✓ SRC ~~JBB~~ 6/24/75

Control Room Units 1+2

GPU 2511

(17) Mgr JSA 6/25/75

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

INCIDENT INVESTIGATION REPORT FORM

Incident Investigation Report No. B-350 Date 6/13/75

Unit 3 Time/Date of Incident 1442 6/13/75

Unit Status at Time of Incident ~19% Shutdown in progress.

Incident 3RC-66 stuck in the open position resulting in RPS Low Pressure Trip. [illegible] 3RC-66 opened due to a small pressure transient. Failure resulted in rapid depressurization of RCS and 1500 psi ES actuation.

Time/Date Reported to Station Manager 1450 6/13/75

Time/Date Reported to General Office 1600 6/13/75

General Office Representative Contacted [illegible] M.S. Tuckman

Time/Date Reported to NRC/OIE Region II 1605 6/13/75

NRC Inspector Contacted T N Epps

Type of Incident: X AO, ___ UE, ___ TSV, ___ OTHER

Investigator Assigned T Curtis

Report Due to SRC on 6/19/75 Report Due to NRC on 6/27/75

Routing of Copies:

This Form	Report	SRC Report
Tech. Ser. Supt. SRC Gen. Office Investigator	SRC (4)	NSRC Gen. Office Investigator Ops. Supt. (4) Tech. Ser. Supt. F. C. Hayworth Maintenance Supt.

Remarks: Reported under 1.8.f of Tech Specs.

H2733-5

1406

0 1 4 2

Duke Power Company
Oconee Nuclear Station
Incident Report #3-350
Unit 3 Trip #12

1.0 Introduction

On June 13, 1975, Unit 3 was shutting down for RCP seal maintenance. At 1439, the trubine was taken into manual at 19% FP, 120 MWe. An RCS pressure spike occurred, opening the power actuated pressurizer relief valve (3RC66). 3RC66 failed to close, the quench tank rupture disc burst, the reactor tripped on low RCS pressure, and an HPI ES actuation occurred. Closure of 3RC4 ended the transient.

The station manager was notified at 1450, the general office was notified at 1600, and the NRC/OIE Region II inspector was contacted at 1605.

2.0 Sequence of Events

6/13/75 1200	Unit shutdown from 100% FP was begun at 6 MWe per minute.
1439:17	Assistant Control Operator A swapped auxiliaries and placed the turbine station in manual. MS bypass valves MS19 and MS22 opened.
1440:15	Shift Supervisor A took the MS bypass valves in manual.
1440:45	Control Operator A notified Assistant Control Operator A that RCS pressure was swinging. Assistant Control Operator A began running back load on the turbine generator.
1440:47	Assistant Shift Supervisor A took FWP A in manual.
1441:20	RCS pressure spiked to 2267 psi, opening 3RC66. 3RC66 did not close, but the open/closed lights on the control panel did not indicate that it had remained open. Rapid RCS depressurization began.
1441-1445	The quench tank rupture disc burst. Mirror insulation was blown off the bottom of the pressurizer.
1441:52	Unit load reached approximately 10 MWe. Assistant Control Operator A opened PCB 58.
1442:40	RP Channels B & D tripped on low RCS pressure, tripping the unit. PCB 59 opened.

1406 0143

1443:20 Control Operator A started HPI pump A.
Control Operator A opened HP26 to bypass HP120 on the RCS makeup line.

1444:49 RCS pressure reached 1500 psi. ES HP injection actuation occurred, automatically starting HPI pump C.

1445:00 Control Operator A shut off HPI pump C.

1447:30 Control Operator A closed 3RC4.

1447:45 Control Operator A opened 3RC4.

1500 Pressurizer level reached 367 inches.

1506:30 Control Operator A closed 3RC4.

1507 RCS pressure bottomed out at 720 psi.

1509 The transient was under control.

1550 RCS Tav reached 429°F.

3.0 Evaluation

I. The Causal Initial Oscillation:

Before the turbine was taken into manual, unit load demand (ULD) was at about 65 MWe, but 115 MWe were being generated. This difference existed because the reactor was operating at its low limit of 15% FP while in automatic ICS control and could not follow ULD further down.

When the turbine was taken into manual, ULD was less than 90 MWe, so that MS pressure control was switched to the bypass valves. MS pressure was 910 psi, so MS 19 and MS 22 opened immediately. A rapid MS pressure drop to about 875 psi occurred, at which point the bypass valves closed. Meanwhile, ULD had automatically run up to match generated megawatts at about 115 MWe, so that MS pressure was no longer controlled by the bypass valves. The bypass valves were taken into manual before load went below 90 MWe. (See Enclosure 1; B, C, D, and E)

ICS FDW pump demand, which could not handle the rapid ULD increase, went into an oscillation which diverged after about 30 seconds. It was therefore necessary to take the feedwater pump (FWP A) into manual. Control of feedwater could not be reestablished well enough to stabilize OTSG level. OTSG level swings caused RCS temperature, pressure, and power swings; RCS pressure spiked to 2267 psi, opening 3RC66. (See Enclosure 1; F, G, H, I, and J)

0T4

Automatic control of MS pressure was apparently satisfactory. However, automatic feedwater control was not adequate, indicating that the ICS cannot handle the rapid change in ULD that occurs when the turbine is placed in manual while a large ULD/generated MWe differential exists.

II. The 3RC66 Failure

3RC66 opened properly when RC pressure reached its 2255 psi setpoint, but it did not close. The open/closed lights in the control room did not indicate that the valve was open.

Upon inspection, the lever arm of the pilot valve for 3RC66 was found to be stuck in the open position. This sticking was due to heat expansion, boric acid crystal buildup on the lever connecting pin, and binding of the lever against solenoid brackets.

The solenoid operator plunger was also found to be stuck in the open position. A bent spring bracket above the plunger had caused it to stick. (See Enclosure 3; A, B, and C)
The position indication failure could not be repeated. It could have been caused by sticking of the solenoid plunger at slightly less than the full open position or by the crud buildup around the plunger operated microswitch to the open/closed lights.

III. The Pressure - Temperature Transient

Because there was no control room indication that 3RC66 had stuck open, the reason for the rapid pressure loss was not obvious. 3RC4, the block valve to 3RC66 was closed for about 15 seconds when RC pressure had reached about 1300 psi. No change in the pressure transient was observable on the wide range RC pressure chart, and a rapidly rising pressurizer level prompted reopening 3RC4. 3RC4 was again closed at about 800 psi, and the pressure transient was brought under control after a total duration of 26 minutes. (See Enclosure 1; K, L, M, and N)

When the pressure transient ended, RC temperature had dropped to 480°F. To expedite evaluation of system damage, RCS cooldown was continued as rapidly as allowed. This rapid cooldown rate, combined with the RC temperature drop during the transient, produced a temperature change from 530°F to 429°F in a one hour period. This 101°F/hr rate exceeds the T.S. 3.1.2.6 cooldown rate limit of 100°F/hr below 530°F. (See Enclosure 1, P)

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During the transient, Operating Limits for RCP NPSH and Fuel Compression were violated for 20 minutes and 1 hr. and 20 minutes, respectively. (See Enclosure 2; A and B)

IV. The Loss of Reactor Coolant to the Reactor Building

The failure of 3RC66 and consequent rupture of the quench tank rupture disc resulted in releasing not more than 1550 gallons of RCS water to the reactor building sump.

The following is a calculation of the amount of water released to the sump:

While 3RC 66 was open, HPI pump A was on for 16 minutes, 22 seconds at 300 gpm. For ten seconds, 3HP120 was not bypassed, so that RCS makeup was limited to 100 gpm. Pressurizer and LDST levels returned to pre-transient values as the coolant loss ended. The RCS cooled down from 579°F to 476°F.

16 m, 12 sec at 300 gpm	=	4860 gal.
10 sec at 100 gpm	=	17 gal.
		4877 gal.
System Shrinkage	-	3336 gal.
		1541 gal.

Some of this water remained in the quench tank (volume, 780 gal.), and was pumped into Bleed Hold up tank.

Activity increase in the reactor building was small, with none of the radiation monitoring recorders showing as much as a decade increase in counts. (See Enclosure 1; Q and R) Health Physics personnel sampled the reactor building activity and approved entry for inspection within an hour of the transient.

V. Componential Damage

The quench tank rupture disc was blown. Mirror insulation was blown off the bottom of the pressurizer, exposing the bottom level taps.

4.0 Corrective Action

Recommendations

I. The Causal Initial Oscillation

1) An Instrument Department representative has recommended that a change be made to all three unit shutdown procedures that would prevent running ULD below 120 MWe before ~~turning the turbine into manual~~. putting ICS in Track. This would prevent the existence of large ULD/generated MWe differentials.

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II. The 3RC66 Failure

3RC66 was removed, repaired, and replaced as per ~~WO~~ WR #02667A. (Enclosure 3; A)

III. The Pressure - Temperature Transient

Babcock & Wilcox representatives were informed of the cooldown rate, NPSH curve, and fuel compression curve violations by the general office.

IV. The Loss of Reactor Coolant to the Reactor Building

The water in the reactor building sump, which was not excessive, was processed routinely. Cleanup of the loose water in the reactor building was completed on 6/14/75.

(2) It is recommended that control room operating personnel be made aware of this occurrence, emphasizing that immediate closure of RC4 is the proper corrective action.

V. Componential Damage

The quench tank rupture disc was replaced on 6/14/75 as per ~~WO~~ WR #02666A. The bottom nozzles on the pressurizer were dipenetrant tested on 6/19/75 as per WO #1649A. Mirror insulation was replaced on the pressurizer on 6/21/75.

5.0 Verification

I. N/A

II. The 3RC66 Failure
3RC66 is to be cycled and verified to be operating correctly when 3RC4 is closed to perform the 2285 psi RCS pressure test prior to startup.

III. N/A

IV. N/A

V. Componential Damage

The quench tank is back in operation and functioning properly.

6.0 Safety Analysis

No radioactivity was released to the environment. The ES actuation occurred properly, preventing loss of cooling to the core.

The health and safety of the public was not endangered.

