



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

June 25, 1980

Docket No. 50-335

LICENSEE: Florida Power & Light Company (FP&L)

FACILITY: St. Lucie Unit No. 1

SUBJECT: SUMMARY OF MEETING WITH FP&L AND COMBUSTION ENGINEERING (CE) REGARDING
ST. LUCIE UNIT NO. 1 COOLDOWN ON NATURAL CIRCULATION

On June 20, 1980 a meeting was held in Bethesda, MD regarding the June 11, reactor trip and cooldown on natural circulation at St. Lucie Unit No. 1.

Significant points discussed are summarized below. Enclosure 1 is a list of attendees.

Discussion

A brief chronology of the event was presented with traces of parameters enclosed as Enclosure 2. The plant experienced a complete loss of component cooling water (CCW) to the reactor coolant pumps (RCP). This loss was due to a direct short on the terminal board for a solenoid operated CCW common return valve from the RCP's. Plant procedures allow ten minutes to correct the problem before securing the RCP's. Subsequently, the reactor was tripped and the RCP's secured. About three minutes after shutdown one RCP was run briefly to aid natural circulation flow. The licensee stated that intermittent RCP leakoff flow alarms were actuated and that subcooled margin remained within the range 65 to 180°F subcooled during the cooldown.

The licensee indicated that a steam bubble had formed in the head of the reactor vessel during cooldown. This was indicated by abnormal pressurizer level changes during charging operations and was apparently due to elevated temperatures in the hydraulically stagnant area of the upper head.

The possibility of steam bubble formation was confirmed with an analysis by CE using an in-house model. This model decoupled the vessel head region from the rest of the reactor vessel with respect to temperature. As a result of the analysis CE issued an information bulletin (Enclosure 2) warning of the long vessel head cooldown times which may be required (10-15 hours) and recommending actions to maintain plant conditions until the vessel head has cooled should a bubble form.

The licensee indicated that while in the shutdown cooling mode of operation some primary coolant may have leaked to the refueling water tank through LPSI 1B pump's recirculation line. The isolation valve in this line was found not to be completely shut. The licensee stated that there were no indications of radioactivity release. While on shutdown cooling LPSI Pump 1B was operating in the injection mode with its recirc line open.

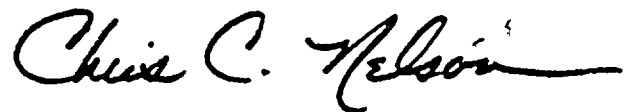
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For corrective actions the licensee has modified its procedures to include the CE guidelines and installed backup means (additional air supplies and manual ratchet) of opening the CCW containment isolation valves.

Conclusions

The NRC staff indicated the need for more detailed analyses of the natural circulation cooldown including consideration of secondary makeup supplies. In addition, the impact of steam bubble formation and its effects on depressurization rates may have to be considered in the analysis of other transients. This information will be requested of the licensee by separate letter and does not have to be resolved prior to restart.

The NRC's Office of Inspection and Enforcement will further review the licensee's corrective actions as well as the acceptability of operating one train of the shutdown cooling system in the injection mode with the other train operating in the shutdown cooling mode prior to plant restart.



Chris C. Nelson, Project Manager
Operating Reactors Branch #3
Division of Licensing

Enclosures:

1. List of Attendees
2. Chronology of Events,
Evaluation, Actions Taken
& Summary

cc w/enclosures:
See last page

JUNE 20, 1980 MEETING WITH FP&L - ST. LUCIE UNIT NO. 1 - ATTENDEES

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Chris C. Nelson

Themis Speis

Brian Sheron

Ed Jordan

Edward Blackwood

Jerry Mazetis

Kris Parczewski

Phil Matthews

George Lanik

E. V. Imbro

R. A. Clark

J. S. Cresswell

Monte Conner

Chang Li

Thomas R. Wolf

H. F. Conrad

CE

Charlie Brinkman

R. S. Turk

R. S. Daleas

J. C. Mouhton

R. E. Wolf

FP&L

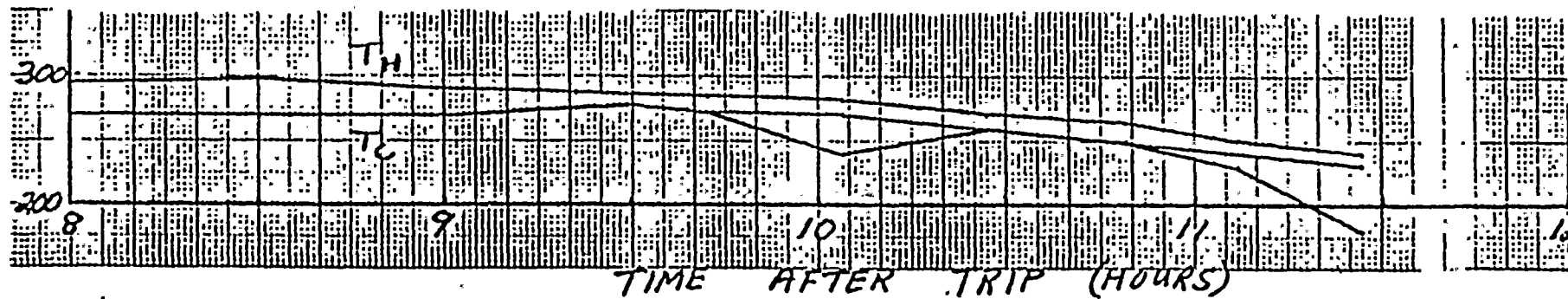
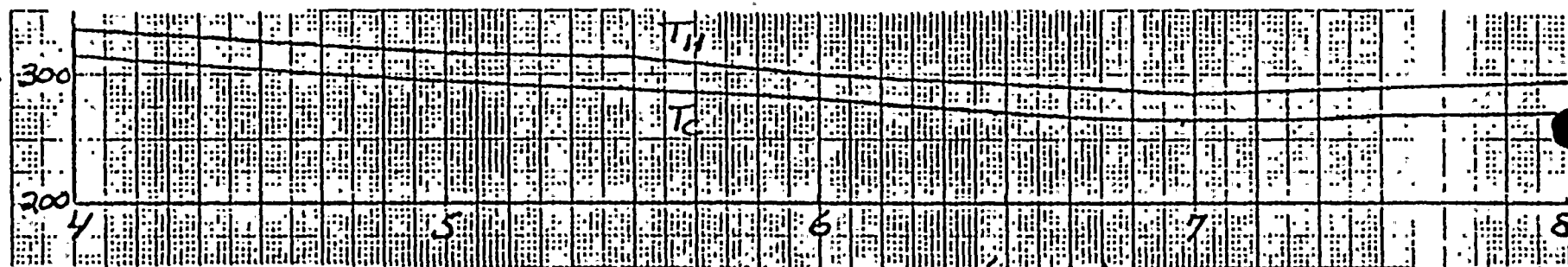
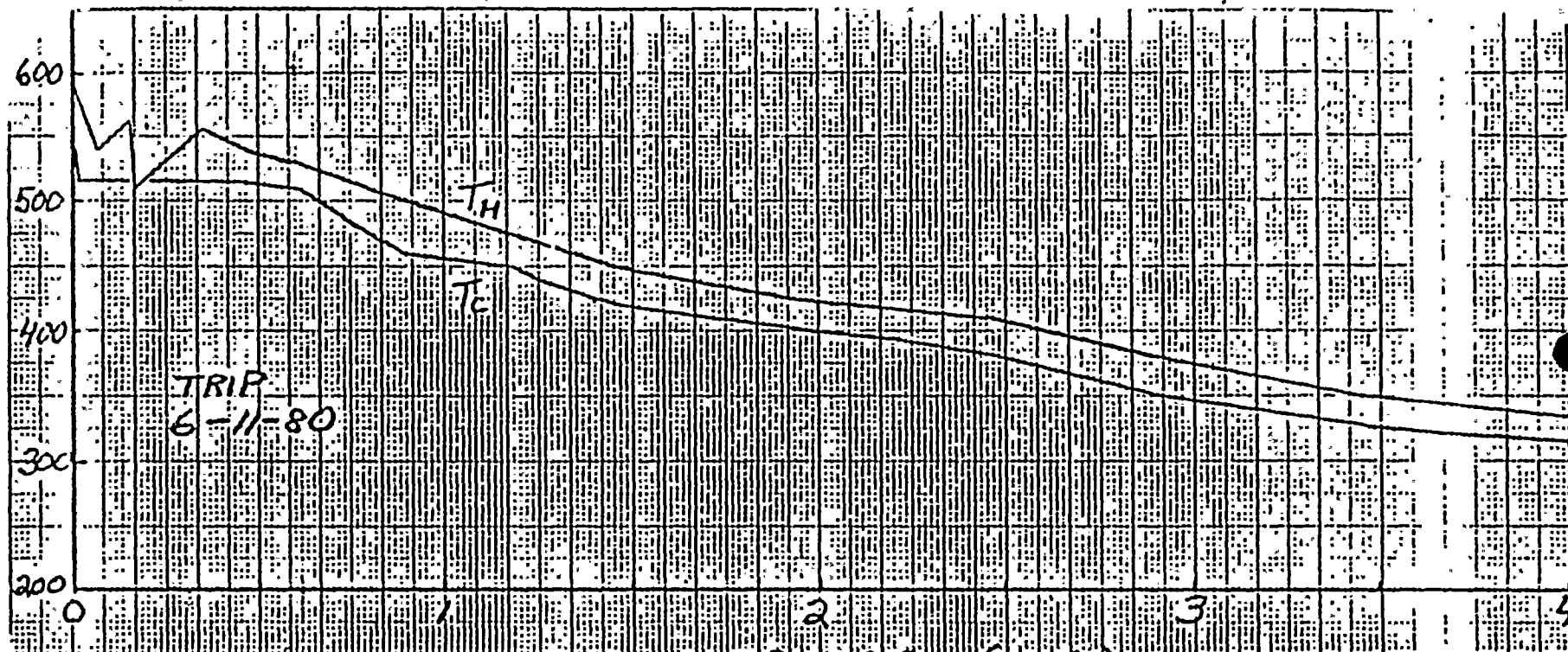
C. M. Wethy

