}\mu C/CC$.

2.0 Objective

To outline action required in the event that a General Emergency is declared.

3.0 Symptoms

Examples of symptoms of a General Emergency are as follows:

1. Off-site survey results indicate dose levels, down-wind from the site boundary, in excess of 30 Rem to the thyroid or 5 Rem to the whole body.

2. Radiation monitor Rm-G8 indicates an exposure rate of 8 R/hr. in the dome of the Reactor Building.

3. Radiation monitor RM-L7 detects radioactivity in excess of $6.8 \times 10^{-3}$ µ Ci/cc in the discharge to the Susquehanna River.

4.0 <u>General Emergency Immediate Action</u>

I. Station Superintendent/Assistant Superintendent/Shift Supervisor (back shift and holidays).

1. The initial actions and responsibilities are delineated in 1670.2 (Site Emergency Procedure).

2. Declare a General Emergency when any or all symptoms listed above are present.

3. In addition to 1 above, the Station Superintendent/ Assistant Superintendent shall:

   a. Request off-site support group assistance from any or all of the following, if results of off-site radiation monitor survey indicate dose rates that could result in a 2 hour off-site exposure in excess of 30 Rem to the thyroid or 5 Rem to the whole body. (See Figure #2)

      1. AEC Brookhaven (RAP) Radiation Assistance Program
      2. Radiation Management Corporation
      3. Medical Consultants

         NOTE: Telephone numbers of above are listed in Contact List Radiation Emergency Procedure 1670.14

      4. Pennsylvania Bureau of Radiological Health.
      5. State Police shall be notified to establish road blocks in the vicinity of Three Mile Island as indicated in Figure 1 of the Interface Plan found in Section 3 of the Emergency Plan.

RADIATION EMERGENCY PROCEDURE 1670.3

4. Inter-act and provide information to various groups outlined in the Interface Plan found in Section 3 of the Emergency Plan, i.e., Civil Defense, Bureau of Rad. Health, Coast Guard and State Police.

5. In the event Three Mile Island and/or off-site agency monitoring teams determine that the off-site radiation doses to the public exceed dose outlined in the State of Pennsylvania Radiation Protection Guide, found in the Met-Ed Radiation Emergency Plan (Section 4), recommend to State of Pennsylvania representatives that affected portions of the LPZ be evacuated according to Section 3 of the Radiation Emergency Procedure 1670.4.

   NOTE: The State of Pennsylvania Radiation Protection Guide values for probable evacuation of LPZ are greater than 5 Rem whole body or greater than 30 Rem to the thyroid.

6. In the event the Bureau of Radiological Health cannot be contacted and the situation is catastrophic, causing severe danger to the local population, as determined by the Off-Site Monitoring Team, then the Station Superintendent/Assistant Superintendent, in conjunction with the State Police, will initiate evacuation of affected portions of the LPZ in accordance with Section 3 of the Radiation Emergency Procedure 1670.4. The Station Superintendent/

Assistant Superintendent will use the following dose criterion for initiating LPZ evacuation in the event the Bureau of Radiological Health cannot be contacted.

1. Greater than 5 Rem whole body and/or greater than 30 Rem Thyroid.

II Duties of the following personnel during a General Emergency are outlined in Radiation Emergency Procedure 1670.2 -- Site Emergency.

a. Shift Supervisor
b. Control Room Operator
c. Supervisor of Operations
d. Station Engineer
e. Supervisor of Maintenance
f. Nuclear Engineer
g. Radiation Protection Supervisor
h. Chemical Supervisor
i. Radiation Monitoring Teams
j. Emergency Repair Party
k. Security Guards

NOTE (1): It shall be the responsibility of all the above to provide maximum assistance and information possible to the various off-site groups, i.e., AEC, State of Pa., Bureau of Radiological Health, State Police, Civil Defense and Coast Guard.

NOTE (2): Should the General Emergency occur during other than normal working hours, then the Shift Supervisor will assume the duties of the Station Superintendent/Assistant Superintendent, Station Engineer, Radiation Protection Supervisor, Supervisor of Maintenance, until suitably relieved.

RADIATION EMERGENCY PROCEDURE 1670.3

NOTE (3): On determining that a possible General Emergency exists, the Shift Supervisor will immediately contact appropriate plant management in accordance with Administrative Procedure #1C14 (Recall of Standby Personnel), found in Section 7, Three Mile Island Emergency Plan.

5.0 Post Emergency Action

1. Post Emergency Actions following a General Radiation Emergency are as outlined in Section 5 of Radiation Emergency Procedure 1670.2 (Site Emergency).

2. In addition to 1 above:

   a. If portions of the LPZ were evacuated, persons will be provided shelter, food and clothing by the Civil Defense Organization of the State of Pennsylvania for duration of High Radiation levels in the LPZ.

   b. If road blocks were established and no evacuation of the LPZ was initiated, the road blocks would be removed on direction from the State Bureau of Radiological Health.

   c. Evacuated personnel will be permitted to reoccupy the LPZ when conditions are declared safe by the Pennsylvania Bureau of Radiological Health.

P R O C E E D I N G S

MR. GAMBLE: This interview is being conducted as a portion of the Nuclear Regulatory Commission's investigation into the exchange of information between the Metropolitan Edison Company and the NRC on March 28th, 1979.

At this time if you would raise your right hand to administer an oath.

Whereupon,

WILLIAM DORNSIFE

was called as a witness and, having been first duly sworn, was examined and testified as follows:

E X A M I N A T I O N

BY MR. GAMPLE:

Q Will you please state your full name for the record.

A William Paul Dornsife.

Q Okay. Thank you.

BY MR. MOSELEY:

Q Mr. Dornsife, it was perceived by the plant staff that shortly following the automatic shutdown of the reactor, the reactor was returning to criticality, as indicated by the source and intermediate range instrumentation.

To your knowledge, on 3/28, was this knowledge provided to the Commonwealth of Pennsylvania by the Met Ed or GPU organization?

A Not initially. The only indication that we got that they were having some problem with return to criticality was a boron concentration reading they did give us at about 9:00 a.m., when I talked to Gary Miller, and I think they were saying that the levels were -- it's on my notes -- 100 parts per million boron, which was way down from what it was before the trip, and they suspected that a possible reason was a primary secondary leak, and when the reactor pressure went low, they could have got some secondary water into the primary. That's the information they gave me concerning it.

Q Did they mention to you the source and intermediate range instrumentation readings?

A No.

BY MR. CRAIG:

Q What discussions did you have with Gary Miller by way of explanation of the 100 ppm reading?

A I was really pressed for time. In fact, I was about half an hour late going to the Lieutenant-Governor's office when I finally got the information, so I didn't have any chance to ask any follow-up questions. It was just a matter of him filling me in on information he had. It was not a real good interchange, by me asking him questions. I just didn't have the time to do it. It took a while for me to get ahold of him, first of all, to get the information. I was really rushed for time to get over there for the briefing. So it was just him -- a one-way information flow, basically. Very little. I asked

Q Yes.

A Yeah, there was a lack of direct communications with what was going on. We had the open line, but again it was a delay in getting information when we needed it. There could have been better communications.

Q Do you feel the utility saw no need to pass this information on to you?

A That could have been part of it.

Q Do you feel that other organizations within the state may have received this, that is the --

A No, I can't imagine who, because we were the only ones in direct communications with the plant at that point.

Q Okay.

A Now, unfortunately I wasn't invited -- it was an oversight on the state's part -- to the meeting that occurred in the afternoon with the operator, so I don't know what information was passed during that meeting.

Q We intend to talk with others about that.

A Okay.

Q On March 28th, the reactor coolant pumps had been secured and were unable to pump water because of the significant voiding in the reactor coolant system hotlegs.

To your knowledge, on March 28, was this information provided to the Commonwealth of Pennsylvania?

A Not that directly. The information -- the best information I was able to sort out was the pumps were not running, but the plant was being cooled by forced -- by a feed-and-bleed method, and that there wasn't anticipated to be a problem in continuing to use that method.

There was an indication that Gary Miller told me in the conversation there was a possibility that there were bubbles or some voids in the systems, but certainly not indicating the core could have been uncovered. But there were fuel failures, probably due, in his opinion, probably due to the low pressure transient, some gap activity being released.

Q But specifically in terms of the voiding in the hotlegs and the fact that the pumps were not pumping water, that was not passed on to you as a specific piece of information?

A No, no.

Q Should this information have been passed on?

A Yes.

Q And again, if we can differentiate between how you might have felt on March 28th and how you feel today, if you would.

A It would have made a difference, obviously. It would have probably prompted more questions. Any of these bits of information could have, you know, sprung the point, "Hey, you know, if this is the case, what are some of these parameters?"

Q But on March 28th, you believe you would have felt

BY MR. HOEFLING:

Q But on March 28th, you felt that you were getting the information from the site you needed?

A Yeah. We had no reason -- I think I indicated to the Rogovin group, I never had any reason to believe they were holding anything back.

BY MR. MOSELEY:

Q Do you believe that other organizations within the state may have received this information?

A If they did, I don't know who. I don't know if any other organization would understand what it would mean.

Q Going to another specific, the reactor coolant pumps had been secured and were unable to pump water because of significant voiding in the reactor coolant system hotlegs.

To your knowledge, was this information passed on to you at BRP by Met Ed or GPU?

A I don't know that I got it, but I know there were notes to the effect that there were voids in the system, that there was something about -- some information come through to the effect --

Q Do you want to refer to this?

A (Witness examining document.)

There was something some place about, "We are going to shut the pump down to avoid cavitation," but I don't know if that's written.

Okay, here is an indication that they knew there was a void in there alluded to as a bubble, which would suggest that --

Q I guess maybe the question that we can -- if I can rephrase it slightly differently. Did you have a perception on March 28 that they could not run the pumps because of the amount of voiding that existed in the loops?

A I think it was on the -- I knew on the 28th, there was words to the effect that there were voids in the system.

Q I'm trying to get some feel for cause and effect.

A The thing is, I'm not a nuclear engineer. Bill was doing most of the talking. We knew things were not wonderful. That's about as far as I can legitimately talk about it.

Q Okay.

A And without going into speculation or whatever.

Q Do you feel that this information, that is the fact of the amount of voiding and its effect on primary coolant pump operation, do you feel that should have been passed on to you at BRP?

A It should have been passed to the state, yes, and I think in a way maybe it was, sort of, you know, in light of you have voids in the system, you have to kill the pump to avoid cavitation. You know, to that extent.

Now to the extent of how big this void was physically, you know, in terms of the bottom line being the core is uncovered we didn't have that information, or that didn't sink in. It would have asked for more information. I don't believe that we -- you know, the technical features of what was happening individually with components in the reactor at that time, we considered important for our activities related to the accident.

We didn't know, for example, that NRC had not been contacted until 8:00 o'clock. We assumed they were contacted at the same time we were contacted, and that they were on their way.

So, you know, by -- and they were in contact with them over the telephone, the same way they were in contact with us, only someone else -- we didn't ask. We just made the assumption the NRC was aware of what was going on, and they were handling that aspect of it.

Q Okay. I think you have answered generically a number of questions I have here, but I think just for clarity we would go through these and get a specific answer to some of these.

Do you feel that other organizations within the state may have received the -- again right now I'm specifically talking about the source range and intermediate range nuclear instrument readings?

A No.

Q On March 28th, the reactor coolant pumps had been secured and were unable to pump water because of significant voiding in the reactor coolant system hotlegs.

To your knowledge, was this information passed on to you?

A I am not sure if that -- I didn't look again at these notes, especially the notes that Bill took, before coming over here. We had another minor problem today at Three Mile Island.

