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ADDITIONAL INFORMATION REQUIRED FOR NRC STAFF GENERIC REPORT ON BOILING WATER REACTORS VOLUME 2

GENERAL ELECTRIC

8104020225

4. TABLES AND FIGURES

This section contains all of the tables and figures for Sections 2 and 3.

Table 2.1-1

SYSTEMS APPLICABLE TO PLANTS

	BWR Type	RCIC	Isolation Condenser	HPCS	HPCI	CS(LP)	LPCI	(2) RHR	Shutdown Cooling	Steam Condensate (Rx Standby)	Containment Spray/Supp. Pool Cooling	LPCI Loop Selection (Y=Yes; N=No	Feedwater Pump Type M=Motor T=Turbine	Feedwater Coolant Injection (1)	ADS & Pressure Relief Valves	CRD (3)
Dresden 1	1		X		(4)	X			X		X		M			X
Humboldt Bay 3	1		X			(5)	X		X		X	N	M	X	X	X
Big Rock Point	1		X			X			X(3)		X		M		X	X
Oyster Creek	2		X			X			X		X		M		X	X
Nine Mile Point	2		X			X			X		X		M/T	X	X	X
Dresden 2	3		X		X	X	X		X		X	Y	M		X	X
Dresden 3	3		X		X	X	X	X(1)	X		X	Y	M		X	X
Millstone	3		X			X	X		X		X	Y	M	X	X	X
Pilgrim	3	X			X	X		X			X	Y	M		X	X
Monticello	3	X			X	X		X			X	Y	M		X	X
Quad Cities 1	3	X			X	X		X			X	Y	M		X	X
Quad Cities 2	3	X			X	X		X			X	Y	M		X	X
Hatch 1	4	X			X	X		X		X	X	N	T		X	X
Hatch 2	4	X			X	X		X		X	X	N	T		X	X
Browns Ferry 1	4	X			X	X		X			X	N	T		X	X
Browns Ferry 2	4	X			X	X		X			X	N	T		X	X
Browns Ferry 3	4	X			X	X		X			X	Y	T		X	X
Vermont Yankee	4	X			X	X		X			X	N	M		X	X
Peach Bottom 2	4	X			X	X		X			X	N	T		X	X
Peach Bottom 3	4	X			X	X		X			X	N	T		X	X
Cooper	4	X			X	X		X		X	X	N	T		X	X
Duane Arnold	4	X			X	X		X		X	X	Y	M		X	X
Fitzpatrick	4	X			X	X		X		[illegible]	X	N	T		X	X
Brunswick 1	4	X			X	X		X		X	X	N	T		X	X
Brunswick 2	4	X			X	X		X		X	X	N	T		X	X
LaSalle 1	5	X		X		X		X		X	X	N	M/T		X	X
LaSalle 2	5	X		X		X		X		X	X	N	M/T		X	X
Zimmer	5	X		X		X		X		X	X	N	T		X	X
Shoreham	4	X			X	X	X	X		X	X	N	T		X	X
Fermi 2	4	X			X	X		X		X	X	Y	T		X	X
Grand Gulf 1	6	X		X		X		X		X	X	N	T		X	X
Grand Gulf 2	6	X		X		X		X		X	X	N	T		X	X
Handford 2	5	X		X		X		X		X	X	N	T		X	X
Susquehanna 1	4	X			X	X		X		X	X	N	T		X	X
Susquehanna 2	4	X			X	X		X		X	X	N	T		X	X

Comments

NOTE:

(1) These plants have containment/suppression cooling as part of the LPCI System and a seporate shutdown cooling system.

(2) The RHR system includes LPCI, shutdown cooling, steam condensing, containment spray, suppression pool cooling, as integrated systems for the plants where these systems are indicated to exist.

(3) Non Engineered Safety Feature, except Millstone's FWCI.

(4) Installation in process.

(5) Includes suppression pool cooling.

POOR ORIGINAL

Table 2.1-2a

SYSTEM DESIGN INFORMATION (BWR/2-5)

	System	1 Instruments and Equipment Affected by Containment Flooding	2 Direct or Indirect Indication of Valve Position (Note X-2)	3 Failed State of Each Valve (Note X-3)	4 Power Sources Required for System Operation
1.	RCIC	No	Direct	As is	DC (Note 1-4)
2.	Isolation Condenser	No	Direct	As is (Note 2-3)	DC
3.	HPCS	No	Direct	As is	On-site AC
4.	HPCI	No	Direct	As is	DC (Note 4-4)
5.	LPCS	No	Direct	As is	On-site AC
6.	LPCI	No	Direct	As is	On-site AC
7.	ADS	No	Indirect	Closed	DC
8.	SRV	No	Indirect	Closed	DC (Note 8-4)
9.	RHR - incl. shutdown, cooling, stm. cond., supp. pool cooling, cont. spray modes	No	Direct	As is	DC, On-site AC
10.	SSW	N/A	Direct	As is	On-site AC
11.	RBCCW	No	Direct	As is	On-site AC
12.	CRDS	No	Direct	Note 12-3	On-site AC
13.	CST	N/A	N/A	N/A	N/A
14.	Main Fd. Wtr. Sys.	N/A	Direct	Note 14-3	Normal AC (Note 14-4)
15.	Recirc. Pump/Motor Cooling Sys.	No	Direct	As is	On-site AC

Table 2.1-2a (Continued)

SYSTEM DESIGN INFORMATION (BWR/2-5)

	System	8 Auxiliary Systems Required for Operation	9a Automatic Startup Logic	9b Power Source
		X-8	Note X-9a	
1.	RCIC	None (Note 1-8)	Lo Level H_2O, 1x2x2	DC
2.	Isolation Condenser	None (Note 2-8)	Lo Level H_2O, 1x2x2 Hi Pres., 1x2 or 1x2x2	DC
3.	HPCS	None (Note 3-8)	Lo Level H_2O, 1x2x2 Hi Drywell, 1x2x2	DC
4.	HPCI	None (Note 4-8)	Lo Level H_2O, 1x2x2 Hi Drywell Pres., 1x2x2 (Nine Mile Pt. Turbine Trip 1x2x2)	DC
5.	LPCS	None (Note 5-8)	Lo Level H_2), 1x2x2 Hi Drywell Pres., 1x2x2	DC
6.	LPCI	None (Note 6-8)	Lo Level H_2O, 1x2x2 Hi Drywell Pres., 1x2x2	DC
7.	ADS	None	Lo Level H_2O, 2x2 or 2x2 Hi Drywell Pres., 2x2 or 2x2 (Note 7-9a)	DC
8.	SRV	None	N/A	N/A
9.	RHR - incl. shutdown, cooling, stm. cond., supp. pool cooling, cont. spray modes	RHR service water, RBCCW (Note 9-8)	N/A (Note 9-9a)	N/A
10.	SSW	Service water	N/A	N/A
11.	RBCCW	Service water	N/A	
12.	CRDS	Turbine or Reactor BCCW	N/A	N/A
13.	CST	None	N/A	N/A
14.	Main Fd. Wtr. Sys.	Condensate, TBCCW, Service Water, Feed Pump Ventilation System	N/A	N/A
15.	Recirc. Pump/Motor Cooling Sys.	RBCCW	N/A	N/A

Table 2.1-2a (Continued)

SYSTEM DESIGN INFORMATION (BWR/2-5)

	System	10 Auto Initiation Built In Time Delay	11 Manual Initiation of the Sys. Done in the Control Room What Actions Reqd. & How Long They Take	12 ECCS Initiation Signals Override All Other Modes of Operation Note X-12	13 Action Performed by the Operator for System Operation & Control After Initiation of the System Within 2 Hours
1.	RCIC	No	Yes	Yes	None (Note 1-13)
2.	Isolation Condenser	Yes (Note 2-10)	Yes	Yes	None (Note 2-13)
3.	HPCS	No	Yes	Yes	None (Note 3-13)
4.	HPCI	No	Yes	Yes	None (Note 4-13)
5.	LPCS	Note 5-10	Yes	Yes	None (Note 5-13)
6.	LPCI	Note 6-10	Yes	Yes (Note 6-12)	None (Note 6-13)
7.	ADS	Yes (Note 7-10)	Yes	Yes	None
8.	SRV	N/A	Yes	N/A	N/A
9.	RHR - incl. shutdown, cooling, stm. cond., supp. pool cooling, cont. spray modes	N/A	Yes	Yes	N/A (Note 9-9a)
10.	SSW	N/A	Yes	N/A	N/A
11.	RBCCW	N/A	Yes	N/A	N/A
12.	CRDS	N/A	Yes	N/A	N/A
13.	CST	N/A	Yes	N/A	N/A
14.	Main Fd. Wtr. Sys.	N/A	Yes	N/A	N/A
15.	Recirc. Pump/Motor Cooling Sys.	N/A	Yes	N/A	N/A

Table 2.1-2a (Continued)

SYSTEM DESIGN INFORMATION (BWR/2-5)

	System	15a Primary Water Source	15b Total Gallons	15c Dedicated Capacity, Cals.	16a Secondary and Backup Water Sources
1.	RCIC	CST	700K to 100K	135K to 37K	Suppression Pool
2.	Isolation Condenser	Demineralized water or CST	63K to 21K	56K to 11K	CST or firewater
3.	HPCS	CST	700K to 200K	135K to 75K	Suppression Pool
4.	HPCI	CST (Note 4-15a)	550K to 100K	225K to 75K	Suppression Pool
5.	LPCS	Suppression Pool	965K to 500K	965K to 500K	CST
6.	LPCI	Suppression Pool	965K to 500K	965K to 500K	CST or SSW
7.	ADS	N/A	N/A	N/A	N/A
8.	SRV	N/A	N/A	N/A	N/A
9.	RHR - incl. shutdown, cooling, stm. cond., supp. pool cooling, cont. spray modes	(Note 9-15a)	965K to 500K	965K to 500K	Note 9-16a
10.	SSW	Ponds, rivers, lakes, oceans	Infinite	N/A	N/A
11.	RBCCW	Closed loop	N/A	N/A	N/A
12.	CRDS	CST or condensate reject	Continuous	Continuous	N/A
13.	CST	N/A	N/A	N/A	Demin. water
14.	Main Fd. Wtr. Sys.	Condensate system	N/A	CST	N/A
15.	Recirc. Pump/Motor Cooling Sys.	Closed loop	N/A	N/A	N/A

Table 2.1-2a (Continued)

SYSTEM DESIGN INFORMATION (BWR/2-5)

	System	16b Backup Source Auto/Manual (Note X-16b)	16c Backup Source Proceduralized	16d Backup Source Time Reqd. for Manual Operation (Note X-16d)	17a Strainers in System (Note X-17a)
1.	RCIC	Man	Yes	≤30 min	Yes
2.	Isolation Condenser	Man	Yes	≤30 min	No
3.	HPCS	Man	Yes	≤30 min	Yes
4.	HPCI	Auto or Man	Yes	≤30 min	Yes
5.	LPCS	Man	Yes	≤45 min	Yes
6.	LPCI	Man	Yes	≤30 min	Yes
7.	ADS	N/A	N/A	N/A	N/A
8.	SRV	N/A	N/A	N/A	N/A
9.	RHR - incl. shutdown, cooling, stm. cond., supp. pool cooling, cont. spray modes	Man	Yes	≤30 min	Yes
10.	SSW	N/A	N/A	N/A	Yes
11.	RBCCW	N/A	N/A	N/A	N/A
12.	CRDS	N/A	N/A	N/A	No
13.	CST	Man	Yes	≤30 min	No
14.	Main Fd. Wtr. Sys.	Auto	N/A	N/A	Yes (Note 14-17a)
15.	Recirc. Pump/Motor Cooling Sys.	N/A	N/A	N/A	N/A

Table 2.1-2a (Continued)

SYSTEM DESIGN INFORMATION (BWR/2-5)

	System	17b Strainer Location	17c Strainer Size	18 Number of Power Source Trains	22 Can the System be Operated From Control Rm.	23 Do the Alarms in the Control Room Give the Operator the Sys. Status?
1.	RCIC	Suppression Pool Suction	Coarse	One	Yes	Yes
2.	Isolation Condenser	N/A	N/A	Note 2-18	Yes	Yes
3.	HPCS	Suppression Pool Suction	Coarse	Two	Yes	Yes
4.	HPCI	Suppression Pool Suction	Coarse	One (Note 4-18)	Yes	Yes
5.	LPCS	Suppression Pool Suction (Note 5-17b)	Coarse	Two	Yes	Yes
6.	LPCI	Suppression Pool Suction	Coarse	Two	Yes	Yes
7.	ADS	N/A	N/A	Two	Yes	Yes
8.	SRV	N/A	N/A	N/A	Yes (Note 8-22)	Yes
9.	RHR - incl. shutdown, cooling, stm. cond., supp. pool cooling, cont. spray modes	Suppression Pool Suction (Note 9-17b)	Coarse	Two	Yes	Yes
10.	SSW	Pump Suction and Discharge (Note 10-17b)	Coarse	Two	Yes	Yes
11.	RBCCW	N/A	N/A	Two	Yes	Yes
12.	CRDS	N/A	N/A	Two	Yes	Yes
13.	CST	N/A	N/A	N/A	No	Yes
14.	Main Fd. Wtr. Sys.	N/A	Coarse	One (Note 4-18)	Yes	Yes
15.	Recirc. Pump/Motor Cooling Sys.	N/A	N/A	Two	Yes	Yes

Table 2.1-2a (Continued)

SYSTEM DESIGN INFORMATION (BWR/2-5)

	System	24 Are Sys. Flow Paths Indicated in the Control Rm. (Note X-24)	25 Remote Control Panels (Note X-25)	26 Methods for Detecting/Leaking Safety/Relief Valves
1.	RCIC	Yes	No	-
2.	Isolation Condenser	Yes	No	-
3.	HPCS	Yes	No	-
4.	HPCI	Yes	No	-
5.	LPCS	Yes	No	-
6.	LPCI	Yes	No	-
7.	ADS	Yes	No	Discharge Temp. Sensor (Note 7-22)
8.	SRV	Yes	No	Discharge Temp. Sensor (Note 7-22)
9.	RHR -incl. shut-down, cooling, stm. cond., supp. pool cooling, cont. spray modes	Yes	No	-
10.	SSW	Yes	No	-
11.	RBCCW	Yes	No	-
12.	CRDS	Yes	No	-
13.	CST	Yes	No	-
14.	Main Fd. Wtr. Sys.	Yes	No	-
15.	Recirc. Pump/Motor Cooling Sys.	Yes	No	-

Table 2.1-2a (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

	System	28a Is the Method of Verification of Correct Test Lineup and Restoration to Normal Condition Proceduralized? Note X-28a	28b Is There an Independent Verification Note X-28b	29 Is There System and and Component Testing Following Maintenance?	30 Aside from Those Sys. Normally In-Service Identify Any Component Not Normally Tested
1.	RCIC	Yes		Yes	None
2.	Isolation Condenser	Yes		Yes	None
3.	HPCS	Yes		Yes	None
4.	HPCI	Yes		Yes	None
5.	LPCS	Yes		Yes	None
6.	LPCI	Yes		Yes	None
7.	ADS	Yes		Yes	None
8.	SRV	Yes		Yes	None
9.	RHR - incl. shutdown, cooling, stm. cond., supp. pool cooling cont. spray modes	Yes		Yes	Note 9-30
10.	SSW	Yes		Yes	Note 10-30
11.	RBCCW	N/A		Yes	N/A
12.	CRDS	N/A		Yes	N/A
13.	CST	N/A		Yes	N/A
14.	Main Fd. Wtr. Sys.	N/A		Yes	N/A
15.	Recirc. Pump/Motor Cooling Sys.	N/A		Yes	N/A

NOTES FOR TABLE 2.1-2a

X-2 See typical drawings (Figures 2.1-1 and following) in which normal valve positions for power operation are generally depicted. Main flow path valves without indication are maintained in their appropriate positions during power operation by administrative procedures. Zimmer and LaSalle have valve stem indication for ADS.

X-3 Air operated valves fail in the safe direction.

X-8 This question refers to cooling system components.

X-9a Reactor low pressure and Lo H_2O level or reactor Lo pressure and Hi drywell pressure are required for LPCS and LPCI injection. In some cases, low reactor pressure is required for LPCS and LPCI pump start.

X-12 Logic system functional tests and surveillance testing of systems may impede systems from auto initiating but must be performed in many plants by Technical Specifications.

X-16b Some backup sources are automatic.

X-16d Times for manual actuation of backup water vary from 1.5 minutes to 45 minutes.

X-17a Answers are for strainers only. The CRDS system contains filters/strainers and the feedwater trains have condensate demineralizers.

X-24 Several plants have manual valves with only indirect indication and are administratively locked in the appropriate positions.

X-25 Some plants have remote shutdown control panels. Other plants have procedure to shut down from outside the control room.

NOTES FOR TABLE 2.1-2a (Continued)

X-28a	Not applicable answers means that system is normally in service and not tested during power operation.
X-28b	Some plants perform independent verification by review of completed procedures, others do physical verifications.
1-4 4-4 14-4	Some plants require on-site AC power for small break protection. Prolonged operation of RCIC and HPCI can require AC powered space coolers.
1-8	Long term operation may require space cooling.
1-13	RCIC flow is manually controlled once level recovers. If RCIC trips, turbine must be reset locally.
2-3	Return valve fails open at Nine Mile Point-1.
2-8	Long term operation may require makeup water.
2-10	Nine Mile-10 secs., Oyster Creek-3 secs., others-15 secs.
2-13	Some plants will require manual makeup.
2-18	Return valves are DC powered, BWR 2's have 2 trains, BWR 3's have one train.
3-8	Long term operation may require space cooling.
3-13	Once level recovers, HPCS is throttled.
4-4	See 1-4.
4-8	Long term operation may require space cooling.

NOTES FOR TABLE 2.1-2a (Continued)

4-13, 5-13, 6-13 HPCI, LPCS, and LPCI flows are manually controlled once level recovers.

4-15a Some plants treat the CST and the condenser hotwell as primary source.

4-18 FWCI plants have two trains.

5-8, 6-8, 9-8 Long term operation may require space cooling; some plants require lube oil and seal cooling.

5-10, 6-10 Many plants provide for minimizing in-rush tripping of breakers by sequencing the closing of low pressure pump breakers onto safety buses. The maximum delay time is 25 seconds.

5-13 See 4-13.

5-17b Some plants have strainers in the core spray lines.

6-8 See 5-8.

6-10 See 5-10.

6-12 LPCI injection overrides all other modes automatically except shutdown cooling in some plants.

6-13 See 4-13.

7-9a Need both signals for most plants plus one core spray or one RHR pump running for ADS auto initiation. In addition, BWR/4 & 5 plants need a confirmatory low level signal in the tripped logic train for ADS initiation.

NOTES FOR TABLE 2.1-2a (Continued)

7-10 Range on ADS time delay is 105 secs to 125 secs.

7-22 Some plants have diverse means of leak detection.

8-4 Target Rock valves-none required. Electromatics require DC.

8-22 Safety/relief valves can be operated from the control room, safety valves lift automatically on high pressure.

9-8 See 5-8.

9-9a BWR 2's have automatic initiation of containment spray.

9-15a Source of water for containment spray is suppression pool, all other modes are recirculation modes.

9-16a Some plants can get suction for containment spray from the CST, others require standby service water or suppression pool cooling water.

9-17b Some plants have strainers in the containment spray lines.

9-30 All system components are normally tested except for those that have low pressure interlocks.

10-17b Some plants have service water screens and others have strainers.

10-30 Those plants which have separate emergency water systems, test them, those plants with a common service water system normally have the system in service. Emergency cross tie valves for standby coolant are not normally tested.

12-3 Scram inlet and discharge valves fail open, flow control valves fail closed.

NOTES FOR TABLE 2.1-2a (Continued)

14-3 Feedwater regulating fail as is on loss of air and signal.

14-4 Se.

14-17a Some plants have coarse strainers in the condensate pump suction lines.

The information in Table 2.1-2a applies to Fermi 2, Grand Gulf 1/2, Hanford 2, and Susquehanna 1/2 as modified by the following notes. The notes are numbered by the system number - column number of Table 2.1-2a.

X-25 (General note - Remote Control Panels) Some plants can control RCIC, LPCI, SRV's RHR, SSW, and CRD pumps from the remote shutdown panel

1-15C (RCIC and HPCS - Dedicated Capacity) maximum capacity is 170K.
3-15C

3-18 (HPCS - Number of power Train Sources) - Single Division HPCS for BWR/6

5-8 (LPCS, LPCI, RHR - Auxiliary Systems Required for Operation)
6-8 Some plants also require motor cooling.
9-8

5-15b, c (LPCI, LPCI, RHR - Total Gallons & Dedicated Capacity) - Maximum
6-15b, c capacity is 1020K.
9-15b, c

5-16a (LPCS - Secondary and Backup Water Sources) - BWR/6 plants may use upper containment building pool water.

10-9a (SSW - Automatic Startup Logic) Some plants have DC powered automatic startup on low water level, Hi drywell pressure, RHR pump start, LPCS pump start, diesel generator start, or RCIC turbine start.

BRP - Big Rock Point
HB - Humboldt Bay
D-1 - Dresden Unit 1

Table 2.1-2b

SYSTEM DESIGN INFORMATION (BWR/1)

	System	1 Instruments and Equipment Affected by Containment Flooding	2 Direct or Indirect Indication of Valve Position (Note X-2)	3 Failed State of Each Valve
1.	RCIC	N/A	N/A	N/A
2.	Isolation Condenser	No	Direct	As is
3.	HPCI (D-1 only)	No	Direct	As is
4.	FWCI (HB & D-1)	No	D-1 Direct HB Direct, flow CV indirect	As is, D-1 open
5.	LPCS	No	Direct	As is, HB Bypass valve closed
6.	LPCI (HB only)	No	Direct	As is or open
7.	ADS	No	BRP direct & indirect D-1 & HB - indirect	BRP Note 7-3 HB closed D-1 open
8.	SRV	No	N/A	Spring operated N/A
9.	RHR - incl.			
	A. shutdown clg	BRP - Yes HB, D-1; No	HB - Flow CV none HB others, D-1 BRP direct	HB - flow CV - open HB others & BRP as is
	B. cleanup (HB only)	No	HB flow CV indirect HB & others BRP direct	HB Note 9B-3
	C. suppression pool clg mode LPCS	No	Direct	HB bypass v!v closed HB others & BRP - as is
	D. containment spray (BRP & D-1)	No	Direct	As is
10.	SWS (BRP & HB)	N/A	None	Manual
11.	CCW	BRP - Yes HB-N/A D-1 - No	Flow CV indirect Others - None	Flow CV-Open Others - Manual
12.	CRDS	D-1, BRP-Yes HB-N/A	Cooling vlvs - None Scram vlvs - direct	Note 12-3
13.	CST	N/A	N/A	N/A
14.	Main Fd. Wtr. Sys.	N/A	Flow CV indirect HB - Mov Direct	As is
15.	Recirc. Pump/ Motor Cooling Sys. (BRP and D-1)	Yes	BRP - None D-1 - indirect	BPP - Manual D-1 - as is

Table 2.1-2b (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

System	4 Power Sources Required for System Operation	8 Auxiliary Systems Required for Operation	9a Automatic Startup Logic (Note X-9A)
1. RCIC	N/A	N/A	N/A
2. Isolation Condenser	DC	No (Note 2-8)	BRP Hi press 1x2x2 HB Hi press 1x2 & ADS 1x2
3. HPCI (D-1 only)	DC/on site AC	Includes own HVAC & service water	D-1 Lo drum level, Hi Rx press, Hi cont press, & MSIV closure 1x2x2 Lo drum level or hi cont press 1x2x2
4. FWCI (HB & D-1)	HB on site AC D-1 off site AC	HB CCW, air, SWS, Condensate D-1 condensate & air	Continuously in service D-1 N/A
5. LPCS	HB on site AC BRP-DC & on site AC	No	BRP-Lo level 1 of 2 HB-Lo level, Hi Drywell Press, MS Break 1x2x2
6. LPCI (HB only)	On site AC	No	Same as LPCS
7. ADS	HB-DC or on site AC BRP-DC	No Yes, fire sys. press.	BRP-Lo drum level, Lo Rx level, Fire hdr press 2/4 HB-Lo level & Hi drywell press 1 & 1
	D-1 on site AC	No	D-1 N/A
8. SRV	None	N/A	N/A
9. RHR - incl.			
A. shutdown clg	On site AC/D-1 off site AC	CCW & Air	N/A
B. cleanup HB only	On site AC	CCW	N/A
C. suppression pool clg mode LPCS	On site AC	HB Note 9C-8	N/A
D. containment spray BRP & D-1	BRP DC & on site AC D-1 off site AC	D-1, BRP-fire water Fire water	BRP-Hi cont pressure 1 of 2 D-1 N/A
10. SWS (BRP & HB)	BRP-normal AC HB-on site AC	No	N/A
11. CCW	BRP-normal AC D-1, HB-on site AC	D-1, BRP-SWS HB-SWS or fire water	N/A
12. CRDS	BRP-normal AC D-1, HB-on site AC	No	N/A
13. CST	N/A	No	N/A
14. Main Fd. Wtr. Sys.	BRP-normal AC D-1, HB-on site AC	Condensate, SWS, CCW (D-1 & HB only), Air	N/A
15. Recirc. Pump/Motor Cooling Sys. (BRP and D-1)	Normal AC, D-1 off site AC also	CCW	N/A

Table 2.1-2b (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

	System		9b Power Source	10 Auto Initiation Built in Time Delay	11 Manual Initiation of the Sys. Done in the Control Rm. What Actions Reqd. & How Long They Take (Note X-11)	12 ECCS Initiation Signals Override All Other Modes of Operation
1.	RCIC		N/A	N/A	N/A	N/A
2.	Isolation Condenser	BRP HB & D-1	AC DC	No No	Yes Yes	Yes Yes
3.	HPCI		DC	No	Yes	Yes
4.	FWCI (HB & D-1)		N/A	N/A	Yes	HB Continuously in service D-1 N/A
5.	LPCS	BRP & D-1 HB	DC DC or AC	No	Yes	BRP-Note 5-12 D-1 & HB-Yes
6.	LPCI (HB only)		DC or AC	No	Yes	Yes
7.	ADS	BRP & D-1 HB	DC DC or AC	BRP 2 minutes HB 1 minute D-1 N/A	Yes	BRP-Note 7-12 D-1 N/A
8.	SRV		None	N/A	N/A	N/A
9.	RHR - incl.					
	A. shutdown clg		N/A	N/A	Note 9A-11	N/A
	B. cleanup (HB only)		N/A	N/A	Yes	N/A
	C. suppression pool clg mode LPCS		N/A	N/A	Note 9C-11	Yes
	D. containment spray (BRP only)		BRP DC D-1 N/A	BRP 15 min D-1 N/A	Yes HB-Yes	D-1 & BRP-No
10.	SWS (BRP & HB)		N/A	N/A	Note 10-11	N/A
11.	CCW		N/A	N/A	D-1 & BRP-Yes HB-Local pump start 2 min.	N/A
12.	CRDS		N/A	N/A	Yes	N/A
13.	CST		N/A	N/A	N/A	N/A
14.	Main Fd. Wtr. Sys.		N/A	N/A	Yes	N/A
15.	Recirc. Pump/Motor Cooling Sys. (BRP&D-1)		N/A	N/A	Yes	N/A

Table 2.1-2b (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

	System	13 Action Performed by the Operator for System Operation & Control After Initiation of the System (up to 2 hrs)	15a Primary Water Source	15b Total Gals.	15c Dedicated Capacity Cals.
1.	RCIC	N/A	N/A	N/A	N/A
2.	Isolation Condenser	None	Demin water	5K-30K	8000-30,000
3.	HPCI (D-1 only)	Manual control when level recovers	HPCI storage tank	200K	None
4.	FWCI (HB & D-1)	HB-Yes, regulate flow & turn off when drywell is flooded. D-1-N/A	Condensate Hotwell or CST	HB 6000 Note 4-15b D-1 N/A	HB 2800 Note 4-15c D-1 50K
5.	LPCS	D-1-Manual control when level recovers	Lake or River HB-Supp. pool	Infinite HB-167K	N/A HB-167K
6.	LPCI (HB only)	Yes, turn off when drywell is flooded	Raw water tank	300K	200K
7.	ADS	None	N/A	N/A	N/A
8.	SRV	N/A	N/A	N/A	N/A
9.	RHR - incl.				
	A. shutdown clg	N/A	Closed Loop	N/A	N/A
	B. cleanup (HB only)	N/A	Closed Loop	N/A	N/A
	C. suppression pool clg mode LPCS	N/A	Closed Loop	N/A	N/A
	D. containment spray (BRP only)	N/A D-1 Note 9d-13	Lake or River	Infinite	N/A
10.	SWS (BRP & HB)	N/A	Bay or Lake	Infinite	N/A
11.	CCW	N/A	Closed Loop N/A	N/A	N/A
12.	CRDS	N/A	CST or condensate	Continuous	Continuous
13.	CST	N/A	N/A	25 to 200K	None
14.	Main Fd. Wtr. Sys.	N/A	Condensate system	N/A	N/A
15.	Recirc. Pump/Motor Cooling Sys. (BRP&D-1)	N/A	Closed system	N/A	N/A

Table 2.1-2b (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

System	16a Secondary and Backup Water Sources	16b Backup Source Auto/Manual	16c Backup Source Proceduralized	16d Backup Source Time Reqd. for Manual Operation	17a Strainers in System (Note X-17a)
1. RCIC	N/A	N/A	N/A	N/A	N/A
2. Isolation Condenser	Demin, fire water, or CST	Manual	Yes	10 min 10 min; 1 hr, 2 hr	No
3. HPCI (D-1 only)	N/A	N/A	N/A	N/A	No
4. FWCI (HB&D-1 only)	HB-CST and firewater D-1 N/A	Auto & Manual (Note 4-16b)	Yes	2 min/15 min	No
5. LPCS	BRP & D-1-None HB-Fire Water Makeup	N/A Manual	N/A Yes	N/A 15 min	Yes Yes
6. LPCI (HB only)	a. 2 wells b. Bay	Manual Manual	Yes No	15 min 1 hour	No
7. ADS	N/A	N/A	N/A	N/A	N/A
8. SRV	N/A	N/A	N/A	N/A	N/A
9. RHR - incl.					
A. shutdown clg	N/A	N/A	N/A	N/A	No
B. cleanup (HB only)	N/A	N/A	N/A	N/A	Yes
C. suppression pool clg mode LPCS	N/A	N/A	N/A	N/A	Yes
D. containment spray (BRP only)	None	N/A	N/A	N/A	Yes
10. SWS (BRP & HB)	N/A	N/A	N/A	N/A	Yes
11. CCW	N/A	N/A	N/A	N/A	No
12. CRDS	N/A	N/A	N/A	N/A	No
13. CST	BRP-Demin water HB-Fire & Demin water	Manual	Yes	10 min	No
14. Main Fd. Wtr. Sys.	CST	Auto	N/A	N/A	No
15. Recirc. Pump/Motor Cooling Sys. (BRP&D-1)	N/A	N/A	N/A	N/A	No

Table 2.1-2b (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

System	17b Strainer Location	17c Strainer Size	18 Power Source Number of Trains	22 Can the System be Operated From the Control Room
1. RCIC	N/A	N/A	N/A	N/A
2. Isolation Condenser	N/A	N/A	one DC	Yes
3. HPCI	N/A	N/A	Two	Yes
4. FWCI (HB & D-1)	N/A	N/A	HB-two, D-1-one	Yes
5. LPCS	Pump suction and/or discharge	coarse	two	Yes
6. LPCI (HB only)	N/A	N/A	two	Yes
7. ADS	N/A	N/A	BRP-one/HB-three/D-1-N/A	Yes
8. SRV	N/A	N/A	N/A	N/A
9. RHR - incl.				
A. shutdown clg	N/A	N/A	D-1, BRP-one/HB-two	Yes/BRP Note 9a-22
B. cleanup (HB only)	Rx suction	coarse	two	Yes
C. suppression pool cooling mode LPCS	Pump suction	coarse	BRP-one/HB-two D-1-two	Yes
D. containment spray (BRP only)	Pump suction & discharge	coarse	two	Yes
10. SWS (BRP & HB)	Pump suction & discharge	coarse	BRP-one/HB-two	No
11. CCW	N/A	N/A	D-1, BRP-one/HB-two	Yes/HB-No
12. CRDS	N/A	N/A	BRP-one/HB & D-1-two	Yes
13. CST	N/A	N/A	N/A	N/A
14. Main Fd. Wtr. Sys.	N/A	N/A	D-1, BRP-one/HB-two	Yes
15. Recirc. Pump/Motor Cooling Sys. (BRP&D-1)	N/A	N/A	One	Yes

Table 2.1-2b (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

System	23 Do the Alarms in the Control Room Give the Operator the Sys. Status?	24 Are Sys. Flow Paths Indicated in the Control Rm.	25 Remote Control Panels (Note X-25)	26 Methods for Detecting Leaking Safety/Relief Valves
1. RCIC	N/A	N/A	N/A	
2. Isolation Condenser	yes	yes	no	
3. HPCI	yes	yes	yes	
4. FWCI (HB & D-1 only)	yes	yes	no	
5. LPCS	yes	yes	no	
6. LPCI (HB only)	yes	yes	no	
7. ADS	yes	yes	no	discharge temp sensor
8. SRV	yes	yes	no	discharge temp. sensor
9. RHR - inc.				
A. shutdown clg.	yes	yes	no	
B. cleanup (HB-only)	yes	yes	no	
C. suppression pool cooling mode LPCS	yes	yes	no	
D. containment spray (BRP only)	yes	yes	no	
10. SWS (BRP & HB)	yes	yes	no	
11. CCW	yes	yes	no	
12. CRDS	yes	yes	no	
13. CST	yes	yes	no	
14. Main Fd. Wtr. Sys.	yes	yes	no	
15. Recirc. Pump/Motor Cooling Sys. (BRP & D-1)	yes	yes	no	

Table 2.1-2b (Continued)

SYSTEM DESIGN INFORMATION (BWR/1)

System	28a Is the Method of Verification of Correct Test Lineup and Restoration to Normal Condition Proceduralized? Note X-28a	28b Is There an Independent Verification Note X-28b	29 Is There System and Component Testing Following Maintenance?	30 Aside from Those Sys. Normally In-Service Identify Any Component Not Normally Tested
1. RCIC	N/A		N/A	N/A
2. Isolation Condenser	Yes		Yes	None
3. HPCI	Yes		Yes	None
4. FWCI HB & D-1	N/A		Yes	None
5. LPCS	Yes		Yes	None
6. LPCI HB only	Yes		Yes	None
7. ADS	Yes		Yes	None
8. SRV	N/A		Yes	None
9. RHR - incl.				
A. shutdown clg.	N/A		Yes	Note 9A-30
B. cleanup HB only	N/A		Yes	None
C. suppression pool cooling mode LPCS	N/A		Yes	None
D. containment spray BRP & D-1	N/A		Yes	None
10. SSW BRP & HB	N/A		Yes	N/A
11. RBCCW	N/A		Yes	N/A
12. CRDS	N/A		Yes	N/A
13. CST	N/A		Yes	N/A
14. Main Fd. Wtr. Sys.	N/A		Yes	N/A
15. Recirc. Pump/Motor Cooling Sys.	N/A		Yes	N/A

NOTES FOR TABLE 2.1-2b

X-2 See typical drawings (Figs 2.1-1 and following) in which normal valve positions for power operation are generally depicted. Main flow path valves without indication are maintained in their appropriate positions during power operations by administrative procedures. Manual valves without position indicators are maintained in their required position by administrative controls.

X-9a Reactor low pressure is permissive for LPCS and LPCI in addition to logic shown.

X-11 Automatic reactor low pressure permissive is required to open the LPCI and LPCS valves.

X-17a Answers for strainers only. The CRD system contains filters and the feedwater trains have condensate demineralizers.

X-25 Procedures exist for shutdown from outside the control room.

X-28a Not applicable answers means that system is normally in service and/or not tested during power operation.

X-28b Independent verification consists of physical verification or review of completed procedures.

2-8 Long term cooling may require makup.

4-15c 2800 gallons is the normal minimum in the hotwell during operation and is the volume which would be available following reactor isolation trip for the HPCI function of the feedwater system and for the CRD system via the condensate system.

NOTES FOR TABLE 2.1-2b (Continued)

4-16b Normal automatic makeup from the CST to the hotwell is continuously in service. Manual makeup from the CST to the hc well is required to be able to utilize the full volume of the CST. Manual makeup to the CST may also be required to obtain the required water volume for drywell flooding.

5-12 ECCS signal will not override the test mode of this system.

7-3 The isolation valve fails open or loss of air or fails closed on electric failure. The depressurization valve fails closed.

7-12 ECCS does not override however on line testing disables only one train of the four.

9a-11 BRP: Shutdown cooling pump breakers must be closed at the power panel inside containment.
D-1 & HB: CCW must be lined up to the shutdown heat exchangers. These actions take less than 15 minutes.

9a-22 See BRP 9a-11.

9a-30 Not testable during power operation due to low pressure interlock.

9b-3 The air operated valves fail in the position (open or closed) necessary to place the system in the RHR mode. The other valves fail as is. Refer to the system drawing.

9c-8 HB: Any one of the following auxiliary systems is required:

a. Screen wash system.
b. Portable pump system; this system consists of two portable gasoline driven pumps and hoses to supply water from Humboldt Bay.
c. Fire water system (maximum of 17 hours).

NOTES FOR TABLE 2.1-2b (Continued)

9c-11 BRP: Change over to the core spray recirculation mode requires manual valving out of the control room which can be done in less than 5 minutes.
HB: Pool side may be initiated from the control room. CCW must be cut in to the heat exchanger (takes less than 5 minutes) and subsequently SWS must be cut in. See note 10-11 HB.

9d-12 ECCS signal does not override however no on line testing done.

9d-13 Start PI pumps when level reaches 505'.

10-11 HB: Manual valves must be positioned and the SWS pumps started. Times to supply various systems are less than:

1. To CCW heat exchanger 10 min.
2. To suppression chamber cooler 45 min.

10-11 BRP: The service water system valves are all manual and the pump start is local. With correct valve line up it takes less than 5 minutes to start system, however system normally runs continuously.

12-3 Scram inlet and discharge valves fail open, flow control valves fail closed.

Table 2.1-3

SAFETY/RELIEF VALVE DESIGN INFORMATION

Plant	Total Number of Safety and/or Relief Valves	Capacity (each), Klb/hr at Lowest Setpoint		Lowest Setpoint, psig	
		Relief	Safety	Relief	Safety
Big Rock Point	8(5) - 6(6)	518(5)	240(6)	N/A	1535-1585
Dresden-1	10 - 2	-	200(6)	1070	1210-1250
Humboldt Bay	2(5) - 4(6)	400(5)	400(6)	N/A	1220
Oyster Creek	21	561	630	1050	1212
Nine Mile Point-1	22	600	633	1090	1218
Millstone	6	800	-	1095	-
Dresden 2/3	13	540	640	1115	1240
Quad Cities 1/2	13	540	640	1115	1240
Monticello	8	840	-	1108	-
Vermont Yankee	6	800	925	1080	1240
Pilgrim	6	800	640	1095	1240
Peach Bottom 2/3	13	819	925	1105	1230
Hatch 1/2	11	870	-	1090	-
Browns Ferry 1	11	850	940	1105	1250
Browns Ferry 2/3	13	850	940	1105	1250
Brunswick 1/2	11	830	-	1105	-
Duane Arnold	8	830	642	1080	1240
Fitzpatrick	11	798	-	1090	-
Cooper	11	800	642	1080	1240
LaSalle 1/2	18	850	-	1076	-
Zimmer	13	865	-	1150	-
Shoreham	11	889	-	1115	-
Fermi 2	15	885		1110	
Grand Gulf 1/2	20	904		1165	
Hanford 2	18	864		1148	
Susquehanna 1/2	16	845		1146	

Notes for BWR/2-5:

(1) Number of cycles for ADS: minimum 5
(2) Number of cycles for S/R: unlimited
(3) Alternate air supply for ADS
(4) No air supply necessary for safety function

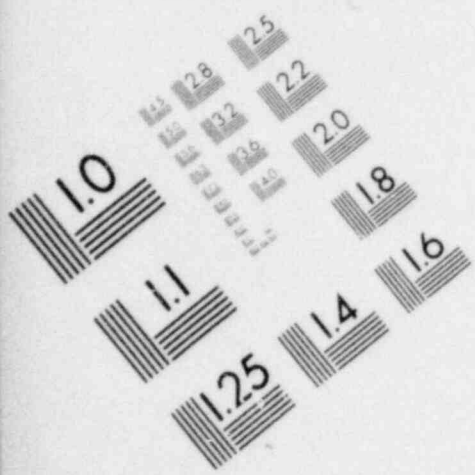
Notes for BWR/1:

(5) Automatic depressurization system
(6) Spring safety
(7) Humboldt Bay ADS: 2 cycles minimum, has alternate air supply
(8) Big Rock Point: cycling capacity and alternate air not applicable

Table 2.1-4a

REACTOR CORE ISOLATION COOLING SYSTEM (RCIC)

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• Reactor Vessel Level Trip • Manual Switches	• None	Turbine and Isolation Trips • Manual isolation • Steam line high flow • RCIC steam supply low pressure • Turbine exhaust diaphragm high pressure • High areas temperature Turbine Trips • Turbine exhaust pressure high • Pump suction low pressure • Reactor vessel level trip • Manual • Turbine overspeed • Reactor low press. Turbine Trip - Vendor Supplied • Turbine Overspeed	• Pump discharge bypass line to suppression pool open • Condensate storage tank empty and transfer to suppression pool blocked • Pipe to HPCI test line to cond storage tank open	• Logic power failure (DC) • Complete pipe blockage	• This is a single channel system not directly dependent on ON or OFF site AC power. However: 1) RCIC Room Cooling may be from off site power and may impair long term operation. 2) Suppression Pool Cooling uses AC power.



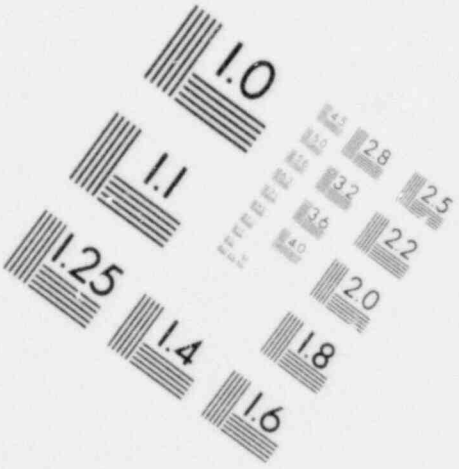
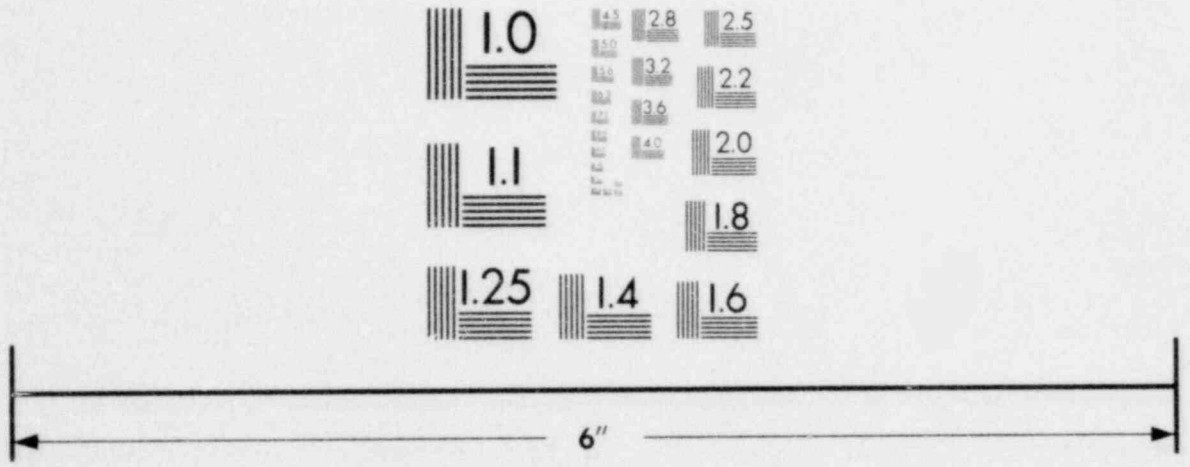
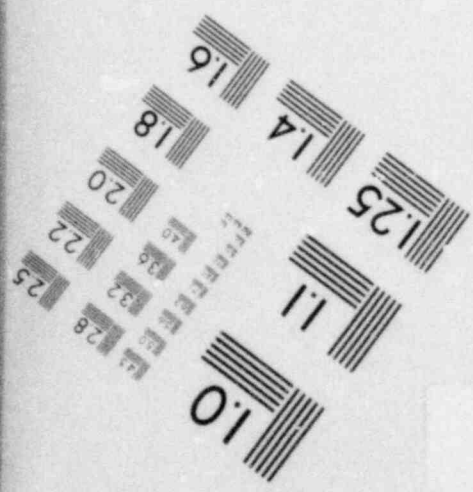
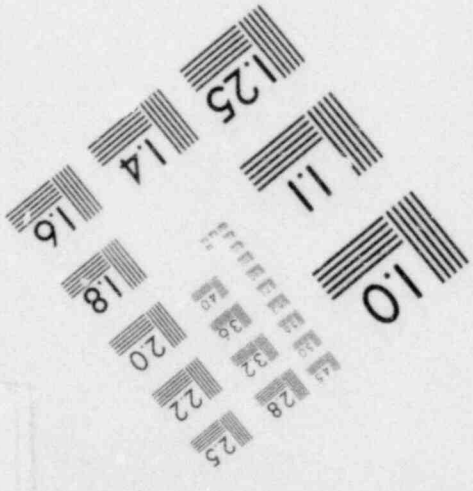
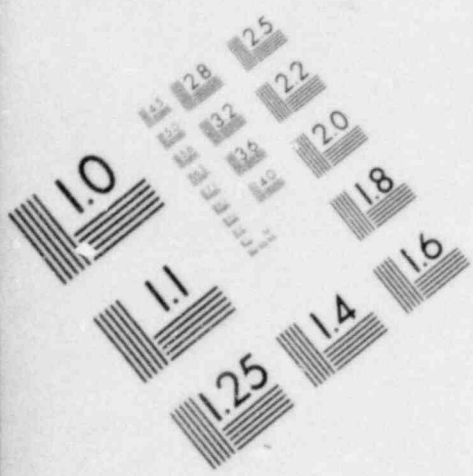


IMAGE EVALUATION TEST TARGET (MT-3)









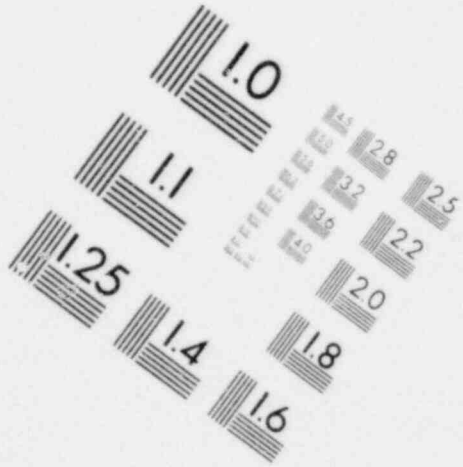
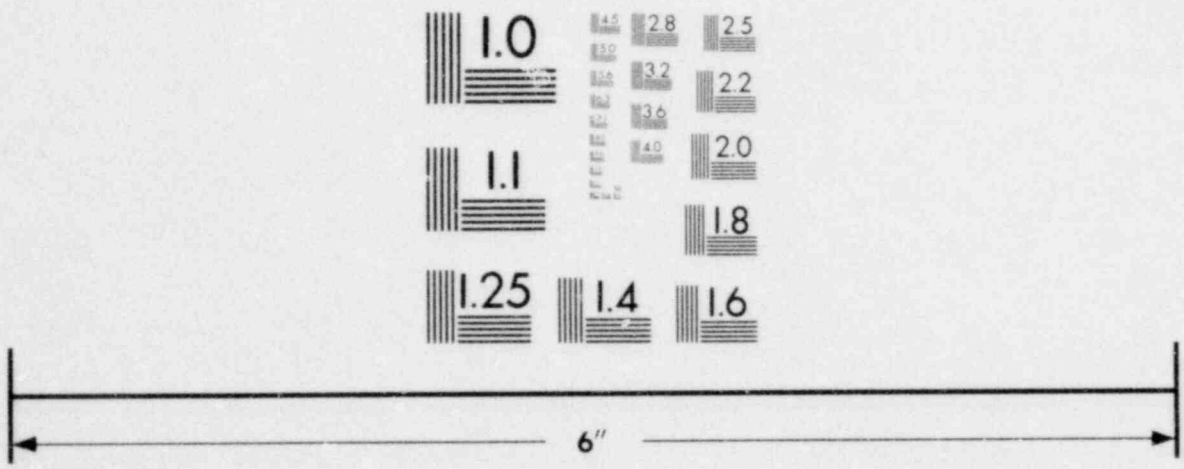
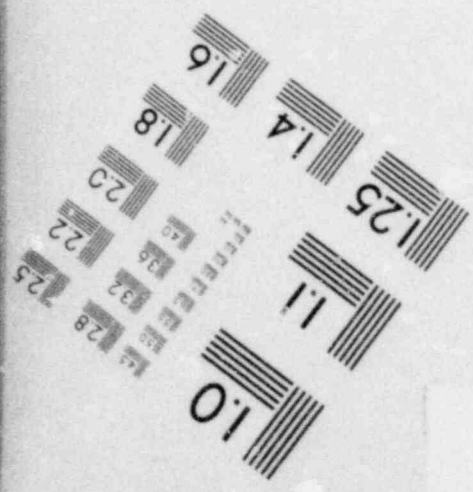


IMAGE EVALUATION TEST TARGET (MT-3)





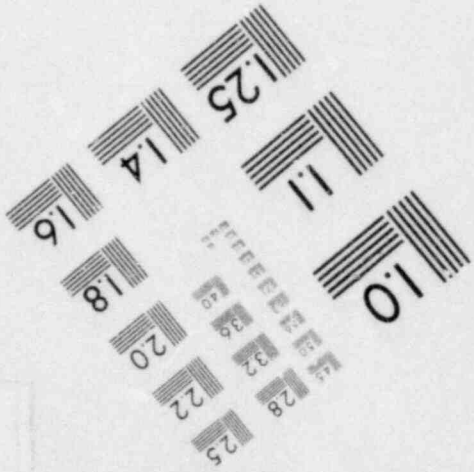


Table 2.1-4b

ISOLATION CONDENSER SYSTEM

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• Reactor High Pressure • Low Water Level • Manual Initiation	• None	• High flow in steam line to condenser • Manual switches • High flow in liquid line	• Vent valves open (1301-17, 1301-20) • Area vent valves not closed (1301-14, 1301-15) • Test line valves not closed (1301-32 thru 35) • Diaphragm seal leak • Overflow line valve not closed (1301-5) • Drain valves NOT closed (1301-44, 1301-45) • Firewater supply not closed (1301-38, 1301-39) • Liquid level fill valve not opening (1301-10)	• DC bus power failure • Recirculation loop failure • Complete flow blockage • Steam line valves (1301-2, 1301-1) or return line valve (1301-4) closed • Return line valve closed (1301-3)	• Some plants have one isolation condenser; while others have more than one isolation condenser.

Table 2.1-4c

HIGH PRESSURE CORE SPRAY SYSTEM (HPCS)

Initiation	Permissive	Trip Conditions	Degraded Conditions: Reduced Capacity	Degraded Conditions: Inoperable	Comments
• Reactor Vessel Level Trip • High Drywell Pressure • Manual Initiation	• None	System Trips • Reactor Vessel water level • Manual Trip Diesel Trips (Any operating Condition) • Overspeed at 110% • Manual switch (Brkr control) • Three phase fault (differential relay) • Motor overcurrent • Motor underfrequency	• Return line to suppression pool open • Return line to condensate storage tank open • Incomplete switching of water source from condensate tank to suppression pool • Safety valve suppression pool return open	• Logic power failure • Pump mtr power failure (offsite + diesel) • Complete pipe blockage	• This is a single channel system.

Table 2.1-4d

HIGH PRESSURE COOLANT INJECTION (HPCI)

Initiation	Permissive	Trip Conditions	Degraded Conditions: Reduced Capacity	Degraded Conditions: Inoperable	Comments
• High Drywell Pressure • Water Level Trip • Remote Manual Switches	• None	Turbine Isolation Trips • Steam supply line high differential pressure (steam line break) • Turbine exhaust diaphragm pressure high • Low steam pressure in supply • Area leak detection (high area temp.) Turbine Trips • Water level trip • Low pump suction pressure • High turbine exhaust pressure • Manual pushbutton (depressed) • Auto isolation signal HPCI Turbine Trip • Hyd. trip due to overspeed (auto reset in presence of auto initiation signal)	• Steam line isolation valves not open (F002, F003) • Steam supply line valve not opening (F001) • Pump discharge valves not opening or not open (F006, F007)	• Logic power failure (DC) • Complete flow blockage	• This is a single channel system; not generally dependent on ON or OFF site AC power

Table 2.1-4e

CORE SPRAY SYSTEM (LOW PRESSURE)
(APPLIES TO BWR/1/2/3/4)

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• Reactor Vessel Water Level Trip • High Drywell pressure • Manual Operation	• Reactor pressure low	System Trip • Manual switches	• Injection valves not functioning properly • Bypass line return to suppression pool open. Both 3" and 10" • Single pump trip • Logic power failure (one division) • Pump power failure (one division	• Logic power ure (both divisions) • Pump power failure (both divisions) (offsite + diesel) • Complete flow blockage	• Two identical systems, either of which can provide adequate flooding • System operates essentially on offsite power. However, in the event of failure transfer to standby diesel (onsite power) is made • Low pressure core spray is a single division system on BWR/1.