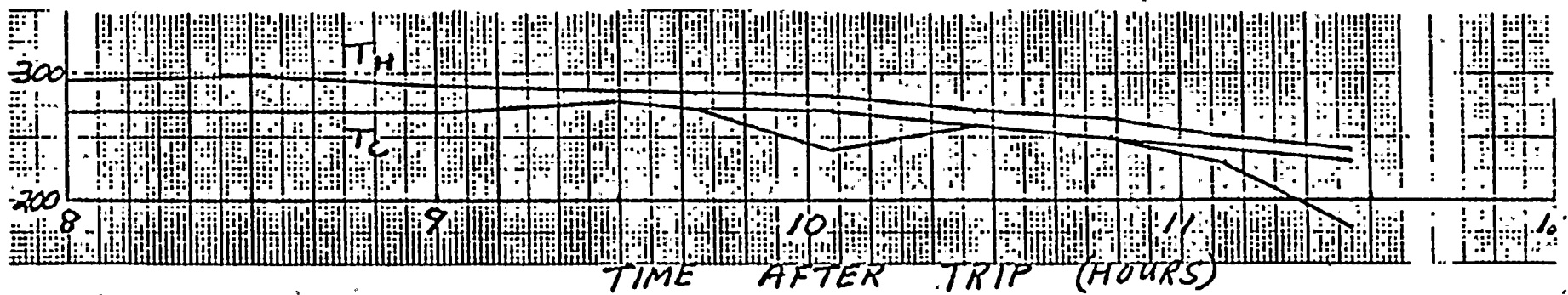
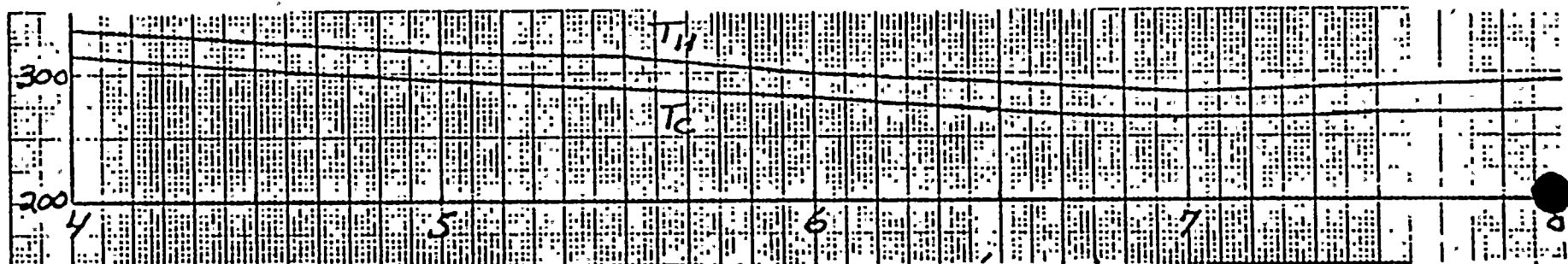
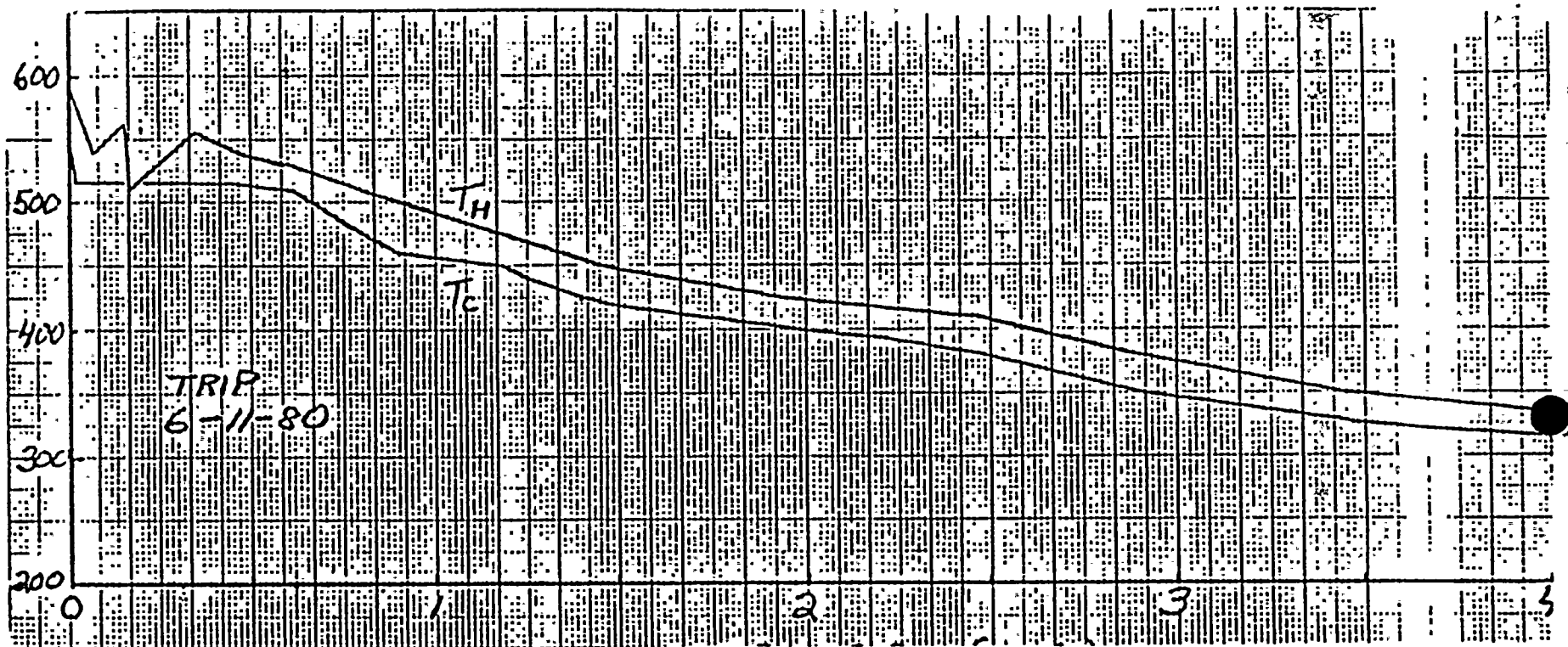
J. A. DeMastry