7.0 Enclosures

Enclosure 1, Unit Parameters

A. RX Power and Generated MWe

B. ULD and MWe

C. MWe and BP Valve Position

D. SG Pressure and BP Valve Position

E. MS Pressure

F. FWP Demand and ULD

G. FW Flow

H. FWP Demand and SG Level

I. SG Level and RC T cold

J. RX Power and RC Pressure

K. RC Pressure

L. RC Pressure (Control Room Chart)

M. RC Pressure and Pressurizer Level

N. Pzr Level (Control Room Chart)

O. LDST Level

P. RC T_h & T_c (Control Room Charts)

Q. Radiation Trend

R. RIA Monitor

Enclosure 2, Safety Limits & Precautions Curves

A. Fuel Compression Curve

B. NPSH Curve

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Enclosure 3, 3RC66 Repair Documentation

A. WO #02667A

B. "Repair of RC-66"

C. RC 66 Illustration

Allowable Plant Transient Classification #9

Thomas D. Curtis
Unit III Asst. Reactor Engineer

TDC/bkh

SRC Recommendations

① Same as section 4 of this report.

② The SRC notes that the cause of cool down rate violation was the initial temperature drop plus a maximum allowable cool down rate established after the transient. It is recommended that after such transients a cool down rate ~~[illegible]~~ JSB be established based on 100°F/hr. prior to continuing to cool down. This will require a case by case evaluation in each ~~case~~ JSB situation.

JSB 6/24/75

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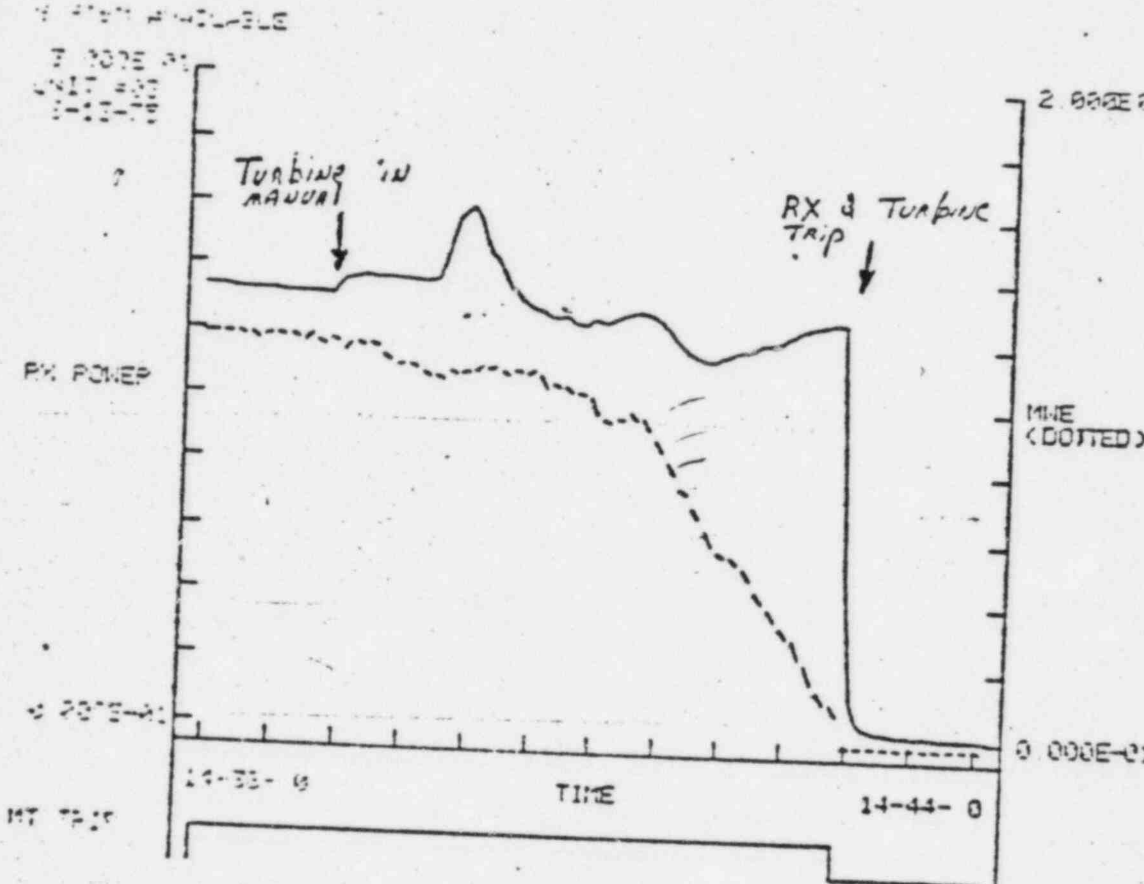
Enclosure i

A



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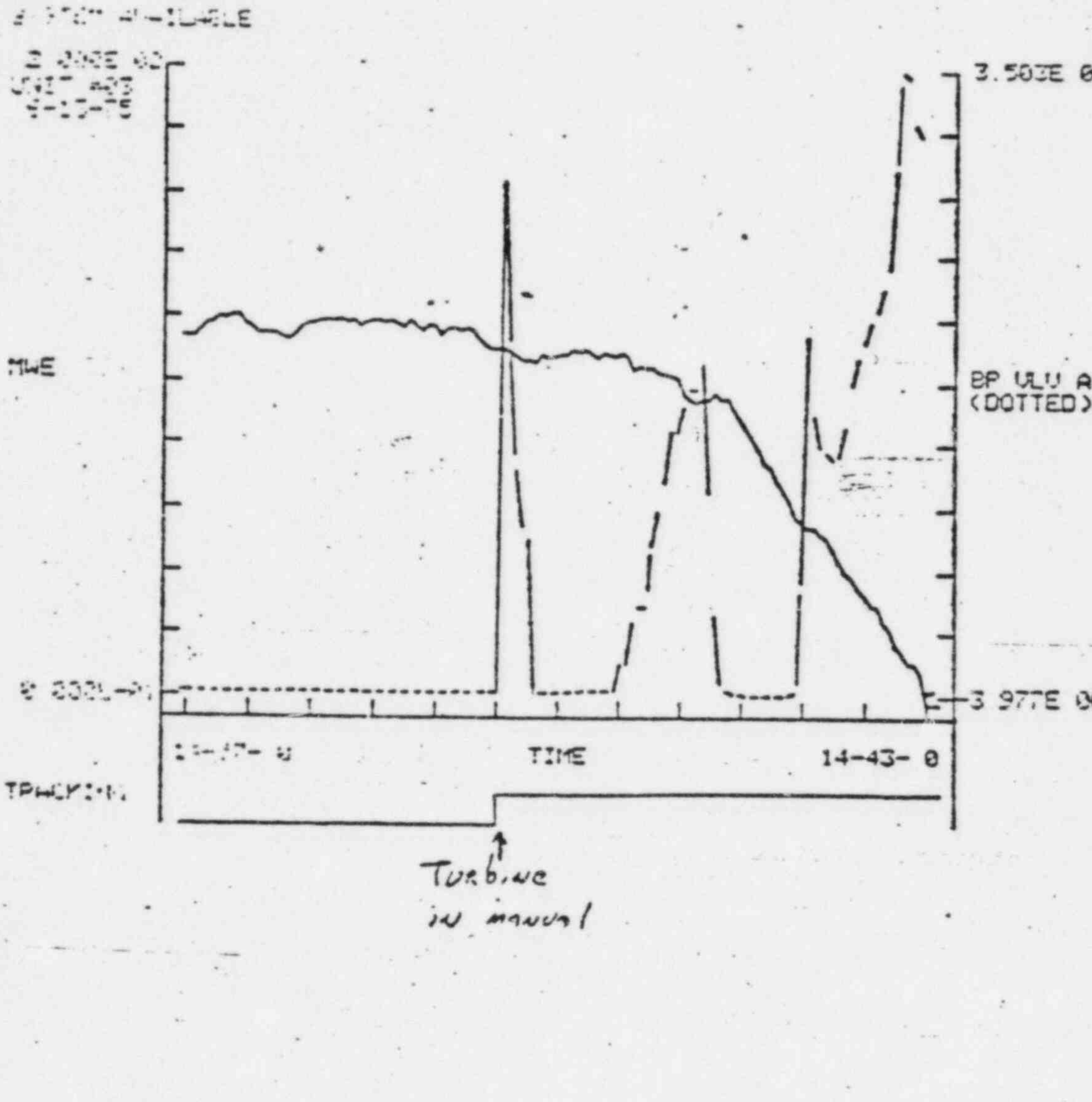
Enclosure 1

