

UNCLASSIFIED

ACRS-1682

December 5, 1979

MINUTES OF THE TMI-2 SUBCOMMITTEE MEETING TO
REVIEW NUREG-0600
"INVESTIGATION INTO THE MARCH 28, 1979 THREE MILE
ISLAND ACCIDENT BY OFFICE OF INSPECTION AND ENFORCEMENT"

October 30, 1979
Room 1046, 1717 H st. N.W.
Washington, D. C. 20555

THIS DOCUMENT CONTAINS
POOR QUALITY PAGES

The ACRS Three Mile Island Subcommittee met in Washington, D. C. to review NUREG-0600 "Investigation into the March 28, 1979 Three Mile Island Accident by Office of Inspection and Enforcement", Investigative Report No. 50-320/79-10. The notice of the meeting with program agenda appeared in the Federal Register, P. 59301, Vol. 44 No. 200, Monday, October 15, 1979 (Attachment A). A copy of the Tentative Detailed Schedule is attached. (Attachment B) and a list of attendees is included. (Attachment C). Presentation slides used by Mr. T. Martin are included as Attachment D, and those used by Mr. A. Gibson to discuss the radiological investigation are included as Attachment E. Formal presentations were made only by representatives of the NRC Office of Inspection and Enforcement. Comments were made by representatives of the Three Mile Island licensee, Metropolitan Edison Company. No written requests nor oral requests were received from other members of the public to make statements at this meeting.

Executive Session (Open) - (Not transcribed)

Present were: Mr. H. Etherington, ACRS TMI Subcommittee Chairman
Dr. M. W. Carbon, ACRS Subcommittee Member
Mr. C. Michelson, ACRS Consultant
Dr. I. Catton, ACRS Consultant
Dr. W. C. Lipinski, ACRS Consultant
Mr. R. Muller, ACRS Senior Staff Engineer, Designated Federal Employee

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The Chairman called the meeting to order at 8:30 A. M. and made an introductory statement noting that Mr. R. Muller, was the Designated Federal Employee.

He then solicited the comments of the members and consultants on the detailed schedule and those items to be covered, noting that there were disagreements between the accident chronologies in NUREG-0600 and those in NSAC-1 ("Analysis of Three Mile Island - Unit-2 Accident," July 1979, Nuclear Safety Analysis Center), and that there was non-compliance with emergency procedures. He suggested focussing on permitted departures from procedures.

Dr. Carbon noted that there could not be procedures for each possible event. Actions were dependent on operator's judgement and training. He wanted to determine where the line was drawn between permitted and not permitted departure from procedures.

Mr. Michelson was interested in how one distinguishes between the procedures for a leak and for a rupture. What Tech. Specs. apply during an accident? Also, he wondered where the operation of the letdown system was described in the report - and, if omitted, why.

Dr. Catton was interested in how the operators were steered into the path they took. Why wasn't training properly done? How is it audited?

Dr. Lipinski was interested in how much emphasis is placed on following procedures when the symptoms don't match those listed in the procedures. How were defective procedures allowed to exist and escape the NRC audit procedures? How many similar things to the defeat of all AFW trains are not uncovered in the audit process?

Meeting with NRC Staff (Open) - (Transcribed)

Mr. Jordan called on Jim Allen, Region I, I&E, to make the introductory remarks.

The investigation took four months and involved 3500 man days of effort. The team included twelve technical specialists and two investigative specialists divided into two groups of seven. One group investigated the operational aspects and the other the radiological aspects.

Mr. Tim Martin, assisted by Mr. Darwin Hunter, discussed the former, and Mr. A. Gibson reported on the latter.

The following observations were made:

Jim Allen, Deputy Director Region I, I&E, stated that the report involved 3500 man-days of effort over a four-month period. Seven members of the team examined reactor operations from surveillance testing of the auxiliary FW systems on March 26 until restart of RCP A at 8 P.M., March 28 and seven members, the radiological and emergency response actions of the licensee from the start of the accident until midnight March 30. The investigation did not include:

- (a) Evaluation of actions of NRC or other agencies
- (b) Evaluation of the regulatory process
- (c) Evaluation of the Legislative authority of the NRC
- (d) Evaluation of safety research
- (e) Evaluation of the licensing process, or the inspection and enforcement process
- (f) Review of design, of the systems shortcomings, instrumentation etc.

Mr. R. C. Arnold, Sr. V.P. Metropolitan Edison, stated that a final Met. Ed. report on the sequence of events and other accident related matters would be out of the printers about the middle of December.

The Staff investigation did not review the adequacy of the procedures. The procedures were admittedly ambiguous. The Office of Inspection and Enforcement reviews operating procedures for adequacy on a sampling basis (about 50%) but does not approve them.

Darwin Hunter, NRC Staff stated that operators had, on this occasion and others, throttled high pressure injection in violation of their procedures and training which called for maintaining the HPI whenever the pressure was below 1640 pounds. Dr. Catton noted that the LOCA procedures called for throttling as necessary to maintain level. Also, he pointed out that the symptoms of a major LOCA are rapid pressure decrease and rapid decrease in pressurizer level, (which did not occur).

Unidentified leakage had exceeded limits since October 1978, but this was not recognized by the operator because of a calculational error. Also, tailpipe temperatures in excess of procedural limits (135⁰) had existed since fall of '78. High tailpipe temperatures required closing of the block valve.

According to the I&E Staff, the operators were indoctrinated to prevent sodium hydroxide addition if possible, so they tried to limit the amount of injection so that the NaOH valves would not open. (This is not consistent with the fact that the A Makeup pump was manually started 13 seconds into the event as required by procedures.)

Dr. Lipinski questioned the wisdom of interconnecting the service and the instrument air lines, if this could be the initiating cause for the TMI-2 event.

Both signals on the EMOV indicated it should have been shut. The fact that the valve was stuck open was not known to the operator. The reason for the A Make-up pump failure has not yet been determined (p. 52).

Ed Jordan, I&E, indicated (p.57) that information developed after the investigation, will help to better understand the whole event.

The Staff feels the operator first deviated from his procedures when he throttled back the make-up to less than 250 gal/min per leg. At this point, the reactor trip and turbine trip were complete (p.61). The operator limited high pressure injection based on pressurizer level alone with no attention to pressure.

Mr. Michelson observed that the operator noted the level and that the safety injection was on, and, as had happened before for a non-LOCA case, he noted that water level was recovering. The fact that pressure remained low confused him but did not lead immediately to the obvious conclusion that he had a LOCA. There are procedures for hot and cold leg breaks, but there is no procedure for a break at the top of the pressurizer. Furthermore, part B of the LOCA procedure, which the Staff felt should be followed, called for continuing decrease in pressurizer level and this was not happening. Mr. Hunter indicated this was because the low pressure kept conditions outside the design envelope for which the procedure was written.

Mr. Hunter reported that the alternate shift supervisor knew almost immediately when the reactor coolant drain tank, (RCDT) rupture disc blew, because he at one point, noted high pressure on the RCDT pressure gauge behind the main panel, and almost immediately afterward noted the pressure was zero. Mr. Martin indicated (p. 50) that the control room operators and the shift supervisor had this information which should have revealed the open PORV. However,

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later (p. 140), Mr. Zewe, the shift supervisor, stated that he was not aware of the RCDT leak until much later and it was not until several days later that he realized the cause was the blown rupture disc. He said he "could not relate" to the account given by Mr. Martin. Mr. Jordan stated that at the existing temperatures and with safety valves, the operator should not have been so concerned with going solid. The Staff did not believe the operator was the sole cause of the accident, but they feel he had an opportunity to prevent it. The operators had been trained to expect saturation only on the secondary side.

NUREG-0600 does not go into detail on the operator's thought process.

(P. 82).

The diesels were manually tripped, according to procedures, but the fuel racks were not reset, which rendered the diesels inoperable, so that they could not respond to a start signal from the ESP or the control room. The Staff was unable to identify the operator who failed to reset the fuel racks. Dr. Lipinski expressed concern that this could have been deliberate, or worse yet, out of ignorance.

The duty superintendent, who arrived at 4:50 A.M. was trained on Unit 1 and was unaware of several important differences between the units (p. 86). He left the shift supervisor in charge.

There were errors on the part of the technical management as well as on the part of the operators. Errors are attributed to "the licensee," and that can be anyone in the licensee organization.

Computer records did little to support the operation because of the time delay but are valuable historical records. They are not necessarily chronologically accurate.

There was no clear point at which "non-compliance" terminated, even when the operators "ran out of procedures." Whenever pressure dropped below 1640 again "non-compliance" resumed. Mr. Michelson pointed out that to achieve cold shutdown, at some point, pressure would have to drop below 1640.

There is no explanation for the loss of A/C motor control centers.
(non-safety-related).

Conferences with B&W and GPU, as well as Met. Ed. management resulted in the order to repressurize. (The long period of low pressure operation may have aided in degassing the loops significantly.)

Once 400 gpm HPSI flow was established, condenser vacuum was regained, and a heat sink reestablished.

Inadequacies in licensee performance were enumerated by the Staff as follows:

- (a) Changes were made to EFW surveillance tests, disabling both EFW trains simultaneously.
- (b) After automatic ESF initiation, the operators reduced HPI flow with "complete disregard for RCS pressure and temperature conditions". Further, licensee training and operating practices contributed significantly to these actions.
- (c) Failure to provide changes to procedures for coping with pressurizer system failures, once routine leaks developed, invalidating existing procedures.
- (d) Failure to recognize saturation conditions.
- (e) Failure to reestablish emergency diesel generator operability.

Dr. Lipinski noted that an LER issued on Unit 1 on March 27 indicated that after maintenance on the turbine-driven feed system, a valve was left in the closed position. He inquired if the investigation had looked for a relationship between that LER and the closed AFW valves in Unit 2. Mr. Jordan indicated it had not.

Mr. Michelson asked about operation of the letdown system. Mr. Martin indicated it was included in the sequence of events, including its interplay with the makeup system but there was no reason to put it in the body of the report. He pointed out that the operators did not recognize they had a LOCA, so the blocking and bypassing of the ES system allowed them to continue makeup and letdown, defeating the isolation that occurs automatically with safety injection. Mr. Hunter noted that letdown operation is not recorded.

Resetting the diesels requires running out to them to reset the fuel racks if they are tripped. The shift foreman did not want the diesels to restart with each ES actuation. They could have been started from the control room and stopped if the racks were not tripped. This was not covered in the procedures or training. Mr. Arnold (Met. Ed.) said he felt his company knew who shut down the diesels and he would pursue finding out why they were not reset.

At one point in the accident, licensed personnel were getting advice from non-licensed B&W personnel. The Staff pointed out that the ultimate responsibility rests with the licensed operator, who may, if he wishes, reject the advice. Mr. Jordan agreed that that policy requires clarification. Dr. Carbon observed that the operator started the pumps on orders from higher management, unlicensed, although he did not wish to. Mr. Jordan stated that NRC has not directed criticism to that advice. Mr. Arnold, (Met. Ed.) pointed out that the operator did not believe starting the pumps was unsafe.

During 1978, there were seven emergency drills. As in one of the drills, after the TMI-2 accident, an iodine survey instrument taken to Goldsboro, was not operating properly. The drills identified a need to review site emergency criteria. During the accident, declaration of a site emergency was delayed because operations personnel did not realize the criteria had been met.

Offsite monitoring team members were not trained in the use of instruments which were used for measurement of radioactive iodine in the environment. Less than half of the portable radiation survey instruments were operable. Respirators were equipped only with particulate filters and were ineffective for iodine protection. A meter reading 1000R/hr pegged on occasion. There were no meters available for higher measurements.

The Staff feels that lack of a specific definition of "loss of reactor coolant system pressure" and "high reactor building pressure" in the procedures or emergency plan was a factor in the delay in declaring a site emergency.

Several entries were made into high radiation areas without the knowledge of the Supervisor of Radiation Protection and Chemistry. (High airborne radioactivity and whole body rates over 100R/hr.) Two persons received doses over regulatory limits. At times, high range pocket dosimeters could not be located and were not worn. Several cases of head contamination resulted. High radiation levels in the plant were unanticipated in the emergency procedures.

An error in reading a meter resulted in an actual level of 400 mr/hr being read as 30,000 mr/hr.

No plume measurements were made during several critical periods on March 28 and 29.

Required retraining of chemistry technicians had not been done.

The Staff has no policy on helicopter flying in close proximity to a plant (especially one undergoing a crisis). Mr. Arnold (Met. Ed.) confirmed Mr. Michelson's concern for the safety of the power lines.