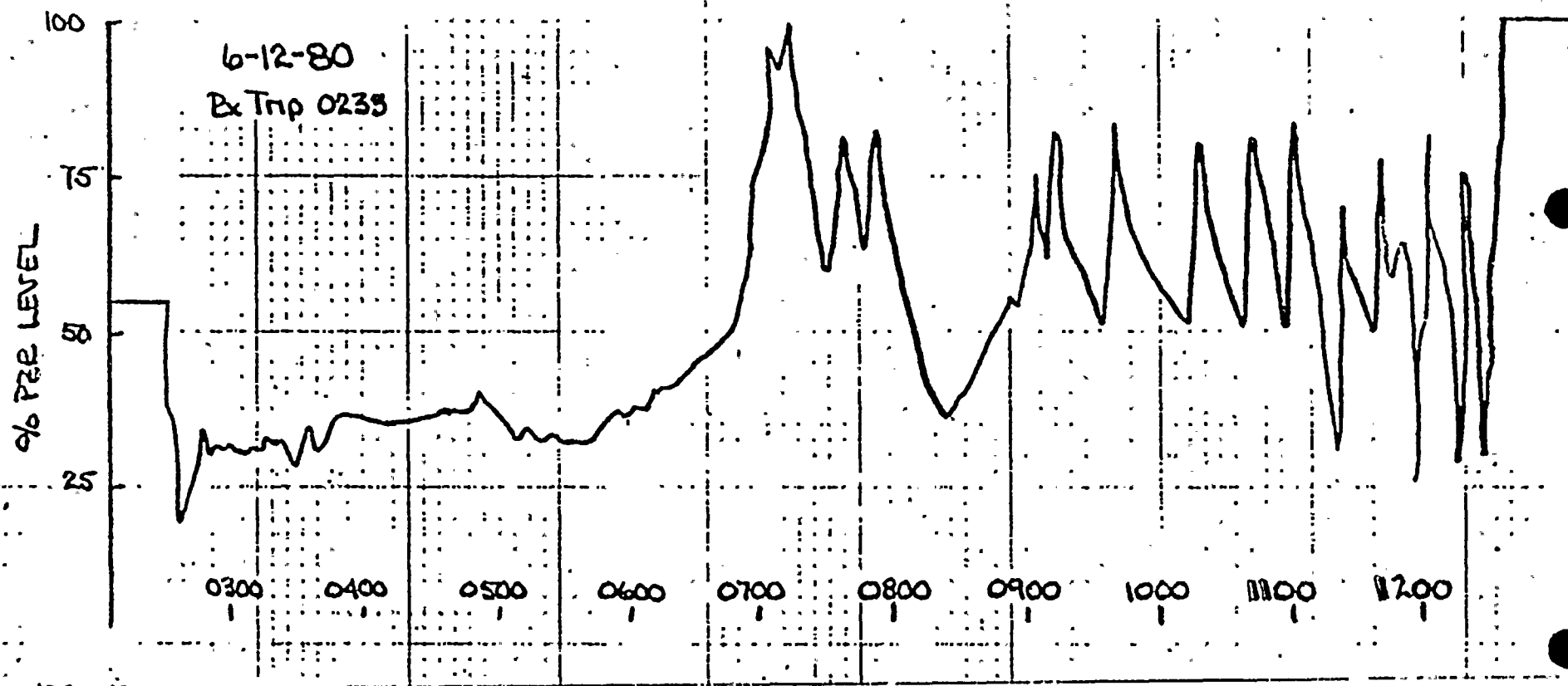
H. N. Paduano

AGENDA

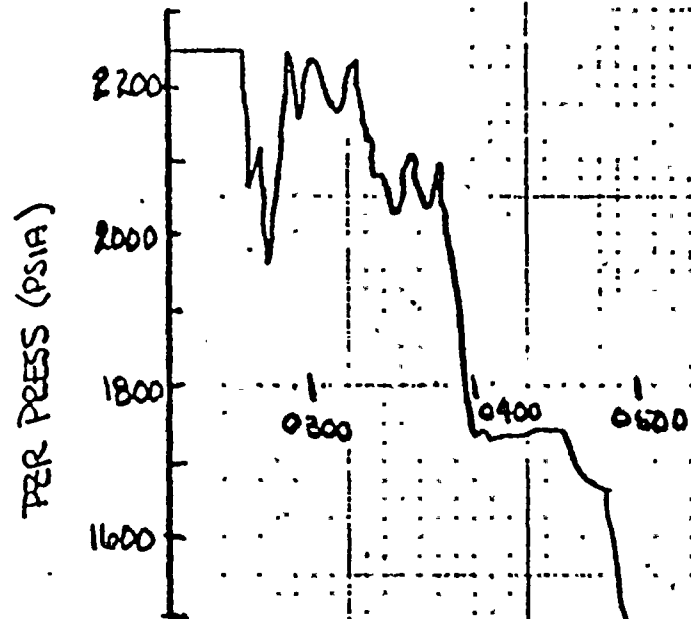
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|-------------------------|----------|
| I. CHRONOLOGY OF EVENTS | D. SAGER |
| II. EVALUATION | |
| A. FP&L | D. SAGER |
| B. CE | R. TURK |
| III. ACTIONS TAKEN | D. SAGER |
| IV. SUMMARY | D. SAGER |