Table 2.1-4f

CORE SPRAY SYSTEM PERFORMANCE
(APPLIES TO BWR/5)

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• Low Vessel Water Level • High Drywell Pressure • Manual Initiation	• Differential pressure across injection valve less than setpoint	System Trip • High Water Level	• Bypass test line to suppression pool open • Safety valve F031 open to suppression pool	• Loss of off site power + diesel generator failure • Single pump trip Complete flow blockage • Logic power failure	

LOW PRESSURE CORE SPRAY SYSTEM (LPCS)
(APPLIES TO BWR/6)

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• Low Vessel Water Level • High Drywell Pressure • Manual Initiation	• Reactor pressure low	System Trip • Manual switches Motor Trips • Overcurrent • Ground • ESF Bus Load Shedding	• Bypass test line to suppression pool open • Safety valve open to suppression pool	• Loss of off site power + diesel generator failure • Complete flow blockage • Logic power failure	This is a single division system

Table 2.1-4g

LOW PRESSURE COOLANT INJECTION SYSTEM (MODE OF RHR)

Initiation	Permissive	Trip Conditions	Degraded Conditions: Reduced Capacity	Degraded Conditions: Inoperable	Comments
• High Drywell Pressure • Reactor Water Low Level Trip • Manual Switches	• Reactor low pressure	System Trip • Manual switches	• Single pump trip • Inboard/outboard injection valves not opening* (F015,F017) • Containment/ spray cooling valves not closing (F021,F022) • Min. flow bypass valve not closing (F007) • Divisional motive power failure (offsite + diesel) • Divisional logic power bus failure * For loop selection logic plants, this is an inoperable condition.	• Motive power failure in both divisions (offsite + diesel) • Complete flow blockage • Loop selection failure, if applicable	• In most plants, this is a two divisional redundant system. Either system is capable of providing sufficient core cooling requirements.

Table 2.1-4h

AUTOMATIC DEPRESSURIZATION SYSTEM (ADS)

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• High Drywell Pressure Plus Reactor Water Level Trips • Manual Switches	• Core spray pump or RHR pump running • Time delay	• None	• Electrical pilot operation failure • Any single valve failure will reduce system capacity	• DC control power failure on both divisions	• This is a two division redundant system. One division will meet system requirements.

Table 2.1-4i

REACTOR DEPRESSURIZATION SYSTEM (RDS)
(APPLIES TO BIG ROCK POINT)

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• Low steam drum level	• Fire pump header pressure • 120 Second Timer • Low vessel water level	• Manual operator closure • Less than 50 psid vessel pressure	• Malfunction of 2 or more of 4 valve trains • Loss of 2 or more of 4 DC power sources • Loss of 2 or more of 4 logic circuits • Restricted steam flow in pipes	• Loss of all 4 valve trains • Loss of all 4 DC power sources • Loss of all 4 logic circuits • Complete flow blockage in main header	• RDS consists of 4 valve trains, of which any 3 in operation will sufficiently depressurize the steam drum and RPV. Each valve has independent DC power and logic.

Table 2.1-4j

SAFETY/RELIEF VALVES

Initiation	Permissive	Trip Conditions	Degraded Conditions		
			Reduced Capacity	Inoperable	Comments
• High Vessel Pressure • Manual Switches	• None	• None	Relief Mode • Any single valve failure will reduce system capacity Manual Mode • Electrical pilot Operator failure	Manual Mode • Low instrument air pressure • DC control power failure	• This is a single channel system for manual operation. Pressure relief is supplied by pilot valves internal to each safety/relief valve.

Table 2.1-4k

RESIDUAL HEAT REMOVAL SYSTEM

Initiation	Permissive	Trip Conditions	Degraded Conditions: Reduced Capacity	Degraded Conditions: Inoperable	Comments
* Manual Switches A) Shutdown Cooling	A) Reactor pressure low A) Vessel level A) Drywell pressure low	Modes A) thru D) • Initiation of LPCI signal; i.e. - Low vessel water level - High drywell pressure • Manual switches	Modes A) thru D) • Service water line discharge valve not opening (F068) • Inboard/outboard valves not opening (F015,F017) • Heat exchanger bypass valve not closing (F048) Mode A) Only • Mode B,C,D valves not closing Mode B) Only • Heat exchanger to RCIC drain valve not closing/opening (F026) • Vent valves not opening (F103,F104) • Drain to suppression pool valve not opening (F011) • Steam pressure reducing valves not opening/closing (F051, F091) • Condensate to RCIC/ suppression pool valve not opening (F053) • Mode A,C,D valves not closing	Modes A) thru D) • Logic power failure in divisional instrument bus • Motive power failure in both divisions (offsite + diesel) • Complete flow blockage	• This is a two division redundant system.
B) Steam condensing	B) Vessel level, time delay				
C) Suppression Pool Cooling	C) Vessel level, time delay				
D) Containment Spray	D) Vessel level, time delay, high containment pressure				

* A,B,C,D, represent modes of operation. BWR1/2/3 may have separate systems which accomplish similar functions.

Table 2.1-4k (Continued)

RESIDUAL HEAT REMOVAL SYSTEM

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
			Mode C) Only • Suppression pool valve not opening (F065) • Suppression pool valves not closing (F027,F028)		
			Mode D) Only • Containment spray inboard/outboard valves not opening (F021,F016) • Mode A,B,C valves not closing		

Table 2.1-41

CONTROL ROD DRIVE SYSTEM

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• None (Continuously Operating)	• None	System Trip • Motor trip	• Single pump trip	• Both pump trips • Power Failure • Complete flow blockage	• This is a single channel system. The power does not transfer to on site if off site power is lost in most plants.

Table 2.1-4m

CONDENSATE STORAGE TANK

Initiation	Permissive	Trip Conditions	Degraded Conditions		Comments
			Reduced Capacity	Inoperable	
• Static Unit	• None	• None	• None	• Tank empty	• For additional information on Condensate Storage Tank see individual ECC system matrices (RCIC, HPCI, HPCS

Table 2.1-4n-1

FEEDWATER CONTROL SYSTEM (TURBINE DRIVEN PUMP)

Initiation	Permissive	Trip Conditions	Degraded Conditions: Reduced Capacity	Degraded Conditions: Inoperable	Comments
• Continuously operates	• Main condenser vacuum	• Reactor vessel level trip • Turbine and pump protection trips	• One of two injection lines becomes blocked • Restricted steam line flow to turbine • Lack of manual reset inhibits automatic function	• Power Failure a) logic b) loss of off-site power • MSIV closed • Condensate pumps not operating • Complete flow blockage	• This is a nonessential control system

Table 2.1-4n-2

FEEDWATER CONTROL SYSTEM (MOTOR DRIVEN PUMPS)

Initiation	Permissive	Trip Conditions	Degraded Conditions: Reduced Capacity	Degraded Conditions: Inoperable	Comments
• Continuously operates	• None	• Reactor vessel level trip • Pump and motor protection trips	• Air operated valves lock open on signal loss until manual operation takes over	• Power Failure a) logic b) loss of off-site-power • Loss of control air • Condensate pumps not operating • Complete flow blockage	• This is a nonessential control system except for FWCI plants

Table 2.1-5a

LCO'S - BIG ROCK POINT

System Component Out of Service	Required to be Operable	Shutdown	Cold Shutdown	Allowable Time Out of Service
Emergency Condenser	Power Operation	X		
Core Sprays	Power Operation	initiate in 24 hrs		
Original Core Spray (Ring)	Refueling	X		
Core Spray Recirculation	Power Operation	initiate in 24 hrs		
Core Spray Recirculation Heat Exchanger	Power Operation	initiate in 24 hrs		4 hr
Reactor Depressurization Sys	Power Operation	X		
One Depress Vlv or Iso Vlv Closed	Power Operation			7 day
One Depress Vlv or Iso Vlv Open	Power Operation		in 12 hrs	
One RDS Vlv Train	Power Operation	after 7 days		7 day
One Input Channel	Power Operation	after 7 days		7 day
One Output Channel	Power Operation	after 7 days		7 day
One UPS Power Supply	Power Operation	after 7 days		7 day
Containment Spray	Power Operation	initiate in 24 hrs		
Control Rod Drive	Power Operation			
Loss of Poison	Power Operation	X		
Hi Drive Temp	Power Operation	X		
Abnormal System Behavior	Power Operation	X		
Withdraw Permissive Interlocks	At all times			
Both Reactor Recirc. Pumps	Power Operations	X		

Table 2.1-5b

LCO'S BROWNS FERRY

System/ mponent Out of Service	Systems Required to be Operable	Redundant Core Spray	Both Core Sprays	LPCI	Redundant Diesel Generator	All Diesel Generators	Redundant RHRSW	All RHRSW	Redundant RBCCW	All RBCCW	RCIC	ADS	HPCI	Containment Cooling	Redundant Containment Cooling	Allowable Out of Service Time (days)	Cold Shutdown
One Core Spray Subsystem		X		X		X										7 days	
Both Core Spray Subsystems																24 hrs	X
One LPCI Pump			X	X		X										7 days	
LPCI Subsystem																24 hrs	X
One RBCCW Pump								NOT TECH SPEC									
One RHRSW Pump								NOT TECH SPEC									
Two RBCCW/RHRSW Pumps not in Same Loop								NOT TECH SPEC									
One Containment Cooling Subsystem						X									X	30 days	
Both Containment Cooling Subsystems																24 hrs	X
HPCI			X	X							X	X				7 days	
RCIC													X			7 days	
3 ADS Valve													X				
More than 3 ADS Valve																6 hrs	X
A Diesel Generator			X	X	X									X			
All Diesel Generators																	X
A Safety Relief																No Limit	U-3 Only
																	X
Tight Control Rod Drives																	X
Condensate Storage Tank								NOT TECH SPEC									
Feedwater System								NOT TECH SPEC									
A Recirc. Pump																24 hrs	X
Both Recirc. Pumps																12 hrs	X

Table 2.1-5c

LCO'S - BRUNSWICK

Systems Req'd	One Core Spray System	Both Core Spray Systems	One LPCI System	Both LPCI Systems	Three D/G's	All D/G's	One RHR SW System	Both RHR SW Systems	Two SW Pumps	One SW Pump	RCIC System	ADS	HPCI System	One Cont. ment Cooling System	Both Containment Cooling Systems	Allowable Out-of-Service Time	Time to Hot Shutdown	Time to Cold Shutdown
System Out of Service																		
One Core Spray System	X			X												7d	12h	24h
Both Core Spray Systems																0	12h	24h
One LPCI Pump		X	X													7d	12h	24h
One LPCI System		X	X													7d	12h	24h
Both LPCI Systems																0	12h	24h
Three SW Pumps									X							7d	12h	24h
Four SW Pumps										X						3d	12h	24h
All SW Pumps																0	6h	30h
RBCCW																N/A	N/A	N/A
One RHRSW Pump								X								31d	12h	24h
One RHRSW System							X									7d	12h	24h
Both RHRSW Systems																8h	12h	24h
One Containment Cooling System														X		7d	12h	24h
Both Containment Cooling Systems																8h	12h	24h
HPCI System*		X		X								X				14d	12h	24h
RCIC System*													X			31d	12h	24h
One ADS Valve*		X		X								X	X			14d	12h	24h
>One ADS Valve*																0	12h	24h
One D/G					X											3d	12h	24h
>One D/G																2h	12h	24h
One SRV																31d	12h	24h
Two SRV's																7d	12h	24h
>Two SRV's																0	12h	24h
Tight CRD																2d	12h	N/A
CST																N/A	N/A	N/A
One Recirc Pump																12h	12h	N/A
Both Recirc Pumps																12h	12h	N/A
RBCCW																N/A	N/A	N/A
FW																N/A	N/A	N/A

*Only required when reactor pressure is >112 psi.

Table 2.1-5d

LCO'S - COOPER

System/Component Out of Service	Systems Required to be Operable	Redundant Core Spray	Both Core Sprays	LPCI	Redundant Diesel Generator	Both Diesel Generators	Redundant SSW	All SSW	Redundant RBCCW	All RBCCW	RCIC	ADS	HPCI	Containment Cooling	Redundant Containment Cooling	Allowable Out of Service Time (days)	Cold Shutdown Within 24 hrs
One Core Spray Subsystem		X		X		X										7	
Both Core Spray Subsystems																	X
One LPCI Pump			X	X		X		X								30	
LPCI Subsystem			X	X		X		X							X	7	
One RBCCW Pump					X			X	X					X		30	
One SSW Pump					X	X				X				X		30	
Two RBCCW/SSW Pumps not in Same Loop							X	X							X		X
One Containment Cooling Subsystem					X										X	7	
Both Containment Cooling Subsystems																	X
HPCI			X	X							X	X				7	
RCIC															X	7	
One ADS Valve												X	X			7	
More Than One ADS Valve																	X
The Diesel Generator			X	X	X			X		X				X		7	
Both Diesel Generators																	X
Inoperable (1)																30	
Safety Relief(s) (2)																7	X
Tight Control Rod Drives																	X
Condensate Storage Tank																	X
Feedwater System																	
One Recirc. Pump						Can Operate for 24 Hrs w/One Pump											X
Both Recirc. Pumps																	X

Table 2.1-5e

LCO'S - DRESDEN - 1

System/Component Out of Service	Systems Required to be Operable	Core Spray	Redundant Diesel Gen. (1)	Both Diesel Generators (2)	All SSW	All RBCCW	RCIC (Emergency Condition)	ADS	HPCI (1)	Containment Cooling	34.5 KV System	Allowable Out of Service Time (days)	Cold Shutdown
Core Spray				X			X					2	
One RBCCW Pump		(3)											
One SSW Pump		(3)											
Two RBCCW/SSW Pumps in Same Loop		(3)											
Containment Cooling		X		X								2	
HPCI(1)													
RCIC (Emergency Condition)		X		X								1	
One ADS Valve		(4)											
>One ADS Valve		(4)											
One Diesel Generator		X					X				X	1	
Both Diesel Generators(1;2)													
Safety Relief												1	X
(4) CRD													X
Condensate Storage Tank		(3)											
Feedwater [At Least One Pump Operating]		(6)										7	
One Recirculation [Power < 525 MW_t]		(5)											
Two Recirculation (Power < 350 MW_t]		(5)											
>Two Recirculation Pumps													X
D-1 Fire Pump												2	
D-2/3 Fire Pump												2	
Screen Wash Pump (D-1)												2	
Emergency Feed Pump		(7)										7	

(1) Installation in progress.
(2) Only one diesel generator at this time.
(3) No tech spec requirements.
(4) No ADS, only safety-relief valves.
(5) With 1 recirculation pump out of service - power must be less than 525 MW_t; with 2 recirculation pumps out of service - power must be less than 350 MW_t.
(6) Until HPCI operable, at least 1 feedwater shall be operable with power source from TR-12 transformer.
(7) Until HPCI operable.

Table 2.1-5f

LCO'S DRESDEN UNITS 2 AND 3

System/Component Out of Service	Systems Required to be Operable	Redundant Core Spray	Both Core Sprays	LPCI	Redundant Diesel Generator	Both Diesel Generators	Redundant SSW	All SSW	Redundant RBCCW	All RBCCW	RCIC	ADS	HPCI	Containment Cooling	Redundant Containment Cooling	Isolation Condenser	Allowable Out of Service Time (days)	Cold Shutdown
One Core Spray Subsystem		X		X		X											7	
Both Core Spray Subsystems																	1	X
One LPCI Pump			X	X		X								X			30	
One LPCI Subsystem			X	X		X									X		7	
One RBCCW Pump														X			30	
One SSW Pump/One RBCCW Pump																		
Two RBCCW/SSW Pump not in Same Loop			X			X									X		7	
One Containment Cooling Subsystem																	1	X
Both Containment Cooling Subsystems			X	X								X				X	7	
HPCI			X	X								X	X				7	
RCIC																	1	X
One ADS Valve														X			7	
More Than One ADS Valve			X	X	X												1	X
One Diesel Generator																	1	X
Both Diesel Generators																	1	X
Safety Relief																		
Eight Control Rod Drives																		
Condensate Storage Tank																	1	X
Feedwater System																		X
One Recirculation Pump																	7	
Both Recirculation Pumps																		
Isolation Condenser System																		

Table 2.1-5g

LCO'S - DUANE ARNOLD

System/Component Out of Service	Systems Required to be Operable	Redundant Core Spray	Both Core Sprays	LPCI	Redundant Diesel Generator	Both Diesel Generators	Redundant SSW	All SSW	Redundant RBCCW	All RBCCW	RCIC	ADS	HPCI	Containment Cooling	Redundant Containment Cooling	Allowable Out of Service Time (days)	Cold Shutdown
One Core Spray Subsystem		X		X		X										7	
Both Core Spray Subsystems																24 hrs	X
One LPCI Pump			X	X		X								X	X	30	
LPCI Subsystem			X	X		X									X	7	
One RBCCW Pump (not part of Core Cooling)																	
One SSW Pump					X		X									7	
Two RBCCW/SSW Pumps Not in Same Loop (RBCCW is not used for SSW)																24 hrs	X
One Containment Cooling Subsystem															X	30	
Both Containment Cooling Subsystems																24 hrs	X
HPCI			X	X							X	X				7	
RCIC												X	X			7	

Table 2.1-5h

LCO'S - FITZPATRICK

System/Component Out of Service	System Required to be Operable	Redundant Core Spray	Both Core Sprays	LPCI	Redundant Diesel Generator Sys.	Both Diesel Generator Sys.	Redundant SW	Test Same Redundant Component	Reserve Power Available	All RBCCW	RCIC	ADS	HPCI	Containment Cooling	Redundant Containment Cooling	Allowable Out of Service Time (days)	Cold Shutdown
One Core Spray Subsystem		X		X		X										7	
Both Core Spray Subsystems																	X
One LPCI Pump			X	X		X										7	
LPCI Subsystem			X	X		X								X		7	
LPCI Mov Power Sup. 1 Out								X								7	
2 Out																	X
ESW Pump 1 Out					X											7	
2 Out																	X
One Containment Cooling Subsystem				X		X									X	7	
Both Containment Cooling Subsystems																	X
HPCI			X	X							X	X				7	
RCIC													X			7	
One ADS Valve												X	X			30	
More Than One ADS Valve																	X
One Diesel Generator Sys.					X			X	X							7	
Both Diesel Generator Sys.																	X
Safety Relief 1 Out																30	
2 Out																7	
Condensate Storage Tank																	
One Recirc. Pump																	X
Both Recirc. Pumps																	X
Recirc. Disch. Valves & Bypass																	X
MCR Ventilation 1 Subsystem																7	
Crescent Area Vent. 1 Cooler																7	
More Than 1																7	
SBLC 1 Out								X								7	
2 Out																	X
Station Batteries 1 Out					X			X								7	
2 Out																	X
SBGT 1 Out								X								7	
2 Out																	X
Intake Heaters if More Than 18 Out of 88																	X

Table 2.1-5i-1

LCO'S - HATCH UNIT 1

Out of Service	RCIC	HPCI	CS	LPCI	ADS	SRV	RHR	SCSS	RBCCW	CRD	CST	FW	Tech Spec	Time
RCIC	NA	Yes	No	No	No	No	No	No	No	No	No	No	3/4.5.E	7D
HPCI	Yes	NA	Yes	Yes	Yes	No	No	No	No	No	No	No	3/4.5.D	7D
CS	No	No	NA	Yes	No	No	No	No	No	No	No	No	3/4.5.A	7D
LPCI	No	No	Yes	NA	No	No	No	No	No	No	No	No	3/4.5.B	7D
ADS	No	Yes	No	No	NA	No	No	No	No	No	No	No	3/4.5.F	7D
SRV	No	No	No	No	No	NA	No	No	No	No	No	No	1/2.2A	0
RHR*	No	No	No	No	No	No	NA	No	No	No	No	No	3/4.5.G	NA
SCSS#	No	No	No	No	No	No	No	NA	No	No	No	No	3/4.5.C	7D 1 pump 14D 2 pump
RBCCW	No	No	No	No	No	No	No	No	NA	No	No	No	NA	NA
CRD	No	No	No	No	No	No	No	No	No	NA	No	No	NA	NA
CST	No	No	No	No	No	No	No	No	No	No	NA	No	NA	NA
FW	No	No	No	No	No	No	No	No	No	No	No	NA	NA	NA

*Shutdown cooling, steam condensing, toros cooling, containment spray.

#Standby coolant supply system (RHRSW)

Table 2.1-5i-2

LCO'S - HATCH UNIT 2

Out of Service	RCIC	HPCI	CS	LPCI	ADS	SRV	RHR*	SCSS#	RBCCW	CRD	CST	FW	Tech Spec	Time
RCIC	NA	Yes	No	No	No	No	No	No	No	No	No	No	3/4.7.3	14D
HPCI	Yes	NA	Yes	Yes	Yes	No	No	No	No	No	No	No	3/4.5.1	14D
CS	No	No	NA	Yes	No	No	No	No	No	No	No	No	3/4.5.3.1	7D
LPCI	No	No	Yes	NA	No	No	No	No	No	No	No	No	3/4.5.3.2	7D
ADS	No	Yes	Yes	Yes	NA	No	No	No	No	No	No	No	3/4.5.2	14D
SRV	No	No	No	No	No	NA	No	No	No	No	No	No	3/4.4.2	0
RHR*	No	No	No	No	No	No	NA	No	No	No	No	No	3/4.6.2.2	30D/pump 7D/loop
SCSS#	No	No	No	No	No	No	No	NA	No	No	No	No	3/4.7.1.1	30D/pump 7D/loop
RBCCW	No	No	No	No	No	No	No	No	NA	No	No	No	NA	NA
CRD	No	No	No	No	No	No	No	No	No	NA	No	No	NA	NA
CST	No	No	No	No	No	No	No	No	No	No	NA	No	3/4.5.3.1	NA
FW	No	No	No	No	No	No	No	No	No	No	No	NA	NA	NA

*Shutdown cooling, steam condensing, torus cooling, containment spray.

#Standby coolant supply system (RHRSW)

Table 2.1-5j

LCO'S - HUMBOLDT BAY-3 (NOTE 1)

Component Required to be Operable	Redundant Spray Pump on Emergency 480V Power	All Three LPCI Pumps	Both LPCS Pumps	Shutdown if Not Met. (Note 2)
System/Component Out of Service				
Emergency Condenser				X
FWCI				
LPCS: One Pump	X	X		X
LPCI: One Pump (Note 3)			X	X
ADS				X
SRV				N/A
Shutdown System				
Cleanup in RHR Mode				
LPCS IN Suppression Pool Cooling Mode	X	X		X
Screen Wash (SWS)				
CCW				
CRDS				X
CST				
Main Feedwater				

Note 1: Humboldt Bay does not have Standard Technical Specifications (STS) except for fire protection. Issuance of STS is pending resolution of the seismic issue.

Note 2: Time limits for shutdown are not specified.

Note 3: The diesel LPCI pump must be operable whenever the emergency propane engine generator is required to be operable.

Table 2.1-5k

LCO'S - LA SALLE

The LaSalle station does not yet have approved technical specifications.

Table 2.1-51

LCO'S - MILLSTONE - 1

System/Component Out of Service	System Required to be Operable	One Core Spray LPCS	Both LPCS	LPCI	Diesel or Gas Turbine	Both Diesel and Gas	Other ESW	All ESW	Redundant RBCCW	All RBCCW	Isolation Condenser	ADS	CST	FWCI	Containment Cooling	Redundant Containment Cooling	Allowable Out-of-Service Time (Days	Cold Shutdown If Not Met	
One Core Spray Subsystem Subsystem LPCS		X		X		X											15	X	
Both LPCS Subsystems				X		X											7	X	
One LPCI Pump			X	X		X											30	X	
LPCI Subsystem			X	X		X										X	30	X	
One RBCCW Pump																			
One EWS Pump							X			X					X		30	X	
Two RBCCW/EWS Pumps Not in Same Loop							X		X							X	7	X	
One Containment Cooling Subsystem			X		X											X	4	X	
Both Containment Cooling Subsystems																		X	
FWCI			X	X							X	X	X				7	X	
One ADS Valve					X							X		X			7	X	
More Than One ADS Valve																		X	<90 psig and <320°F in 24 hours
One Diesel Generator			X	X	X			X		X		X		X	X		7	X	
One Gas Turbine			X	X	X			X		X		X			X		4	X	
Both Diesel and Gas Turbine																		X	
Safety Relief																		X	<90 psig and <320°F in 24 hours
Eight Control Rod Drives																		X	
CST																		X	
Feedwater System																		X	
One Recirculation Pump																		X	
Both Recirculation Pumps																		X	
Isolation Condenser					X									X			15	X	

Table 2.1-5m

LCO'S - MONTICELLO

System/Component Out-of-Service \ System Required to be Operable	RCIC	HPCI	LPCS 1 Loop	LPCS 2 Loops	LPCI (All)	LPCI (Rem.)	All RHR Cont. Clg.	SSW	RCCW	DG	ADS (All)	ADS (Rem.)	RHR Serv. Water (Remaining)	Allowable OOS Time
RCIC		X												15 Days * 24 Hours
HPCI	X			X	X		X				X			17 Days * 24 Hours
LPCS 1 Loop			X		X					X				1> Days * 24 Hours
LPCS 2 Loops					X					X				7 Days * 24 Hours
LPCI 1 Pump or 1 Admission Valve				X		X				X				30 Days * 24 Hours
LPCI 2 Pump or 2 Admission Valves				X		X				X				7 Days * 24 Hours
ADS 1 Valve		X										X		7 Days * 24 Hours
ADS 2 Valves		X												24 Hours
RHR Containment Cooling One DW Spray Loop														30 Days * 24 Hours
RHR Serv. Water 1 Pump													X	30 Days * 24 Hours
RHR One Serv. Water System													X	7 Days * 24 Hours

*Upper time is limit if Req. Systems are Operable

Table 2.1-5n

LCO'S - NINE MILE POINT - 1

System/Component Out of Service	Systems Required to be Oprrable .	Redundant Core Spray System	Redundant Emergency Condenser System	Redundant Control Rod Drive Coolant Injection System	Redundant High Pressure Coolant Injection System	All Emergency Equipment Aligned to Operable Diesel-Generator Shall Have No Inoperable Components	Two 115 KV Energized External Lines	Redundant Containment Spray System and Associated Raw Water Cooling System	Allowable Out-of-Service Time (Days)	Reduce Reactor Pressure to Less Than 110 Psig	Hot Shutdown	Cold Shutdown
One Emergency Condenser/ System			X						7			
Both Emergency Condenser Systems												24
Redundant Component of One Core Spray System									15			
Redundant Component In Each Core Spray System									7			
One Core Spray System		X							7			
Both Core Spray Systems												10
One of the Six ADS Valves										10		
Redundant Component of One Control Rod Drive Coolant Injection System				X					7			
Both Control Rod Drive Coolant Injection Systems												10
Redundant Component of High Pressure Coolant Injection System					X				15			
Both High Pressure Coolant Injection Systems										24		
One Safety Valve										10		

Table 2.1-5n (Continued)

LCO'S - NINE MILE POINT - 1

Systems Required to be Operable	Redundant Core Spray System	Redundant Emergency Condenser System	Redundant Control Rod Drive Coolant Injection System	Redundant High Pressure Coolant Injection System	All Emergency Equipment Aligned to Operable Diesel-Generator Shall have No Inoperable Components	Two 115 KV Energized External Lines	Redundant Containment Spray System and Associated Raw Water Cooling System	Allowable Out-of Service Time (Days)	Reduce Reactor Pressure to Less Than 110 Psig	Hot Shutdown	Cold Shutdown
One of the Six Solenoid Actuated Pressure Relief Valves											
Two or More Solenoid Actuated Pressure Relief Valves									10		
Redundant Component of One Containment Spray or Raw Water Cooling System								15			
Redundant Component in Each Containment Spray System or Their Associated Raw Water System								7			
One Containment Spray System or its Associated Raw Water System							X	7			
One Diesel Generator					X	X		7			
Two Diesel Generators											10
Both Containment Spray Systems or Their Associated Raw Water Systems											10

Table 2.1-5o

LCO'S - OYSTER CREEK

System/Component Out of Service	Systems Required to be Operable	Redundant Standby Liquid Control Pumping Circuit	Redundant Core Spray System	Redundant Active Loop Component - Core Spray	150 Valves of Both Isolation Condensers	Redundant Containment Spray System	Redundant ESW. Spray	Redundant Pump	Redundant CRD Hydraulic Pump	Both Core Spray System Loops	Secured In Closed Position	Physically Verified to be Closed	Redundant Standby Gas Treatment System Circuit	Redundant Diesel	Redundant Isolation Condenser	Establish Backup Fire Suppression System	Allowable Out of Service Time (days)	Cold Shutdown
One Standby Liquid Control System Pumping Circuit		X															7	
Both Standby Liquid Control System Pumping Circuits																		X
Two Idle Recirculation Pumps																		X
One Core Spray System			X											X			7	
Both Core Spray Systems																		X
One Redundant Active Loop Component of Core Spray				X													15	
Fire Protection System										X						X	1	
One Diesel Inoperable			X			X	X							X			7	X
Both Diesel Inoperable																		X
One Electromatic Relief Valve					X												3	
Two Electromatic Relief Valves																	1	
One Containment Spray System							X	X							X		7	
Both Containment Spray Systems																		X
One ESW System							X	X							X		7	
Both ESW Systems																		X
One Pump Per Containment Spray System									X								15	
One Pump Per ESW System									X								15	
One CRD Hydraulic Pump										X							7	
Both CRD Hydraulic Pumps																		X
One Reactor Building to Suppression Chamber Vacuum Breaker																	7	
Both Rx Building to Suppression Chamber Vacuum Breakers																		X
Two Drywell Vacuum Breakers												X						
One Position Alarm Circuit Per Operable Drywell Vacuum Breaker													X				15	
One Inoperable Snubber																	3	
One Standby Gas Treatment System Circuit														X			7	
Both Standby Gas Treatment System Circuits																	1	X
One Isolation Condenser																X	7	
[illegible] Isolation Condensers																		X

Table 2.1-5o (Continued)

LCO'S - OYSTER CREEK

3.7 AUXILIARY ELECTRICAL POWER

Applicability: Applies to the operating status of the auxiliary electrical power supply.

Objective: To assure the operability of the auxiliary electrical power supply.

Specification:

A. The reactor shall not be made critical unless all of the following requirements are satisfied:

1. The following buses or panels energized.

   a. 4160 volt buses 1C and 1D in the turbine building switchgear room.
   b. 460 volt buses 1A2, 1B2, 1A21, 1B21 vital MCC 1A2 and 1B2 in the reactor building switch gear room; 1A3 and 1B3 at the intake structure; 1A21A, 1B21A, 1A21B, and 1B21B and isolation valve MCC 1/B2 on 23'6" elevation in the reactor building; 1A24 and 1B24 at the stack.
   c. 208/120 volt panels 3, 4, 4A, 4B, 4C and VACP-1 in the reactor building switchgear room.
   d. 120 volt protection panel 1 and 2 in the cable room.
   e. 125 volt DC distribution centers A and B, and panel D in the battery room; isolation valve motor control center DC-I on 23'6" elevation in reactor building and panel E in the cable room.
   f. 24 volt D.C. power panels A and B in the cable room.

2. One 230 KV line is fully operational and switch gear and both startup transformers are energized to carry power to the station 4160 volt AC buses and carry power to or away from the plant.

3. An additional source of power consisting of one of the following is in service connected to feed the appropriate plant 4160 V bus or buses:

   a. A second 230 KV line fully operational.
   b. One 34.5 KV line fully operational.

4. The station batteries are available for normal service and a battery charger is in service for each battery, except one battery and associated charger may be removed from service as required for surveillance testing as set forth in Specification 4.7.B.

B. The reactor shall be placed in the cold shutdown condition if the availiability of power falls below that required by Specification A above, except that the reactor may remain in operation for a period not to exceed 7 days in any 30 day period if a startup transformer is out of service. To be considered operational none of the engineered safety feature equipment normally fed by the transformer may be out of service.

Table 2.1-5p

LCO'S - PEACH BOTTOM 2-3

System/Component Out of Service	Systems Required to be Operable	Redundant Core Spray Subsystems	LPCI	Both Core Spray Subsystems	Remaining LPCI Subsystems	Remaining Containment Cooling Subsystem Components	Diesel for Operable Loop	RCIC	ADS	HPCI	Remaining Diesel Generators	Containment Cooling Subsystems	Remaining Relief Valves	Remaining Recirc. Loop	Allowable Out of Service Time (days)	Shutdown
One Core Spray Subsystem		X	X												7	
Both Core Spray Subsystems															2	X
One LPCI Pump			X	X											7	
One LPCI Subsystem			X	X											7	
Both LPCI Subsystems															2	X
Two HPSW Pumps						X									30	
Three HPSW Pumps						X									15	
Three Containment Cooling Subsystem Loops						X	X								7	
All Containment Cooling Subsystem Loops															1	X
HPCI			X	X				X							7	
RCIC										X					7	
One ADS Valve										X					7	
More Than One ADS Valve															1	X
One Diesel Generator			X	X							X	X			7	
More Than One Diesel															1	X
Safety Valve Function of One Relief Valve													X		30	
Safety Valve Function of Two Relief Valves													X		7	
Safety Valve Function of More Than Two Relief Valves															1	X
One Recirculation Loop														X	1	
More Than One Inoperable Control Rod in a 5x5 Array															1	X
Withdrawn Control Rod Which Can't be Moved Because of Possible Collet Housing Failure															2	X

NOTES

1. With irradiated fuel in reactor vessel and reactor in cold shutdown condition, both core spray subsystems, the LPCI and containment cooling subsystems may be inoperable, provided no work is being done which has the potential for draining the reactor vessel.
2. During a refueling outage, refueling operation may continue with one core spray system or the LPCI system inoperable for a period of thirty days.

Table 2.1-5q

LCO'S - PILGRIM - 1

System/Component Out of Service	Systems Required to be Operable	Redundant Core Spray	Both Core Sprays	LPCI	Redundant Diesel Generator	Both Diesel Generators	Redundant SSW	All SSW	Redundant RBCCW	All RBCCW	RCIC	ADS	HPCI	Containment Cooling	Redundant Containment Cooling	Allowable Out of Service Time (days)	Cold Shutdown
One Core Spray Subsystem		X		X		X										7	
Both Core Spray Subsystems																1	X
One LPCI Pump			X	X		X		X		X						30	
One LPCI Subsystem			X			X		X		X					X	7	
One RBCCW Pum								X	X					X		30	
One SSW Pump							X			X				X		30	
Two RBCCW/SSW Pumps not in Same Loop							X		X						X	15	
One Containment Cooling Subsystem					X										X	7	
Both Containment Cooling Subsystems																1	X
HPCI			X	X							X	X				7	
RCIC													X			7	
One ADS Valve												X	X			7	
More Than One ADS Valve																1	X
One Diesel Generator			X	X	X			X		X				X		7	
Both Diesel Generators																1	X
Safety Relief																	X
Eight Control Rod Drives																	X
Condensate Storage Tank																	
Feedwater System																	
One Recirculation Pump																	

Table 2.1-5r

LCO'S QUAD CITIES UNITS 1 AND 2

System/Component Out of Service	Systems Required to be Operable	Redundant Core Spray	Both Core Sprays	LPCI	Redundant Diesel Generator	Both Diesel Generators	Redundant SSW	All SSW	Redundant RBCCW	All RBCCW	RCIC	ADS	HPCI	Containment Cooling	Redundant Containment Cooling	Isolation Condenser	Allowable Out of Service Time (days)	Cold Shutdown
One Core Spray Subsystem		X		X		X											7	
Both Core Spray Subsystems																	1	X
One LPCI Pump			X	X		X								X			30	
One LPCI Subsystem			X	X		X									X		7	
One RBCCW Pump																		
One SSW Pump/One RBCCW Pump														X			30	
Two RBCCW/SSW Pump not in Same Loop																		
One Containment Cooling Subsystem			X			X									X		7	
Both Containment Cooling Subsystems																	1	X
HPCI			X	X							X	X					7	
RCIC													X				7	
One ADS Valve												X	X				7	
More Than One ADS Valve																	1	X
One Diesel Generator			X	X	X									X			7	
Both Diesel Generators																	1	X
Safety Relief																	1	X
Eight Control Rod Drives																	1	X
Condensate Storage Tank																		
Feedwater System																		
One Recirculation Pump																	1	X
Both Recirculation Pumps																		X
Isolation Condenser System																	7	

TABLE 2.1-5s

LCO'S - SHOREHAM

The Shoreham station does not yet have approved technical specifications.

Table 2.1-5t

LCO'S - VERMONT YANKEE

System/Component Out-of-Service \ Systems Required to be Operable	Redundant Core Spray Subsystem	Both LPCI Subsystems	Both Diesel Generators	LPCI Containment Cooling Subsystem	Both Core Spray Subsystems	Redundant LPCI	Redundant Containment Cooling Subsystem	All Other Active Components of the RHR SW Subsystem	All Other Active Components of the SW System	Alternate Cooling Tower System	Both SW Subsystems	ADS	RCIC	Remaining ADS Valves	HPCI	Operable Diesel Generator	Allowable Out-of-Service Time (days)	
One Core Spray Subsystem	X	X	X														7	
Both Core Spray																	0	Cold shutdown in 24 hours
One LPCI Pump			X	X	X												7	
LPCI Subsystem			X	X	X	X											7	
Both LPCI Subsystems																	0	Cold shutdown in 24 hours
Recirc. Pump Discharge and Bypass Valves																		Must be operable or closed prior to plant startup
Containment Cooling Subsystem							X										30	
Both Containment Cooling																	0	Cold shutdown in 24 hours
One RHR Service Water Pump								X									30	
One RHR Service Water Subsystem			X		X			X									7	
Both RHR Service Water Systems																	0	Cold shutdown in 24 hours
One Service Water Subsystem									X	X							15	
Both Service Water Subsystems										X							7	
Alternate Cooling Tower Subsystem											X						7	
HPCI		X			X							X	X				7	CST must contain more than 75,000 gallons
(One of Four Relief Valves) ADS														X	X		7	Malfunction of the electrical portion of the valve
More Than One ADS Valve																	0	Rx press less than 100 psig in 24 hours
RCIC															X		7	
One Diesel Generator		X		X	X											X	7	
Both Diesels																	0	Cold shutdown in 24 hours
One Safety Relief Valve																		Reduce and maintain power at less than 95%
More Than One SRV																	0	Rx (Pressure less than 120 psig, temperature less than 350°) in 24 hours

Table 2.1-5u

LCO'S - ZIMMER

The Zimmer station does not yet have approved technical specifications.

Table 2.1-5v

LCO's - FERMI 2, GRAND GULF 1/2, HANFORD 2, SUSQUEHANNA 1/2

These stations do not yet have approved technical specifications.