C



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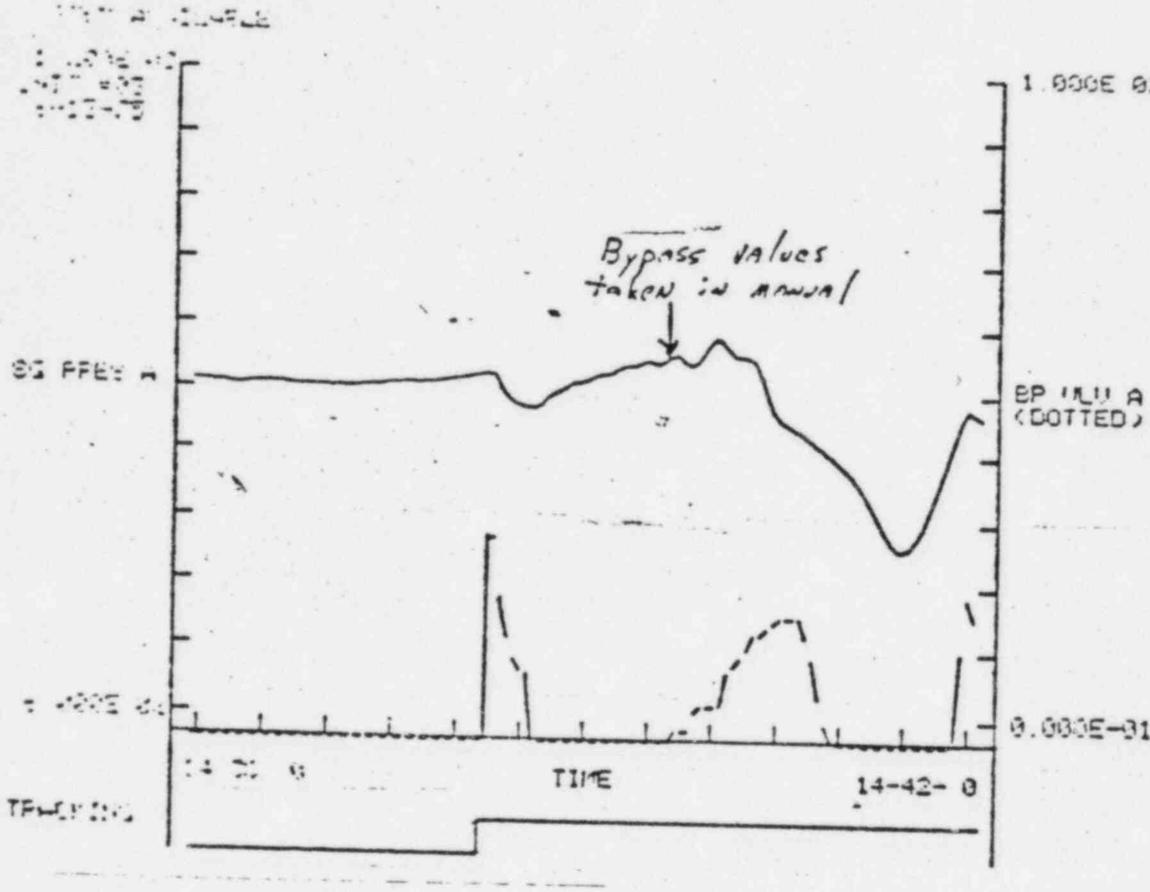
Enclosure 1

D



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0 1 5 3

ENCLOSURE 1

E

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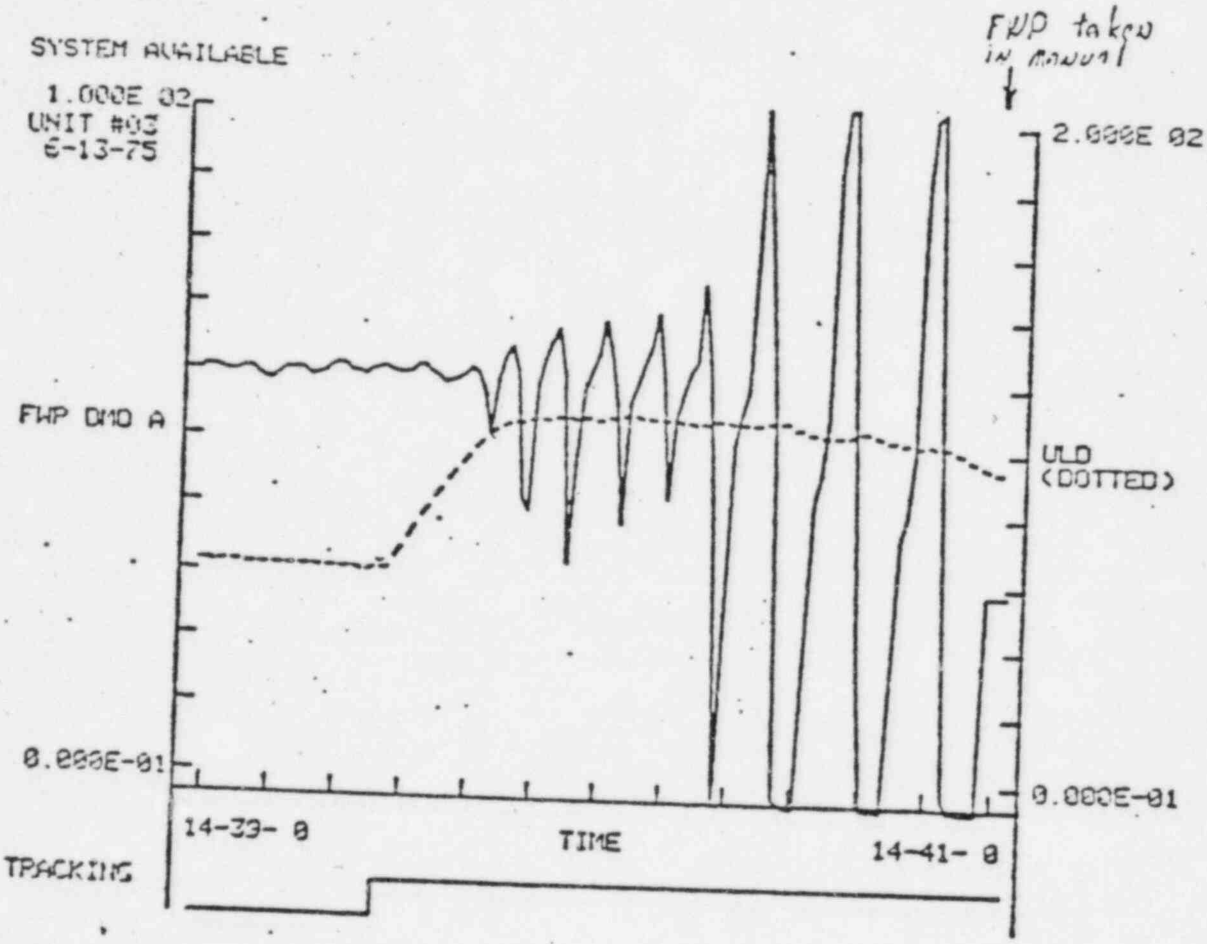
0 1 5

Enclosure 1

F



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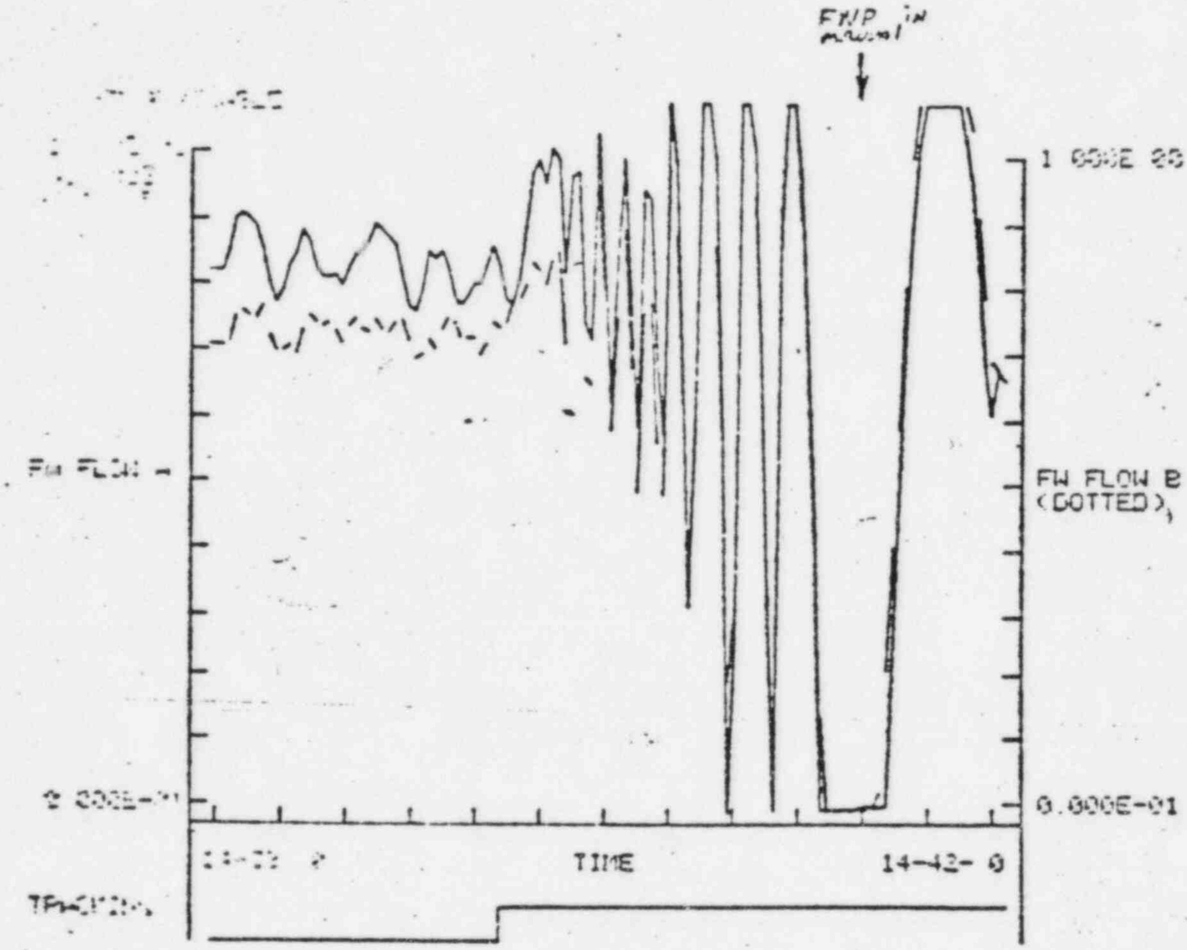
Enclosure 1

