



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

JUL 15 1983

Ms. Lynn M. Danielson  
MHB Technical Associates  
1723 Hamilton Avenue, Suite K  
San Jose, CA 95125

IN RESPONSE REFER  
TO FOIA-83-325

Dear Ms. Danielson:

This is in partial response to your letter dated June 7, 1983 in which you requested, pursuant to the Freedom of Information Act, four (4) documents regarding TMI Restart, and copies of SECY-83-98B and SECY-83-98D.

A copy of items 1, 2, 4 and 5 are enclosed. Item 3 is included within item 2.

The NRC has not completed its review of item 6 of your request. We will respond as soon as that review is completed.

Sincerely,

A handwritten signature in dark ink, appearing to read "J. M. Felton", written over a horizontal line.

J. M. Felton, Director  
Division of Rules and Records  
Office of Administration

Enclosures: As stated



# TECHNICAL ASSOCIATES

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June 7, 1983

## FREEDOM OF INFORMATION ACT REQUEST

FOIA-83-325

Rec'd 6-15-83

J. M. Felton, Director  
Division of Rules & Records  
Office of Administration  
U. S. Nuclear Regulatory Commission  
7735 Old Georgetown Road  
Bethesda, MD 20814

SUBJECT: Freedom of Information Act Request

Dear Mr. Felton:

Pursuant to the Freedom of Information Act, as amended (5 U.S.C. 552), and the rules of the Nuclear Regulatory Commission, we request copies of the following written materials:

Re: TMI Restart

1. "Review of B&W - GPU Trial Court Record". March 28, 1983. V. Stello, Jr., Deputy Executive Director for Regional Operations and Generic Requirements.
2. Report on staffing utilization and efficiency at GPU by Basic Energy Technology Associates.
3. Report on psychological study of operators by RHR Inc.
4. Report or memo from V. Stello to W. Dircks re: integrity of GPU's program for the requalification of licensed operators. May 17, 1983.

Re: Salem-1

5. SECY-83-98 B. Region I Task Force Report on Salem Unit 1 ATWS Events, March 17, 1983.
6. SECY-83-98D. Salem Restart Evaluation, April 8, 1983.

We expect to receive your response to this request within ten (10) working days.

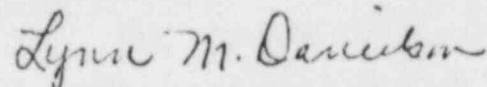
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J. M. Felton, Director  
June 7, 1983  
Page Two

We will pay search and copying fees as set out in the NRC's regulations. If such fees are expected to exceed \$200.00, please notify the undersigned before the sum is exceeded.

On the event that access is denied to any of these materials, please identify the withheld material, the statutory basis for the denial, and your reasons for believing that an exemption applies.

Sincerely,

A handwritten signature in cursive script that reads "Lynn M. Danielson".

Lynn M. Danielson

LMD:cv

MAY 17 1983

4.

MEMORANDUM FOR: Darrell G. Eisenhut, NRR  
Edward L. Jordan, IE  
Richard E. Cunningham, NMSS  
Denwood F. Ross, RES  
Clemens J. Heltemes, Jr., AEOD  
Joseph Scinto, ELD

FROM: Victor Stello, Jr., Chairman  
Committee to Review Generic Requirements

SUBJECT: CRGR MEETING NUMBER 38 AGENDA MODIFICATION


As requested by NRR, the briefing concerning the Operator Requalification Program is postponed until CRGR Meeting No. 40, which is tentatively scheduled for June 1, 1983. As noted in the announcement for CRGR Meeting No. 38, the Committee to Review Generic Requirements (CRGR) will meet on Wednesday, May 18, 1983 from 1-5 p.m. in Room 6507 MNBB.

Original Signed by  
V. Stello

Victor Stello, Jr., Chairman  
Committee to Review Generic Requirements

cc: SECY  
Commission  
W. Dircks  
Office Directors  
Regional Administrators  
G. Cunningham

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March 18, 1983

1

MEMORANDUM FOR: Chairman Palladino  
Commissioner Gilinsky  
Commissioner Ahearne  
Commissioner Roberts  
Commissioner Asselstine

FROM: William J. Dircks  
Executive Director for Operations

SUBJECT: REVIEW OF B&W-GPU TRIAL COURT RECORD

On December 29, 1982, the Chairman requested that knowledgeable staff review the record then being developed in the B&W-GPU lawsuit and to advise the Commission whether the NRC's understanding of the TMI-2 accident, including but not limited to the sequence of events, is significantly affected. Subsequently, the team reviewing the trial court record was requested to give particular attention in its review to information which could affect the Commission's decision on whether to allow TMI-1 to resume operation.

The team has completed its review. The team's report is enclosed.

(Signed) William J. Dircks

William J. Dircks  
Executive Director  
for Operations

Enclosure:  
As Stated

cc: SECY

Dupe of

~~83-33-335~~

REPORT OF THE REVIEW OF THE  
BABCOCK AND WILCOX -  
GENERAL PUBLIC UTILITIES  
LAWSUIT TRIAL COURT RECORD

March 28, 1983

Dupe of -

~~8303300338~~

## OVERVIEW

This review of the Babcock and Wilcox (B&W) and General Public Utilities (GPU) lawsuit trial court record was initiated to determine if information was presented that significantly affected the NRC's understanding of the accident at Three Mile Island Unit 2 (TMI-2) on March 28, 1979. The review team examining the trial court record concluded that the record does not contain information which significantly affects NRC's understanding of the accident, including but not limited to the sequence of events. The review team also concluded that the record does not contain significant information that would affect the Commission's decision regarding restart at Three Mile Island Unit 1 (TMI-1), other than the potentially significant information concerning the adequacy of small-break loss-of-coolant and natural circulation procedures. This information has been reviewed by NRR and a Board Notification has been issued.

## I. INTRODUCTION

By his memorandum of December 29, 1982, the Chairman of the Commission requested that the EDO have knowledgeable staff review the B&W-GPU trial court record and to advise the Commission whether the agency's understanding of the accident, including but not limited to the sequence of events, is significantly affected. In response to that memorandum, a review team was assembled under the direction of the Deputy Executive Director for Regional Operations and Generic Requirements. The Office of the Executive Legal Director provided legal advice and assistance to the review team.