Q I'll be happy to let you review them, if that would help you.

A I don't think so, early on. Later in the day we may have been told that. We knew that there were some voids early on, some voids in the system, but I don't know if that -- if the actual reactor coolant pump problem we were privy to during the first day.

Q You were not sure or don't know -- and I'd like for you to say which -- but let me finish the question, whether or not you had a belief that the pumps could not be run because of the extent of the void?

A I was under the impression that the pumps were shut off because of vibration, and I believe that information came from NRC inspectors onsite, rather than from the operators.

Q So this would have come some hours later?

A Well, it would have come after 9:00 o'clock, 9:30 in the morning, when they arrived. The time, you know, went by so fast it seemed like they were there before we had plotted the dose rates across the river, so it -- and we were talking to them.

Q Again I'd like to ask you if you believe this information -- again on the ability of the reactor coolant pumps to wasn't said in those words, or wasn't understood, whatever. It's one of my key points before the action, was if the core is uncovered, you have necessarily big trouble, and to that point I used to have sort of a set point in my mind that if the core is uncovered, you are going to pack up the folks and move them out, and if I had known that on the 28th, you'd still have a wrecking crew still trying to get me off the wall, to be perfectly honest.

Q Well, I'm not sure this is worth further pursuit, but let me try it.

A Try it.

Q The sense that I am trying to understand is whether or not you had the feeling that this voiding was of high significance in leading us down to this core uncovery, or that it was an operational inconvenience.

A It sort of had the flavor of an operational inconvenience, if memory serves.

Q Why do you feel this information wasn't passed on to you?

A The way you are phrasing the question suggests that this was indeed the case, and they knew it, right? Am I to assume that?

Q Yes.

A Okay. The framework of your question is indeed a fact. Assuming that that was the case, I have no idea why it

this is something he should have told you?

A Yes.

Q Okay. Or they should have told you.

A Yes.

Q Again I would like to ask you why you feel this information was not passed on to you.

A Again probably the same reasons I gave for the other.

Q Okay. And then I will ask you -- I won't go through the list of questions again, but could I ask you whether you feel that other organizations within the state may have been given this information?

A I don't believe so, not to my knowledge.

Q Another fact, the electromatic relief valve had been stuck open for a period in excess of two hours. To your knowledge on March 28th, was this information passed on?

A Yes, it was, in conversation with Gary Miller, he told me the valve had been stuck open. The indication was faulty, and it wasn't indicating the proper position on the indicator, and the valve was now closed. But this was again at 9:00 a.m.

Q Did he tell you how long the valve had been open? Maybe not two hours, but a long time? Or do you recall a period of time?

A I think he indicated it was open for a fairly long period of time, I believe.

Q Okay. Before we started the interview, you gave us

some notes that had been taken on that day. Can you refer to those notes and point to us the note that you may have made that would reflect on this?

A (Witness examining document.)

I don't believe it's on those particular notes, but I did write a more detailed list of things that Gary did tell me very shortly, a few days after this particular conversation, because at that point I realized it was going to become a very critical piece of information.

Q Do you have a copy of that?

A Yes, I do.

Q Could we take a look at that?

A This is basically my recollection of the first -- of what I did from 0700 when I first received the call from Clarence Deller up until, oh, about 9:00 a.m., when I received a call from Gary Miller. It includes that conversation. And this again has not been given to anybody officially. This information -- and this has been given in other records -- this is something I wrote down on my own after, I would say, two weeks after the incident occurred.

Q I was going to ask you to try to identify when this was prepared. Would you say it was within two weeks?

A I would say within two or three weeks afte., yes.

Q Then I'm trying for as much specificity as we can get here, would you say by the middle of April?

A Yes, I would say by the middle of April.

MR. MOSELEY: Let's take a short break.

(Recess.)

MR. MOSELEY: During the short recess, we have reviewed the three pages of notes or report -- I don't know how to title it.

THE WITNESS: Recollection is probably more like it.

BY MR. MOSELEY:

Q An area I would like to pursue just a little bit more has to do with what Miller told you about the valve having been stuck open and the block valve having been closed.

Do you recall any discussions of inventory deficiency or deficiency of primary coolant as a result of this valve having been open for an extended period of time?

A Other than him saying possibly there were voids in the system, he didn't know how big, I believe he might have said possibly the candy canes could have been blocked.

Q Did he relate the opening of the valve or the valve having been open as the cause of these bubbles or voids?

A I believe so, yeah. That would be obvious, the only way to do it, to remove the inventory from the system. I don't know if he specifically said that. It was just, you know, assumed on my part that was the reason.

Q But that's an assumption you made on March 28th, based on what Mr. Miller had told you?

A I believe so, yes.

BY MR. HARPSTER:

Q Do you recall, in looking at your notes, the plant was characterized as being stable at some later point. Was this as a result of the block valve having been closed, that they now felt that the transient was stable?

A I believe it was that, along with the feed-and-bleed cooling they thought was taking place as being a stable mode.

BY MR. MOSELEY:

Q Did Miller characterize this, the open block valve, as being the cause of why the plant was in the condition it was in?

A I don't think directly, but I inferred that was the case.

Q Can you give us any benefit of your recollection of what he actually said to you?

A It's been so long ago. It was difficult to write those recollections or other set of papers. I really have no idea. Things were going so fast at that point, a lot of it was a blur.

BY MR. CRAIG:

Q Did you believe the plant was stable when you got that report?

A Yeah. I guess so. That was what I told everybody. I didn't really question, I didn't have time to question that

FASANO: What time did you actually take over the console?

ILLJES: I think the log says around 1820, or somewhere in 1800.

FASANO: O.K. So it was close to 6:30?

ILLJES: Right. 6:30 p.m.

FASANO: You actually started to manipulate approximately 12.5 minutes and when you go back again, when you just got to the control room, how did it appear to you? How were things being conducted?

ILLJES: Well, the shift supervisor was running it. He was at the console and he was directing each and every move of the control room operator, and that's the way we operated more or less the same way. Anything that we did, any recommendations that we did, went through the shift supervisor.

FASANO: This was Mr. Zewe at the time, when you came in?

ILLJES: When we came in, I believe Joe Chwastyk had relieved Bill Zewe. He was directing our operations at the time.

FASANO: Let's see. The primary, you were on the primary?

ILLJES: The primary side. We were taking care of the reactor coolant pumps, pressurizer, make up system. That's the left hand side of the console.

FASANO: That would be close to the reactor building, wide range-narrow range indication?

ILLJES: Correct, correct.

FASANO: Do you recall being briefed on the wide range-narrow range reactor building indications?

ILLJES: I was told that they had a spike on both indications of the reactor building pressure recorder. There was some discussions as to what it was. A hydrogen explosion was discussed. This was later on in the evening.

FASANO: How late in the evening?

ILLJES: Oh my.

FASANO: You took the controls at 6?

ILLJES: At 6. Well....

FASANO: 6:20 or so?

ILLJES: No, I would say it was more... It was later cause we were... It was after we drew a bubble. O.K. If I want to relate it, I would say it was after we drew the bubble in the pressurizer which we did after that. As far as what time that was mentioned, as far as we discussed it, I know it was discussed when we turned over, when we came in, but we didn't make any bones about it because we were interested in getting flow through the reactor and the bubble in the pressurizer and so. They had recovered from the building isolation high pressure injection. They had recovered from that situation, and our concern was cooling the reactor and insuring it had flow. Later on when we had things stablized, we had a bubble in the pressurizer and had a reactor coolant pump running and that term area, we were discussing with, I can't remember if it was one of our engineers. But we did have a pressure spike. We pulled it out and I don't know who wanted a copy but we made a couple copies of the chart.

FASANO: O.K. This was sometime after 6?

ILLJES: Somewhere.... Hell, I would say it was after 8:00.

FASANO: After 8:00 that night?

ILLJES: Yea, I'd say it was if I had to put a time on it.

FASANO: Let's go back a bit. When you first came in, where there xerox copies of that at that time?

ILLJES: I don't know.

FASANO: You didn't see any?

ILLJES: I didn't see any.

FASANO: Discussion was not really centered on that? Or was it centered on that to any degree that you remember?

ILLJES: No, it wasn't centered on that.

FASANO: As far as the ...?

ILLJES: It was over.

FASANO: Were you there when they were talking about it?

ILLJES: Not when I came in. I was there and I wasn't involved in any discussion until it was brought up.... Except when it was turned over it was mentioned that we did have a pressure spike, when we turned over. That was the only thing that was mentioned, and that they had recovered from reactor building isolation.

FASANO: So a pressure spike was discussed at the turn over, when you first came in, about 3:45. And then somewhere about 8:00 further discussion and also xerox copies?

ILLJES: Right.

FASANO: And apparently...

ILLJES: I think we remembered the xerox machine wasn't working too good

FASANO: At this time you discussed what and with whom, if you can remember?

ILLJES: We talked, I talked about it with the trainee on our shift, who was Chuck Mell. And the person that asked for the information, and I don't remember who that was, whether it was an NRC inspector or a B&W representative.

FASANO: Was any discussion related to this? Was the hydrogen burn or was a real spike or was this discussed as an electrical spurious signal possibly?

ILLJES: This was discussed that evening but we also talked about it several times after that and I cannot separate the two different discussions but as far as I remember we related it to a cycling of the electromatic relief isolation, which is a DC operated valve I believe and that has a contact in there which will cause arcing which possibly could ignite the hydrogen.

That was discussed, but I can't say we discussed it that night. We didn't really have that much time to do a lot of discussion, but we talked about it and when I walked away from the panel, the guy that wanted the copy, you know, he wanted it now, and I had to walk away from the panel to make sure that the other guy, my shift supervisor, was there while I walked away so...

FASANO: On the first evening, can you recall if on that first evening you were discussing after 8:00 that it was possibly a hydrogen burn?

ILLJES: As far as I know that possibility was discussed that evening.

FASANO: With this engineer, you don't know whether he was GPU or NRC or what? Can you recall?

ILLJES: No, I won't say. I don't remember. No. We... It was also that night, you know, that we determined that we had a hard bubble and what that bubble was, you know, we had talked about that too, you know... What is the gas and is it hydrogen or other and all that water that went through the reactor and out into the RC drain tank and out into the reactor building.

FASANO: So at that time it appeared to be still inconclusive within your own ...?

# REPORT OF INTERVIEW

**Karl E. Plumlee**, Radiation Specialist, Radiation Support Section, Fuel Facility and Materials Safety Branch, Office of Inspection and Enforcement, Region I, was interviewed telephonically on December 2, 1980, by Roger A. Fortuna and David H. Gamble of the Office of Inspector and Auditor (OIA). Plumlee indicated that he did not have his notes regarding the TMI accident readily available, therefore, his responses were based entirely upon his recollection.

Plumlee said he arrived at TMI's North Gate around 10:00 to 10:30 am on March 28, 1979, with four other Region I employees: Ronald Nimitz, Charles Gallina, Donald Neely, and James Higgins. He believed it took about a half hour to get in and that by 11:00 am they were certainly in the room adjoining the Unit 1 Control Room (CR). Upon arrival they were informed by Met Ed that all personnel entering the Unit 2 CR had to wear respirators; because respirators were in short supply, Met Ed asked that only two NRC inspectors go to the Unit 2 CR. Plumlee recalled that Neely and Higgins donned respirators and left for Unit 2 CR. He did not believe there was much delay after their arrival in Unit 1 before they left, so he estimated their departure time at 11:00 am. Plumlee said that Nimitz, Gallina, and he remained at Unit 1.