G



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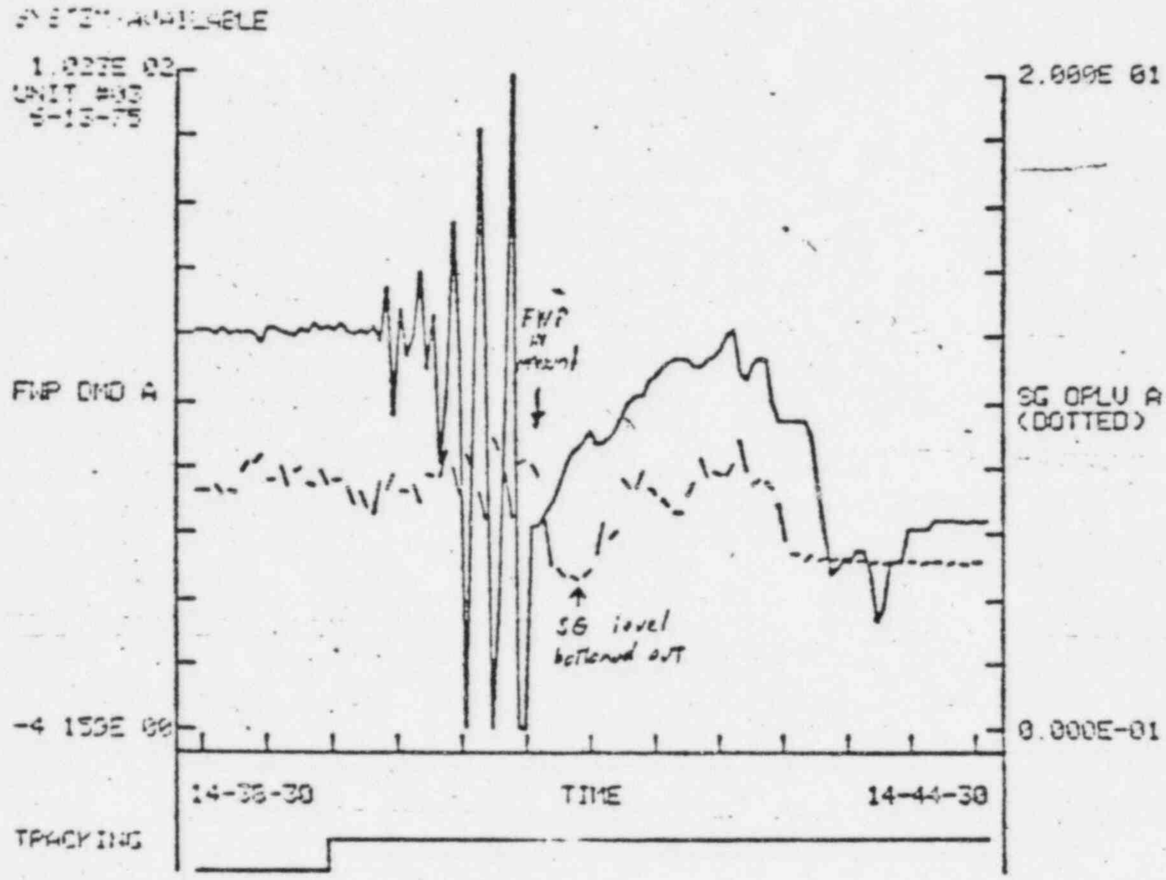
OTSA

Enclosure 1

H



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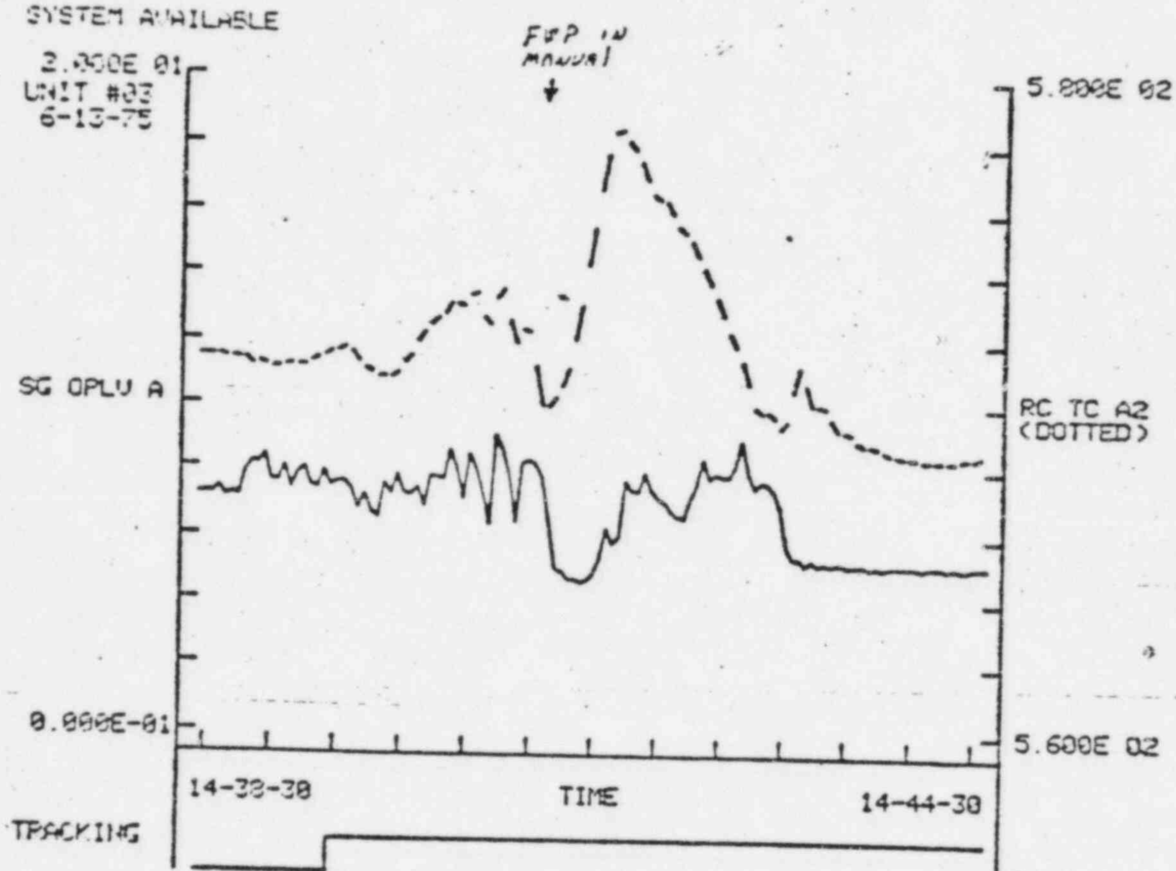
Enclosure 1

I



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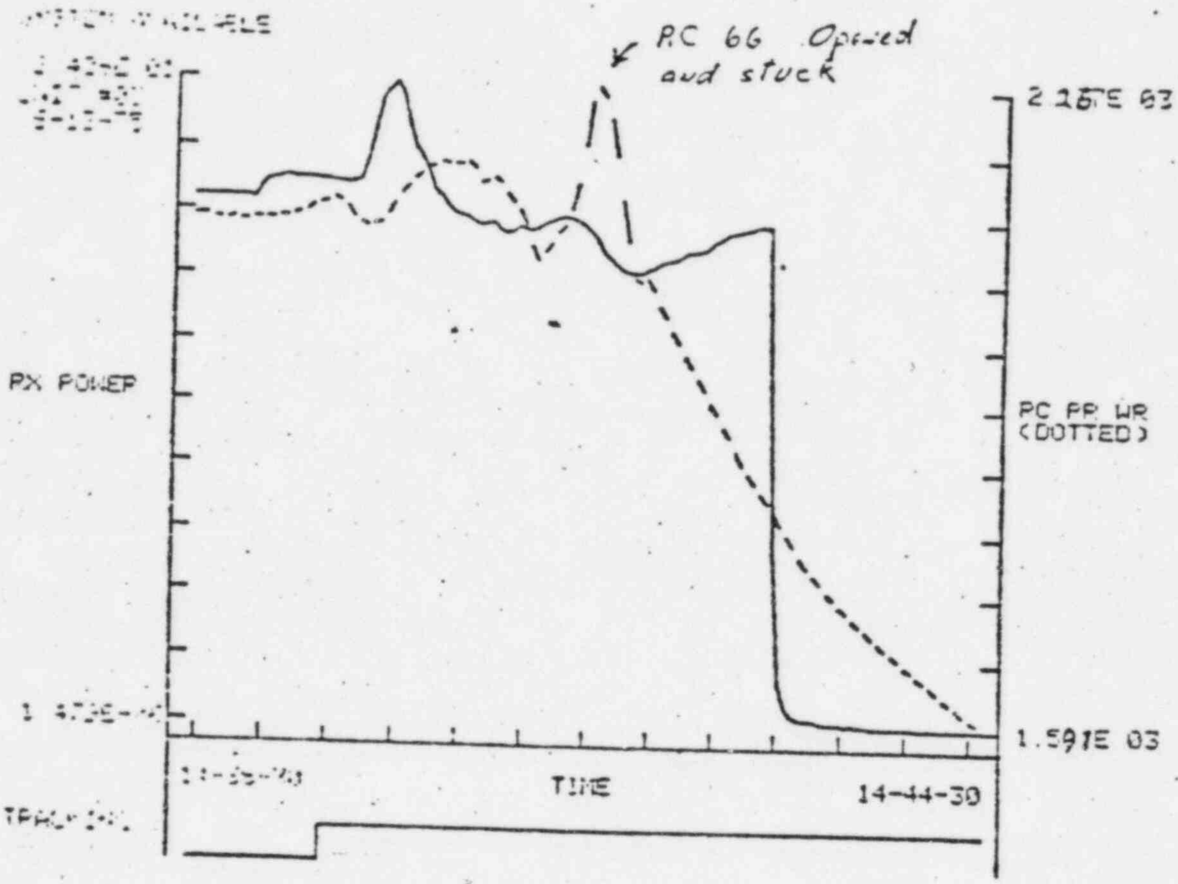
0 1 5