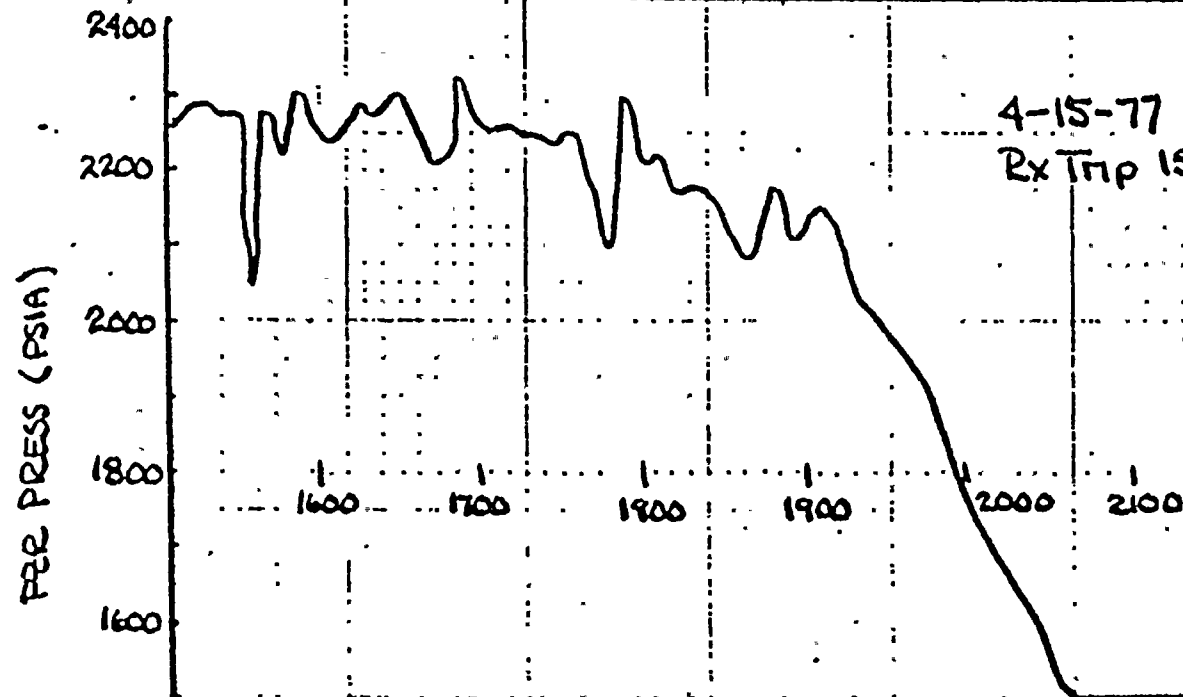




6-12-80
Rx Trip 0233



4-15-77
Rx Trip 1539



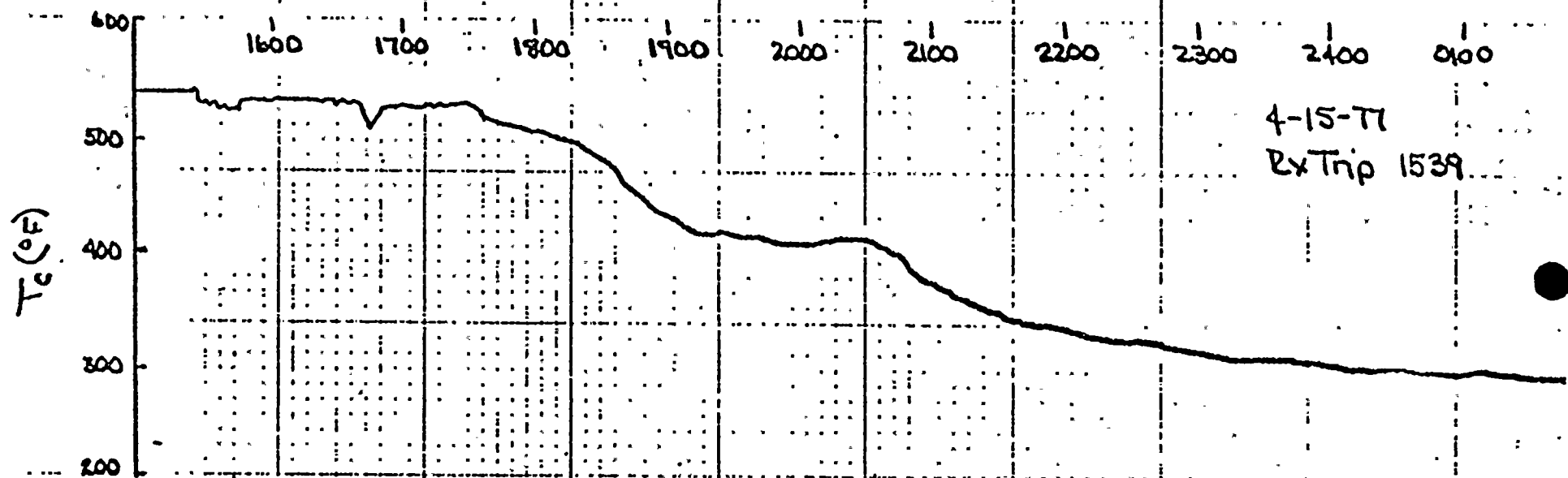
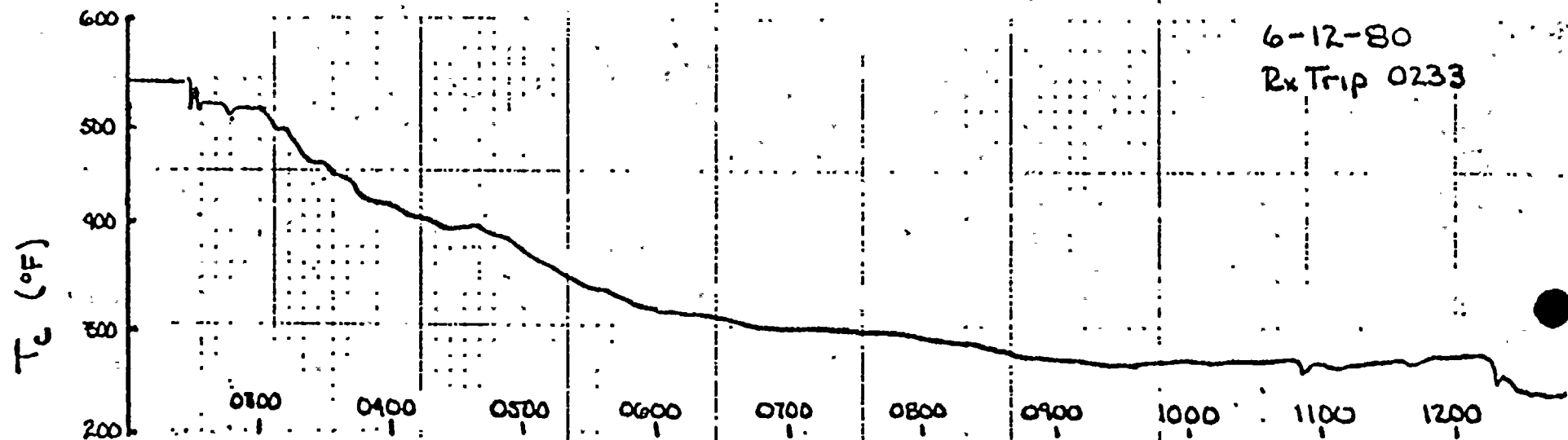
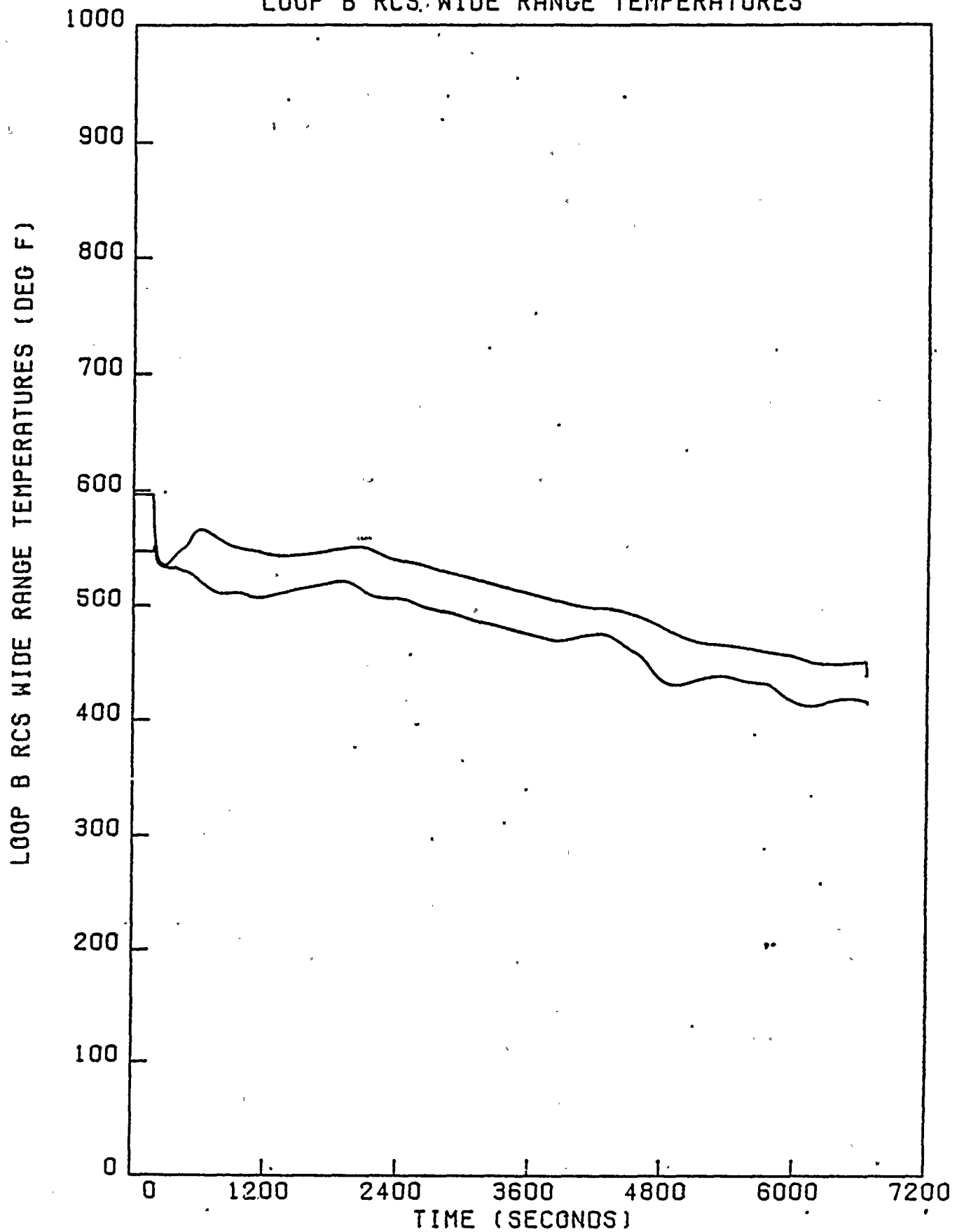