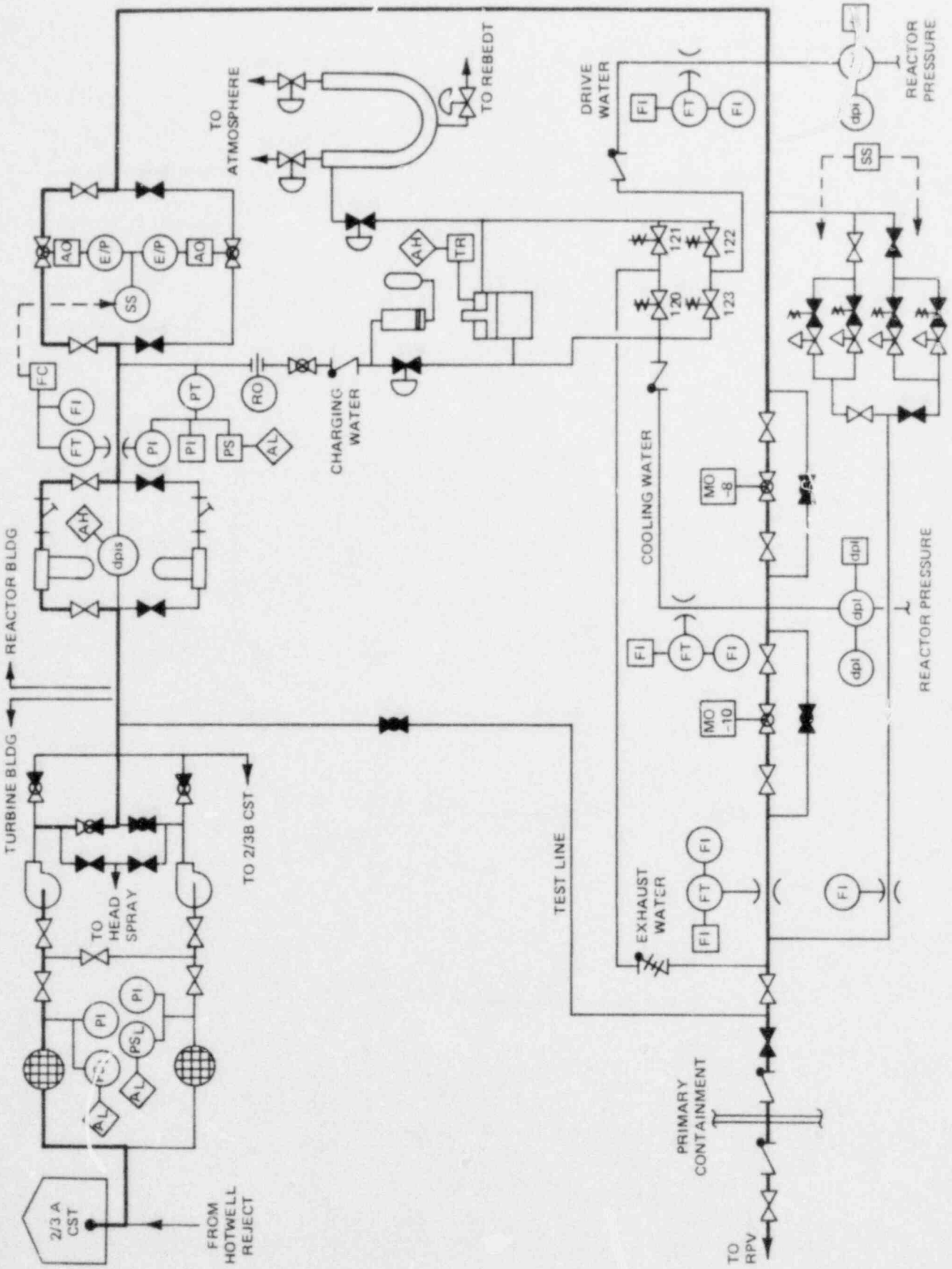


Figure 2.1-1. Control Rod Drive Hydraulic System

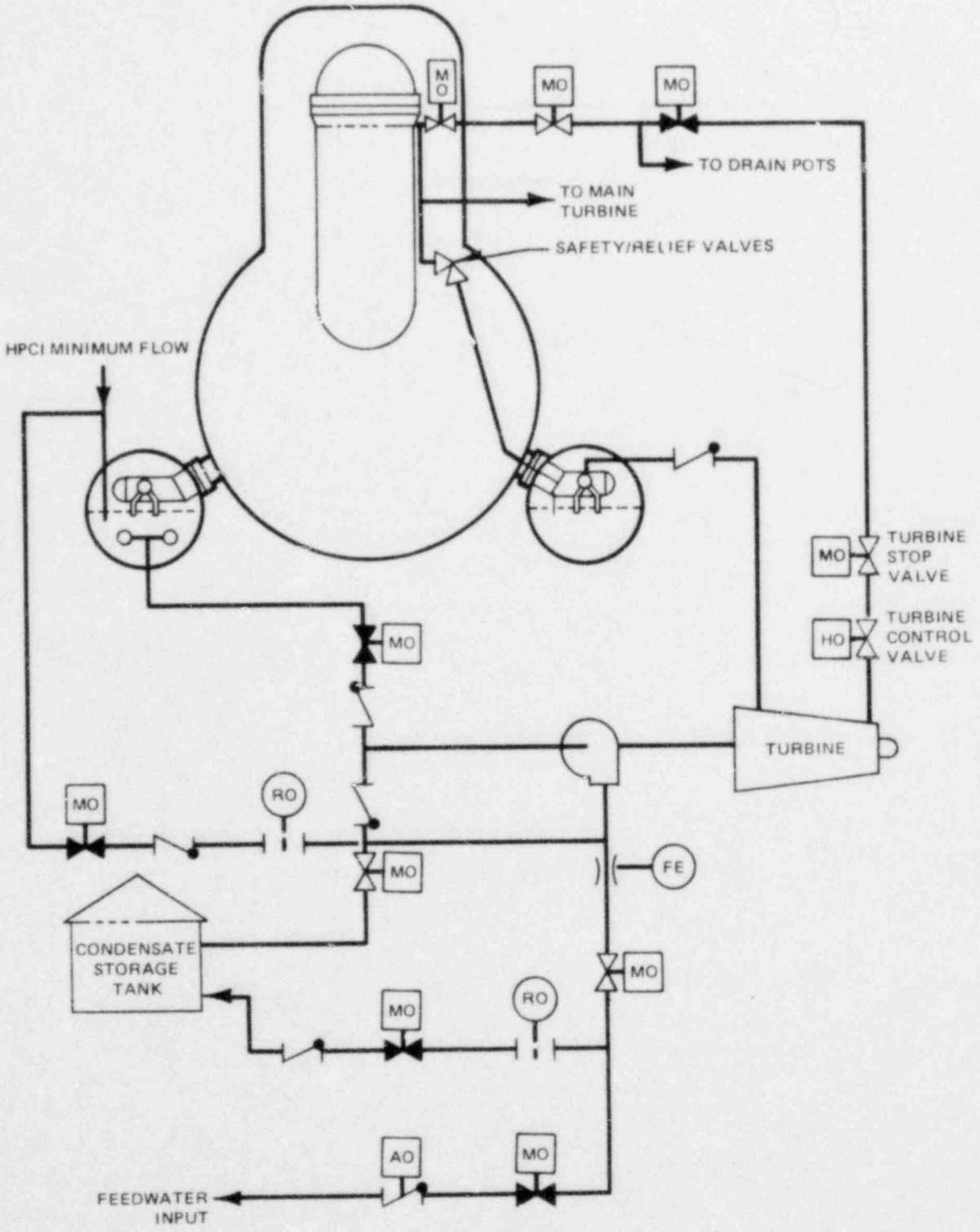


Figure 2.1-2. Reactor Core Isolation Cooling System

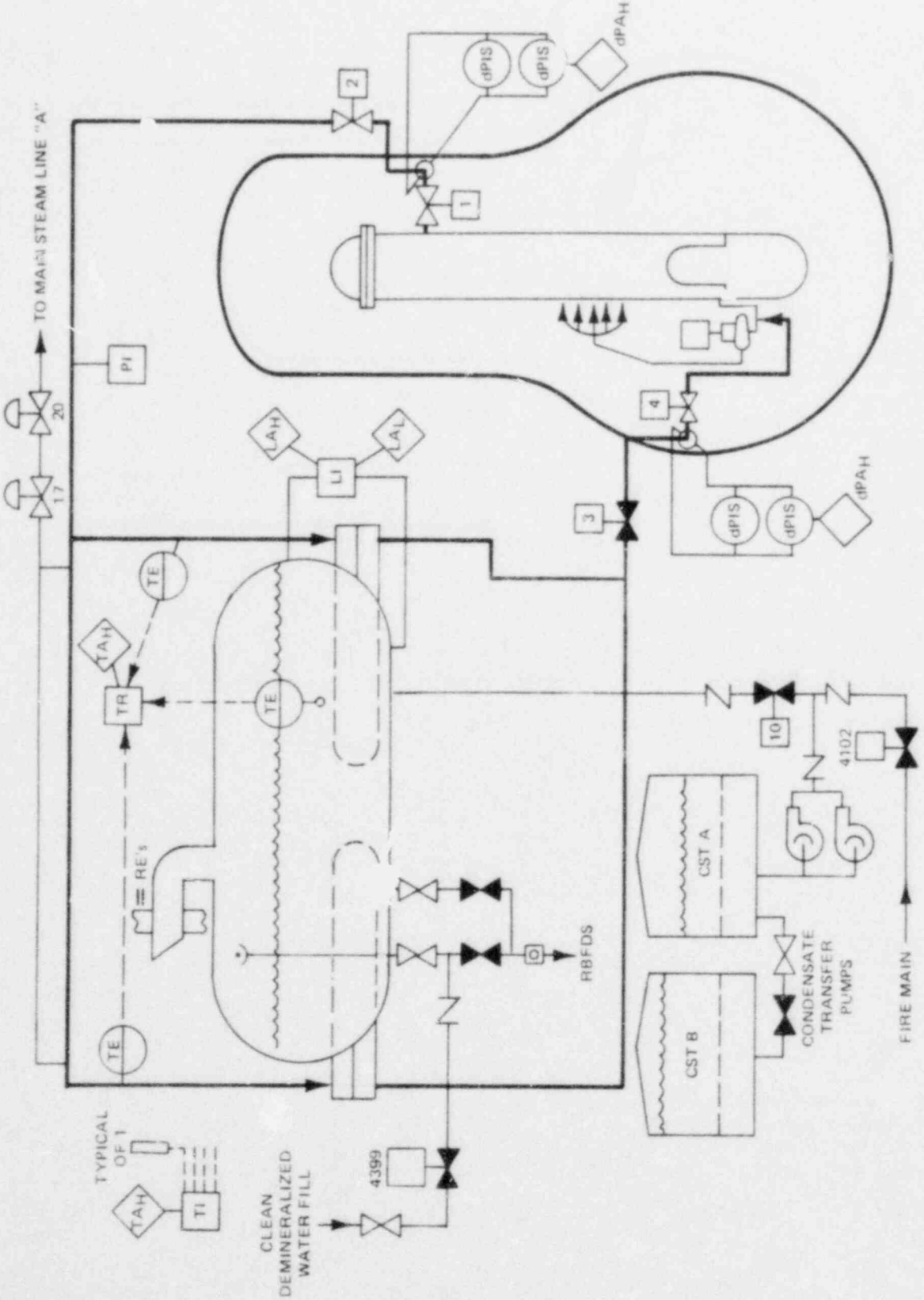


Figure 2.1-3. Isolation Condenser System

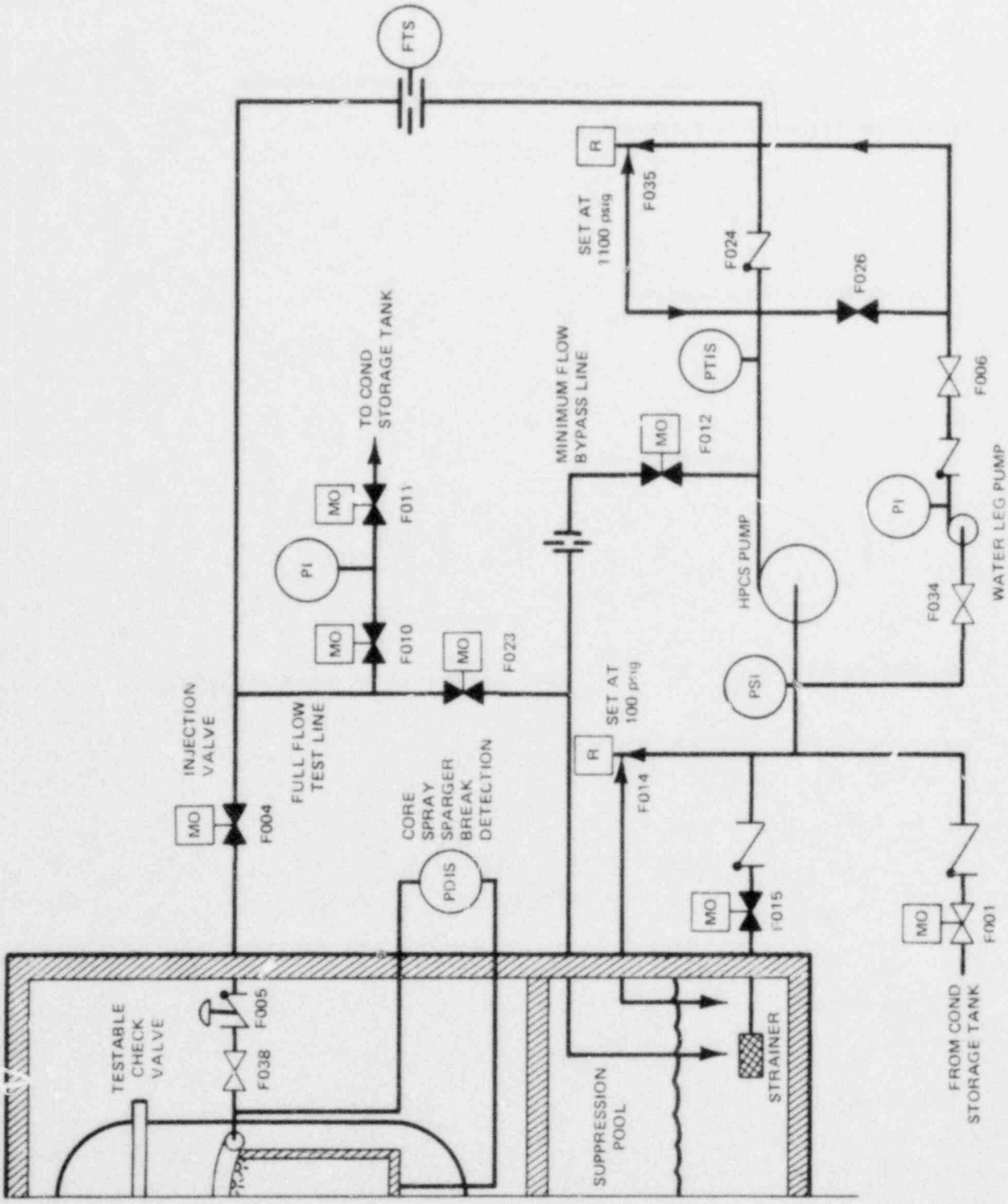


Figure 2.1-4. High Pressure Core Spray System

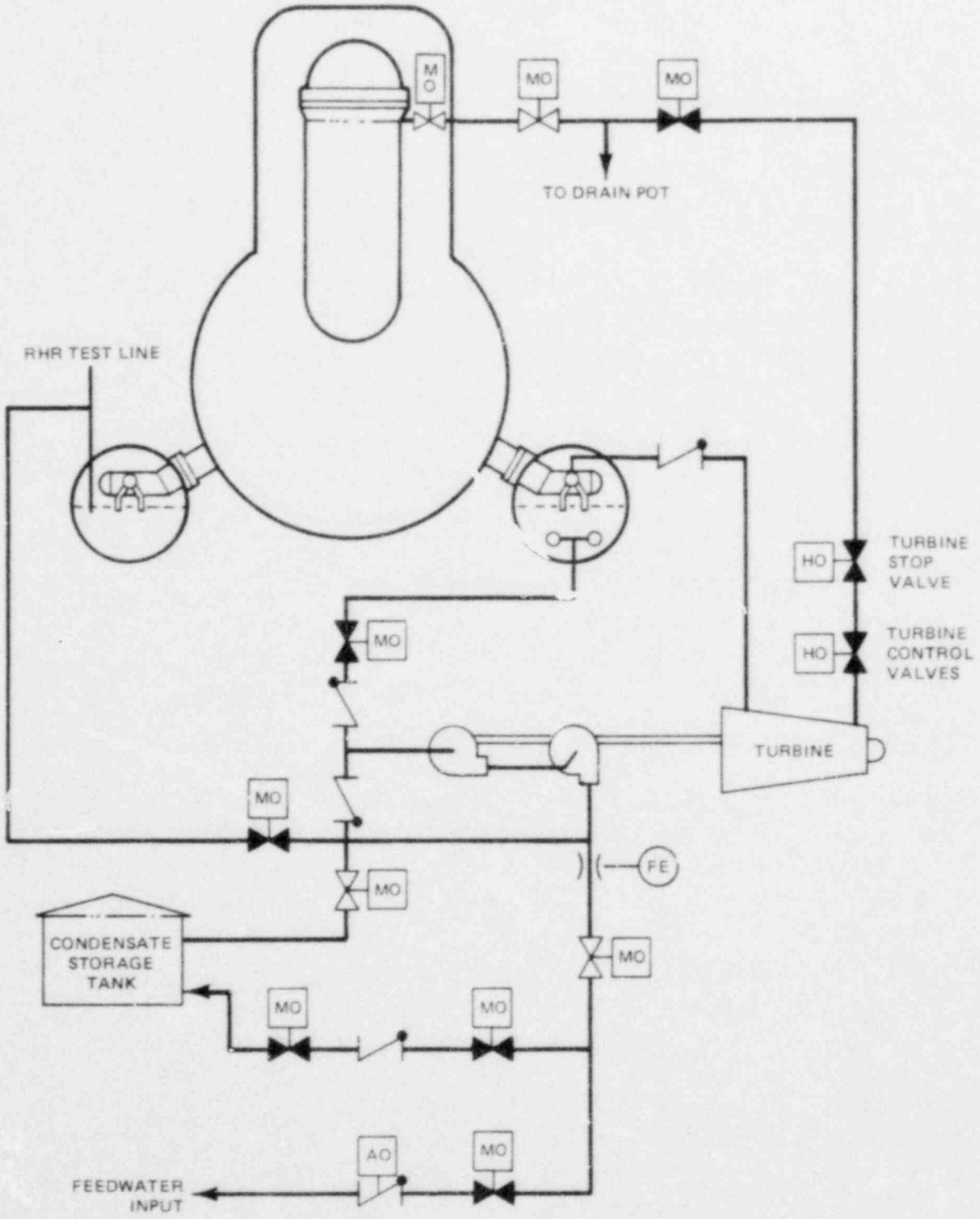


Figure 2.1-5. High Pressure Coolant Injection System

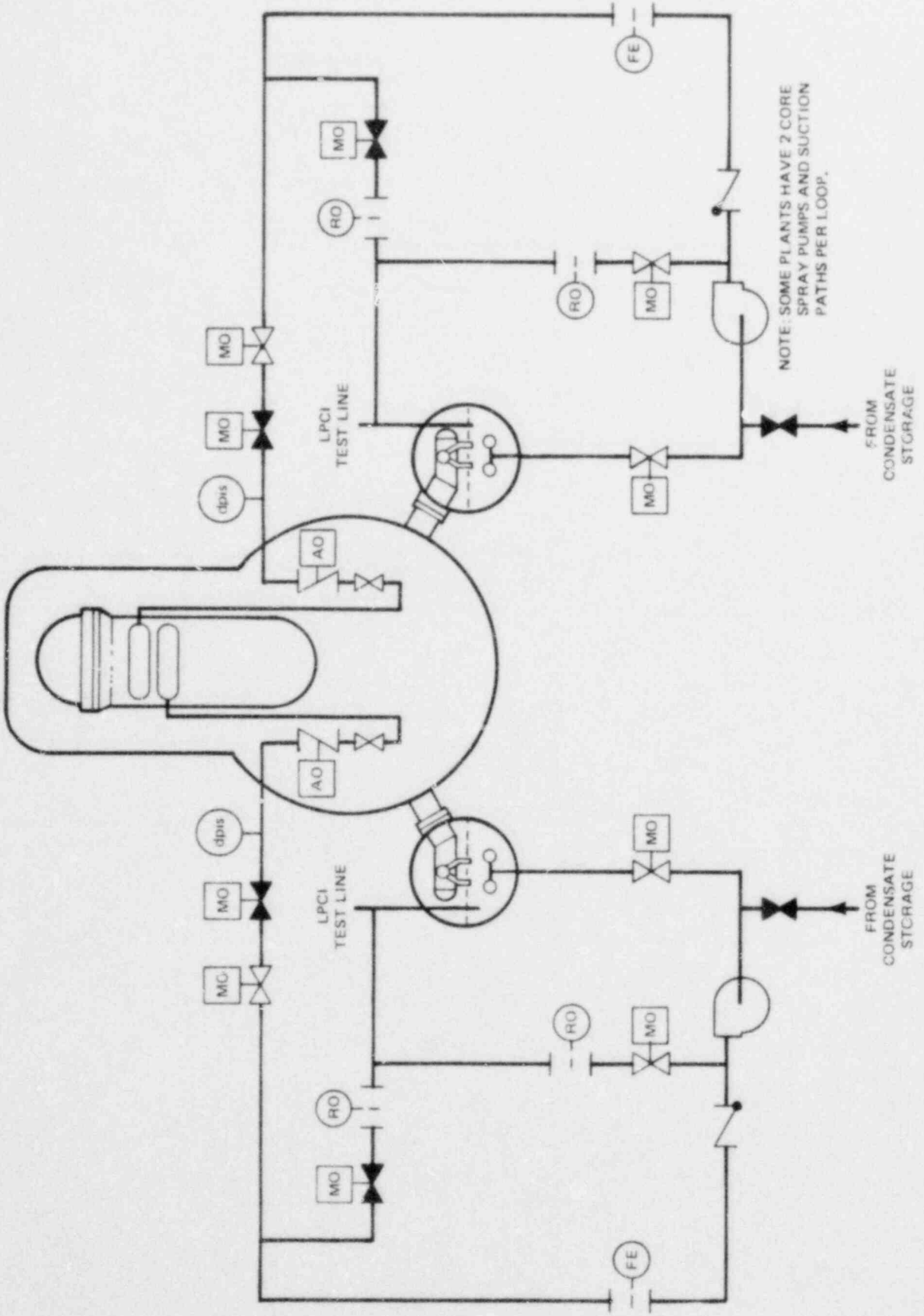


Figure 2.1-6. Core Spray System

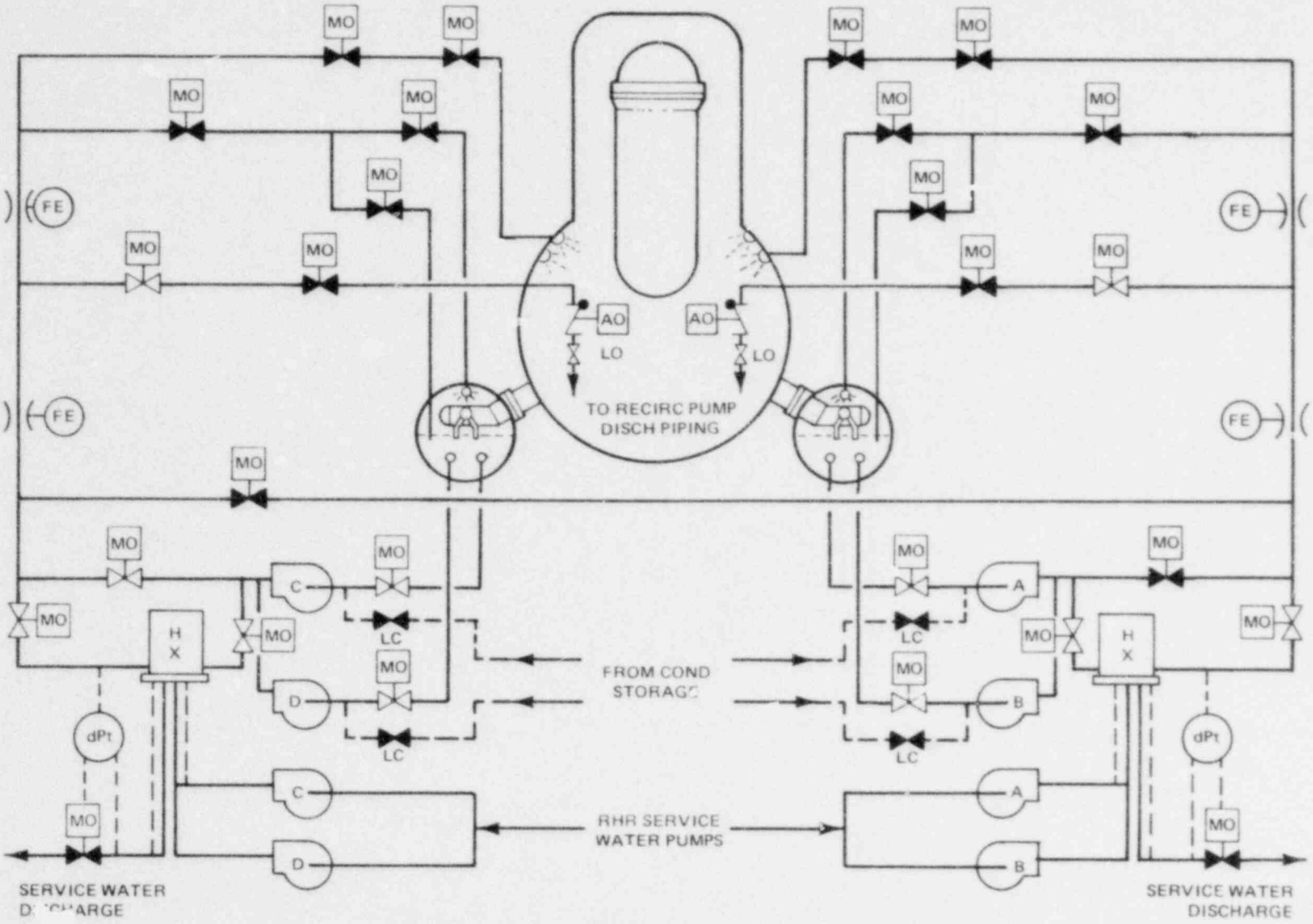


Figure 2.1-7. Low Pressure Coolant Injection System and Containment Spray/Cooling

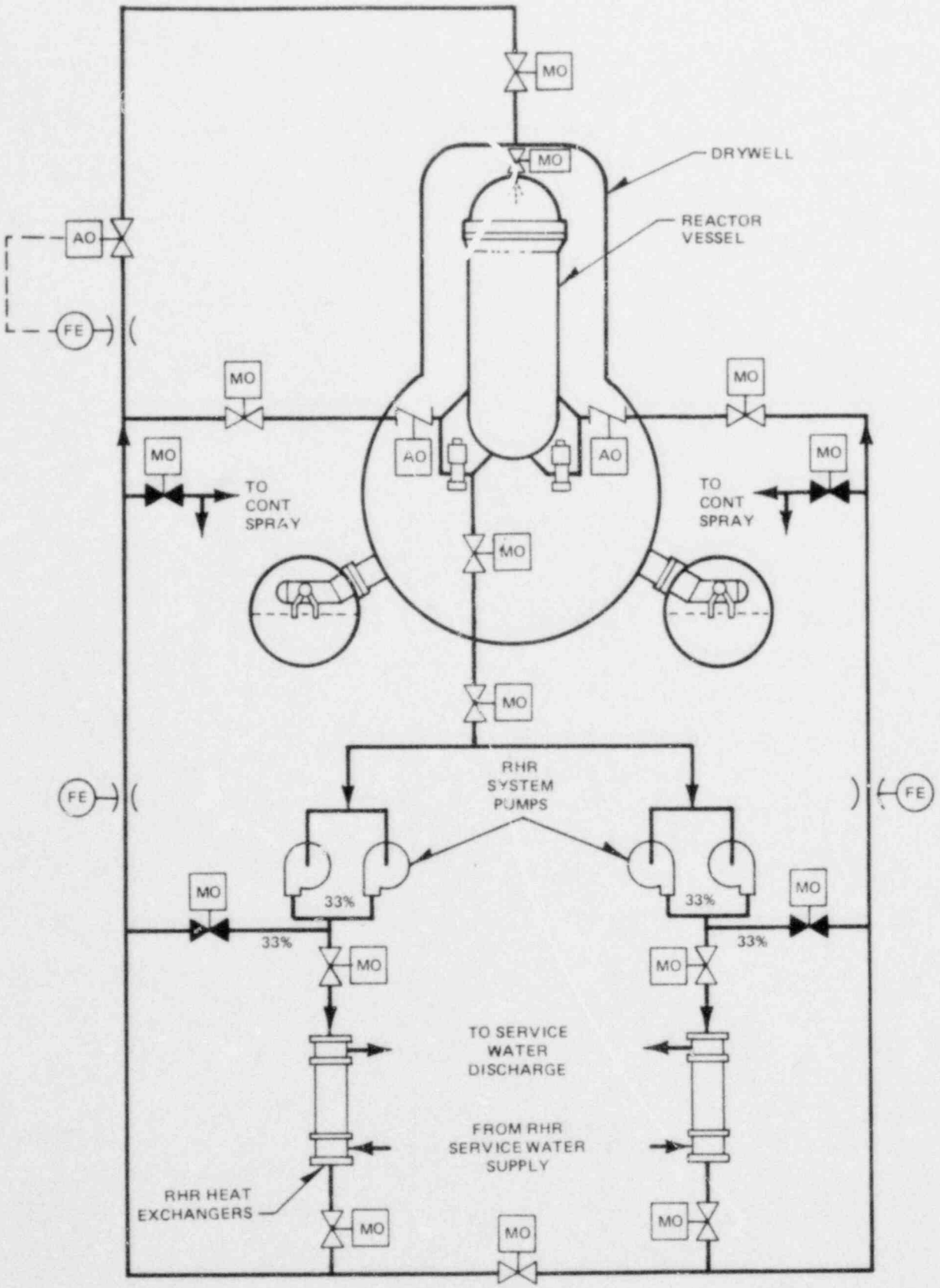


Figure 2.1-8. Shutdown Cooling System

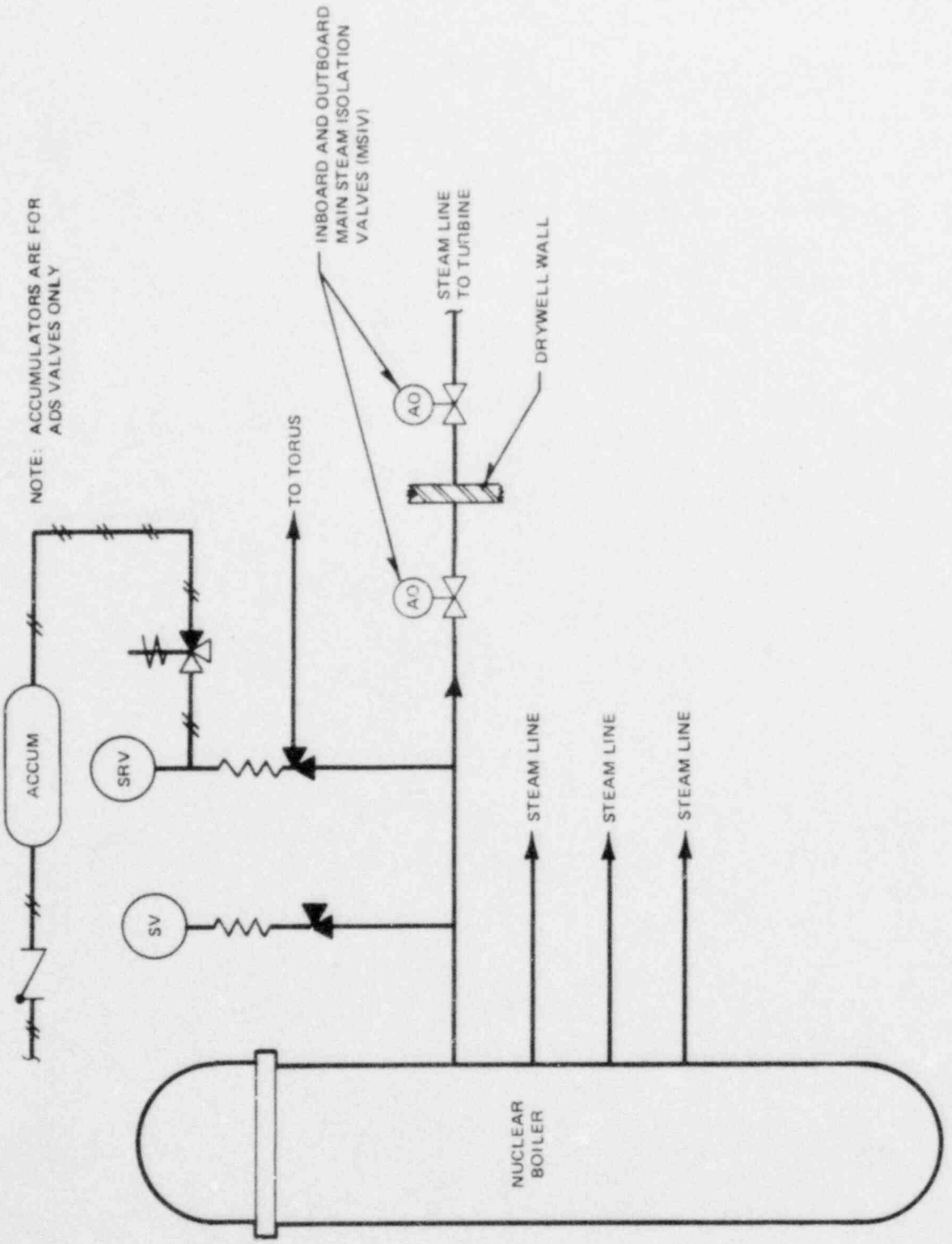


Figure 2.1-9. Automatic Depressurization System Safety Relief Valves

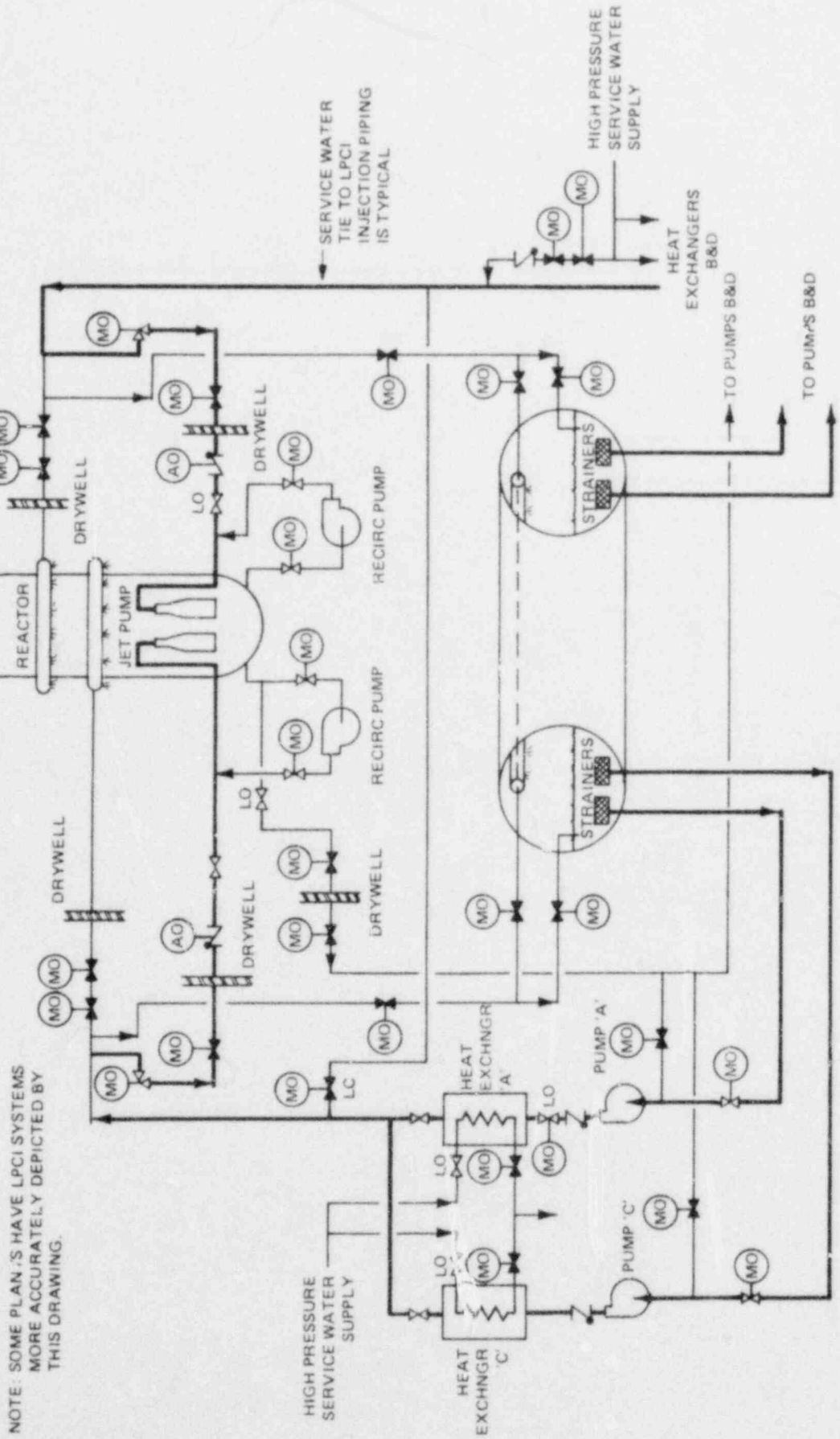


Figure 2.1-10. Residual Heat Removal System Low Pressure Coolant Injection System