Enclosure 1

J



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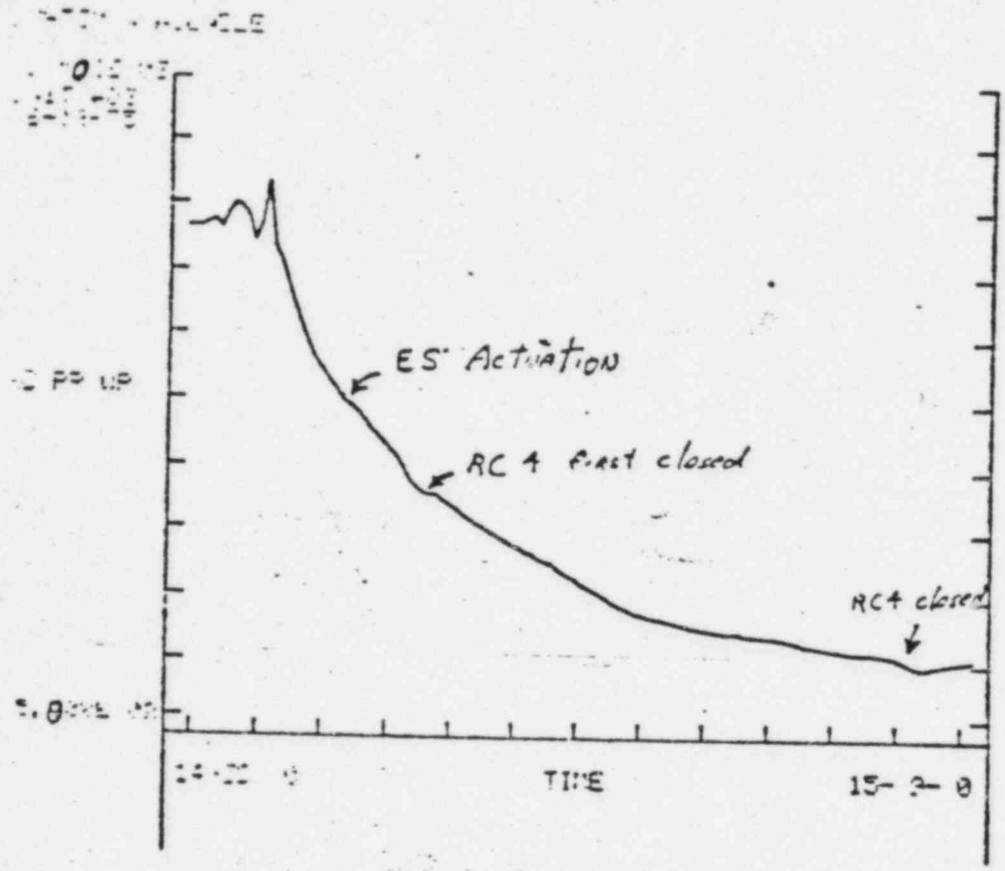
Enclosure 1 K



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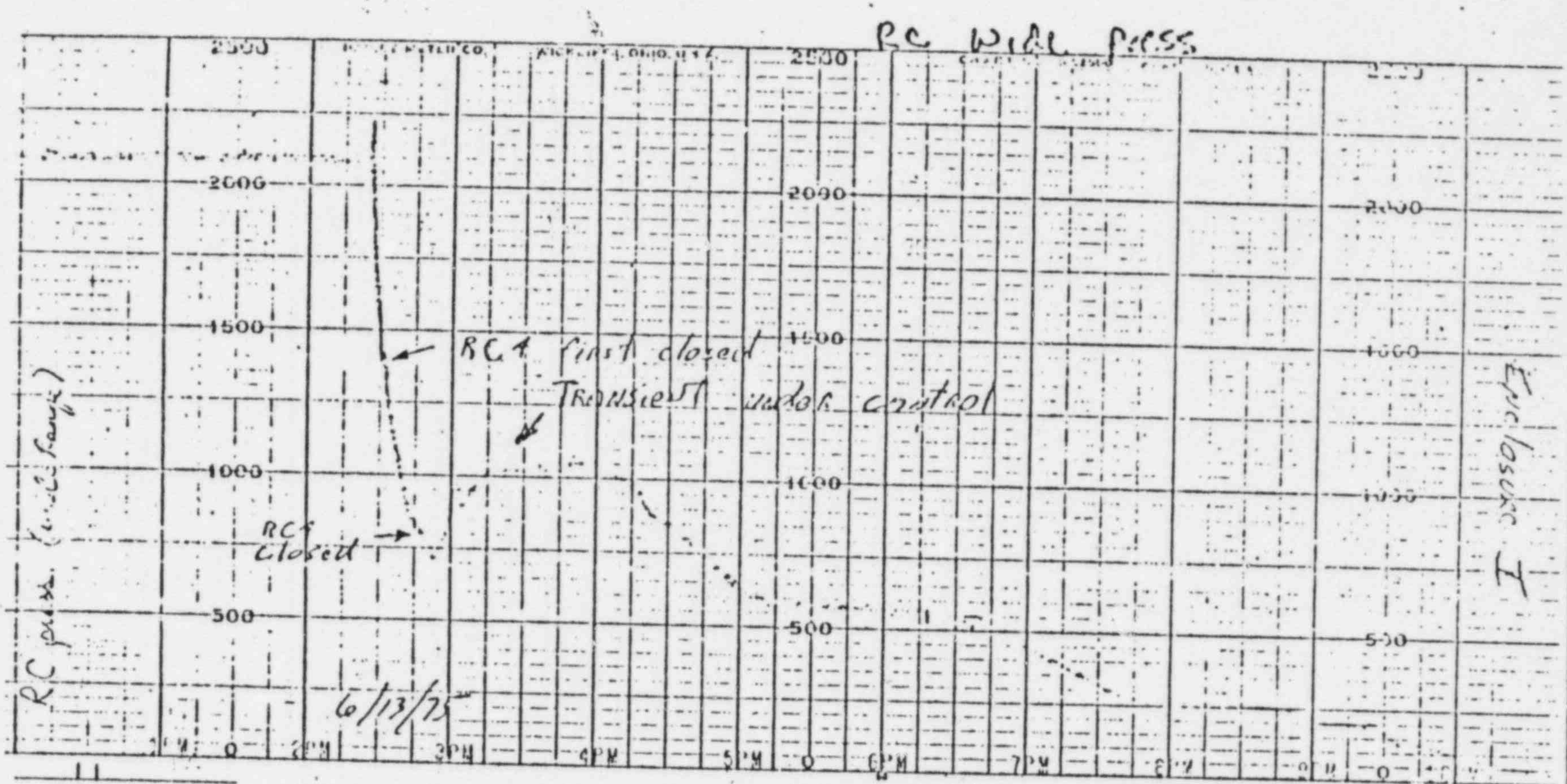
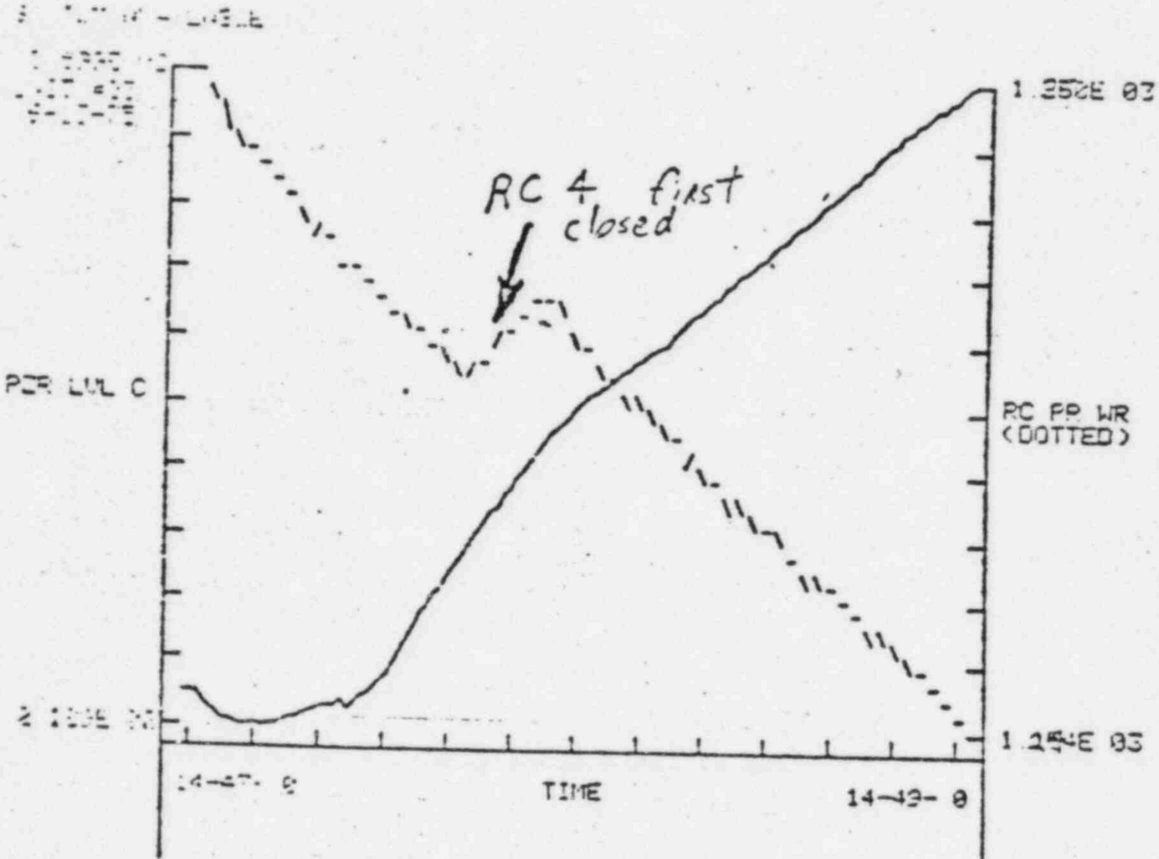
Enclosure I