FIGURE A1-18
JUNE 12, 1980 NATURAL CIRCULATION COOLDOWN
LOOP B RCS WIDE RANGE TEMPERATURES



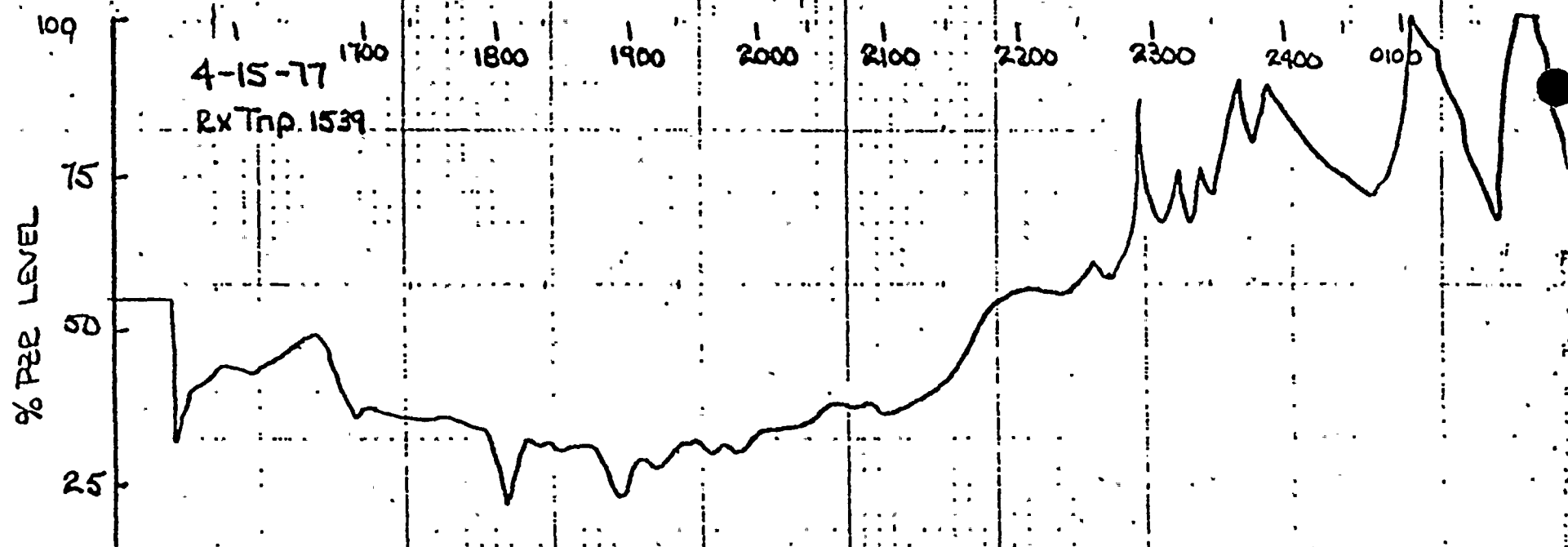
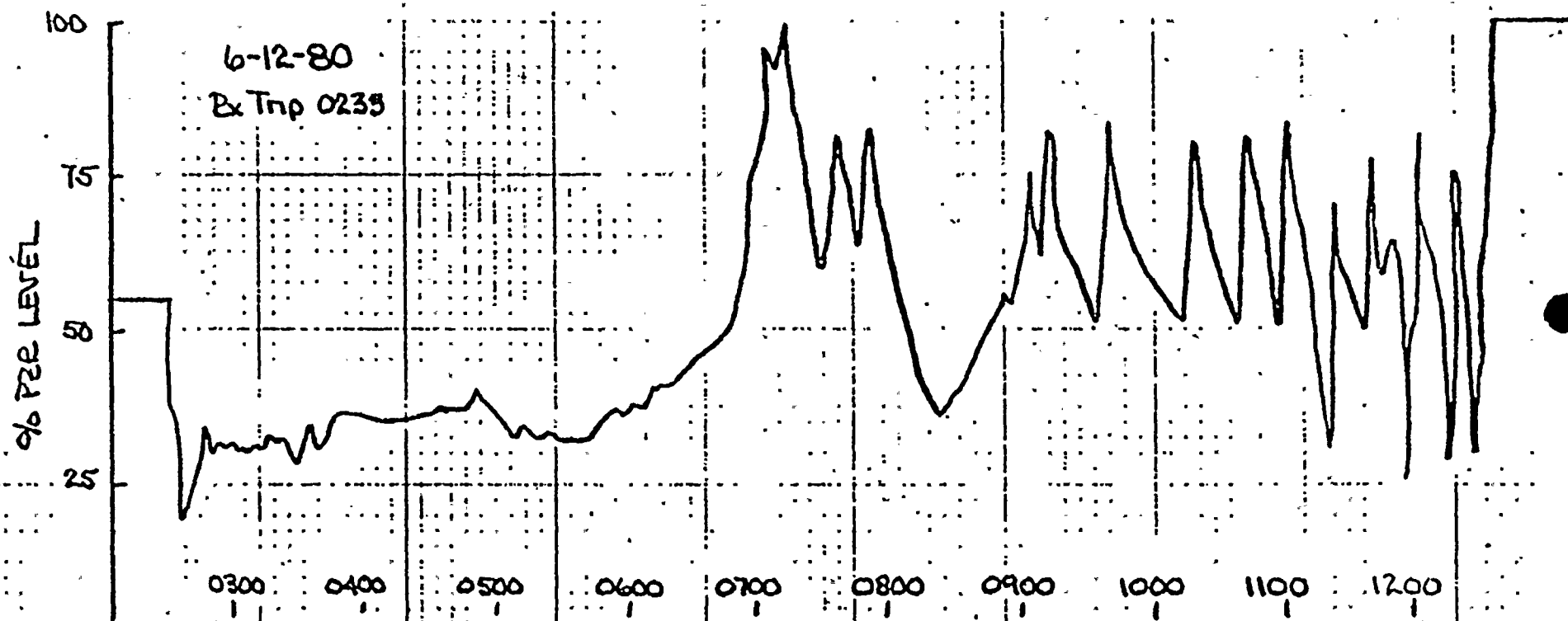