The team assembled and reviewed the trial court record. This record was comprised of approximately 7400 pages of testimony and 478 exhibits. The team examined the record to determine if significant new information was presented that changed NRC's understanding of the accident. During this process, the team referred to some of the reports of previous investigations into the accident at TMI-2 on March 28, 1979. The team concluded that the trial court record did not contain significant new information that changed NRC's understanding of the accident. In the midst of the trial on January 24, 1983, B&W and GPU jointly announced that they had settled the lawsuit. Nonetheless, the trial court record accumulated until that time was substantial and consequently the review of the trial court record went forward. The team's findings in this area are presented in Section II of this report.

Subsequent to the initiation of the review team effort, the Chairman requested that the review team advise the Commission whether or not the trial court record contains any significant information that might affect the Commission's decision regarding the restart of TMI-1. The team's findings in this area are presented in Section III of this report. The team's effort in this area included consideration of questions raised by Commissioner Gilinsky in his memorandum to the Acting General Counsel dated February 2, 1983.

Should the reader of this report review the trial court record itself, the review team would offer the following words of caution.

1. Although the review team concluded that the trial court record does not contain significant new information, there is new information contained in this record. The TMI Management Audit Report conducted by Metropolitan Edison Company in February 1978 is an example of new information.

First, the accident at Three Mile Island is a unique event in the degree to which it has received formal scrutiny. The accident has been studied by this agency in NUREG-0600 <sup>2</sup>/<sub>2</sub>, NUREG-0760 <sup>3</sup>/<sub>3</sub>, the NRC Special Inquiry Group (NUREG/CR-1250) <sup>4</sup>/<sub>4</sub>, and by the President's Commission <sup>5</sup>/<sub>5</sub>, the Electric Power Research Institute's (EPRI's) Nuclear Safety Analysis Center (NSAC) <sup>6</sup>/<sub>6</sub>, the U.S. Senate <sup>7</sup>/<sub>7</sub>, the U.S. House of Representatives <sup>8</sup>/<sub>8</sub>, and the State of Pennsylvania <sup>9</sup>/<sub>9</sub>. The information amassed in these and other studies and in the TMI-1 Restart Proceeding substantially exceeds the information presented in the trial court record.

This is understandable because the various studies of the accident had as their goal an objective and comprehensive examination of the accident. This is a far broader goal than the goal of this litigation, which was essentially to assess blame for the accident. Consequently, the trial court record presents an incomplete picture of the accident. To adequately understand the accident and to properly assess the trial court record, one must look beyond the trial court record and understand the accident as a whole.

2. "Investigation Into the March 28, 1979 Three Mile Island Accident by the Office of Inspection and Enforcement" published in August 1979.
3. "Investigation Into Information Flow During the Accident at Three Mile Island" published in January 1981.
4. "Three Mile Island, A Report to the Commissioners and to the Public" published in January 1980.
5. "Report of the President's Commission on the Accident at Three Mile Island" published in October 1979.
6. "Analysis of Three Mile Island Unit 2 Accident" NSAC-80-1 revised March 1980.
7. "Report to the United States Senate Nuclear Accident and Recovery at Three Mile Island A Special Investigation," Subcommittee on Nuclear Regulation for the Senate Committee on Environmental and Public Works published in 1980.
8. "Accident at the Three Mile Island Nuclear Power Plant," Oversight Hearings Before a Task Force of the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs, House of Representatives published in 1979.
9. "Report of the Governor's Commission on Three Mile Island" published February 26, 1980.



Second, even in areas in which the trial court record is extensive, such as tailpipe temperatures, the trial court record is incomplete. Consequently, even to assess issues litigated extensively, the reader will still need to look beyond the trial court record. This is made even more true in this litigation because it was settled in mid-trial.

When examining the trial court record, the review team was aware that the total number of exhibits developed during the litigation exceeded those admitted into the trial record. In addition, many of the depositions taken to prepare for trial were not part of the trial record. In many instances where depositions were used at trial, only excerpts were introduced into evidence.

The review team did not examine these supplemental documents <sup>10/</sup>. The examination of these supplemental documents would have constituted a substantial undertaking--equivalent or greater than the examination of the trial court record itself. Although such an effort might have been warranted had any significant new information surfaced regarding TMI, the examination of the trial court record revealed no new significant information affecting TMI <sup>11/</sup>. In the absence of any indication that the additional substantial effort of examining the supplemental documents would add anything significant to NRC's knowledge concerning the TMI-2 accident or TMI-1 restart, the effort was not undertaken.

It should be noted that the entire GPU case had been presented at trial before the lawsuit was settled. GPU presumably presented its "best" issues and B&W had a full opportunity to respond to these issues. This adjudicating process would tend to surface any significant new information. Furthermore, the supplemental documents assembled for trial were likely closely scrutinized by both B&W and GPU in preparation for trial. NRC reporting requirements apply to both B&W and GPU and they would be required to report any significant new safety information that might have been uncovered. Finally, the events surrounding the accident at TMI-2 have received close scrutiny by a number of investigative teams and by adjudicatory board, of this agency. One must have a certain degree of confidence that these efforts have developed an adequate record of events for this agency to make decisions. The lack of any significant new information in the trial court record bears out this presumption of confidence.

10. GPU offered to make all of the exhibits and depositions developed during the litigation available for the review team. See Appendix A.
11. In the single area in which a potentially significant problem was identified (i.e., small-break loss-of-coolant and natural circulation procedures), it has been found that the TMI-1 procedures have been modified following the accident at TMI-2 to preclude the problem. See further discussion of this subject at pp. 16-17.



## II. THE AGENCY'S UNDERSTANDING OF THE ACCIDENT AT TMI-2

The agency's understanding of the TMI-2 accident is essentially set forth in three prime documents. The first is the NRC Special Inquiry Group (SIG) investigation report. The principal objectives of this investigation were to determine what happened during the accident and why, to assess the actions of the utility and NRC personnel before and during the accident, and to identify deficiencies and areas where further investigation might be warranted.

The second document is NUREG-0600. There the facts concerning the events of the accident at TMI-2 were comprehensively examined and the performance of Metropolitan Edison Company (Met Ed, the licensee) was evaluated. The investigation culminated in the issuance to the licensee of a Notice of Violation with associated civil penalties.

The third document is NUREG-0760. There the transfer of information among individuals and agencies was analyzed to ascertain what knowledge was held by various individuals of the specific events, parameters, and systems during the accident at TMI-2. The following conclusions were reached in NUREG-0760 at pp. 10-11:

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.

This investigation culminated in the issuance of another Notice of Violation to the licensee.