Airborne filter samples from early entry into the auxiliary building read off-scale in the TMI laboratory. Mr. Herbein (Met. Ed.) stated that entry was necessary to identify sources of leakage and to restore power to some lube oil pumps needed to start the RCP.

Face masks probably were not necessary but were used conservatively because failure of gamma spectroscopy at 9 A.M. rendered the isotope content of the airborne radioactivity unknown. Mr. Arnold observed that the switchboard operator functioned adequately wearing a mask.

The Staff observed that there are at present no plans for an integrated report of all aspects of the problem. They agreed it was a good idea. During the Executive Session, the following suggestions were made for matters to be included in an ACRS report:

- (a) A rigorous procedure approval system should be instituted.
- (b) A plant process computer is needed that works well, has proper displays, and is prompt.

Executive Session (Open) - (Not transcribed)

The Subcommittee discussed items for consideration by the Full Committee in their report.

Mr. Etherington asked that Mr. Allen, Mr. Martin, and Mr. Gibson plan to present 15, 30, and 30 minutes worth of discussion respectively to the Full Committee on Friday, November 10.

The matter of a balanced, integrated report covering not only defects in operation, but such matters as design, training, audit, review of procedures, etc. was discussed. It was agreed an approval procedure for operating procedures was needed as was a greatly improved plant process computer.

The meeting was adjourned at 4:05 P.M.

Greater detail and a verbatim record of the discussion of the transcribed parts of this meeting are contained in the transcript which may be obtained from the Public Document Room at 1717 H Street, N.W., Washington, D. C. or from ACE Federal Reporters, Inc., 415 Second Street, N.E., Washington, D.C. (202-547-6222).

including educational programs in juvenile correctional facilities, and alternative education programs).

(13) *Delinquency*—is the behavior of a juvenile in violation of a statute or ordinance in a jurisdiction which would constitute a crime if committed by an adult.

(14) *Truancy*—is when the student is absent from school without permission.

(FR Doc. 79-31728 Filed 10-12-79 8:45 am)
BILLING CODE 4910-10-01

NATIONAL FOUNDATION ON THE ARTS AND THE HUMANITIES

Humanities Panel; Changed Meeting

October 9, 1979.

This is to announce a change in the date of the Humanities Panel announced in the Federal Register on September 8, 1979, Vol. 44, No. 174, Page 52857, Item #1. The meeting to review NEH Practitioners Seminar applications will be held on October 23, 1979 instead of September 20, 1979.

Stephen J. McCleary,

Advisory Committee Management Officer.

(FR Doc. 79-31732 Filed 10-12-79 8:45 am)
BILLING CODE 7530-01-01

Humanities Panel Changed Meeting

October 9, 1979.

This is to announce a change in the date of the Humanities Panel announced in the Federal Register on October 4, 1979, vol. 44, page 57243, #194. The meeting to review applications in State and Local History will be held on November 2, 1979 only instead of on November 1 and 2, 1979.

Stephen McCleary,

Advisory Committee Management Officer.

(FR Doc. 79-31733 Filed 10-12-79 8:45 am)
BILLING CODE 7530-01-01

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Reactor Safeguards; Subcommittee on the Three Mile Island Nuclear Powerplant; Meeting

The ACRS Subcommittee on the Three Mile Island Nuclear Power Plant will hold a meeting on October 30, 1979 in Room 1046, 1717 H St. NW, Washington, DC 20555 to review the NRC Inspection and Enforcement Report, "Investigation into the March 28, 1979, Three Mile Island Accident by Office of Inspection and Enforcement," Investigative Report No. 50-320/79-10 (NUREG-0600). Notice of this meeting was published September 20, 1979 (44 FR 54589).

In accordance with the procedures outlined in the Federal Register on October 1, 1979, (44 FR 56408), oral or written statements may be presented by members of the public, recordings will be permitted only during those portions of the meeting when a transcript is being kept, and questions may be asked only by members of the Subcommittee, its consultants, and Staff. Persons desiring to make oral statements should notify the Designated Federal Employee as far in advance as practicable so that appropriate arrangements can be made to allow the necessary time during the meeting for such statements.

The agenda for subject meeting shall be as follows:

Tuesday, October 30, 1979

8:30 a.m. until the conclusion of business.

The Subcommittee may meet in Executive Session, with any of its consultants who may be present, to explore and exchange their preliminary opinions regarding matters which should be considered during the meeting and to formulate a report and recommendation to the full Committee.

At the conclusion of the Executive Session, the Subcommittee will hear presentations by and hold discussions with representatives of the NRC Staff, the Metropolitan Edison Company, and their consultants, and other interested persons regarding this review.

In addition, it may be necessary for the Subcommittee to hold one or more closed sessions for the purpose of exploring matters involving proprietary information. I have determined, in accordance with Subsection 10(d) of Public Law 92-463, that, should such sessions be required, it is necessary to close these sessions to protect proprietary information (5 U.S.C. 552(b)(4)).

Further information regarding topics to be discussed, whether the meeting has been cancelled or rescheduled, the Chairman's ruling on requests for the opportunity to present oral statements and the time allotted therefor can be obtained by a prepaid telephone call to the cognizant Designated Federal Employee, Mr. Ragnwald Muller (telephone 202/634-1413) between 8:15 a.m. and 5:00 p.m., EDT.

Background information concerning items to be discussed at this meeting can be found in documents on file and available for public inspection at the NRC Public Document Room, 1717 H Street NW, Washington, DC 20555 and at the Government Publications Section, State Library of Pennsylvania, Education Building, Commonwealth and Walnut Street, Harrisburg, PA 17126.

Dated: October 5, 1979.

John C. Moyle,

Advisory Committee Management Officer.

(FR Doc. 79-31580 Filed 10-12-79 8:45 am)
BILLING CODE 7590-01-01

OFFICE OF MANAGEMENT AND BUDGET

Agency Forms Under Review

October 30, 1979.

Background

When executive departments and agencies propose public use forms, reporting, or recordkeeping requirements, the Office of Management and Budget (OMB) reviews and acts on those requirements under the Federal Reports Act (44 U.S.C. Chapter 35). Departments and agencies use a number of techniques including public hearings to consult with the public on significant reporting requirements before seeking OMB approval. OMB in carrying out its responsibility under the Act also considers comments on the forms and recordkeeping requirements that will affect the public.

List of Forms Under Review

Every Monday and Thursday OMB publishes a list of the agency forms received for review since the last list was published. The list has all the entries for one agency together and grouped into new forms, revisions, extensions, or reinstatements. Each entry contains the following information:

The name and telephone number of the agency clearance officer.

The office of the agency issuing this form:

The title of the form:

The agency form number, if applicable:

How often the form must be filled out:

Who will be required or asked to report:

An estimate of the number of forms that will be filled out:

An estimate of the total number of hours needed to fill out the form; and

The name and telephone number of the person or office responsible for OMB review.

Reporting or recordkeeping requirements that appear to raise no significant issues are approved promptly. In addition, most repetitive reporting requirements or forms that require one half hour or less to complete and a total of 20,000 hours or less annually will be approved ten business days after this notice is published unless specific issues are raised; such forms are identified in the list by an asterisk (*).

Comments and Questions

Copies of the proposed forms and supporting documents may be obtained from the agency clearance officer whose name and telephone number appear under the agency name. Comments and

RM
11/7

TENTATIVE DETAILED SCHEDULE
MEETING OF THE
THREE MILE ISLAND SUBCOMMITTEE
TO REVIEW NUREG-0600
Room 1046, 1717 H Street
Washington, D. C.
OCTOBER 30, 1979

Times are Approximate

8:30 A.M.

EXECUTIVE SESSION (OPEN)

Introductory Statement - H. Etherington
Subcommittee Chairman

Discussion of Agenda, Subcommittee and
Consultants questions

9:00 A.M.

MEETING WITH NRC Office of Inspection and
Enforcement Staff

I.a. Introduction - (James Allen, I&E)

- (1) Purpose and objectives
- (2) Scope
- (3) Methodology
- (4) Presentation

b. Comment by Licensee, if desired - (R.C. Arnold,
V.P., GPU)

9:30

BREAK *****

9:45

II. a. Operational Aspects - (Tim Martin/Darwin Hunter,
I&E)

- (1) Conditions prior to turbine trip
- (2) Sequence of events
- (3) Evaluation of Licensee Performance

b. Comment by Licensee, if desired

11:45 A.M. III. a. Radiological Aspects - (L. Gibson, I&E)

- (1) General description of radiological aspects
- (2) Preaccident conditions
- (3) Initial emergency response
- (4) Radioactive effluents

12:30 - 1:30 LUNCH *****

1:30 III. (CONTINUED)

- (5) In-plant radiation protection
- (6) Environmental assessment
- (7) Evaluation of Licensee performance

III. b. Comment by Licensee, if desired

2:30 - 2:45 BREAK *****

2:45 - 4:00 P.M. IV. EXECUTIVE SESSION (OPEN)

Discussion of proposed subcommittee recommendations

4:00 P.M. ADJOURN *****
Approximately

ATTACHMENT C

TMI-2 SUBCOMMITTEE MEETING TO REVIEW NUREG-0600
"INVESTIGATION INTO THE MARCH 28, 1979, THREE MILE
ISLAND ACCIDENT BY OFFICE OF INSPECTION AND ENFORCEMENT

October 30, 1979
Washington, D. C. 20555

ATTENDEES:

ACRS

H. Etherington, Chairman
M. W. Carbon, Member
C. Michelson, Consultant
I. Catton, Consultant
W. C. Lipinski, Consultant
R. Muller, DFE

GILBERT ASSOCIATES

J. Russell Hoke II

OTHERS

Barbara Whittier, Reporter, CAE Fed.
R. Borsum, B&W
Roger P. Smith, McGraw-Hill
R. Leyse, EPRI
B. G. Wauacs, GPOUSE
M. Schuel, SNF. I. A.
J. E. Silberg, Shew Pitnan

GAO

Edward G. Herron
Mikis Pistai
James A. Przeozial

MET. ED.

J. G. Herbein
J. R. Floyd
Zewe
R. C. Arnold
G. P. Miller

Operational Aspects

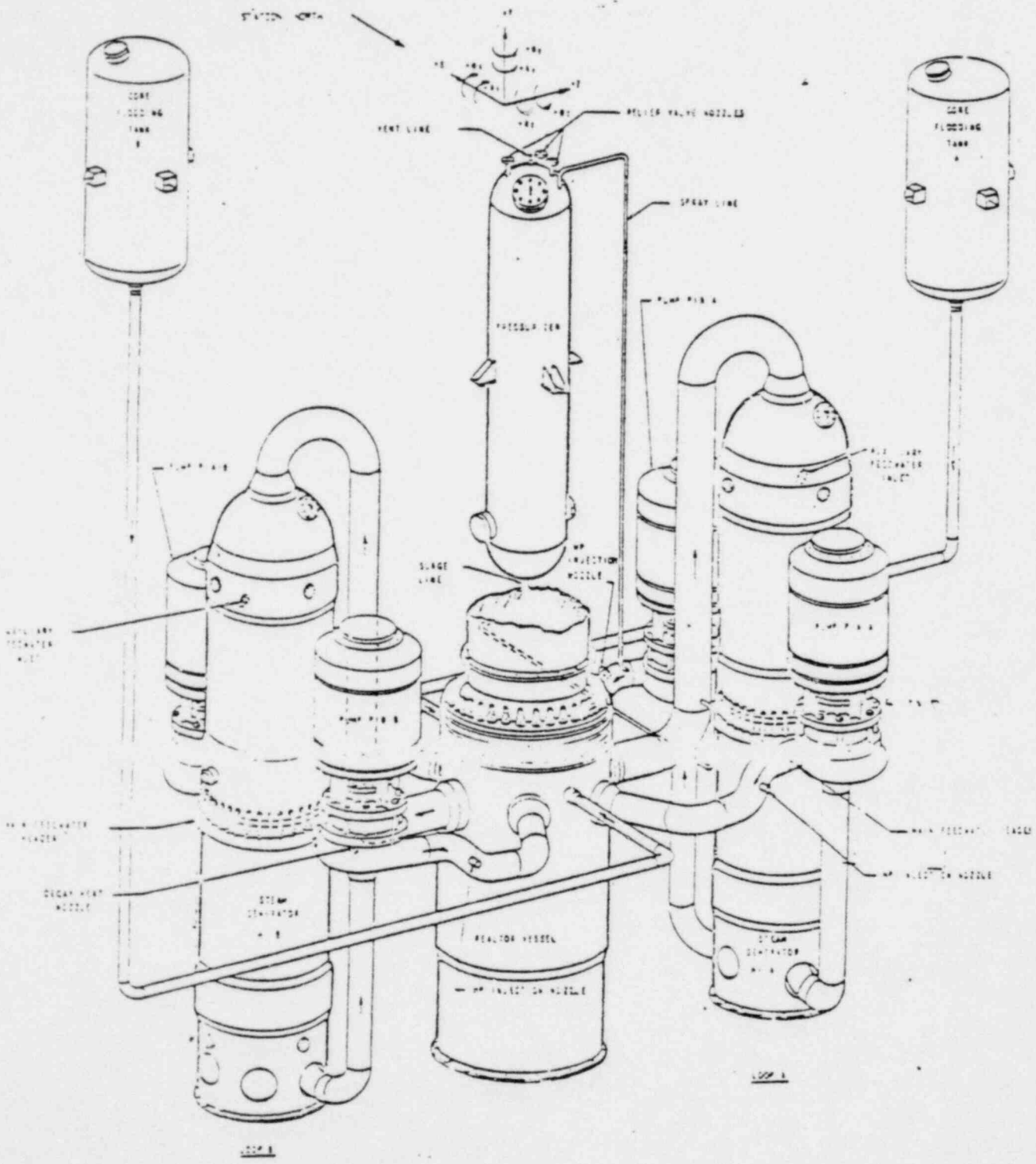
A. Conditions Prior to the Turbine Trip

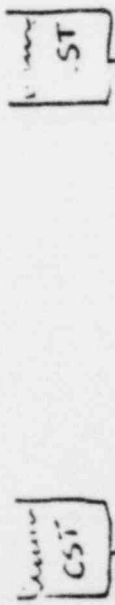
1. General
2. Primary Systems
3. Secondary Systems
4. Emergency Systems
5. Staffing
6. Training and Conditioning