Plumlee said they established telephone contact from Unit 1 to Region I shortly after arriving. He recalled that about 11:30 George Smith (his branch chief) asked him to survey the radiation levels outside the buildings out of a concern over possible airborne releases. Plumlee said he conducted these surveys with Joe Manosky (a Met Ed plant operator) from about 11:30 until noon. Plumlee said he did not go inside Unit 2 then or anytime that day; he surveyed as close as Unit 2's innermost fence. Plumlee understood that Nimitz and Gallina continued to review Met-Ed's efforts in the Unit 1 CR during the time he (Plumlee) was surveying.

Plumlee said he returned to Unit 1 shortly after noon. He said that by this time Raymond Smith and another Region I inspector had arrived. Plumlee said that not long after he returned with his outside surveys, he discussed the condition of the plant with the senior Met Ed manager in Unit 1: Plumlee believed it was James Seelinger. Plumlee said they discussed things such as the plume and whether it came from the plant or the steam dump lines. Plumlee recalled that he informed Seelinger that because the wind was variable, the airborne radiation probably would get into Unit 1's air intake structure. Plumlee said it was only about a half hour later that the Unit 1 CR area became filled with airborne radiation and the NRC inspectors were asked to leave because they did not have respirators. Plumlee said that he, Nimitz, and (he believed) Raymond Smith and the inspector who arrived with Raymond Smith all moved off the site to a reception center. Plumlee said Gallina remained at Unit 1. Plumlee said that he and Nimitz then performed (separately) offsite radiation surveys with Met Ed personnel. He believed that he next returned to the site about 5:00 or 6:00 pm that day, but that Nimitz did not return until the following day (March 29, 1979).

Plumlee related that he and the other inspectors were briefed on the status of TMI before they left Region I on the morning of March 28, 1979. Plumlee said that at the briefing he understood George Smith to say that one of Met Ed's samplings of the reactor containment atmosphere showed it contained 2.4 percent hydrogen. Plumlee said that when he sought to confirm this with George Smith after the briefing, George Smith said that he (Plumlee) was mistaken and George Smith actually had imparted that the containment had 2.2 pounds overpressure. Plumlee indicated that this exchange had him thinking about hydrogen during the day. He said that based on this concern, during his conversation with Seelinger (just before being asked to leave Unit 1 in the early afternoon), he asked Seelinger if he had any better information about hydrogen content in the Unit 2 containment. Plumlee explained by way of background that the only gas analyzer at TMI which could detect hydrogen was in Unit 1; so samples pulled from Unit 2 were taken to Unit 1 to be analyzed. Plumlee recalled that Seelinger had a sequence of numbers representing the percentage of hydrogen in each of the samples tested. He recalled that Seelinger had varying amounts, with a lower current figure than the one Plumlee thought George Smith mentioned (2.4 percent), but with another figure that was higher than 2.4 percent. Plumlee said that Seelinger indicated he had been in contact with a number of people in Unit 2 CR and that some Met Ed personnel had guessed that there might have been an explosion based upon the reduction in hydrogen levels. Plumlee understood that Seelinger received his instructions that day from TMI Station Manager Gary Miller, but Plumlee did not know whether the conjecture about the hydrogen explosion came from Miller.

Plumlee said his conversation had to have occurred between the times he arrived at Unit 1 (about 11:00 am) and left (about 1:00 pm) on March 28, 1979. He said that based upon surrounding events, he would estimate the time to have been sometime between 12:00 and 12:30 pm.

Plumlee did not recall anyone being with him when he discussed hydrogen with Seelinger. Plumlee said he did discuss with Gallina what he learned from Seelinger. Plumlee said Gallina was manning the telephone to Region 1 at the time and it was just at this time that they were told to leave Unit 1 because of the airborne radiation. Plumlee said that they (he and Gallina) did not report his information to Region 1 because they assumed the inspectors in Unit 2 CR (Neely and Higgins) were providing this information. He said it did not occur to him that the inspectors in Unit 2 CR did not know everything he knew. Plumlee said that in restrospect he has no indications that Neely or Higgins actually knew of the hydrogen content of the containment.

Plumlee related that two or three days after the accident, he and Gallina discussed his conversation he had had with Seelinger. He said that Gallina then indicated that he believed it occurred later in the day on March 29, 1979 (the day after the accident). Plumlee indicated, without refuting his recollection of when the conversation had occurred in relation to other events, that the conversation thus could have been either on the 28th or the 29th of March 1979.

Plumlee believed that in general, Unit 2 management was only following the policies they were expected to follow. He explained that it appeared Met Ed's main interest was to get the plant back on line to start generating electricity. Plumlee felt this influenced much of the underlying logic for the actions of Met-Ed personnel, and it is something of which they are not now proud. Plumlee said they followed a strict attitude of "mind your own business" vis-a-vis NRC until the problems got big enough that they realized it could not be done. Plumlee expressed the opinion that Met Ed only told NRC what it was bound to tell and that at his level, Met Ed personnel pretty much only provided the information that was asked of them.

INVESTIGATORS'NOTE: During his May 30, 1979, interview by IE (for "NUREG-0600"), Plumlee, described a number of details he received during a briefing re TMI about 8:15 a.m. on March 28, 1979. One of the details he recalled receiving was "...the fact that the containment building had the hydrogen present in the atmosphere in a significant quantity. I don't know whether it was 2% or 3%, but it was well above the detection limit..." (Tr.5 at line 8).

## REPORT OF INTERVIEW

Karl E. Plumlee, Radiation Specialist, Radiation Support Section, Fuel Facility and Materials Safety Branch, Office of Inspection and Enforcement, Region I, was reinterviewed on December 3, 1980, by David H. Gamble of the Office of Inspector and Auditor. Plumlee indicated he had located his notes for March 28, 1979, and was providing OIA with a copy. He said the notes were taken on single sheets of paper which he numbered consecutively at the time. He said he was providing all his notes for the 28th except one page that only contained motel information.

Plumlee said it was common knowledge, even in Unit 1, that the trips associated with the hydrogen explosion had occurred. He said that it was obvious that the only thing that could have caused these trips (e.g., the actuation of the containment sprays) was a pressure increase in the containment. Plumlee said his notes reflect that he was at the North Gate on his way out at 1:30 pm; therefore, he estimated that he was asked to leave Unit 1 sometime around 1:20 pm. Plumlee said that by 1:50 pm he was probably at the observation center.

Plumlee said the first time he heard about the spike was from Gallina. He believed that Gallina told him about it immediately after he (Plumlee) informed Gallina about his conversation with Seelinger about hydrogen in Unit 2's containment.

Plumlee recalled that Gallina said he received this information either from the NRC inspectors in Unit 2 or from a Met-Ed person, such as Greg Hitz who was relaying information. Plumlee said that his belief that Gallina already knew of the pressure spike indicates that his (Plumlee's) conversation with Seelinger may have been on March 29, 1979, or even later.

Plumlee then related that the possible reasons Met-Ed and NRC may have had for keeping some details about the accident from being widely disseminated must be considered. He said that, if it were known that the accident was far beyond anything anticipated and that the fuel had lost much of its cladding, they would have run the risk of some Met-Ed employees walking out, some number of NRC inspectors deciding against going in, and a major problem of frightened citizens jamming the highways leaving the area.

Plumlee recalled what he thought he heard George Smith say during their briefing regarding hydrogen content of the containment. Plumlee said his guess at the time was that Met-Ed had told NRC (probably Smith or Eldon Brunner - another Region I branch chief) about the hydrogen and Smith "slipped" when he mentioned hydrogen during his briefing. Plumlee said that it was for this reason that he broached the subject of hydrogen with Seelinger.

Interview of Former Met-Ed Employee

James L. Seelinger, Manager, Facilities Advance Planning, Government Products Division, Pratt and Whitney Aircraft Group, United Technologies Corporation, West Palm Beach, Florida, (formerly Unit 1 Superintendent, Three Mile Island Nuclear Station), was interviewed telephonically at his residence on December 23, 1980, by David H. Gamble of the Office of Inspector and Auditor. Also participating in the conference call on behalf of Seelinger was Harry H. Voigt, Esq., of Lebouf, Lamb, Leiby, and MacRae, 1333 New Hampshire Avenue, N.W., Washington, D.C.

Seelinger stated that he knew NRC Inspector Karl Plumlee and recalled Plumlee's presence at TMI on the day of the accident (March 28, 1979). Seelinger said he could not recall any conversation around mid-day with Plumlee and could not recall discussing hydrogen content in the Unit 2 containment with him anytime that day. Seelinger said the only conversation he remembered having with Plumlee on the day of the accident was that night when they discussed radiation readings Plumlee had taken from a car off Route 230.

Seelinger was not aware of any analyses completed that day of the gas content in the Unit 2 containment. He was aware of one unsuccessful attempt to draw a sample in the morning by one of Richard Dubiel's employees. Seelinger said he recalled first hearing of data on hydrogen content in the Unit 2 containment sometime after the day of the accident - although he was not sure just when.

r?5

Dave Limroth who is a superintendent I still am required to support the individual units superintendent, with the appointment of technical superintendent, it allowed me to go through him to assist in priority between the two units. Also, gave us a better direction in trying to support both of them on a day-to-day operation. The superintendent technical support then reports directly to the station manager as does the unit superintendent from each unit.

DONALDSON: Then the, your group essentially is somewhat autonomous in that the line or chain of command goes directly from yourself through one additional supervisor directly to the station superintendent.

DUBIEL: That's correct. Station superintendent, the exact title means Station Manager which is Gary Miller.

DONALDSON: Under you, would you briefly outline the first line supervisors under your command?

DUBIEL: To the foremen level?

DONALDSON: That would be two levels, right?

DUBIEL: That's correct.

DONALDSON: OK let's take it down to the foremen level.

DUBIEL: OK. In the area of health physics I have Tom Mulleavy, reports directly to me as radiation protection supervisor and below Tom, reporting to Tom there are four radiation protection foremen. Did you want names, Dale?

DONALDSON: Why don't you go ahead and fill those in.

DUBIEL: The four radiation protection foremen are: Joe Deman, Pete Velez, Bob McCann, and Fred Huwe. They report directly to Tom, and are radiation protection foremen. Also reporting to Tom are two radwaste foremen, Jim Smith, and Leo Hydrick. Reporting directly me is a health physics engineer, Len Landry who reports to me and works closely with Tom in handling most of the project oriented problems, something that isn't a day-to-day type of a problem. Also there is a radwaste engineer, Ed Fuhrer, who reports directly to me, again working hand in hand with Tom in trying to solve some of the problems associated with radwaste that are a little bit beyond the ability or the scope of the foremen. In the chemistry area I have four, let me back up, three chemistry foremen there is no chemistry supervisor in an attempt I have and intended to follow through on as to structure similar to the HP site. There is no chemistry supervisor so the three chemistry foremen are all on a equal level. There is a unit 1, and I will refer to it as a Plant Chemist, Gary Reed. Gary is very knowlegeable chemist in the area of systems chemistry, demineralization, evaporation, the effects of

CRAWFORD: 7:10 to 7:15.

ESSIG: 7:10 to 7:15 and it was apparent then from the calculation anyway whether it was right or wrong at that time you assumed it was right since you couldn't find any errors in it that there was an apparently a dose rate of 40 R per hour in Goldsboro and that was perceived to be confirmed by dispatching the onsite teams survey at point GE-8 which is in the general direction of the predicted value of Goldsboro and then that measurement came back in at 0746 according to your sheet there.

CRAWFORD: Right and between the time that I told Dick Dubiel and I guess I came back and there was a lot of conversation between Dubiel, myself, and Jim Seelinger mostly between Dubiel and Seelinger that I was kind of standing there listening to you know what reasons there could be that the Dome Monitor was so high that this calculation was so high could that in fact be an actual number or could it be a bad number. I don't know how long that conversation went on.