The Special Inquiry Group (SIG) report, NUREG-0600, NUREG-0760, the information supporting these three studies, and the associated enforcement actions provide an overall baseline of this agency's understanding of the accident at TMI-2, including the sequence of events. The baseline for this review is enhanced by the cumulative knowledge and familiarity of the review team members of the events surrounding the accident at TMI-2. This has resulted from long association with those events including participation in previous investigations of the accident. Specifically, the team leader participated extensively in the development of NUREG-0600 and all team members participated in the development of NUREG-0760.

With regard to the day of the accident, the trial focused on events between 4:00 a.m. and approximately 6:20 a.m. The review team has concluded that the agency's understanding of the accident at TMI-2, including but not limited to the sequence of events, is not significantly affected by the trial court record. The review of the record does lead to additional appreciation of factors contributing to the operator's confusion within this time frame. Specifically, insight was gained concerning the influence on the operators of concerns for recriticality and leaks in the B steam generator, and the discovery by the control room operators that the emergency feedwater valves were shut during the early minutes of the accident. Previous NRC investigations into the accident have concluded that the operators failed to understand the events that occurred on the morning of the accident. Conclusion 3 of NUREG-0760 above is one example. The information reviewed in the trial court record reinforced this conclusion.

The trial court record contains testimony that conflicts with earlier information developed on a particular subject. In some instances, the trial court testimony of one individual is at variance with testimony given by that same individual in a prior inquiry examining the accident. Such variations can be considered significant in two regards. First, do the variations alter the technical understanding or the sequence events of the accident? The review team has found no variations that would affect its technical understanding of the accident, or the sequence of events.

Second, variations can also call into question the integrity of an individual. A "variation" suggests that either the original information or the subsequent information was a lie. This subject of variations and conflicts in information provided by individuals regarding the accident was specifically addressed in NUREG-0760. That investigation concluded that, in some cases, the accumulated information contained apparent conflicts concerning the knowledge of individuals about specific information. It was concluded there that none of the conflicts examined was the result of lying. Other possible explanations for variations identified in NUREG-0760 included poor recall, different statements by an individual on the same subject as a result of a slightly differently worded 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. As in NUREG-0760, the review team did not attempt to assign a specific cause for each of the variations noted. The review team did conclude that none of the variations examined were the result of lying.

Instances of apparent conflict in the trial court record include information concerning high pressure injection (HPI) initiation at about 5:41 a.m., identification and interpretation of tailpipe temperatures during the early morning and the potential influence of precursor events on events occurring during the day of the accident. These conflicts are not new and have been discussed in previous investigations. These issues are discussed below.

Alleged Initiation of High Pressure Injection (HPI) at  
Approximately 5:41 a.m. on the Day of the Accident

The trial court record contains a lengthy discussion of whether or not HPI was fully initiated (makeup pumps 1A and 1C operating and injecting about 1000 gallons per minute) at approximately 5:41 a.m. on the day of the accident. This topic is not new and, as discussed below, has been examined during previous investigations into the accident. There is a discrepancy concerning this topic between the GPU sequence of events (which states HPI was fully actuated at 5:41 a.m.) and the sequences contained in other investigations (which state HPI was not fully actuated at 5:41 a.m.).

The GPU sequence contains the following entry at pp. 41-42 that was based solely on operator interviews:

0541:37 (approximate) The operator manually initiated the Safety Injection portion of Engineered Safety Feature Trains A and B to supply additional cooling water to the core. Makeup Pump C started automatically. Makeup Pumps A and C are now operating.

During the trial, GPU presented an analysis prepared by EDS Nuclear Inc. (GPU Exhibit No. 2223) and the expert testimony of Dr. James Holderness



that concluded that the GPU sequence of events was incorrect. The EDS analysis examined makeup tank level behavior and its relationship to HPI initiation. The analysis used two computer modeling techniques to determine if conclusions could be drawn based on this relationship. The analysis verified that it is possible to determine whether or not HPI was initiated based upon makeup tank level response. Based on this analysis, GPU asserted that HPI was not, and could not have been, fully initiated at approximately 5:41 a.m. on March 28, 1979. ..

Additionally, two operators whose earlier statements formed the basis for the 5:41 a.m. HPI entry in the GPU sequence testified during the trial. William Zewe testified that he does not remember HPI being fully initiated at about 5:41 a.m. on March 28, 1979, even though his earlier statements are to the contrary. Another operator, Edward Frederick, testified during the trial that he does not recall ever having said that HPI was initiated at the same time the second set of reactor coolant pumps were secured, nor does he recall that HPI was initiated in that time frame.

The third operator involved was Craig Faust. Faust did not testify during the trial. Rather, an earlier interview was read into the record. In this interview, conducted by IE on April 24, 1979, Faust stated "Something else I would like to just emphasize is that just prior to stopping those pumps, we did reinitiate, we hit high pressure injection just prior to stopping the pumps." He also stated in this IE interview that Frederick was the operator who manually initiated the engineered safety features (ESF) resulting in two HPI pumps automatically starting at a flow rate of 1,000 gallons per minute.

To summarize, Faust recalled that Frederick initiated HPI at approximately 5:41 a.m. Frederick stated that he does not recall HPI actuation in this time period. Zewe's earlier recollection was that Faust initiated HPI. However, Zewe does not now believe that it was initiated at approximately 5:41 a.m.

During the trial, B&W maintained that the GPU sequence of events was correct. B&W reviewed the earlier statements of Zewe which reflect his recollection that HPI was initiated at approximately 5:41 a.m.

The conflict between the GPU sequence of events (SOE) and other sequences (which do not reflect HPI actuation of 5:41 a.m.) has been examined in previous investigations and was identified in the report prepared by EPRI's Nuclear Safety Analysis Center. This report states in Appendix SOE that:

A manually initiated actuation of the high pressure injection portion of the engineered safety features at approximately 5:41 a.m. was noted in the latest GPU SOE. This occurred at a time when the computer alarm history was lost, so it cannot be verified. The entry was based on two separate interviews of one control room operator. A review of those interviews indicates that there may

have been a manual actuation about the time the reactor coolant pumps were shut down, but this actuation does not appear to be certain enough to be considered factual.

The NRC Special Inquiry Group (SIG) also examined the operation of HPI at approximately 5:41 a.m. This report concluded at p. 665 of Vol. II, part 2, that the SIG review disproved the entry in the GPU sequence that stated makeup pump 1C had been started.