B. Sequence of Events

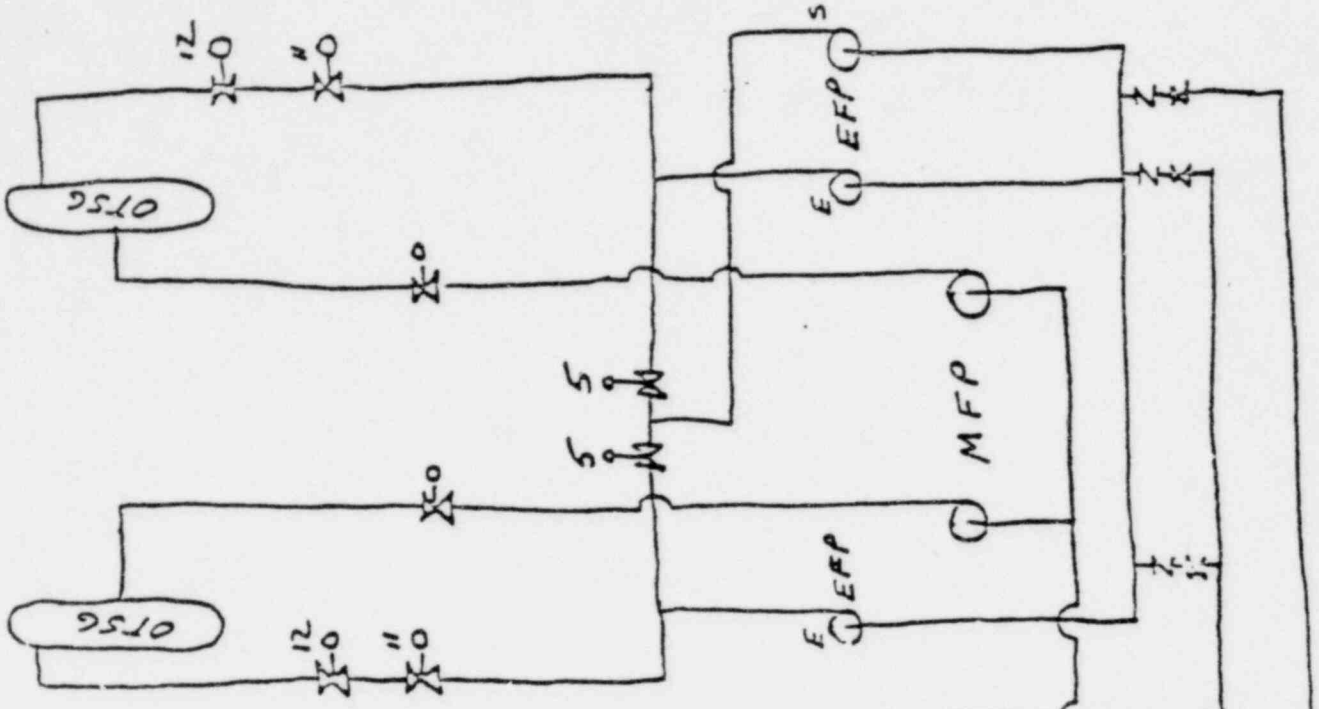
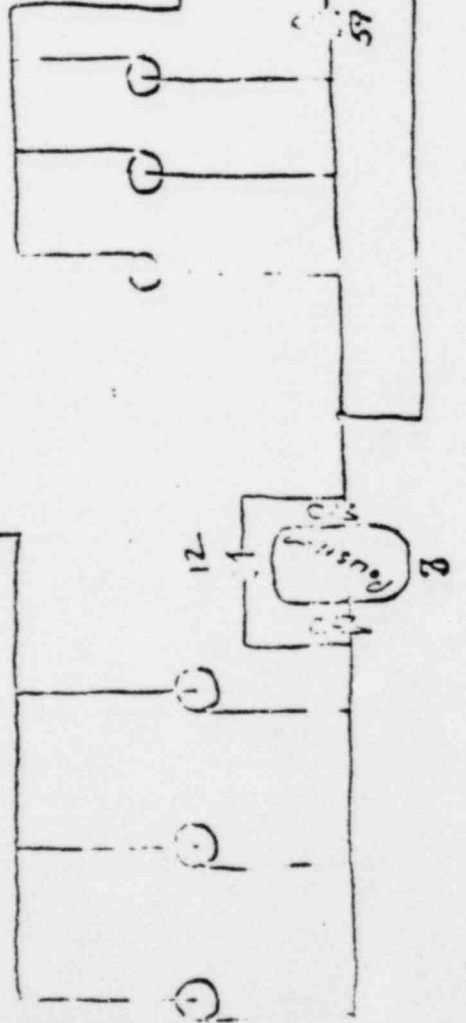
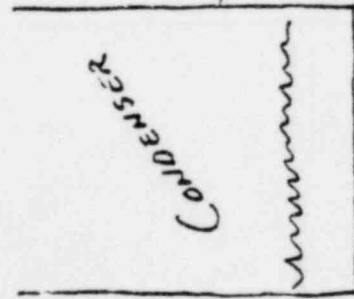
1. Loss of Feedwater
2. Turbine Trip - Reactor Trip
3. EMOV Failure to Close
4. MJP Starting Problems
5. Early Void Formation
6. Saturation
7. HPI Flow Adjustment
8. Sump Pump Operation
9. Late Initiation of Emergency Feedwater
10. Secondary System Distraction
11. Diesel Generator Inoperability
12. Duty Superintendent Activities
13. Tripping "B" Loop RCPs

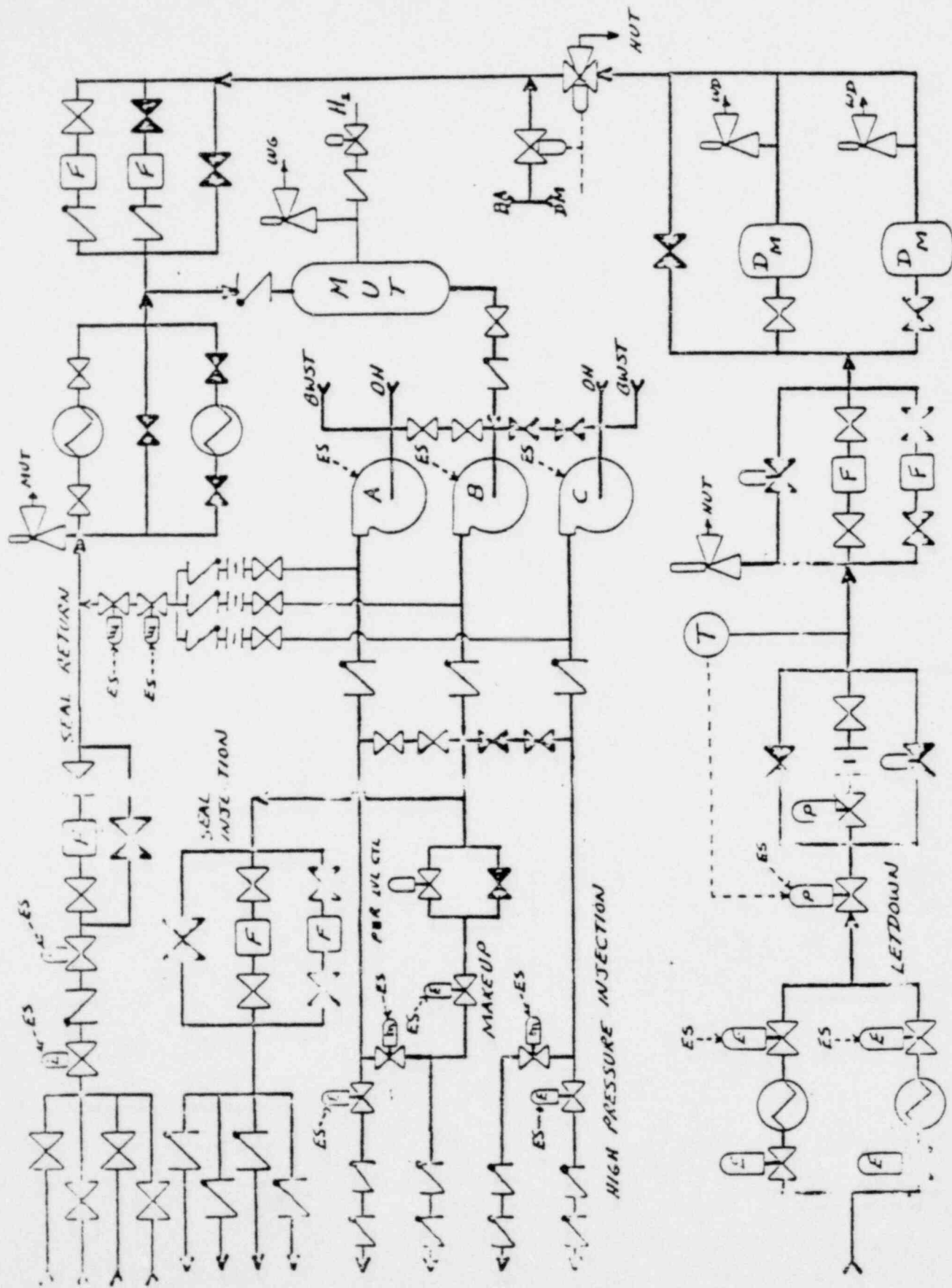
14. Isolating "B" OTSG
15. Emergency Boration
16. Tripping "A" Loop RCPs
17. Isolation of CFT
18. Isolation of CFTs
19. Conference Call
20. Shutting of EMOV Block Valve
21. Plant Computer Alarms and Records
22. RCS Average Temperature Indication
23. Preparations for Containment Entry
24. RCP Restart
25. Declaration of Site Emergency
26. High Temperature and Core Response
27. Core Geometry Change
28. Establishment of Command Team and RCP Restart Attempt
29. Containment Isolation
30. Pressurization
31. Depressurization
32. Hydrogen Burn
33. Emergency Director Leaves Site
34. Pressurizer Level Response
35. Re-pressurization
36. RCP Restart