ESSIG: Okay. Mike were you involved in any of those conversations between Dubiel and Seelinger? Were you asked for any input on this monitor as to whether or not it was reading?

BENSON: I don't correctly remember any. I may have to talked with Howard. I remember talking about the possibility of steam damage to it. I'm not sure if Howard got that from conversation with Dick and Jim or how it come about. I don't remember directly talking to Dubiel.

 TMI-2

No: PN-NRC:I-38
Date: 3/28/79

PRELIMINARY NOTIFICATION OF EVENT OR UNUSUAL OCCURRENCE

This preliminary notification constitutes EARLY notice of events of POSSIBLE safety or public interest significance. The information presented is as initially received without verification or evaluation and is basically all that is known at the time of this notification. IT SHOULD BE SPECIFICALLY NOTED THAT THIS NOTIFICATION MAY CONTAIN INFORMATION THAT LATER MAY BE DETERMINED TO BE INACCURATE OR INCONSISTENT.

Facility: Three Mile Island Unit 2
Middletown, Pennsylvania
(Docket No. 50-320)

Subject: NUCLEAR INCIDENT AT THREE MILE ISLAND - UNIT 2

The licensee notified Region I at approximately 7:45 AM of an incident at TMI-2 which occurred at approximately 4:00 AM at 98% power when the secondary feed pumps tripped due to a feedwater polishing system problem. This resulted in a turbine trip and subsequent reactor trip on High Reactor Coolant Pressure. A combination of Feed Pump Operation and Pressurizer Relief - Steam Generator relief valve operation caused an RCS cooldown. At 1600 psig, Emergency Safeguards Actuation occurred. All ECCS components started and operated properly. Water level increased in the Pressurizer and Safety Injection was secured manually approximately 5 minutes after actuation. It was subsequently resumed. The Reactor Coolant Pumps were secured when low net positive suction head limits were approached.

About 7:00 AM, high activity was noted in the RCS Coolant Sample Lines (approximately 600 mr/hr contact readings). A Site Emergency was then declared. At approximately 7:30 AM, a General Emergency was declared based on High Radiation levels in the Reactor Building. At 8:30 AM site boundary radiation levels were reported to not be significant (less than 1 mr/hr). The source of activity was stated to be failed fuel as a result of the transient, and due to a known previous primary to secondary leak in Steam Generator B.

| Contact: | D. Haverkamp | | R. Keimig | | E. J. Brunner | 5240 |
|---|---|---|---|---|---|---|
| | Prepared by | Ext. | Section Chief | Ext. | Branch Chief | Ext. |

Distribution:

Dudley Thompson, Executive Officer for Operations Support, HQ
N. C. Moseley, Director, Division of Reactor Operations Inspection, HQ
G. Klingler, PN Coordinator

Transmitted to HQ 11:52am 3/28/79
(TIME)

Transmitted to Other Regions ____________
(TIME)



Region I Form 83
(Rev. Oct. 78)

The Region RI Incident Response Center was activated at 8:10 AM and direct communications with the licensee and IE:Headquarters was established. The Response Team was dispatched at 8:45 AM and arrived at the site at 10:05 AM.

At 10:45 AM the Reactor Coolant System Pressure was being held at 1950 psig with temperature at 250°F in the cold leg. By 10:45 AM, Iodine-131 levels as high as 1.25 E-8 uc/ml and radiation levels of 3 mr/hr had been detected offsite.

There is significant media interest at the present time because of concern about potential offsite radiation/contamination. The Commonwealth of Pennsylvania and EPA have been informed. Press contacts are being made by the licensee and NRC.

this is something he should have told you?

A Yes.

Q Okay. Or they should have told you.

A Yes.

Q Again I would like to ask you why you feel this information was not passed on to you.

A Again probably the same reasons I gave for the other.

Q Okay. And then I will ask you -- I won't go through the list of questions again, but could I ask you whether you feel that other organizations within the state may have been given this information?

A I don't believe so, not to my knowledge.

Q Another fact, the electromatic relief valve had been stuck open for a period in excess of two hours. To your knowledge on March 28th, was this information passed on?

A Yes, it was, in conversation with Gary Miller, he told me the valve had been stuck open. The indication was faulty, and it wasn't indicating the proper position on the indicator, and the valve was now closed. But this was again at 9:00 a.m.

Q Did he tell you how long the valve had been open? Maybe not two hours, but a long time? Or do you recall a period of time?

A I think he indicated it was open for a fairly long period of time, I believe.

Q Okay. Before we started the interview, you gave us

A Yes, I would say by the middle of April.

MR. MOSELEY: Let's take a short break.

(Recess.)

MR. MOSELEY: During the short recess, we have reviewed the three pages of notes or report -- I don't know how to title it.

THE WITNESS: Recollection is probably more like it.

BY MR. MOSELEY:

Q An area I would like to pursue just a little bit more has to do with what Miller told you about the valve having been stuck open and the block valve having been closed.

Do you recall any discussions of inventory deficiency or deficiency of primary coolant as a result of this valve having been open for an extended period of time?

A Other than him saying possibly there were voids in the system, he didn't know how big, I believe he might have said possibly the candy canes could have been blocked.

Q Did he relate the opening of the valve or the valve having been open as the cause of these bubbles or voids?

A I believe so, yeah. That would be obvious, the only way to do it, to remove the inventory from the system. I don't know if he specifically said that. It was just, you know, assumed on my part that was the reason.

Q But that's an assumption you made on March 28th, based on what Mr. Miller had told you?

Q Yes.

A Yes. I think --

BY MR. GAMBLE:

Q Mr. Gerusky, during the time interval from when you received the calculated dose rate of 10-R per hour, and when you received the actual Goldsboro other-side-of-the-river measurements that caused everyone to discount the calculated reading, was there any other information passed during that time, any other onsite measurements or any other kind of information which would tend to discount the original reading?

A I don't remember. I know that we were not very -- we didn't really believe that evacuation would have to take place. I don't think there was any time in there we felt we would have to evacuate people. We just didn't want to take any chances, even, until that reading came back.

BY MR. HOEFLING:

Q And how long was that, again?

A I don't know. I think in reconstructing it, or at least the telephone -- the PEMA telephone duty log indicated it may have been an hour, which surprised me a little bit the first time I heard that, six months ago at another one of these briefings.

BY MR. MOSELEY:

Q Going back, I have one more specific period to touch on, as we have done in others. George Kunder, who is the utility superintendent of Technical Support, told the Senate Investigative Group that he and others had been concerned that the core had been uncovered for a period of hours after 6:45 a.m.

To your knowledge, was this information passed on to the Commonwealth of Pennsylvania?

A No, not until Friday, with Joe Hendrie's probably second or third telephone call, or the visit to the Governor's office where he informed us of that.

Q Should this information have been passed on to you?

A As a matter of fact, it may have been Thursday night, in a telephone call from the Governor back to the onsite NRC inspector, who said, "There are more problems than we anticipated. There is a possibility the core was uncovered." I didn't even know that telephone call took place at all until reading it in one of the reports of one of the committees.

Q This was late Wednesday night?

A Thursday.

Q Thursday.

A That's when things started happening, Friday morning.

Q Yes.

A Thursday night and Friday morning, Washington started to get involved.

Q I'm not sure, did you answer when I said -- did I ask you, should this information have been passed on to you?

A Oh, hell, yes. I mean if --

any direct knowledge about this, I think we ought to ask the questions of him.

George Kunder, the superintendent of Technical Support at Three Mile Island, told the Senate Special Investigatic that he and others had been concerned that the core had been uncovered for a period of time after 6:45 a.m.

To your knowledge, on March 28th, was this information passed on to the Commonwealth?

A No, it was not.

Q Should it have been?

A Yes, it should have been.

Q Why, in your view, was this information not passed on?

A Well, primarily because the people who were believing that were not talking to us. It was the final data coming from the utility to us, not the dissenting opinions. But I think we should have been alerted that there is a question of whether the core is uncovered, or whether the core is covered.

Q The fact that someone --

A There are people that believe the core may have been uncovered, and why, you know, why they believe it.

Q Then if we are trying to characterize this, according to my little list here, then you would say -- would you categorize it as the utility didn't recognize or adequately evaluate this information? Would it fit in that category?

A I believe it would fit in that category, yes.

arrived in the office, and the two of us were talking to the person on the phone -- I think it was Dick Dubeal who we were talking to at that point, and he gave us a quick and dirty update based upon what we knew at the time, and it was very quick and dirty.

We assumed NRC was on its way and had been told at the same time, so I didn't pursue it any further, other than what was happening offsite.

Q Then you didn't have a perception at that point as to the extent of core coolant that had been lost?

A No, nor the failed fuel. There had to be failed fuel to get those kind of readings. That was just, you know, an automatic reaction. I wrote it down. I have no idea what -- it didn't make -- it didn't -- although it was hectic in the background, there was an awful lot of noise on the telephone, and it appeared that things were going to -- getting worse rather rapidly, it still didn't seem like it was, you know, approaching a loss-of-coolant type accident, the kind where you would have a severe -- you know, a major loss-of-coolant accident, from the telephone conversation. They were having some problems, but nothing that serious at that point. That was the general impression that I got from the telephone conversation.

Q It was perceived by the plant staff that -- this is on the morning of March 28th -- that shortly following the

A No. Again, they didn't think we needed to know that information. It was irrelevant to our activities.

Q During a good part of the day on March 28th, there was superheated steam in the reactor coolant system.

To your knowledge, on March 28, was this information --

A No, to my knowledge, it was.

Q To your knowledge it was not. Should it have been?

A Well, in retrospect, yes.

Q On March 27th, what would you have answered?

A Yeah, I think so.

Q There was a serious inventory deficiency, a loss of water or absence of water, voids in the large part of the -- both the steam generators and the hotlegs.

To your knowledge, on March 28th, was this inventory deficiency communicated to the Commonwealth?

A Yeah, I believe we had information that the -- that both -- both were dry and there may have been a leak from the primary to the secondary side some time during that day, and that may have come from that meeting with the Lieutenant Governor.

Q Was this the secondary side that was dry?

A Secondary side being dry.

Q I am thinking about the primary side and the extent of the voiding, rather than that there was a void.

A No, I'm sure it was not. If it was, it didn't register with me as being important.

Q March 27, same answer?

A We have always said if they had known that the core was -- if the core had been uncovered and they couldn't get it covered again, we would have evacuated people with no questions asked. But we felt if we knew the core was uncovered, they would have known the core was uncovered, and they could have gotten it covered again. It just doesn't seem reasonable to me that they knew the core was uncovered and didn't do something about covering it.

Q Can you recall any other information which should have been passed on to yourself or BRP on March 28, but was not?

A No. I really don't know how much they knew on March 28th.

BY MR. GAMBLE:

Q I have one thing, Mr. Gerusky. It is something more about the dose rate in Goldsboro. Do you know of any subsequent recollections, if not by your office, maybe by PEMA or anyone, as to the events that occurred during that early time, the first reports of the calculated dose rates, the first readings? Has anybody written any reports or recollections on that?

A I don't understand your question.

Q I'm talking about the --

A Did anybody get anything in between the time?

Q No, no, no. Subsequent, days, weeks, months later, did

Q Now you have testified to others, and in fact I notice on your note sheet of your knowledge of the 10-R per hour prediction in Goldsboro --

A That's what they gave us.