The U.S. Senate report states at p. 105:

At 5:41 a.m., still unaware that a LOCA was in progress, the control room personnel took a critical step. They shut down the last two reactor coolant pumps, which also were vibrating excessively. (Reference omitted.) This ended the forced flow of cooling water through the core. So long as the pumps had been running, the combination of water and steam flowing through the core removed enough heat to protect it even though coolant was being lost. (Reference omitted.) Once the pumps were stopped, the steam separated from the water and rose to the top of the hotlegs--the so-called "candy canes"--and the water level in the reactor vessel dropped.

The uncovering of the core began very soon after circulation stopped. Water was continuing to escape out the PORV, at the same time that HPI was being throttled, so that the lost coolant was not being replaced. The water level continued to decline, temperatures to increase, the coolant to boil. Not only did the boiling release saturated steam, which continued to rise toward the higher portions of the system, such as the hotlegs, but the steam displaced more coolant forcing it into the pressurizer and out the PORV. This process would continue to uncover the core.

The NRC's initial investigation into the accident (NUREG-0600) also examined the operation of HPI on the morning of the accident. This report states at p. I-4-22 that:

Only 15,000 gallons of water were injected into the reactor from the SWST during the first 3 1/2 hours, approximately 2/3 of it during two HPI actuations. As indicated in Section 4.3.1, the overall average flow for this period was 70 gpm. However, during most of this time the flow was much less. During the first minute of the accident, the operators started MUP-1A and opened MU-V-16B. This was followed by ES initiation at 2 minutes, which was throttled back at 4 minutes. (Reference omitted.) Thus, the net flow during the first 4 minutes was about 3,000 gallons. At 0720 hrs, ES was initiated and maintained for 7 minutes, resulting in a flow rate of 1,000 gpm for a total injection of 7,000 gallons. The remaining 5,000 gallons injected during the period from 0404 hrs until 0720

hrs, when ES was not actuated, results in an average net flow rate of about 25 gpm for that period.

The findings of the Senate investigation and the NUREG-0600 inventory balance lend additional evidence to support the NSAC and SIG conclusion that HPI was not fully initiated between 4:04 and 6:18 a.m.

The review team concludes that the NRC's understanding of the accident is not significantly affected by the information presented in the trial court record related to the alleged HPI operation at 5:41 a.m. The issue has previously been examined and the evidence presented during the trial reinforces earlier conclusions that HPI was not initiated at 5:41 a.m. Further, the review team concludes that HPI was not fully initiated at approximately 5:41 a.m.

It should be noted that the operator's recollections that HPI was manually initiated after a reactor coolant pump was stopped is consistent with the events that occurred at approximately 7:15 a.m. The 2B reactor coolant pump was run from approximately 6:55 a.m. until 7:13 a.m. HPI was manually initiated resulting in makeup pump 1C starting automatically (makeup pumps 1A and 1C were then operating) at approximately 7:20 a.m.

#### Consideration Given to Tailpipe Temperatures on the Day of the Accident.

Power operated relief valve (PORV) and code safety valve tailpipe temperatures have been examined extensively in previous investigations of the accident. The trial court record provides no new information that significantly affects the agency's understanding of this element of the accident.

The trial court record is consistent with NRC's previous understanding in that:

- ° Tailpipe temperatures observed by the operators were considerably less than the temperatures they expected with a PORV or code safety valve stuck open. Brian Mehler, who entered the control room shortly after 6 a.m., read out the tailpipe temperatures and closed the PORV block valve. However, Mehler also has testified that he believed the tailpipe temperatures with an open PORV would be greater than 300°F.
- ° The operators' evaluation of the tailpipe temperatures was influenced by the prolonged elevated temperatures prior to the accident.
- ° The operators believed that the elevated temperatures prior to the accident were a result of valve seat leakage.



- The operators believed that the elevated conditions following the trip were a result of the PORV cycling during the transient, and thus the operators did not use the pressurizer system failed emergency procedure.

This record, like the previous record developed on the subject of tailpipe temperatures, is unable to resolve differences between Zewe and Kenneth Bryan regarding the tailpipe temperatures read in the control room the morning of the accident. One new piece of information provides insight into the operators' inability to identify from tailpipe temperatures which valve was leaking prior to the accident. This is given in GPU Exhibit No. 399. In a presentation by John M. MacMillan (B&W) to the ACRS on April 16, 1979, MacMillan stated that B&W expected in the near term to recommend certain design improvements to improve operator performance during transients similar to the one that occurred on the day of the accident. One design improvement specifically identified was a more positive indication of PORV position. B&W had completed an effort to identify possible methods of detecting PORV status based on various process variables and noncontact methods. GPU Exhibit No. 399 summarizes B&W's investigative efforts, identifies several methods considered to have a high probability of success and recommends a test to confirm the workability of the proposed methods. It was concluded for the "temperature only" method of determining PORV position that:

- It may not be possible to tell leakage from normal operation.
- It may be difficult or impossible to set a threshold temperature for the identification of leakage.
- This method would not distinguish between leakage from the PORV and the code safety valves.

The questionable validity of relying on tailpipe temperatures as an indication of valve position is reinforced by the NRC's requirements in this area as a result of "Lessons Learned" from TMI. The staff required (NUREG-0660 and NUREG-0737, Item II.D.3) that reactor coolant system relief and safety valves be provided with a positive indication in the control room derived from a reliable valve position detection device or a reliable indication of flow in the discharge pipe. The staff found, as did B&W above, that tailpipe temperature (as a sole indication) was not a reliable measure of valve position indication.

The Influence of Precursor Events at Both Davis-Besse and TMI-2 on the Events Occurring on the Day of the Accident.

As in previous inquiries into the accident, the trial court record contains a discussion of several events that were described as

precursors of the accident at TMI-2 <sup>12/</sup>. None of the events discussed during the trial are new. Although there are reports or records associated with various events that were new to this review team, the team concludes that no information was presented that significantly changes the NRC's understanding of the accident. Rather, a review of this portion of the trial court record reinforces conclusions reached in previous investigations. Previous investigations have concluded that the precursor events were generally not well understood by vendors, utilities or NRC. In those instances where a precursor was understood by an individual, this understanding did not reach the operating personnel of B&W reactors and consequently did not place them in a position to respond differently to events such as those that occurred at TMI-2.

The Special Inquiry Group (SIG) in its discussion of how the nuclear industry and the NRC viewed precursor events stated at p. 130 of Vol. II, part 1, that:

The nuclear industry and the NRC had little or no concern about what the operators saw during a transient and what they did as a result. Actual plant operating and emergency procedures were not reviewed in any systematic fashion by the NRC or by the vendor. Incidents were assessed almost entirely from the perspective of the hardware with little concern about what the operator saw or did.