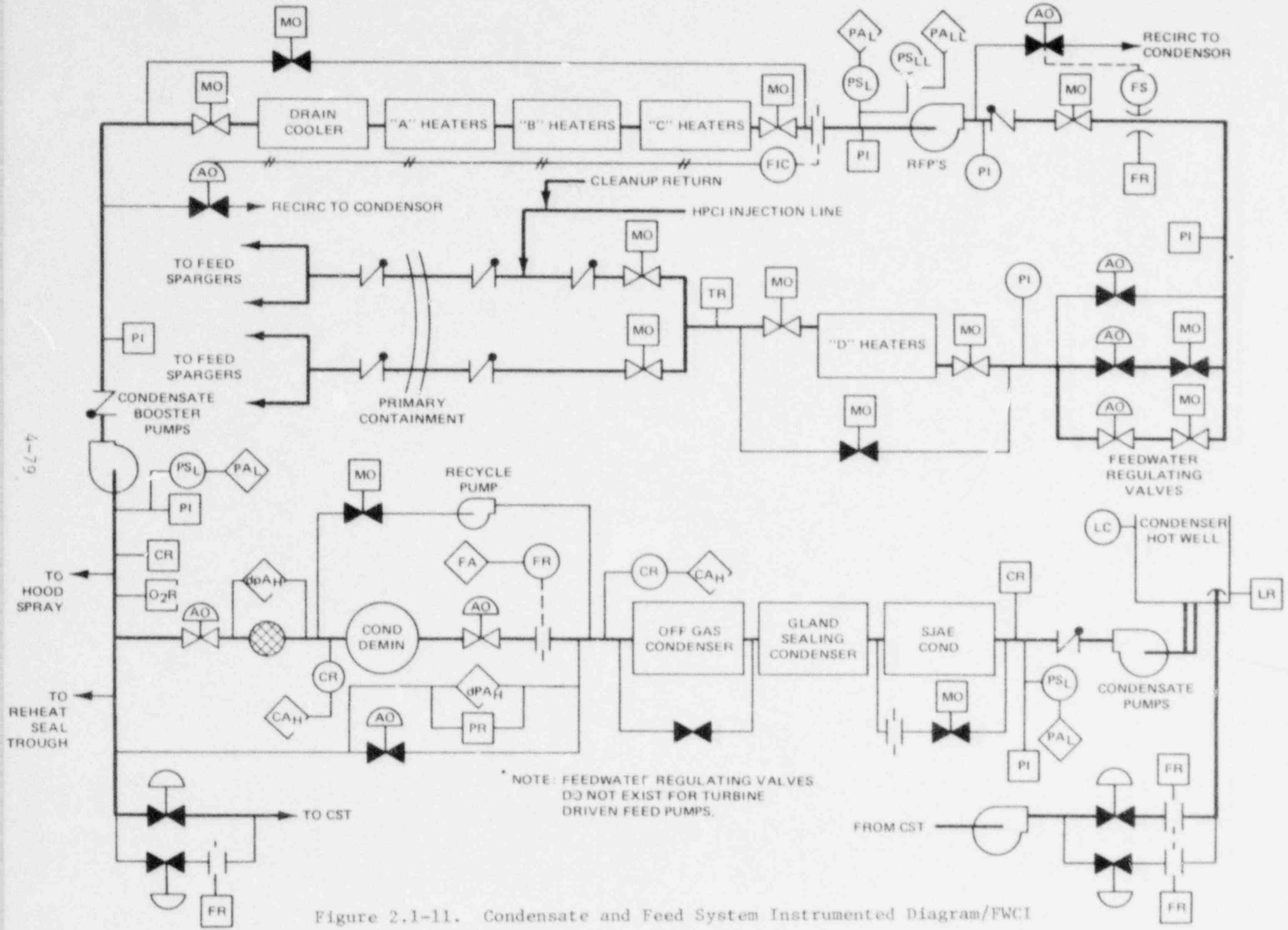


Figure 2.1-11. Condensate and Feed System Instrumented Diagram/FWCI

NEDO-24708A

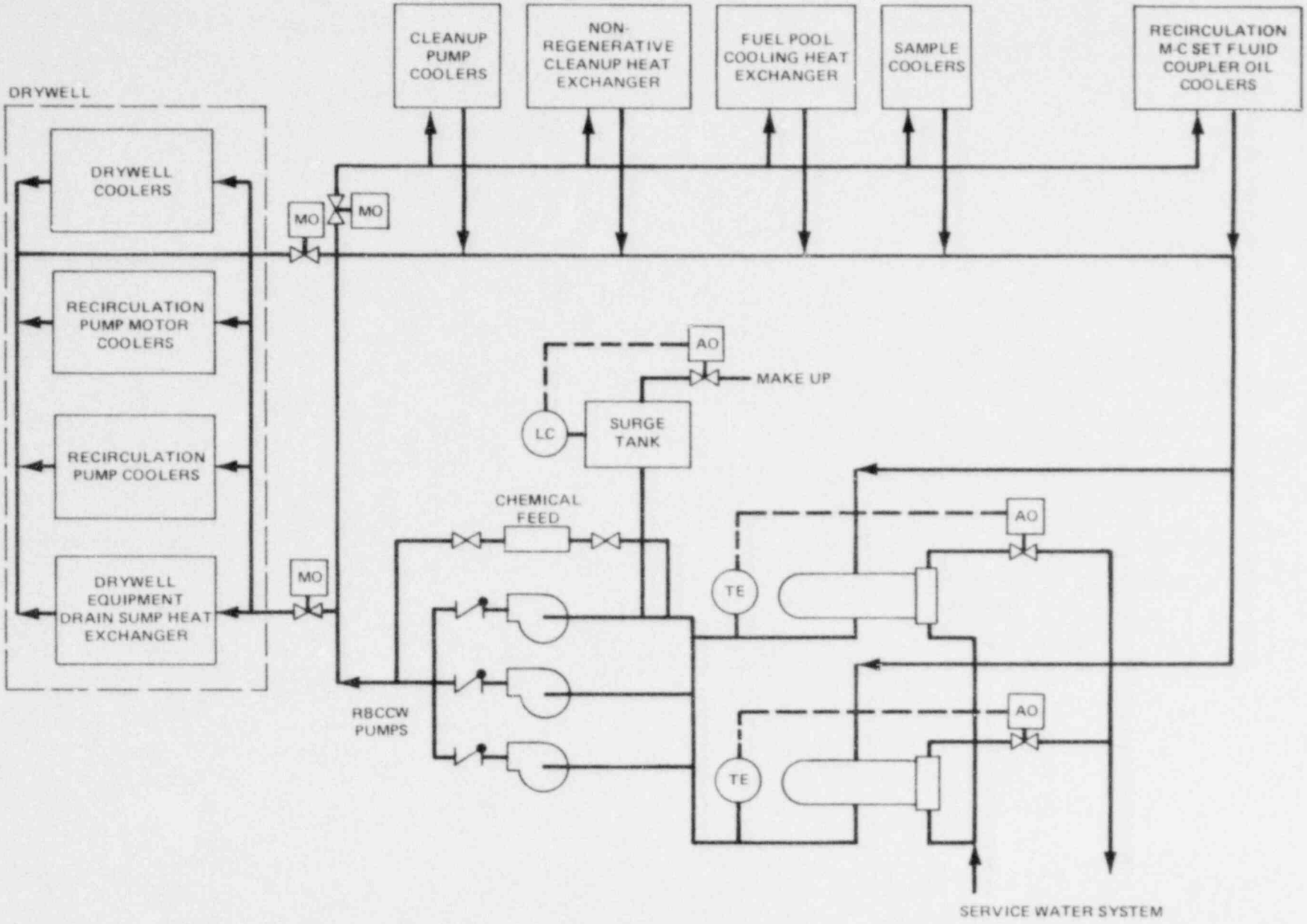


Figure 2.1-12. Reactor Building Closed Cooling Water System

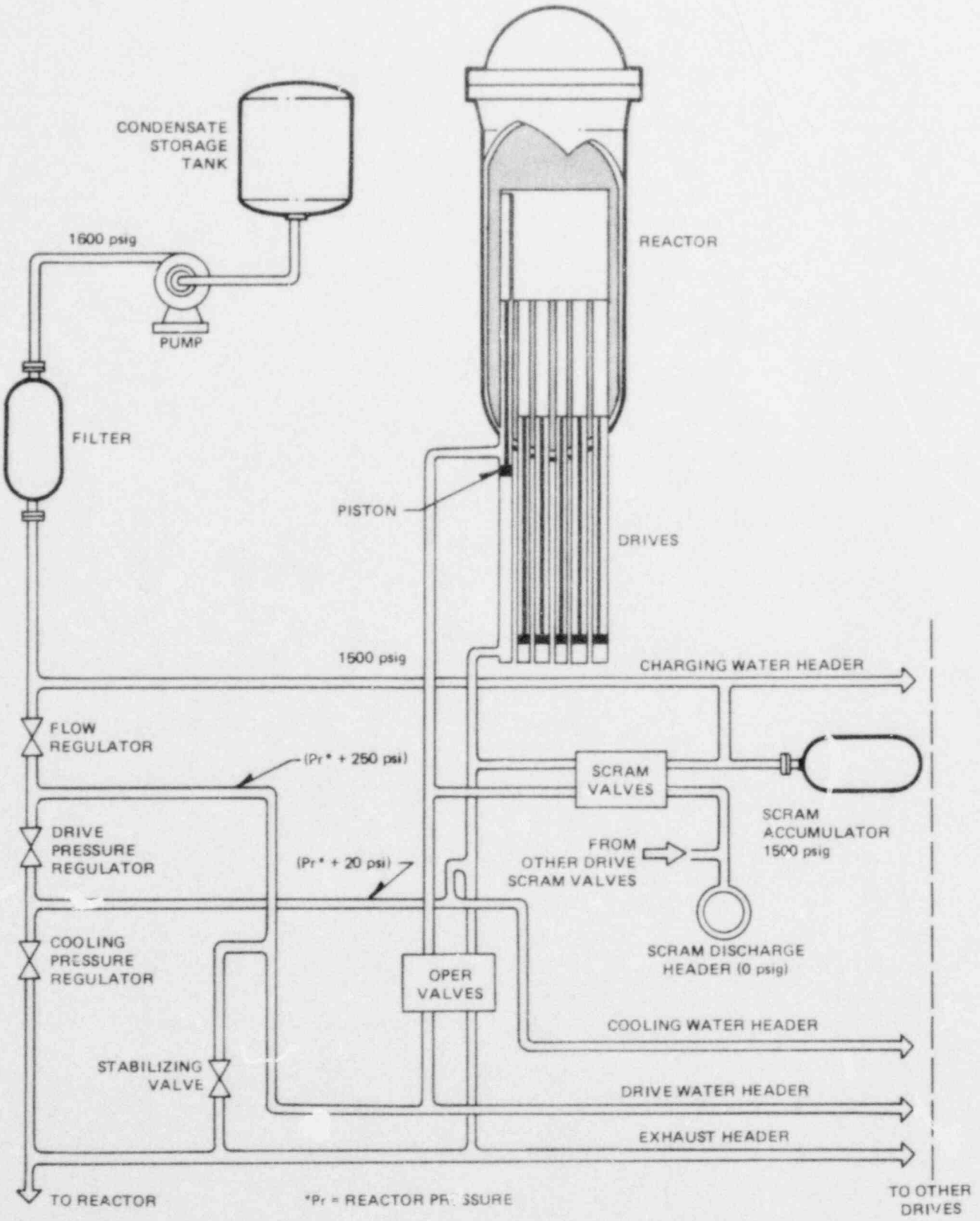


Figure 2.1-13. Basic Control Rod Drive System

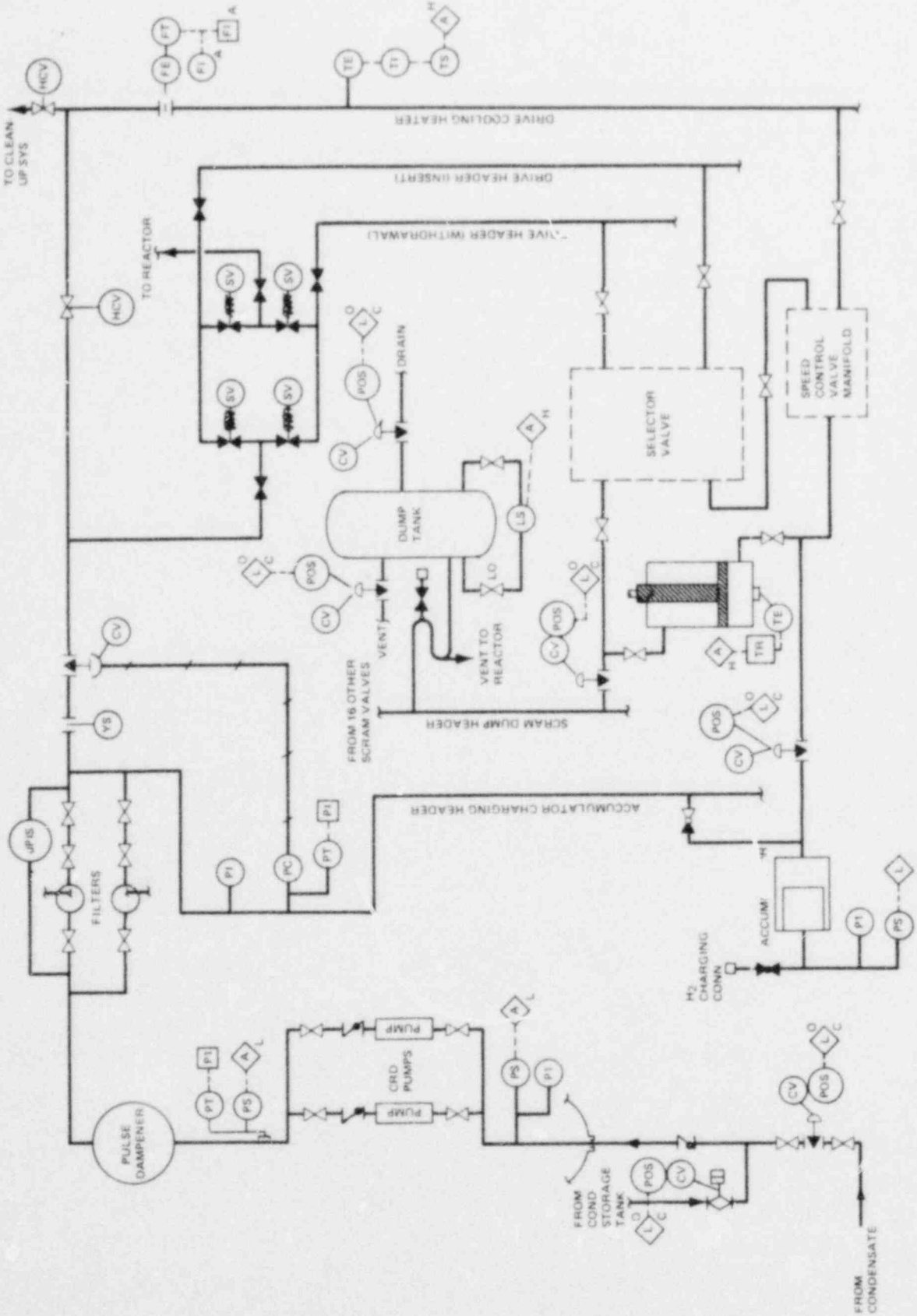


Figure 2.1-14: Big Rock Point - Control Rod Drive System

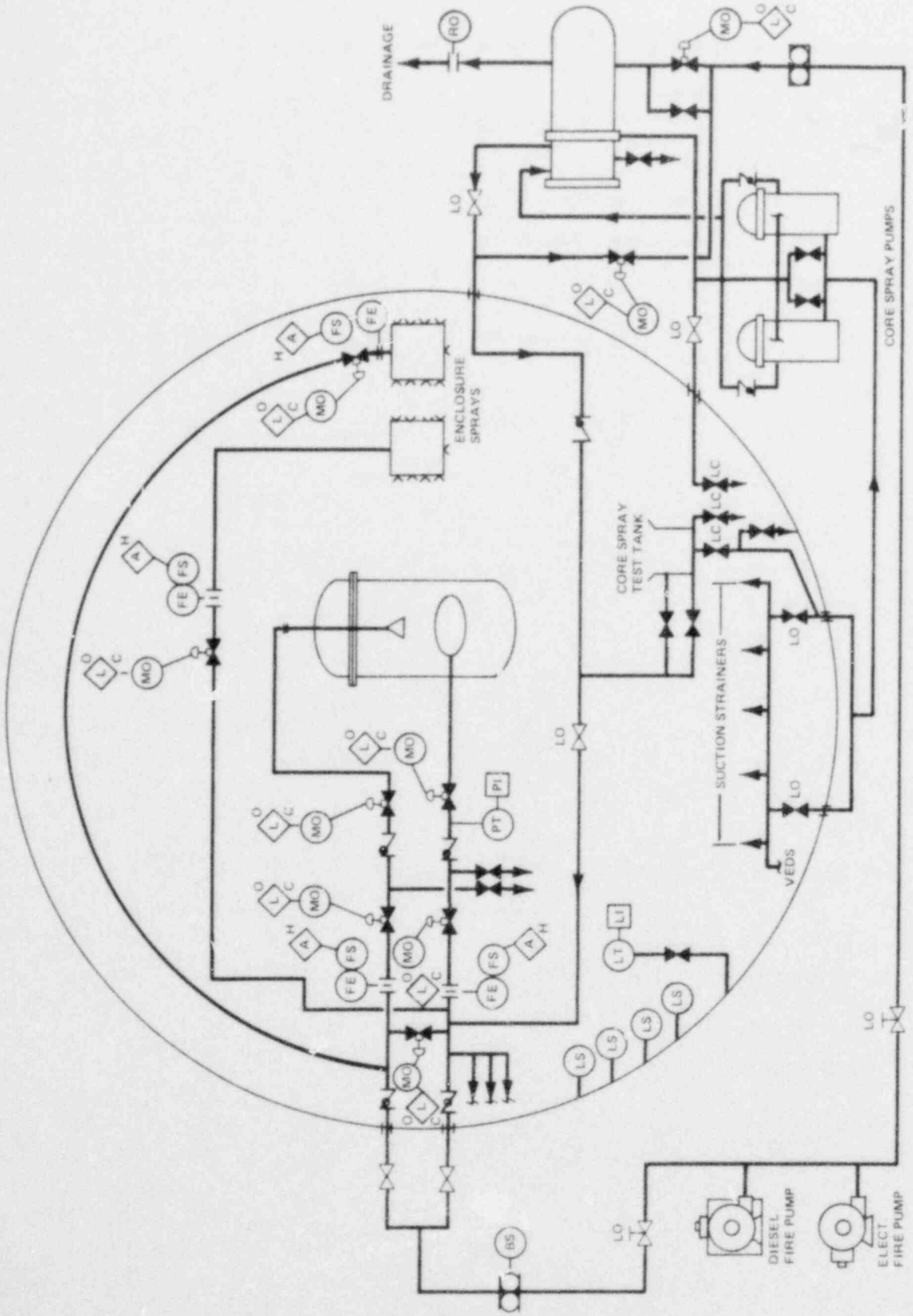


Figure 2.1-15: Enclosure & Core Spray System - Big Rock Point

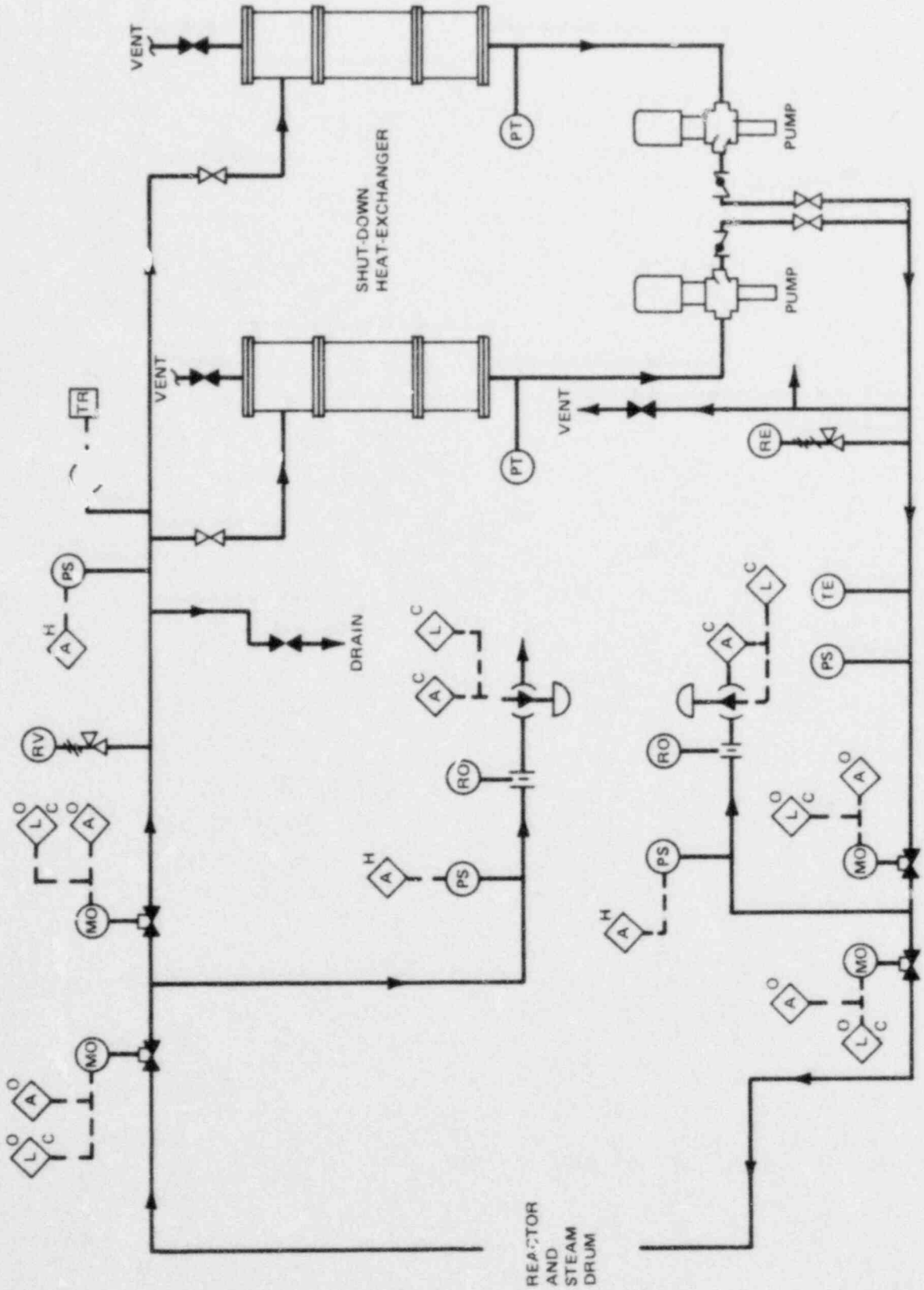


Figure 2.1-16: Big Rock Point - Shutdown Cooling System

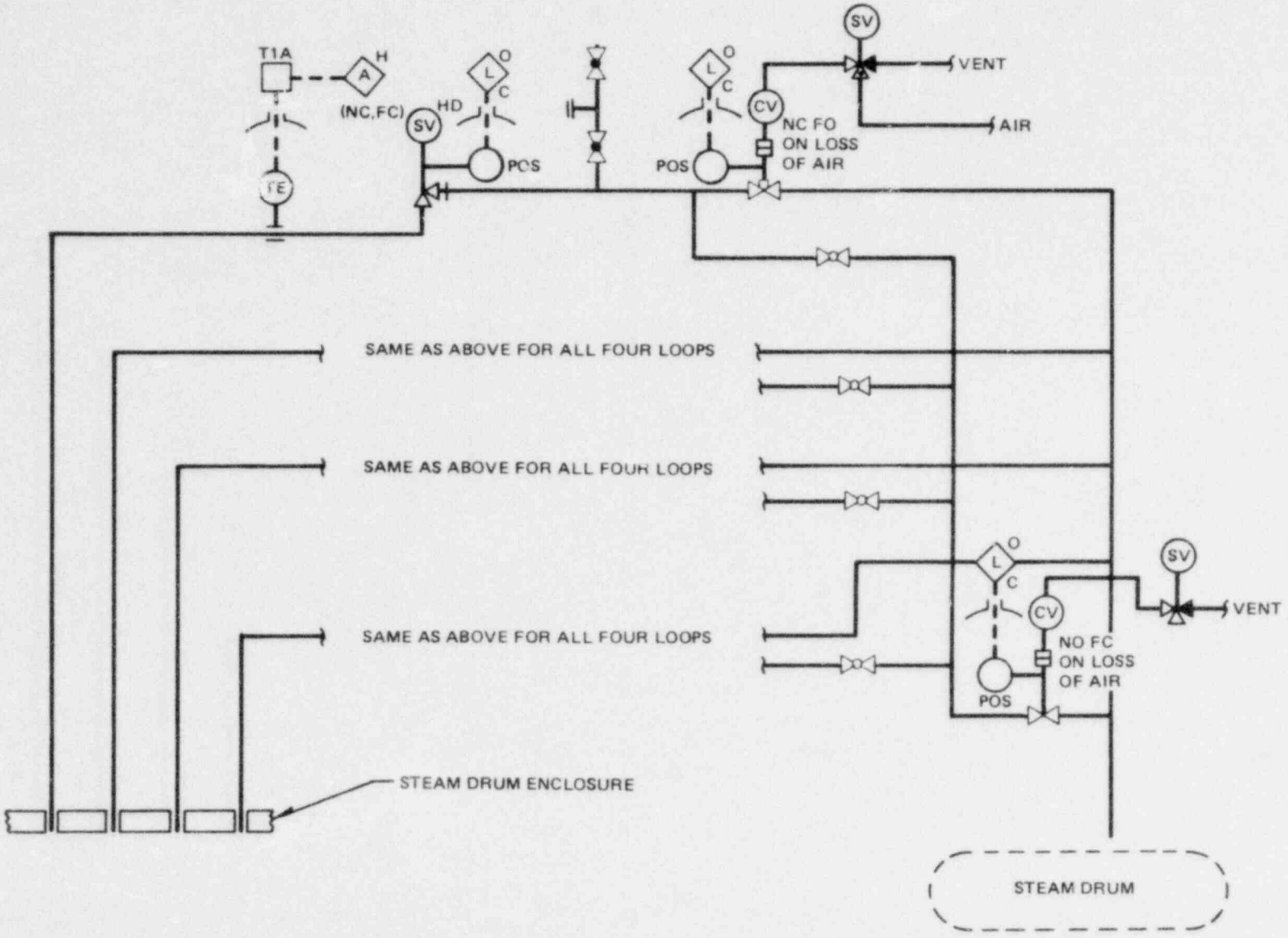


Figure 2.1-17: Big Rock Point - Reactor Depressurization System

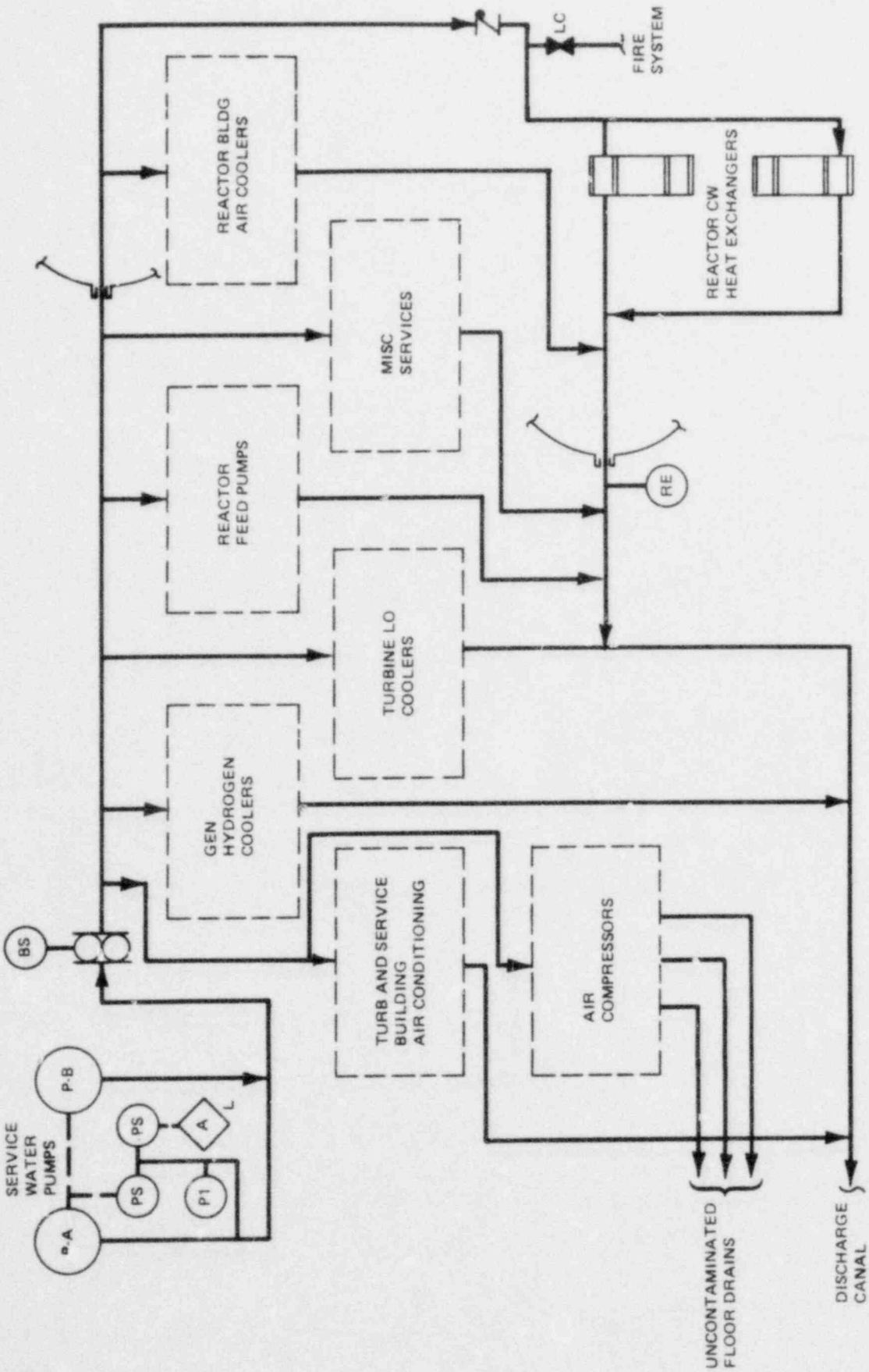


Figure 2.1-18: Big Rock Point - Service Water System

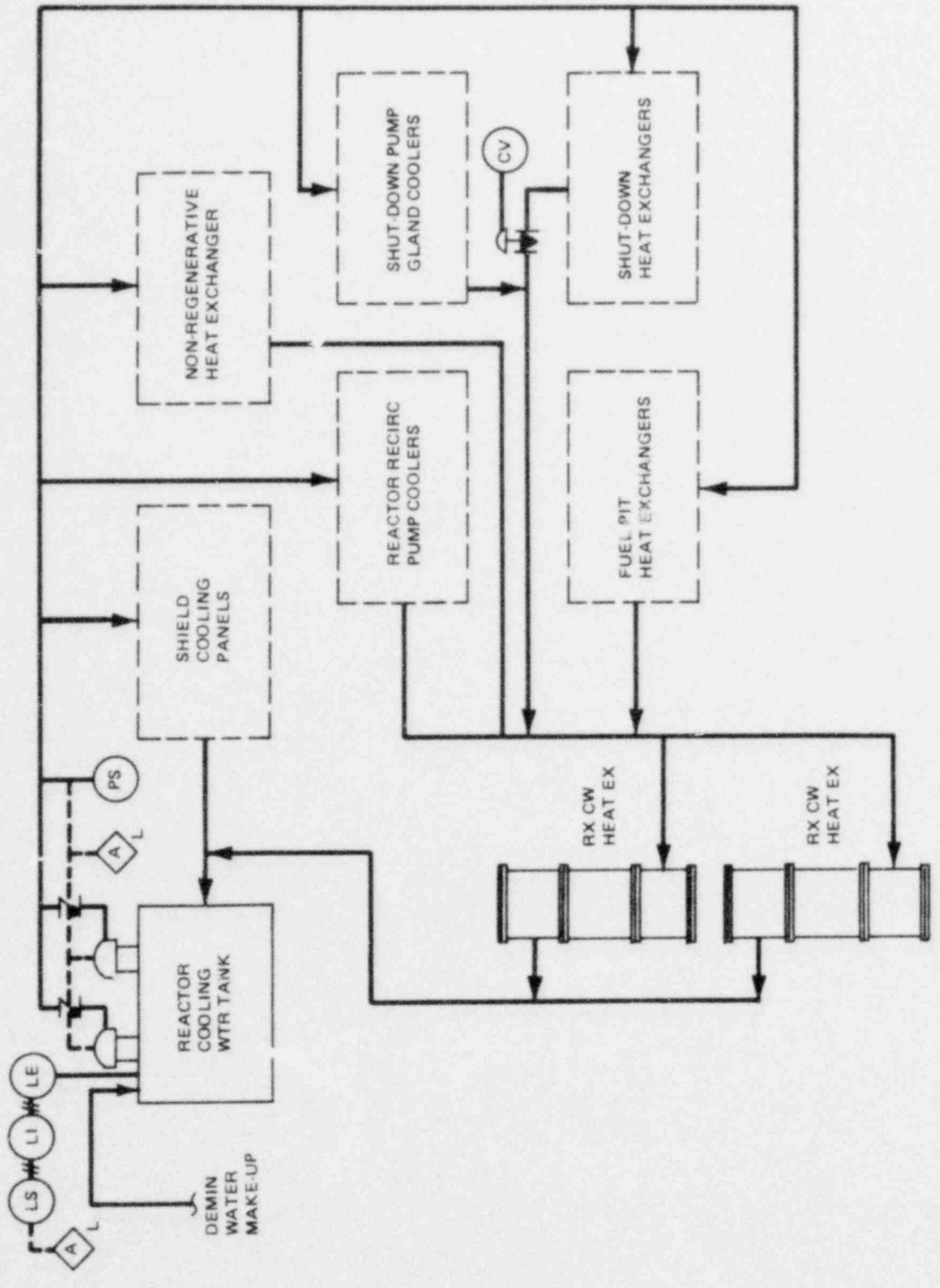


Figure 2.1-19: Big Rock Point - Reactor Cooling Water System

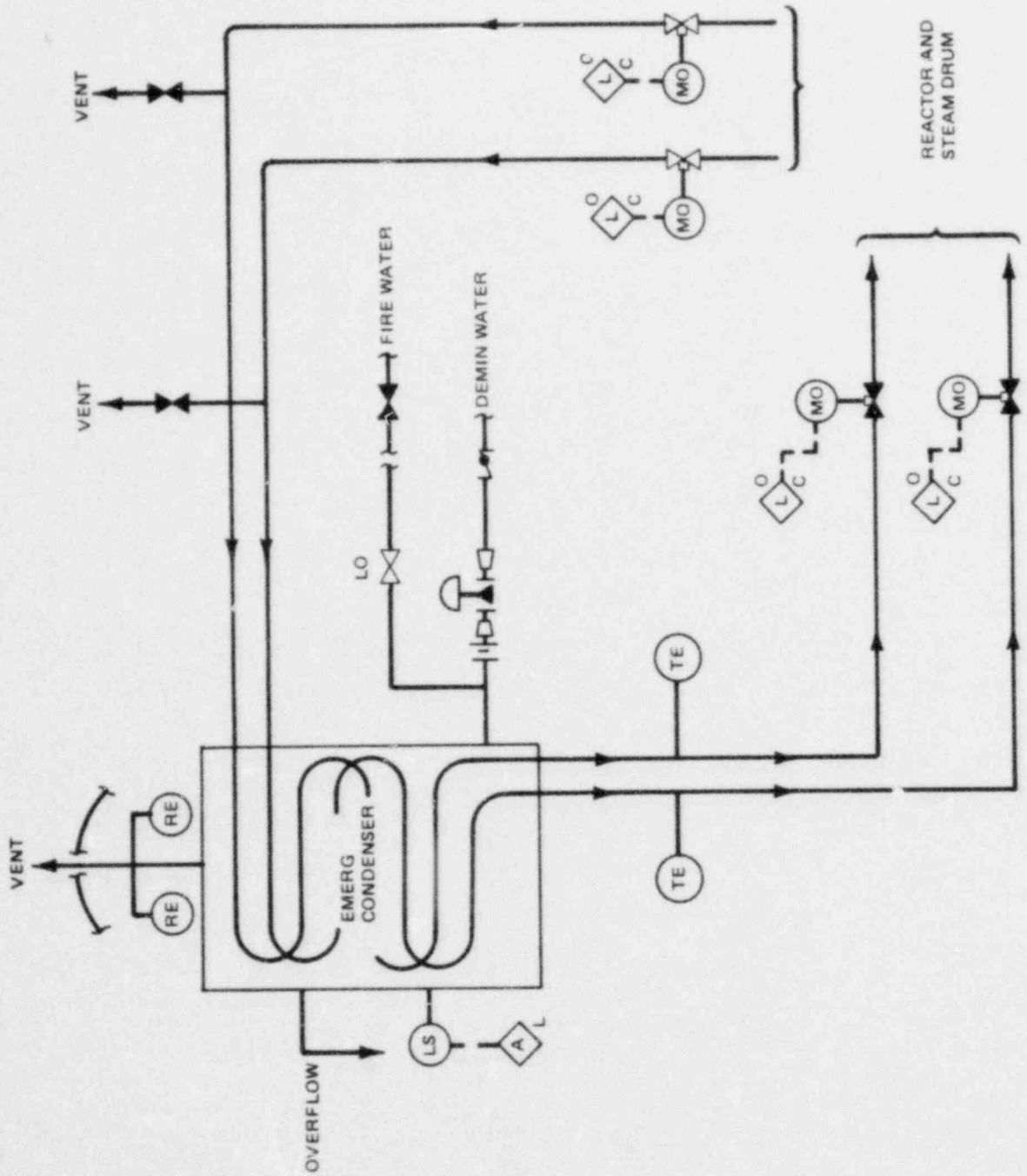


Figure 2.1-20: Big Rock Point - Emergency Condenser System

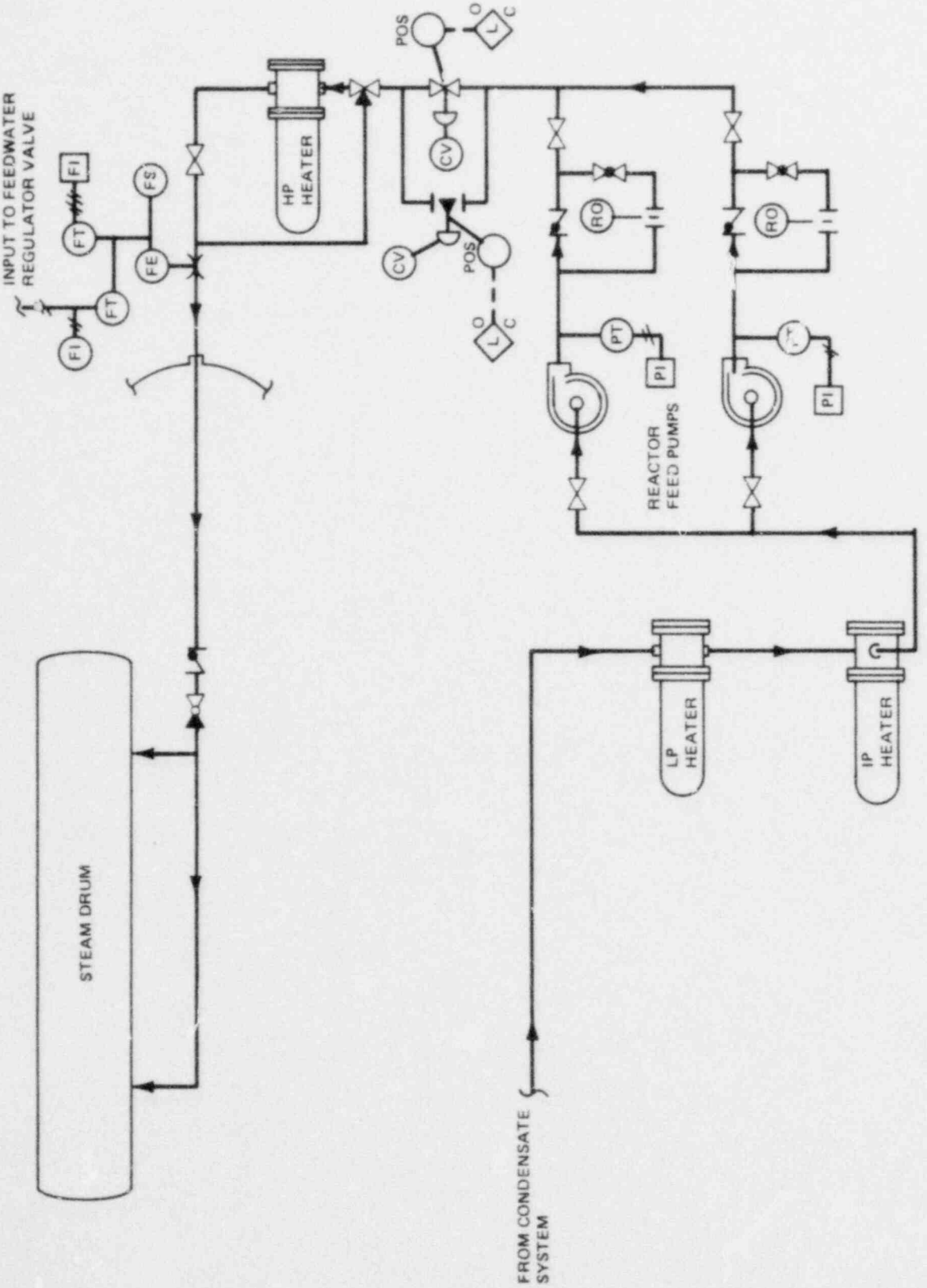


Figure 2.1-21: Big Rock Point - Feedwater System

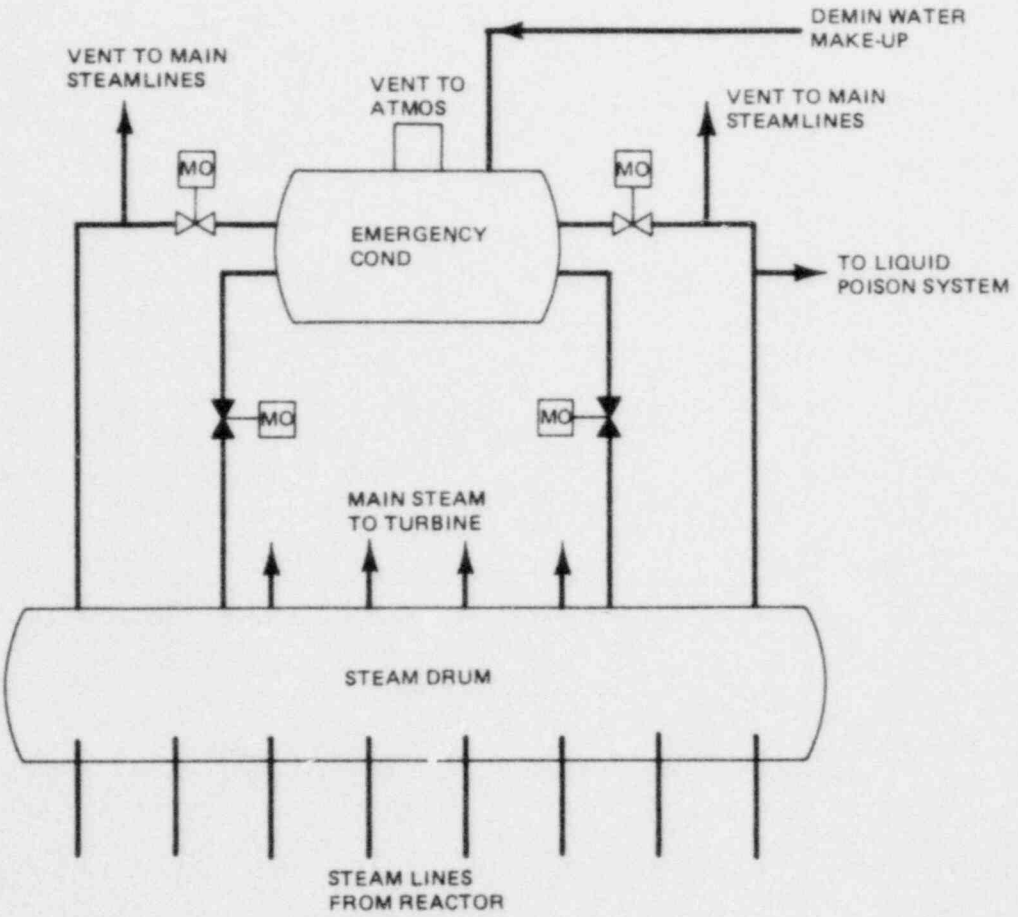


Figure 2.1-22: Emergency Cond. System (RCIC) - Dresden-.

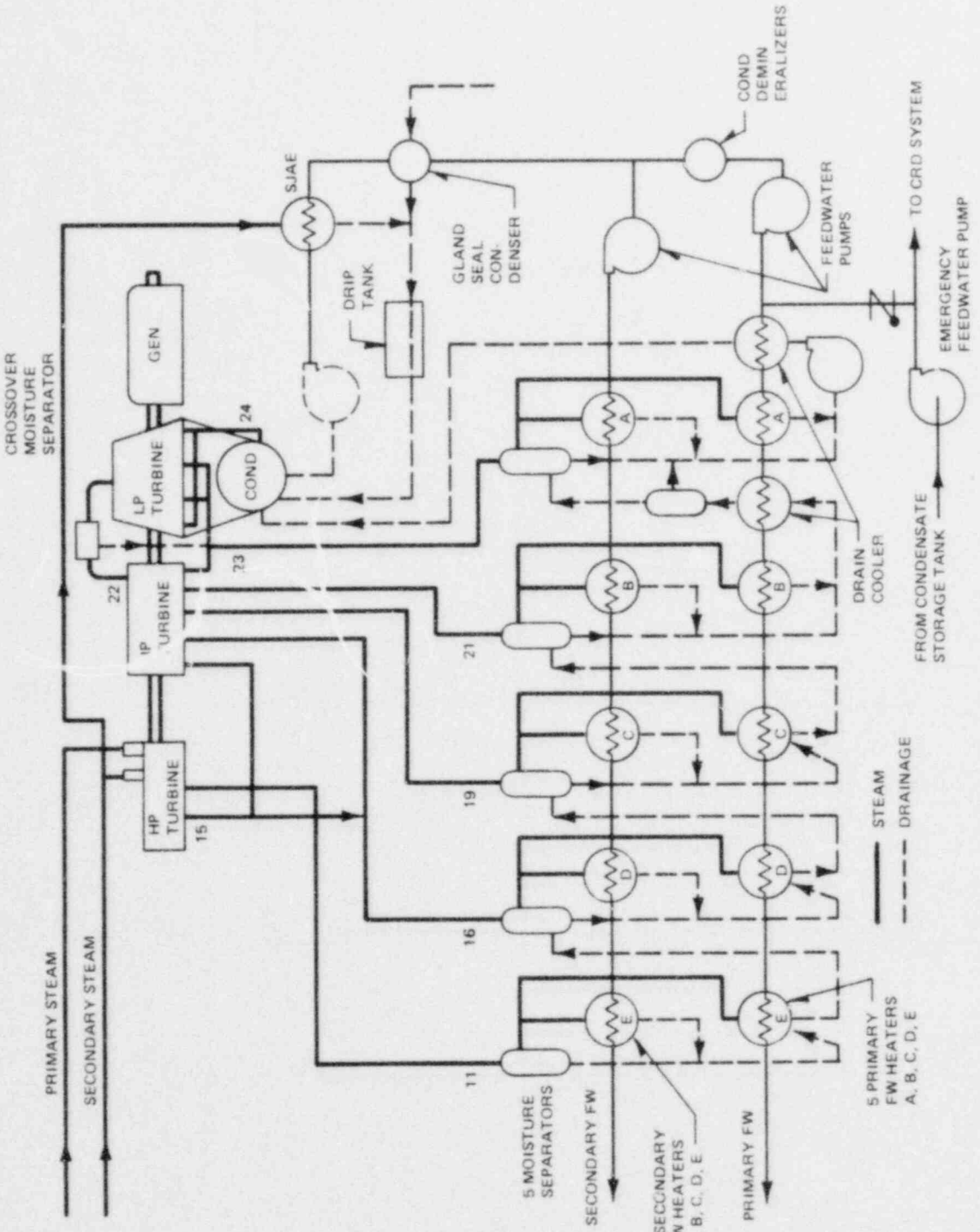


Figure 2.1-23: Feedwater System - Dresden-1

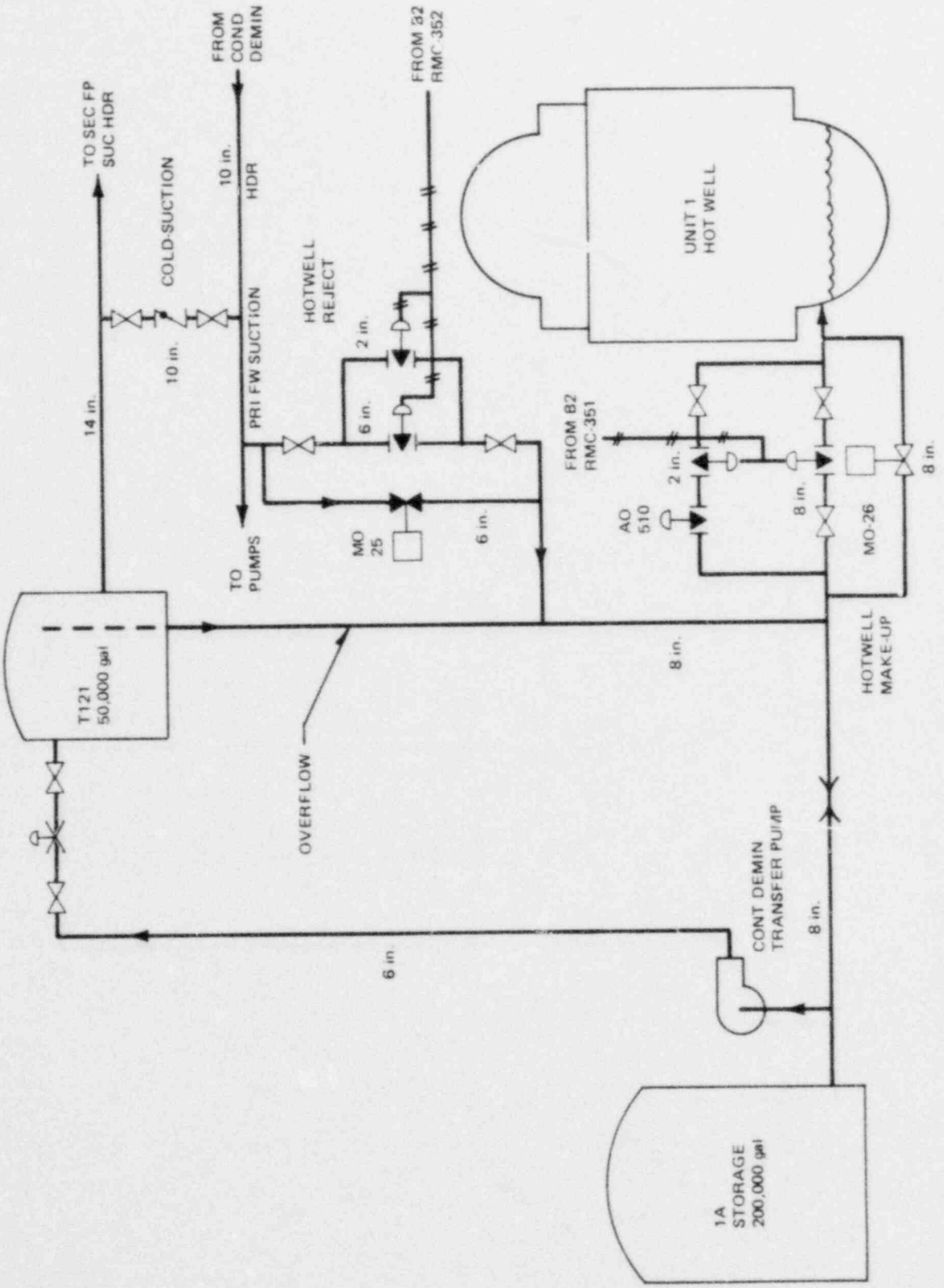


Figure 2.1-24: Condensate System - Dresden-1

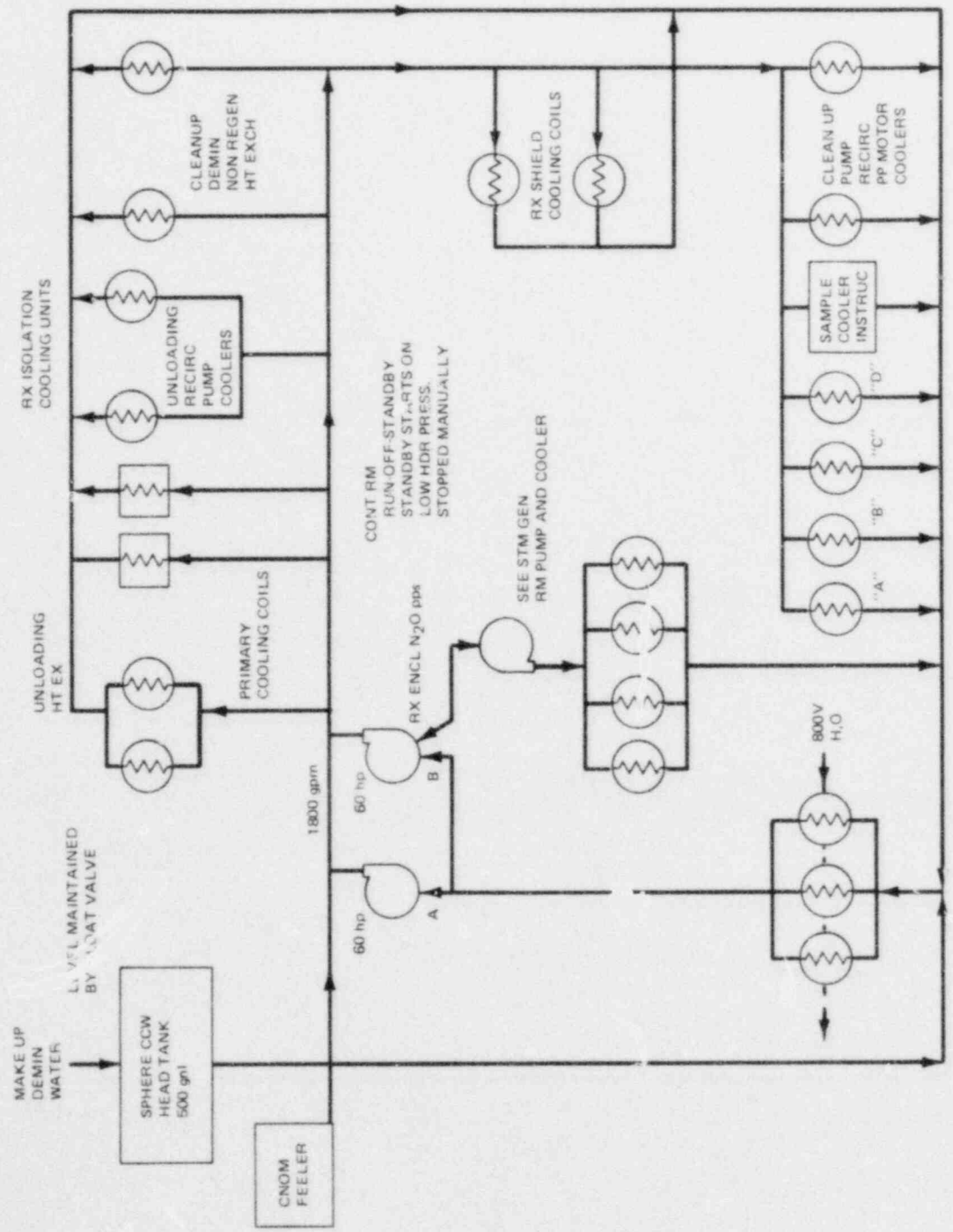


Figure 2.1-25: Rx C.C.W. System - Dresden-1

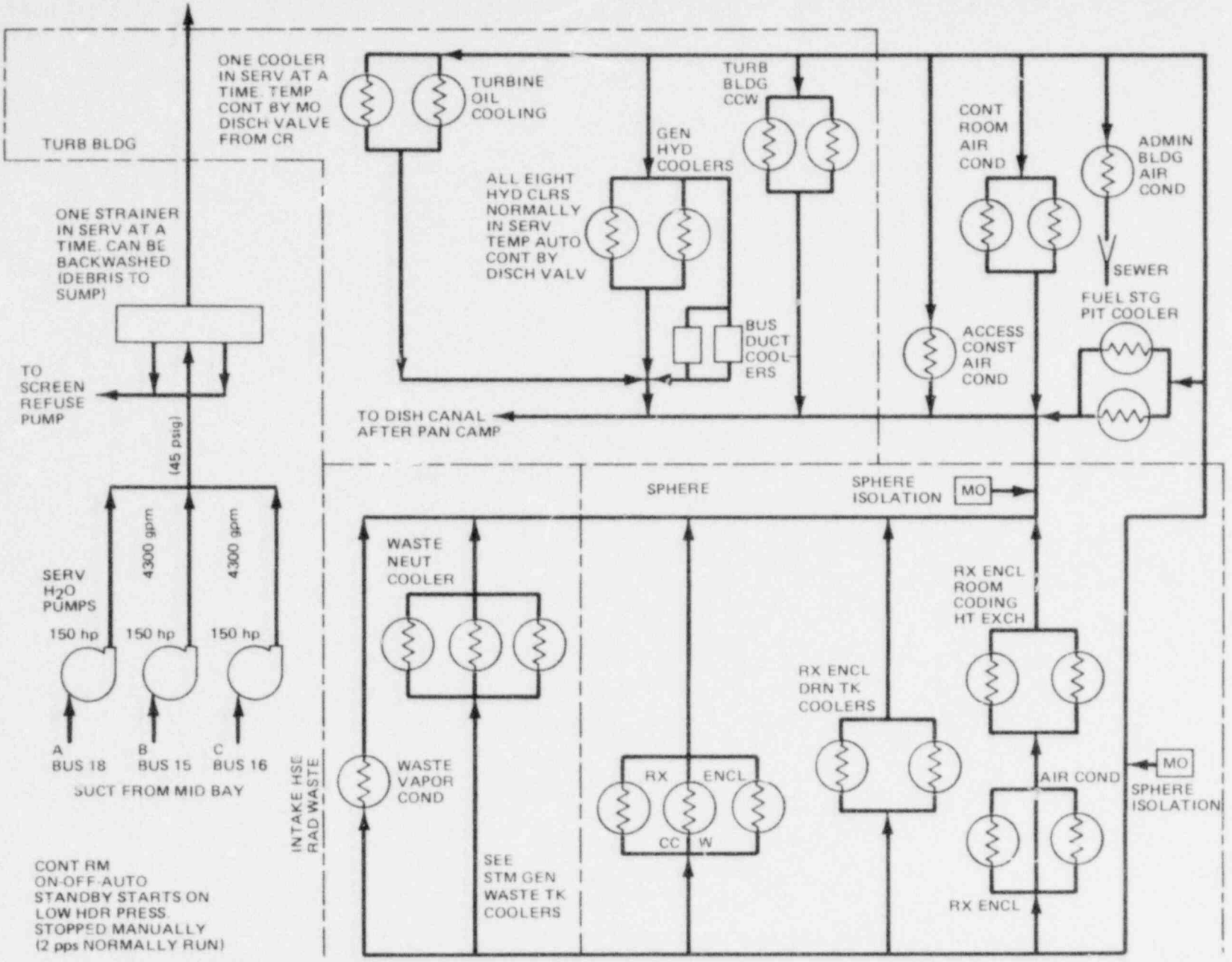


Figure 2.1-26: Service Water System - Dresden-1

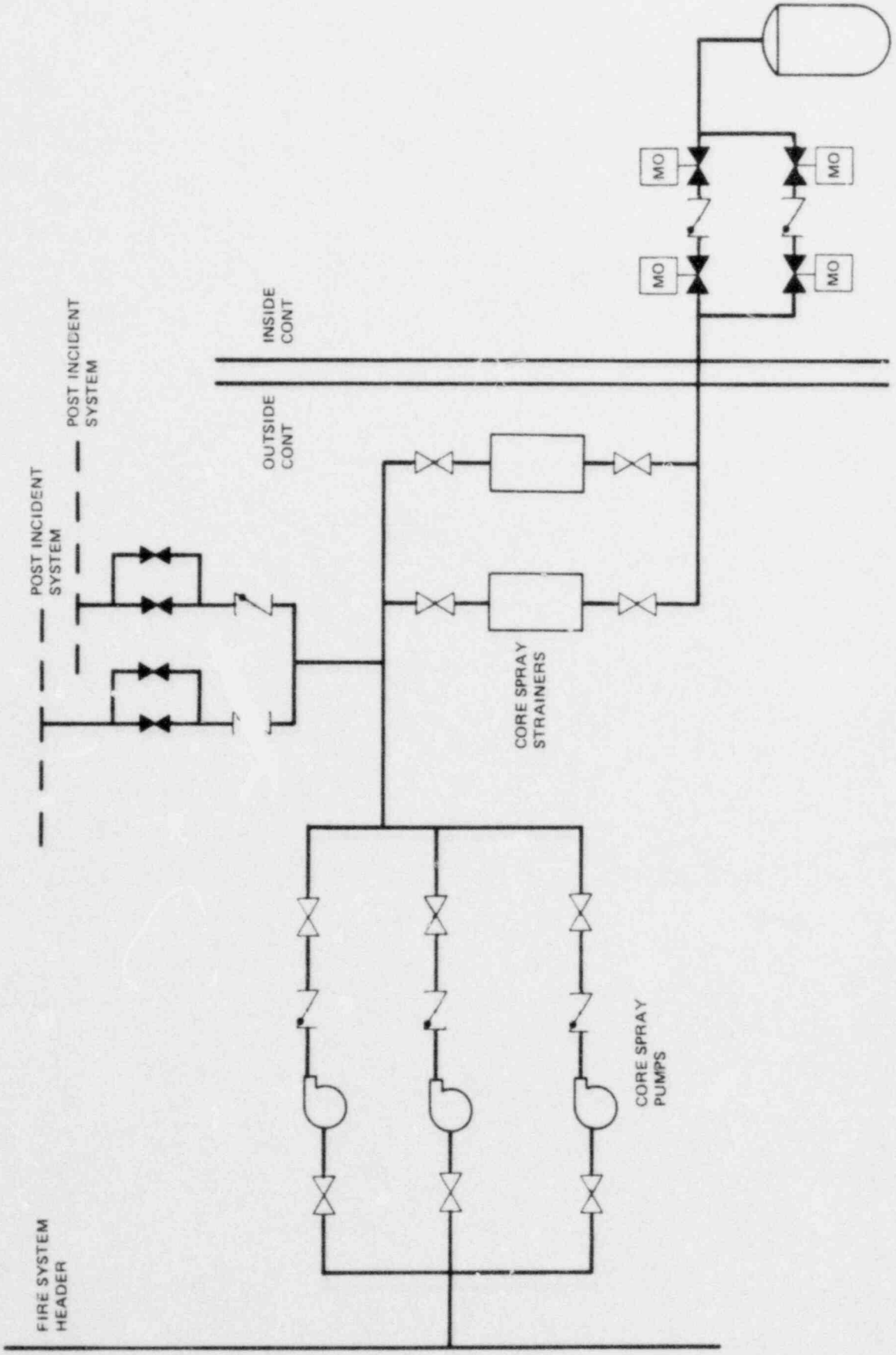


Figure 2.1-27: Dresden-1 Core Spray System

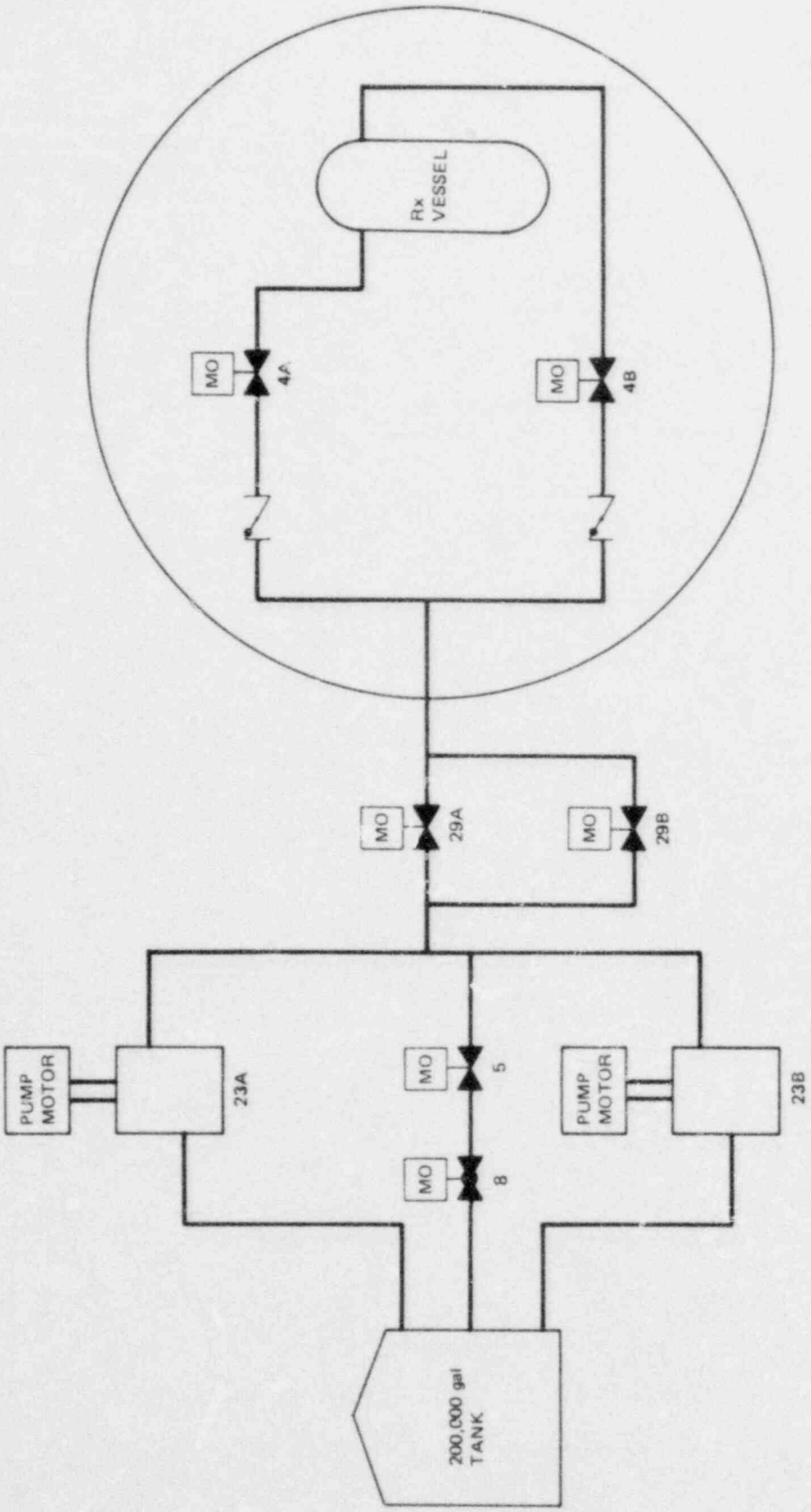


Figure 2.1-28: Dresden Unit One HPCI System

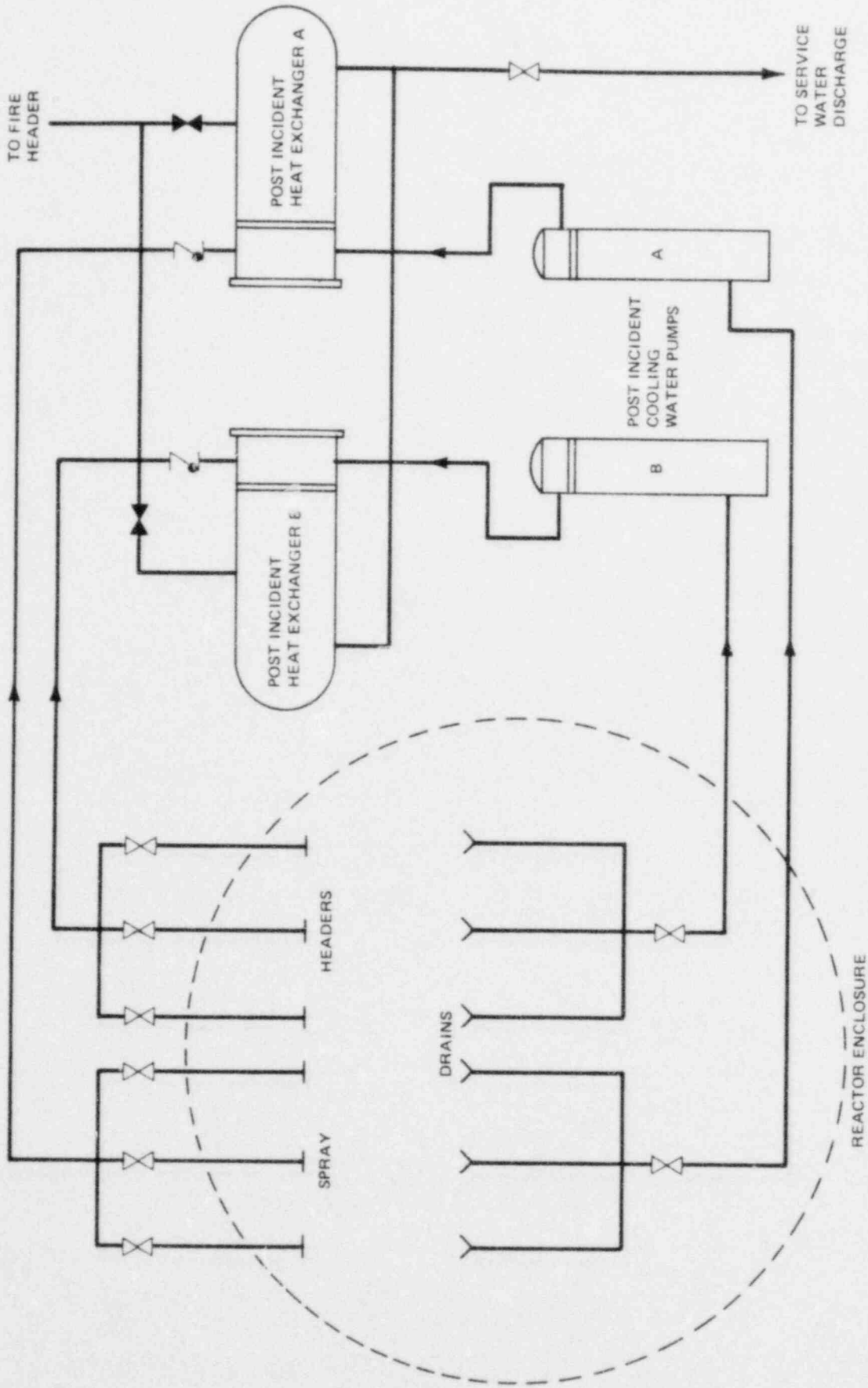
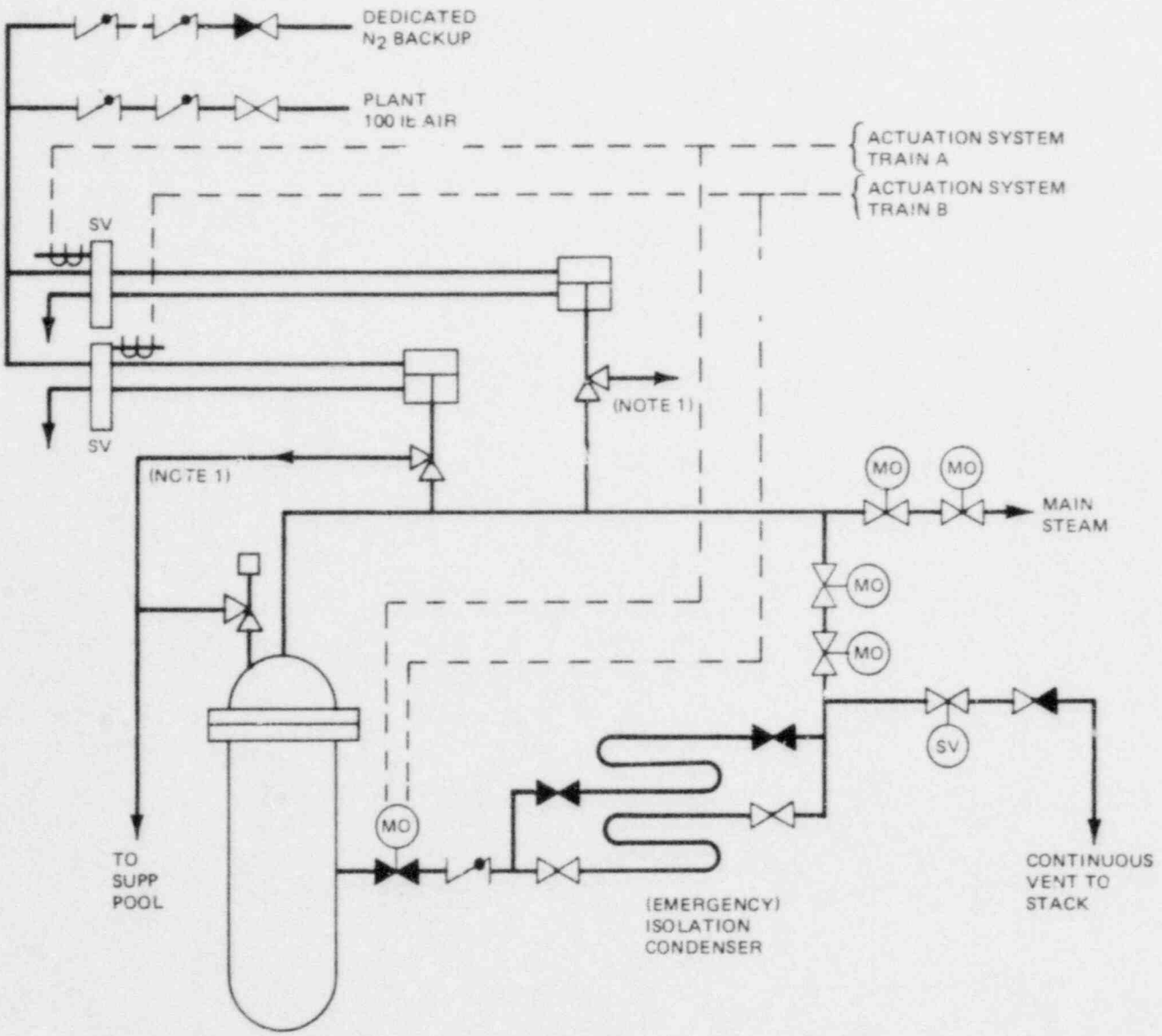


Figure 2.1-29: Post Incident [Containment Cooling] - Dresden-1



NOTE 1: ADS VALVES DISCHARGE DISCHARGE TO SUPPRESSION POOL THROUGH COMMON LINES WITH HIGHEST SET CODE SAFETIES. TYPICAL SHOWN

Figure 2.1-30: Isolation Condenser & Automatic Depressurization System - Humboldt Bay