Q Are there other records, notes, or reports or accumulated recollections, any of those things, that might contain additional information concerning --

A That particular --

Q -- that particular -- for instance, that we could use to nail down more precisely the time in which you received that information. Did you personally receive that?

A I think it was on the speaker phone. If I wrote it down, I received it one way or the other, either on the speaker phone or direct phone. Margaret Reilly was there, and she went to get the maps to start her plot of the wind direction, wind speed, and she -- so we both received the information, I believe, over the speaker phone.

Q Do you recall what was told you -- what specifically was told you which caused you to no longer give any credibility to the 10-R per hour reading? I'm talking about surveys. What surveys were made, for instance?

A Yeah, we were told that there were no onsite readings of any consequence, in that wind direction. We were also told that the containment pressure was still very, very low, and that this was designed -- that the calculation he was using was

A Yes.

Q -- from the state on March 28th. Is that your view?

A Yeah. Essentially it was my feeling earlier on, and maybe it's wrong, but that's the feeling I had.

Q So whatever information wasn't passed on, there may have been a variety of reasons which would include that maybe they didn't think you were interested in it, or --

A They forgot to tell us, or they didn't realize it was a problem.

Q Okay. Any others that we could add to that list?

A Not really. I think it sort of characterizes the situation.

Q Okay. Mr. Gerusky has testified and, in fact, it appears on this note which he had taken, that there was a 10-R per hour calculation made at Goldsboro.

A A projection, yes.

Q For Goldsboro. Were you aware of this on March 28th?

A Yeah, that was very early. That was on the order of 7:30, quarter to 8:00 in the morning.

Q Are there any other records, documents or any other material that might bear on the information that was exchanged with you, you or any other members of BRP, about this, other than this note that I have in my hand?

A I have the distinct recollection at one time I wrote some of this stuff down, especially having to do with some of

information I was able to sort out was the pumps were not running, but the plant was being cooled by forced -- by a feed-and-bleed method, and that there wasn't anticipated to be a problem in continuing to use that method.

There was an indication that Gary Miller told me in the conversation there was a possibility that there were bubbles or some voids in the systems, but certainly not indicating the core could have been uncovered. But there were fuel failures, probably due, in his opinion, probably due to the low pressure transient, some gap activity being released.

Q But specifically in terms of the voiding in the hotlegs and the fact that the pumps were not pumping water, that was not passed on to you as a specific piece of information?

A No, no.

Q Should this information have been passed on?

A Yes.

Q And again, if we can differentiate between how you might have felt on March 28th and how you feel today, if you would.

A It would have made a difference, obviously. It would have probably prompted more questions. Any of these bits of information could have, you know, sprung the point, "Hey, you know, if this is the case, what are some of these parameters?"

Q But on March 28th, you believe you would have felt

A I believe so, yes.

BY MR. HARPSTER:

Q Do you recall, in looking at your notes, the plant was characterized as being stable at some later point. Was this as a result of the block valve having been closed, that they now felt that the transient was stable?

A I believe it was that, along with the feed-and-bleed cooling they thought was taking place as being a stable mode.

BY MR. MOSELEY:

Q Did Miller characterize this, the open block valve, as being the cause of why the plant was in the condition it was in?

A I don't think directly, but I inferred that was the case.

Q Can you give us any benefit of your recollection of what he actually said to you?

A It's been so long ago. It was difficult to write these recollections or other set of papers. I really have no idea. Things were going so fast at that point, a lot of it was a blur.

BY MR. CRAIG:

Q Did you believe the plant was stable when you got that report?

A Yeah. I guess so. That was what I told everybody. I didn't really question, I didn't have time to question that much the information he was giving. We were relying on their information at that point.

Q Well, if you could describe your impression of the plant, why you inferred it was stable. The feed-and-bleed method implies that they are cooling the core. Did Miller tell you he had a cooldown rate, that the plant was being cooled effectively?

A I recall someone along the line mentioning a cooldown rate. Whether it was in that conversation or not, I'm not sure, but I believe at one point on that day somebody mentioned a cooldown rate.

Q In the morning or afternoon?

A Again, I don't know. I only believe somebody mentioned a cooldown rate at some point.

BY MR. GAMBLE:

Q Somebody from Met Ed?

A Yeah.

BY MR. MOSELEY:

Q But you don't recall whether that was morning or afternoon?

A No, I don't.

BY MR. CRAIG:

Q Could you relate that to before or after the Lieutenant Governor was briefed by the Met Ed people?

A No, I can't. I really can't.

"Recollections" prepared by W. Dornsife in April 1979
Times are approximate

0705 - Received call from C. Deller, PEMA duty officer indicating that TMI has a site emergency and to call plant to get details

0706 - Called Maggie to inform her and verify number to call at plant site - only number we had was thru plant switchboard 944-4041

0707 - Called plant site - had difficulty getting through switchboard to Unit 2 control room - finally gave switchboard my home number to have control room directly call me

0710 - Shift supervisor called back to my home number. He told me the plant had suffered a transient and RB [reactor building] radiation level was high initiating the site emergency - things sounded very confused at this point in time - I tried to get a status of important safeguards without very much success - they did tell me that reactor was shutdown and RB pressure was about 1 or 2 psi - SI [safety injection] had been initiated and was cooling core - They informed me that they had sent out monitoring teams and there was no detectable radiation levels outside the plant. I then heard in background the announcement to evacuate the Unit 2 fuel handling and auxiliary buildings. At this point a health physics type got on the phone and things sounded extremely confused and finally he hung up saying he would call back.

0720 - Called office - talked to Diane - told her briefly about what had happened and I was on my way in to the office - told her first technical type who arrives in office should call Unit 2 control room immediately.

I arrived in office about 0750. Tom was there with open line established to plant control unit. Plant had declared a general emergency about 0730 due to high radiation levels in the reactor building. There still were no releases outside plant. Met Ed monitoring teams were out and around.

I talked to plant to get a later status. As I recall, they said they were being core cool by feeding with makeup pumps and bleeding out through pressurized electromechanical relief valve. From the information that I was getting it sounded as if plant conditions were stabilized (In reality the core was probably being uncovered at this time and fuel damage was continuing).

For the next hour or so we kept getting plant status reports periodically. (The open line was not manned continuously by Met Ed. They would come to the phone when ready to report). Things seemed to remain the same with still no release occurring. At about 0900 I was asked by Middendorf or Duncan to go brief the Lt. Governor and attend a press briefing that was scheduled for about 1000. I called back to plant to get more details on what had initiated accident and what the present status was in order to brief Lt. Governor and Governor. At this point, Gary Miller, plant superintendent, came on the line and briefed me on what had occurred. His briefing was as follows (based partly on notes and partly on recollection):

At 4:00 a.m. a turbine trip from 98% power occurred - reactor shutdown automatically - violation of tech specs in that aux feed was valued out temporarily S/G may have boiled dry - electromechanical relief valve lifted but did not reseat - indication in control room (elec signal to valve) indicated that it had reseated - block valve upstream is now closed - High pressure safety injection was initiated - all safeguard system operated as designed - pressurizer may have gone solid and low pressure in primary probably caused flashing and bubbles in primary - may have temporarily lost main coolant circulation - even currently stabilized and cooling normally on A S/G - possible primary to secondary leak in B S/G - B S/G has been isolated - 100 ppm Boron in primary may have been diluted by secondary to primary feedback thru tube leakage - there has probably been a slight amount of failed fuel no speculation as to amount RB dome monitor reading 600 R/hr - RB pressure or approximately 1 psig - fence post dose $<$ 1 mr/hr - wind blowing to west currently sending monitoring team to Goldsboro

cooling mode [illegible]
forced circulation conditions

[illegible] [illegible] effect [illegible]
<1 mm/hr
1723 latest

behind warehouse Pick 6 GM
B windows open 150
8C Pick 6

if lose vacuum
vent to atmosphere with 4 5/6
which is clean

---

[illegible] 0 [illegible]

(215) 488-1362 [illegible] SMITH

1000 psi 350 F°
15°F/hr 3 to 4 hours

Self 7-5403 Dornsife notes

Governor's office ~0900 3/28/79

100 ppm B

1 lb Rb press

fence post < 1 mrem/hr

violation of tech spec

primary

B SG bottled up

evacuate gas thru

people going to Goldsboro to monitor

shutdown

HP injection

primary to secondary leak

failed fuel - temp lost MC overstation

600 R/hr

may have ~~bubble~~ had bubble in primary

110-1

2030 3/28/79

A RCP running 325°F in both loops
1100 psi in
cooling down A S/G with vacuum
shift bubble to pressure at 785 psi
lost some heater prog
25_ F 300 psi into shutdown
cooling mode ___
forced circulation cooldown

all ___ offsite complex
<1 mrem/hr
1923 latest

behind warehouse Pick 6 GM
B window open 150
8C Pick 6

if lose vacuum
vent to atmosphere with A S/G
which is clean

[illegible]

[illegible] 488-1362 [illegible]

110-2

01-80-001 Volume 1 (3/28/79 - 3/30/79)
General Communications Record
TMI-2 Transient of 3/28/79

01-80-001

VOL. 1

(0745 3/28/79 to 0818 3/30/79)

GENERAL COMMUNICATIONS RECORD

TMI-2 TRANSIENT

G.K. WANDLING & D.G. CULBERSON

CLASSROOM B ~~RITRAN~~ 2105 TMI - 2 CALL @ no745 3/28/79 Page

~0400 98% POWER

LOSS OF FW (POLISHERS SCREWED UP)

HPI TURB. TRIP RX TRIP ON HIGH PRESS

PRZ SOLID RCS PRES ≥ 2500#

DRAIN TANK RUPTURE DISC BLEW

FUEL LEAK?

800 R/HR IN DOME?

LOST FLOW INDICATIONS?, TRIPPED PUMPS

INDICATION OF PRI- SEC. LEAK

0800 300° - 1500#

SITE IN STATE OF EMERGENCY - ONLY ROSS AND MILLER HAVE BEEN ALLOWED ON SITE THIS MORNING.

DON ROY, ET AL, CONTACTED - WILL SET UP TASK FORCE - KARRASCH TO LEAD.

0900- PRELIMINARY TASK FORCE / INFO. MTG CLASSROOM TO GET RECOMMENDED ACTIONS:

1. IMMEDIATE OPERATIONS:

ENSURE CORE COVERED / BEING COOLED (HPI F?

CALL ~~B~~ JIM FLOYD (TMI) TO MET ED (INFO FROM JIM P[illegible])

PRI/SEC LEAK B S/G

60,000 R IN ~~B~~ DOME ?

$10^4$ COUNTS ON MONITOR # 748 (200 BACKGR[illegible]

100 MR/HR AT PERSONNEL ACCESS OUTSIDE BLDG

IODINE OFF-SCALE HIGH

NAT CIRC. COOLDOWN

IC TEMP 450° F (COMPUTER)

TC 250° F

ON SITE EMER

ON & OFF SITE RADIATION NEGLIGIBLE

WATER IN AIR LINES OF VALVES OF POLISHERS

WENT SHUT → LOSS OF FW (COND PUMPS → BOOST[illegible]

ESFAS ACT.

WENT SOLID

STOPPED MU PUMPS, EST. LETDOWN

RUPTURE DISC BLOWN (SECURED RC V2)

AUX FW INITIATION BUT NO FLOW TO S/G's [illegible]

~ 12 MIN > TRIP, S/G's NOT DRY

LOW PRES OF 1200# (@ SATURATION? POSSIBLE GAS BUBBLE)

SAW 1/3 DECREASE IN FLOW - TRIPPED RCP[illegible]

* NEED RADIOCHEMIST – FUEL PROBLEM } START TO SI
YOCHHEIM / DALE (LRC) } ASAP * TO
CALL FROM SCHAEDER @ ~ 11⁴⁵ (HAD JUST TALKED
TO ROGERS)

2827
3707

~ SAME STORY ABOUT TRANSIENT
RCP: S/D

7 GOING SOLID STM BUB. IN LOOP

ACT. IN ATMOS (LOW LEVEL) REPORTED

RELEASE FROM MET ED TO NEWS

RAD. TEAMS DOING MONITORING

NRC SENT TEAM TO INVEST.