The Senate Investigation also examined the manner in which the nuclear industry and the NRC responded to precursor events. This report found at p. 18 that:

- a. Three Mile Island was not the first nuclear facility to experience the conditions that occurred in the early stages of the March 28, 1979 accident. Important information had been available to the reactor-designer of TMI and to the NRC on minor accidents at two other plants--Oconee in South Carolina and Davis-Besse in Ohio (footnote omitted) that were similar to the beginning of the TMI accident.
- b. Both the reactor-vendor, Babcock & Wilcox (B&W), and the NRC had programs for evaluating and acting upon individual problems occurring at nuclear power plants. However, the responses of the reactor-vendor and the NRC to these similar accidents suggest that neither had procedures to assure an effective systematic review and analysis of potentially recurring problems. (Footnote omitted.) For these reasons, TMI control room personnel did not have the benefit of

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The precursor events are listed in Appendix B as well as an identification of other reports wherein they are discussed.

analysis and guidance, based on similar accidents, that would have helped them in diagnosing and responding correctly to the early events of the accident on March 28. (Footnote omitted.)

The deficiencies in industry and NRC programs for evaluating and acting on operating experience at nuclear power plants were among the most important inadequacies in the nuclear safety program brought to light by the accident.

The President's Commission into the accident reached similar conclusions concerning precursor events (see Commission Finding 7, p. 29). In addition, the President's Commission Recommendations addressed operator training related to operating experience and industry analysis of operating experience. The recommendations concerning training are stated at p. 70:

Training should not end when operators are given their licenses.

- a. Comprehensive ongoing training must be given on a regular basis to maintain operators' level of knowledge.
- b. Such training must be continuously integrated with operating experience.

The recommendation concerning the utility and its suppliers stated is at p. 68:

There must be a systematic gathering, review, and analysis of operating experience at all nuclear power plants coupled with an industry-wide international communications network to facilitate the speedy flow of this information to affected parties. If such experiences indicate the need for modifications in design or operation, such changes should be implemented according to realistic deadlines.

The SIG investigation also reviewed the relevance of precursor events to the accident at TMI-2. Although the review of precursor events does provides insight into underlying causes of the accident, there is considerable doubt as to how knowledge and understanding of these prior events would have affected the accident at TMI-2. The SIG investigation examined this aspect. This report posed the following questions and answers concerning the relevance of precursor events at p. 138 of Vol. II, part 1:

Two issues can be considered with respect to the handling of precursor events. First, if lessons had been learned and applied, how might the actual accident at TMI been reduced or avoided; and second, how does the handling of a precursor reflect on the overall performance of the utility-vendor-regulatory system.



The first issue is itself made up of two questions

- ° Should additional guidance or information have been made available to the operators if a certain precursor had been handled differently?
- ° Would the operators at TMI have responded differently during the Accident on the basis of that guidance or information?

The answer to the first question is certainly, yes. Precursors such as the Kelly-Dunn memoranda or the Michelson report should have produced guidance that if it had been used, would have prevented the extensive core damage that occurred at TMI.

Unfortunately the answer to the second question can never be known for certain. It is impossible to determine if one additional piece of information integrated with the massive amount of data already available to the operators at TMI would have caused them to diagnose the problem properly and take appropriate actions to prevent the severe consequences that occurred. However, when one looks at the fact that the massive amount of significant, meaningful information that should have indicated the TMI operators that the actions being taken were incorrect, and one realizes that this bulk of information was essentially ignored one must conclude that any additional guidance produced as a result of any of the identified precursors might have been equally ignored.

This conclusion does not, however, detract from the fact that the second issue, how the precursors were handled by the licensee-vendor system, is inherently significant.

Finally, although not a precursor, an issue was examined during the trial that is related to Met Ed's knowledge of the Davis-Besse event.

A portion of the trial court record is devoted to a discussion of the B&W Users' Group meetings sponsored by B&W and attended by various utilities using B&W nuclear steam supply systems. At such Users' Group meetings, B&W would disseminate information to its customers concerning its products. Also, the various users of B&W nuclear steam supply systems would relate their experiences to the group. The meetings constituted basically an information exchange. A number of Users' Group meetings were held in the years prior to the accident at TMI-2. At trial, B&W attempted to demonstrate that information regarding the Davis-Besse transient of September 24, 1977, which involved a stuck-open PORV and a resulting high pressurizer level and premature operator termination of HPI, was disseminated to attendees including Met Ed personnel at the November 16-17, 1977, Users' Group meeting by Terry Murray, Superintendent of the Davis-Besse plant. Although a number of Users' Group meetings occurred prior to the accident, B&W claimed that it was only at the November 16-17, 1977, Users' Group meeting that

information was provided to GPU (specifically to Messrs. Miller and O'Hanlon) with regard to the Davis-Besse incident <sup>13/</sup>.

In support of its argument, B&W sponsored the testimony and notes of Frank Fahland, an employee of B&W who attended the Users' Group meeting in November 1977 as a nonparticipant. Although Fahland testified that he had no independent recollection of the presentation of Murray at the meeting in question, he indicated that he prepared notes of the Users' Group meeting covering the presentation of Murray. Fahland's notes contain brief entries regarding Murray's discussion of the Davis-Besse transient. Fahland's notes indicate that the incident consisted of a steam feed rupture control system failure eventually leading to rupture disc failure on the quench tank caused by the PORV sticking open. His notes further reflect that the pressurizer level indication was reading full and that system pressure went to saturated conditions.

Fahland's notes are also pertinent for the information that they do not contain regarding the September 1977 transient. Fahland did not make note of the primary cause of the PORV failure: part of the control circuit for the valve was not installed. This resulted in rapid cycling of the PORV before it failed. He did not note that low reactor coolant system pressure resulted in actuation of the emergency core cooling system (ECCS) including HPI. Nor did he note that HPI had been terminated in violation of procedures before system pressure had recovered. In addition, reactor power level and other initial conditions pertinent to the transient were not noted.

GPU sponsored the testimony of James O'Hanlon on this subject. O'Hanlon, a former Met Ed employee, attended the meeting with Gary Miller and took notes. His notes reflect no discussion of the Davis-Besse transient. O'Hanlon testified that he did have an independent recollection of the Murray presentation and that, regardless of the Fahland notes, there was no discussion of pressure going to saturation conditions with the PORV open and pressurizer level going up.