FIGURE A1-3
JUNE 12, 1980 NATURAL CIRCULATION CCGLOWN
PZR WIDE RANGE PRESSURE

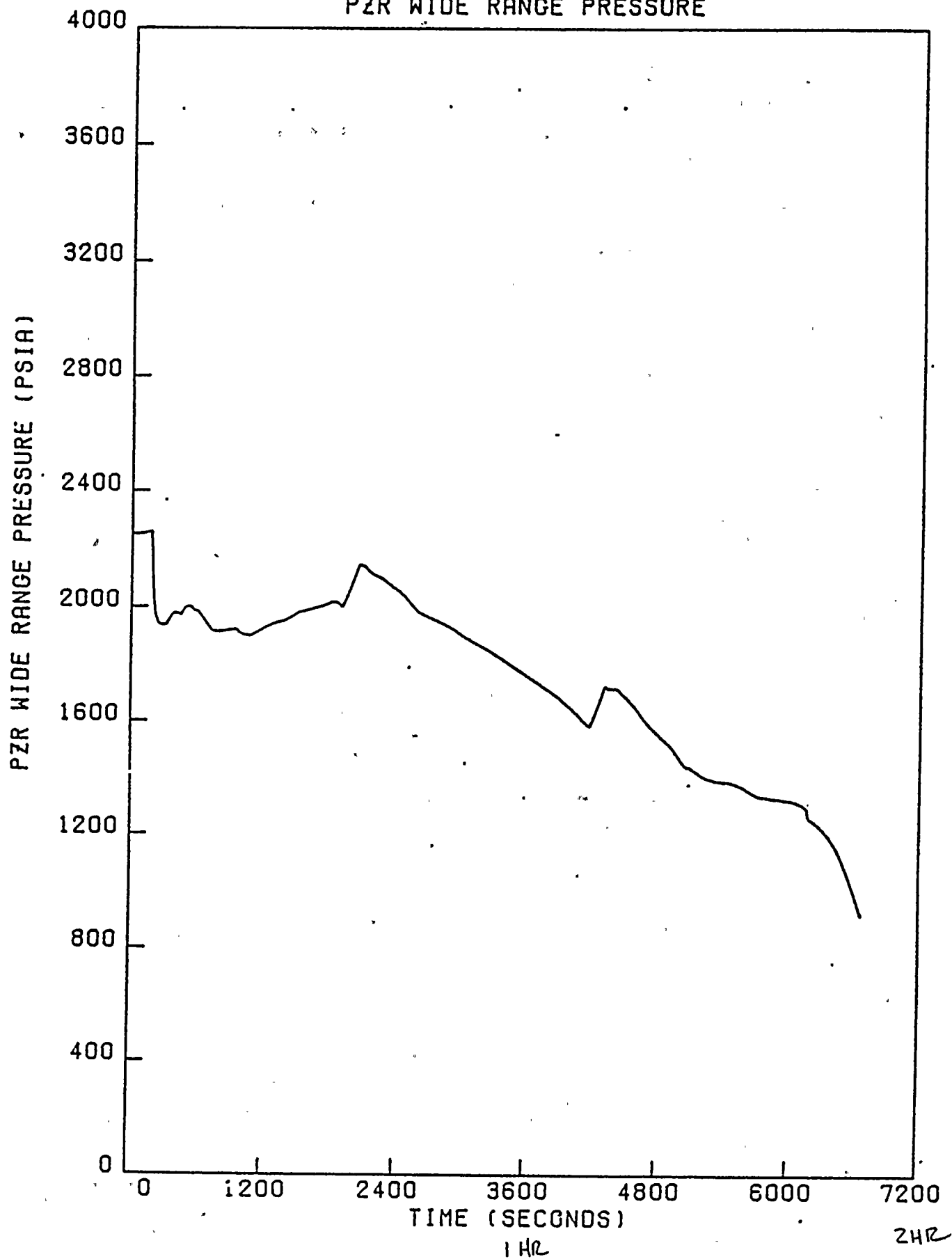


FIGURE A1-
JUNE 12, 1980 NATURAL CIRCULATION COOLDOWN
PZR LEVEL

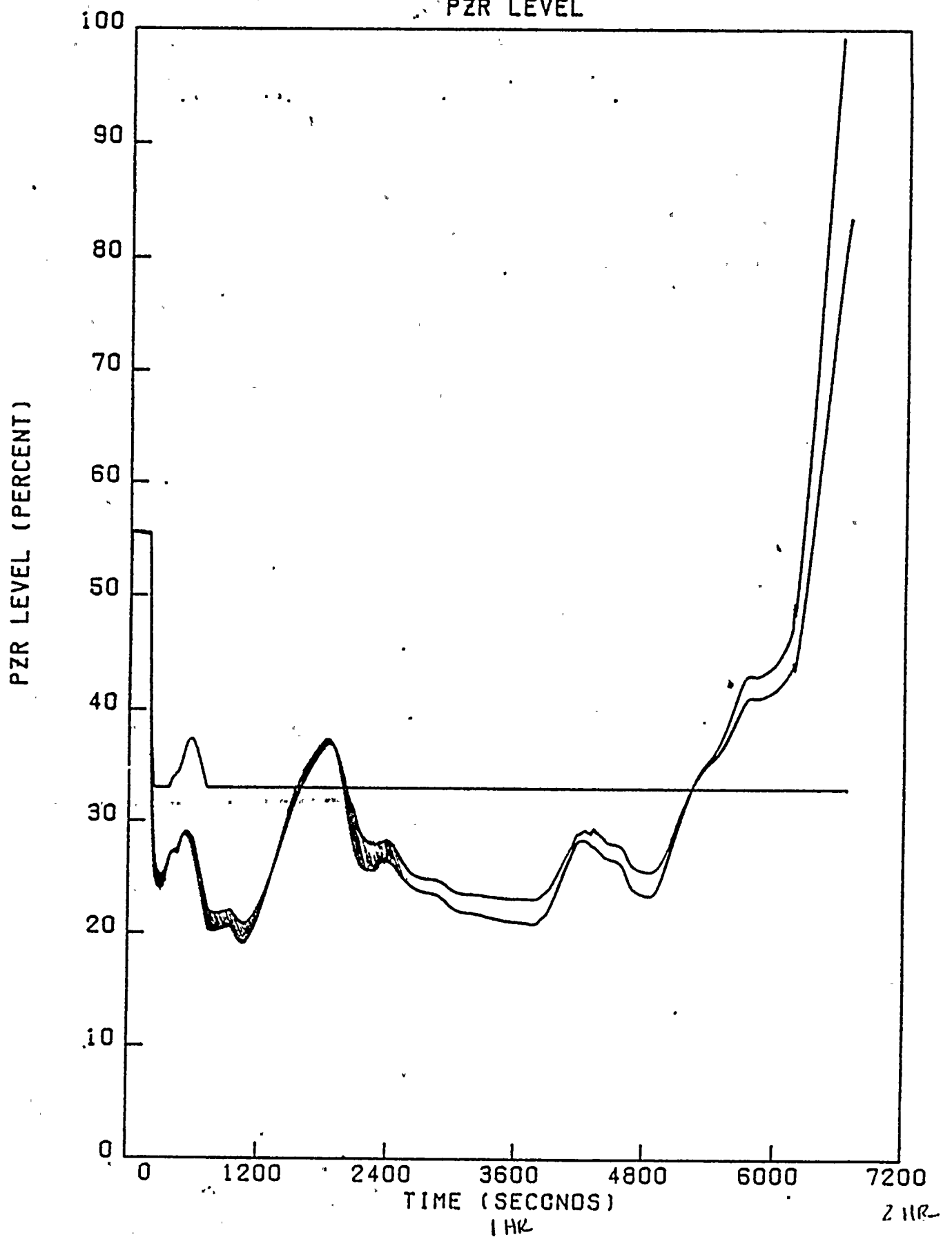


FIGURE A1-6
JUNE 12, 1980 NATURAL CIRCULATION CCGLOGWN
PZR LEVEL

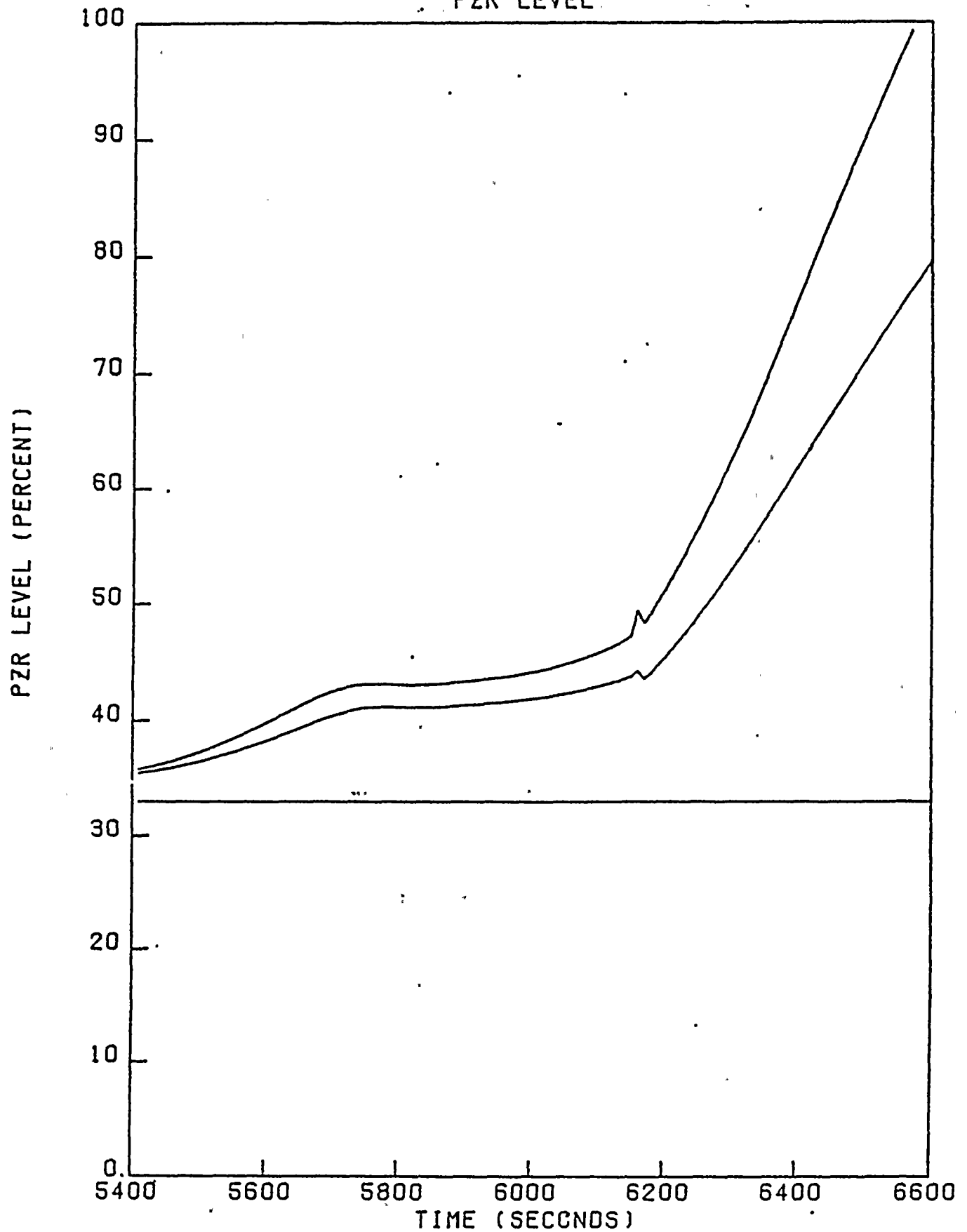
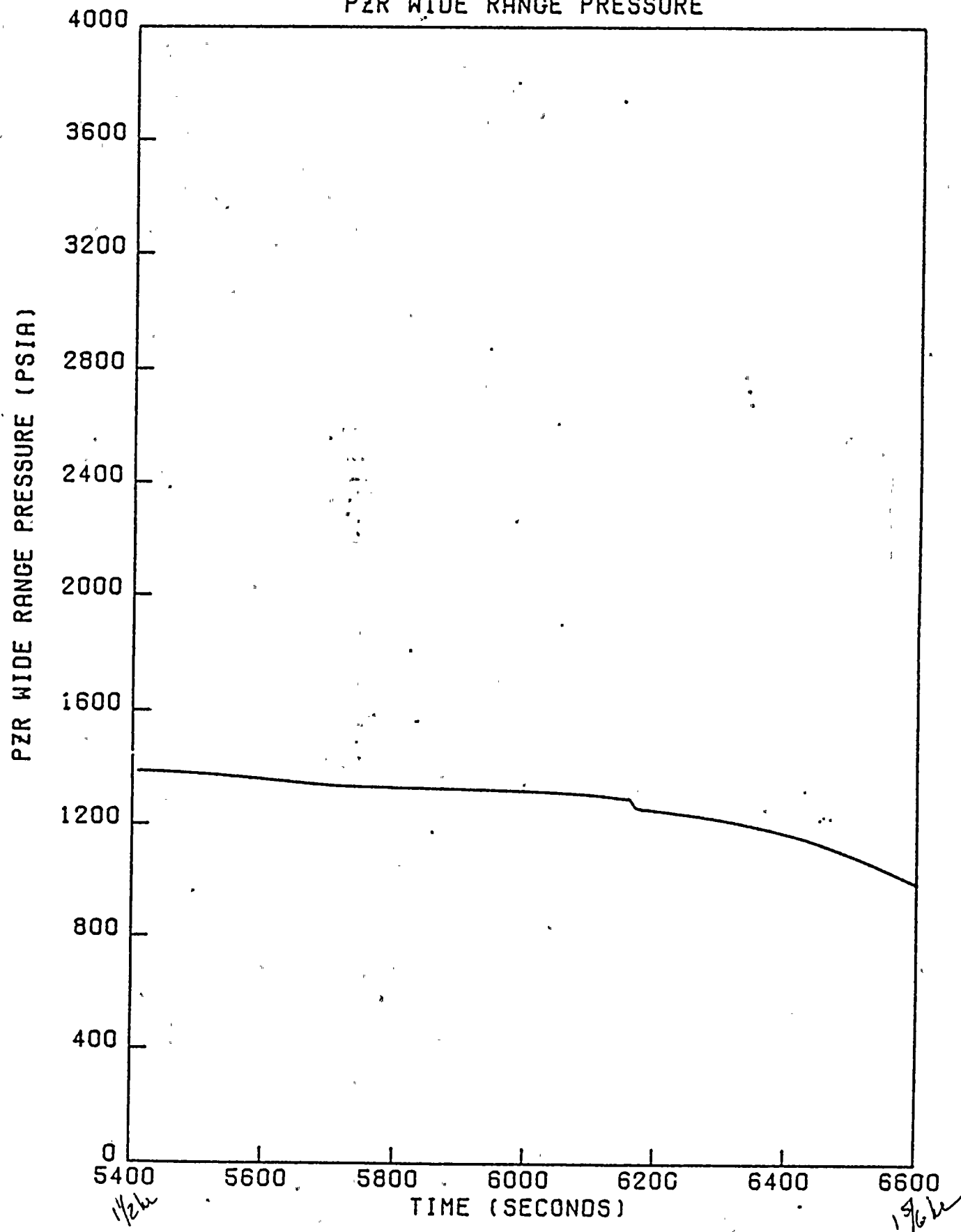


FIGURE A1-3
JUNE 12, 1980 NATURAL CIRCULATION COOLDOWN
PZR WIDE RANGE PRESSURE



AN ADVISORY CONCERNING A TECHNICAL DEVELOPMENT RELATED TO THE APPLICATION OR OPERATION OF NUCLEAR PLANT EQUIPMENT SUPPLIED BY COMBUSTION ENGINEERING.

June 20, 1980

NATURAL CIRCULATION COOLDOWN

INTRODUCTION: On June 12, 1980, C-E was informed by FPSL that unexpected variations in pressurizer level were observed while attempting to reduce plant pressure during a natural circulation cooldown at St. Lucie 1. The variations were determined to have resulted from the expansion and collapse of a steam void in the Reactor Vessel (RV) head region. This bulletin provides details currently known about this event and appropriate operational guidance for utilities with operating C-E NSSSs.

DISCUSSION: Following a loss of Component Cooling Water to the RCPs, St. Lucie 1 commenced an expeditious natural circulation cooldown to cold shutdown conditions. RCS depressurization via pressurizer auxiliary spray was initiated approximately 3.5 hours after the reactor trip. During depressurization, saturation conditions were reached in the RV head region which limited further depressurization until the head region had cooled off. Under natural circulation flow conditions there was minimal coolant flow in the upper head region and effectively all cooling was by heat loss to the ambient or by reactor coolant surge flow through the head region. An RCS pressure appropriate for initiating shutdown cooling (SCS) was attained approximately 9 hours following the reactor trip. During this event, the core region was always significantly subcooled.