PRI/SEC LEAK "B" S/G (S/G SAMPLE

"B" S/G ISOL.

Going NAT. CIRC. COOLING DOWN ON "A" S/G (FEEDING)

HPI FROM BWST PZR HTRS SHORTED OUT / SECURED

USING ELECT. ISOL. VALVES TO CONTROL

300° RCS ~ 11⁰⁰ (TC) (STRATIFICATION

~ 2100 # RCS PRES. (PLANT SOLID?)

PLANS APPARENT TO COOLDOWN & DEPRESSURE

SPEC. OF FUEL LEAKAGE – NO IND. OF RAD. LEV.

SOME LEVEL INCREASE IN RB SUMP

CCW & SI HAS BEEN MAINTAINED

HIGH MOISTURE LEVEL IN RB

ROGERS TO CALL BY 1¹⁵ IF NOT, WE SHOULD
CALL SCHAEDER

KARRASCH
WHAT TO DO w/ RCP

BEFORE STARTING A RCP

MEGGAR RCP MOTORS PHASE TO PHASE

PHASE TO GROUND

KELLEY, WINKS, TWILLEY SHOULD GO TO OBSERVAT CENTER TO GET ON SITE OK

3781 - WAR ROOM

GET DATA ON COOLDOWN

SCHAEDEL CALL TO WAR ROOM @ ~ 1^30

RCS 495# FLOATING ON CFT'S

700° TH (VOLTMETER/BRIDGE)

PRZ FULL

CONTROLLING WITH ELEC. RELIEF VALVE

HPI FROM BWST - SWITCHING OVER TO BLEE. TANKS (IN PROCESS)

"B" S/G ISOL. ~ 60% FULL OPERATE LEVEL

MIN. C/D FROM "A" S/G

ATMOS DUMP VALVES IS HEAT SINK

GLAND SEAL LOST ON TURB. - COND. VAC. BRE

EMER FDWTR SYSTEM TO "A" S/G THROUGH NORMAL FDWTR NOZZLES

NO #'S FOR RADIATION

ACTIVITY IN RD SYSTEM

< 1 MR AT SITE SEC. FENCE (WORD FROM EARLY THIS MORNING)

AIRBORNE ACT IN AUX BLDG & CONTROL AREA (RB SUMP TO AUX BLDG SUMP BEFORE ISOLATION)

TRIED TO START RCPs BUT DREW ONLY ~100 AMPS (PUMPING STM) - PUMPS REMAIN OFF - NOT SURE WHY THEY WERE SEC.

TWILLEY, WINKS, KELLY AT SCHNEDER'S HOME TO GO TO SITE OBS. CENTER

ROGERS TO CALL SCHNEDER @ ~3⁰⁰ & CONTACT HIM FOR NEEDED SUPPORT

FLINT ALSO ON-SITE

JIM MOORE - GARY BROUGHTON (MET E/GPU) GOING SITE ALSO.

PLAN TO GO ON DH AS SOON AS POSSIBLE

RECOMMENDED TO SCHNEDER/ROGERS

1. COOLDOWN DATA
2. TRUE RCS TEMP BEFORE GOING ON DH
3. CONFIRM CORE OUTLET TEMP. NOW BY PRZ TEMP SINCE THIS IS FLOW PATH

BWST LEVEL ~37' LAST KNOWN

KLINGAMAN CALLED BY DEDDENS TO GET COMMUNICATION LINK FROM SITE TO B&W / SPANGLER

MESSAGE GIVEN TO UNIT 1 TO GO TO UNIT 2

"PUT IN 500 GPM BORATED WATER VIA HPI

JIM FLOYD (AT LEAST 400)

ELECT. RELIEF VALVE STUCK OPEN (BLEW RUP. DISC

DELAY IN AUX (EMER.) FDWTR BECAUSE OF BAD INDIC

(PUMPS RUNNING - VALVES IND. OPEN BUT NOT)

RCP'S STOPPED BECAUSE OF IND. OF CAVITATIONS

COND. OFF GAS ALARM - S/G LEAK

>60 K R READING BECAUSE OF MOISTURE (BAD INST.

~100 R BEST ESTIMATE ~~#~~ FROM 100 MR AT

THE PERSONNEL HATCH.

RB PRES ~ 2 1/2 # INITIALLY WENT TO ~ 4# ~6 HRS

AFTER TRANSIENT

KENNEDY/DEMPSEY

CAN'T MEGGAR RCP MOTORS - MOISTURE NOT MAJOR CONCER IF NOT SIG.

CAN ALLOW UP TO ~ 30 MINS VIB. TEMP.

TO OP RCP'S (SPRAY LINE LOOP RCP'S IF

POSSIBLE)

POSSIBILITY THAT RCP'S ARE NOT TRULY CONNEC-

(SHEARED DRIVE PIN) BECAUSE NO LOAD AMP

SHOULD BE ~100 (WHICH IS WHAT THEY ~~HAVE~~

IF CONNECTED SHOULD BE SIGNIF. > 100 AM

~4⁰⁰ GREG SCHAEDEL (JUST TALKED TO SITE

DIFFICULT TO ESTABLISH DIRECT COMMUN. WITH SITE

COLLAPSED BUBBLE IN "A" LEG {GOOD IND. T!?

NORMAL LETDOWN + PRZ.

TRYING TO COLLAPSE BUBBLE IN "B" LOOP

190# 460° 560 #. IN PRZ. (BUBBLE)

TRYING TO GET ON DH VIA SUCTION FROM BWST

WHAT CONSIDERATIONS DO WE HAVE FOR RUNNING RCP's (AT LEAST ONE) IN "B" LOOP? (DH DROP LINE SIDE)

540°?

STILL FLOATING ON CFT's ~400-500#?

2A RCP HAS IND. OF LEAKAGE (UNSURE)

DATA AVAIL. FROM REACTIMETER TAPES.

"A" S/G FILLED TO 80% - "B" @ ~50%

400 → 500 GPM FLOW RECOMMENDED TO SCHAE

RCP START

→ BASED ON 100 DAY ~~? ~ 6 HRS SINCE~~ + CONSERVATISM

30 MILS VIB. LIMIT

HPI > SAT COND'S FOR LOOP

GOOD AMP READING

NUC. SERVICE (WATER)

PROPER (NORMAL) PREREQ'S FOR START

NOT FLASHING STM AT SEALS

@4⁴⁰

~~550° TH 450# RCS FROM CONTROL ROOM~~
SUPERHEATED CONDITIONS

**ATTACHMENT C**

Transcript of phone call from Gary Miller at TMI about 9:30 A.M., March 28, 1979, to George Troffer, Reading, to assist in providing info for Met-Ed Communications Services staff by reporting on what he said to Lt. Governor Scranton.

MILLER: Lt. Governor - - I had no choice but to talk to him. What I said and its probably not in very good verbage is that this morning very early we experienced a turbine trip. Two problems were in the secondary plant not the nuclear plant. When the unit trips from 100 percent, the reactor sometimes trips from 100 percent and it did. There was very high power. That's not a problem and not unexpected. When the reactor trips due to high pressure, its one of the parameters that normally trips the reactor. At the same time it was in the reactor building and due to the high pressure we had some relief valve lift which released from the reactor coolant to the building floor. This was not a break or a leak or anything that was designed to release at a high pressure. Obviously on all reactor pressure that doesn't occur. But it didn't on this one. That gave us indication of reactor building radioactivity because of the reactor coolant being released to the floor of the building. It's got radioactivity in it.

In addition to this the plant obviously experienced a pressure and temperature change fairly fast. I didn't say this to them -- I'm just saying it to the group. I was on the phone with a nuclear engineer over there so he knows about fuel pins. I said yes we may have had some fuel pin leakage. I don't know that right now. That's part of small term assessment on this thing and that's economic. He asked if I had any melting on fuel. I said I don't have any indication of melted fuel, but I may have had some fuel pin leakage which is not abnormal in the industry. I didn't say any at the present but I did say that we had reactor coolant released in the building which was giving radioactivity on the monitor.

When we get that, I said our emergency plan mandates that when I see it in the reactor building I assume it's getting out. Therefore, I go into the general emergency. I fully gear-up like I already got an

7001170535

emergency in the public. That means that I put people on stations, I closed the gates, I get the State Police, I make all the phone calls and I say subsequent to doing everything in the plant we have had confirmation very rapidly the number 1. (?) From the time the incident started we have had no release to the environment especially above background. We have had no indication of a millirem an hour that I know of. We know where the wind is moving -- it is moving slowly to the west. We have people at the west site boundary. We had a helicopter fly over to Goldsboro. We had the meters taken out at York Haven -- if I have to go back I will. Never had any indication. We have been in communications with Molloy in the State for most of the day. We had no action level by the plan for the public.

We do not expect any additional or any release. We are in the process of taking the plant to a cold shutdown to evaluate the situation and that evaluation is probably more economically damaging than anything else -- from the public standpoint.

Is Troffer there?

TROFFER: Yes.

MILLER: I don't expect any effect on the public. That's what I had said to people. I didn't have any time to think about it.

TROFFER: That sounds good. Did anybody have an overdose?

MILLER: Nobody had one. Nobody had an overdose or an overexposure. We have surveyed all the areas internally and roped the appropriate areas off.

We had nobody, as a result of the incident, that got any overexposure. We have taken reactor coolant samples afterwards. We may have used up a lot of quarterly doses of some people. I had nothing at the time of the incident. I may have had some exposures of people during the action we needed to take in the correction of this thing in the plant. I have some people that I'm not totally sure of but I don't believe that we have anybody overexposed. And we didn't overexpose anybody at the time of the incident do to anything. For example, I have a chemist foreman that went into a room to get a sample for me. He may have gotten a fairly good dose. I wouldn't expect that he exceeded his limit.

OK, George. When I come back and re-assess this thing I may find some doses higher than I expect right now because I've had people doing things that must be done. I've got full dosimetry on anybody out there -- full body count and everything else. That's too much detail but that's just so you know. I will say I've had nobody overexposed. And I will say that we will have to fully evaluate that as a result of the incident when we can collect all the people from this thing. It will effect nobody inadvertently, George.

TROFFER: Do you know when we will be able to decide when people should come to work -- I think we are thinking about the Observation Center overcrowding.

MILLER: The best thing is that I am keeping them here now. I guess I wanted to be damn sure I had total control of the cooldown before I worried about that. I have had some people come to work. I've got one guy in charge of the Observation Center.

I believe that it's Gary Hahn. I have had Shovlin bring in whoever he needed. I've sent the contractors that didn't get there home.

TROFFER: So we did not do that. We did not call of the contractors and send them home.

MILLER: I didn't call them off. There were some on-site but the ones that went to the center I probably sent home. We did send them home. We made that decision. It's just been too hard to worry about them. They probably went home anyway. I've been here since 7:00 in the morning and I've been up since 4:00 and I don't think I'll worry about the economic consequences of the contractors. To get them out of our way to be honest with you. If anybody was on-site I kept them to use them.

KLINGAMAN: We did not send our people home though, right Gary.