The record thus contains apparent conflicting testimony as to what information was disseminated at the November 1977 meeting. It should be noted that Fahland has no independent recollection of the meeting and his notes may contain some of his own thoughts. The official B&W minutes of the meeting noted only that, during the Davis-Besse transient, the PORV stuck open. James Seelinger testified that he and Miller had made a search of the Met-Ed files to look for information related to the Davis-Besse transient. The search revealed only a

13. At that time, Miller was the Station Superintendent and O'Hanlon was the Superintendent of Unit-1 at the TMI facility.

one-line statement concerning the Davis-Besse transient commenting on PORV failure. It should be further noted that Murray, who made the presentation at the Users' Group meeting, did not offer testimony for either party on this point.

As with the precursor events in general, it may be that any information that may have been presented at the November 1977 meeting was insufficient, standing alone, to cause the listener to capture the true significance and implications of the Davis-Besse transient of September 1977. The review team concludes that, during the November 1977 meeting, Murray made a presentation that included a brief discussion of the Davis-Besse transient. The review team further concludes that the information presented by Murray was not sufficient to permit a thorough understanding of the significance of the transient or its implications. This conclusion is supported by the testimony of Metropolitan Edison and B&W personnel as well as the official B&W minutes of the meeting. However, this issue cannot be conclusively resolved in the absence of Murray's testimony.

In conclusion, the review of the trial court record requested by the Commission reveals no significant information that affects NRC's understanding of the accident.

### III. SIGNIFICANT INFORMATION BEARING ON THE RESTART OF THE TMI-1 FACILITY

Subsequent to the initiation of the review team effort, the Commission requested that the review team analyze the trial court record for any significant information that might affect the Commission's decision regarding the restart of TMI-1. It should be noted that GPU has made numerous changes to the equipment and organizational systems at TMI-1 in preparation for restart. Many changes have been required and reviewed by the NRC. The trial court record did not examine these changes. The information in the trial court record does not focus on events that took place after approximately 6:20 a.m. on March 28, 1979. Therefore, the information presented during the lawsuit has limited impact on restart.

The review team reviewed the trial court record for significant information bearing on the restart of the TMI-1 facility. The baseline for this analysis is the same as that discussed in Section II above. It should be noted that, before this review, the team did not examine the transcripts and exhibits of the Restart Proceeding. The Licensing Board and Special Master decisions were reviewed by the team. The team is aware that the Commission has decided to permit the parties to the TMI-1 Restart Proceeding to submit, if they wish, written comments on this report. In view of the fact that the record of the Restart Proceeding was not completely analyzed by the review team, the team recommends that the Commission request the parties to the Restart Proceeding, who are intimately familiar with that record, to apprise the Commission of their views as to whether the trial court record contains significant new information.



The TMI-1 Restart Proceeding (Docket No. 50-289-SP) was initiated by the Commission's Order and Notice of Hearing dated August 9, 1979, Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), CL1-79-8, 10 NRC 141 (1979). The decision as to whether or not to permit restart of TMI-1 is currently before the Commission for immediate effectiveness review...

During the review of the trial court record, one potentially significant item was identified. The item may also be applicable to other B&W reactors. This item was referred to NRR for evaluation and possible Board Notifications in accordance with NRR Office Letter No. 19, Rev. 2. NRR has reviewed this matter and has concluded that a Board Notification was appropriate. On February 18, 1983, Board Notification 83-21 was sent informing the Commission, Boards and parties of the staff's ongoing evaluation of two concerns raised during the testimony of Dr. R. Lahey of the Rensselaer Polytechnic Institute (RPI) and Dr. G. Wallis of Dartmouth College <sup>14</sup>.

The first concern involves procedures and relates to whether or not the operators have sufficient instructions and training to ensure that they will raise the secondary level of the steam generator to 95 percent of the operating level under all conditions necessary to ensure natural circulation. The second concern involves recent test data that was reported to show that auxiliary feedwater entering from the sparger ring does not penetrate into the steam generator tube bundle but only contacts a small percentage of the tubes. Previous analysis models had assumed good penetration of auxiliary feedwater spray into the tube bundle. Recent B&W models may account for the new data.

On February 23, 1983, the B&W Owners' Regulatory Response Group (RRG) met with the staff to present information on these two concerns. Subsequent to this meeting, the Owners' Group submitted a technical report, "Evaluation of SBLOCA Operating Procedures and Effectiveness of Emergency Feedwater Spray for B&W Designed Operating NSSS," which documented the information presented at the February 23, 1983 meeting <sup>15</sup>. On March 11, 1983, Board Notification 83-21A was sent to the Commission, Boards and parties <sup>16</sup>. This notification provided the staff's evaluation and conclusions with respect to the two concerns previously

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14. Memorandum from D. G. Eisenhut, NRC, to the Commission, dated February 10, 1983, subject: "Board Notification 83-21."
  15. "Evaluation of SBLOCA Operating Procedures and Effectiveness of Emergency Feedwater Spray for B&W-Designed Operating NSSS," B&W DOC. ID. 77-1141270-00, dated February 1983.
  16. Memorandum from D. G. Eisenhut, NRC, to the Commission, dated March 11, 1983, subject: "Board Notification 83-21A."

identified in BN-83-21 for TMI-1 only. The staff concluded that the information described in BN-83-21 did not adversely affect its conclusions regarding the ability of TMI-1 to achieve and maintain decay heat removal by natural circulation through the steam generators under transient and accident conditions. On March 16, 1983, Board Notification 83-21B <sup>17/</sup> forwarded to the Commission, Boards and parties the B&W Regulatory Response Group report. The staff completed its review of these concerns for TMI-1. Reviews for the remaining B&W plants are continuing.

No other significant information bearing on the restart of TMI-1 was identified.

The Memorandum For the Acting General Counsel of February 2, 1983 from Commissioner Gilinsky identified four areas which Commissioner Gilinsky sought to be evaluated for significance. These areas were:

- GPU's falsification of leak rate calculations;
- The flow of information on March 28, 1979;
- Cheating on the NRC and Company administered operator examinations; and,
- Maintenance at Three Mile Island.

A discussion of each of these areas is presented below.