Control Room Chart



Enclosure 1

M



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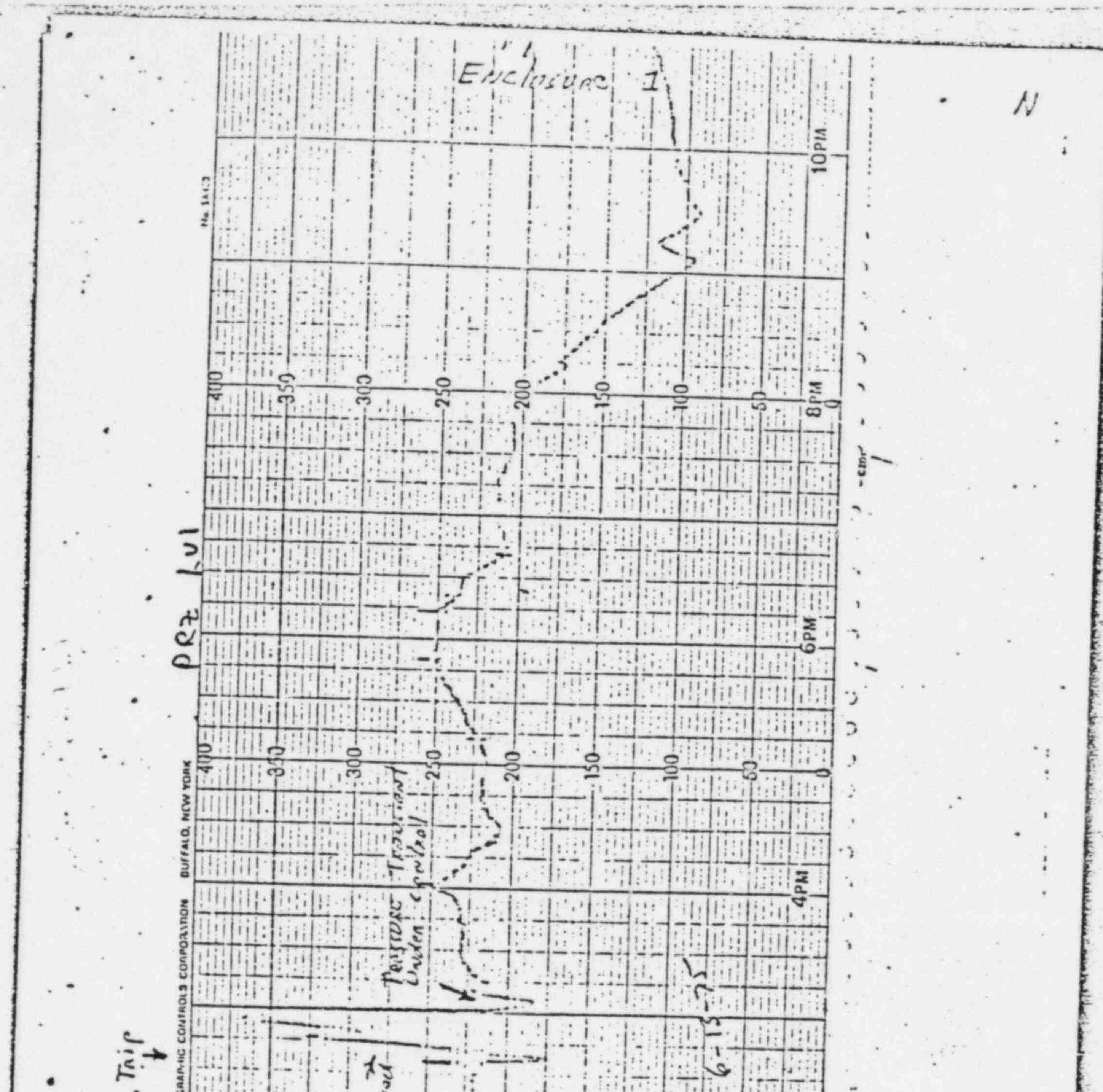

Enclosure 1
N
PRZ LVL
Trip
GRAPHIC CONTROLS CORPORATION BUFFALO, NEW YORK
400
350
300
250
200
150
100
50
0
2PM
4PM
6PM
8PM
10PM

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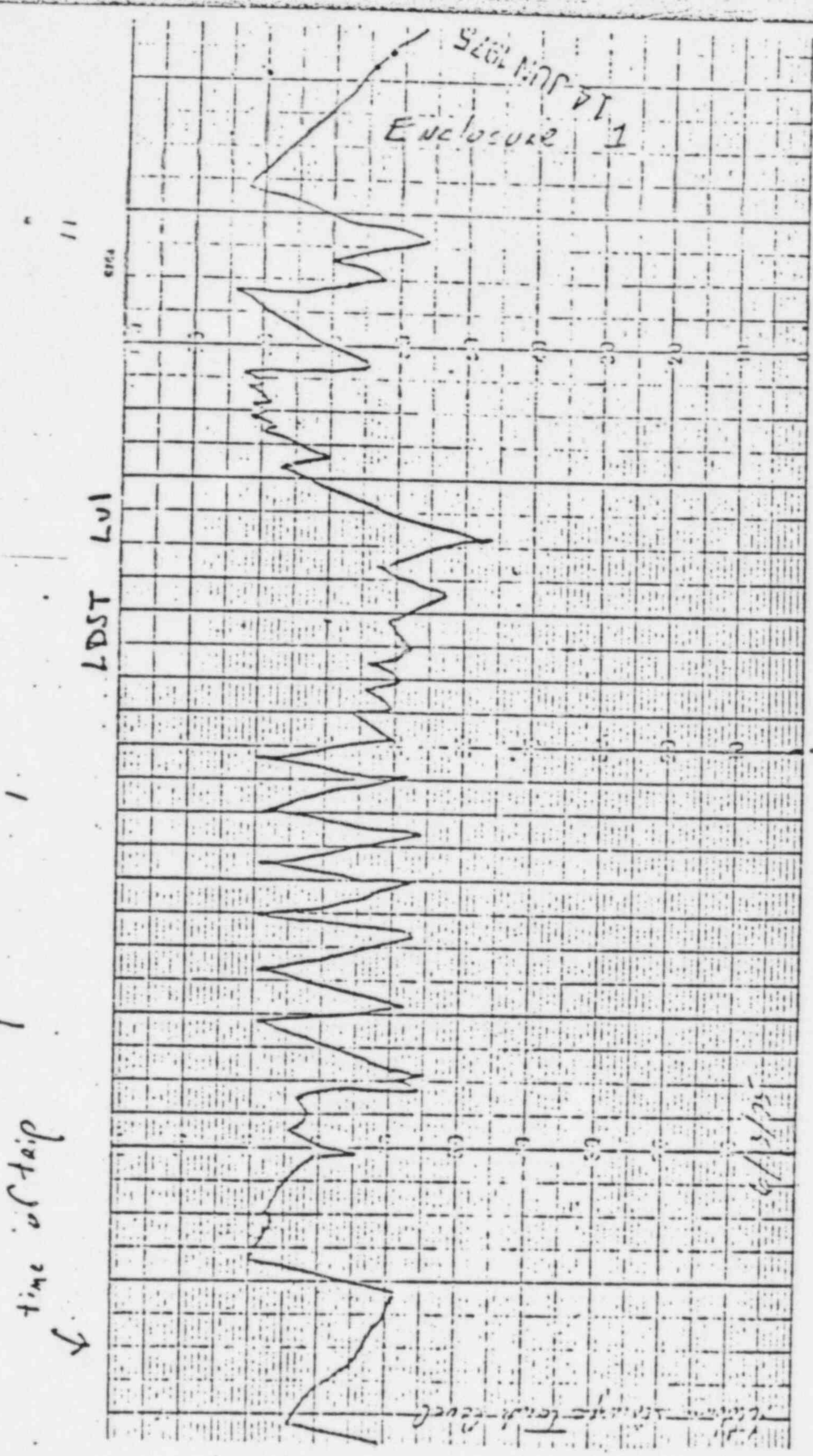

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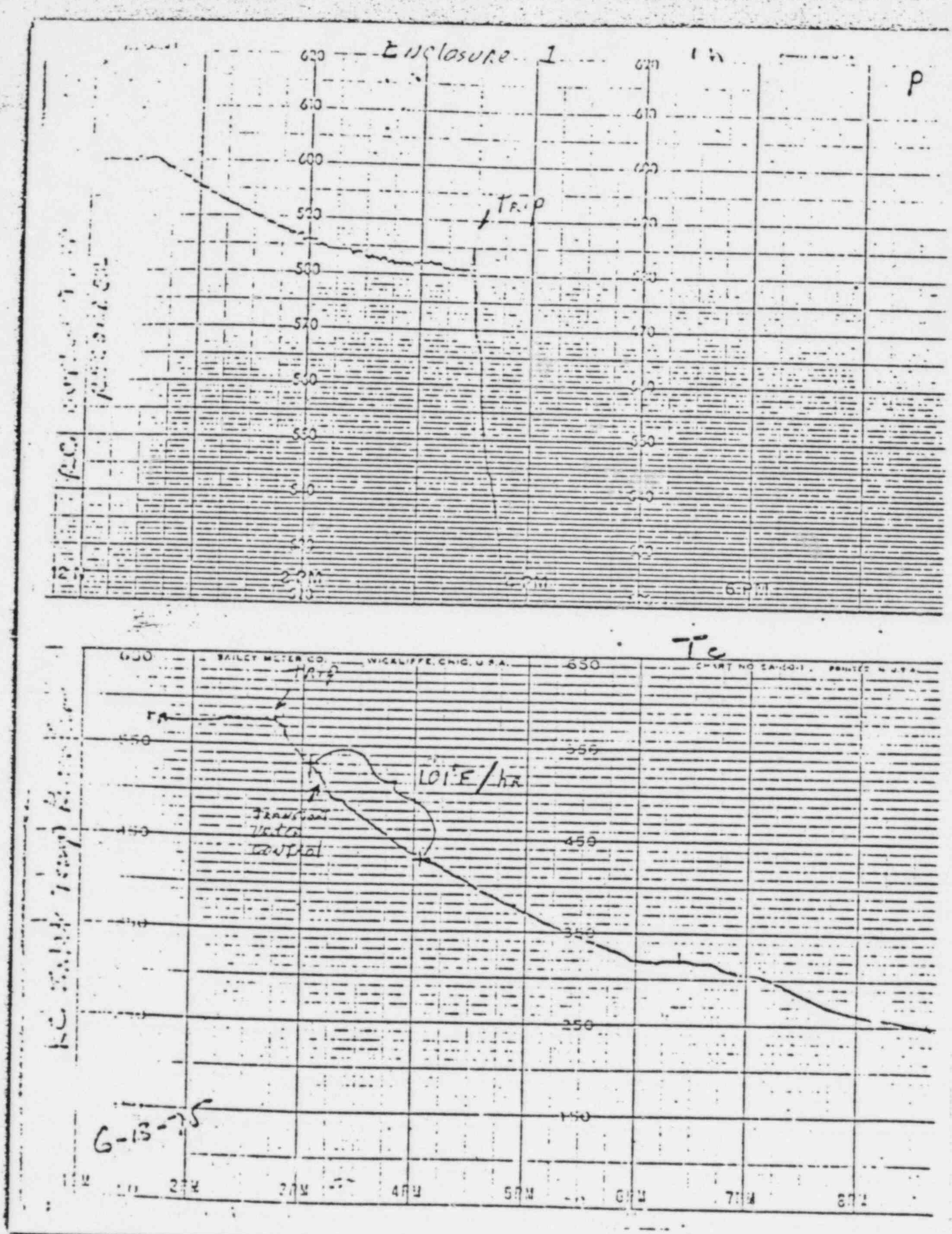
Enclosure 1
P
Trip
Tc
BAILEY METER CO.
WICKLIFFE, OHIO, U.S.A.
100°F/hr
Transient
Trip
6-13-75
2PM
3PM
4PM
5PM
6PM
7PM
8PM
650
550
450
350
250
150