CONDENSATE FEED WATER





MAIN STEAM TURBINE BYPASS

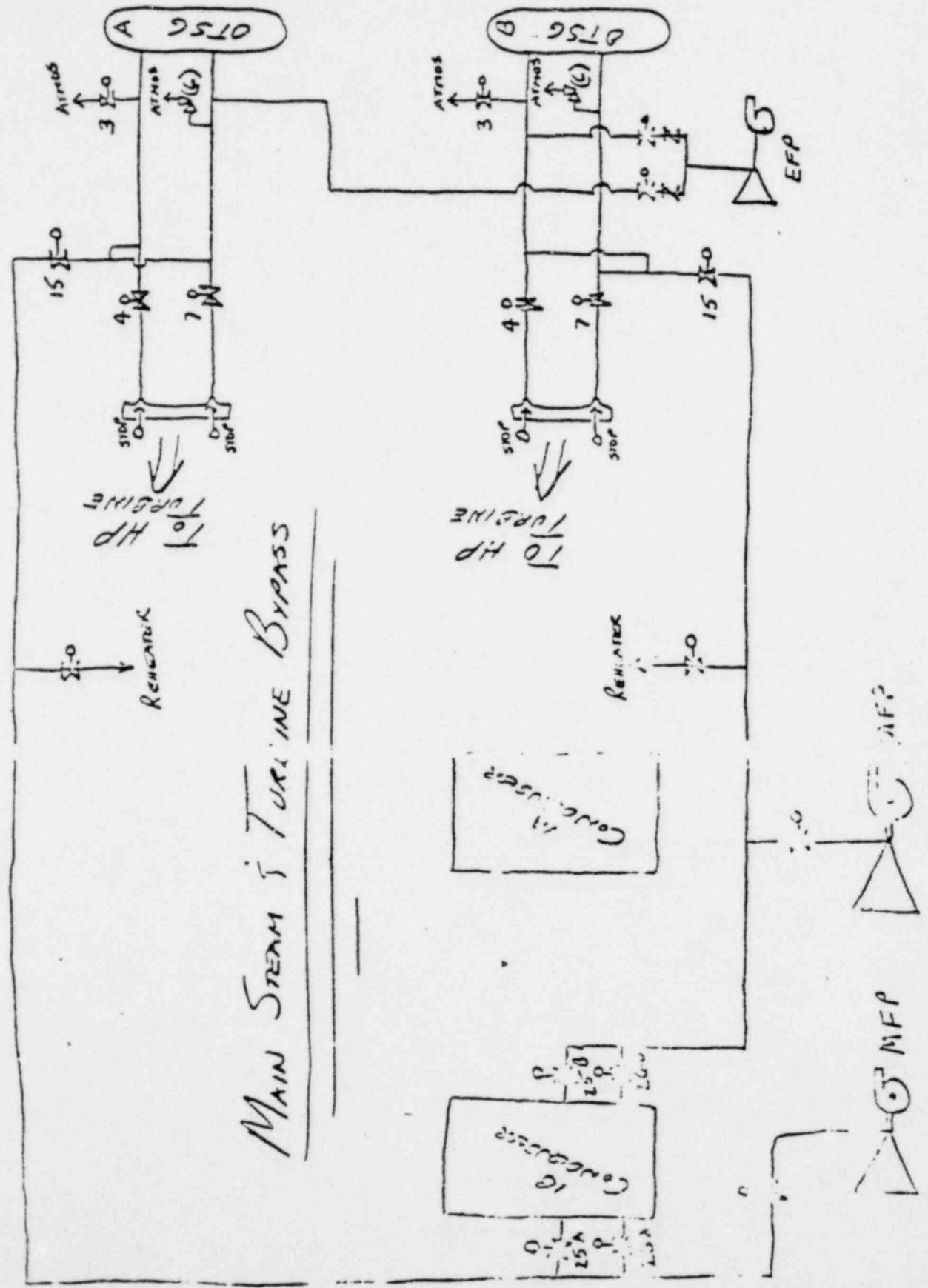


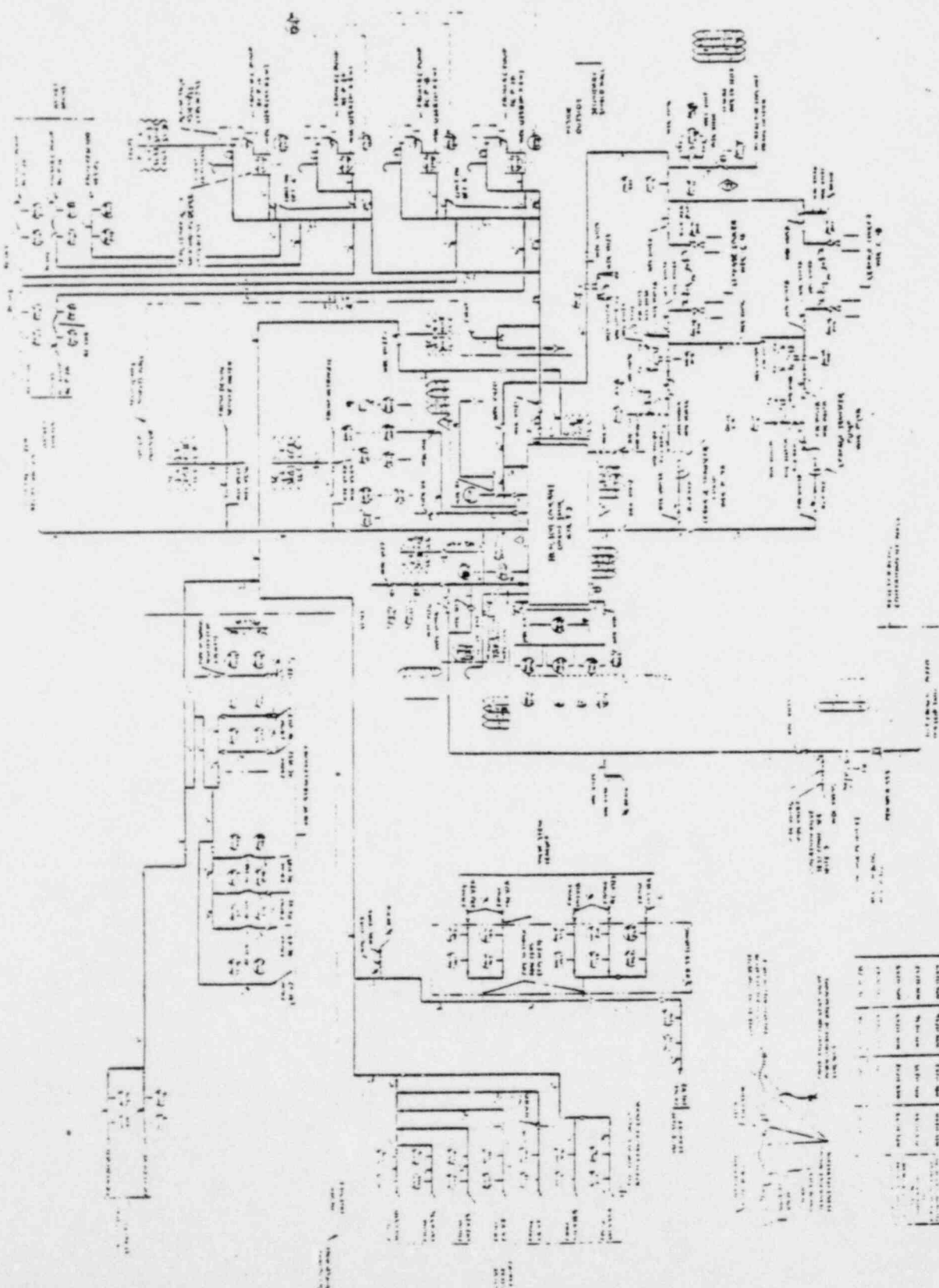
TABLE I.4-6

PRESSURIZER LEVEL RESPONSE DURING 1-4
MINUTES

<u>Time</u>	<u>Makeup Pump Letdown: Status</u>	<u>Press'ur Level</u>	<u>RCS Liquid Volume (Ft3)</u>	<u>RCS Pressure</u>	<u>RCS Tav</u>	<u>RCS Mass (lb)</u>	<u>Apparent Mass Addition*</u>	<u>Possible Mass Addition*</u>
60 sec	1A & 1B on - max Flow N420 gpm (flow thru 16B & MU Line only or letdown secured)	165"	10,938	1800 psig	576°F	489,000	---	---
122 sec	1A&1C full on (ECCS) - 1000 gpm; letdown secured.	210"	11,095	1720 psig	578°F	494,000	5,000	3,600
195 sec	1A & 1C on Operator; Starting to throttle (less than 1000 gpm); letdown secured	290"	11,346	1600 psig	578°F	503,000	9,000	10,100
278 sec	1C off; 1A throttled (less than 500 gpm)	370"	11,656	1450 psig	579°F	518,000	15,000	11,500

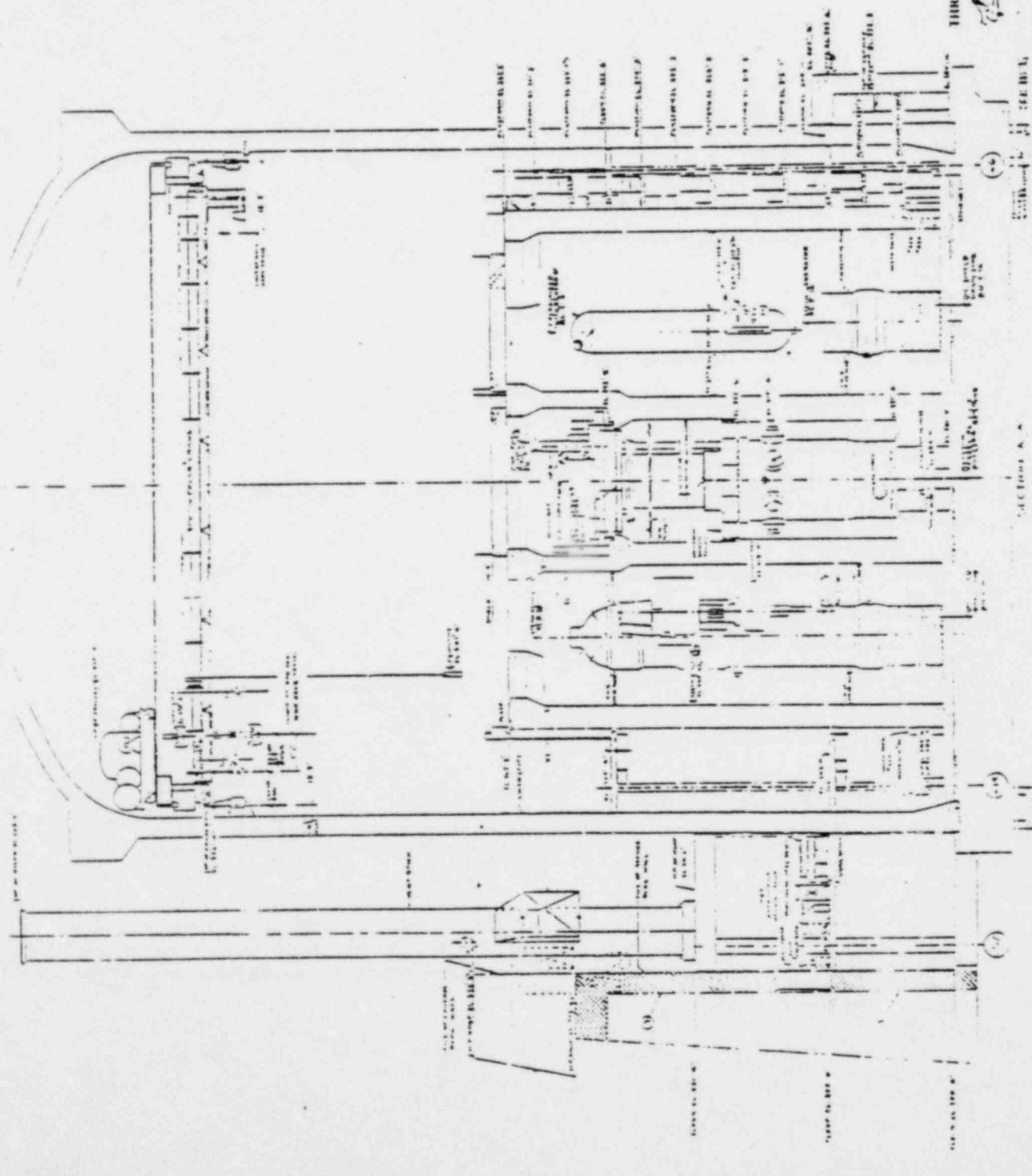
*This does not include mass loss out of EMOV during this period, which, if fully open, should be approximately 1500 lb/minute.