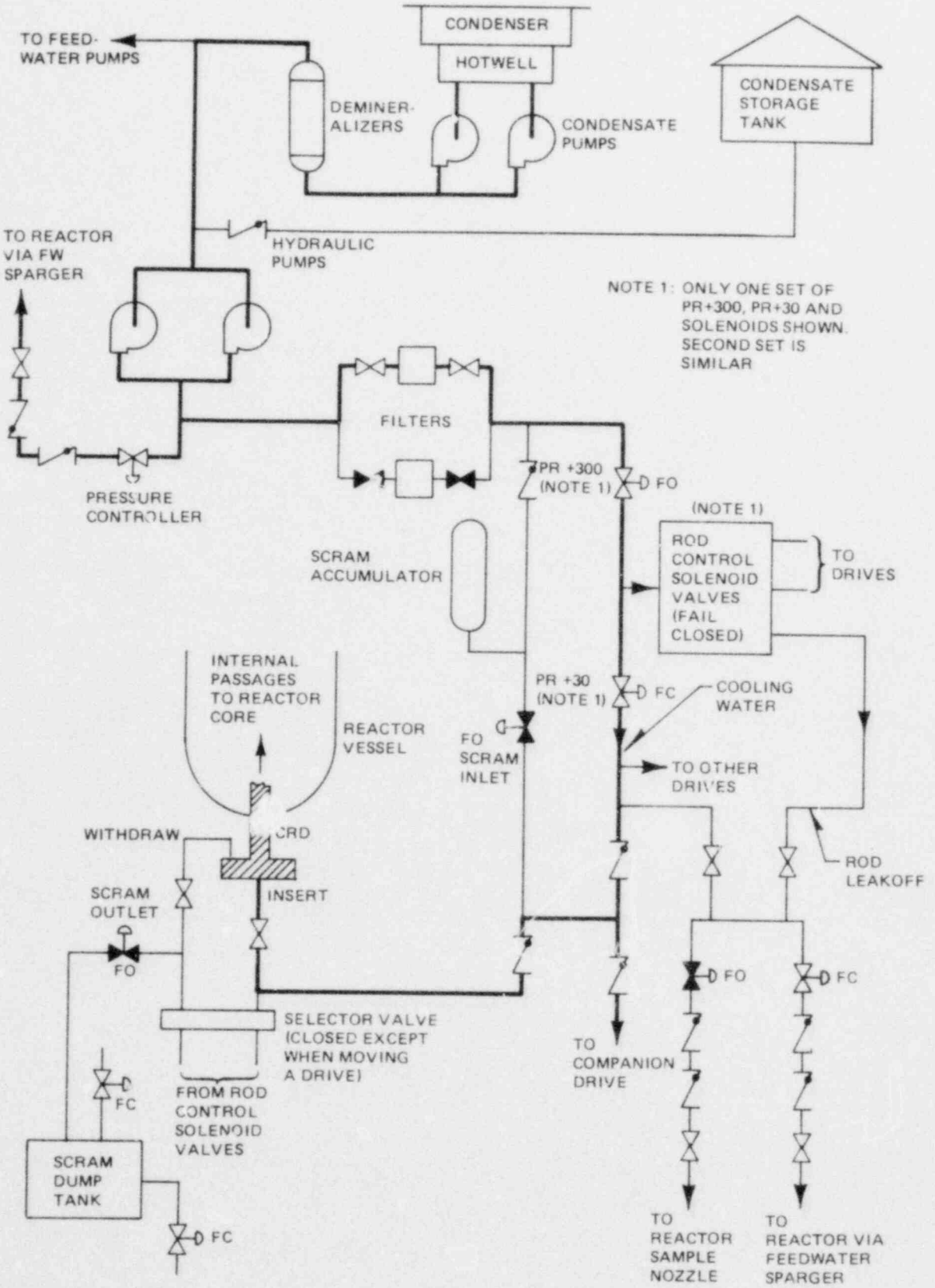


Figure 2.1-31: Control Rod Drive System - Humboldt Bay

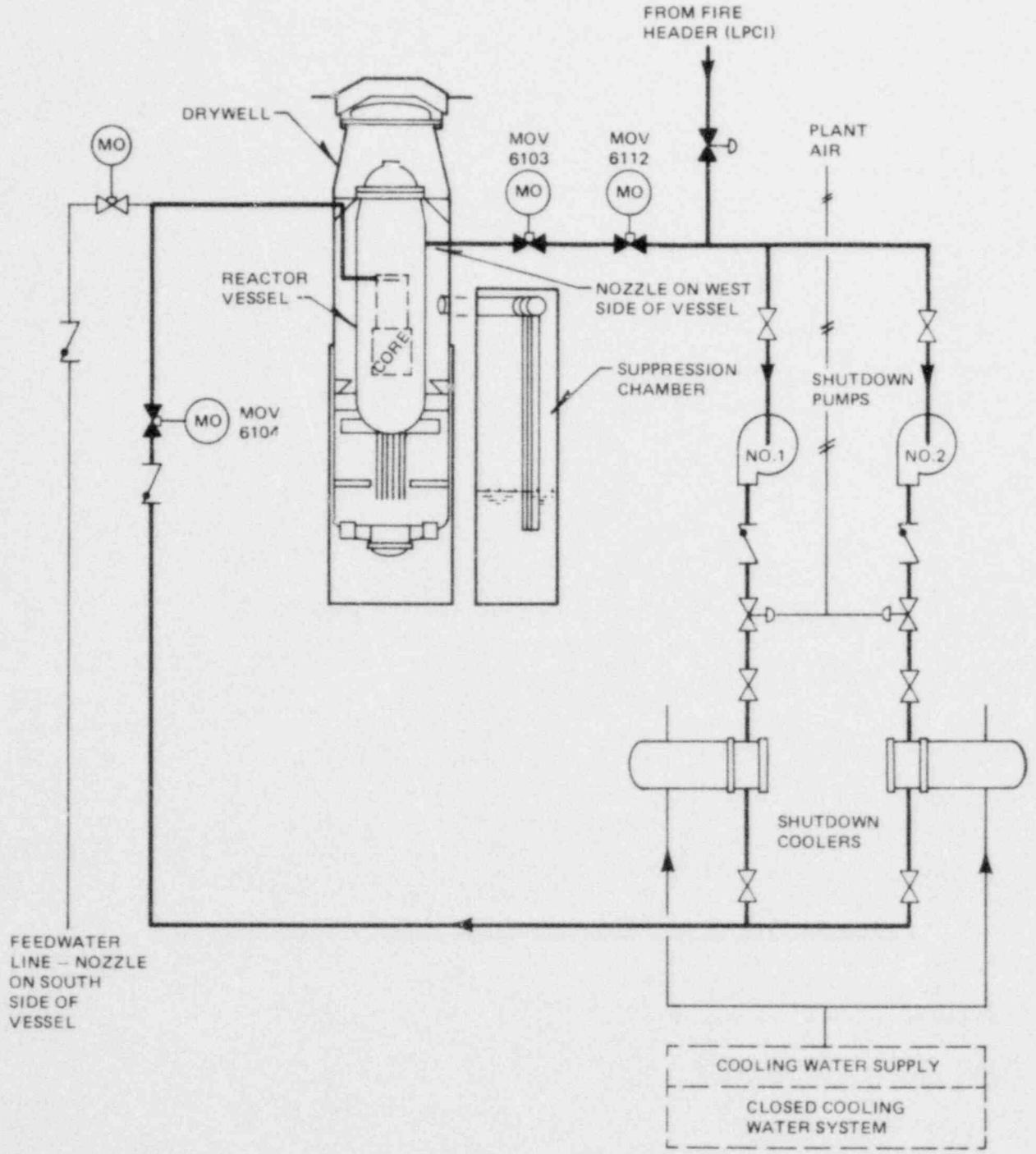


Figure 2.1-32: Shutdown Cooling System - Humboldt Bay

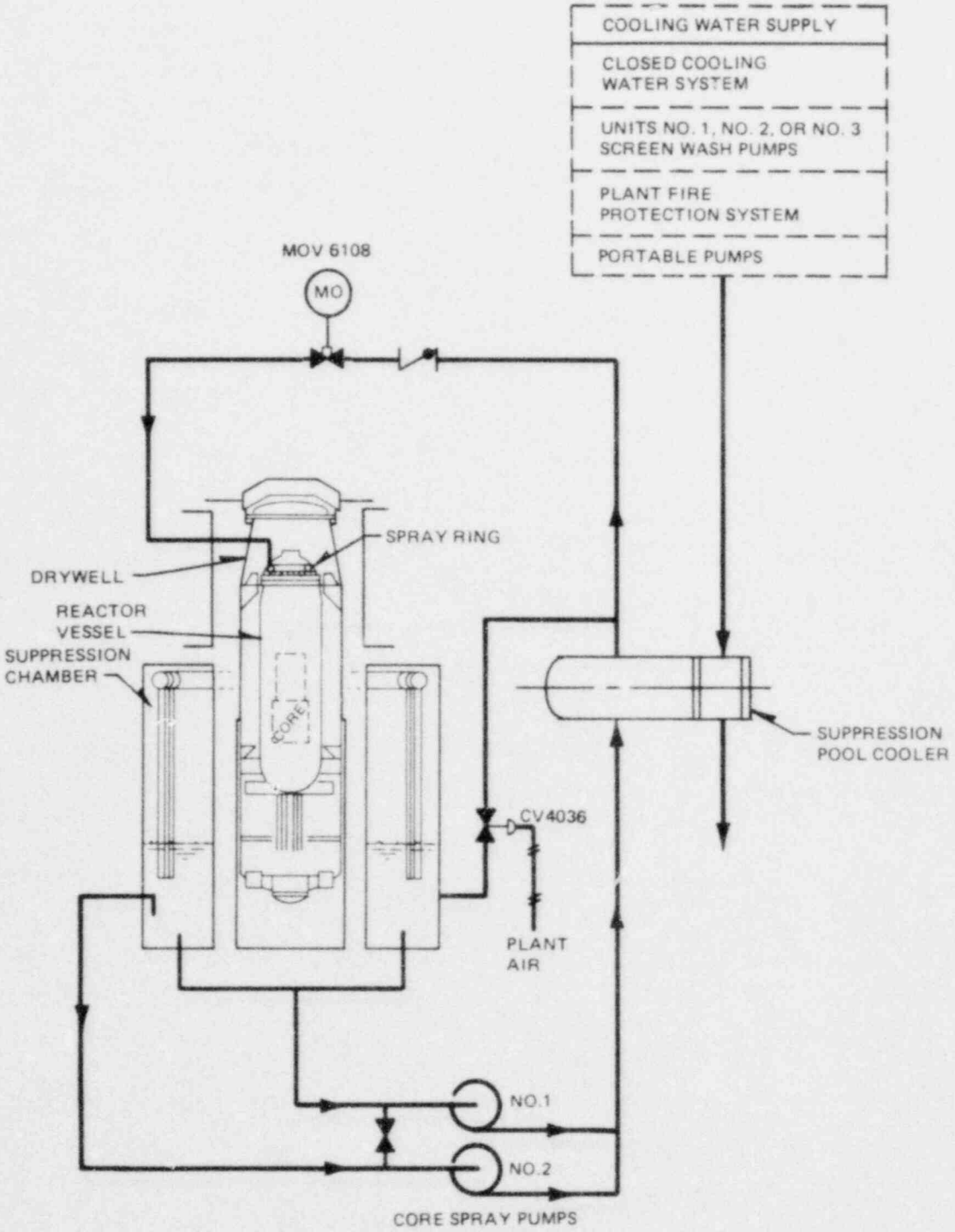


Figure 2.1-33: Low Pressure Core Spray - Humboldt Bay

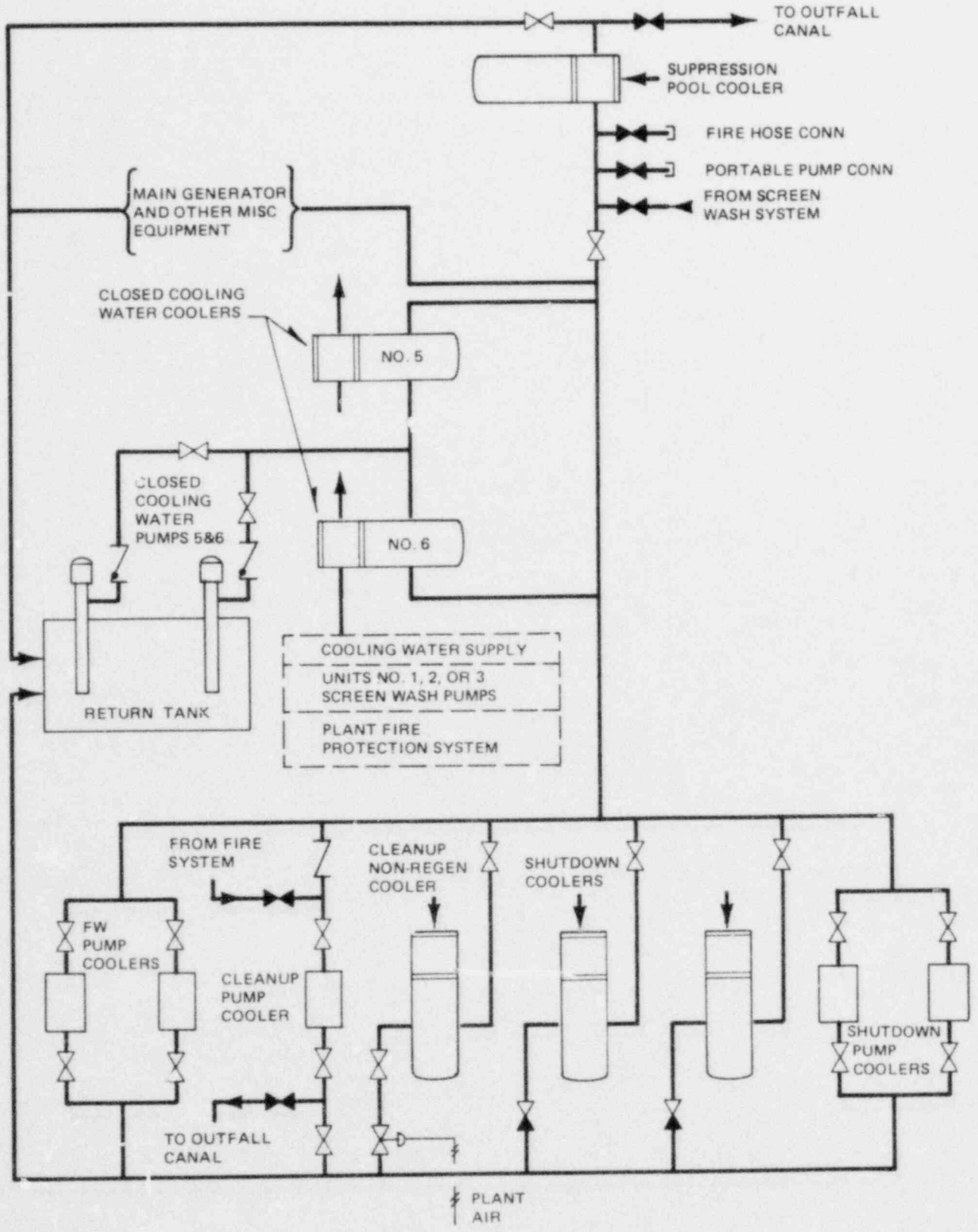


Figure 2.1-34: Closed Cooling Water System - Humboldt Bay

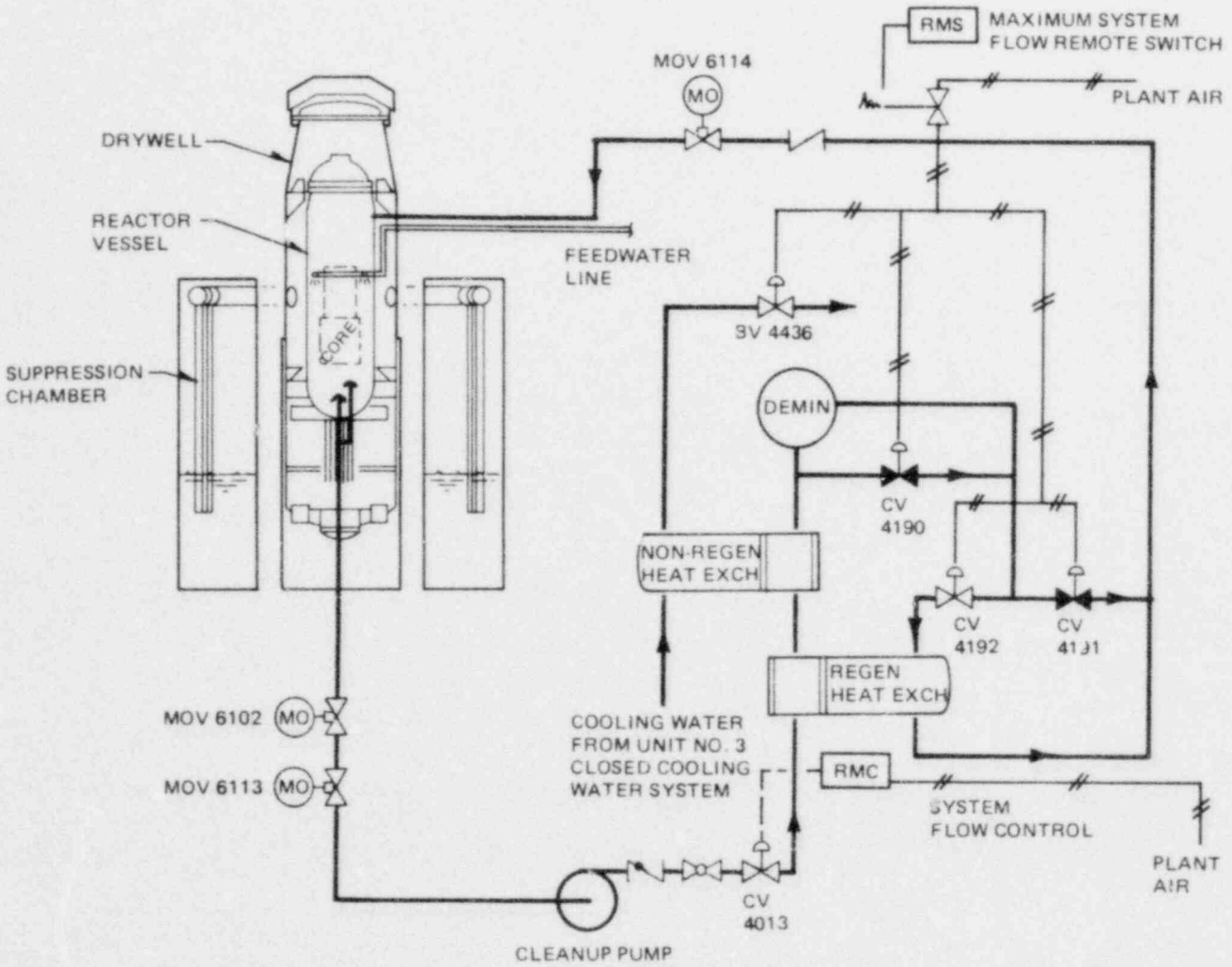


Figure 2.1-35: Reactor Cleanup & Post-Incident Cooling System - Humboldt Bay

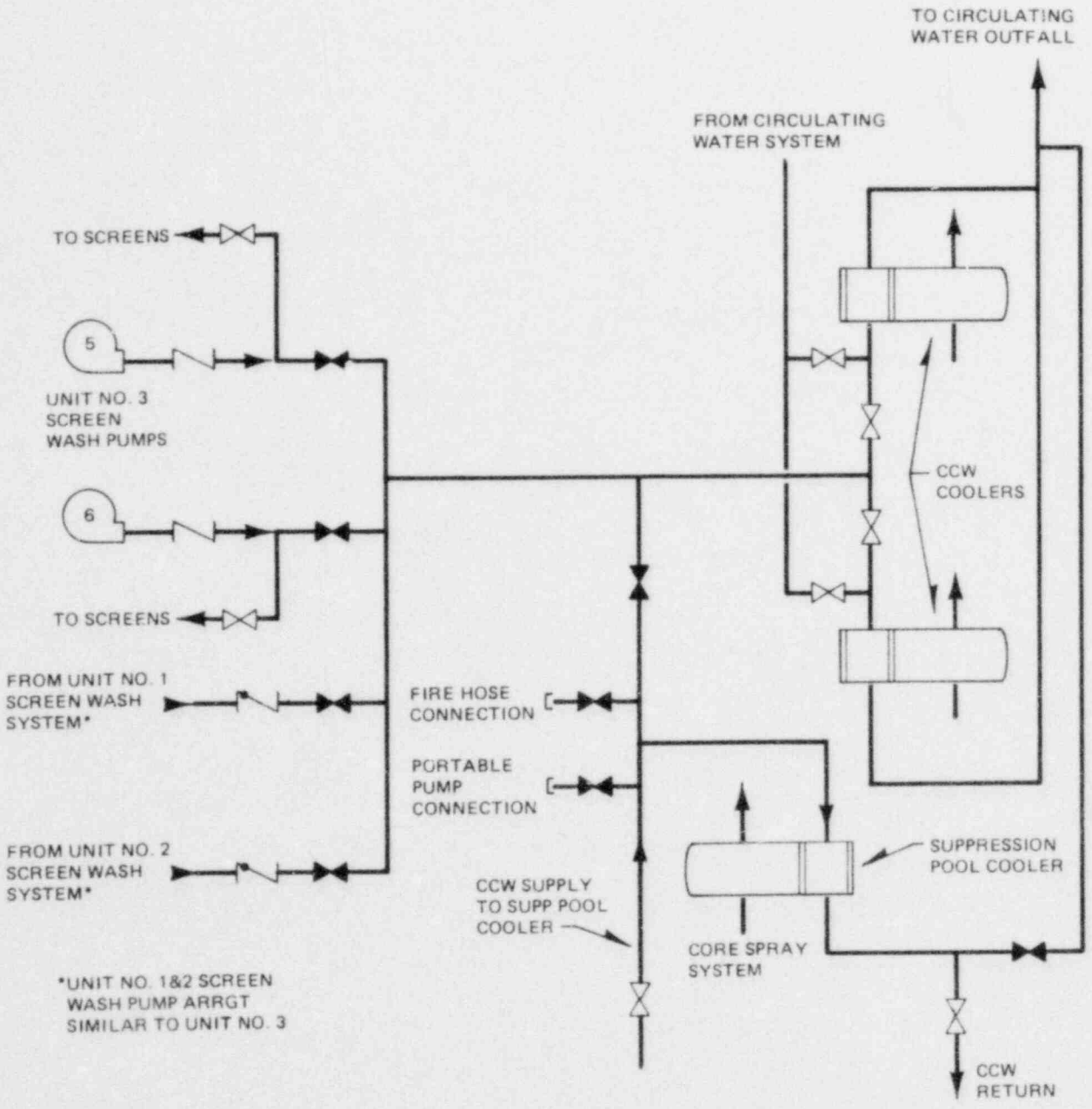


Figure 2.1-36: Screen Wash System - Humboldt Bay

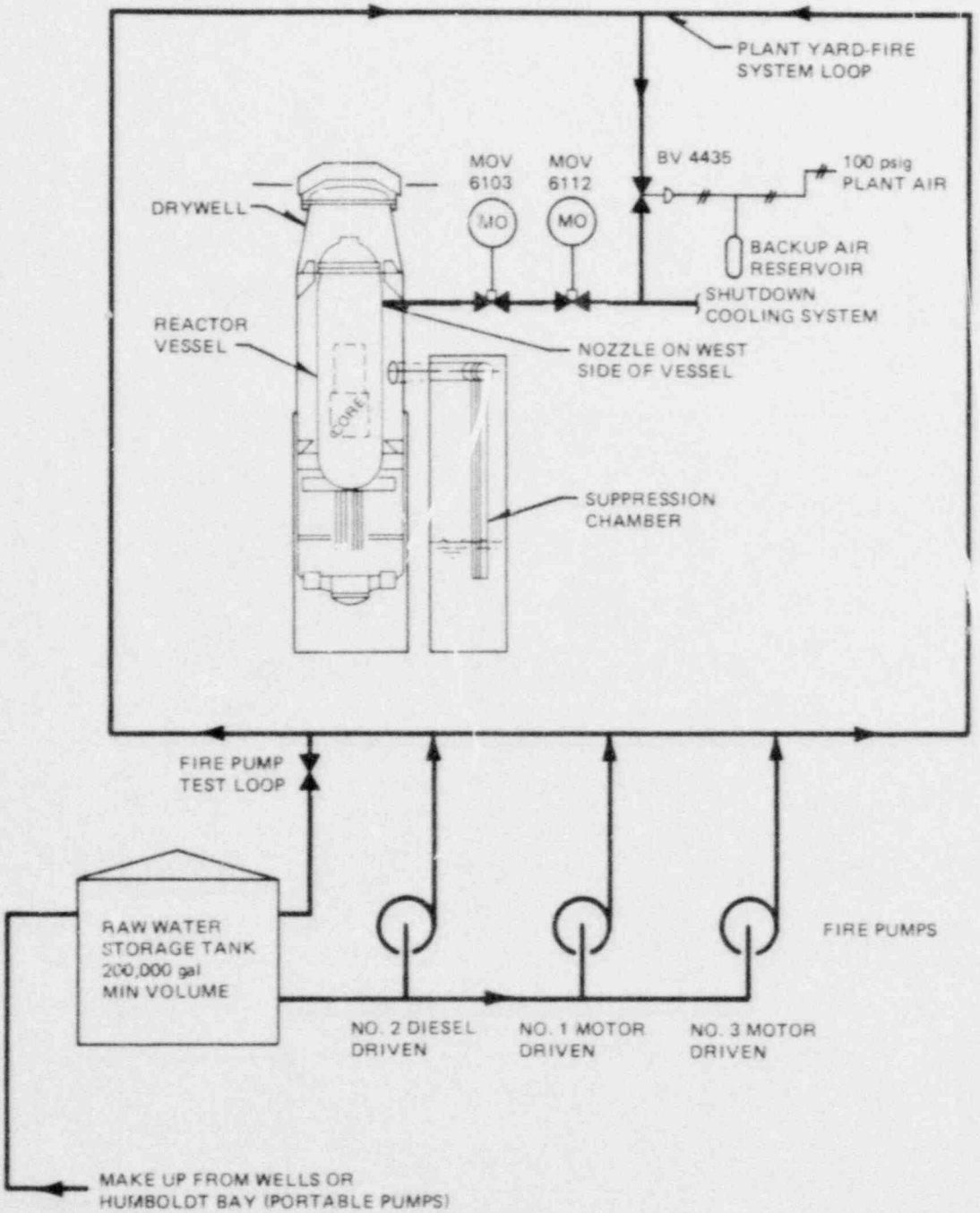


Figure 2.1-37: Low Pressure Coolant Injection - Humboldt Bay

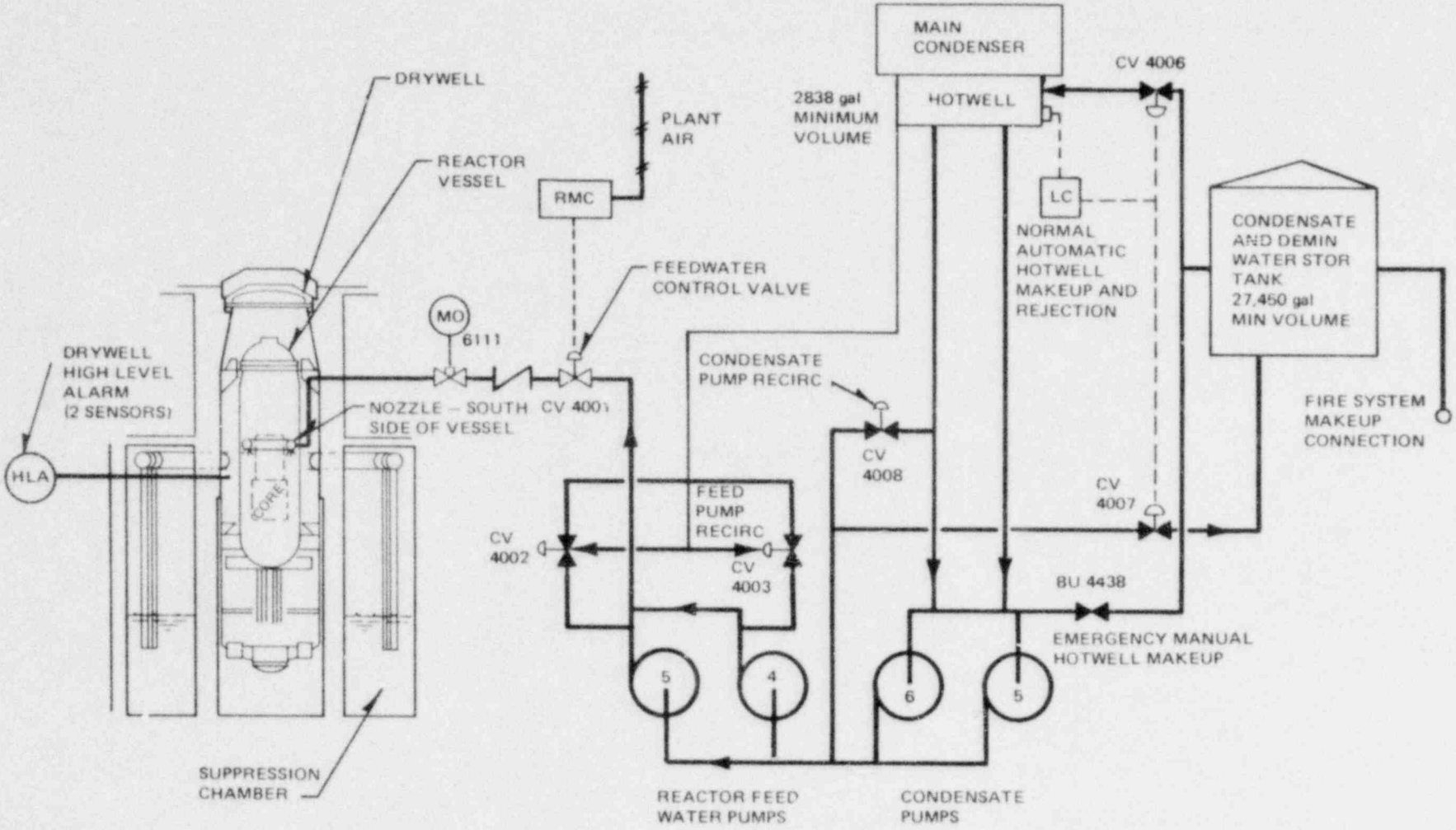


Figure 2.1-38: Feedwater Coolant Injection System - Humboldt Bay

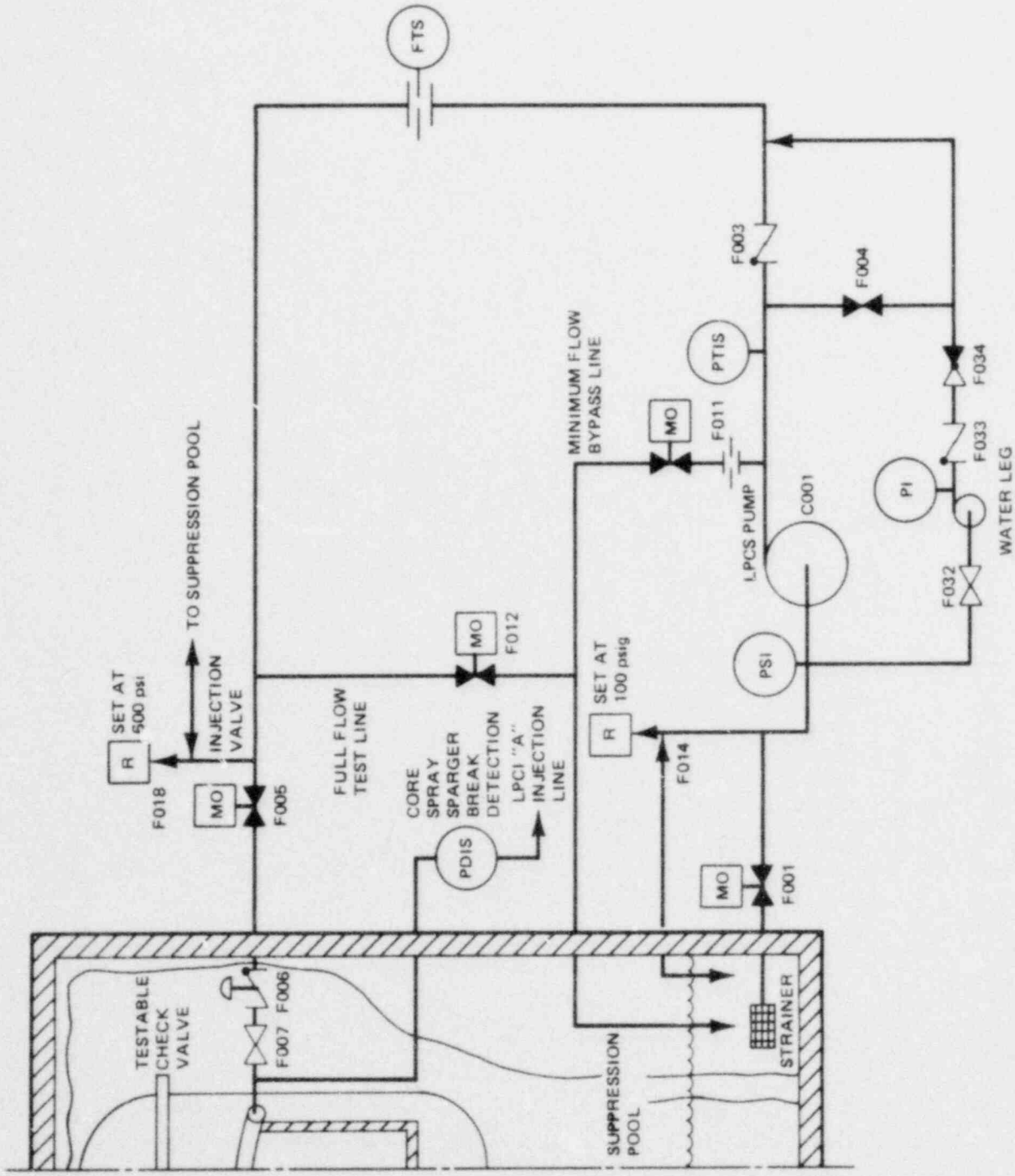


Figure 2.1-39: BWR/6 Low Pressure Core Spray System

POOR ORIGINAL

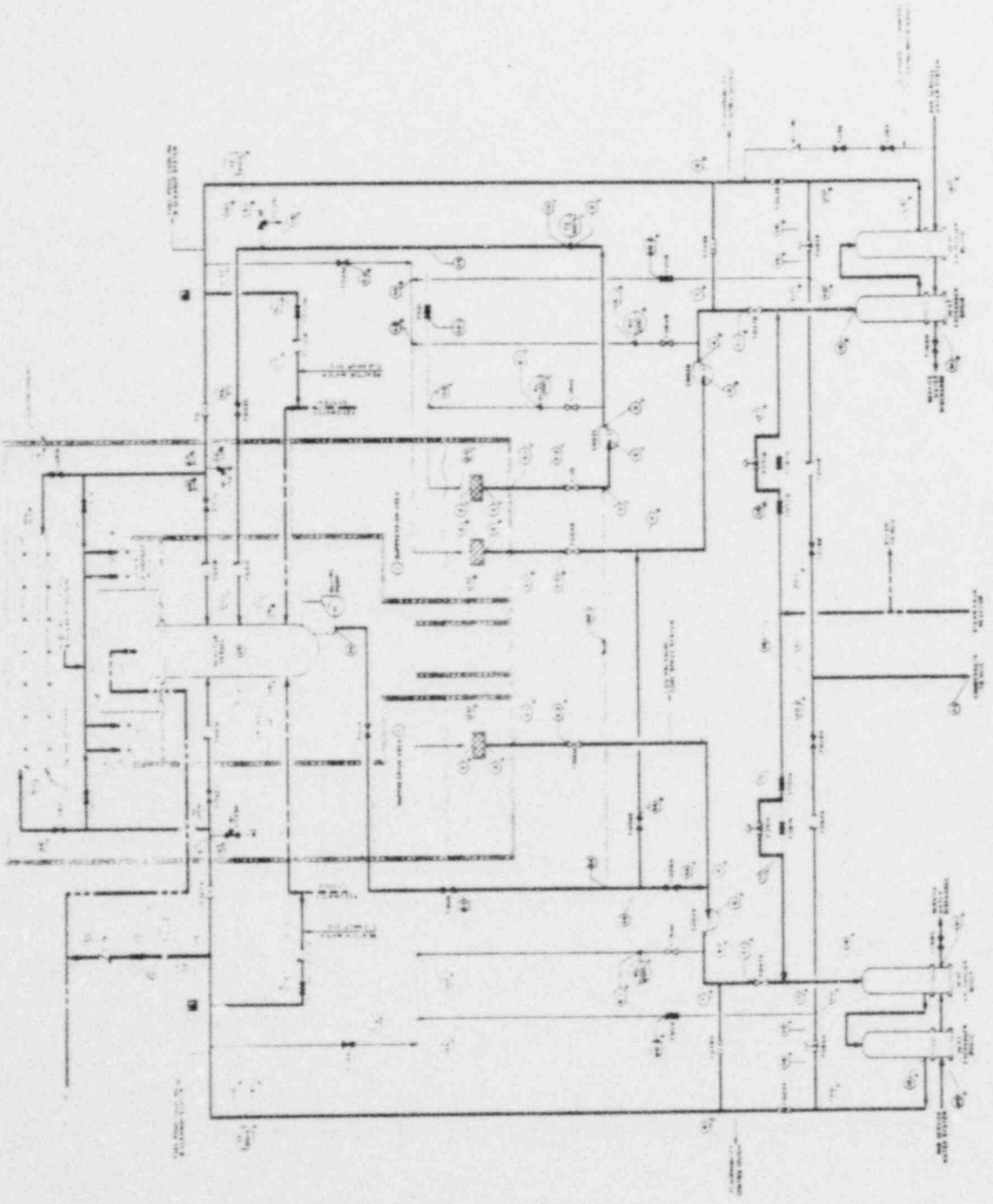


Figure 2.1-40: BWR/6 Residual Heat Removal System

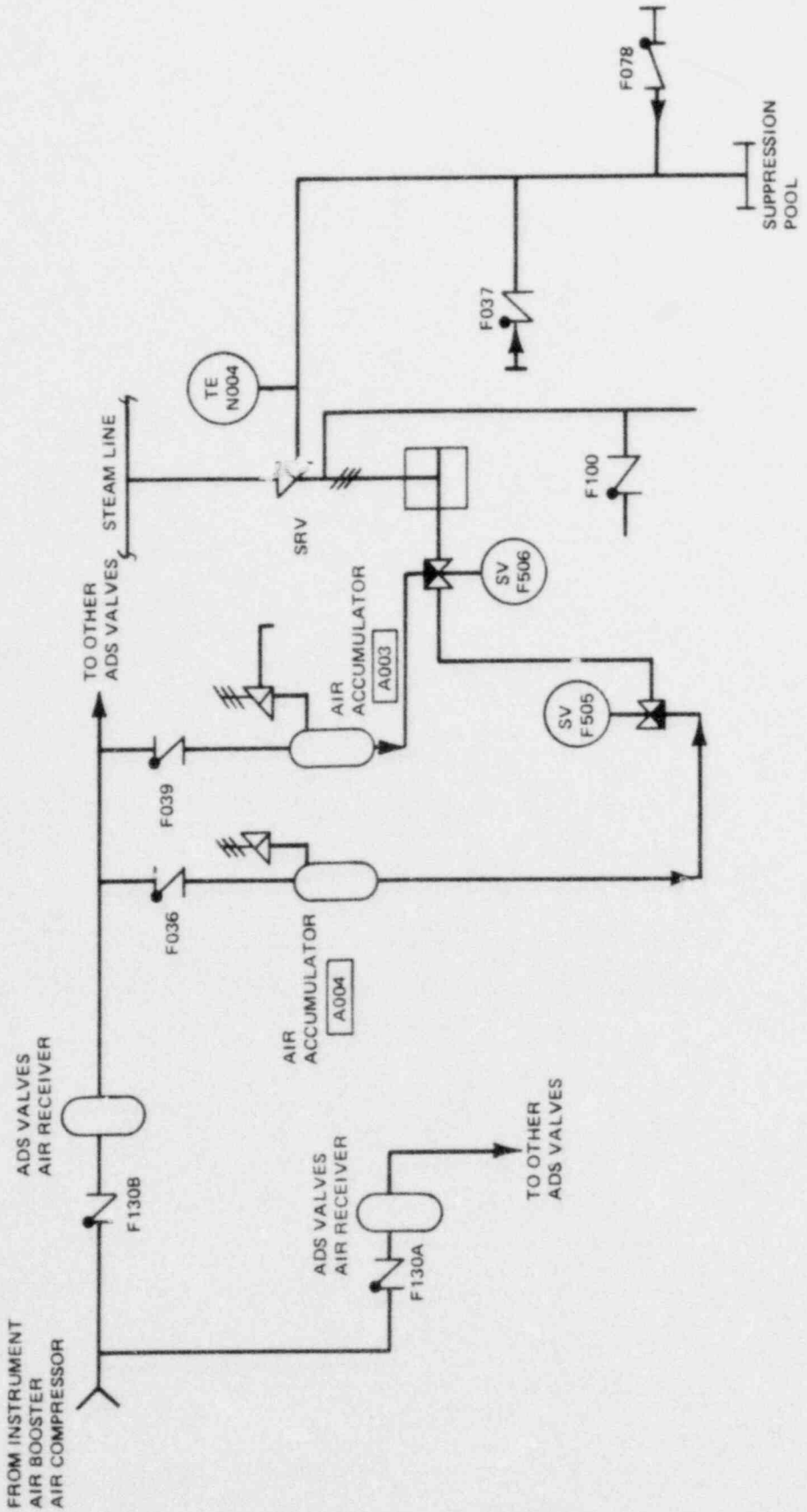


Figure 2.1-41: Typical BWR/6 Air Accumulator Arrangement for ADS Relief Safety Valve

POOR ORIGINAL

Table 2.2-1a

BWR/1 ISOLATION SYSTEM (HUMBOLDT BAY)

Penetration Function	Number	Diameter	Type of Closure and Seal	Position During Power Operation (1)
Main steam line	1	24 inch	Two 12 inch motor operated isolation valves	Open (2)
Emergency condenser steam supply line	1	16 inch	Two 6 inch motor operated isolation valves	Open (3)
Emergency condenser return line	1	12 inch	One 4 inch motor operated and one 4 inch check isolation valve	Closed (Opens automatically on high reactor pressure) (3)(6)
Liquid poison injection line	1	8 inch	Two 2 inch check isolation valves	Closed (Open during poison injection)
Hydraulic supply pump dump line	1	6 inch	Two 1 inch check isolation valves	Open
Control rod leak-off line	1	6 inch	Two 1 inch check isolation valves	Closed (Open during control rod movement)
Feedwater line	1	20 inch	One 8 inch motor operated and one 8 inch check isolation valve	Open
Reactor head flange inner seal leak detection line	1	6 inch	One 1 inch manual and two 1/2 inch solenoid isolation valves	Manual valve open. Solenoid valves: one closed, one open (5)
Coolant cleanup supply line	1	8 inch	Two 2 inch motor operated isolation valves	Open (2) (3)
Coolant cleanup return line	1	10 inch	One 2 inch motor operated and one 2 inch check isolation valve	Open (2) (3)
Control rod hydraulic lines	4	24 inch	Blind flange and gasket	Closed
Incore flux monitor calibration thimbles	1	6 inch	Eight closed thimbles and a check valve to the dry well terminate in a flange plate at the penetration. A 4 inch manual isolation valve is mounted on flange. A 1/2 inch manual test valve connects to the body of the isolation valve between the valve gate and the flange	Closed (Open during flux wire irradiation)
Reactor water sample line and test connections	4	6 inch	Two 1 inch manual isolation valves on each line. One line contains a 1/2 inch solenoid valve which connects to the control rod hydraulic system pressure sensing line and a 1/2 inch deadman solenoid valve which connects to a reactor water sample station or to the low pressure connection of the downcomer manometer. The second line contains a 1/2 inch deadman solenoid valve which connects to the high pressure connection of the downcomer manometer. The remaining two lines are for future use.	Manual valves in two lines connecting to other systems open. Solenoid valve on reactor pressure sensing line open (5). Deadman solenoid valves open during sampling or testing. Manual valves in future use lines closed.
Access opening, top	1	14 feet	Flanged and double "O" ring seal	Closed
Reactor vent valve control line	1	4 inch	Four air supply lines, each with a 1/2 inch manual and a 1/2 inch 3-way solenoid operated isolation valve. A 1 1/2 inch test connection with a 1 1/2 inch manual valve and cap, and a 1/4 inch test connection with a 1/4 inch valve and cap connect into the 4 inch line	Manual valves on air supply lines open. Solenoid valves closed (5). Manual valves in test connections closed.
Reactor extension tank overflow	1	4 inch	Blind flange	Closed
Peripheral control rod hydraulic lines	1	14 inch	Welded into pipe cap	Closed
Drywell purge air supply line	1	8 inch	Two 8 inch manual isolation valves	Closed (6)
Shutdown cooling supply line	1	18 inch	Two 8 inch motor operated isolation valves	Closed (Opens automatically if low pressure core flooding is initiated when pressure is below 150 psig) (4)
Shutdown cooling return line	1	18 inch	One 8 inch motor operated and one 8 inch check isolation valve	Closed (4)
Reactor pressure control line	1	6 inch	One 1 inch manual and one 1/2 inch solenoid operated isolation valve	Open (5)
Instrument lines connecting to the reactor vessel	8	6 inch	One 1 inch manual and one 1/2 inch solenoid operated isolation valve on each line	Open (5)

POOR ORIGINAL

Table 2.2-1a (Continued)

BWR/1 ISOLATION SYSTEM (HUMBOLDT BAY)

Penetration Function	Number	Diameter	Type of Closure and Seal	Position During Power Operation (1)
Drywell water level tap (vent pipe elevation)	3	2 inch	Two level instruments	Closed System
Drywell cooling water lines	8	1½ inch	One 2 inch air operated isolation valve on supply and return headers. One 1 inch manual valve on each line.	Open (5)
Access opening, bottom	1	6 feet	Flanged and double "O" ring seal	Closed
Continuous leak rate monitoring system penetration (Nitrogen fill line)	1	3/4 inch	One 3/4 inch manual and one 3/4 inch air operated valve	Manual valve open. Air operated valve opens on drywell low pressure.
Continuous leak rate monitoring system pressure sensing line	1	½ inch	One 1/2 inch manual valve. One 1/2 inch deadman solenoid plus one 1/2 inch manual valve in manometer line. Pressure transmitter on other branch is closed system.	Deadman solenoid and manual valve in manometer line closed except when taking readings
Reactor safety valves vent lines to suppression pool	4	10 inch	Safety valves	-
Drywell pressure tap	1	1 inch	Pressure instrument	Closed System
Core spray and post-incident cooling supply line	1	6 inch	One 3 inch motor operated and one 3 inch check isolation valve	Closed (Opens automatically if core spray is initiated) (6)
Vacuum breaker line to suppression chamber	1	20 inch	Two 14 inch vacuum breakers in parallel in the line	-
Drywell vent lines to suppression pool	6	40 inch		-
Drywell air space sample line	1	½ inch	One 1/2 inch manual isolation valve and pipe cap	Closed (Open during drywell air space sampling)
Reactor head flange outer seal leak detector line	1	½ inch	One 1/2 inch manual and one 1/2 inch solenoid operated isolation valve	Closed (5)
Drywell purge suction and venting lines	4	8 inch	Two 8 inch manual isolation valves, and one 1 inch manual and two 2 inch solenoid operated isolation valves on bypass line	8 inch valves: Closed (6) 1 inch manual valve: Open 2 inch solenoid valves: Closed (Open during drywell venting)
Drywell lower head drain line and drywell lower head water level indicators	2	2 inch	Two 1 inch manual and one 1 inch solenoid operated valve on drain line. Three level instruments.	Drain line valves closed (Open during dry well draining (8). Closed system
Electrical leads	5	24 inch	Blind flange and gasket	Closed
Safety valve discharge line vacuum breakers	1	1 inch	Three 1 inch check valves in parallel	-

POOR ORIGINAL

Table 2.2-1a (Continued)

BWR/1 ISOLATION SYSTEM (HUMBOLDT BAY)

Penetration Function	Number	Diameter	Type of Closure and Seal	Position During Power Operation
Access openings	2	30 inch	Flanged and double gasketed manholes	Closed
Dry well vent lines to the suppression chamber	6	40 inch	-	-
Reactor safety valve discharge lines	4	10 inch	Safety valves	-
Vacuum breaker line from drywell	2	20 inch	Two 14 inch vacuum breakers in parallel in the line	-
Pool bottom core spray pump suction lines	2	3 inch	One 4 inch manual valve	Open
Pool normal core spray pump suction line	1	3 inch	One 4 inch manual valve	Open
Pool water level instrument lines	2	2 inch	Level instruments	Closed system
Chamber pressure instrument line	1	1 inch	Pressure Instrument	Closed system
Chamber gas treatment suction line	1	4 inch	Two 4 inch manual isolation valves, and one 1-1/2 inch manual and two 1-1/2 inch solenoid operated isolation valves on bypass line.	4 inch valves: Closed 1-1/2 inch manual valve: Open 1-1/2 inch solenoid valves: Closed (Open during venting)
Chamber vacuum relief line	1	6 inch	One 6 inch air operated isolation valve followed by two 6 inch vacuum relief valves.	Air operated valve open (Closed on high drywell pressure)
Shutdown system drain lines	2	1 inch	Two 1 inch check isolation valves, one 1 inch manual valve	Closed (Open when draining shutdown system)
Pool water make-up and suppression cooler return line	1	3 inch	Manual isolation valve in each of the three lines which enter this line. Air operated valve in cooler return line.	Make-up lines manual valves closed (Open when adding water to pool). Cooler return line air operated valve closed (Open when cooling pool water)
Continuous leak rate monitoring system penetration (Nitrogen fill line)	1	3/4 inch	One 3/4 inch manual and one 3/4 inch air operated valve.	Manual valve open, air operated valve closed (Opens on low suppression chamber pressure)
Continuous leak rate monitoring system pressure sensing line	1	1/2 inch	One 1/2 inch manual valve. One 1/2 inch deadman solenoid plus one 1/2 inch manual valve in manometer line. Pressure transmitter in other branch is closed system.	Deadman solenoid and manual valve in manometer line closed except when taking readings
Pool temperature instrument line	1	1 inch	Thermowell	Closed System
Spare	1	6 inch	Welded cap	Closed
Spare	1	3 inch	Welded cap	Closed
Spare	1	2 inch	Welded cap	Closed
Leak rate reference chamber	1	14 inch	Blind flanged	Closed

Notes: (1) Isolation valves which are listed as closed may be opened under the conditions noted. Isolation valves which are listed as open may be closed under certain conditions.

(2) Automatic closure on reactor water level, dry well high pressure, main steam line break, or low voltage on 115 volt preferred a-c busses (safety system power supply).

(3) Automatic closure on Refueling Building high differential pressure.

(4) Can be opened manually during reactor "cool down" when pressure is below 120 psig. Automatic closure when reactor pressure reaches 135 psig.

(5) Remote manual closure.

(6) Valve opening annunciated in the control room.

(7) If sample systems are added in future, a remote manual solenoid valve will be added. Valves will then be open during sampling.

(8) Solenoid valve opened from local pushbutton station. Valve automatically closes to maintain water seal in drain line or when pushbutton is released.

Table 2.2-1b

BWR/1 ISOLATION SYSTEM (BIG ROCK POINT)

Item	Line	Class	Pent No. Refer Dwg. C-102	Refer P&ID	Valve Loc.	Control Type	Actuated By	Type of Valve	Mark No.	Elect. Scheme	Voltage	Valve On Air Failure	Valve On Power Failure	Indication On Main Control Panel	Remarks
1	Ventilation Supply	A	H-7	M-125	Outside	Rem. Man.	HS-9001 Vacuum Relief	Air Cyl. Oper. B. Fly	CV-4096	E-114	125V. D-C	Closes	Closes	Open & Close	Two Valves in Series Auto & Rem. Man. Open On Lo. Sph. Press.
						Auto.	All Scrams Fuel Pool Rad Mon		CV-4097						
2	Ventilation Exhaust	A	H-8	M-125	Outside	Rem. Man.	HS-9001 Vacuum Relock	Air Cyl. Oper. B. Fly	CV-4094	E-114	125V. D-C	Closes	Closes	Open & Close	Two Valves in Series
						Auto.	Fuel Pool Rad Mon		CV-4095						
3	Ventilation Probe (DPC-9071)	A	H-97	M-125	Outside	Rem. Man.	HS-9001 Vacuum Relief All Scrams	(2) Solen.	SV-9155	E-114	125V. D-C	Closes	Closes	No	Two Valves In Series
						Auto.	All Scrams		SV-9156						
4	Clean Sump Pump Discharge	A	H-21	M-108	Outside	Auto.	Hi. Sph. Press & Lo. R.W.I.	Air Oper.	CV-4102	E-115	115V. A-C	Closes	Closes	Open & Close	Both Valves Rem. Man. & Auto
					Inside	Rem. Man.	HS-7003	Air Oper.	CV-4031	E-115	115V. A-C	Closes	Closes	Open & Close	
5	Dirty Sump Pump Discharge	A	H-15	M-108	Outside	Auto.	Hi. Sph. Press & Lo. R.W.I.	Air Oper.	CV-4103	E-115	115V. A-C	Closes	Closes	Open & Close	Both Valves Rem. Man. & Auto
					Inside	Rem. Man.	HS-7019	Air Oper.	CV-4025	E-115	115V. A-C	Closes	Closes	Open & Close	
6	Instrument Air	A	H-20	M-133	Outside	Man.	---	Gate	MK-66	-	-	-	-	No	
					Inside	Auto.	Loss of Inst. Air	Check	MK-263	-	-	-	-	No	
7	Service Air	A	H-25	M-133	Outside	Man.	---	Gate	MK-66	-	-	-	-	No	
					Inside	Auto.	Loss of Serv. Air	Check	MK-263	-	-	-	-	No	
8	Demineralized Wtr.	A	H-18	M-110	Inside	Auto.	Lo. Demin. Wt. Press.	Check	MK-253F	-	-	-	-	No	
					Outside	Rem. Man.	HS-7025	Air Oper.	CV-4105	E-112	115V. A-C	Closes	Closes	Open & Close	

PENETRATION CLASS

A) Penetrations open to the interior of the enclosure.

B) Penetrations open to the reactor or any portion of the nuclear steam supply system.

D) Penetrations that are normally closed.

E) Penetrations for lines which enter the containment vessel but are not physically connected to either the interior or to the primary system and those which leave the containment but are not physically open to the exterior. In these cases the lines themselves form the boundaries of the containment.

LEGEND

VALVE REQUIREMENTS

Class A and B above require two valves in series, at least one of which must close automatically in event of an incident. Both can be closed manually (check valves do not have to be closed manually), either from the control room or from another place that would be tenable after an incident. To minimize release in the event of a line rupture, valves in Class D lines must be on opposite sides of the containment shell.

Class D penetrations require only a single valve; however locks or interlocks, or operating procedures must insure against valve being opened during reactor operation or otherwise potentially hazardous situations.

Class E penetrations do not require isolation valves, provided that the systems are not subject to damage by a reactor system rupture and are otherwise not expected to leak after an incident. The heating system and service water systems are normally pressurized and leaks will be kept to a minimum as a part of normal maintenance procedure. The core spray system will be all welded construction and will be periodically tested.

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POOR ORIGINAL

Table 2.2-1b (Continued)

Item	Line	Class	Item No. Refer Sect. 6-102	Refer Fig.	Valve Loc.	Control Type	Actuated By	Type of Valve	Mark No.	Elect. Scheme	Voltage	Valve on Air Failure	Valve on Power Failure	Indication On Main Control Panel	Remarks
		5	B-10	M-121	Inside	Auto Rem. Man.	Hi., Sph. Press & Lo. R.W.L. RWC-5500	M.O. Gate	MO-7050	E-112	125V. D-C	--	closes	Open & Close	
		8		M-104	Outside	Auto. Rem. Man	Lo. Cond. Vac. Gen. Trip	Hyd. Oper.	--	E-107	125V. D-C	Lo. Hyd. Oil Press. Closes	Closes	Open & Close	Main Turb. Stop (1)
9	Main Steam	5		M-106	Outside	Auto. Rem. Man.	Lo. Cond. Vac. RWC-5506	Hyd. Oper.	CV-4014	E-107	115V. A-C	--	Closes	Open & Close	Turb. Bypass (2)
		8		M-106	Outside	Auto. Rem. Man.	Lo. Cond. Vac. HS-7036	Air Oper.	CV-4106	E-107	115V. A-C	Closes	Closes	Open & Close	[illegible]
		8		M-106	Outside	Auto. Rem. Man.	Hi. Air Ejct Press. HS-7036	Air Oper.	CV-4104	E-110	115V. A-C	Closes	Closes	Open & Close	[illegible] to Seals & Air Ejs Elec
				M-121	Inside	Rem. Man.	RWC-5520 HS-7036	M.O. Gate	MO-7065	E-112	125V. D-C	--	--	Open & Close	
10	Main Steam Drain	5	B-37	M-106	Outside	Rem. Man. Auto.	Lo. Cond. Vac.	Air Oper.	CV-4107	E-[illegible]2	115V. A-C	Closes	Closes	Open & Close	
				M-121	Inside	Auto	Lo. Feed Press	Check	MK-207	--	--	--	--	No	
11	Reactor Feed	8	B-11	M-106	Outside	Rem. Man.	RWC-1018	Air Oper.	CV-4000	E-115*	--	Locks	--	Open & Close	In Parallel
				M-106	Outside	Rem. Man.	RWC-5502	Air Oper.	CV-4012	E-115*	--	Closes	--	Open & Close	* Indicating Lights Only
				M-106	Inside	Auto.	Drive Pump Fail	Check	MK-210	--	--	--	--	--	In Parallel (4)
				M-106	Inside	Auto.	Drive Pump Fail	Check	MK-210	--	--	--	--	--	
12	Control Rod Hydraulic Syst.	8	B-35	M-106	Outside	Auto. Rem. Man.	Opens on Cond. Pump Fail HS-7022	Air Oper.	CV-4090	E-110	115V. A-C	Opens (3)	Opens	Oper & Close	In Parallel
				M-106	Outside	Auto.	Closes On Cond. Pump Fail	Air Oper.	CV-4010	E-110	115V. A-C	Opens (3)	Opens	Open & Close	
				M-123	Inside	Auto.	Fire System Fail	Check	MK-249	--	--	--	--		
13	Post Incident & Fire Supply	A	B-36	M-123	Outside	Man.	--	Gate	MK-42	--	--	--	--		
				M-107	Inside	Rem. Man.	HS-7025	Air Cyl. Oper	CV-4091	E-112	115V. A-C	Closes	Closes	Open & Close	
14	Rewin Sluice	A	B-23	M-107	Inside	Auto.	Hi. Sph. Press.	Air Cyl. Oper	CV-4092	E-112	115V. [illegible]	Closes	Closes	Open & Close	All Valves Interlock on T.B. Sump
				M-107	Inside	Auto.	Lo. R.W.L.	Air Cyl. Oper	CV-4093	E-112	115V. A-C	Closes	Closes	Open & Close	

Note (1): Turbine Control Valve (Throttle) also closes on Lo. Syst. Press.

Note (2): Also closes on Lo. System Pressure.

Note (3): Fails open to insure water supply to control rod system and avoid mal-operation.

Note (4): Supplemented by Integral Pump Discharge Checks.

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POOR ORIGINAL

Table 2.2-1b (Continued)

Item	Line	Class	Tent No. Refer Dwg. C-102	Refer P&ID	Valve Loc.	Control Type	Actuated By	Type of Valve	Mark No.	Elect. Scheme	Voltage	Valve On Air Failure	Valve On Power Failure	Indication On Main Control Panel	Remarks
15	Treated Waste Return	A	H-17	M-108	Inside Inside	Rem. Man. Auto.	HS-7011 Pump Failure	Air Oper. Check	CV-4049 MK-232	E-115 -	115V. A-C -	Closes -	Closes -	Open & Close No	
16	Reactor & Fuel Pit Drain	B	H-22	M-107	Inside Outside	Rem. Man. Auto.	PG-7006 Hi.Sph.Press. Lo.R.W.I.	Air Oper. Air Oper.	CV-4027 CV-4117	E-112	115V. A-C	Closes	Closes	Open & Close	
17	Post Incident Back-up	A	H-27	M-123 M-123	Inside Outside	Auto. Man.	Fire System Fail -	Check Gate	MK-249 MK-30	-	-	-	-	-	
18	Heating Steam	E	H-14	M-125	None Req'd	-	-	-	-					-	
19	Heating Condensate	E	H-19	M-125	None Req'd	-	-	-	-	-	-	-	-	-	
20	Ventilating Vacuum Breaker Sensing Line	E	H-96	M-125	None Req'd	-	-	-	-	-	-	-	-	-	
21	Service Water Supply	E	H-13	M-111	None Req'd	-	-	-	-	-	-	-	-	-	
22	Service Water Return	E	H-12	M-111	None Req'd	-	-	-	-	-	-	-	-	-	
23	Core Spray Pump Disch.	E	H-113	M-123	None Req'd	-	-	-	-	-	-	-	-	-	
24	Core Spray Pump Return	E	H-28 H-29	M-123	None Req'd	-	-	-	-	-	-	-	-	-	
25	Core Spray Pump Vent	E	H-112	M-123	None Req'd	-	-	-	-	-	-	-	-	-	
26	Emerg. Cond. Vent.	E	H-9	M-107	None Req'd	-	-	-	-	-	-	-	-	-	
27	Control Air to CV-4029	E	H-92	M-111	None Req'd	-	-	-	-	-	-	-	-	-	
28	Control Air to CV-4040	E	H-93	M-107	None Req'd	-	-	-	-	-	-	-	-	-	
29	Control Air to CV-4114	E	H-94	M-107	None Req'd	-	-	-	-	-	-	-	-	-	
30	Chemical Recirc.	D	H-31	M-106	Outside	Man.	-	Gate	MK-26	-	-	-	-	-	Two valves in parallel

POOR ORIGINAL

Table 2.2-1c

BWR/1 ISOLATION SYSTEM (DRESDEN-1)

Description	Avg Stroke Time	Upper Limit	Closure Time	Returned To Normal	*Normally Open	*Normally Closed
Sphere Vent Inlet-Outside	3	4.5	4.		X	
Sphere Vent Inlet-Inside	4	6.	5.5		X	
Sphere Vent Outlet-Inside	3	4.5	4.5		X	
Sphere Vent Outlet-Outside	3	4.5	4.5		X	
"A" SSG Sample Line MO-529	5	7.5	5.2			X
"B" SSG Sample Line MO-532	5	7.5	5.0			X
"C" SSG Sample Line MO-533	5	7.5	5.2			X
"D" SSG Sample Line MO-534	5	7.5	5.0			X
Steam to Air Ejectors MO-1	26	33	28.2		X	
Filtered Water to Canal ADV 313	1	1.5	0.8			X
Reactor Cleanup Demin MO-523	27	34	25		X	
Sphere Drain Tanks MO-506	45	56	44		X	
Service Water Discharge MO-521	61	76	61		X	
Sphere Heating Steam Condenser FCV-534	1	1.5	1.0		X	
Demin Water to Sphere Booster Pump FCV-504	3	4.5	1.8		X	
Primary Steam Line Drain at Turbine FCV-365	2	3	1.9		X	
Secondary Steam Line Drain at Turbine FCV-364	2	3	2.0		X	
Cleanup Demin Resin Transfer Pump FCV-509	5	7.5	5.0			X
SSG Blowdown FCV-515	5	4.5	3.4			X
"A" SSG Line Drain FCV-519	4	6	6.0			X
"B" SSG Line Drain FCV-518	4	6	4.5			X
"C" SSG Line Drain FCV-520	3	4.5	1.0			X

*At present plant conditions.