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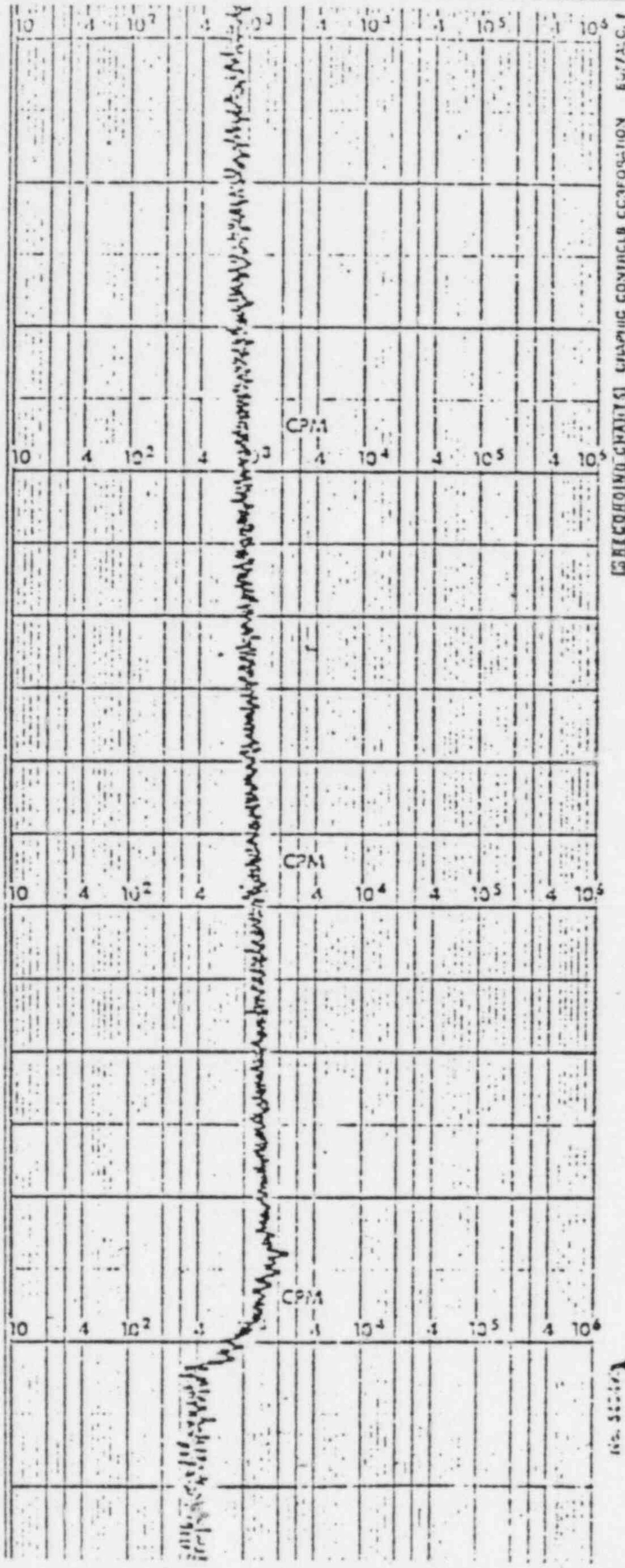
Enclosure 1

Q

RB Particulate Monitor

Radiation Trend Recorder



← Qrech Tank rupture disc blown

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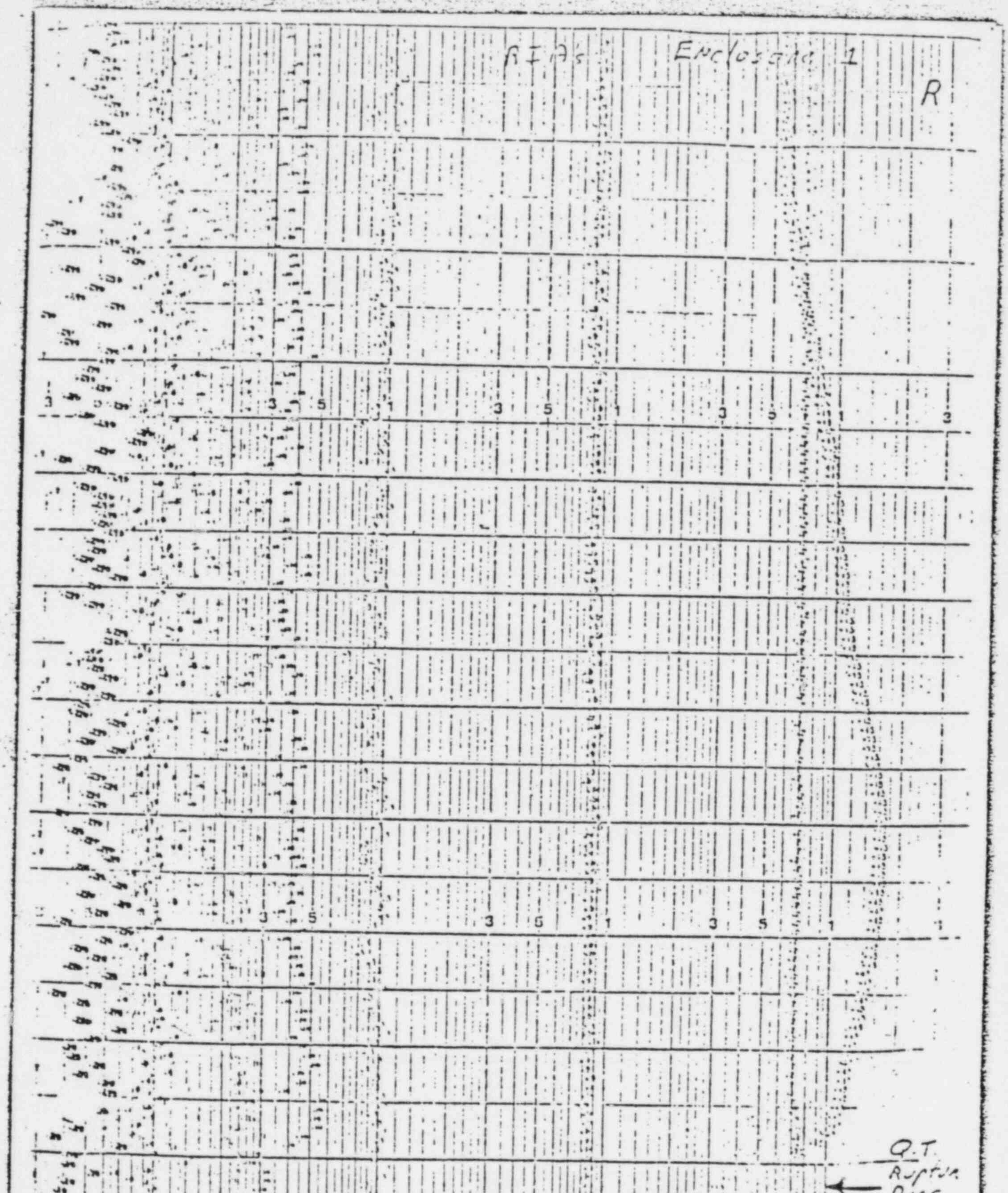

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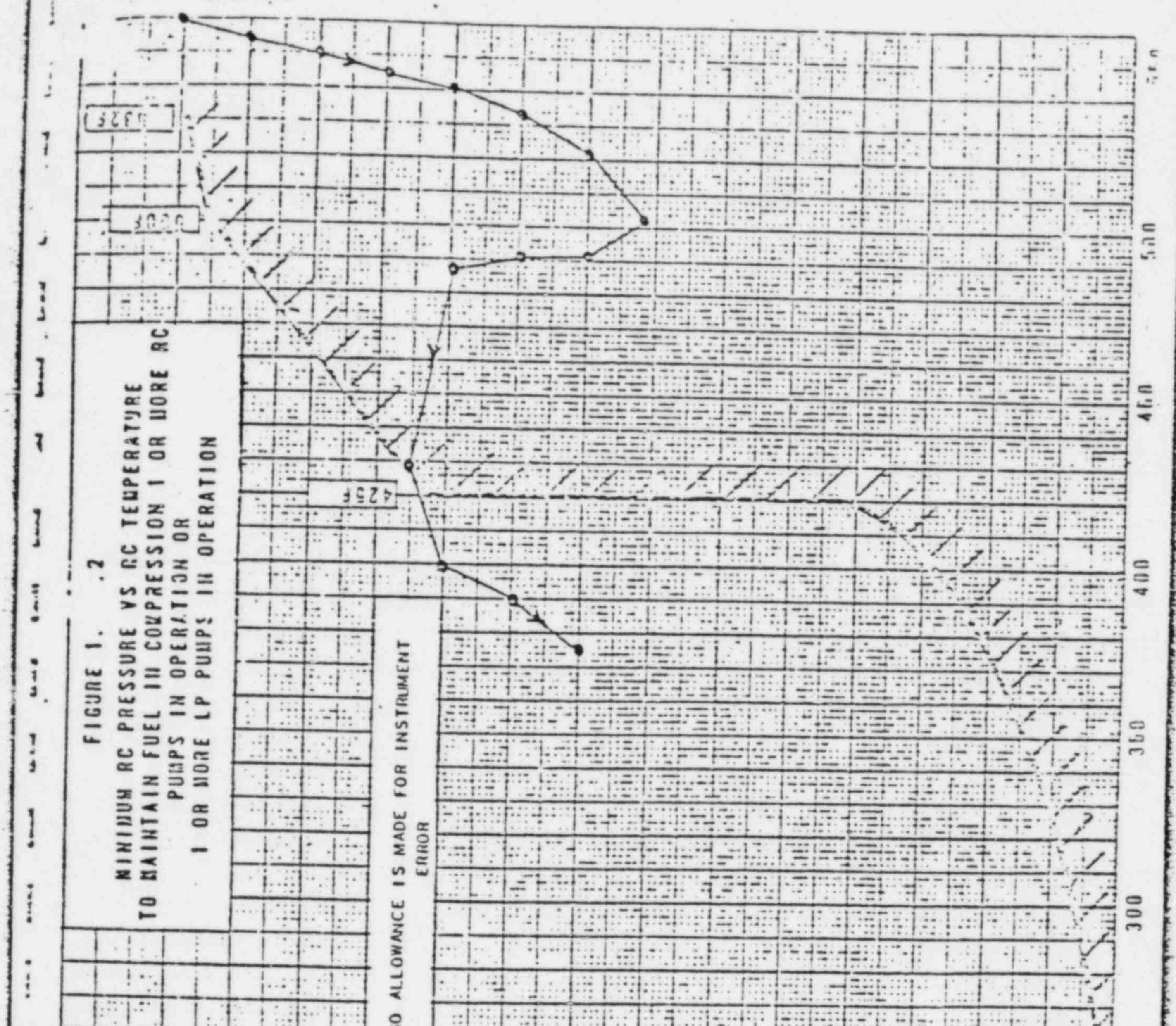
Enclosure 2