- 1. THE REACTOR COOLANT SYSTEM (RCS) IS A PRESSURIZED WATER REACTOR (PWR) SYSTEM.
- 2. THE RCS IS DESIGNED TO OPERATE AT A PRESSURE OF 1550 PSI TO PREVENT BOILING.
- 3. THE RCS IS DIVIDED INTO TWO MAIN LOOPS: THE PRIMARY LOOP AND THE SECONDARY LOOP.
- 4. THE PRIMARY LOOP CIRCULATES WATER BETWEEN THE REACTOR AND THE STEAM GENERATOR.
- 5. THE SECONDARY LOOP CIRCULATES WATER BETWEEN THE STEAM GENERATOR AND THE CONDENSER.
- 6. THE CONDENSER IS COOLED BY SEAWATER THROUGH A CONDENSER COOLING WATER SYSTEM (CCWS).
- 7. THE RCS IS EQUIPPED WITH A PRESSURE SAFETY SHUT-OFF SYSTEM (PS-SOS) TO MAINTAIN SYSTEM PRESSURE.
- 8. THE PS-SOS IS A PASSIVE SYSTEM THAT RELIES ON GRAVITY AND THERMAL EXPANSION TO SHUT OFF THE REACTOR.
- 9. THE PS-SOS IS DESIGNED TO OPERATE FOR UP TO 72 HOURS WITHOUT OPERATOR INTERVENTION.
- 10. THE PS-SOS IS A KEY FEATURE OF THE RCS THAT ENHANCES THE SAFETY OF THE REACTOR.

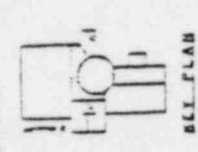


NUCLEAR SAFETY RELATED
ENGINEERED SAFETY FEATURES

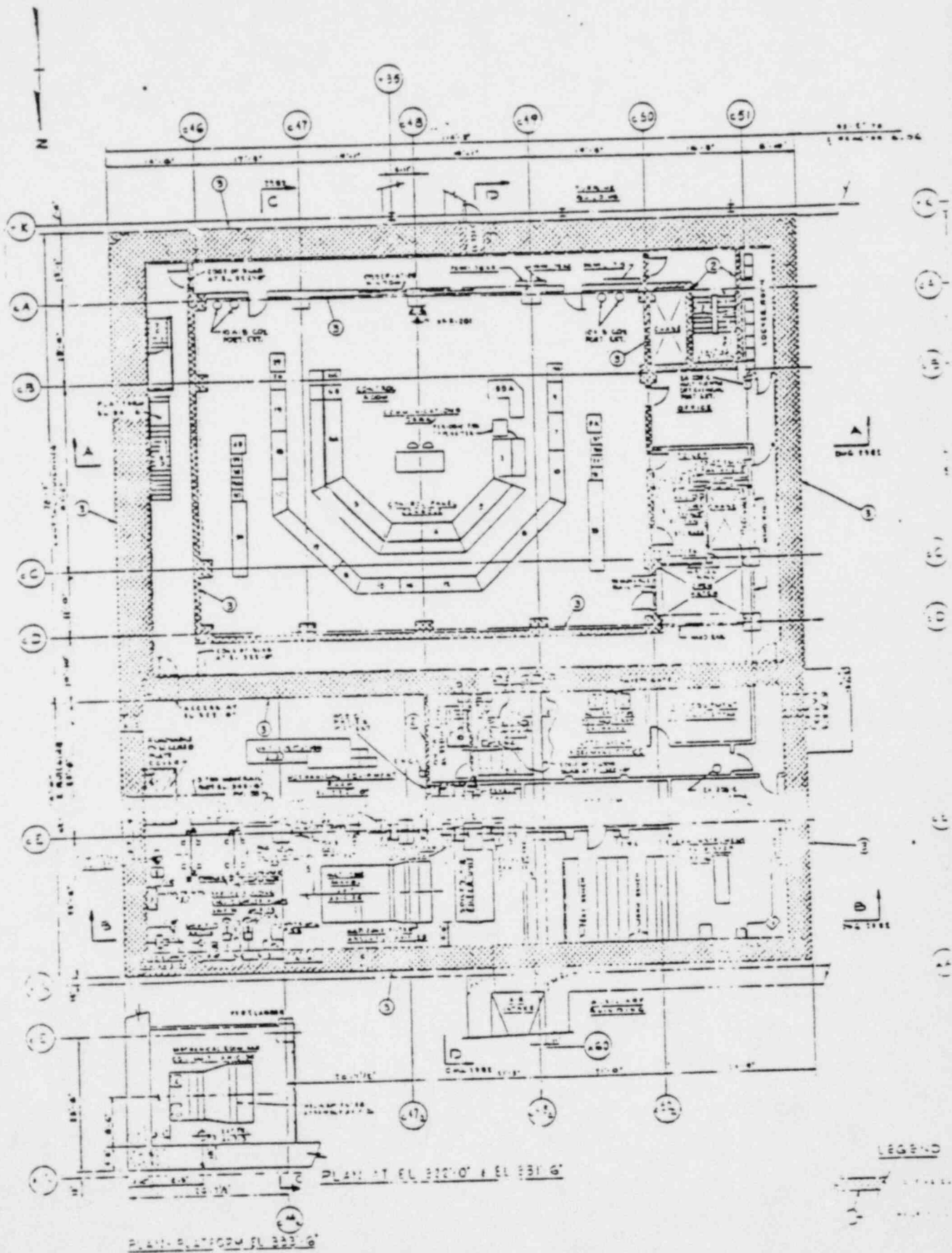
FIGURE 3.5



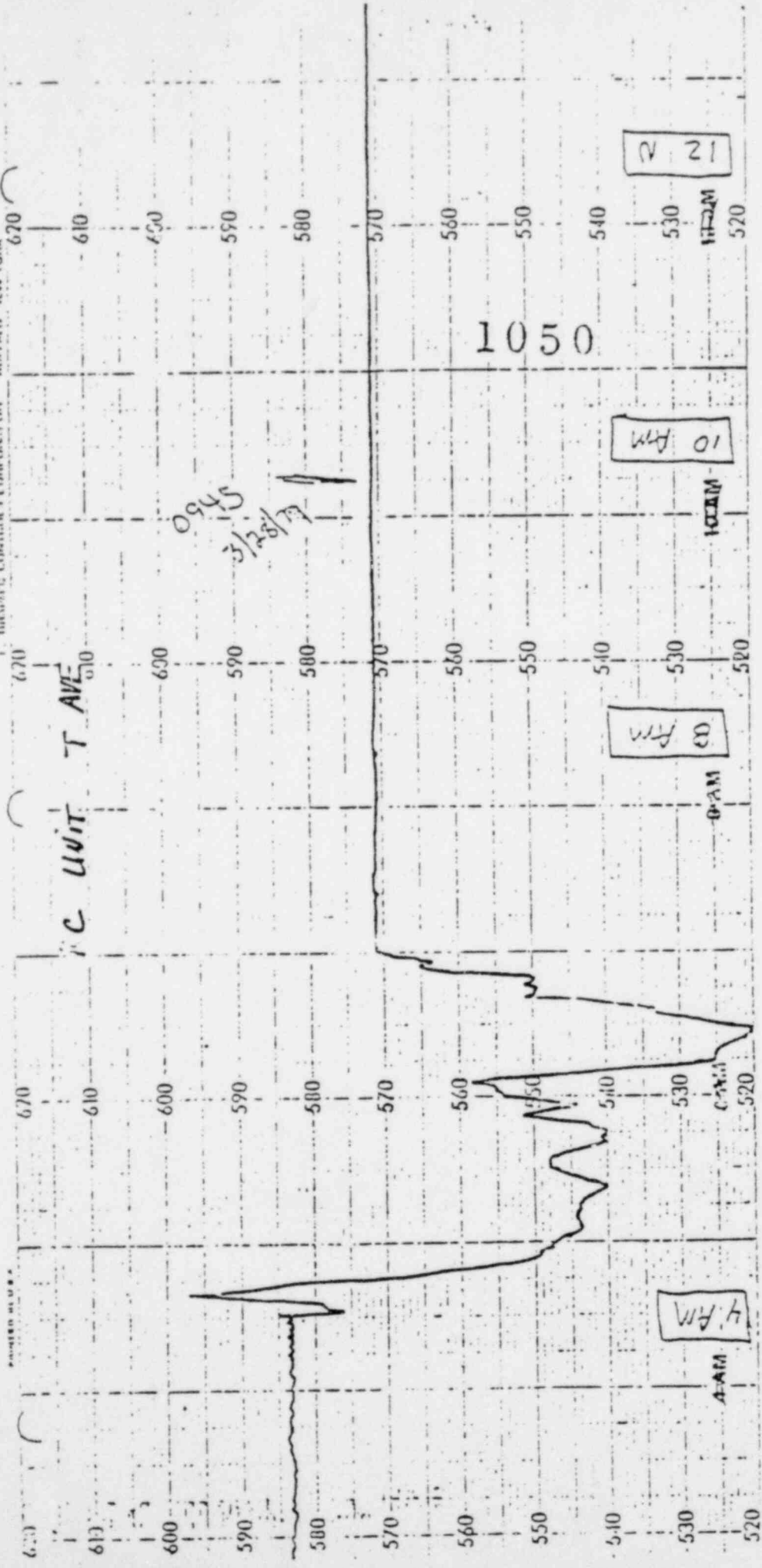
REACTOR BUILDING SECTION A-A
THREE MILE ISLAND NUCLEAR STATION UNIT 2
FIGURE 1-2-6
REV. 10-28-77