#### GPU's Falsification of Leak Rate Calculations <sup>18/</sup>

NRC information on this matter is incomplete. The allegations concern falsification of reactor coolant system leak rate measurements made at TMI-2 prior to the accident for purposes of Technical Specification compliance. The original NRC investigation into this matter was suspended upon referral of the matter to the United States Department of Justice (DOJ). NRC's investigative effort was suspended pending the conclusion of the DOJ investigation at the request of DOJ to avoid parallel administrative and criminal proceedings. The DOJ investigation is ongoing. The review team was briefed on this issue by one of the original NRC investigators who examined information developed before

17. Memorandum from D. G. Eisenhut, NRC, to the Commission, dated March 16, 1983, subject: "Board Notification 83-21B."

18. For an overview of the information contained in the trial court record concerning this area, refer to the references in Appendix C.

suspension of the investigation. This issue was also the subject of a Licensing Board decision. <sup>19</sup>

The NRC investigation conducted to date has been limited, but the information discussed in the trial court record does not add substantially to the information of which the NRC is already aware.

### Flow of Information

The trial court record contains limited discussion concerning the flow of information on March 28, 1979. The record contains scattered excerpts of operator testimony that bear on this issue. The record does not contain a review of the information available or events that occurred after approximately 6:20 a.m.

The issue of the flow of information on March 28, 1979 was the specific subject of NUREG-0760, as discussed in Section II. The review team concluded that the trial court record revealed no information significantly affecting the conclusions reached in NUREG-0760 with regard to information flow.

In addition to NUREG-0760, the SIG investigation examined the issue of information flow to the NRC. The SIG report provides an overview of the issue of information flow at pp. 159-160, Vol. I:

We undertook to determine if there was evidence of any willful failure on the part of utility personnel to provide information to the NRC in order to cover up the seriousness of the accident. A detailed account of the results of that investigation are contained in Volume II of this report.

In sum, we concluded that the evidence failed to establish that Met Ed management or other personnel willfully withheld information from the NRC. There is no question that plant information conveyed from the control room to offsite organizations throughout the day was incomplete, in some instances delayed, and often colored by individual interpretations of plant status. Indeed, information conveyed by Met Ed, NRC, and B&W employees in the control room to their own managements and offsite organizations was in many cases incomplete and even inaccurate.

However, based on the evidence, we could not conclude that the causes of this breakdown in information flow went beyond confusion,

19. The Licensing Board considered leak rates under Section K. Licensee's Management Response to the TMI-2 Accident, Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-81-32, 14 NRC 381 (1981) at pp. 557-558.



poor communications, and a failure by those in the control room, including NRC and B&W employees, to comprehend or interpret the available information, a failing shared to some extent by offsite organizations as well.

A number of factors other than deliberate attempts to downgrade the seriousness of the situation could have accounted for the failure of the control room crew to communicate critical information. These include the inability to recognize and comprehend the full significance of the information, and certain psychological factors: the difficulty of accepting a completely unexpected situation, the fear of believing that the situation was as bad as the instruments suggested, and a strong desire to focus on getting the reactor stable again rather than dwelling on the severity of the accident.

The failure to recognize and act on significant data in our view demonstrates a lack of technical competency by site employees to diagnose and cope with an accident. Moreover, the inability of the utility's management to comprehend the severity of the accident and communicate it to the NRC and the public was a serious failure of the company's management. But neither lack of such a capability nor the psychological factors mentioned above amount, in our view, to an intentional withholding of information.

Moreover, NRC and B&W employees in the control room also did not recognize or communicate critical information. And their offsite organizations did no better, and perhaps worse, than the utility's offsite engineers at GPU in New Jersey in demanding reporting of important information and in recognizing the significance of the information that they did receive. The fact that NRC and B&W did no better than Met Ed/GPU in reporting critical information up the management chain and acting upon it tends to support our conclusion that there is no evidence to show willful withholding of information by Met-Ed from NRC.

The review team also examined the Licensing Board's decision on this matter. <sup>20/</sup> The Board's discussion of this issue focussed in large part on NUREG-0760. The trial court record related to this issue contained no significant information affecting restart.

20. The Licensing Board considered information flow under Section K. Licensee's Management Response to the TMI-2 Accident, Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-81-32, 14 NRC 381 (1981) at pp. 537-556.

### Cheating on the NRC and Company-Administered Operator Examinations 22/

The "cheating" issue was the subject of a Special Master's decision and a Licensing Board decision in the Restart Proceeding and included the issue of the Miller letter to the NRC Staff on August 3, 1979 certifying that a licensed Met Ed operator had completed the TMI requalification program 22/. The review team examined both of these decisions. The information produced on this matter in the B&W-GPU trial court record is but a minor subset of the information presented to the Licensing Board. The trial court record contains no significant new information concerning the involvement and actions of the operator, Miller, Herbein and Arnold with regard to the requalification and certification.

### Maintenance at Three Mile Island 23/

The issue of maintenance has been examined in previous investigations. This issue was also a subject that was examined by the Licensing Board in the TMI-1 Restart Proceeding 24/. The discussion of maintenance contained in the trial court record included information concerning maintenance budget and maintenance staff size in the years preceding the accident, and maintenance issues related to the PORV and code safety valves.

To supplement its understanding of the issue of maintenance, the review team examined the portion of the Licensing Board decision referenced above. The review team concludes that there is no new significant information in the trial court record related to this issue that could affect the restart of TMI-1.

## IV. CONCLUSIONS

The review team concludes that the trial court record does not contain information that significantly affects the agency's understanding of the accident, including but not limited to the sequence of events.

21. For an overview of the information contained in the trial court record concerning this area, refer to the references in Appendix C.
22. Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-82-348, 15 NRC 918 (1982); Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-\_\_\_\_, \_\_\_\_ NRC \_\_\_\_, (Slip Opinion, July 27, 1982).
23. For an overview of the information contained in the trial court record concerning this area, refer to the references in Appendix C.
24. Metropolitan Edison Company (Three Mile Island Nuclear Station, Unit 1), LBP-81-32, 14 NRC 381 (1981) at pp. 479-504.

The review team concludes that the trial court record does not contain significant information that would affect the Commission's decision regarding restart, other than the potentially significant item of concerning the adequacy of small-break loss-of-coolant and natural circulation procedures. This information has been reviewed by NRR and a Board Notification has been made.

#### ADDENDUM

On March 22, 1983, the Government Accountability Project (GAP) issued a press release discussing charges made by Richard Parks, a senior startup engineer for the Bechtel Corporation at TMI-2. Parks' allegations address, in part, an issue which was discussed in the trial court record. His allegations include one which states:

appointment to a key oversight role of the individual reported on-site as the "mystery man" who shut off the safety injection pumps responsible for much of the damage of the original accident.

Parks' affidavit, identifies the so-called "mystery man" and further particularizes the allegation.