In the event of a natural circulation cooldown it should be realized that cooling of the vessel head region may be limiting in establishing SCS entry conditions. Cooling of the RV head region may require as much as 10 to 15 hours. Periodic attempts to depressurize to SCS entry conditions can be made while watching for indications of void formation. When SCS entry conditions are achieved, the shutdown cooling system may be aligned in accordance with operating procedures.

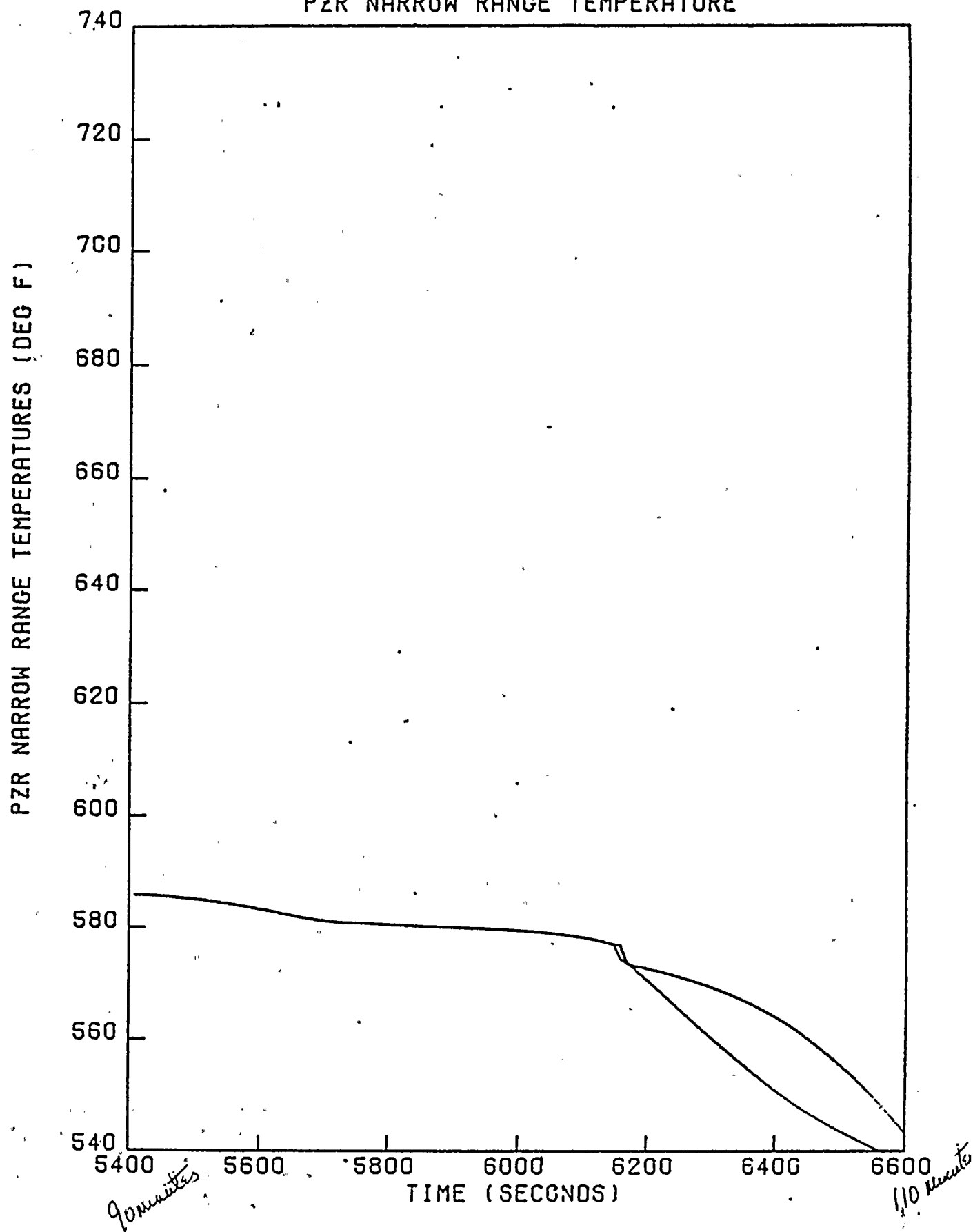
During depressurization, formation of a steam void in the RV head would be indicated by a rapid increase in pressurizer level while delivering auxiliary spray, which may be followed by a decrease in pressurizer level when charging is realigned to the RCS loop. These responses are indicative of an expanding void in the RV head as the pressurizer is sprayed and collapse of the steam void in the RV head as charging is directed to the loop. These indications may be preceded by an indication of letdown flow in excess of charging flow if the pressurizer level control system has been in automatic during the cooldown. Upon indication of a steam void the following actions are recommended in order to maintain plant conditions until the RV head has cooled:

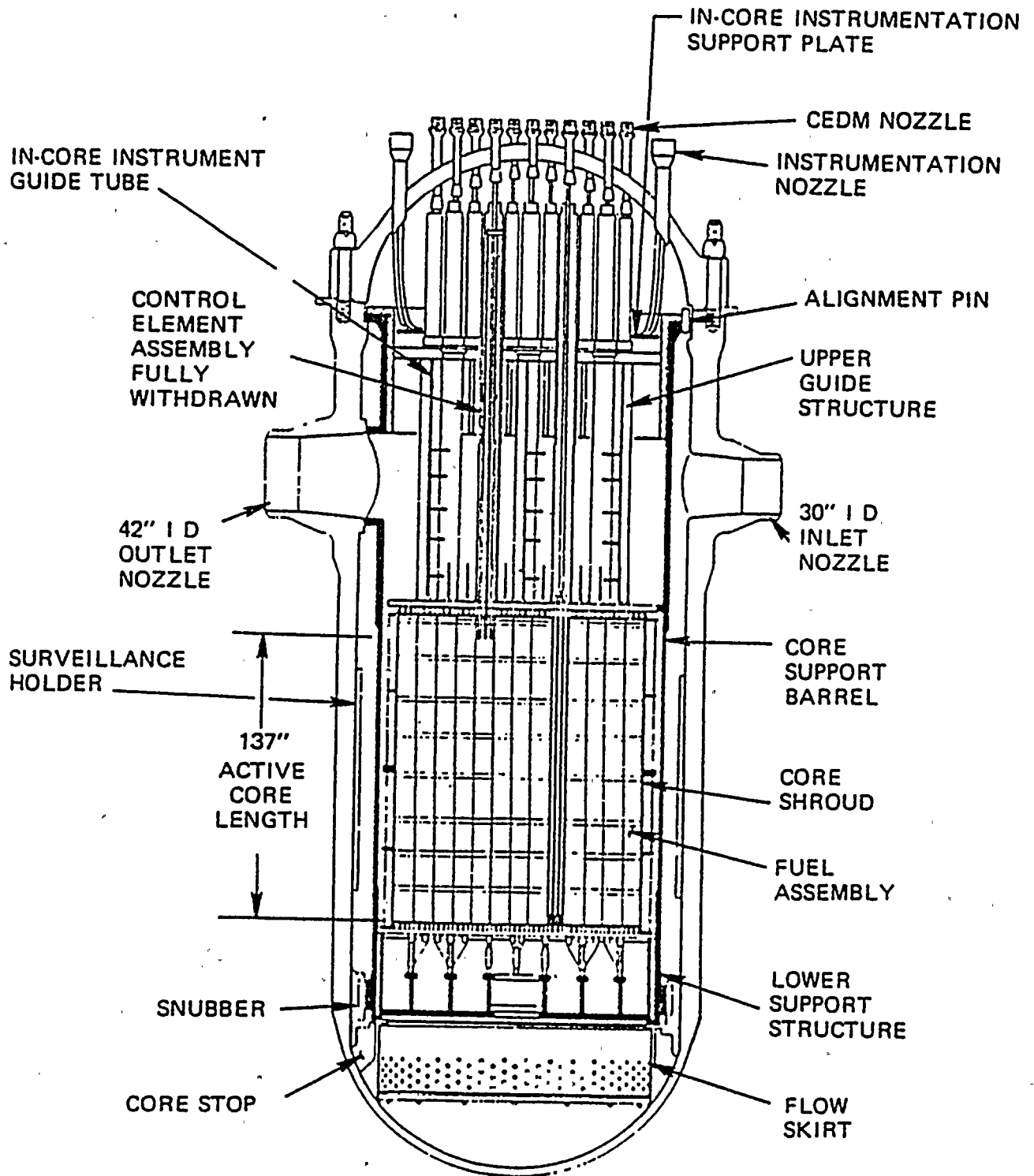
1. Isolate letdown.
2. Stop further RCS cooldown until indications of RV head steam void cease.
3. Energize pressurizer heaters to limit rate of depressurization.
4. Operate charging and auxiliary spray to maintain pressurizer level between 30% and 70% in order to limit void expansion.

STATUS: The event is currently being reviewed. Additional operator guidance will be incorporated into C-E training programs and forwarded to utility operating staffs as appropriate.