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Table 2.2-1c (Continued)

BWR-1 ISOLATION SYSTEM (DRESDEN-1)

Description	Avg Stroke Time	Upper Limit	Closure Time	Returned To Normal	*Normally Open	*Normally Closed
"D" SSC Line Drain FCV-517	8	12	2.2			X
Steam Seal Req Supply MO-49	14	18	14		X	
Service Water Inlet MO-520	70	88	75		X	
Service Water Discharge Outside MO-510	69	86	69		X	
Reactor Heating Steam Inlet MO-522	45	56	44			X
Sphere Demin Makeup Water Inlet MO-527	31	39	31		X	
Secondary Feedwater Isolation MO-8	28	35	30		X	
Sphere Drain Tanks Outside MO-505	50	63	53		X	
Primary Feedwater to Containment Rods MO-24	9	13.5	9.5		X	
South Primary Steam Isolation Valve Drain MO-167	9	13.5	9.0			X
North Primary Steam Isolation Valve Drain MO-168	11	14	9.8			X
"D" Secondary Steam Shutoff MO-159	53	66	54		X	
"D" Secondary Steam Shutoff MO-160	53	66	55		X	
"B" Secondary Steam Shutoff MO-161	53	66	54		X	
"B" Secondary Steam Shutoff MO-162	53	66	55		X	
"A" Secondary Steam Shutoff MO-163	54	68	53		X	
"A" Secondary Steam Shutoff MO-164	55	69	56		X	
"C" Secondary Steam Shutoff MO-165	53	66	54		X	
"C" Secondary Steam Shutoff MO-166	54	68	52		X	
North Emergency Cond Primary Steam Inlet MO-100	42	53	42		X	
North Emergency Cond Primary Steam Outlet MO-101	31	39	27			X
South Emergency Cond Primary Steam Inlet MO-108	44	55	43		X	

*At present plant conditions.

POOR ORIGINAL

Table 2.2-1c (Continued)

BWR-1 ISOLATION SYSTEM (DRESDEN-1)

Description	Avg Stroke Time	Upper Limit	Closure Time	Returned To Normal	*Normally Open	*Normally Closed
South Emergency Cond Primary Steam Outlet MO-109	31	39	33			X
A1 Post Incident Cooling Water MO-511	22	28	21			X
A2 Post Incident Cooling Water MO-512	19	24	20			X
A3 Post Incident Cooling Water MO-513	20	25	20			X
B1 Post Incident Cooling Water MO-514	13	16	14			X
B2 Post Incident Cooling Water MO-515	21	26	21			X
B3 Post Incident Cooling Water MO-516	18	23	17			X
"A" Reactor Cleanup Demin Waste MO-104	7	10.5	5.6		X	
"B" Reactor Cleanup Demin Waste MO-103	5	7.5	5.0		X	
North Primary Steam Safety Valve RV-351	1	1.5	0.6			X
South Primary Steam Safety Valve RV-352	1	1.5	0.5			X
Cleanup Demin Resin Trans Pump FCV-508	6	9	6.0			X
Secondary Steam Gen Sample Drains FCV-510	9	13.5	6.0		X	
Instrument Air SO-562	1	1.5	1.0		X	
Service Air SO-561	1	1.5	0.5		X	
Secondary Steam Gen Blowdown FCV-516	4	6	5.0			X
Primary Steam Bypass Valve (1)	4	6	0.8			X
South Secondary Steam Stop Valve	7	10.5	7.1		X	
North Secondary Steam Stop Valve	7	10.5	7.2		X	
	Operable (✓)					
Primary Steam Isolation Valve MO-169			67		X	
Primary Steam Isolation Valve MO-170			66		X	

*At present plant conditions.

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Table 2.2-2

BWR/2 ISOLATION SYSTEM

	Number of Lines	Pipe Size (Inches)	Closing Time (Seconds)	Automatic Isolation Signal	Comment
I. Penetrating Drywell and entering the nuclear station supply system					
Main Steam					
Inside Valve	3	24	10	A,C,D,E	Valves have capability of slow closure for test during plant operation.
Outside Valve			10	A,C,D,E	
Main Steam Drain					
Inside	2	2		A,C,D,E	
Outside				A,C,D,E	
Emergency Condenser					
Condenser Inlet Steam) (Both Outside)	2	10	60 (Max)	A	D-c valve on condenser outlet to open at 12 in./min.
Condenser Outlet (condensate), Outside	2	10	60 (Max)	A	
Inside		10	60 (Max) (Inside containment)	A	
Cleanup System					
Suction Inside	1	6	60	C	
Suction Outside			60	C	
Discharge Inside	1	6	60	C	
Discharge Outside			60	C	
Cleanup Auxiliary Pump System (Both Outside)	1	6	60 (Max)	C	
Shutdown System					
Suction Inside	1	14	60	C,F	
Suction Outside	3	10	60		
Discharge Inside	1	14	60	C,F	
Discharge Outside	3	10	60		
Instrument Lines					
Control Rod Hydraulic System Bypass Flow	1	3			
Feedwater Inlet	2	18			
Head Cooling System Inside	1	2			
Head Cooling System Outside					
Liquid Poison	1	1-1/2			
II. Penetrating Drywell and entering free space of drywell's absorption chamber					
Sumps, Equipment and Drywell					
Outside Valve	2	2-1/2		B	
Vents Purge, Drywell Supply	1	18		B	
Exhaust	1	18			
Absorption Chamber Vacuum Breaker	2	20		B	
Exhaust	1	12		B	
III. Traveling In-Core Probe	4	1/4		B	
IV. Normal Ventilation					
Ducts to Reactor Building					
Inlet Valves	22	36 (Max)		C,B	
Outlet Valves	2	60		C,B	
V. Core Spray	2	8			Testable
Inside					No isolation requirements
Outside					No isolation requirements
Containment spray, outside	2	14			No isolation requirements

A - High flow in line
B - High drywell pressure
C - Reactor low low water level
D - Steam line high radiation
E - High temperature in steam tunnel
F - Reactor pressure above 120 psig
G - High reactor building radiation

* Coincident d-c and d-c signals trigger air solenoid, which allows spring to actuate valve.
** Dependent on operating conditions.

Table 2.2-3

BWR/3 ISOLATION SYSTEM

Valve Pt Number	Line Isolated	Drywell Penetration (1)	Location Ref To Drywell	Valve Type	Valve Size	Power	Closure Signal	Minimum Closing Rate (2)	Normal Status
203-1A,B,C,D	Main Steam	X-105A,B,C,D	Inside	AO Globe	20 in.	AC/DC SOL (spring close)	B,C,D,P	3-10 sec (Total)	Open
203-2A,B,C,D	Main Steam	X-105A,B,C,D	Outside	AO Globe	20 in.	AC/DC SOL (spring close)	B,C,D,P	3-10 sec (Total)	Open
220-1	Main Steam Line Drain	X-106	Inside	MO Globe	2 in.	AC	B,C,D,P	Standard	Closed
220-2	Main Steam Line Drain	X-106	Outside	MO Globe	2 in.	DC	B,C,D,P	Standard	Closed
220-62A,B	Feedwater	X-107A,B	Outside	Check	18 in.	Self	Rev. Flow	-	Open
220-58A,B	Feedwater	X-107A,B	Inside	Check	18 in.	Self	Rev. Flow	-	Open
220-44	RX Water Sample	X-122	Inside	Solenoid	3/4 in.	AC	B,C,D,P	Standard	Closed
220-45	RX Water Sample	X-122	Outside	Solenoid	3/4 in.	AC	B,C,D,P	Standard	Closed
301-95	Crd Hyd Sys Ret	X-138	Outside	Check	4 in.	Self	Rev. Flow	-	Open(during rod movement)
301-98	Crd Hyd Sys Ret	X-138	Inside	Check	4 in.	Self	Rev. Flow	-	Open (during rod movement)
1201-1	Cleanup Sys Sup	X-113	Inside	MO Gate	5 in.	AC	B,W,Y,E,I,J	23"/min	Open
1201-2	Cleanup Sys Sup	X-113	Outside	MO Gate	8 in.	DC	B,W,Y,E,I,J	23"/min	Open
1201-3	Cleanup Sys Sup	X-113	Outside	MO Gate	8 in.	DC	B,W,Y,E,I,J	23"/min	Closed
1001-1A,B	Shutdown Cool. Sup	X-111A,B	Inside	MO Gate	16 in.	AC	B,U	26"/min	Closed
1001-2A,B,C	Shutdown Cool. Sup	X-111A,B	Outside	MO Gate	14 in.	DC	B,U	26"/min	
1001-5A,B	Shutdown Cool. Ret	X-116B	Outside	MO Gate	14 in.	AC	B,U	Standard	Closed
1501-5A,B,C,D	LPCI Pump Suct	X-303A,B,C,D	Outside	MO Gate	14 in.	AC	RM	Standard	Open
1501-22A,B	LPCI Core Flooding	X-116B	Outside	MO Gate	16 in.	AC	RM	Standard	Closed
1501-26A,B	LPCI Core Flooding	X-116B	Inside	AO Check	16 in.	AC	RM	-	Closed
1501-18A,B	LPCI Suppression Spray	X-311A,B	Outside	MO Globe	6 in.	AC			
1501-19A,B	LPCI Suppression Spray	X-311A,B	Outside	MO Gate	6 in.	AC	G	Standard	Closed
1501-38A,B	LPCI Test	X-310A,B	Outside	MO Globe	14 in.	AC	G	Standard	Closed
1501-20A,B	LPCI Test	X-310A,B	Outside	MO Gate	14 in.	AC	G	Standard	Closed
1501-13A,F	LPCI Pump Min Flow	X-310A,B	Outside	MO Gate	3 in.	AC	G	Standard	Closed
1501-28A	LPCI Containment Spray	X-150A,B	Outside	MO Gate	16 in.	AC	G	Standard	Closed
205-2-4	RX Head Cooling	X-147	Outside	MO Gate	2-1/2 in.	AC	B	Standard	Closed
205-2-7	RX Head Cooling	X-147	Inside	Check	2-1/2 in.	Self	Rev. Flow	-	Closed
1101-16	Standby Liquid Control	X-110	Outside	Check	1-1/2 in.	Self	Rev. Flow	-	Closed
1101-15	Standby Liquid Control	X-110	Inside	Check	1-1/2 in.	Self	Rev. Flow	-	Closed

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Table 2.2-3 (Continued)

BWR/3 ISOLATION SYSTEM

Valve Pt Number	Line Isolated	Drywell Penetration (1)	Location Rel To Drywell	Valve Type	Valve Size	Power	Closure Signal	Minimum (2) Closing Rate	Normal Status
1301-1	Isolation Cond. Steam Sup	X-108	Inside	MO Gate	14 in.	AC	K	28"/min	Open
1301-2	Isolation Cond. Steam Sup	X-108	Outside	MO Gate	14 in.	DC	K	28"/min	Open
1301-3	Isolation Cond. Cond. Ret	X-109	Outside	MO Gate	12 in.	DC	K	28"/min	Closed
1301-4	Isolation Cond. Cond. Ret	X-109	Inside	MO Gate	12 in.	AC	K	28"/min	Open
1402-3A,B	Core Spray Pump Suct	X-303A,B,C,D	Outside	MO Gate	16 in.	AC	RM	Standard	Open
1402-25A,B	Core Spray to Reactor	X-199A,B	Outside	MO Gate	10 in.	AC	RM	Standard	Closed
1402-9A,B	Core Spray to Reactor	X-199A,B	Inside	AO Check	10 in.	AC	RM	-	Closed
1402-4A,B	Core Spray Test	X-310A,B	Outside	MO Globe	8 in.	AC	G	Standard	Closed
1402-3A,B	Core Spray Pump Min Flow	X-310A,B	Outside	MO Gate	1-1/2 in.				
2301-36	HPCI Pump Suct Fr Torus	X-303A,B,C,D	Outside	MO Gate	16 in.	DC	RM	Standard	Closed
2301-9	HPCI Turb Steam Sup	X-115A	Inside	MO Gate	10 in.	AC	L	28.5"/min	Open
2301-5	HPCI Turb Steam Sup	X-115A	Outside	MO Gate	10 in.	DC	L	28.5"/min	Open
2301-13	HPCI Turb Exhaust	X-317	Outside	Stop Check	24 in.	Self	Rev. Flow	-	Closed
2301-34	HPCI Cond. Drain	X-312	Outside	Check	2 in.	Self	Rev. Flow	-	Open
2301-40	HPCI Pump Min Flow	X-310	Outside	Check	4 in.	Self	Rev. Flow	-	Closed
2001-105	Drywell Floor Dr. Sump Disch	X-117	Outside	AO Gate	3 in.	AC SOL	B,F	Standard	Open
2001-106	Drywell Floor Dr. Sump Disch	X-117	Outside	AO Gate	3 in.	AC SOL	B,F	Standard	Open
2001-102A,B	Drywell Floor Dr. Sump Disch	X-117	Inside	Check	2-1/2 in.	Self	Rev. Flow	-	Open (when pump running)
2001-5	Drywell Equip Dr. Sump Disch	X-118	Outside	AO Gate	3 in.	AC SOL	B,F	Standard	Open
2001-6	Drywell Equip Dr. Sump Disch	X-118	Outside	AO Gate	3 in.	AC SOL	B,F	Standard	Open
2001-1A,B	Drywell Equip Dr. Sump Disch	X-118	Inside	Check	2-1/2 in.	Self	Rev. Flow	-	Open (when pump running)
3702	RX Building Closed C.W. Sup	X-123	Outside	MO Gate	6 in.		RM	Standard	Open
	RX Building Closed C.W. Sup	X-123	Inside	Check	6 in.	Self	Rev. Flow	-	Open
3703	RX Building Closed C.W. Ret	X-124	Outside	MO Gate	6 in.		RM	Standard	Open
3706	RX Building Closed C.W. Ret	X-124	Inside	MO Gate	6 in.		RM	Standard	Open
1601-60	Suppression Chamber Vent	X-318	Outside	AO Butterfly	18 in.	AC SOL	B,F	Standard	Closed
1601-61	Suppression Chamber Vent Relief	X-318	Outside	AO Gate	2 in.	AC SOL	B,F	Standard	Closed
1601-31A,B	Suppression Chamber Vac Relief	X-304	Outside	Check	20 in.	Self	Rev. Flow	-	Closed
1601-20A,B	Suppression Chamber Vac Relief	X-304	Outside	AO Butterfly	20 in.	AC SOL		Standard	Closed
1601-23	Drywell Vent	X-125	Outside	AO Butterfly	18 in.	AC SOL	B,F	Standard	Closed
1601-24	Drywell Vent	X-125	Outside	AO Butterfly	18 in.	AC SOL	B,F	Standard	Closed

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Table 2.2-3 (Continued)

BWR/3 ISOLATION SYSTEM

Valve Pt Number	Line Isolated	Drywell Penetration (1)	Location Ref To Drywell	Valve Type	Valve Size	Power	Closure Signal	Minimum Closing Rate (2)	Normal Status
1601-62	Drywell Vent Relief	X-125	Outside	AO Globe	2 in.	AC SOL	B,F	Standard	Closed
1601-21	Drywell Inerting and Purge	X-126	Outside	AO Butterfly	18 in.	AC SOL	B,F	Standard	Closed
1601-55									
1601-59	Drywell N_2 Make-up	X-126	Outside	AO Butterfly	1 in.	AC SOL	B,F	Standard	Closed
1601-58	Suppression Chamber N_2 Make-up	X-304	Outside	AO Butterfly	1 in.	AC SOL	B,F	Standard	Closed
1601-56	Suppression Chamber Inert and Purge	X-304	Outside	AO Butterfly	18 in.	AC SOL	B,F	Standard	Closed
1601-57	Drywell and Suppr. Chamber N_2 Make-up	X-304,X-126	Outside	MO Globe	1 in.	AC	B,F	Standard	Closed
1601-22	Drywell and Suppr. Chamber Vent Fr RX Building	X-304,X-126	Outside	AO Butterfly	18 in.	AC SOL	B,F	Standard	Closed
1601-63	Drywell Vent to Emer Gas Tr Sys	X-125	Outside	AO Butterfly	6 in.	AC SOL	B,F	Standard	Closed
1601-68	N_2 Inerting	X-126	Outside	AO Butterfly	6 in.	AC SOL	B,F	Standard	Closed
	Service Water Supply	X-119	Outside	Hand Gate	3 in.	Hand	-	-	Closed
	Service Water Supply	X-119	Inside	Hand Globe	3 in.	Hand	-	-	Closed
	Service Air Supply	X-120	Outside	Hand Gate	1 in.	Hand	-	-	Closed
	Service Air Supply	X-120	Inside	Hand Gate	1 in.	Hand	-	-	Closed
	Instr Air Supply	X-121	Outside	Hand Globe	1 in.	Hand	-	-	Open
	Instr Air Supply	X-121	Inside	Hand Globe	1 in.	Hand	-	-	Open

Closure Signals

B Reactor Low Wtr Level
C Main Stmline High Radiation
D Main Stmline Break (high temp. high flow)
F High Drywell Press.
G Reactor Low Wtr Level - Initiate ECC Systems
H High Reactor Press.
K Isol. Condenser Line Break (steam or cond high flow)
L LPCI Line Break (steam or cond high flow)
P Main Steamline Low Press (run mode only)
S High Drywell Pressure
T Low Reactor Press - Open Core Spray and LPCI Valves
U High Recirc Line Temp
V High Temp Non Regen Heat Exchr Outlet
X Standby Liquid Control System Actuated
Z High Radiation, Process Radiation, RX Building Vent Exhaust
RM Remote Manual Switch (control room)
E High Cool Wtr Temp from Aux C.O. Pump
I Low Flow Through C.O. Filter
J High Press Downstream C.O. Press Red Sta

NOTES:

(1) 100 series are drywell penetrations
300 series are suppression chamber penetration

(2) Standard closing rate for MO Globe valves - 4 in./min
Standard closing rate for MO Gate valves - 12 in./min

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Table 2.2-4

BWR/3-4 ISOLATION SYSTEM

(Numbers in parentheses are keyed to notes on following pages; signal codes are listed on following pages)

Line Isolated	Drywell Penetration	Valve Type (7)	Power to Open (5)	Class (13)	Location Ref. to Drywell	Power to Close (5)	Isolation Signal	Minimum Closing Rate (8,15,16)	Normal Status (10,14)	Remarks and Exceptions
Main steam line	X-7	AO Globe	air&ac,dc	A	Inside	air & spring	B,C,D,P,AA,RM	Note (1)	Open	
Main steam line	X-7	AO Globe	air&ac,dc	A	Outside	air & spring	B,C,D,P,AA,RM	Note (1)	Open	
Main steamline drain	X-8	MO Gate	ac	A	Inside	ac	B,C,D,P,AA,RM	Standard	Closed*	*Note (10)
Main steamline drain	X-8	MO Gate	dc	A	Outside	dc	B,C,D,P,AA,RM	Standard	Closed*	*Note (10)
From reactor feedwater	X-9	Check	--	A-X	Inside	Process	Rev. flow	Not Applicable	Open	
From reactor feedwater	X-9	Check	--	A-X	Outside	Process	Rev. flow	Not Applicable	Open	
Reactor water sample	X-41	SO Valve	ac	A	Inside	Spring	B,C,D,P,AA,RM	Not Applicable	Closed*	*Note (10)
Reactor water sample	X-41	SO Valve	ac	A	Outside	Spring	B,C,D,P,AA,RM	Not Applicable	Closed*	*Note (10)
Control rod hydraulic return	X-36	Check		A-X	Outside	Process	Rev. flow	Not Applicable)	Opens on rod movement and closed at all other times	Note (4)
Control rod hydraulic return	X-36	Check	--	A-X	Inside	Process	Rev. flow	Not Applicable)		
Control rod drive exhaust	None	SO Valve	ac	A-X	Outside	Spring	Note (4)	Not Applicable)		
Control rod drive exhaust	None	SO Valve	ac	A-X	Outside	Spring	Note (4)	Not Applicable)		
Control rod drive inlet	None	SO Valve	ac	A-X	Outside	Spring	Note (4)	Not Applicable)		
Control rod drive inlet	None	SO Valve	ac	A-X	Outside	Spring	Note (4)	Not Applicable)		

SO = Solenoid-Operated
MO = Motor Operated
AO = Air-Operated

Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

Line Isolated	Drywell Penetration	Valve Type (7)	Power to Open (5)	Class (13)	Location Ref. to Drywell	Power to Close (5)	Isolation Signal	Minimum Closing Rate (8,15,16)	Normal Status (10,14)	Remarks and Exceptions
RHR Reactor shutdown cooling supply	X-12	MO Gate	dc	A	Outside	dc	F,A,U,M,RM	44 in/min	Closed	M alarms only; no auto closure
RHR Reactor shutdown cooling supply	X-12	MO Gate	ac	A	Inside	ac	F,A,U,M,RM	44 in/min	Closed	M alarms only; no auto closure
RHR to suppression spray header	X-211	MO Globe	ac	B-X	Outside	ac	G,S,RM		Closed	Throttling type valve Note (2)
RHR - containment spray	X-38	MO Gate	ac	B-X	Outside	ac	G,S,RM		Closed	Note (2)
RHR - containment spray	X-39	MO Gate	ac	B-X	Outside	ac	G,S,RM		Closed	Note (2)
RHR - reactor head spray	X-17	MO Gate	ac	A	Inside	ac	F,A,U,RM	Standard	Closed	
RHR - reactor head spray	X-17	MO Gate	dc	A	Outside	dc	F,A,U,RM	Standard	Closed	Throttling type valve Note (2)
RHR test line to suppression pool	X-210	MO Globe	ac	B-X	Outside	ac	G,S,RM	Standard	Closed	Note (2)
RHR - suppression pool	X-210,X-211	MO Gate	ac	B-X	Outside	ac	G,S,RM	Standard	Closed	Notes (11) and (6)
RHR - LPCI to reactor	X-13	MO Gate	ac	A-X	Outside	ac	RH, H	Standard(15)	Open	Throttling type Note (11)
RHR - LPCI to reactor	X-13	MO Globe	ac	A-X	Outside	ac	RH, H	Standard(15)	Closed	
RHR - LPCI to reactor	X-13	Check	--	A-X	Inside	Process	Rev. flow	Standard(15)	Closed	
RHR pump suction from suppression	X-204	MO Gate	ac	B-X	Outside	ac	RM	Note (15)	Open	Valves open on low level signal G

SO = Solenoid-Operated
MO = Motor Operated
AO = Air-Operated

Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

Line Isolated	Drywell Penetration	Valve Type (7)	Power to Open (5)	Class (13)	Location Ref. to Drywell	Power to Close (5)	Isolation Signal	Minimum Closing Rate (8,15,16)	Normal Status (10,14)	Remarks and Exceptions
RHR discharge to radwaste	None	MO Gate	ac	B-X	Outside	ac	F,A,RM	Standard	Closed	
RHR discharge to radwaste	None	MO Gate	dc	B-X	Outside	dc	F,A,RM	Standard	Closed	
Standby liquid control	X-42	Check	--	A-X	Outside	Process	Rev. flow	Not Applicable	Closed	
Standby liquid control	X-42	Check	--	A-X	Inside	Process	Rev. flow	Not Applicable	Closed	
Reactor water cleanup from reactor	X-14	MO Gate	ac	A	Inside	ac	A,W,Y,J,RM	Standard	Open)	Pumps are signaled to stop as a result of valve closure
Reactor water cleanup from reactor	X-14	MO Gate	dc	A	Outside	dc	A,W,Y,J,RM	Standard	Open)	
Reactor water cleanup return	X-9	MO Globe	ac	A	Outside	ac	A,W,Y,J,RM	Standard	Open)	
Reactor water cleanup return	X-9	Check	--	A-X	Outside	Process	Rev. flow	Not Applicable	Open	
RCIC - turbine steam supply	X-10	MO Gate	ac	A-X	Inside	ac	RM,K	Standard	Open)	Opens on Sig B; line break Sig K overrides to close valves.
RCIC - turbine steam supply	X-10	MO Gate	dc	A-X	Outside	dc	RM,K	Standard	Open)	
RCIC - turbine exhaust	X-212	Check	forward	B-X	Outside	Process	Rev. flow	--	Closed)	Closes on rev. flow or low exh pr
RCIC - turbine exhaust	X-212	Stop Check	flow	B-X	Outside	Process	Rev. flow	--	Closed)	
RCIC - condensate vac disch to supp	X-223	Check	--	B-X	Outside	Process	Rev. flow	--	Open	
RCIC - steam line drain	None	AO Globe	air/dc	A-X	Outside	Spring	B,RM	Standard	Open	

SO = Solenoid-Operated
MO = Motor-Operated
AO = Air-Operated

Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

Line Isolated	Drywell Penetration	Valve Type (7)	Power to Open (5)	Class (13)	Location Ref. to Drywell	Power to Close (5)	Isolation Signal	Minimum Closing Rate (8,15,16)	Normal Status (10,14)	Remarks and Exceptions
RCIC - condensate pump disch valve	None	AO Globe	air/dc	A-X	Outside	Spring	B,RM	Standard	Open	
RCIC - pump suct. from suppl chamber	X-227	MO Gate	dc	B-X	Outside	dc	RM	Standard(15)	Closed	
RCIC - pump suct. from supp chamber	X-227	MO Gate	dc	B-X	Outside	dc	RM	Standard(15)	Closed	
Core spray to reactor	X-16	MO Gate	ac	A-X	Outside	ac	RM	(15)	Open	Note (12)
Core spray to reactor	X-16	MO Gate	ac	A-X	Outside	ac	RM	(15)	Closed	Note (12)
Core spray to reactor	X-16	Check	--	A-X	Inside	Process	Rev. flow	Not Applicable	Closed	
Core spray test to suppression pool	X-210	MO Globe	ac	B	Outside	ac	G,RM	--	Closed*	*Note (10), closes on signal "C"
Core spray pump suction	X-226	MO Gate	ac	B-X	Outside	ac	RM	--	Open	
Drywell equipment drain discharge	X-19	AO Gate	air/ac	B	Outside	Spring	A,F,RM	Standard	Open	
Drywell equipment drain discharge	X-19	AO Gate	air/ac	B	Outside	Spring	A,F,RM	Standard	Open	
Drywell floor drain discharge	X-18	AO Gate	air/ac	B	Outside	Spring	A,F,RM	Standard	Open	
Drywell floor drain discharge	X-18	AO Gate	air/ac	B	Outside	Spring	A,F,RM	Standard	Open	
HPCI - turbine steam supply	X-11	MO Gate	ac	A-X	Inside	ac	L,RM	17 sec(16)	Open)	Signal "G" opens valve. Signal "L" overrides and closes valve.
HPCI - turbine steam supply	X-11	MO Gate	dc	A-X	Outside	ac	L,RM	17 sec (15)	Open)	

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Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

Line Isolated	Drywell Penetration	Valve Type (7)	Power to Open (5)	Class (13)	Location Ref. to Drywell	Power to Close (5)	Isolation Signal	Minimum Closing Rate (8,15,16)	Normal Status (10,14)	Remarks and Exceptions
HPCI steam line drain	None	AO Globe	air/dc	A-X	Outside	Spring	G,RM	Standard	Open	
HPCI - turbine exhaust	X-221	Check	High exh. pressure	B-X	Outside	Process	Rev. flow	Standard	Closed	Closes on rev. flow or low exhaust pressure.
HPCI - turbine exhaust	X-221	Stop Check		B-X	Outside	Process	Rev. flow	Standard	Closed	
HPCI pump suction	X-226	MO Gate	dc	B-X	Outside	dc	RM,L	Not Applicable	Closed	Valves open on low cond tank level or high supp chamber level
HPCI hotwell pump disch drain	None	AO Globe	air/dc	A-X	Outside	Spring	G,RM	Standard	Open	
Traversing in-core probe	X-35	Squib Shear	dc	A-X	Outside	dc	RM	Not Applicable	Open)	Typical assembly
Traversing in-core probe	X-35	SO Ball	ac	A-X	Outside	ac	F	Not Applicable	Closed)	
				INSTRUMENT SENSING LINES						
Instrument sensing line	X-30	Hand Globe	Hand	A-X	Outside	Hand	--	Not Applicable	Open	Typical all Class A inst. lines
Steam flow measurement	X-30	Flow Check	Spring	A-X	Outside	--	Excess flow	Not Applicable	Open	Typical all Class A inst. lines
Instrument sensing drywell pressure	X-40	Hand Globe	Hand	B-X	Outside	Hand	--	Not Applicable	Open	Typical all Class B inst. lines

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MO = Motor-Operated
AO = Air-Operated

Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

Line Isolated	Drywell Penetration	Valve Type (7)	Power to Open (5)	Class (13)	Location Ref. to Drywell	Power to Close (5)	Isolation Signal	Minimum Closing Rate (8,15,16)	Normal Status (10,14)	Remarks and Exceptions
				DRYWELL ATMOSPHERIC CONTROL AND SERVICES						
Service air to drywell	X-21	Check	--	B-X	Outside	Process	Rev. flow	Standard	Open	
Service air to drywell	X-21	AO Globe	air	B	Outside	Spring	RM	Standard	Open	
Instrument air to drywell	X-22	Check	--	B-X	Outside	Process	RM	Standard	Open	
Instrument air to drywell	X-22	AO Globe	air	B	Outside	Spring	B	Standard	Open	
Reactor building closed cooling water - in	X-23	Check	--	C-X	Outside	Process	Rev. flow	Standard	Open	
Reactor building closed cooling water - out	X-24	MO Gate	ac	C-X	Outside	ac	RM	Standard	Open	
Service water - in	X-20	Check	--	C-X	Outside	Process	Rev. flow	Not Applicable	--	
Vacuum breaker sec. cont. to supp.	X-205	Check	--	B-X	Outside	Process	Rev. flow	--	--	
Vacuum breaker sec. cont. to supp.	X-205	AO Butterfly	Spring	B-X	Outside	Air press.	--	Closed	Open by dp is when on vacuum in supp chamber.	
Vacuum breaker suppression to drywell	X-203, X-201	Vac. Brkr.	Vacuum	B-X	Ins. [illegible] sber	Drywell pressur	-- Rev. flow	--	Check valve remotely testable.	
Drywell purge and vent outlet	X-25	AO Butterfly	[illegible]	[illegible]-X	Outside	Spring	F,A,Z(9),RM	Standard	Closed	
Drywell purge inlet	X-26	AO Butter[illegible]	[illegible]/ac	B	Outside	Spring	F,A,Z(9),RM	Standard	Closed	
Drywell main exhaust	X-25	AO [illegible]y	air/ac	B-X	Outside	Spring	F,A,Z(9),RM	Standard	Closed	Manual override of all auto sig.
Drywell exhaust valve bypass	X-25	AO Globe	air/ac	B-X	Outside	Spring	F,A,Z(9),RM	--	Closed	See Note (17)

SO = Solenoid-Operated
MO = Motor-Operated
AO = Air-Operated

Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

Line Isolated	Drywell Penetration	Valve Type (7)	Power to Open (5)	Class (13)	Location Ref. to Drywell	Power to Close (5)	Isolation Signal	Minimum Closing Rate (8,15,16)	Normal Status (10,14)	Remarks and Exceptions
Supp. chamber exhaust valve bypass	X-218	AO Butterfly	air/ac	B-X	Outside	Spring	F,A,Z(9)	Standard	Closed	See Note (17)
Supp. chamber purge inlet	X-205	AO Butterfly	air/ac	B-X	Outside	Spring	F,A,Z(9)	Standard	Closed	See Note (9)
Supp. chamber main exhaust	X-231	AO Butterfly	air/ac	B-X	Outside	Spring	F,A,X(9)	Standard	Closed	See Note(9)
Exhaust to standby gas treatment	X-26,218	AO Butterfly	air/ac	B-X	Outside	Spring	F,A,Z	Not Applicable	Closed	See Note (9)
Drywell Makeup	X-26	AO Butterfly	air/ac	B	Outside	Spring	F,A,Z(9),RM	Standard	Open	See Note(9)
Supp. chamber makeup	X-205	AO Butterfly	air/ac	B	Outside	Spring	F,A,Z(9),RM	Standard	Open	See Note (9)
Air to primary cont. air comp.	X-47	AO Globe	air	B	Outside	Spring	F,A,Z,RM	Standard	Open	
Air to primary cont. air comp.	X-47	AO Globe	air	B	Outside	Spring	F,A,Z,RM	Standard	Open	

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MO = Motor-Operated
AO = Air-Operated

NOTES FOR TABLE 2.2-4

These notes are keyed by number to correspond to numbers, in parentheses, in Table 2.2-4.

1. Main steam isolation valve closing rate is adjustable to permit valve closure within 3 seconds minimum to 10 seconds maximum after trip by automatic isolation signals or by manual control switch.

2. Containment spray and suppression cooling valves have interlocks that allow them to be manually reopened after autuomatic closure. This setup permits containment spray for high drywell pressure conditions and/or suppression water cooling. When automatic signals are not present these valves may be opened for test or operating convenience.

3. Testable check valves are designed for remote opening with approximately zero differential pressure across the valve seat. The valves close on reverse flow even though the test switches may be calling for open. The valves open when pump pressure exceeds reactor pressure even though the test switch may be calling for close.

4. Control rod hydraulic lines can be isolated by the solenoid valves outside the primary containment. Lines that extend outside the primary containment are small and terminate in a system that is designed to prevent out-leakage. Solenoid valves normally are closed, but they open on rod movement and during reactor scram.

Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

NOTES FOR TABLE 2.2-4 (Continued)

5. A-c motor-operated valves are powered from the a-c emergency power buses. D-c operated isolation valves shall be powered from the station batteries.
6. Interlocks permit signals F, A, U to close these valves only when both RHR reactor shutdown cooling supply valves are not fully closed.
7. All motor-operated isolation valves remain in the last position upon failure of valve power. All air-operated valves shall close on motive air failure or power failure at the solenoid pilots. (For exception, see Note 1.)
8. The standard minimum closing rate for automatic isolation valves is 12 inches of stem travel per minute unless otherwise specified in Table 7.3-1.
9. Reactor building vent exhaust high radiation signal "Z" is generated by two trip units; this requires one unit at high trip or both units at down scale (instrument failure) trip, in order to cause isolation.
10. Valves identified by an asterisk in the "Normal Status" column can be opened or closed by remote manual switch for operating convenience during any mode of reactor operation except when automatic signal is present.
11. Coincident low reactor water level signal "C" and low reactor pressure signal "I" open LPCI* valves, except that recirculation line break signal "H" overrides to close LPCI* valves on broken side and automatically opens the LPCI* valves in the opposite loop. Special interlocks permit testing these valves with manual switch during any mode of reactor operation except when coincident signals "C" and "I" are present.
12. Coincident signals "C" and "I" open valves. Special interlocks permit testing these valves by manual switch except when automatic signals are present.
13. Those valves which are exceptions to the basic classifications as defined in paragraph 7.3.2 are referenced by their class designations followed by an "X" suffix.
14. Normal status position of valve (open or closed) is the position during normal power operation of the reactor.
15. The specified closure rates are as required for containment isolation only. See appropriate system design specification or valve data sheets on system operational requirements, which may be more restrictive.
16. Closing rate is the minimum rate at which line closure shall be effected.
17. Manual switches shall override all automatic signals on the two smaller valves that bypass the suppression chamber and drywell exhaust valves. The two smaller bypass valves shall be interlocked to allow either to be opened but not both at the same time.

Table 2.2-4 (Continued)

BWR/3-4 ISOLATION SYSTEM

ISOLATION SIGNAL CODES FOR TABLE 2 2-4

Signal	Description
A*	Reactor vessel low water level - scram and close isolation valves except main steam lines.
B*	Reactor vessel low water level - initiate RCIC system, close main steamline isolation valves, trip recirculation pumps.
C*	High radiation - main steam line.
D*	Line break - main steam line (steam line high space temperature or high steam flow).
F*	High drywell pressure - close drywell atmospheric control and secondary containment isolation valves.
G	Reactor vessel low water level or high drywell pressure - initiate core spray, RHR, and HPCI systems.
H	Line break in recirculation loop - close corresponding RHR-LPCI loop valves.
(J)*	Line break in cleanup system - high space temperature; alarm only; no auto closure.
K*	Line break in RCIC system steam line to turbine (high steamline space temperature, high steam flow).
K1	Low RCIC steamline pressure.
L*	Line break in HPCI system steam line to turbine (high steamline space temperature, high steam flow).
L1	Low HPCI steamline pressure.
(M)*	Line break in RHR shutdown and head cooling (high space temperature; alarm only; no auto closure).
N*	Low main steamline pressure at inlet to main turbine (RUN mode only).
S	Low drywell pressure - close containment spray and suppression cooling valves.
T	Low reactor pressure permissive to open core spray and RHR-LPCI valves.
U	High reactor vessel pressure - close RHR-shutdown cooling valves and head cooling valves.
W	High temperature at outlet of cleanup system nonregenerative heat exchanger.
Y	Standby liquid control system actuated.
Z*	High radiation, reactor building ventilation exhaust.
RM*	Remote manual switch from main control room. (All Class A and Class C isolation valves except check valves are capable of remote-manual operation from the main control room).

* These are the isolation functions of the primary containment and reactor vessel isolation control system; other functions are given for information only.

*RHR/LPCI System.

Table 2.2-5

BWR/4 ISOLATION SYSTEM

Para. Number	Line Description	Fluid Contained	Line Size	Valve Location	Valve Type	Isolation Group (Signals)
N-7A to D	Main Steam	steam	26"	Inside	GB	I (A,B,C,D,E)
				Outside	GB	I (A,B,C,D,E)
N-8	Main Steam Drain	steam/water	3"	Inside	GB	I (A,B,C,D,E)
				Outside	GB	I (A,B,C,D,E)
N-9A	Feedwater	water	24"	Inside	CK	--
				Outside	CK	--
				Outside	GT	II (A,B,F)
				Outside	GT	RM
N-9B	Feedwater	water	24"	Inside	CK	--
				Outside	CK	--
				Outside	GT	RM
				Outside	GB	II (A,C,D,G)
				Outside	GT	II (A,B,F)
N-10	Steam to RCIC Turbine	steam	3"	Inside	GT	IV (A,B,C)
				Outside	GT	IV (A,B,C)
N-11	Steam to HPCI Turbine	steam	10"	Inside	GT	V (A,B,C)
				Outside	GT	V (A,B,C)
N-12	RHR Shutdown Cooling Suction	water	20"	Inside	GT	II (A,B,E)
				Outside	GT	II (A,B,E)
N-13A,B	RHR Shutdown Cooling Return	water	24"	Outside	GT	II (A,B) if in shutdown cooling
				Outside	GB	RM
				Outside	SV	SF
				Outside	CK	--
N-14	RWCU Pump Suction	water	6"	Inside	GT	II (A,C,D,G)
				Outside	GT	II (A,C,D,G)
N-16A,B	Core Spray Pump Discharge	water	12"	Outside	GT	RM
				Outside	GT	RM
				Outside	SV	SF
				Outside	CK	--
N-17	RHR Head Spray	water	6"	Inside	GT	II (A,B,E)
				Outside	GT	II (A,B,E)
N-18	Drywell Fl. Dr. Pump Disch.	water	3"	Outside	DCV	II (A,B)
				Outside	DCV	II (A,B)
N-19	Drywell Equip. Dr. Pump Disch.	water	3"	Outside	DCV	II (A,B)
				Outside	DCV	II (A,B)
N-21	Service Air Supply	air	1"	Inside	GB	LC
				Inside	GB	LC
N-22	Inst. Gas Supply	air	1"	Outside	CK	--
				Outside	DCV	II (A,B)
N-23	RBCW to Recirc. Pumps	water	4"	Outside	GT	RM
N-24	RBCW from Recirc. Pumps	water	4"	Outside	GT	RM
N-25	Drywell Purge Supply	air	18"	Outside	B	III
				Outside	B	III
				Outside	B	III
				Outside	B	III
				Outside	B	III
				Outside	DCV	III
				Outside	CK(2)	--
N-26	Drywell Purge Exhaust	air	18"	Outside	DCV	III
				Outside	DCV	III
				Outside	B	III
				Outside	B	III
				Outside	DCV	III
				Outside	SV	III
				Outside	SV	III
				Outside	PV	RM
				Outside	SV	RM
				Outside	SV	RM
N-27E,F	Inst. Lines - Core Plate Pressure	water	1"	Inside	RO	--
				Outside	XFCV	--

Table 2.2-5. (Continued)

Para. Number	Line Description	Fluid Contained	Line Size	Valve Location	Valve Type	Isolation Group (Signals)
N-28A,B,C, E,F	Inst. Lines - RPV Level & Pressure	water/steam	1"	Inside Outside	RO XFCV	-- --
N-28D	Inst. Lines - RPV Head Pressure	steam	1"	Inside Outside	RO XFCV	-- --
N-29A,D, E,F	Inst. Lines - RPV Level & Pressure	water/steam	1"	Inside Outside	RO XFCV	-- --
N-30A,B, C,D	Inst. Lines - Main Stm. Pressure	steam	1"	Inside Outside	RO XFCV	-- --
N-30E,F	Inst. Lines - Recirc. Loop B Flow	water	1"	Outside	XFCV	--
N-32A,B	Inst. Lines - Recirc. Loop A Flow	water	1"	Outside	XFCV	--
N-32C,D	ILRT Connections	air	3/4"	Outside	GB(2)	LC
N-32E,F	Inst. Lines - CS Inj. Pressure	water	1"	Inside Outside	RO XFCV	-- --
N-33A,B, C,D	Inst. Lines - Recirc. Pump ΔP	water	1"	Inside Outside	RO XFCV	-- --
N-33E	Inst. Line - Recirc. Pump Motor Cooler Flow	water	1"	Outside	GB	M
N-33F	Inst. Line - Drywell Pressure	air	1"	Outside	GB	M
N-34A to D	Inst. Lines - Main Stm. Pressure	steam	1"	Inside Outside	RO XFCV	-- --
N-34E,F	Inst. Lines - HPCI Stm. Pressure	steam	1"	Inside Outside	RO XFCV	-- --
N-35A to E	TIP Drives	air	3/8"	Outside Outside	BL XV	II (A,B) RM
N-35F	TIP Purge	air	1"	Outside	CK	--
N-36	CRD Return	water	4"	Inside Outside	CK CK	-- --
N-37A to D	CRD Insert	water	1"	Inside Outside	BCK HCU	-- --
N-38A to D	CRD Withdrawal	water	1"	Inside Outside	BCK HCU	-- --
N-39A,B	RHR Containment Spray	water/air	14"	Outside Outside Outside Outside	GT GT SV SV	LI LI RM RM
N-40A to D	Inst. Lines - Jet Pumps	water	1"	Outside	XFCV	--
N-41	Recirc. Loop Sample	water	3/4"	Inside Outside	DCV DCV	I (A,B,C,D,E) I (A,B,C,D,E)
N-42	Standby Liquid Control	Sodium Pentabrate Solution	1½"	Outside Inside	CK CK	-- --
N-49E,F	Inst. Lines - Unit 2, Drywell Pressure	air	1"	Outside Outside	GB GB	M M
N-50A	Inst. Line - Recirc. Suct. Pressure	water	1"	Inside Outside	RO XFCV	-- --
N-50B,C	Inst. Lines - RCIC Suct Pressure	steam	1"	Inside Outside	RO XFCV	-- --
N-50D,E	Inst. Lines - RWCU Pump Suct. Pressure	water	1"	Inside Outside	RO XFCV	-- --
N-51A,B	CACS Sample Lines	air	1"	Outside Outside	SV SV	III III
N-51C	CACS Sample Line	air	1"	Outside Outside Outside Outside Outside	SV SV SV SV SV	RM III III RM RM

Table 2.2-5. (Continued)

Para. Number	Line Description	Fluid Contained	Line Size	Valve Location	Valve Type	Isolation Group (Signals)
N-51D	CACS Sample Return	air	1"	Outside	CK	--
				Outside	SV	III
N-51E	Inst. Line - Recirc. Suct. Pressure	water	1"	Inside	RO	--
				Outside	XFCV	--
N-52E	Inst. Line - Core Plate Pressure	water	1"	Inside	RO	--
				Outside	XFCV	--
N-52F	Inst. Gas Supply	air	1"	Outside	CK	--
				Outside	DCV	II (A,B)
N-53	Chilled Wtr. from Drywell Coolers, Loop A	water	8"	Outside	GT	RM
N-54	Chilled Wtr. from Drywell Coolers, Loop B	water	8"	Outside	GT	RM
N-55	Chilled Wtr. to Drywell Coolers, Loop B	water	8"	Outside	GT	RM
N-56	Chilled Wtr. to Drywell Coolers, Loop A	water	8"	Outside	GT	RM
N-57	Main Stm. Line 'D' Sample	steam	3/4"	Inside	DCV	I (A,B,C,D,E)
				Outside	DCV	I (A,B,C,D,E)
N-102B	Inst. Line - Unit 2, Drywell Pressure	air	1"	Outside	GB	M
				Outside	GB	M
N-203	CACS Sample Wine	air	1"	Outside	SV	III
				Outside	SV	III
				Outside	SV	RM
				Outside	SV	RM
				Outside	SV	RM
N-205A	Torus Vacuum Breaker	air	20"	Outside	B	RM
				Outside	VB	--
N-205B	Torus Vacuum Breaker	air	20"	Outside	B	RM
				Outside	VB	--
				Outside	B	III
				Outside	B	III
				Outside	CK	--
				Outside	DCV	III
N-206A,B	Inst. Lines - Torus Level	air/water	2"	Outside	GB	M
N-210A,B	RHR Test & Pool Cooling Return	water	18"	Outside	GB	VII
				Outside	CK	--
N-211A,B	RHR Torus Spray	water	6"	Outside	GB	VII
				Outside	GT	VII
				Outside	GB	VII
				Outside	SV	RM
				Outside	SV	RM
N-212	RCIC Turbine Exhaust	water	12"	Outside	SCK	--
				Outside	CK	--
				Outside	DCV	TT
				Outside	DCV	TT
				Outside	GT	IV (C,D,E)
N-213A	Torus Drain (with level inst. line	water	1"	Outside	BG	M
N-214	HPCI Turbine Exhaust	water	24"	Outside	SCK	--
				Outside	CK	--
				Outside	DCV	TT
				Outside	DCV	TT
				Outside	GT	V (C,D,E)
N-215	Inst. Line - Unit 2, Torus Level	air	1"	Outside	GB	M
N-216	HPCI Min. Flow	water	4"	Outside	CK	--
N-217B	HPCI & RCIC Vacuum Relief	air	2"	Outside	GT	V (C,D,E)
				Outside	GT	III (C,D,E)
N-218A	Inst. Gas Supply	air	1"	Outside	CK	--
				Outside	DCV	II (A,B)
N-218B	CACS Sample Line	air	1"	Outside	SV	III
				Outside	SV	III
N-218C	ILRT Connection	air	3/4"	Outside	CB(2)	LC

Table 2.2-5 (Continued)

Para. Number	Line Description	Fluid Contained	Line Size	Valve Location	Valve Type	Isolation Group (Signals)
N-219	Torus Purge Exhaust	air	18"	Outside	B	III
				Outside	B	III
				Outside	DCV	III
				Outside	DCV	III
				Outside	SV	III
				Outside	SV	III
				Outside	SV	RM
				Outside	SV	RM
				Outside	SV	RM
N-221	RCIC Vacuum Pump Discharge	air	2"	Outside	SCK	--
				Outside	CK	--
N-223	HPCI Turbine Drain	water	2"	Outside	SCK	--
				Outside	CK	--
N-224	Core Spray Test Line - Unit 2	water	10"	Outside	GB	VI
				Outside	CK(3)	--
				Outside	CK	--
N-225	CS & Torus Water Cleanup Suction	water	6"	Outside	GT	RM
				Outside	GT	RM
				Outside	GT	II (A,B)
				Outside	GT	II (A,B)
N-226A to D	RHR Pump Suction	water	24"	Outside	GT	RM
				Outside	RV	--
N-227	HPCI Pump Suction	water	16"	Outside	GT	V (A,B,C)
				Outside	GT	V (A,B,C)
N-228A to D	CS Pump Suction	water	16"	Outside	GT	RM
N-229	CS Pump Min. Flow - Unit 2	water	4"	Outside	CK	--
				Outside	CK(4)	--
N-230	RCIC Pump Min. Flow	water	2"	Outside	CK	--
N-233	HPCI Test Line - Unit 2	water	4"	Outside	GT	V (D,F)
N-234	CS Test Line - Unit 2	water	10"	Outside	GB	VI
				Outside	CK(3)	--

NOTES:

1) Valve Types:

GB - Globe	B - Butterfly	DCV - Diaphragm Control Valve	BCK - Ball Check
GT - Gate	SV - Solenoid	VB - Vacuum Breaker	HCU - Hydraulic Control Unit
CK - Check	RV - Relief	XV - Explosive Valve	
BL - Ball	SCK - Stop Check	RO - Restricting Orifice	

2) Isolation Signals:

Group I
A. Reactor Low Water Level
B. High Steam Line Flow
C. High Steam Tunnel Temperature
D. Low Steam Line Pressure
E. High Steam Line Radiation

Group II
A. Reactor Low Water Level
B. High Drywell Pressure
C. RWCU High Flow
D. RWCU non-regen. heat exch. high temp.*
E. High Reactor Pressure (shutdown cooling)
F. High Reactor Pressure
G. Standby Liquid Control System Operation*

Group III
A Reactor Low Water Level
High Drywell Pressure
Reactor Bldg. High Radiation
Refueling Floor High Rad.