A discussion of the operation of HPI at approximately 5:41 a.m. on the day of the accident is presented in Section II of this report.

The accident at TMI-2 has been reviewed extensively in the four years that have passed since March 28, 1979. The various individuals associated with HPI operation on the day of the accident, including those identified by Parks, have been interviewed at various times in the past, in many cases under oath. In light of the extent of these previous efforts, the likelihood is remote that the Parks' allegations contain significant new information which could affect the NRC's understanding of HPI operation on the morning of March 28, 1979.



APPENDIX A  
MEETING SUMMARY

On March 21, 1983, R. Arnold of General Public Utilities (GPU) telephoned V. Stello and requested a meeting with Mr. Stello to discuss information Mr. Arnold considered related to the review team's examination of the B&W-GPU trial court record. Mr. Stello agreed to a meeting which was held later in the day and attended by R. Arnold, V. Stello, J. Craig, T. Harpster and R. Hoefling.

At the beginning of the meeting, Mr. Stello informed Mr. Arnold that the review team's draft report would not be discussed at the meeting and that a meeting summary would be prepared. Mr. Arnold indicated agreement with this approach. Neither the draft report nor any team activities were discussed during this meeting.

Mr. Arnold then related at the meeting GPU's concern that the trial court record may not include all the information germane to the review currently being conducted by the NRC staff. Mr. Arnold stated that a number of documents which may be of interest were not a part of the trial court record. Specifically, the B&W-GPU trial preparation has resulted in 1767 exhibits and 81 depositions. While a number of exhibits and excerpts from depositions were included in the trial court record, Mr. Arnold stated that much of this material was not a part of the trial court record. GPU has conducted a preliminary sorting of this material removing from consideration such documents as were publicly available, which had already been provided to the NRC or those judged to have no potential significance. As a result of this sorting, GPU concluded that about 580 documents remain which may contain something of interest. Mr. Arnold stated that all of the documents were indexed and available for NRC inspection and copying at GPU's Parsippany offices.

Mr. Stello asked Mr. Arnold whether he felt the documents contained important information which the NRC did not now have. Mr. Arnold stated that he believed that the NRC had previously reviewed all of the significant information and that no significant new information was contained in the documents.

Mr. Stello stated that he would consider GPU's offer and would contact Mr. Arnold if the NRC staff wished to review the documents.

Also discussed during the meeting was the Hartman matter regarding leak rate calculations. Mr. Stello indicated that he had attempted to obtain the Hartman deposition taken in the lawsuit by B&W. Mr. Arnold offered to provide the document expeditiously. Mr. Arnold also commented that some 20 depositions taken in the lawsuit touched upon the Hartman matter. Further, he stated that, when the Hartman matter first surfaced, GPU conducted an initial inquiry into the matter and prepared a confidential report on the

matter. Mr. Arnold noted that GPU was considering providing this document to the U.S. Attorney conducting the grand jury investigation.

Also discussed was B&W Exhibit No. 843 (Internal Audit Report of TMI Management performed in early 1978). Mr. Stello expressed an interest in learning when that document was first made publicly available. Mr. Arnold offered to pursue that matter and to provide Mr. Stello with a response. \*

Finally, the issue of natural circulation procedures, which had been the subject of a Board Notification, was briefly discussed. Mr. Arnold noted that this issue had been resolved some time ago for TMI-1 through procedure revisions.

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\* Mr. Stello was informed on March 22, 1983 that GPU was not aware of any review of this internal GPU document by any external organization prior to the initiation of the B&W-GPU lawsuit.

# APPENDIX B PRECURSOR EVENTS

The precursor events discussed in the trial court record are summarized below. Prior reports wherein the precursors are discussed are also identified. These reports also discuss other precursor events. Caution should be used during any review of these six or other precursor events in attempting to predict past operator actions based on a piece of information now believed to be significant. The numbers in brackets indicate which events were examined in the respective report. For example, the SIG report contains a discussion of events 2, 3, 4, 5, and 6.

<u>Number</u>	<u>Precursor Event</u>
1.	The TMI-2 September 1977 event: Steam formation during hot functional testing before fuel load.
2.	Davis-Besse transient in September 1977: rapid depressurization of the reactor coolant system which was initiated by a failure in the Steam Feed Rupture Control System compounded by a failure of the auxiliary feed pump turbine speed control, PORV failure and operator error.
3.	TMI-2 April 23, 1978, over-cooling transient: reactor trip resulting from spurious signal, 5 main steam valves fail to close.
4.	TMI-2 November 7, 1978, over-cooling transient: reactor trip due to loss of feedwater.
5.	TMI-2 December 2, 1978, over-cooling transient: reactor trip due to loss of feedwater.
6.	TMI-2 March 29, 1978, transient: power failure to the control circuit for the PORV that resulted in the PORV opening.

## Precursor Events Discussed

## Report

[2, 3, 4, 5, 6]

Three Mile Island, A Report to the Commissioners and to the Public, (Rogovin Special Inquiry Group), NUREG/CR-1250, Volume II, Part 1.C, Precursor Events.

[2, 6]

Report of the President's Commission on the Accident at Three Mile Island (Kemeny Commission), Volume III, C.12.

[1, 2, 3, 6]

Nuclear Accident and Recovery at Three Mile Island (Senate Report), Chapter 6, Prior to the Accident.

[2]

Analysis of Three Mile Island - Unit 2  
Accident, Nuclear Safety Analysis Center,  
Appendix PE - Precursor Events.

[3, 4, 5, 6]

Investigation Into the March 28, 1979 Three  
Mile Island Accident by Office of Inspection  
and Enforcement, NUREG 0600, Section 1.5.2,  
Review of Selected Prior Trips.



## APPENDIX C INFORMATION OVERVIEW

The reader may develop an overview of the information contained in the trial court record concerning each area by reviewing the references provided below. An overview of the area of the flow of information is not provided because the record did not address events after approximately 6:20 a.m. on March 28, 1979 and because of the fact that this area was not pursued during the trial. The reader should refer to NUREG-0760 for an overview of this area.

<u>AREA</u>	<u>Trial Court Record Reference</u>
Alleged GPU Falsification of Leak Rate Calculations	Frederick Tr 3938 - 4043 Hartman Tr 7008 - 7995
Cheating on NRC and company administered examinations	Arnold Tr 1720 - 1754 Herbein Tr 7124 - 7156
Maintenance	Arnold Tr 1487 - 1500 Tr 1645 - 1675 Seiglitz Tr 5701 - 5911