LEGEND
SYMBOLS AND NOTATION
FOR THIS DRAWING



UNIVERSITY COMPANY'S CORPORATION: 1971 BUFFALO, NEW YORK



C UNIT T AVE

0945
5450
3/18/77

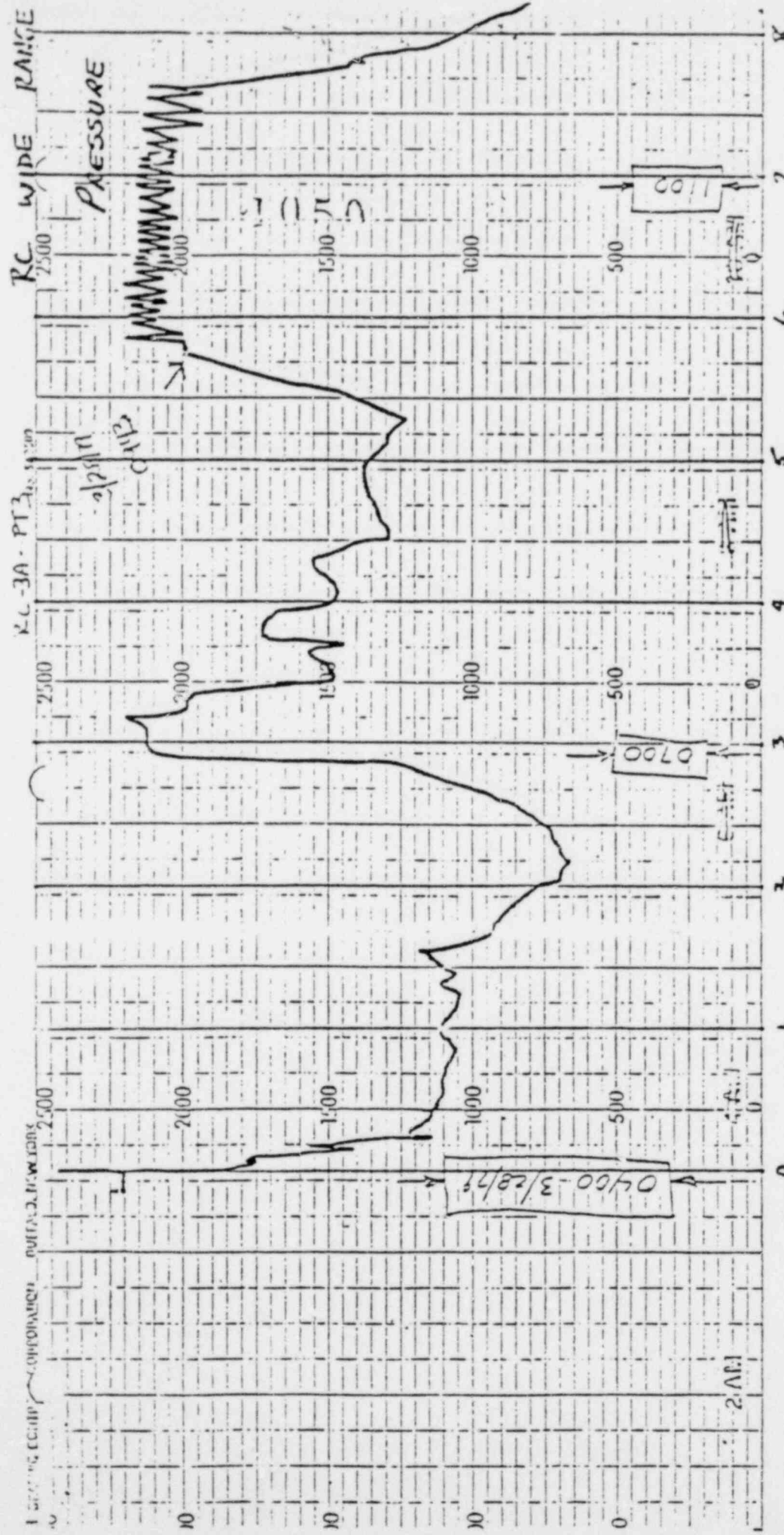
12 AM

10 AM

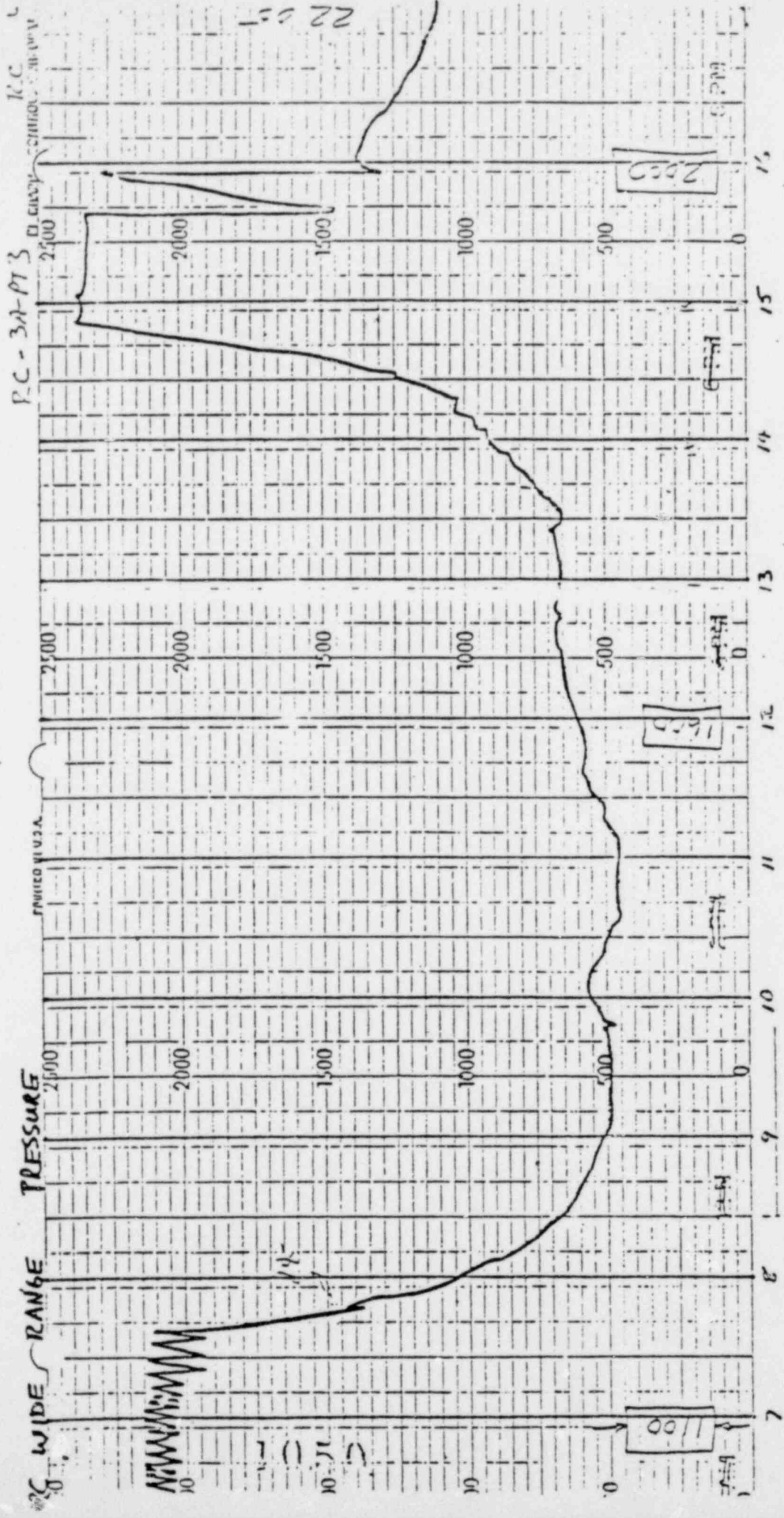
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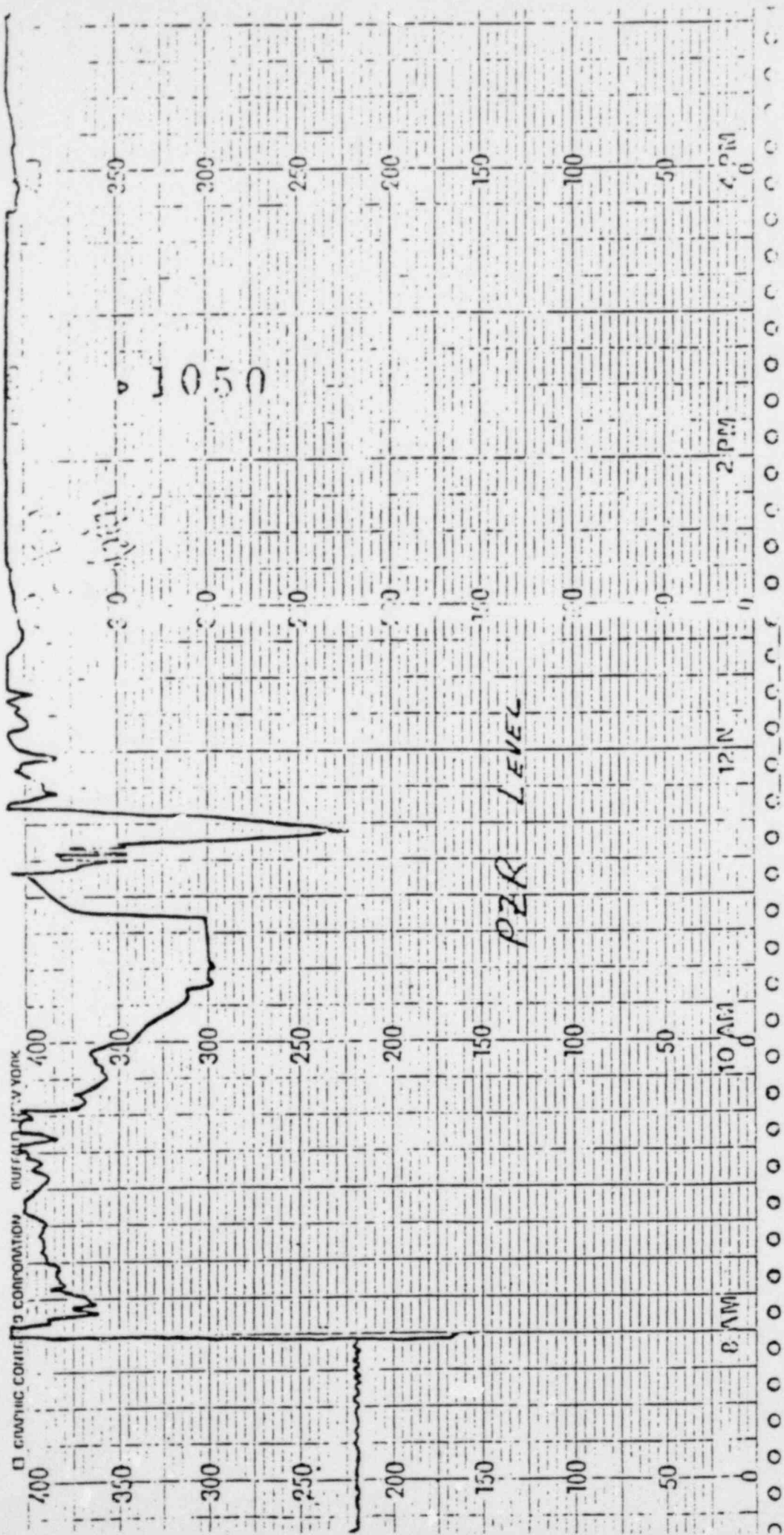
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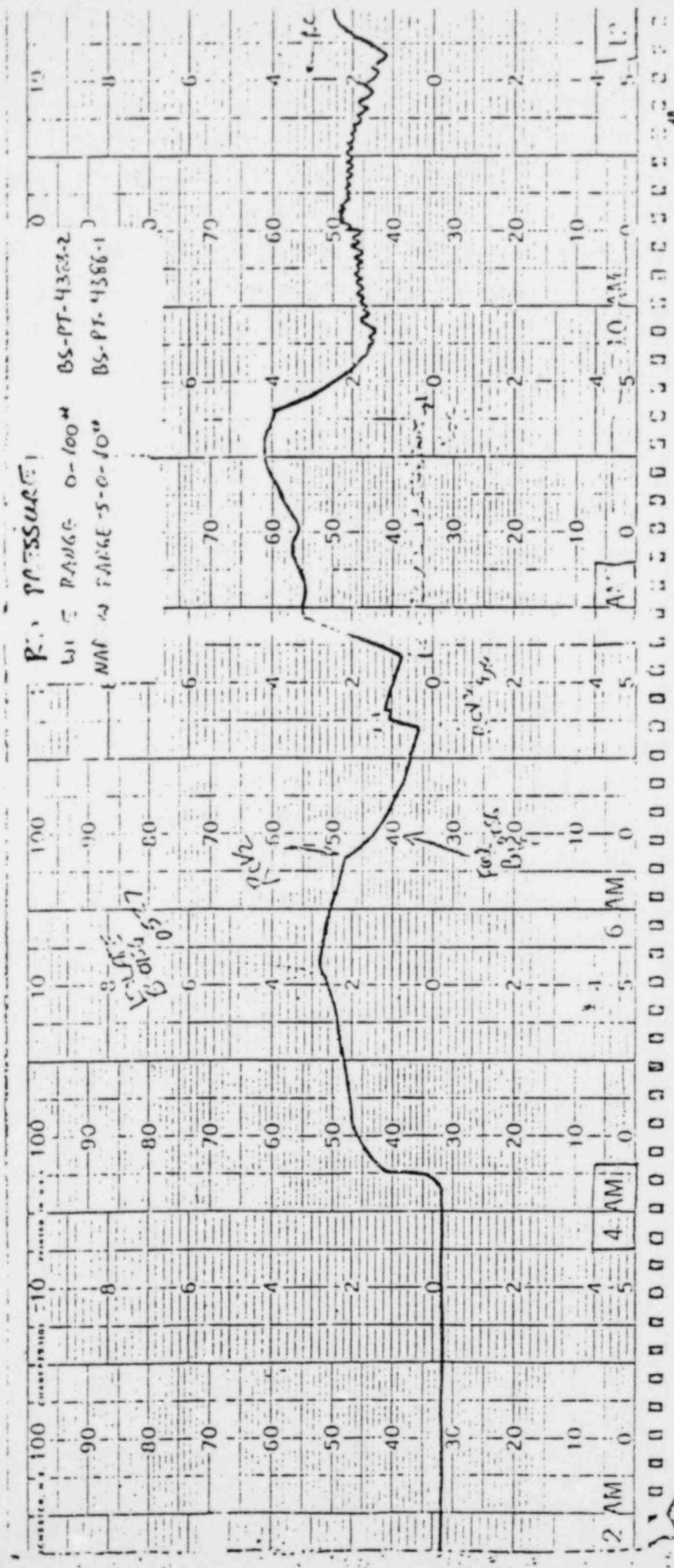
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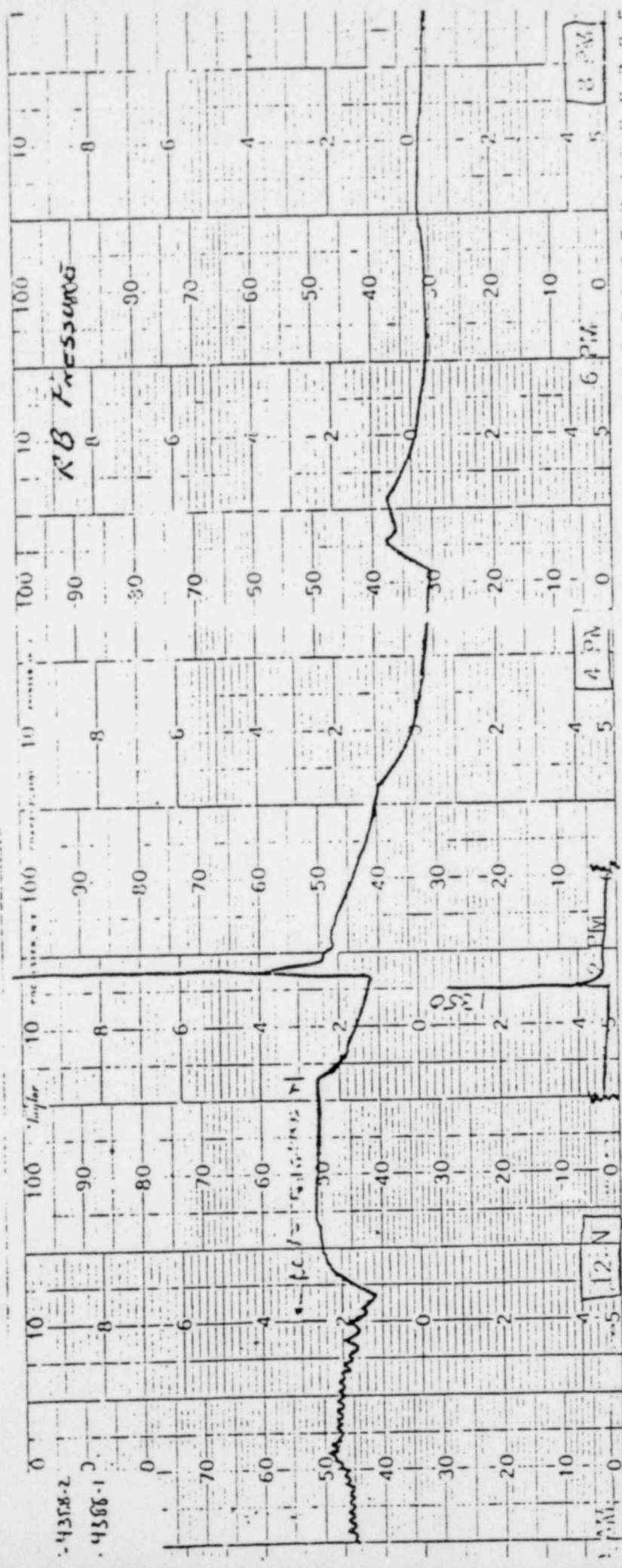