THE INFORMATION CONTAINED IN THIS ENGINEERING INFOBULLETIN IS PROVIDED BY C-E UNDER THE TERMS OF THE NUCLEAR STEAM SUPPLY SYSTEM CONTRACT FOR THE APPLICABLE PLANT, AS A SERVICE TO YOUR ORGANIZATION. AS A RESULT, AND SINCE OPERATION OF YOUR PLANT IS COMPLETELY WITHIN YOUR CONTROL AND RESPONSIBILITY, AND INVOLVES MANY FACTORS NOT WITHIN C-E'S KNOWLEDGE, THIS INFORMATION MAY BE UTILIZED ONLY WITH THE UNDERSTANDING THAT C-E MAKES NO WARRANTIES OR REPRESENTATIONS, EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, WITH RESPECT TO THE ACCURACY, COMPLETENESS OR USEFULNESS OF THE INFORMATION CONTAINED IN THIS BULLETIN, AND THAT C-E DISCLAIMS, AND YOU ASSUME, ALL LIABILITY, IN NEGLIGENCE OR OTHERWISE, AS A RESULT OF YOUR USE OF THIS INFORMATION.

FIGURE A1-4
JUNE 12, 1980 NATURAL CIRCULATION COOLDOWN
PZR NARROW RANGE TEMPERATURE

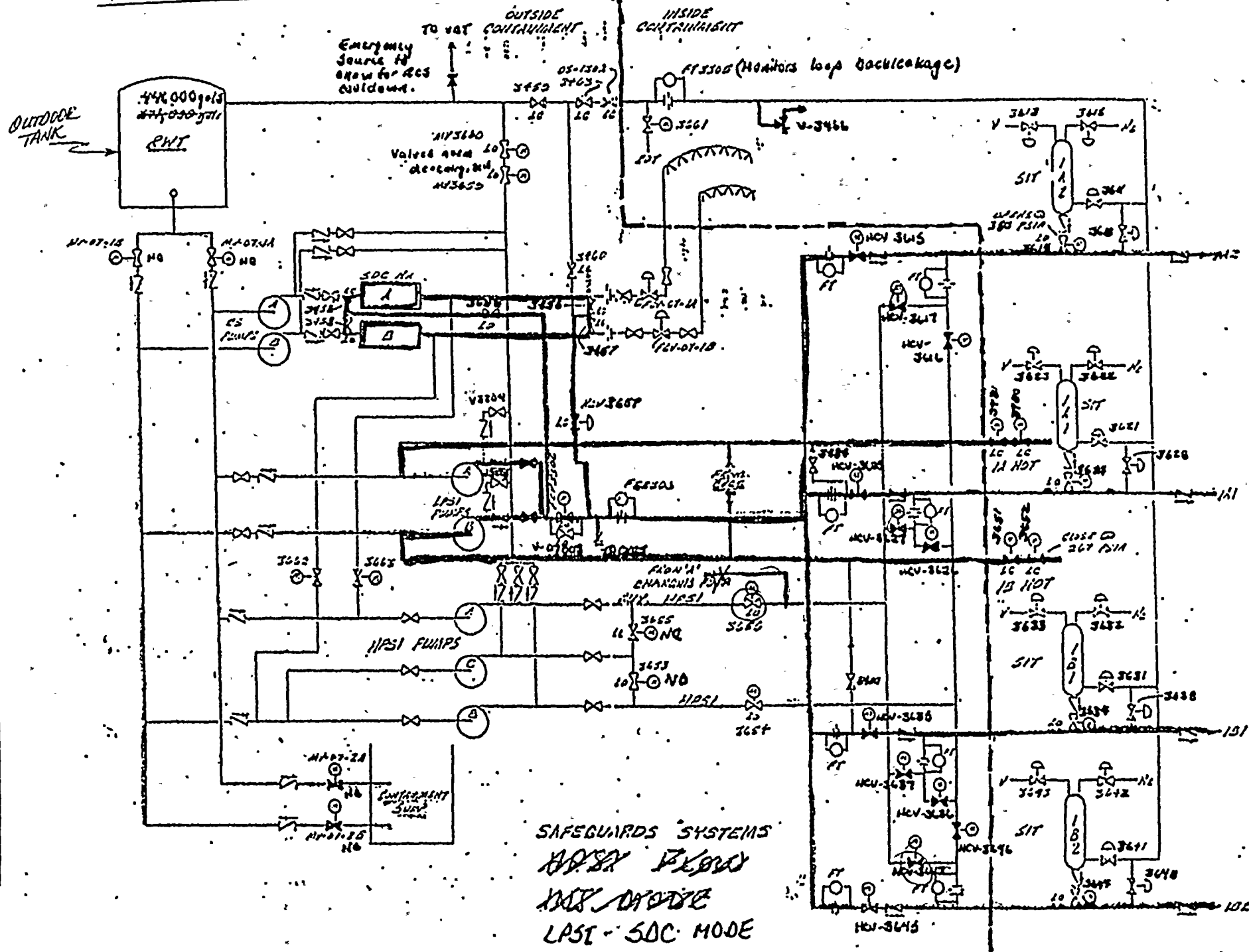




FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT UNIT 2

REACTOR VERTICAL ARRANGEMENT

FIGURE 4.1-1



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MEETING SUMMARY DISTRIBUTION

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Docket File

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SVarga
DCrutchfield
RAClark
ORB Project Manager - CNelson
Licensing Assistant - PKrützer
OELD
AEOD - JHeltemes
IE-3
SShowe (PWR) or CThayer (BWR), IE

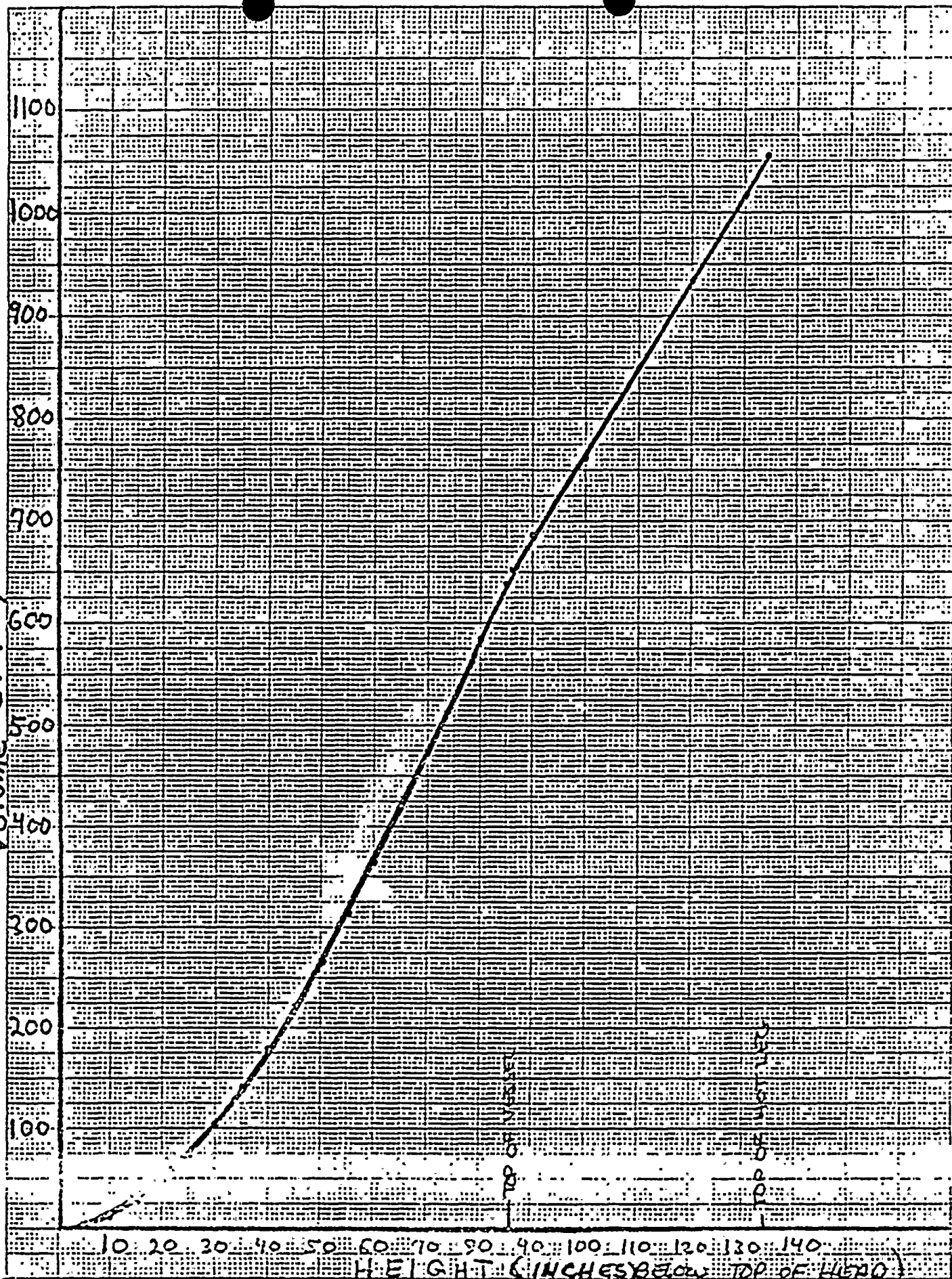
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Program Support Branch
GZech

JOlshinski
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BSheron
EJordan
EBlackwood
JMazetis
KParczewski
PMatthews
GLanik
EImbro
JCresswell
MConner

CLi
TWolf
HConrad

Volume (FT³)



(Height vs. Volume)

DEC 3 1980