MILLER: I've got them on hold at the Observation Center. I put Gary Hahn in charge to be sure that they didn't go home or wander around like what happened to me in August. I have brought on those people that Shovlin needs. Through him. I've got to go back and assess the people right now. Quite frankly, up to now its been Jack, Lee Rodgers and the plant — I've haven't had a shot at that. Jim Seelinger's in charge of that and he's pretty aware of what we're doing.

I just talked to the State and I gave them the scenario that I just gave you, but not with that kind of detail. So they're going to release something whether I like it or not probably.

I did talk to Maggie (DER) and Dornsife which I had known personally. I'm pretty sure I know them well enough that they will release something that will help. I told Maggie that if she has any problems getting us she should call Jack's office and he'll talk to her. I think you should tell Norene that she shouldn't treat Maggie as someone she doesn't know -- if she doesn't know her -- in case I need something. She's probably going to get a lot of questions from management over at the Governor's office.

TROFFER: I think we ought to go ahead cancel this Friday tour now.

MILLER: Yeah, I love that idea. George, I'll tell you what. I'm not sure that I'll be working here Friday! Just kidding. If there's anything else that you need I'll be in the Unit #2 Control Room. You can get me through that. I think you ought to release something. I think we should.

KLINGAMAN: I think I better verify one thing. There are rumors going back and forth as to what we have. My understanding is that what we have is a general emergency declared sometime this morning. And it's still an official general emergency.

MILLER: The emergency was declared sometime around 7:00. I guess I could be off a little bit.

KLINGAMAN: Yes, I got a call around 7:15.

MILLER: We did declare a general emergency here -- that's true.

TROFFER: The sooner we back properly from a general to a site, the better.

MILLER: The reason we have not, and you're right George, is because to be honest with you we've been testing the plant. We don't know where the hell the plant was going. See the situation we're in is a delicate one because we actually have plant integrity. If we had a leak we'd be all right -- as far as we'd have a lot more economic consequences. We've been trying to figure out how to cool down in the most expeditous fashion without releasing and without damaging too much. That's taking a pretty hard assessment. I'll work on getting out of the emergency right now.

went out to cross-check. They should have known, there was adequate time.

Q Did you have the feeling that the information that was being presented was colored or being put in its best light, or some --

A No. I was very disgusted, that it was a typical utility trying to play down a nuclear power plant problem. That was my impression of what the discussion in the Lieutenant Governor's office, that they were acting in the Lieutenant Governor's office the same way they were apparently acting with the press outside. You know, trying to say that there was not a problem, and that everybody was making a big deal out of nothing.

Q Do you believe this was despite the fact they knew that there was a problem of more serious proportions than they were discussing?

A I don't know. I think they were very disturbed that they had to be in the Lieutenant Governor's office, rather than being at the plant. They didn't want to be there, they wanted to get out in a hurry, and they were trying to tell us in effect, "We are going to handle it, it's none of your business. The NRC is down there. Don't worry."

BY MR. HOEFLING:

Q What led you to believe that they were downplaying their presentation?

Mr. CHENEY. That is understood. But it seems to me that one of the risks in this particular accident—obviously, the containment vessel worked and there was no problem. There would have been if there had been a breach on the containment vessel.

Mr. MILLER. That is true.

Mr. CHENEY. If you had any kind of a breach at all, given the levels of radioactivity that have been measured internally, they obviously would have been very serious, and it strikes me that the most serious point in terms of potential leaks was that point at which there was the hydrogen explosion. That is the only time we came remotely even close, conceivably, to breaching the containment vessel.

Mr. MILLER. If you had to pick a point where you came the closest, not arguing what "close" means, that is true.

Mr. WEAVER. Let me ask you this: Can you see the flag? That is the Rayburn House Office Building across the way. Can you see the flag on it? It is right in the middle over there.

Mr. MILLER. I cannot see the flag.

Mr. WEAVER. Well, it is right up there. I watch it frequently.

But during this period of time—Friday, Saturday, Sunday—my office is right up there. We watched that flag constantly to see which way the wind was blowing.

I want to ask you this: Knowing everything you know, not being on this job, would you have been as concerned? Your information is coming from the newspaper; the hydrogen bubble is in there; would you have watched that flag?

Mr. MILLER. I do not know the answer to that. I just do not know the answer. I can tell you this, I have a daughter that lives 10 minutes away from the plant and I never moved her.

Mr. SHEIMANN. My family also lives within 15 miles of the plant and I never moved them.

Mr. WEAVER. Of course, you would have never left the plant yourself.

Mr. MILLER. But I certainly would not hurt my daughter. That is the best way I can describe it. If I thought there was danger, then I certainly would have. If I had, in my own mind, from what I have been trained and known, if I had been sitting where you were—my parents were calling me trying to find me because of the kind of things that were printed in the newspaper. I was inside, communicating what I thought was accurate information. But none of it got out.

Mr. WEAVER. But you said yourself——

Mr. CHENEY. None of it got out through the press?

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Mr. MILLER. The context that I read days later disappointed me.

Mr. WEAVER. There is no question that it is an imperfect system. It is hard to make judgments on that.

But you said a little while ago that if you had known that there had been hydrogen in the containment, that you would be more concerned.

Mr. MILLER. That is right. It would have been another problem that day which would have had to have been assessed and had to have been dealt with, and I would have dealt with it.

By 2 in the afternoon I had the ability to talk to people in Lynchburg or anywhere else, and I would have been talking to them.



Mr. WEAVER. The danger of the hydrogen in the core, in the reactor core, was that it could push the water down so that it revealed the core; is that the danger?

Mr. MILLER. If you had depressurized the system at that time, if you had dropped the pressure, then it would have expanded and possibly put a gas bubble over the core. And again, you would have had—you see, it is still making heat and you would not have been taking the heat away. The core would have heated up again.

Mr. WEAVER. How about an explosion in the reactor vessel?

Mr. MILLER. I never detected that that was a serious concern, personally. I did not know how it was going to initiate. I heard discussions. I think we were more concerned from the depressurization and uncovering standpoint.

Mr. WEAVER. What would an explosion have done to the core; do you have any idea?

Mr. MILLER. I do not know where we were going to get the explosion internally. We have no oxygen. If you want to go in and put a bomb in there and explode it, yes, that is a concern. But that is the context.

Mr. WEAVER. I am talking about the hydrogen in there.

Mr. MILLER. The concern on the hydrogen was that it would expand and uncover the core again, not an explosive concern, therefore. But we knew we could strip it out. We knew it would take time, and that was the context of that concern.

Mr. WEAVER. If you were not afraid of an explosion, why did you not burn it out?

Mr. MILLER. You cannot. You must have oxygen.

Another thing, you can get it out of the reactor system by taking gas out of the reactor system. It is something we do, we know how to do. We do that in operations. I just told you we put hydrogen in. When we take a plant down for maintenance, we do take the gas out of it normally. So that is not an abnormal operator action. So we knew we could degas it. Our concern was to do that without depressurizing, so it did not uncover.

Mr. CHENEY. Who did you talk to in terms of making the decision as to whether or not to recommend an evacuation? Was that strictly your own decision?

Mr. MILLER. During the day of the 28th, after the night of the 28th, I had a pretty senior management structure that had taken effect. In other words, the vice presidents of two of our companies were helping me or had taken charge of the overall operation.

They had taken control of the ultimate decisionmaking from me by that night. That day I dealt with my health physics guy, who was coordinating all of the offsite teams. He was using the Environmental Protection Agency guidelines and the emergency plan guidelines, which give you action levels at certain readings, to take action. You go indoors, you stop eating food, this type of thing.

He was dealing with the State radiological health people direct, Zuruski—I do not know the titles—and Rally, Margaret Rally, who we deal with normally on this type of thing. Then we would say we did not recommend an evacuation, and then would concur with that decision.

Mr. CHENEY. Your decision not to recommend an evacuation, is that a judgment call or is that based upon procedures that are spelled out?

Mr. MILLER. It is based upon procedures that are spelled out, plus judgment.

Mr. CHENEY. You get a certain numerical reading?

Mr. MILLER. If I get 5R whole body projected dose, then I am told to evacuate. If I get 0.5, I tell people to go indoors. But that is my recommendation to the State. It is their responsibility to decide that.

Mr. CHENEY. They decide whether or not to evacuate?

Mr. MILLER. That is their decision. It is their decision as to whether or not they move people. I am supposed to give them all the information I can and make a recommendation.

Mr. CHENEY. But your recommendation is almost automatic?

Mr. MILLER. It is based on action levels in the guide. But the judgment part is based upon what I know the plant is doing. So I must give them input into whether I think the consequence in the plant is going to get severely worse quickly. So that is the judgment, if you call it that.

The other part says that I have done these offsite surveys that give me this level of radiation. The Environmental Protection Agency says that if you are going to get beyond 5R or 25R thyroid, you do this, and that is the basis of moving people.

Mr. CHENEY. You never came close to that?

Mr. MILLER. We never came anywhere near that. We were a thousandth of that.

Mr. CHENEY. What was your reaction when the Governor made the decision to evacuate children and pregnant mothers?

Mr. MILLER. That was not made on the 28th.

Mr. CHENEY. I know. That was much later.

Were you involved in that at all?

Mr. MILLER. I thought it was precautionary, and it was a personal decision on his part. He is the Governor of the State and he has different concerns than I do. I did not think it was necessary. But he lives in a different world.

Like I told him, I did not move my daughter and I would not move her.

Mr. CHENEY. How old is she?

Mr. MILLER. Ten.

Mr. SCOVILLE. This goes back to the issue of the hydrogen bubble and its danger, the hydrogen bubble in the reactor cooling system. Although you said there was no particular concern in your mind regarding the explosion of that bubble over the weekend, Saturday and Sunday, were you aware of discussions that oxygen was being produced by radiolysis?

Mr. MILLER. There was discussion there could possibly be production of oxygen, that is right.

Mr. SCOVILLE. Did you believe it?

Mr. MILLER. There were an awful lot of technical people on the site at this time, and there was a senior group making decisions and deciding which data and which assumptions were going to be taken as the ones to go on. It was hard to decide because of the number of assum-

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Mr. WEAVER. Let us stop for a moment and go off the record.

[Discussion off the record.]

Mr. MILLER. When you get beyond the 28th and start talking about the number of calculations being made about various things, there were so many people making them that I was not aware of all of them. I was an inplant guy at that time, and my opinions are not the ones you should take to make a judgment.

Mr. WEAVER. We are taking them all.

Mr. SCOVILLE. I guess the point of my question was really this: When you were deciding which procedure—you said there were many procedures you could pursue to get rid of the bubble. Was the fact that it was contemplated by some that oxygen was being produced and the bubble might explode a significant factor in making the determination as to what procedure you were going to follow?

Mr. MILLER. No; you would take gas out with the same procedure, take it out using that system the way Bill and I described.

Mr. SCOVILLE. To your knowledge—and I understand you may not know this—was the theory of producing something that Met Ed came up with or did it come from the NRC?

Mr. MILLER. I do not believe it came from either. I think it came from a separate consultant that they both had talked to personally, possibly an expert on hydrogen and oxygen.

Mr. SCOVILLE. Thank you.

Dr. MYERS. Were you concerned that water in the containment or the fact that sodium hydroxide had been sprayed might have caused equipment—or degradation of equipment, of instruments, such that you might lose control at some point?

Mr. MILLER. No; the reason for that would be that we were designed to pump that whole tank into the building.

Dr. MYERS. Pump the tank into——

Mr. MILLER. If you had a loss, a LOCA, a loss of coolant accident, the whole 500,000-gallon tank goes in the building. You have a safety tank on the outside of the building with boric water in it. You put that water in to keep the core down, keep the core cool. You would pump 500,000 gallons of water right into the building.