OUTSIDE OF LIMIT FOR 1 hr, 20 min

Fuel Compression Curve - Does not apply prior to power operation

A



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Enclosure 2

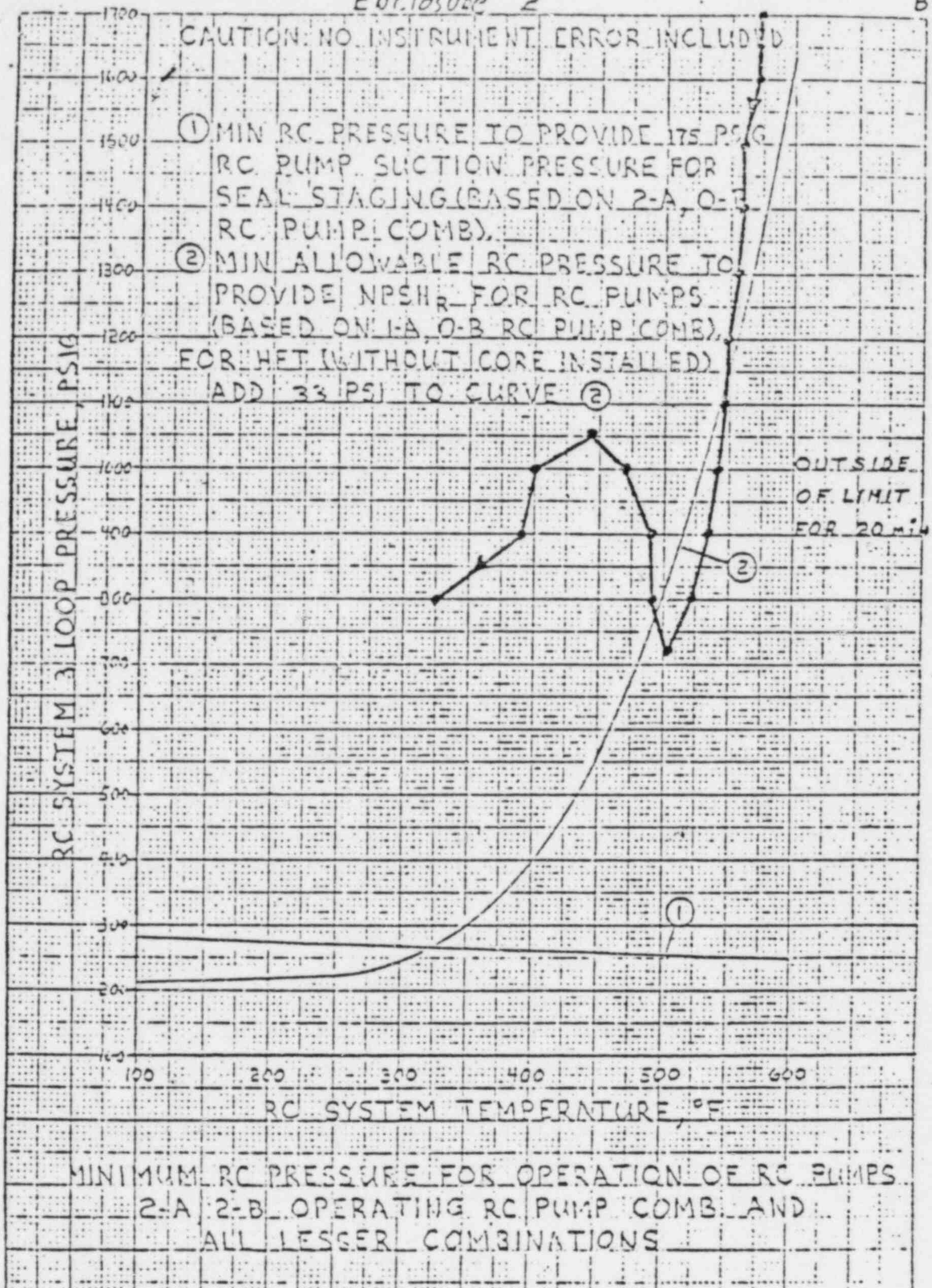

FIGURE 1.0-11.8

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SECTION I: STATION WORK REQUEST — EMERGENCY

DATE / TIME	APPROVED	AVAILABILITY: DATE AND TIME — OR — HRS. NOTICE	COMPLETE WORK BY: DATE / TIME

UNIT NO. — LOCATION — RED TAG REQD. YES NO — RWP REQD. YES NO

DESCRIPTION OF WORK REQUESTED: Check ... RC-66

(handwritten description largely illegible) ... indicator light.

CHECK THE CORRECT BOX: NON-SAFETY RELATED [ ] SAFETY RELATED [✓] ES COMPONENT [YES] [NO]

SECTION II: JOB NO. — * QC REQD. / QC NOT REQD. — *SEE SECTION VII

EQPT. NO. — TYPE — PROC'D. NO. MP/10/... E 23

WELDING/BURNING PERMIT [YES] [NO] RED TAG NO'S. — THRU — CHARGE TO ACCT #

SECTION III: JOB SEQUENCE DESCRIPTION

1. COMPLETE SECTION VIII (OVER) REQD. [ ] NOT REQD. [✓]	SKILL	MEN & HRS.	TOT. EST. M/H	ACTUAL M/H
Repair Valve.	Ent	1x8	8	
	E	1x8	8	
	MC	3x16	48	
TOTALS			64	

SECTION IV: MATERIALS DESCRIPTION

	QA TAG NO.	SEQ. NO.	QTY.	AVAILABLE YES	NO*
~~Pilot valve Disc~~	~~7053~~	~~LOT# 439-172~~	~~1~~	~~6-16-75~~	
(GASKET) Disc Retainer	7054	445-162	1	"	
Pilot valve Bush Gasket	7057	445-161	2	"	
Disc.	8983		1	-	
Flex... 1/4 60.C.O.		445-513	1		

PLANNED BY [signature] DATE 6/14/75 REQ. NO. — EST. DELIVERY — DATE

SECTION V: CLEARANCE TO BEGIN WORK ON OPER. EQUIP. [signature] OPER. REP. SIGNATURE — OR — OPER. REP. CONTACTED — CONTACTED BY — 6/15/75 DATE 0845 TIME

SECTION VI: ACTION TAKEN RWP NO. 533 Contact HP Before Work

1-Pilot valve Bushing QA 8983 6-16-75 Start

1-Inlet Gasket QA 8983 6-16-75

1-P.V. Bush Gasket QA 7056 6-16-75

JUMPERS, OPEN CIRCUITS, INSTRUMENT VALVES, EQUIPMENT CABINETS, AND/OR PIPING, RETURNED TO NORMAL

OPER. REPS. 1. [signature] 2. [signature] DATE: 6/20/75 TIME [illegible]

[signature]

JOB SUPERVISOR'S APPROVAL — DATE — ACCEPTED BY — DATE

PLANNING - EQUIP HISTORY FILE

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Enclosure 3

B

Repair of RC-66

6-15-75 Mechanics went to repair RC-66. We found that when you depress the solenoid plunger it stuck at the bottom of its travel which left the pilot valve open. Also, operating lever on the pilot valve was stuck open. The primary reason the solenoid plunger was stuck was due to the fact that the spring bracket was bent. We straighten the bracket and the solenoid plunger worked properly. The lever was ~~[illegible]~~ stuck due to heat expansion of boric acid crystals on lever pin, and rubbing of ~~[illegible]~~ lever against solenoid brackett. This problem was repaired when RC-66 was taken to hot machine shop for disassembly. The lever pin was removed and the rubbing surfaces were filed to give more clearance for the lever to operate. Also, surfaces were lubricated with [illegible].

6/16/75 RC-66 was taken to decon. room to be deconed. RC-66 could not be deconed below < 200 dpm so valve was taken to hot machine shop. Valve was disassembled and found pilot valve seats had ~~[illegible]~~ small

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steam cuts. New seat and disc were placed in the pilot valve. The two upper seat bushing gaskets were found missing during disassembly but were replaced during reassembly.
The main valve was disassembled and found disc had severely steam cuts and could not be used. The main valve seat was also severely cut.

6-17-75 & 6-18-75 These two days were spent lapping the main valve seat.

6-19-75 We blued the disc to seat and found disc needed to be machined.
The new disc was machined and after machining the seat and disc were blued again. This time the disc seated properly to the seat of the main valve. Then, the disc was lapped to seat. The valve was reassembled and taken to unit #3.
RC-66 was torqued back into line.

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