Group IV
A. RCIC Steam Line High Flow
B. RCIC Steam Tunnel High Temp
C. RCIC Steam Line Low Pressure*
D. High Drywell Pressure
E. RCIC Steam Line Isolated

Group V
A. HPCI Steam Line High Flow
B. HPCI Stm Tunnel High Temp
C. HPCI Steam Line Low Pressure
D. High Drywell Pressure
E. HPCI Steam Line Isolated
F. Reactor Low Water Level

Group VI
Reactor Low Water Level
High Drywell Pressure

Group VII
LPCI Initiation
Reactor Low Water Level
High Drywell Pressure
& Reactor Low Pressure

RM - Remote Manual
M - Manual (local only)
LC - Locked Closed
TT - Turbine Trip*
SF - RHR Stay full system operates vs. water level in local accumulator

*Process Signals

Table 2.2-6

BWR/5 ISOLATION SYSTEM

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Main Steam	M-1	I.C	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	R4	5	No	A	1	Y	See Notes B.10
Main Steam	M-1	O.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	R4	5	No	A	1	Y	See Notes B.10
MSIV Leak Control	M-1	O.C.	55	Globe	Auto	RM	Shut	Shut	Open	As Is	P,Q.	1.5	STD	Yes	A	1	Y	See Note 10
MS Outbd Drain	M-1	O.C.	55	Globe	Auto	RM	Open	Open	Shut	As Is	B,C,D,E,F,J	1.5	STD	No	A	1	Y	See Note 10
Main Steam	M-2	I.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	24	5	No	A	1	Y	See Notes B.10
Main Steam	M-2	O.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	24	5	No	A	1	Y	See Notes B.10
MSIV Leak Control	M-2	O.C.	55	Globe	Auto	RM	Shut	Shut	Open	As Is	P,Q	1.5	STD	Yes	A	1	Y	See Note 10
MS Outbd Drain	M-2	O.C.	55	Globe	Auto	RM	Open	Open	Shut	As Is	B,C,D,E,F,J	1.5	STD	No	A	1	Y	See Note 10
Main Steam	M-3	I.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	24	5	No	A	1	Y	See Notes B.10
Main Steam	M-3	O.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	24	5	No	A	1	Y	See Notes B.10
MSIV Leak Control	M-3	O.C.	55	Globe	Auto	RM	Shut	Shut	Open	As Is	P,Q	1.5	STD	Yes	A	1	Y	See Note 10
MS Outbd Drain	M-3	O.C.	55	Globe	Auto	RM	Open	Open	Shut	As Is	B,C,D,E,F,J	1.5	STD	No	A	1	Y	See Note 10
Main Steam	M-4	I.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	24	5	No	A	1	Y	See Notes B.10
Main Steam	M-4	O.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C,D,E,F,J	24	5	No	A	1	Y	See Notes B.10
MSIV Leak Control	M-4	O.C.	55	Globe	Auto	RM	Shut	Shut	Open	As Is	P,Q,	1.5	STD	Yes	A	1	Y	See Note 10
MS Outbd Drain	M-4	O.C.	55	Globe	Auto	RM	Open	Open	Shut	As Is	B,C,D,E,F,J	1.5	STD	No	A	1	Y	See Note 10
Feedwater	M-5	I.C.	55	Check	Rev. Flow	--	Open	Shut	Shut	--	--	18	--	No	A	1	Y	
Feedwater	M-5	O.C.	55	Check	Rev. Flow	--	Open	Shut	Shut	--	--	18	--	No	A	1	Y	
Feedwater	M-5	O.C.	55	Gate	RM	Man.	Open	Shut	Shut	As Is	--	18	STD	No	A	1	Y	
Feedwater	M-6	I.C.	55	Check	Rev. Flow	--	Open	Shut	Shut	--	--	18	--	No	A	1	Y	
Feedwater	M-6	O.C.	55	Check	Rev. Flow	--	Open	Shut	Shut	--	--	18	--	No	A	1	Y	
Feedwater	M-6	O.C.	55	Gate	RM	Man.	Open	Shut	Shut	As Is	--	18	STD	No	A	1	Y	
RX Water Clean-up	M-6	O.C.	55	Check	Rev.	--	Open	Shut	Shut	--	--	4	--	No	A	1	Y	
RX Water Clean-Up	M-6	O.C.	55	Gate	Flow	RM	Open	Shut	Shut	As Is	B,N,K,W	4	STD	No	A	1	Y	
Main Steam Drain	M-7	I.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	B,C,D,E,J	3	STD	No	A	1	Y	See Notes 11.18
Main Steam Drain	M-7	O.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	B,C,D,E,J	3	STD	No	A	1	Y	See Notes 11.18
Main Steam Drain	M-7	O.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	B,C,D,E,F,J	3	STD	No	A	1	Y	See Note 11
Spare	M-8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Type "A" Test
RBCCW Return	M-9	O.C.	57	Gate	RM	Man.	Open	Open	Open-Shut	As Is	--	6	STD	No	B	1	Y	
RBCCW Return	M-9	I.C.	57	Gate	RM	Man.	Open	Open	Open-Shut	Shut	X --	6	STD	No	C	1	Y	

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Head Spray	M-10	I.C.	55	Check	Rev. Flow	--	Shut	Shut	Shut	--	--	4	--	No	A	1	Y	
RCIC Head Spray	M-10	I.C.	55	Globe	RM	Man.	Shut	Shut	Shut	As Is	--	3/4	STD	No	B	1	Y	
RCIC Head Spray	M-10	O.C.	55	Check	Rev. Flow	--	Shut	Open	Shut	--	--	6	--	No	A	1	Y	
RCIC Head Spray	M-10	O.C.	55	Gate	RM	Man.	Shut	Shut	Shut	As Is	--	6	15	No	A	1	Y	
RCIC Head Spray	M-10	O.C.	55	Check	Rev. Flow	--	Shut	Open	Shut	--	--	6	--	No	A	1	Y	
RCIC Head Spray	M-10	O.C.	55	Globe	Auto	RM	Shut	Open	Shut	As Is	A,C,S,T	6	STD	No	A	1	Y	
RHR LPCI	M-11	O.C.	55	Gate	RM	Man.	Shut	Shut	Open	As Is	--	10	STD	Yes	A	1	Y	See Note 18
RHR LPCI	M-12	O.C.	55	Gate	RM	Man.	Shut	Shut	Open	As Is	--	10	STD	Yes	A	1	Y	See Note 18
RHR LPCI	M-13	O.C.	55	Gate	RM	Man.	Shut	Shut	Open	As Is	--	10	STD	yes	A	1	Y	See Note 18
CRD Return to RPV	M-14	I.C.	55	Check	Rev. Flow	--	Shut	Shut	Shut	--	--	3	--	No	A	1	Y	
CRD Return to RPV	M-14	O.C.	55	Check	Rev. Flow	--	Shut	Shut	Shut	--	--	3	--	No	A	1	Y	
CRD Return to RPV	M-14	O.C.	55	Gate	RM	Man.	Shut	Shut	Shut	As Is	--	3	STD	No	-	1	Y	
LPCS to RPV	M-15	OC	55	Gate	RM	Man.	Shut	Shut	Open	As Is	--	10	STD	Yes	A	1	Y	See Note 18
HPCS to RPV	M-16	O.C.	55	Gate	RM	Man.	Shut	Shut	Open	As Is	--	10	STD	Yes	A	1	Y	See Note 18
RHR Drywell Spray	M-17	O.C.	56	Gate	RM	Man.	Shut	Shut	Shut	As Is	A,I	14	70	No	B	1	Y	See Notes 8a,11,18
RHR Drywell Spray	M-17	O.C.	56	Gate	RM	Man.	Shut	Shut	Shut	As Is	A,I	14	70	No	B	1	Y	See Notes 8a,11
Steam to RHR HX	M-18	I.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	R,S,V_1, V_2 V_3,V_4,V_5	8	30	No	A	1	Y	See Note 18,18
Steam to RHR HX Bp	M-18	I.C.	55	Globe	RM	Man.	Shut	Shut	Shut	As Is	--	1	STD	No	A	1	Y	See Note 12,18
Steam to RHR Hx	M-18	O.C.	55	Gate	Auto	RM	Shut	Shut	Shut	As Is	R,S,V_1,V_4	8	30	No	A	1	Y	See Note 12
	M-19	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
RHR Shutdown Suct.	M-20	I.C.	55	Gate	Auto	RM	Shut	Open	Shut	As Is	A,C,S,T	18	36	No	A	1	Y	
RHR Shutdown Suct.	M-20	O.C.	55	Gate	Auto	RM	Shut	Open	Shut	As Is	A,C,S,T	18	36	No	A	1	Y	
RHR Drywell Spray	M-21	O.C.	56	Gate	RM	Man.	Shut	Shut	Shut	As Is	A,L	14	70	No	B	1	Y	See Notes 8a,11,18
RHR Drywell Spray	M-21	O.C.	56	Gate	RM	Man.	Shut	Shut	Shut	As Is	A,L	14	70	No	B	1	Y	See Notes 8a,11

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time Seconds	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Spare	M-22	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
RHRCW Supply	M-23	O.C.	57	Gate	RM	Man.	Open	Open	Open-Shut	As Is		6	STD	No	B	1	Y	See Notes 18
RHRCW Supply	M-23	I.C.	57	Gate	RM	Man.	Open	Open	Open-Shut	Shut	X	6	STD	No	C	1	Y	See Notes 18
Steam to RCIC Turbine	M-24	I.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	R,S,V_1,V_2, V_3,V_4,V_5	8	30	No	A	1	Y	See Note 12
Steam to RCIC Turbine	M-24	O.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	V_1,V_2,V_3	4	20	No	A	1	Y	See Note 12
RHR Shutdown Return to Rx	M-25	O.C.	55	Globe	Auto	RM	Shut	Open	Shut	As Is	A,G,S,T	10	21	No	A	1	Y	See Note 18
RHR Shutdown Return to Rx	M-26	O.C.	55	Globe	Auto	RM	Shut	Open	Shut	As Is	A,G,S,T	10	21	No	A	1	Y	See Note 18
Reactor Water Clean-up	M-27	I.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	B,N,K	6	30	No	A	1	Y	
Reactor Water Clean-up	M-27	O.C.	55	Gate	Auto	RM	Open	Open	Shut	As Is	B,N,K,W	6	30	No	A	1	Y	
V.I.P. System A,B,C,&D	M-28	O.C.	54	Ball	Auto	Man.	Shut	Shut	Shut	As Is	X	3/8	STD	No	NA	1	Y	
	M-28	O.C.	54	Shear	RM	--	Shut	Shut	Shut	Shut	X	3/8	STD	No	NA	1	H	See Notes 19.16
	M-28	O.C.	54	Check	Rev. Flow	--	Open	Open	Shut	--	--	1/2	--	No	NA	1	Y	
	M-28	O.C.	54	Gate	Auto	Man.	Open	Open	Shut	Shut	--	1/2	STD	No	NA	1	Y	
CRD Hydraulic	M-29	O.C.	55	Gate	Auto	Man.	Shut	Shut	Shut	As Is	X	3/4	STD	Yes	B	1	N	See Notes 9,13
		I.C.	55	Check	Rev. Flow	--	Shut	Shut	Shut	Shut	--	3/4	--	Yes	B	1	N	See Notes 9,13
Equipment Hatch	M-30	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "B" Test
Personnel Hatch	M-31	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "B" Test
Access Hatch	M-32	--	--	--	--	--	--	--	--	--	-	--	--	--	-	-	-	Type "B" Test
Access Hatch	M-33	--	--	--	--	--	--	--	--	--	-	--	--	--	-	-	-	Type "B" Test
RHR Pump "B" Suction	M-34	O.C.	56	Gate	RM	Man.	Open	Shut	Open	As Is	--	20	STD	Yes	B	1	Y	See Note 28
RHR Pump "C" Suction	M-35	O.C.	56	Gate	RM	Man.	Open	Open	Open	As Is	--	20	STD	Yes	B	1	Y	See Note 28
RHR Pump "A" Suction	M-36	O.C.	56	Gate	RM	Man.	Open	Shut	Open	As Is	--	20	STD	Yes	B	1	Y	See Note 28
LPCS Suction	M-37	O.C.	56	Gate	RM	Man.	Open	Open	Open	As Is	--	20	STD	Yes	B	1	Y	See Note 28
HPCS Suction	M-38	O.C.	56	Gate	RM	Man.	Shut	Open	Open	As Is	--	20	STD	Yes	B	1	Y	
RCIC Turbine Exhaust	M-39	O.C.	56	Gate	RM	Man.	Open	Open	Open-Shut	As Is	--	8	STD	No	B	1	Y	See Notes 26,18
RCIC Turbine Exhaust Vacuum Breaker	M-39	O.C.	56	Globe	Auto	RM	Open	Open	Open-Shut	As Is	L,V_4	2	STD	No	B	1	Y	See Notes 26,18
RCIC Turbine Exhaust	M-39	O.C.	56	Check	Key Flow	--	Shut	Shut	Open-Shut	As Is	--	8	STD	No	B	1	Y	See Note 26

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
PCIC Vacuum Pump Disc.	M-40	O.C.	56	Globe	RM	Man.	Open	Open	Open-Shut	As Is	--	8	STD	No	B	1	Y	See Notes R6,18
RCIC Vacuum Pump Disc.	M-40	O.C.	56	Check	Rev. Flow	--	Shut	Shut	Open-Shut	--	--	8	STD	No	B	1	Y	See Note R6
RCIC Pump Suction	M-41	O.C.	56	Gate	RM	Man.	Shut	Shut	Open	As Is	--	6	STD	No	B	1	Y	See Note 18
RCIC Min. Flow Line	M-42	O.C.	56	Globe	RM	Man.	Shut	Shut	Open-Shut	As Is	X	8	STD	No	B	1	Y	See Note 18
Supp. Pool Spray "A"	M-43	O.C.	56	Gate	Auto	RM	Shut	Shut	Shut	As Is	U,L	4	STD	No	B	1	Y	See Notes 8b,18
LPCS Test Line	M-44	O.C.	56	Globe	Auto	RM	Shut	Shut	Shut	As Is	U,L	12	STD	No	B	1	Y	See Note 18
RHR "A" Hx Condensate	M-44	O.C.	56	Gate	Auto	RM	Shut	Shut	Shut	As Is	A,L,3	4	STD	No	B	1	Y	See Note 18
LPCS Min. Flow Bypass	M-44	O.C.	56	Gate	Auto	RM	Shut	Shut	Open-Shut	As Is	X	4	STD	Yes	B	1	Y	See Note 18
RHR "A" Min. Flow Bypass	M-44	O.C.	56	Gate	RM	Man.	Shut	Shut	Open-Shut	As Is	X	4	STD	Yes	B	1	Y	See Note 18
Supp. Pool Spray "B"	M-45	O.C.	56	Gate	Auto	RM	Shut	Shut	Shut	As Is	U, L	4	STD	No	B	1	Y	See Notes 8b,18
RHR "C" Min Flow Bypass	M-46	O.C.	56	Gate	RM	Man.	Shut	Shut	Open-Shut	As Is	X	4	STD	Yes	B	1	Y	See Note 18
RHR "B" Min Flow Bypass	M-46	O.C.	56	Gate	RM	Man.	Shut	Shut	Open-Shut	As Is	X	4	STD	Yes	B	1	Y	See Note 18
RHR Hx "B" Condensate	M-46	O.C.	56	Gate	Auto	RM	Shut	Shut	Shut	As Is	U, L, X	4	STD	No	B	1	Y	See Note 18
RHR "B" Full Flow & Flush	M-46	O.C.	56	Globe	Auto	RM	Shut	Shut	Shut	As Is	U,L	10	STD	No	B	1	Y	See Note 18
RHR "C" Full Flow & Flush	M-46	O.C.	56	Globe	Auto	RM	Shut	Shut	Shut	As Is	U,L	10	STD	No	B	1	Y	See Note 18
HPCS Test Line	M-47	O.C.	56	Globe	Auto	RM	Shut	Shut	Shut	As Is	B,L	10	STD	No	B	1	Y	See Note 18
HPCS Min Flow	M-47	O.C.	56	Gate	RM	Man.	Shut	Shut	Open-Shut	As Is	X	3	STD	No	B	1	Y	See Note 18
Control Rod Drive Hatch	M-48	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	See "B" Test
Drywell Equip. Sump Dr.	M-49	O.C.	56	Globe	Auto	RM	Open	Open	Shut	Shut	B,L	2½	STD	No	B	1	Y	See Notes 11,18
Drywell Equip. Sump Dr.	M-49	O.C.	56	Globe	Auto	RM	Open	Open	Shut	Shut	B,L	2½	STD	No	B	1	Y	See Note 11
Drywell Floor Sump Dr.	M-50	O.C.	56	Globe	Auto	RM	Open	Open	Shut	Shut	B,L	2½	STD	No	B	1	Y	See Notes 11,18
Drywell Floor Sump Dr.	M-50	O.C.	56	Globe	Auto	RM	Open	Open	Shut	Shut	B,L	2½	STD	No	B	1	Y	See Note 11
Cycled Condensate	M-51	I.C.	56	Gate	Man.	--	L.Shut	L.Shut	Shut	L.Shut	--	2½	--	No	B	1	Y	
Cycled Condensate	M-51	O.C.	56	Gate	Man.	--	L.Shut	L.Shut	Shut	L.Shut	--	2½	--	No	B	1	Y	
Instr Air-Cont "B"	M-52	O.C.	57	Globe	RM	Man.	Open	Open	Open-Shut	As Is	--	1	STD	Yes	B	1	Y	

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Spare	M-53	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Hydrogen Gas Control	M-54	O.C.	56	Gate	RM	Man.	Shut	Shut	Open-Shut	As Is	--	2	STD	Yes	B	1	Y	2 valves in para
Hydrogen Gas Control	M-54	O.C.	56	Gate	RM	Man.	Shut	Shut	Open-Shut	As Is	--	2	STD	Yes	B	1	Y	2 valves in para
Spare	M-55	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
SBLC	M-56	I.C.	55	Check	Rev. Flow	--	Shut	Shut	Shut	--	--	1½	--	Yes	A	1	Y	
SBLC	M-56	O.C.	55	Check	Rev. Flow	--	Shut	Shut	Shut	--	--	1½	--	Yes	A	1	Y	
SBLC "A" Disc	M-56	O.C.	55	Explosive	Open	--	Shut	Shut	Shut	Shut	--	1½	--	Yes	A	1	Y	
SBLC "B" Disc	M-56	O.C.	55	Explosive	Open RM	--	Shut	Shut	Shut	Shut	--	1½	--	Yes	A	1	Y	
SBLC Bypass	M-56	O.C.	55	Globe	Man.	--	L.Shut	L.Shut	L.Shut	L.Shut	--	1	-	No	A	1	Y	
Spare	M-57	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-58	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-59	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-60	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-61	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-62	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-63	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-64	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
DW Pneumatic Purge	M-65	I.O/ O.C.	56	Globe	Auto	RM	Open	Open	Shut	Shut	B,L,M,Z	1½	STD	No	B	1	Y	See Note 11
Spare	M-66	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Spare	M-67	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
RR A Cylinder Line	M-68	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	L,B	3/4	STD	No	B	1	H	See Note 28
RR A Drain Line	M-68	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	L,B	1/2	STD	No	B	1	N	See Note 28
RR A Shuttle Line	M-68	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	L,B	1/2	STD	No	B	1	N	See Note 28
RR A Cylinder Line	M-68	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	L,B	3/4	STD	No	B	1	N	See Note 28
RRB Cylinder Line	M-69	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	--	3/4	STD	No	B	1	N	See Note 28
RRB Drain Line	M-69	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	--	1/2	STD	No	B	1	N	See Note 28
RRB Shuttle Line	M-69	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	--	1/2	STD	No	B	1	N	See Note 28
RRB Cylinder Line	M-69	O.C.	57	Globe	Auto	RM	Open	Open	Shut	--	--	3/4	STD	No	B	1	N	See Note 28
Drywell Instrument Supply	M-70	O.C.	56	Check	Rev. Flow	--	Open	Open	Shut	--	--	3	--	No	B	1	Y	See Note 25
Drywell Instrument Supply	M-70	O.C.	56	Globe	Auto	RM	Open	Open	Shut	As Is	B,L,M,Z	3	STD	No	B	1	Y	See Note 25
Service Air	M-71	I.C.	56	Globe	Man.	--	L.Shut	L.Shut	L.Shut	As Is	--	2½	--	No	B	1	Y	
Service Air	M-71	O.C.	56	Globe	Man.	--	L.Shut	L.Shut	L.Shut	As Is	--	2½	--	No	B	1	Y	
HPCS Relief Vent	M-72	O.C.	56	Relief	Over Press.	--	Shut	Shut	Shut	--	--	1	--	No	B	1	Y	Set @ 100 PSIG See Note 18
RHR Relief Vent	M-72	O.C.	56	Relief	Over Press.	--	Shut	Shut	Shut	--	--	2	--	No	B	1	Y	Set @ 500 PSIG See Note 18
LPCS Relief Vent	M-73	O.C.	56	Relief	Over Press.	--	Shut	Shut	Shut	--	--	3	--	No	B	1	Y	Set @ 500 PSIG See Note 18
RHR Relief Vent	M-73	O.C.	56	Relief	Over Press.	--	Shut	Shut	Shut	--	--	1½	--	No	B	1	Y	Set @ 250 PSIG See Note 18
RHR Relief Vent	M-73	O.C.	56	Relief	Over Press.	--	Shut	Shut	Shut	--	--	1½	--	No	B	1	Y	Set @ 500 PSIG See Note 18
RHR Vent Hx-A	M-73	O.C.	56	Globe	RM	Man.	Shut	Shut	Shut	As Is	--	1½	STD	No	B	1	Y	See Note 18
RHR Vent Hx-B	M-73	O.C.	56	Relief	Over Press.	--	Shut	Shut	Shut	--	--	4	--	No	B	1	Y	Set @ 75 PSIG, See Note 18
LPCS Relief Vent	M-73	O.C.	56	Relief	Over Press.	--	Shut	Shut	Shut	--	--	2	--	No	B	1	Y	Set @ 100 PSIG, See Note 18
Drywell Chilled Wtr. "B"	M-74	O.C.	56	Gate	Auto	RM	Open	Open	Shut	As Is	B,L	8	STD	No	B	1	Y	"B" Open when "A" Shut
Drywell Chilled Wtr. "B"	M-74	I.C.	56	Check	Rev. Flow	--	Open	Open	Shut	--	--	8	--	No	B	1	Y	"B" open when "A" Shut
Drywell Chilled Wtr. "B"	M-75	O.C.	56	Gate	Auto	RM	Open	Open	Shut	As Is	B,L	8	STD	No	B	1	Y	"B" Open When "A" Shut
Drywell Chilled Wtr. "B"	M-75	I.C.	56	Gate	Auto	RM	Open	Open	Shut	As Is	--	8	STD	No	B	1	Y	"B" open when "A" Shut

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Drywell Chilled Wtr. "A"	M-76	O.C.	56	Gate	Auto	RM	Shut	Shut	Shut	As Is	B,L	8	STD	No	B	1	Y	"A" open when "B" shut
Drywell Chilled Wtr. "A"	M-76	I.C.	56	Gate	Auto	RM	Shut	Shut	Shut	As Is	B,L	8	STD	No	B	1	Y	"A" oepn when "B" shut
Drywell Chilled Wtr. "A"	M-77	O.C.	56	Gate	Auto	RM	Shut	Shut	Shut	As Is	B,L	8	STD	No	B	1	Y	"A" open when "B" shut
Drywell Chilled Wtr. "A"	M-77	I.C.	56	Check	Rev. Flow	—	Shut	Shut	Shut	—	—	—	—	No	B	1	Y	"A" Open when "B" shut
Through Drywell Floor	M-78	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-79	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-80	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-81	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-82	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-83	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-84	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-85	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-86	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-87	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-88	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-89	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-90	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-91	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
Through Drywell Floor	M-92	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	
I.A. Suction Fr. Cont.	M-93	I.C.	56	Globe	Auto	RM	Open	Open	Shut	F.C.	B,L,M,Z	2½	STD	No	B	1	Y	
I.A. Suction Fr. Cont.	M-93	O.C.	56	Globe	Auto	RM	Open	Open	Shut	F.C.	B,L,M,Z	2½	STD	No	B	1	Y	
Spare	M-94	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	Type "A" Test
Instr. Air-Cont. "A"	M-95	O.C.	57	Globe	RM	Man.	Open	Open	Open-Shut	As Is	—	1	STD	Yes	B	1	Y	
	M-96	—	—	—	—	—	—	—	—	—	—	—	—	—	-	-	-	

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
RHR Relief Vents	M-97	O.C.	56	Relief	Over press	--	Shut	Shut	Shut	--	--	1½	--	No	B	1	Y	Set @ 500 PSIG See Note 18
RHR Relief Vents	M-97	O.C.	56	Relief	Over press	--	Shut	Shut	Shut	--	--	2	--	No	B	1	Y	Set @ 150 PSIG See Note 18
RHR Relief Vents	M-97	O.C.	56	Relief	Over press	--	Shut	Shut	Shut	--	--	2	--	No	B	1	Y	Set @ 500 PSIG See Note 18
RHR Relief Vents	M-97	O.C.	56	Relief	Over press	--	Shut	Shut	Shut	--	--	2	--	No	B	1	Y	Set @ 500 PSIG See Note 18
RHR Hx "B" Vent	M-97	O.C.	56	Globe	RM	Man.	Shut	Shut	Shut	As Is	--	1½	STD	No	B	1	Y	See Note 18
RR Test Line "A"	M-98	O.C.	56	Globe	Auto	RM	Shut	Shut	Shut	As Is	A,L	10	STD	No	B	1	Y	See Note 18
	M-99	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
	M-100	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Type "A" Test
Drywell Purge Inlet	M-101	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	18	5	No	B	1	Y	See Notes 11,18
Drywell Purge Inlet	M-101	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	18	5	No	B	1	Y	See Note 11
Drywell Purge Exhaust	M-102	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	18	5	No	B	1	Y	See Notes 11,18
Drywell Purge Exhaust	M-102	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	18	5	No	B	1	Y	See Note 11
Drywell Purge Exhaust	M-102	O.C.	56	Globe	RM	Man.	Shut	Shut	Shut	Shut	--	2	STD	No	B	1	Y	See Notes 11,18
Drywell Purge Exhaust	M-102	O.C.	56	Globe	RM	Man.	Shut	Shut	Shut	Shut	--	2	STD	No	B	1	Y	See Note 11
Supp.Chamber Purge Exhaust	M-103	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	11	5	No	B	1	Y	See Notes 11,18
Supp. Chamber Purge Exh.	M-103	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	11	5	No	B	1	Y	See Note 11
Combustible Gas Control	M-103	O.C.	56	Globe	RM	Man.	Shut	Shut	Open-Shut	As Is	--	2	STD	Yes	B	1	Y	2 valves in para.
Combustible Gas Control	M-103	O.C.	56	Globe	RM	Man.	Shut	Shut	Open-Shut	As Is	--	2	STD	Yes	B	1	Y	2 valves in para.
Supp. Chamber Purge Inlet	M-104	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	11	5	No	B	1	Y	See Notes 11,18
Supp. Chamber Purge Inlet	M-104	O.C.	56	Butterfly	Auto	RM	Shut	Open	Shut	Shut	B,L,M,Z	11	5	No	B	1	Y	See Note 11
Supp. Chamber Purge Inlet	M-104	O.C.	56	Globe	RM	Man.	Shut	Shut	Shut	Shut		2	STD	No	B	1	Y	See Notes 11,18
Supp Chamber Purge Inlet	M-104	O.C.	56	Globe	RM	Man.	Shut	Shut	Shut	Shut		2	STD	No	B	1	Y	See Note 11
RCIC Steam Vacuum BKR	M-104	O.C.	56	Globe	Auto	RM	Open	Open	Open-Shut	As Is	L, V_4	2	STD	No	B	1	Y	

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
RHR Relief Valves Dis.	M-105	O.C.	56	Relief	Over press.	--	Shut	Shut	Shut	--	--	8	--	No	B	1	Y	Set @ 500 PSIG See Note 18
RHR Relief Valves Dis.	M-105	O.C.	56	Relief	Over press.	--	Shut	Shut	Shut	--	--	8	--	No	B	1	Y	Set @ 480 PSIG See Note 18
RHR Relief Valve Disch.	M-106	O.C.	56	Relief	Over press.	--	Shut	Shut	Shut	Shut	--	8	--	No	B	1	Y	Set @ 500 PSIA See Note 18
RHR Relief Valve Disch.	M-106	O.C.	56	Relief	Over press.	--	Shut	Shut	Shut	Shut	--	8	--	No	B	1	Y	Set @ 480 PSIA See Note 18
Vacuum Breakers Lines	M-107	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Through Drywell Floor
Vacuum Breakers Lines	M-108	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Through Drywell Floor
Vacuum Breakers Lines	M-109	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Through Drywell Floor
Vacuum Breakers Lines	M-110	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Through Drywell Floor
Instrument Lines	I-1/ 104	--	--	--	--	--	--	--	--	--	--	3/4	--	--	B	1	No	See Notes 21,22, 23,24 except for lines listed below
Recirc Pump Seal Purge	I-50	I.O./ O.C.	55	Check Globe	Man.	--	Open	Shut Open	Shut Open		--	3/4	--	No	B	1	Yes	See Note 27
H_2 Air Shape Return	I-7A	2/O.C.	56	Globe	Auto	RM	Open-Shut	Open-Shut	Open-Shut	Shut	B,L,M,Z	3/4	STD	No	B	1	Yes	See Notes 11,18
D.W. Atmos Sample	I-11A	2/O.C.	56	Globe	Auto	RM	Open-Shut	Open-Shut	Open-Shut	Shut	B,L,M,Z	3/4	STD	No	B	1	Yes	See Notes 11,18
Air Sample	I-19A -D	2/O.C.	56	Globe	Man.	--	Locked Shut	Shut	Shut	--	--	1/2	--	No	B	1	Yes	See Notes 11,18
Reactor Recirc. Sample	F	I.C./ O.C.	55	Globe	Auto	RM	Open	Shut	Shut	Shut	B,C	3/4	STD	No	B	1	Yes	
Recirc. Pump Seal Purge	I-21C	I.C./ O.C.	55	Check Globe	Rev. Flow	--	Open	Shut-Open	Shut-Open	--	--	3/4	--	No	B	1	No	See Note 27
Supp. Chamber Air Sampl.	I-27A	2/O.C.	56	Globe	Auto	RM	Shut	Shut	Shut	Shut	B,L,M,Z	3/4	STD	No	B	1	Yes	See Notes 11,18

Table 2.2-6 (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Gp.	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shut/Sam	Post LOCA	Power Failure								
Smp. Chamber Air Samp.	I-29A, D	2/O.C.	56	Globe	Auto	RM	Shut	Shut	Shut	Shut	B,L,M,Z	3/4	STD	No	B	1	Yes	See Notes 11,18
Air Sample-Reactor Bldg	I-50A, B	2/O.C.	56	Globe	Man	--	Shut	Shut	Shut	--	--	1/2	--	No	B	1	Yes	See Notes 11,18
D.W. Atmos Sample	I-65A	2/O.C.	56	Globe	Auto	RM	Open-Shut	Open-Shut	Open-Shut	Shut	B,L,M,Z	3/4	STD	No	B	1	Yes	See Notes 11,18
Scor Safety/Relief Valves	C.O.	2/O.C.	56	Globe	Man.	--	Shut	Shut	Shut	--	--	1/2	--	No	B	1	Yes	See Notes 11,18
Air Sample X.S.	I-66A	2/O.C.	56	Globe	Man.	--	Locked Shut	Shut	Shut	--	--	1/2	--	No	B	1	Yes	See Notes 11,18
Air Sample Recirc. Pump	B,C, D,F,	2/O.C.	56	Globe	Man.	--	Locked Shut	Shut	Shut	--	--	1/2	--	No	B	1	Yes	See Notes 11,18
Air Sample Recirc. Pump	I-67A	2/O.C.	56	Globe	Man.	--	Locked Shut	Shut	Shut	--	--	1/2	--	No	B	1	Yes	See Notes 11,18
Air Sample Recirc. Pump	B,D, D,F	2/O.C.	56	Globe	Man.	--	Locked Shut	Shut	Shut	--	--	1/2	--	No	B	1	Yes	See Notes 11,18
	I-55 to I-63	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Through Drywell Floor
	I-70 to I-104	--	--	--	--	--	--	--	--	--	--	--	--	--	-	-	-	Through Drywell Floor

Table 2.2-6 (Continued)

Signal	Description
A	Reactor Vessel Low-(Level 3) Water Level
B	Reactor Vessel Low-(Level 2) Water Level
C	Main Steamline High Radiation
D	Main Steamline High Flow
E	Main Steamline Low Pressure
F	Main Steamline Tunnel Leak Detection (High Temperature or High Δ Temperature)
G	Shutdown Cooling Reactor Pressure High
H	
J*	Condenser Vacuum Low
K	Reactor Water Cleanup High Differential Flow
L	Drywell Pressure High
M	Plant Exhaust Plenum High Radiation
N	RWCU Leak Detection (High Temperature or High Δ Temperature)
P	High Steamline Pressure
Q	Low Dilution Flow or High Leakage Flow
R	RHR/RCIC Combined Steamline High Differential Pressure (High Flow)
S	RHR Equipment Area Leak Detection (High Temperature or High Δ Temperature)
T	RHR Shutdown Cooling Flow High
U	Reactor Vessel Low (Level 1) Water Level
V	RCIC System (1) Steam Tunnel Leak Detection (High Temperature or High Δ Temperature) (2) RCIC Equipment Area Leak Detection (High Temperature or High Δ Temperature) (3) High Steam Flow (4) Low Steamline Pressure (5) High Turbine Exhaust Pressure
W	High Temperature at Outlet of Cleanup Non-Regenerative Heat Exchanger or Standby Liquid Control System Actuated
X	Close Through Electrical Interlocks with Other Valves or Pump Motors
Z	Refueling Floor Exhaust Radiation - High
RM	Remote Manual From Control Room

*Bypassed when turbine stop and bypass valves shut, reactor pressure less than 1050 psia, and bypass switch in the "Bypass" position and the mode switch is in Startup/Hot Standby, Shutdown, or Refuel positions.

Table 2.2-7

BWR/6 ISOLATION SYSTEM

Line Isolated	Primary Cont. Pene. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position			Power Failure	Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA									
Fuel Pool Cooling & Cleanup - Transfer Tube	4	I	56	Closure Door	Manual	None	Locked Closed	Open	Locked Closed	N/A	Manual	36	N/A	No	B	I	No (Type "B" Test)	
Nuclear Boiler - Main Steam Lines	5	O	55	Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F, P,E,N	28	(Note 1) 3 Minimum	Yes	A	I	Yes	
		I		Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F, P,E,N	28	3 Minimum		A	I		
		O		Globe	Electric	Manual	Open	Closed	Closed	As Is	C,D,E, P,F,N	1½	6.1		A	I		
Nuclear Boiler - Main Steam Lines	6	O	55	Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F, P,E,N	28	3 Minimum	Yes	A	I	Yes	
		I		Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F, P,E,N	28	3 Minimum		A	I		
		O		Globe	Electric	Manual	Open	Closed	Closed	As Is	C,D,E, F,P,N	1½	6.1		A	I		
Nuclear Boiler - Main Steam Lines	7	O	55	Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F, P,E,N	28	3 Minimum	Yes	B	I	Yes	
		I		Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F, P,E,N	28	3 Minimum		A	I		
Nuclear Boiler - Feedwater Inlet	10	O	55	Gate	Electric	Manual	Open	Closed	Closed	As Is	RM	24	120	Yes	B	I	Yes	
		O		Check	(3)	Self	Open	Closed	Closed	Fail Closed	Reverse Flow	24			A	I	Yes	
		I		Check	Process	None	Open	Closed	Closed	N/A	Reverse Flow	24	N/A		A	I	Yes	
RHR Pump - "A" Suction	11	O	56	Gate	Electric	Manual	Open	Closed	Open	As Is	RM	24	124	Yes	B	I	No	
RHR Pump - "B" Suction	12	O	56	Gate	Electric	Manual	Open	Closed	Open	As Is	RM	24	124	Yes	B	I	No	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
RHR Pump - "C" Suction	13	O	56	Gate	Electric	Manual	Open	Closed	Open	As Is	RM	24	124	Yes	B	I	No	
RHR Reactor Shutdown Cooling Suction	14	O	55	Gate	Electric	Manual	Closed	Open	Closed	As Is	A,U,M	20	29	Yes	A	I	Yes	
		I		Gate	Electric	Manual	Closed	Open	Closed	As Is	A,U,M	20	29		A	I	Yes	
Steam Supply to RHR and RCIC Turbine	17	I	56	Gate	Electric	Manual	Open	Open	Open	As Is	J,K,T	10	20	Yes	A	I	Yes	
		O		Gate	Electric	Manual	Open	Open	Open	As Is	J,K,T	10	20		A	I	Yes	
		I		Globe	Electric	Manual	Closed	Closed	Closed	As Is	J,K,T	1	29	Yes	A	I	Yes	
RCIC & RHR to Head Spray	18	I	55	Check	Note 3	None	Closed	Closed	Closed	N/A	Reverse Flow	6	N/A	Yes	A	I	Yes	
		O		Check	Note 3	None	Closed	Closed	Closed	N/A	Reverse Flow	6	N/A		A	I	Yes	
		O		Gate	Electric	Manual	Closed	Open	Closed	As Is	RM	6	15		A	I	No	
		O		Globe	Electric	Manual	Closed	Closed	Closed	As Is	A,U,M	6	63		A	I	Yes	
		O		Check	Process	None	Closed	Closed	Closed	N/A	Reverse Flow	6	N/A		A	I	Yes	
Nuclear Boiler - Main Steam Drains	19	O	55	Gate	Electric	Manual	Open	Closed	Closed	As Is	C,D,F, P,E,N	3	15	Yes	A	I	Yes	
		I		Gate	Electric	Manual	Open	Closed	Closed	As Is	C,D,F, P,E,N	3	15		A	I	Yes	
RHR Heat Exchanger "A" to LPCI	20	O	55	Gate	Electric	Manual	Open	Open	Open	As Is	RM	18	78	Yes	B	I	No	
		I		Gate	Electric	Manual	Closed	Closed	Open	As Is	RM	14	22		A	I	No	
		I		Check	Note 3	None	Closed	--	Open	As Is	Reverse Flow	14	N/A		A	I	No	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position			Power Failure	Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA									
Suppression Pool Level Instruments	119	O	RGI. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Suppression Pool Level Instruments	120	O	RGI. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		O		Globe	Electric	Manual	Open	Closed	Closed	As Is	C,D,E F,P,N	1½	6.1		A	I	Yes	
Nuclear Boiler Main Steam Lines	8	O	55	Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F P,E	28	3 minimum		A	I	Yes	
		I		Globe	Piston	Self	Open	Closed	Closed	Fail Closed	C,D,F P,E,N	28	3 minimum		A	I	Yes	
		O		Globe	Electric	Manual	Open	Closed	Closed	As Is	C,D,F P,E,N	1½	6.1		A	I	Yes	
Nuclear Boiler Feedwater Inlet	9	O	55	Gate	Electric	Manual	Open	Closed	Closed	As Is	RM	24	120	Yes	B	I	Yes	
		O		Check	(Note 3)	None	Open	Closed	Closed	Fail Closed	Reverse Flow	24	N/A		A	I	Yes	
		I		Check	Process	None	Open	Closed	Closed	N/A	Reverse Flow	24	N/A		A	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Drywell Fission Product Monitor Sample	109A	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	No	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM		28.4		B	I	Yes	
Drywell Fission Product Monitor Sample Return	109B	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	No	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM		28.4		B	I	Yes	
Containment Pressure Instrument (Narrow Range)	109D	O	RG1. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	No	B	I	Yes	
Integrated Leak Rate Test Drywell Pressure Instrument	110A	I	56	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3/4	N/A	No	B	I	No (type B test)	
Integrated Leak Rate Test Verification Flow Instruments	110C	I	56	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3/4	N/A	No	B	I	No (type B test)	
Integrated Leak Rate Test Containment Pressure Instruments	110F	I	56	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3/4	N/A	No	B	I	No (type B test)	
Suppression Pool Level Instruments	113	O	RG1. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Suppression Pool Level Instruments	114	O	RG1. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Suppression Pool Level Instruments	115	O	RG1. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Suppression Pool Level Instruments	116	O	RG1. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Suppression Pool Level Instruments	117	O	RG1. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Suppression Pool Level Instruments	118	O	RG1. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Drywell Pressure Instrument (Wide Range)	102D	O	RGL. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Containment Pressure Instrument (Wide Range)	103D	O	RGL. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Containment Pressure Air Instrument (Wide Range)	104D	O	RGL. 11	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Drywell Hydrogen Analyzer Sample	106A	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Drywell Hydrogen Analyzer Sample Return	106B	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Containment Hydrogen Analyzer Sample	106D	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Containment Hydrogen Analyzer Sample Return	106E	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Containment Hydrogen	107A	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Analyzer Sample		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Containment Hydrogen Analyzer Sample Return	107B	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM		28.4		B	I	Yes	
Drywell Hydrogen Analyzer Sample	107D	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
Drywell Hydrogen Analyzer Sample Return	107E	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4		B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position			Power Failure	Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA									
RWCU Pump Suction	87	I	56	Gate	Electric	Manual	Open	Open	Closed	As Is	B,D,Y H,L	6	30	No	A	I	Yes	
		O		Gate	Electric	Manual	Open	Open	Closed	As Is	W,H,Y I,B,D	6	30		A	I	Yes	
RWCU Pump Discharge	88	I	55	Gate	Electric	Manual	Open	Open	Closed	As Is	D,B,Y, L,H	4	21	No	B	I	Yes	
		O		Gate	Electric	Manual	Open	Open	Closed	As Is	B,W,Y L,D,H	4	21		B	I	Yes	
Standby Service Water Supply "A"	89	O	56	Globe	Electric	Manual	Open	Open	Open	Fail Open	RM	2	7.5	Yes	B	I	Yes	
		I		Check	Process	Manual	Open	Open	Open	N/A	N/A	2	N/A		B	I	Yes	
Standby Service Water Return "A"	90	I	56	Globe	Electric	Manual	Open	Open	Open	Fail Open	RM	2	7.5	Yes	B	I	Yes	
		O		Globe	Electric	Manual	Open	Open	Open	Fail Open	RM	2	7.5		B	I	Yes	
Standby Service Water Return "B"	91	I	56	Globe	Electric	Manual	Open	Open	Open	Fail Open	RM	2	7.5	Yes	B	I	Yes	
		O		Globe	Electric	Manual	Open	Open	Open	Fail Open	RM	2	7.5		B	I	Yes	
		O		Globe	Electric	Manual	Open	Open	Open	Fail Open	RM		7.5	Yes	B	I	Yes	
Standby Service Water Supply "B"	92	I	56	Check	Process	Manual	Open	Open	Open	N/A	N/A	2	N/A		B	I	Yes	
Drywell Pressure Instrument (Narrow Range)	101C	O	RGL. II	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	No	B	I	Yes	
Drywell Pressure Instrument (Wide Range)	101F	O	RGL. II	Globe	Electric	Manual	Open	Open	Open	As Is	RM	3/4	28.4	Yes	B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
RHR Heat Exchanger "A" Relief Valve Vent Header to Suppression Pool	77	O	56	Relief	Process	None	Closed	Closed	Closed	N/A	N/A	6	N/A	Yes	B	I	No Type A Test	
		O		Globe	Electric	Manual	Closed	Closed	Closed	As Is	RM	2	11.3		B	I	No	
		O		Globe	Electric	Manual	Closed	Closed	Closed	As Is	RM	2	11.3		B	I	No	
		O		Check	Process	None	Closed	Closed	Closed	N/A	Reverse Flow	1½	N/A		B	I	No	
		O		Check	Process	None	Closed	Closed	Closed	N/A	Reverse Flow	1½	N/A		B	I	No	
Integrated Leak Rate Test Connection (Drywell Pressurization and Depressurization)	82	O	56									5		No	B	I	No (Type B Test)	
		I																
RWCU Line From Regen. Heat Exchanger to Feedwater	83	I	56	Gate	Electric	Manual	Open	Open	Closed	As Is	B,D,H, Y,L	6	31	No	B	I	Yes	
		O		Gate	Electric	Manual	Open	Open	Closed	As Is	D,B,H, Y,L	6	31		B	I	Yes	
Chemical Waste Sump Pump Discharge	84	I	56	Gate	Piston	None	Open	Closed	Closed	Closed	B,G	3	4	Yes	B	I	Yes	
		O		Gate	Piston	None	Open	Closed	Closed	Closed	B,G	3	4		B	I	Yes	
Suppression Pool Cleanup Return	85	O	56	Gate	Piston	None	Open	Open	Closed	Fail Closed	B,G	12	4	Yes	B	I	Yes	
		O		Gate	Piston	None	Open	Open	Closed	Fail Closed	B,G	12	4		B	I	Yes	
Demineralized Water Supply to Containment	86	O	56	Globe	Electric	Manual	Open	Open	Closed	As Is	B,G	2	10	Yes	B	I	Yes	
		I		Globe	Electric	Manual	Open	Open	Closed	As Is	B,G	2	10		B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
		O		But-ter Fly	Piston	Manual	Open	Closed	Closed	Closed	B,G,Z	6	4		B	I	Yes	
RHR Pump "B" Test Line to Suppression Pool	67	O	56	Gate	Electr..	Manual	Closed	Closed	Closed	As Is	RM	18	93	Yes	B	I	No	
		O		Globe	Electric	Manual	Closed	Closed	Closed	As Is	C,G	4	27		B	I	No	
		O		Check	Process	None	Closed	Closed	Closed	As Is	Reverse Flow	4	N/A		B	I	No	
Refueling Water Transfer Pump Suction	69	O	56	But-ter Fly	Piston	None	Open	Open	Closed	Fail Closed	B,G	12	4	No	B	I	Yes	
		O		But-ter Fly	Piston	None	Open	Open	Closed	Fail Closed	B,G	12	4		B	I	Yes	
Instrument Air Supply to ADS Receivers	70	O	56	Globe	Electric	Manual	Open	Open	Closed	Closed	B,G	1	4	Yes	B	I	Yes	
		I		Check	Process	None	Open	Open	Closed	N/A	Reverse Flow	1	N/A		B	I	Yes	
RHR "C" & LPCS Relief Valve Vent Header to Suppresssion Pool	718 & A	O	56	Relief	Process	None	Closed	Closed	Closed	N/A	N/A	1 1½	N/A	Yes	B	I	No	
		O		Relief	Process	None	Closed	Closed	Closed	N/A	N/A		N/A		B	I	No	
RHR Shutdown Vent Header to Suppression Pool	73	O	56	Relief	Process	None	Closed	Closed	Closed	N/A	N/A	4	N/A	Yes	B	I	No (type A test)	
RCIC Turbine Exhanst Vacuum Breaker	75	O	56	Globe	Electric	Manual	Open	Open	Open	As Is	G,J	1½	6.1	No	B	I	Yes	
		O		Gate	Electric	Manual	Open	Open	Open	As Is	G,J	2½	18		B	I	Yes	
RHR Shutdown Suction Relief Valve Discharge	76B	O	56	Relief	Process	None	Closed	Closed	Closed	N/A	N/A	1	N/A	Yes	B	I	No (type A test)	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Penetration Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Drywell & Containment Equipment Drain Sump Pump Discharge	50	I	56	Gate	Piston	None	Open	Closed	Closed	Closed	B,G	6	4	No	B	I	Yes	
		O		Gate	Piston	None	Open	Closed	Closed	Closed	B,G	6	4		B	I	Yes	
Drywell & Containment Floor Drain Sump Pump Discharges	51	I	56	Gate	Piston	None	Open	Closed	Closed	Closed	B,G	6	4	No	B	I	Yes	
		O		Gate	Piston	None	Open	Closed	Closed	Closed	B,G	6	4					
To & From Refueling Water Storage Tank-Upper Containment Pool	54	O	56	Gate	Manual	None	Locked Closed	Open	Locked Closed	N/A	Manual	12	N/A	No	B	I	Yes	
		I		Gate	Manual	None	Locked Closed	Open	Locked Closed	N/A	Manual	12	N/A		B	I	Yes	
Condensate Supply to Containment	56	O	56	Gate	Piston	None	Open	Open	Closed	Fail Closed	B,G	6	30	No	B	I	Yes	
		I		Check	Process	None	Open	Open	Closed	N/A	Reverse Flow	6	N/A		B	I	Yes	
To Upper Containment Pool From Fuel Pool Cooling & Cleanup System	5	O	56	Globe	Electric	Manual	Open	Open	Closed	As Is	B,G	8	44	No	B	I	Yes	
		I		Check	Process	None	Open	Open	Closed	N/A	Reverse Flow	8	N/A		B	I	Yes	
From Upper Containment Pool to Fuel Pool Drain Tank	58	O	56	Gate	Electric	Manual	Open	Open	Closed	As Is	B,G	8	40	No	B	I	Yes	
		I		Gate	Electric	Manual	Open	Open	Closed	As Is	B,G	8	40		B	I	Yes	
Combustible Gas Control Containment Purge (Outside Air Supply)	65	O	56	Butter Fly	Piston	Manual	Open	Closed	Closed	Fail Closed	B,G,Z	6	5	Yes	B	I	Yes	
		I		Butter Fly	Piston	Manual	Open	Closed	Closed	Fail Closed	B,G,Z	6	5		B	I	Yes	
From Purge Radiation Air Detection System to Containment Exhaust Charcoal Filter Train	66	I	56	Butter Fly	Piston	Manual	Open	Closed	Closed	Closed	B,G,Z	6	4	Yes	B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Instrument Air Supply	42	O	56	Gate	Piston	None	Open	Open	Closed	Closed	B,G	2½ 3" diam	4	No	B	I	Yes	
		I		Check	Process	None	Open	Open	Closed	N/A	Reverse Flow	2½	N/A		B	I	Yes	
RWCU to Main Condenser	43	O	55	Gate	Electric	Manual	Closed	Closed	Closed	As Is	B,D,L H,W,Y	4	21	No	B	I	Yes	
		I		Gate	Electric	Manual	Closed	Closed	Closed	As Is	B,D,L H,Y	4	21		B	I	Yes	
Component Cooling Water Supply	44	O	56	Gate	Electric	Manual	Open	Open	As Is	As Is	RM	10	54	Yes	B	I	Yes	
		I		Check	Process	None	Open	Open	Reverse Flow	N/A	N/A	10	N/A		B	I	Yes	
Component Cooling Water Return	45	O	56	Gate	Electric	Manual	Open	Open	As Is	As Is	RM	10	54	Yes	B	I	Yes	
		I		Gate	Electric	Manual	Open	Open	As Is	As Is	RM	10	54		B	I	Yes	
RCIC Pump Discharge Min. Flow Bypass	46	O	56	Globe	Electric	Manual	Closed	Open	Open or	As Is	RM	2	5	No	B	I	No	
		O		Check	Process	None	Closed	Open	Closed	N/A	Reverse Flow	2	N/A		B	I		
RHR Heat Exchanger "B" Relief Valve Vent Header to Suppression Pool	48	O	56	Relief	Process	None	Closed	Closed	Closed	N/A	None	6	N/A	Yes	B	I	No	
		O		Globe	Electric	Manual	Closed	Closed	Closed	As Is	RM	2	11.3		B	I	No	
		O		Globe	Electric	Manual	Closed	Closed	Closed	As Is	RM	2	11.3		B	I	No	
		O		Check	Process	None	Closed	Closed	Open	N/A	Reverse Flow	1½	N/A		B	I	No	
		O		Check	Process	None	Closed	Closed	Open	N/A	Reverse Flow	1½	N/A		B	I	No	
RWCU Backwash Transfer Pump to Spent Resin Tank	49	I	55	Gate	Piston	None	Closed	Closed	Closed	Closed	B,G	4	30	No	B	I	Yes	
		O		Gate	Piston	None	Closed	Closed	Closed	Closed	B,G	4	30		B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
Containment Purge and Ventilation Air Exhaust (5)	35	I	56	Butter Fly	Piston	Manual	Closed	Open	Closed	Closed	B,G,Z	20	4	No	B	I	Yes	
		O		Butter Fly	Piston	Manual	Closed	Open	Closed	Closed	B,G,Z	20	4		B	I	Yes	
Plant Service Water Return	36	I	56	Gate	Electric	Manual	Open	Open	Open	As Is	RM	4	24 Max	No	B	I	Yes	
		O		Gate	Electric	Manual	Open	Open	Open	As Is	RM	4	24 Max		B	I	Yes	
Plant Service Water Supply	37	O	56	Gate	Electric	Manual	Open	Open	Open	As Is	RM	4	24 Max	No	B	I	Yes	
		I		Check	Process	None	Open	Open	Open	N/A	Reverse Flow	4	N/A		B	I	Yes	
Plant Chilled Water Supply	38	O	56	Gate	Piston	Manual	Open	Closed	Closed	Closed	G,B	4	30	No	B	I	Yes	
		I		Check	Process	None	Open	Open	Closed	N/A	Reverse Flow	4	N/A		B	I	Yes	
Plant Chilled Water Return	39	O	56	Gate	Piston	Manual	Open	Closed	Closed	Closed	G,B	4	30	No	B	I	Yes	
		I		Gate	Piston	Manual	Open	Closed	Closed	Closed	G,B	4	30		B	I	Yes	
Integrated Leak Rate Test Connection (Containment Pressurization and Depressurization)	40	O	56									6		No	B	I	No Type "B" Tests	
		I										6			B	I	No Type "B" Tests	
Service Air Supply	41	O	56	Gate	Piston	None	Closed	Open	Closed	Closed	B,G	3 4" diam sleeve	4	No	B	I	Yes	
		I		Check	Process	None	Open	Open	Closed	N/A	Reverse Flow	3	N/A		B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent. Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position				Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA	Power Failure								
HPCS Test Line	27	O	56	Globe	Electric	Manual	Closed	Closed	Closed	As Is	B,G	12	Note 7	Yes	B	I	No	
		O		Gate	Electric	Manual	Closed	Open or Closed	Closed	As Is	RM	4	5		B	I	No	
RCIC F Suction	28	O	56	Gate	Electric	Manual	Closed	Open	Open	As Is	RM	6	34	Yes	B	I	No	
RCIC Turbine Exhaust	29	O	56	Gate	Electric	Manual	Open	Open	Open	As Is	RM	20	102	Yes	B	I	No	
		O		Check	Process	None	Open	Closed	Closed	N/A	Reverse Flow	20	N/A		B	I	No	
LPCS Pump Suction	30	O	56	Gate	Electric	Manual	Open	Open	Open	As Is	RM	24	100	Yes	B	I	No	
LPCS Pump Discharge	31	O	55	Gate	Electric	Manual	Closed	Closed	Open	As Is	RM	14	22	Yes	A	I	No	
		I		Check	Note 3	None	Closed	Closed	Open	N/A	Reverse Flow	14	N/A		A	I	No	
LPCS Test Line	32	O	56	Globe	Electric	Manual	Closed	Closed	Closed	As Is	C,G	14	67	Yes	B	I	No	
		O		Gate	Electric	Manual	Open	Open or Closed	Closed	As Is	RM	4	23		B	I	No	
CSD Pump Discharge	33	C	55	Globe	Electric	Manual	Open	Open	Closed	As Is	RM	2	10	Yes	B	I	Yes	
		1		Check	Process	None	Open	Open	Closed	N/A	Reverse Flow	2	N/A		B	I	Yes	
Containment Purge and Ventilation Air Supply (5)	34	O	56	Butter Fly	Piston	Manual	Closed	Open	Closed	Closed	B,G,Z	20	4	No	B	I	Yes	
		O		Butter Fly	Piston	Manual	Closed	Open	Closed	Closed	B,G,Z	20	4		B	I	Yes	

Table 2.2-7

BWR/6 ISOLATION SYSTEM (Continued)

Line Isolated	Primary Cont. Pent Number	Valve Location	NRC Design Criteria	Valve Type	Actuation		Valve Position			Power Failure	Containment Isolation Signal	Line Size (Inches)	Closure Time (Seconds)	Engineered Safety Feature	Quality Group	Seismic Class	Type "C" Test	Remarks
					Primary Mode	Secondary Mode	Normal	Shutdown	Post LOCA									
RHR Heat Exchanger "B" to LPCI	21	O	55	Gate	Electric	Manual	Open	Open	Open	As Is	RM	18	78	Yes	B	I	No	
		I		Gate	Electric	Manual	Closed	Closed	Open	As Is	RM	14	22		A	I	No	
		I		Check	Note 3	None	Closed	---	Open	As Is	Reverse Flow	14	N/A		A	I	No	
RHR Pump "C" to LPCI	22	O	55	Gate	Electric	Manual	Closed	Closed	Open	As Is	RM	12	30	Yes	A	I	No	
		I		Check	Note 3	None	Closed	----	Open	As Is	Reverse Flow	12	N/A		A	I	No	
RHR - "A" Pump Test Line to Suppression Pool	23	O	56	Gate	Electric	Manual	Closed	Closed	Closed	As Is	RM	18	93	Yes	B	I	No	
		O		Check	Process	None	Closed	Closed	Closed	As Is	Reverse Flow	4	N/A		B	I	No	
		O		Globe	Electric	Manual	Closed	Closed	Closed	As Is	C,G	4	27		B	I	No	
RHR - "C" Pump Test Line to Suppression Pool	24	O	56	Globe	Electric	Manual	Closed	Closed	Closed	As Is	C,G	14	67		B	I	No	
		O		Check	Process	None	Closed	Closed	Closed	As Is	Reverse Flow	4	N/A		B	I	No	
HPCS Pump Suction	25	O	56	Gate	Electric	Manual	Closed	Closed	Open	As Is	RM	24	1" per second Steam Stroke Rate	Yes	B	I	No	
HPCS Pump Discharge	26	O	55	Gate	Electric	Manual	Closed	Closed	Open	As Is	RM	12	27	Yes	A	I	No	
		I		Check	Note 3	None	Closed	Closed	Open	N/A	Reverse Flow	14	N/A		A	I	No	

Table 2.2-7

ISOLATION SIGNAL CODES

Signal	Description
A*	Reactor vessel low water level - level 3. (A scram occurs at this level also. This is the highest of the three isolation low water level signals.)
B*	Reactor vessel low water level - level 2. (This is the second of the three low water level signals. (The RCIC and HPCS systems are initiated at this level.)
C*	Reactor vessel low water level - level 1. (This is the lowest of the three water level signals, and main steam line isolation occurs at this level. The LPCS and LPCI systems are also initiated at this level.)
D*	High radiation - main steam line
E*	Line break - main steam line (steam line high steam flow)
F*	Line break - main steam line (steam line high space temperature)
C*	High drywell pressure
H*	Line break in reactor water cleanup system - (high space temperature)
J*	Line break in RCIC system steam line to turbine (low steam line pressure)
K*	Line break in RCIC system steam line to turbine (high steam line space temperature, or high steam flow)
L*	High differential flow in the reactor water cleanup system
M*	Line break in RHR shutdown and head cooling (high space temperature)
N*	Low main condenser vacuum
P*	Low main steam line pressure at inlet to turbine (RUN mode only)
T	High pressure RCIC turbine exhaust diaphragm
U	High reactor vessel pressure - close RHR - shut down cooling valves and head cooling valves
W	High temperature at outlet of cleanup system non-regenerative heat exchange
Y	Standby liquid control system actuated

Table 2.2-7 (Continued)

Signal	Description
Z*	High radiation, containment and drywell ventilation exhaust
RM*	Remote manual switch from control room (All automatic initiated isolation valves are capable of remote manual operation from the control room.)