2.0psi









4358-2

4368-1

12:00

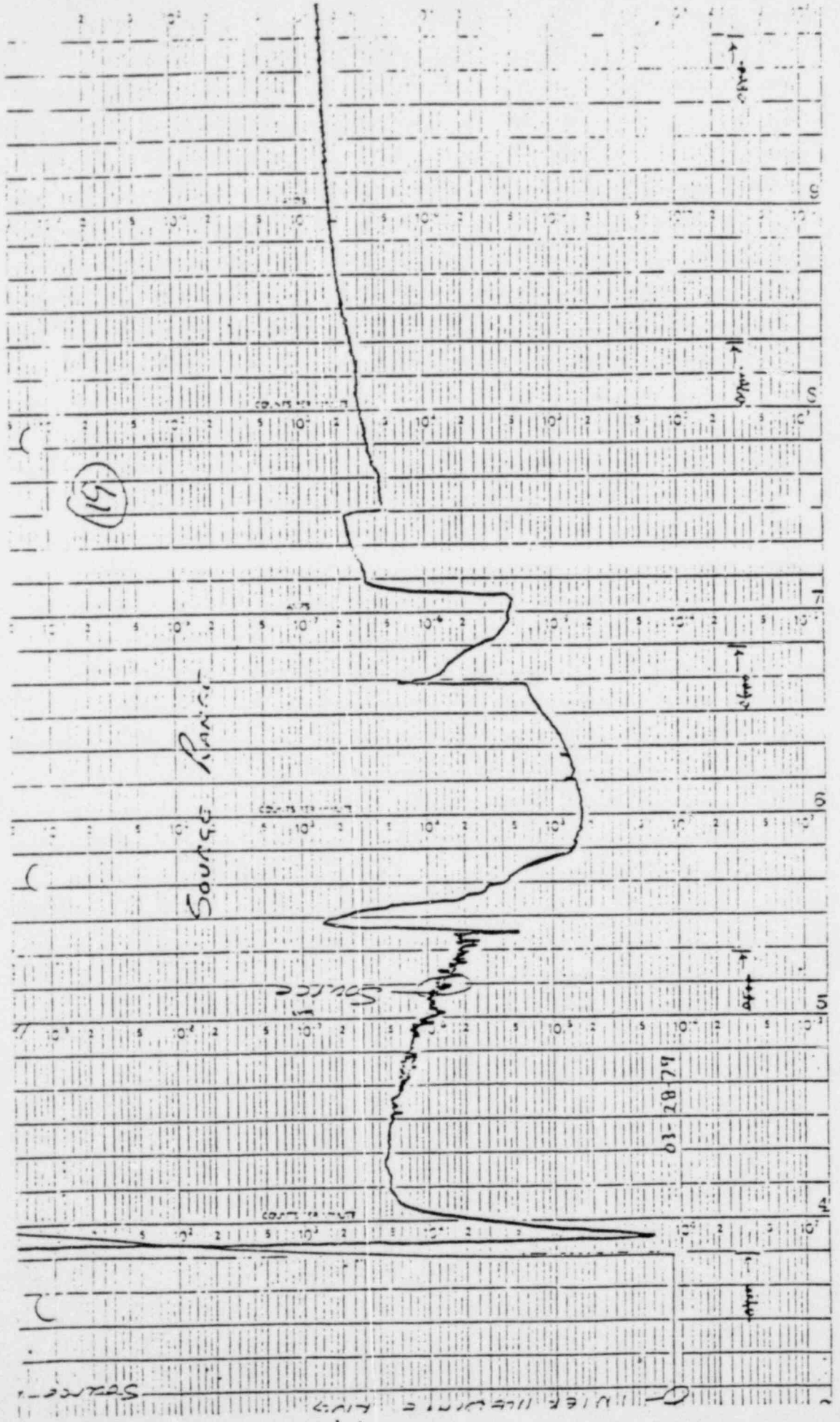
1:35

4:00

6:00

8:00

0 10 20 30 40 50 60 70 80 90 100 10 20 30 40 50 60 70 80 90 100 10 20 30 40 50 60 70 80 90 100 10 20 30 40 50 60 70 80 90 100 10 20 30 40 50 60 70 80 90 100



SOURCE
 01-28-79

OBJECTIVE:

To Determine Facts and Assess Licensee Performance Regarding:

- (1) Emergency Preparedness Prior to the March 28 Incident and,
- (2) Response to In-Plant and Environmental Radiological Conditions Following the Incident.

SCOPE:

- (1) Investigation of Emergency Preparedness Includes Review of Emergency and Health Physics Training Conducted by the Licensee Prior to March 28 and Review of Equipment, Supplies and Procedures Needed for Implementation of the Site Emergency Plan.

SCOPE: (CONT'D)

- (2) Emergency Response Actions From the Time of the Incident Until Midnight on March 30 are Being Investigated Including Actions to Detect and Classify the Incident, Activate the Emergency Organization, Monitor and Control Effluents, Control Occupational Radiation Exposure, and Assess Environmental Conditions. Actions Taken by the Commonwealth of Pennsylvania, the NRC, or Other Government Agencies Will Not be Included in This Investigation.

RADIOLOGICAL TEAM ORGANIZATION

A.F. Gibson — Team Leader

D.M. Collins — Technical Assistant

D.E. Donaldson — Emergency Planning

T.H. Essig — Environmental Monitoring

L.L. Jackson — Effluent Control

G.P. Yuhas — In-Plant Radiation
Protection

SOURCES OF INFORMATION

Licensee Logs

Licensee Records

Transcribed Telephone Communications

Discussions

Interviews

PREACCIDENT CONDITIONS

- RADIATION PROTECTION & CHEMISTRY STAFF
- EMERGENCY DRILLS
- EMERGENCY PLAN TRAINING
- ROUTINE RADIATION PROTECTION TRAINING
- RADIATION PROTECTION EQUIPMENT & SUPPLIES
- EMERGENCY EQUIPMENT
- ROUTINE ENVIRONMENTAL MONITORING PROGRAM
- RADWASTE SYSTEMS

INITIAL EMERGENCY RESPONSE

- DETECTION AND CLASSIFICATION

- ORGANIZATION ACTIVATION

- NOTIFICATIONS

TMI EMERGENCY PLAN

TABLE 1

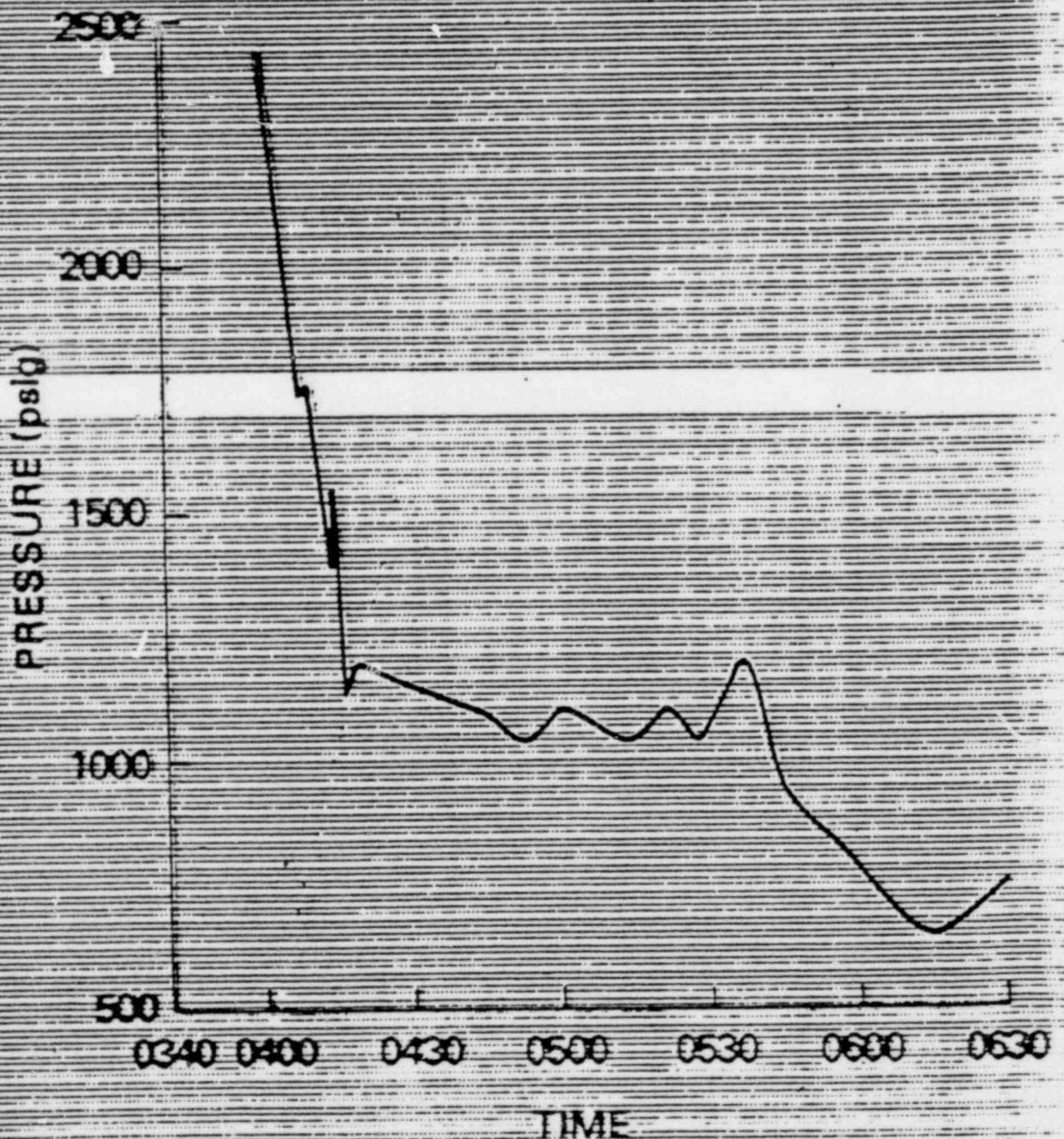
Site Emergency — Condition (c)

“c) Loss of Primary Coolant Pressure, Coincident With High Reactor Building Pressure and/or High Reactor Building Sump Level.”