Dr. MYERS. But with that water going into the containment, would that cause disruption of the 480-volt power supply or cause equipment failures or whatever?

Mr. MILLER. You would have had enough instrumentation left to operate what you needed to at that point.

Dr. MYERS. So you were not concerned that the conditions in the containment, whether by rising water levels or the fact that sodium hydroxide or the fact of radiation or temperature or whatever, might cause loss of instruments or equipment?

Mr. MILLER. If I had to pick, we could have lost pressurizer level and steam generator level, which would have complicated the operation for us.

Dr. MYERS. That is one reason why I think some people were concerned, if you lost control of that equipment inside, that then you would know less of what was going on and you would not be able to——

Mr. MILLER. That is true. At the time, during the day on the 28th, though, we had only pumped 20 feet of that tank into the building, and part of that kind of discussion, yes.

Q What was your evaluation of the meaning of superheated steam in the system?

A It is very hard to not be clouded by what I have read in the last year or so. I just don't recall discussions of that in those concise terms because the cooling method we were in wasn't recognized anywhere that had ever been studied.

The fact that you come in and all the indicators are off scale high wasn't a recognized condition for this reactor plant and it is hard to recall what that meaning was of something that hadn't had much training or discussion in the years of operation. So from a standpoint of what I know today and methods and means of countering this type of problem are different than they were on March 28th. The discussion involved how to cool the core from a condition that we didn't have recognized in any formalized training or implemented document.

Q I guess what I am asking, Mr. Miller, is what your evaluation of the meaning of superheat in the system is. Having concluded that there was superheat, and certainly this isn't something that you would have expected, but what was your assessment of this superheat? Did you relate it to core coverage?

A I can't today remember in our think-tank with the hot fuel elements.

A On steam generator you have some level indicators.

Q I understand. But I am trying to understand did that analogy allow you to conclude the core is uncovered?

A And I can't recall that analogy in discussions on March 28th. You know, I am sure that our discussions were in terms of the inventory deficiency, but I am not sure how far the discussion went relative to the technical terms we are talking of now as far as superheat and lack of superheat, you know what the temperature was and what the degredation of inventory was.

Q A few minutes ago you said you clearly knew you busted up fuel.

A I said we knew there were some degregation of fuel.

Q You busted fuel and you got fission products. I inferred from that that you knew you had poor cooling and the core overheated and busted some fuel, true?

A We knew we had some fuel degredation, Vic, and we knew we had insufficient heat removal.

Q But I am trying to make certain that you coupled the two. The degredation of the fuel was a result of core cooling.

A And I can't remember how close that coupling was on March 28th is what I am trying to say as far as the actual discussion.

Q Give me any other intrepretationd that comes to your mind even now. How do you degrade the core without it being the result of core cooling? Even today can you think of a way?

A Of degrading the core without having a lack of core cooling?

Q Yes.

A No. Unless you are talking of, you know, of some other mechanical damage.

Q Oh, yes.

A Other than that, right.

Q I am talking about the core staying in the fuel without being physically damaged.

A Yes.

Q So the degredation of the fuel you did couple that morning as a result of the core cooling?

A I am saying I can't remember the coupling of that in the discussions of that morning. I can't honestly remember the nice tie we have just discussed.

Q I am not looking for nice ties. I am looking for can you conclude anything other than that you knew you had busted fuel somehow, that that was a result of poor cooling? Is it reasonable to conclude that that was understood by the people that were analyzing the problem then?

A At some point in the morning that was certainly understood and it is one of the reasons we asked for flow rate from B&W for decay heat, the same reason. How much heat removal do I need for what we are at.

Q Good. Now, let me try again looking at the superheat. What do you think was the nature of the core cooling? Describe for me how can you get core cooling in the reactor some two hours after shutdown? What does it mean to you. What does core cooling mean?

A Well, core cooling to me means that we knew natural circulation was adequate for the design of the plant and we weren't getting adequate natural circulation. Beyond that point on March 28th I don't believe there was any information available other than the stuff you knew you had, to pump water in it at the flow rates you had available.

Q Yes, but I am trying to get you to help me understand poor cooling of the core. What does that mean to you?

A And I am saying that what it means is that we were out of a recognized cooling mode and therefore we knew that we had to have more cooling. We didn't know how much more.

Q Gary, we are passing each other in the night. Core cooling, let me give you some things that come to my mind. The flow rate in the core was lower than it should be. There was not enough water. I had steam in the core you were aware that the HPCI was secured for a long period, that the pumps were pumping steam, that the EMOV had been open for an extended period, that the hotleg temperatures were higher than expected.

What evaluations did you make of the significance of this?

A Our evaluations weren't very thorough that day, admittedly, but the evaluation we made is we didn't have a known method to cool the core, and we were trying to cool the core with high pressure injection.

Q And you made no recommendations based on this information?

A Well, the recommendation was establish circulation, and that's what we were trying to do.

Q And again all this information didn't tell you that there was a severe shortage of coolant?

A It does today. It would to anybody. Then it didn't clam up and hit me in the face, no.

BY MR. HARPSTER:

Q Let me go back and ask you a question, Mike. I'm trying to understand what was going on through the morning. I have a picture of what your concerns were. As I understand it, you understood that the loop was voided. Now you're pumping it with HPI and it's going out the MOV, and you're trying to assure yourself that the core is being cooled, and

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THE NUCLEAR REGULATORY COMMISSION
WASHINGTON DC 20555

THIS IS A COPY OF MAILGRAM SENT TO THE HONORABLE MORRIS K UDALL
WASHINGTON DC 20515

THE STORY IN THE NEW YORK TIMES OF MAY 6 1979 REPORTING ON THE VISIT OF YOUR SUBCOMMITTEE TO THE THREE MILE ISLAND PLANT IS GROSSLY IN ERROR.

THE "PRESSURE SPIKE" WAS NOT IN THE REACTOR VESSEL. THE PRESSURE GAGE WHICH SHOWED A SPIKE AT ABOUT 158PM ON THE DAY OF THE ACCIDENT READS PRESSURE WITHIN THE REACTOR CONTAINMENT BUILDING.

THE PRESSURE SPIKE DID INITIATE CONTAINMENT BUILDNG SPRAY WHICH IS DESIGNED TO COOL THE STEAM RELEASED INTO THE CONTAINMENT BUILDING AND TO SCRUB ANTICIPATED IODINE IN THE DESIGN BASIS ACCIDENT. SINCE BUILDING PRESSURE DID NOT INDICATE THE CONTINUING NEED FOR BUILDING SPRAY, THE OPERATOR TURNED OFF THE SPRAY PUMPS. IT WAS THIS ACTION AND THE BUILDING PRESSURE RECORDER THAT MR FLOYD REFERRED TO AS BEING IN VIEW OF THE NRC INSPECTORS IN THE CONTROL ROOM AT THE TIME.

THERE IS NO EVIDENCE THAT ANYONE INTERPRETED THE "PRESSURE SPIKE" AND THE SPRAY INITIATION IN TERMS OF REACTOR CORE DAMAGE AT THE TIME OF THE SPIKE NOR THAT ANYONE WITHHELD ANY INFORMATION.

ON THE EVENING OF THURSDAY MARCH 29 WHEN THE TECHNICAL STAFF SENT TO THE SITE TO INVESTIGATE THE ACCIDENT WAS REVIEWING AND CORRELATING PLANT DATA FROM THE NUMEROUS SOURCES, THE SPIKE WAS NOTED AND POSTULATED TO BE THE RESULT OF A HYDROGEN OXYGEN EXPLOSION WITHIN THE CONTAINMENT BUILDING. THE TECHNICAL STAFF RECOGNIZED THAT THE PROBABLE SOURCE OF ANY HYDROGEN WAS A ZIRCONIUM WATER REACTION IN THE REACTOR CORE. THE PRESENCE OF HYDROGEN WOULD INDICATE THAT HIGH TEMPERATURE CONDITIONS MUST HAVE EXISTED IN ORDER TO RESULT IN SIGNIFICANT REACTION AND HYDROGEN PRODUCTION. THIS RECOGNITION LED TO MEASUREMENTS TO DEDUCE THE EXTENT OF A HYDROGEN BUBBLE WITHIN THE PRIMARY REACTOR COOLING LOOP. THE RESULTS OF THESE MEASUREMENTS WERE PROMPTLY REPORTED TO THE NRC ON FRIDAY MARCH 30. IN ADDITION THE FIRST GAS SAMPLE FROM THE CONTAINMENT BUILDING ATMOSPHERE TAKEN AT 4AM ON MARCH 31 REVEALED THE PRESENCE OF HYDROGEN GAS AND A REDUCED OXYGEN LEVEL WHICH WERE SUPPORTIVE OF THE PREVIOUS POSTULATE.

I REGRET THAT THIS ASPECT OF THE ACCIDENT HAS BEEN MISUNDERSTOOD AND INACCURATELY REPORTED. I THINK THE FULL UNDERSTANDING OF THE THREE MILE ISLAND ACCIDENT IS OF SUCH VITAL IMPORTANCE TO THE NATION THAT THE WORK

Mailgram

OF YOUR COMMITTEE AND THE OTHER BODIES THAT WILL BE INVESTIGATING THE ACCIDENT SHOULD NOT BE DEFLICTED BY INACCURATE REPORTING FOUNDED ON PRESUMPTIONS OF DUPLICITY, SINCERELY

H DIECKAMP, PRESIDENT
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|---|---|
| 4. TITLE AND SUBTITLE (Add Volume No., if appropriate) Investigation into Information Flow During the Accident at Three Mile Island | 2. (Leave blank) |
| | 3. RECIPIENT'S ACCESSION NO. |
| 7. AUTHOR(S) | 5. DATE REPORT COMPLETED MONTH January YEAR 1981 |
| 9. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) U.S. Nuclear Regulatory Commission Office of Inspection and Enforcement Washington DC 20555 | DATE REPORT ISSUED MONTH January YEAR 1981 |
| | 6. (Leave blank) |
| | 8. (Leave blank) |
| 12. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) | 10. PROJECT/TASK/WORK UNIT NO. |
| | 11. CONTRACT NO. |
| 13. TYPE OF REPORT | PERIOD COVERED (Inclusive dates) |
| 15. SUPPLEMENTARY NOTES | 14. (Leave blank) |

16. ABSTRACT (200 words or less)

This report was prepared in response to a request from NRC Chairman Ahearne that directed the Office of Inspection and Enforcement to resume its investigation of information flow during the accident at Three Mile Island (TMI) that occurred on March 28, 1979. This investigation was resumed on March 21, 1980. The transfer of information among individuals, agencies, and personnel from Metropolitan Edison was analyzed to ascertain what knowledge was held by various individuals of the specific events, parameters, and systems during the accident at TMI. Maximum use was made of existing records, and additional interviews were conducted to clarify areas that had not been pursued during earlier investigations. Although the passage of time between the accident and post-accident interviews hampered precise recollections of events and circumstances, the investigation revealed that information was not intentionally withheld during the accident and that the system for effective transfer of information was inadequate during the accident.

| 17. KEY WORDS AND DOCUMENT ANALYSIS | 17a. DESCRIPTORS |
|---|---|
| 17b. IDENTIFIERS/OPEN-ENDED TERMS | |

| 18. AVAILABILITY STATEMENT | 19. SECURITY CLASS (This report) N/A | 21. NO. OF PAGES |
|---|---|---|
| Unlimited availability | 20. SECURITY CLASS (This page) | 22. PRICE $ |



☆U.S. GOVERNMENT PRINTING OFFICE:1981 341-742/682 1-3

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