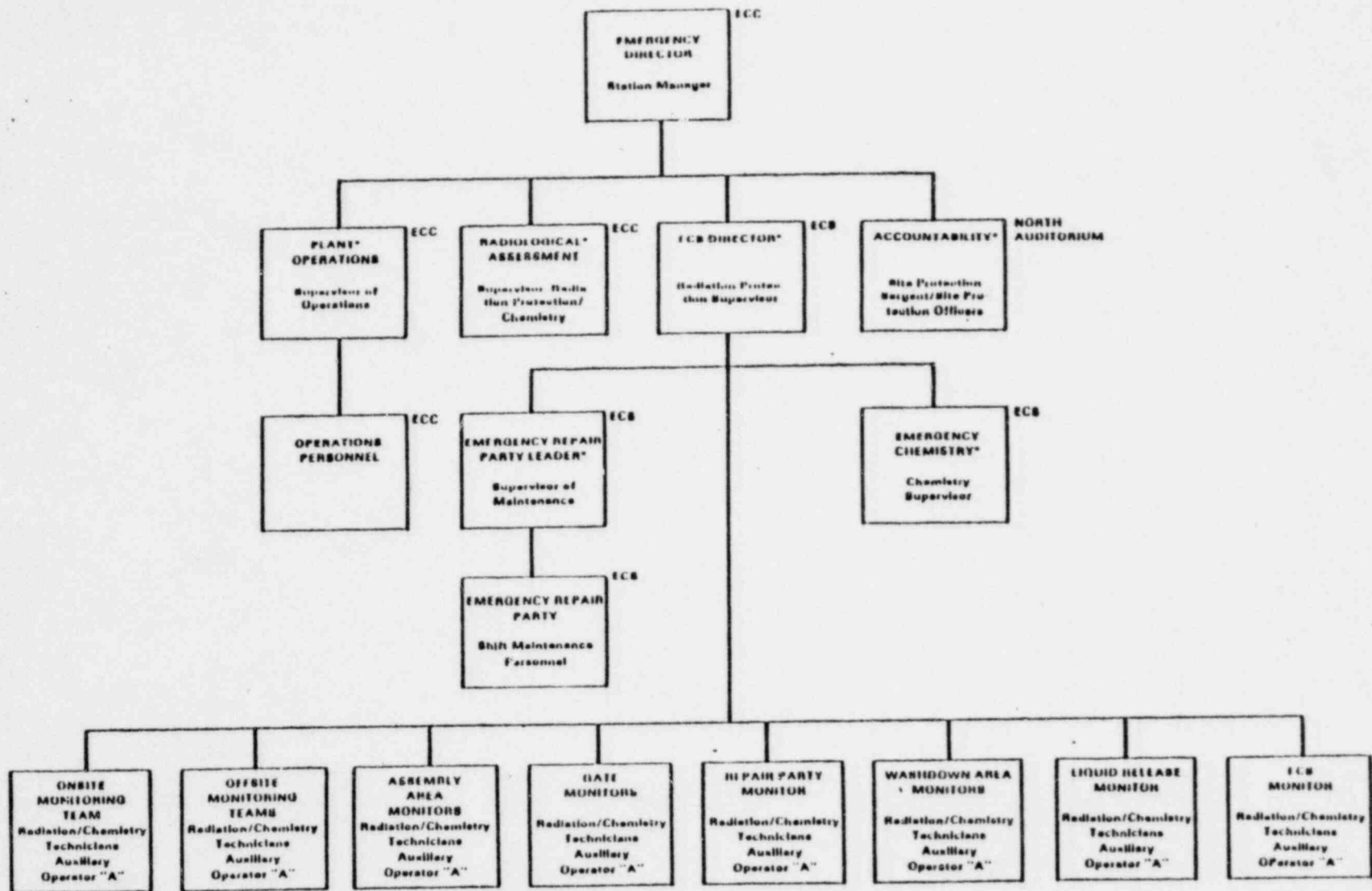
General Emergency — Condition (a)

“a) Reactor Building High Range Gamma Monitor High Alarm.”

REACTOR COOLANT PRESSURE VS.
TIME ON MARCH 28, 1979,
AS DISPLAYED ON THE WIDE
RANGE PRESSURE RECORDER



"NORMAL" EMERGENCY ORGANIZATION



ECC - EMERGENCY CONTROL CENTER, UNIT 2 CONTROL ROOM
 ECB - EMERGENCY CONTROL STATION, UNIT 1 CHEMISTRY/HEALTH PHYSICS LAB AREA
 * - FUNCTIONAL TITLE ADDED FOR CLARITY, LICENSEE'S PLAN LISTS NORMAL DUTY TITLES

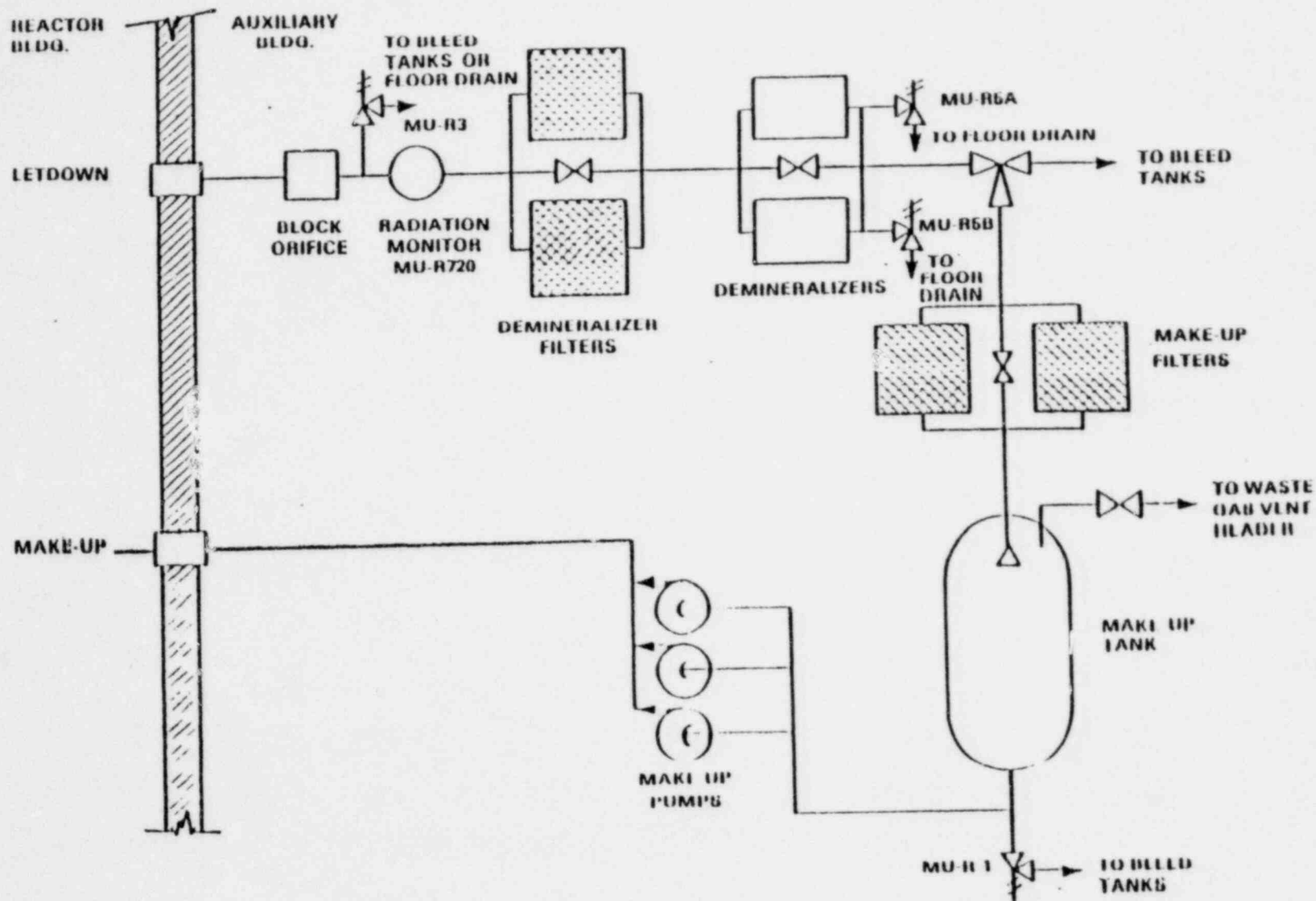
RADIOACTIVE EFFLUENTS

- PATHWAYS

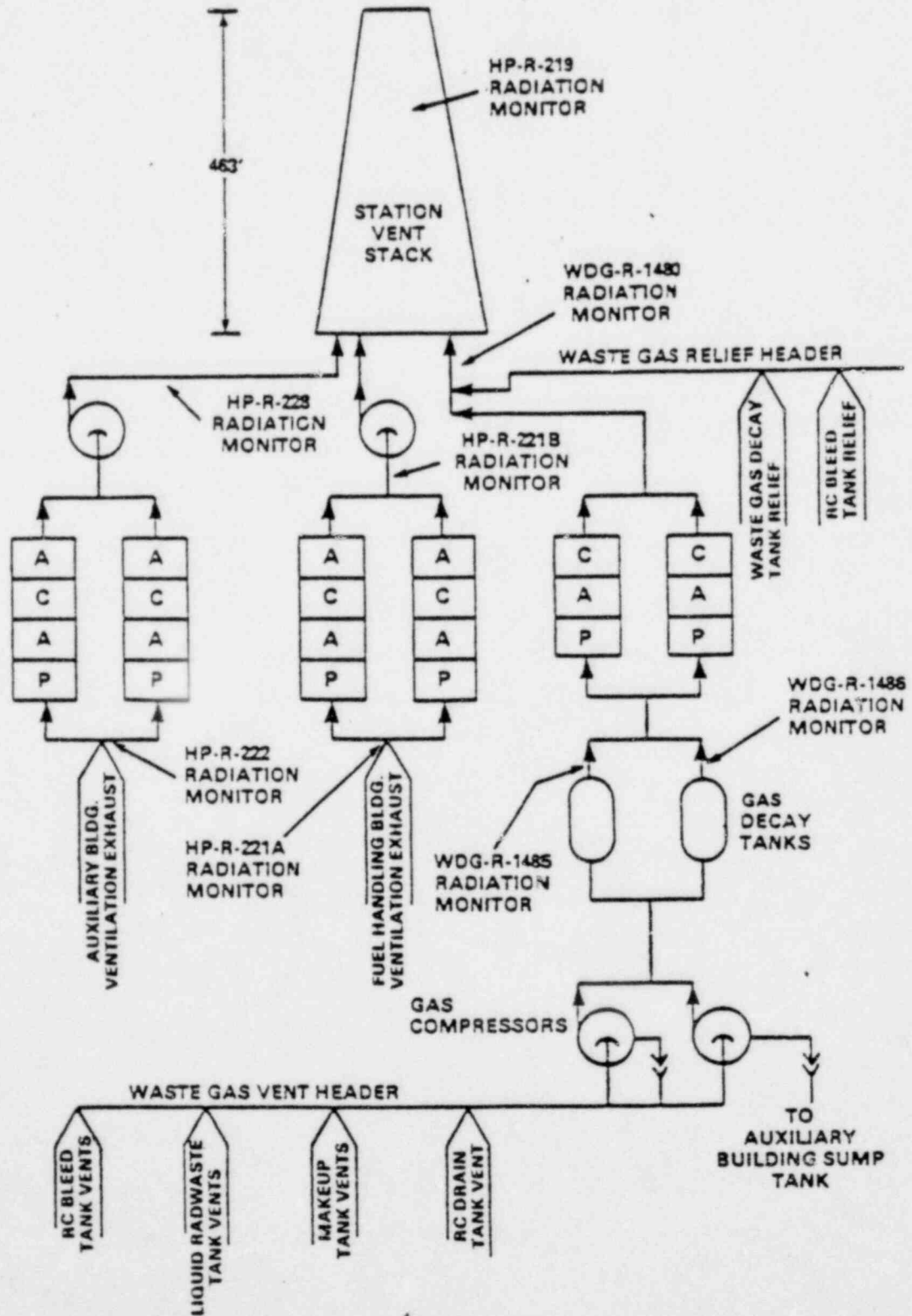
- MONITORING

- QUANTIFICATION

REACTOR COOLANT MAKE-UP AND PURIFICATION SYSTEM (SIMPLIFIED DRAWING)



INPUTS TO STATION VENT (SIMPLIFIED ILLUSTRATION)



PLANT RADIATION PROTECTION

- IMPLEMENTATION OF EMERGENCY PLAN
- ASSESSMENT OF IN-PLANT RADIOLOGICAL CONDITIONS
- ACCESS CONTROL
- AIR SAMPLING
- RADIATION SURVEYS
- PERSONNEL DOSIMETRY
- RESPIRATORY PROTECTION

ENVIRONMENTAL ASSESSMENT

- INITIAL OFFSITE DOSE CALCULATION
- INITIAL CONFIRMATORY SURVEYS
- OFFSITE RADIATION MEASUREMENTS