*These are the isolation functions of the containment, and reactor vessel isolation control system; other functions are given for information only.

NOTES

These notes are keyed by number to correspond to numbers in parentheses, in Table 2.2-7.

1. Main steam isolation valves require that both solenoid pilots be de-energized to close valves. Accumulator air pressure plus spring act together to close valves when both pilots are de-energized. Voltage failure at only one pilot does not cause valve closure. The valves are designed to close fully in 5.5 seconds and a minimum closure time of 3 seconds.

2. Ac motor-operated valves required for isolation functions are powered from the ac standby power buses. Dc-powered isolation valves are powered from the station batteries.

3. Testable check valves are designed for remote opening with zero differential pressure across the valve seat. The valves will close on reverse flow even though the test switches may be positioned for opening. The valves open when pump pressure exceeds reactor pressure even though the test switch may be positioned for closing.

4. All motor-operated isolation valves remain in the last position upon failure of valve power. All air-operated valves close on motive air failure.

5. Containment and drywell vent exhaust high radiation (Signal Z) is generated by two trip systems. This requires two high radiation or inoperative trips on one trip system and two high radiation or inoperative trips on second trip system to initiate isolation.

6. Normal status position of valve (open or closed) is position during normal power operation of the reactor (see Normal valve position column).

Table 2.2-7 NOTES (Continued)

7. The standard minimum closing rate for automatic electric motor operated isolation gate valves is based on a nominal line size of 12 inches. Using the standard closing rate, a 12-inch line is isolated in 60 seconds. Conversion to closing time can be made on this basis, using the actual size of line in which the valve is installed. Air operated isolation valves will have a maximum closing time of 4 seconds. For globe valves the closing time is based on 4 inches per minute.

8. Specified closure rates are as required for containment isolation only.

9. The auxiliary building is part of the boundary for the Standby Gas Treatment System (SGTS). To maintain auxiliary building integrity, isolation is provided on all lines larger than 2 inches not performing a safety function or supplying a source of makeup to the RPV. The valves will be seismic Category I and ASME Section III, Class 3. Lines 2 inches and smaller will be properly orificed so that, if failure of the line would occur, the failure will not jeopardize SGTS operation.

10. Abbreviations noted in table are as follows:

I	- Location inside the containment
O	- Location outside the containment
N/A	- Not applicable
Process	- Actuated by fluid pressure
RG	- NRC regulatory guides

11. The column for engineered safety feature system includes support systems required for shutdown.

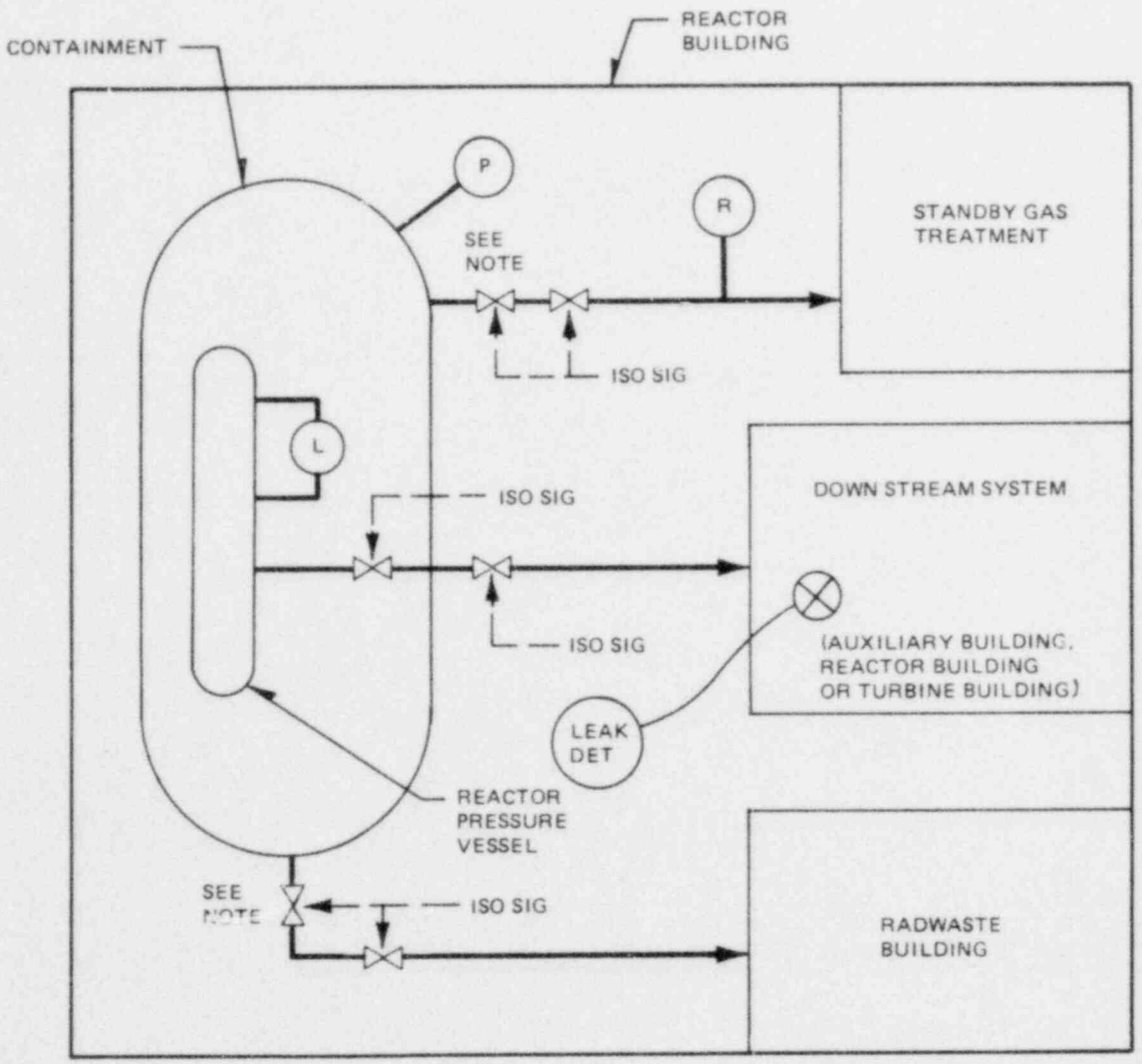


Figure 2.2.2-1: Containment Isolation Schematic

Table 2.2.3-1

SUMMARY OF ISOLATION/ALARM OF SYSTEM MONITORED AND LEAK DETECTION METHODS USED

	Variable Monitored						
Function	A/I	A/I	A	A/I	A/I	A/I	A/I
Source of Leakage Outside of Primary Containment	Equipment Area High Temp. and Δ Temp. (Note 3)	Low Steam Line Pressure	R. Building Floor Drain Sump High Flow Rate	Torus Area High Temp and Δ Temp	High Flow Rate (Note 1)	High RCIC and HPCI Diaphragm Press in Turbine Exhaust Line	RWCU High Δ Flow (Inlet/Outlet)
RHR/SCC	X		X				
RCIC Steam	X	X	X	X	X	X	
RCIC Liquid			X				
HPCI Steam	X	X	X	X	X	X	
HPCI Liquid			X				
RWCU (Hot)	X		X				X
RWCU (Cold)			X				X
Isolation Condenser	X				X		
Core Spray			X				
Feedwater	X (Note 2)		X				

A - Alarm
I - Isolation

NOTE:
1. Break downstream of flow element will isolate the system.
2. Alarm only (steam tunnel)
3. Some plants have only high temperature

Table 2.2.3-2

LEAK DETECTION INSTRUMENTATION DESIGN REQUIREMENTS

System	Instrument Type (See "Instrumentation Symbols" at end of table)	Location and Function	Setpoint	Applicability (Note 3) BWR/1	BWR/2/3/4	BWR/5	BWR/6
RHR	TE & dTS	Equip Room Vent In/Out ΔT	Tech Spec for LaSalle, but numbers not determined. For other BWRs no Tech Spec	N/A	A	A	A
	TE & TS	Equipment Room High Amb Temp					
	dPIS (Stm Cond Mode)	HTX Flow - High ΔP					
	dPIS (N. Shutdown Mode)	High Pump Suction Flow					
HPCS & LPCS	LS HH/H/L (Note 1)	Reactor Building Floor Drain Sump High Ṁ	A/E Determined (BWR/5 calls for alarm at 5 gpm)	N/A	LPCS Only	A	A
	LS HH/H/L	Reactor Building Equipment Drain Sump High Ṁ					
HPCI	TE & dTS	Equip Room Vent In/Out ΔT	Tech Spec	N/A	BWR/3/4s Only	N/A	N/A
	TE & TS	Equip Room High Amb Temp	Tech Spec				
	PS	Low Steam Line Press.	Tech Spec				
	dPIS	High Steam Line ΔP	Tech Spec				
	PS	High Turbine Exhaust P.	Tech Spec				
SCC	TE & TS	Equipment & Pipe Routing Area. High Temperature	A/E Spec	N/A	BWR/2s Only	A	N/A
RCIC	TE & dTS	Equip Room Vent In/Out ΔT	Tech Spec	N/A	BWR/3/4s Only	A	A
	TE & TS	Equip Room High Amb Temp	Tech Spec				
	PS	Low Steam Line Press.	Tech Spec				
	dPIS	High Steam Line ΔP	Tech Spec				
	PS	High Turb Exhaust Press.	Tech Spec				
RWCU	TE & dTS	Equipment Room Vent In/Out	Tech Spec	N/A	A	A	A
	TE & TS	Equip Room Ambient Temp	Tech Spec				
	FI, FE, FT & $\sqrt{\Delta P}$	Cleanup H_2O From RPV	Tech Spec				
	FE, FT & $\sqrt{\Delta P}$	Cleanup H_2O Back to RPV	Tech Spec				
	FE, FT & $\sqrt{\Delta P}$	Cleanup H_2O Pump Line	Tech Spec				
	Σ, dFI & dFS	Cleanup H_2O High Ṁ	Tech Spec				
	dT/SS & dTI (Note 2)	Equip Room or Secondary Containment Vent ΔT	Tech Spec				
	T/SS & TI (Note 2)	Equipment Room or Secondary Containment Amb. T	Tech Spec				

Table 2.2.3-2

LEAK DETECTION INSTRUMENTATION DESIGN REQUIREMENTS (Continued)

System	Instrument Type (See "Instrumentation Symbols" at end of table)	Location and Function	Setpoint	Applicability (Note 3) BWR/1	BWR/2/3/4	BWR/5	BWR/6
IC	dPIS	High Steam Line Flow	Tech Spec	N/A	BWR/2s &	N/A	N/A
	dPIS	High Return Line Flow	Tech Spec		BWR/3s:		
	TE & TS	I.C. Area High Amb Temp	A/E Spec		Millstone Dresden 2/3		
FW	TE & ΔTS	Main Steam Tunnel High Vent In/Out ΔT	Tech Spec	N/A	A	A	A
	TE & TS	Main Steam Tunnel High Ambient Temp	Tech Spec				
Main Steam	TE & ΔTS	Main Steam Tunnel High In/Out ΔT	Tech Spec	N/A	N/A	N/A	A
	TE & TS	Main Steam Tunnel High Ambient Temp	Tech Spec				
	FE, FT, √ΔP, FS	Main Steam Line High Flow	Tech Spec				

NOTES:
1. Drain sump monitoring is common to all system leakage monitoring.
2. For BWR/2s, drain flow temperature is monitored.
3. A - Applicable
   N/A - Not Applicable

INSTRUMENTATION SYMBOLS

FE	-	Flow Element	TE	-	Temperature Element
FT	-	Flow Transmitter	TS	-	Temperature Switch
√ΔP	-	Square Root (Flow Measurement)	dTS	-	Differential Temperature Switch
Σ	-	Summer	LS HH/H/L	-	Level Switch High High/High/Low
dFI	-	Differential Flow Indicator	PS	-	Pressure Switch
dFS	-	Differential Flow Switch	dPIS	-	Differential Pressure Indicator Switch
dT/SS	-	Differential Temperature Selector Switch	FI	-	Flow Indicator
T/SS	-	Temperature Selector Switch			

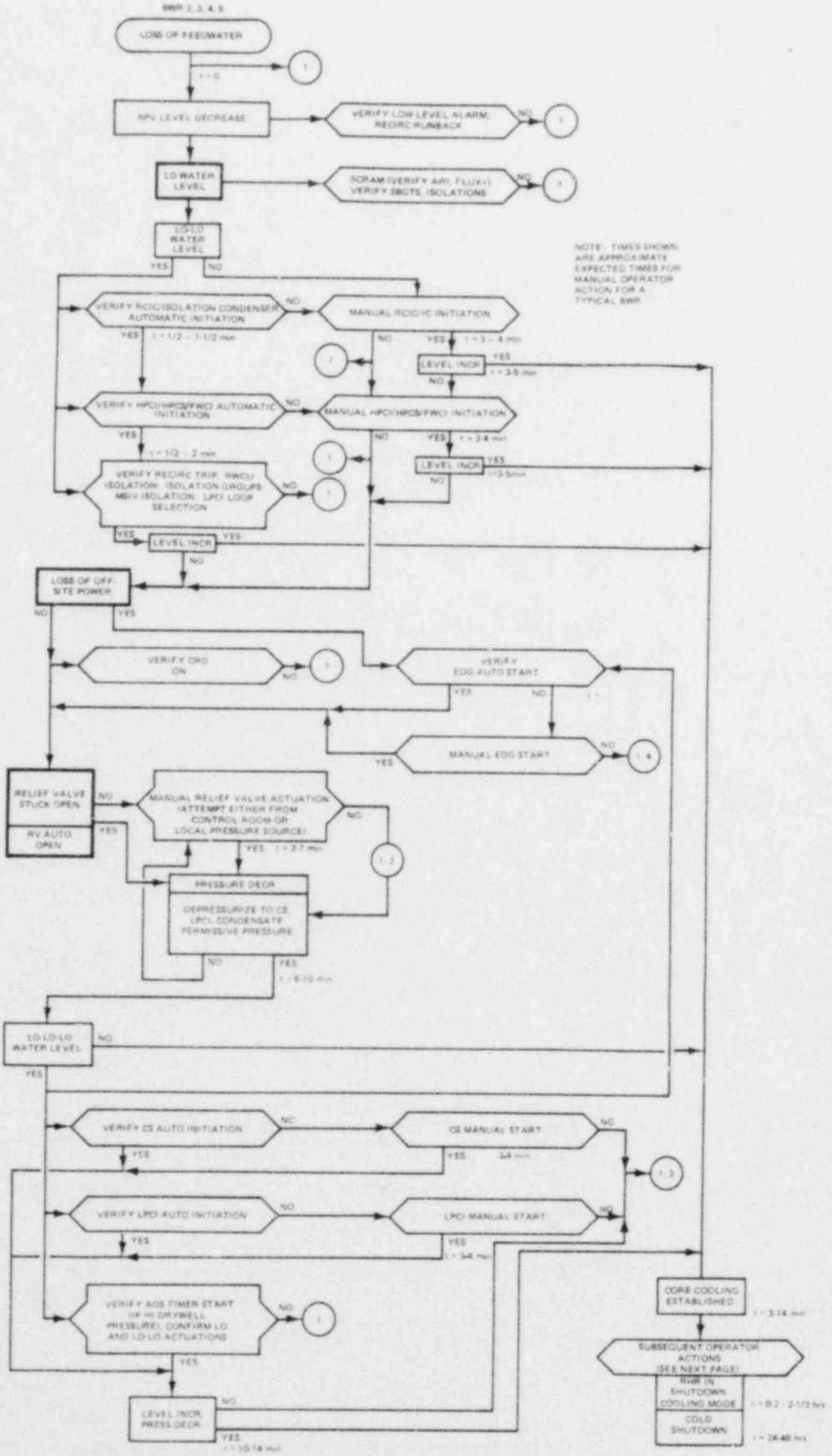


Figure 2.3.1-1a. Operator Action Scenario (BWR/2-5)

NOTES on Figure 2.3.1.1a

(1) Take prompt operator (or maintenance) action as severity of failure or transient warrants; priority of safety actuations must be considered in restoring failed equipment. Do not underman control room. Utilize approved plant operating, maintenance and emergency procedures.

(2) Additional high pressure water sources include CRD, SLC (from test tank only), HPCI and RCIC (install spool for steam from auxiliary boiler), condensate and feedwater (electric driven pumps or deisolate MSIV's with vacuum established), steam condensing mode of RHR/RCIC.

(3) Additional low pressure water sources include HP sources (see (2) above), condensate, ECCS keep-full systems (charging pumps or flushing connections fed from condensate storage), fire water injection, continued blowdown through SDC to torus with service water tie-in to LPCI (last resort only).

(4) Attempt to restore off-site power, transfer station loads and manually start available HP and LP cooling systems. Reestablish plant service systems.

SUBSEQUENT OPERATOR ACTIONS

(A) Maintain HPCI/HPCS in automatic until low pressure core cooling is established. RCIC control may be placed in manual when initial coverage is achieved. Avoid flooding of main steam lines with either HP or LP systems.

(B) Establish Shutdown Cooling (SDC) and suppression pool cooling as soon as LPCI operation permits. Monitor temperatures closely.

(C) Maintain suppression pool water level. Verify HPCI/HPCS suction transfer on low CST or high pool level. Maintain CST inventory (transfer water from hotwell).

(D) Proceed with plant recovery as soon as reactor is in a safe condition. Restore condenser vacuum, deisolate MSIV's and restore condensate and feedwater.

CAUTIONS

(A) Automatic ECCS controls should not be placed in Manual/Override unless (1) misoperation in Automatic/Standby is confirmed by at least two independent indications of system degradation or (2) unless core cooling is established as verified by at least two independent parameters.

(B) Reset trips and isolations as soon as possible after cause of event is determined. Return manual controls to Automatic/Standby promptly (as required by Tech Specs and plant conditions).

(C) Observe all Technical Specification limits.

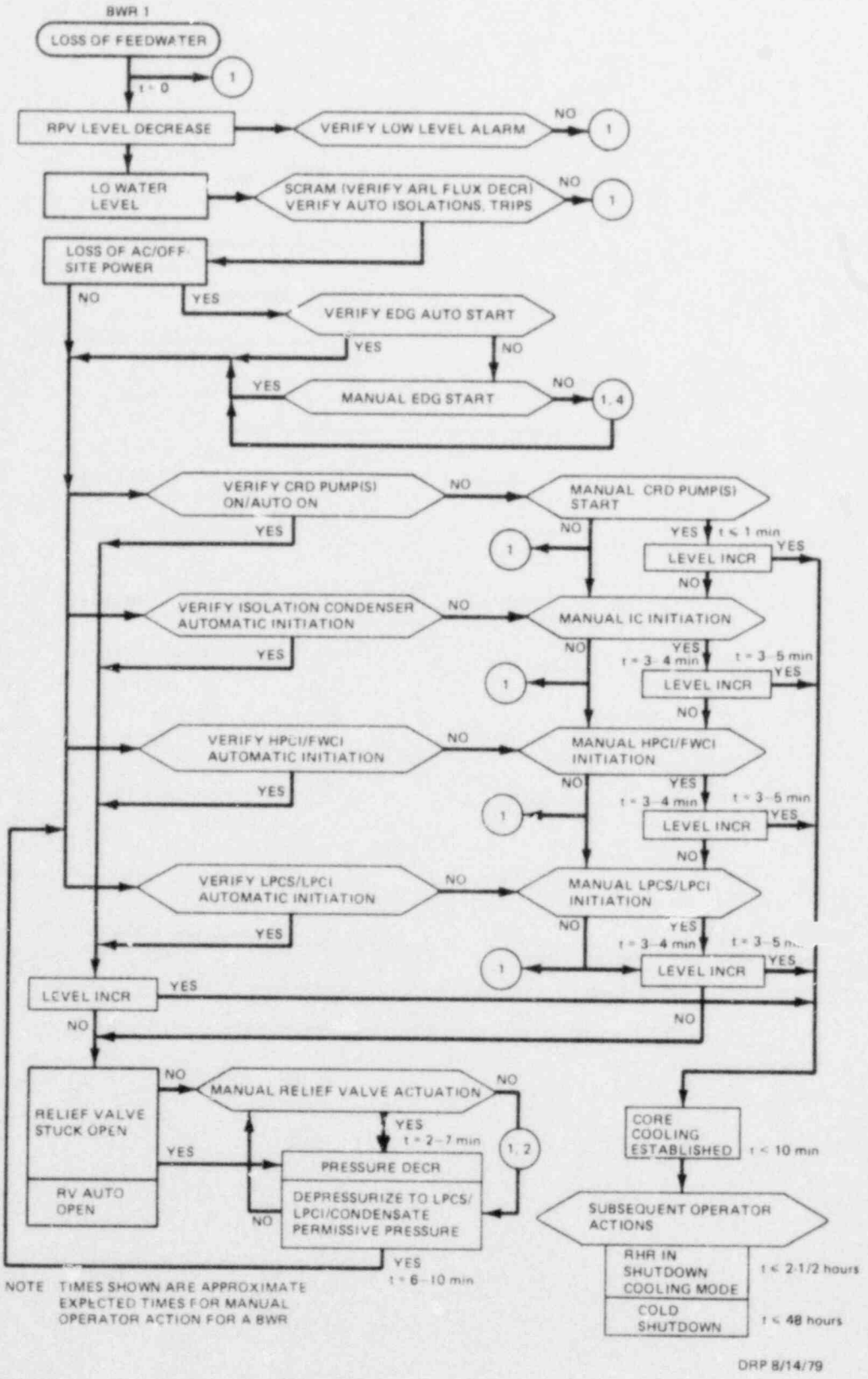


Figure 2.3.1-1b. Operator Action Scenario (BWR/1)

Table 2.3.2.2-1

D-1 REACTOR WATER LEVEL

Function	Existing	Installed For RPS	Installed for ECCS	Comments
Reactor Vessel Water Level	LSL-1 LSL-2 LSL-3 LSL-4		LSL 1-6141-125A LSL 1-6141-125B LSL 1-6141-125C LSL 1-6141-125D	Existing provides reactor safety system scram ECCS provides injection valve permissive.
Primary Steam Drum Water Level	LIS-12 LIS-13 LIS-14 LIS-15	LS-12 LS-13 LS-14 LS-15		Existing will remain and provide recirc pump trip RPS provides safety system scram
Primary Steam Drum Level Recorder	* *	LR-2 LR-12		*Existing replaced with new equipment.
Primary Steam Drum Water Level Indicator	*	LI-6		RPS will provide level indication and recording
Primary Steam Drum Water Level Transmitter	** ** **	LT-1 LT-2 LT-12		**Existing indicating level transmitters being replaced with non-indicating type. Also provides feedwater control.
Primary Steam Drum Level			LI 1-6141-110A LI 1-6141-110B LI 1-6141-110C LI 1-6141-110D	Level indication - HPCI Building
			LI L-6140-55A LI 1-6140-55B LI 1-6140-55C LI 1-6140-559	Level indication - Control Room

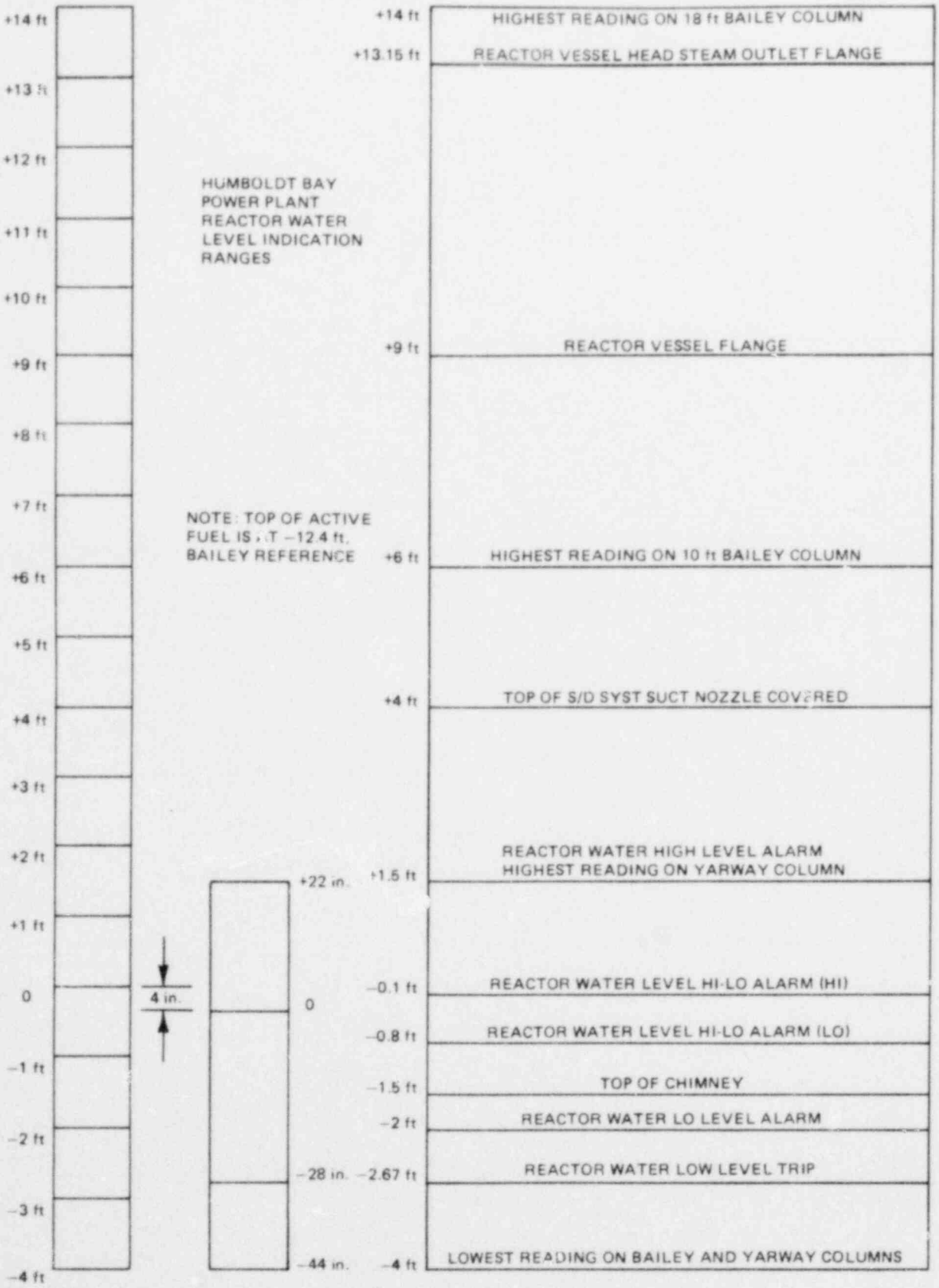


Figure 2.3.2.2-1a. Humboldt Bay Power Plant Reactor Water Level Indication Ranges

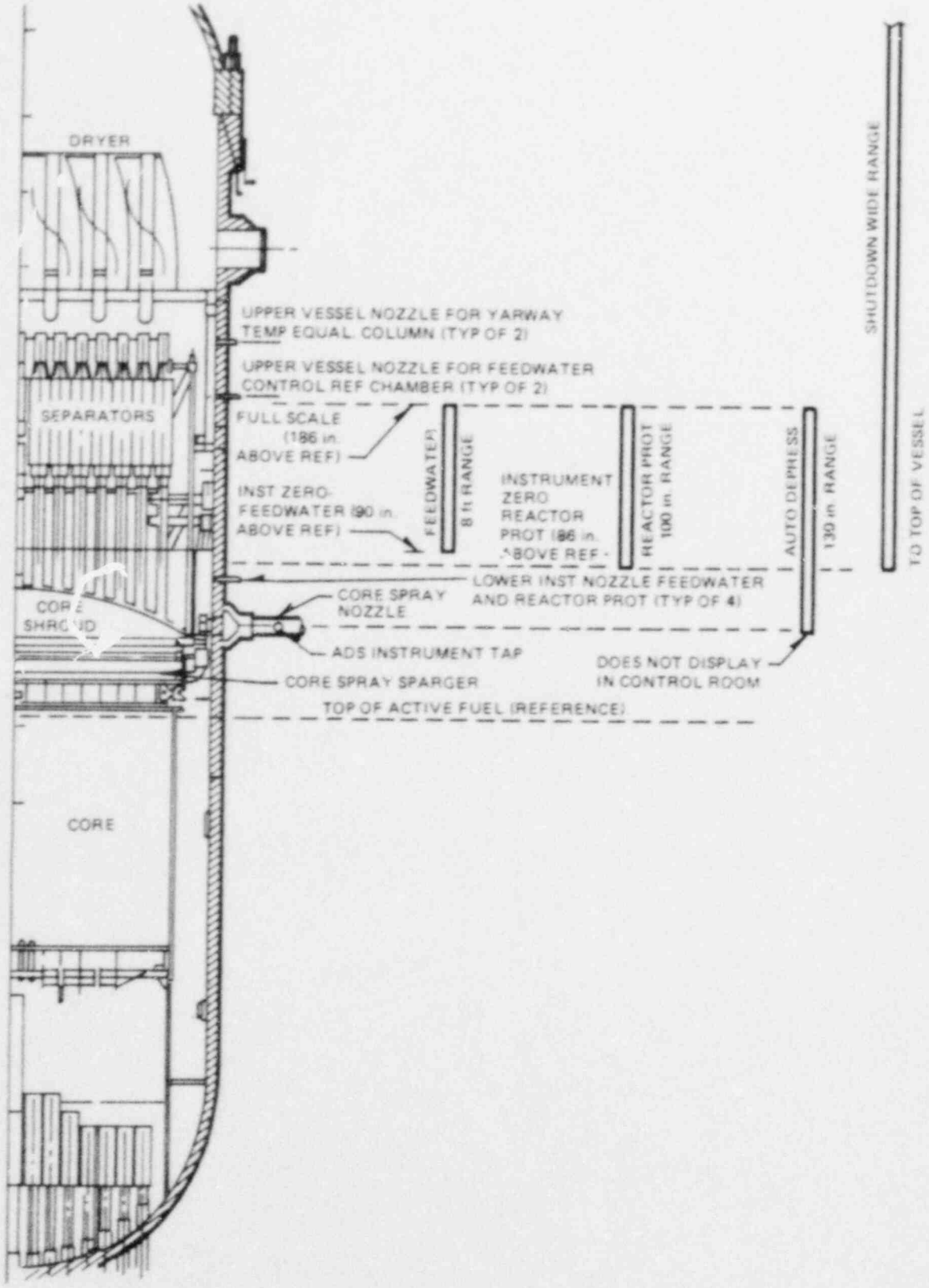
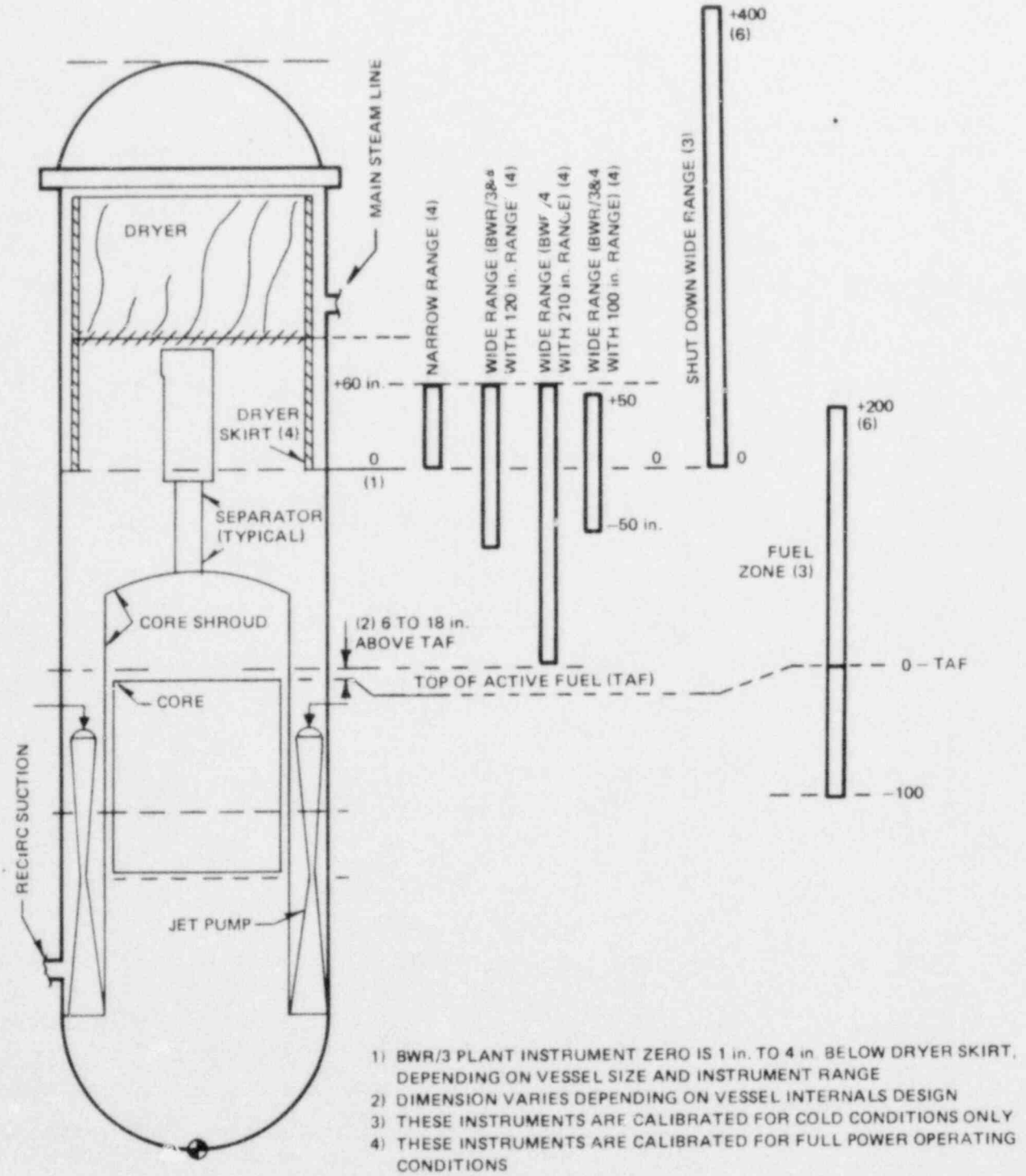
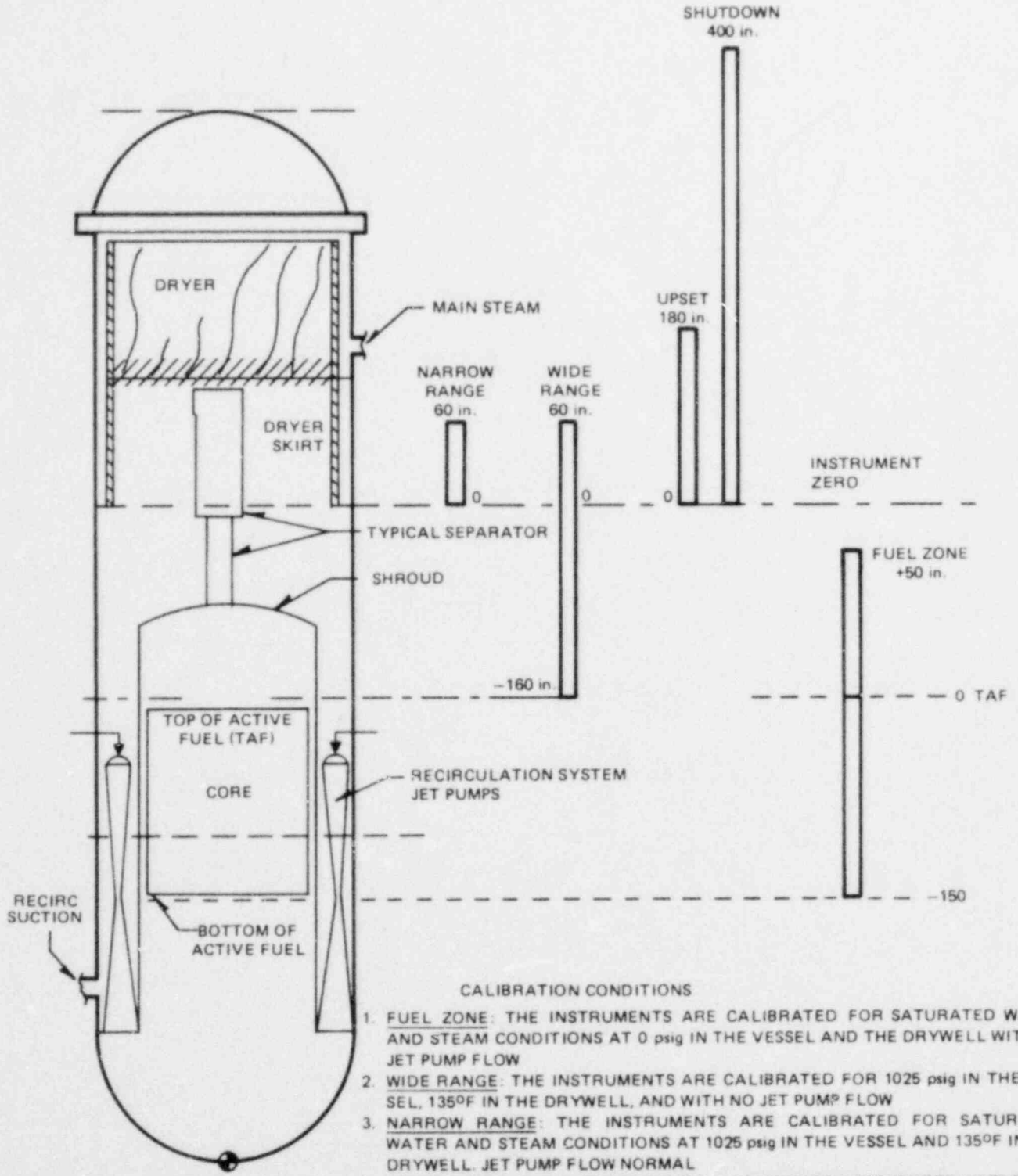


Figure 2.3.2.2.1b. Typical Vessel Instrument Tap Location And Reactor Vessel Level Coverage (BWR/2 Plants)



1) BWR/3 PLANT INSTRUMENT ZERO IS 1 in. TO 4 in. BELOW DRYER SKIRT, DEPENDING ON VESSEL SIZE AND INSTRUMENT RANGE
2) DIMENSION VARIES DEPENDING ON VESSEL INTERNALS DESIGN
3) THESE INSTRUMENTS ARE CALIBRATED FOR COLD CONDITIONS ONLY
4) THESE INSTRUMENTS ARE CALIBRATED FOR FULL POWER OPERATING CONDITIONS

Figure 2.3.2.2-1c. Typical Reactor Vessel Level Range Coverage (BWR/3&4 Plants)



CALIBRATION CONDITIONS

1. FUEL ZONE: THE INSTRUMENTS ARE CALIBRATED FOR SATURATED WATER AND STEAM CONDITIONS AT 0 psig IN THE VESSEL AND THE DRYWELL WITH NO JET PUMP FLOW
2. WIDE RANGE: THE INSTRUMENTS ARE CALIBRATED FOR 1025 psig IN THE VESSEL, 135°F IN THE DRYWELL, AND WITH NO JET PUMP FLOW
3. NARROW RANGE: THE INSTRUMENTS ARE CALIBRATED FOR SATURATED WATER AND STEAM CONDITIONS AT 1025 psig IN THE VESSEL AND 135°F IN THE DRYWELL. JET PUMP FLOW NORMAL
4. UPSET RANGE: THE INSTRUMENT IS CALIBRATED FOR SATURATED WATER AND STEAM CONDITIONS AT 1025 psig IN THE VESSEL AND 135°F IN THE DRYWELL. JET PUMP FLOW NORMAL
5. SHUTDOWN: THE INSTRUMENT IS CALIBRATED FOR 120°F WATER AT 0 psig IN VESSEL AND 80°F IN THE DRYWELL. NO JET PUMP FLOW

Figure 2.3.2.2.1d. Typical Reactor Vessel Level Range Coverage (BWR/5 Plants)

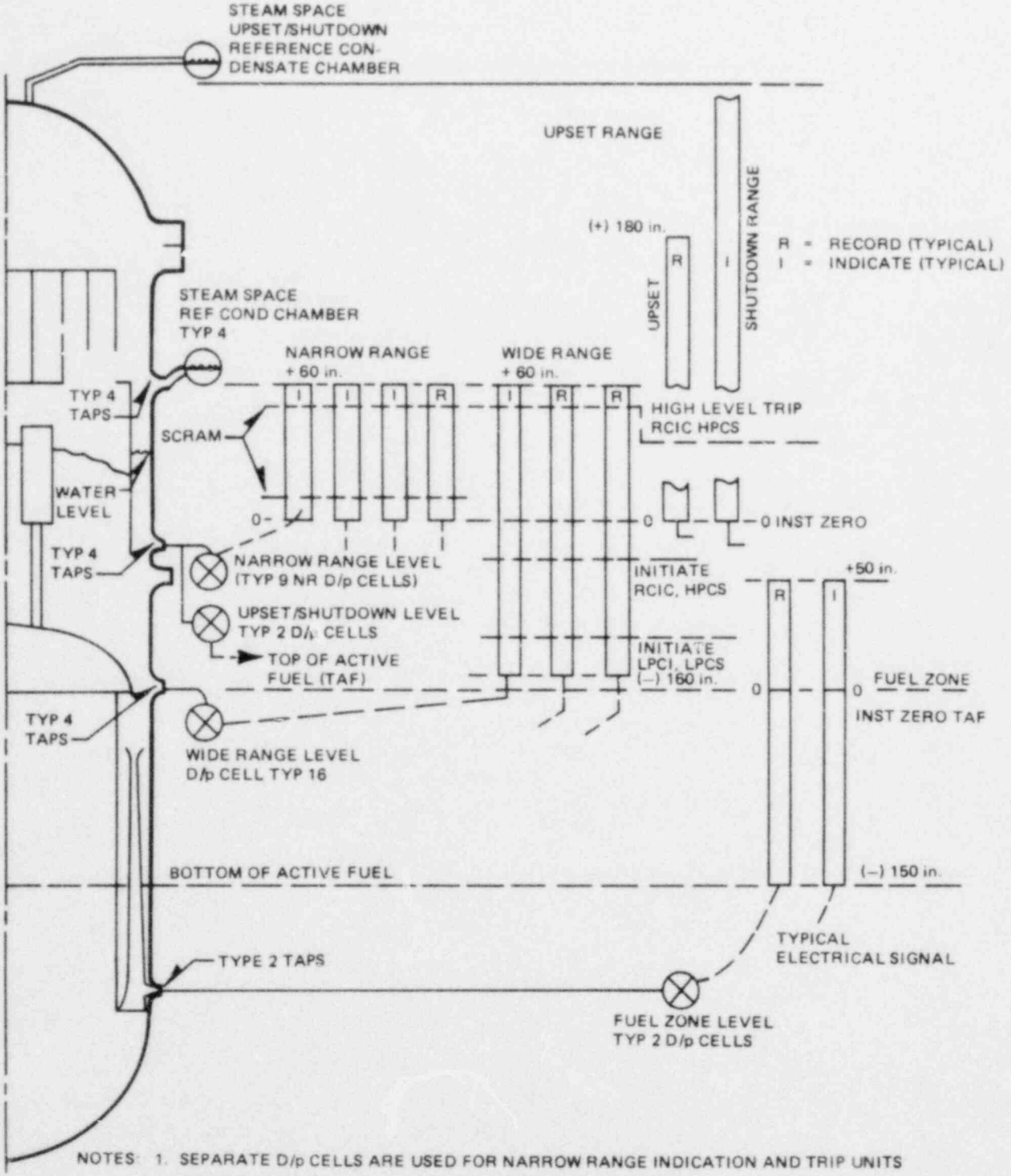


Figure 2.3.2.2-1e. Typical Reactor Level Indicators on Reactor Control Panels - BWR/6

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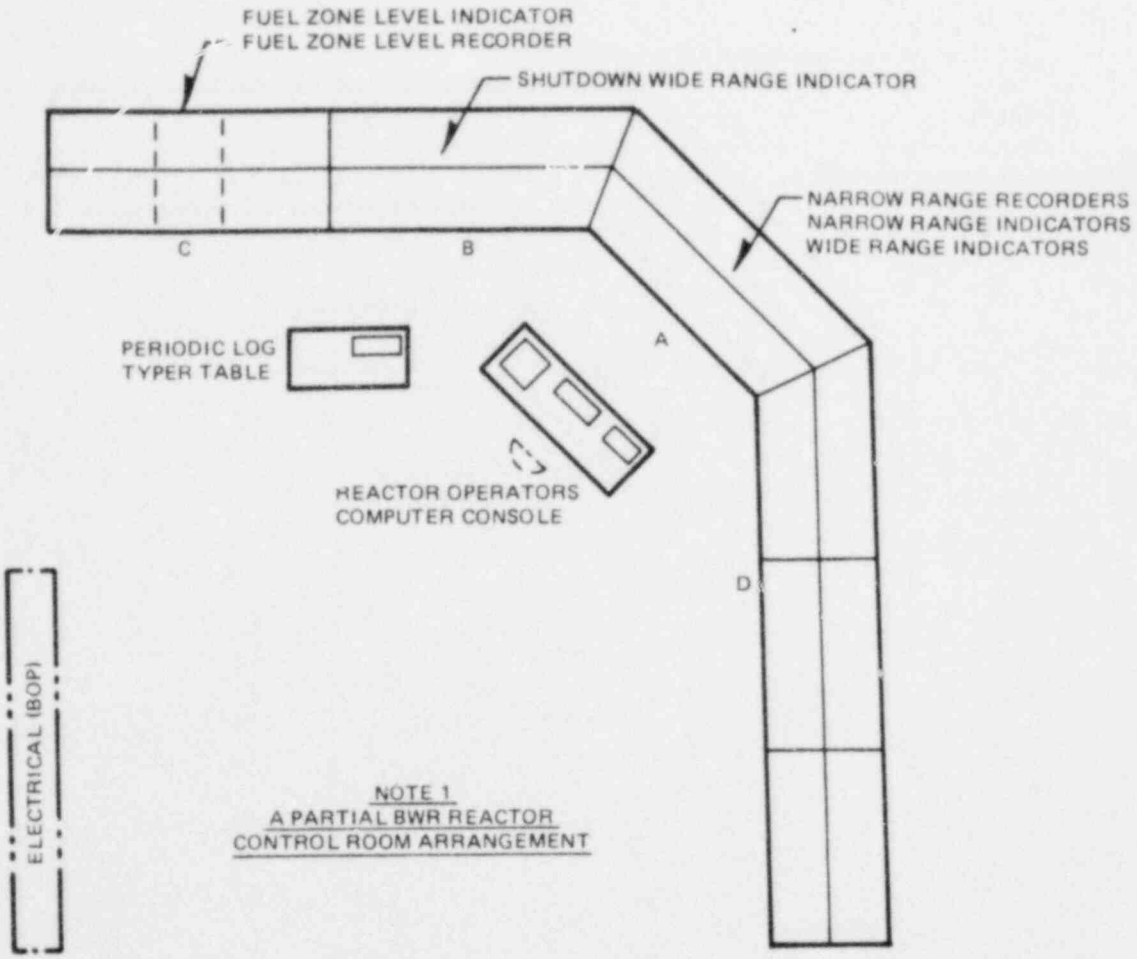


TYPICAL REACTOR WATER LEVEL INDICATIONS IN CONTROL ROOM

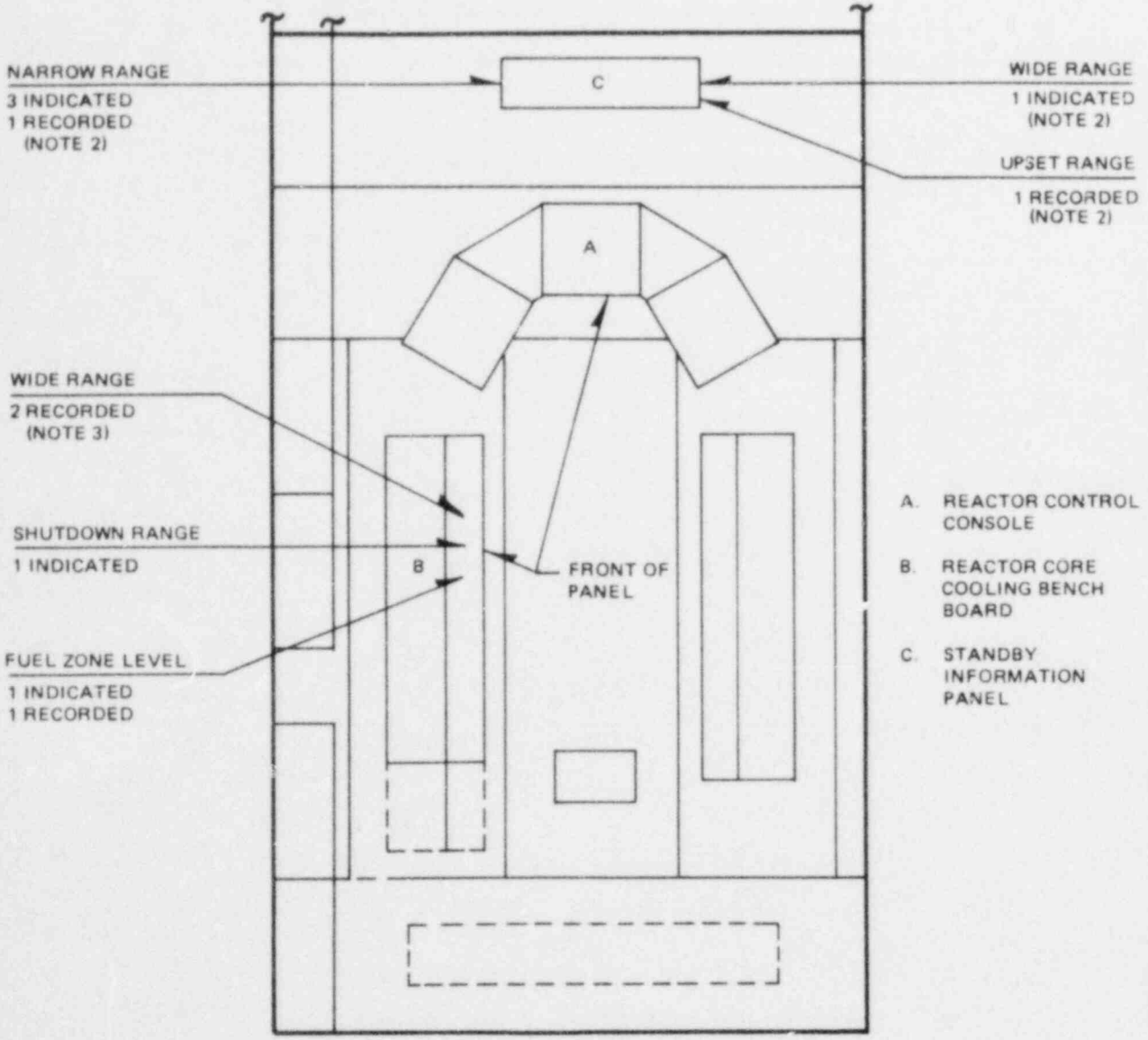
TYPE	NARROW RANGE LEVEL	WIDE RANGE LEVEL	SHUTDOWN WIDE RANGE	UPSET RANGE LEVEL	FUEL ZONE LEVEL	REFERENCE
BWR/2	2 IND, 1 REC	2 IND	1 IND	NO	ALARM	FIGURE 2.3.2.2-1b
BWR/3	2 IND, 1 REC	2 IND	1 IND	NO	2 IND 1 RECORDER*	FIGURE 2.3.2.2-1c
BWR/4	3 IND, 1 REC	2	1	NO	2 IND, 1 REC*	FIGURE 2.3.2.2-1c
BWR/5	3 IND, 1 REC	1 IND 2 REC	1	1 RECORDER	1 IND, 1 REC	FIGURE 2.3.2.2-1d

A REACTOR CONTROL BENCHBOARD (BB)
B REACTOR WATER CLEANUP AND RECIRC BB
C REACTOR CORE COOLING BB
D BALANCE OF PLANT (BOP) PANELS

*SOME PLANTS

NOTE 1 – CONTROL ROOM ARRANGEMENT AND INSTRUMENT LOCATION AND QUANTITY AND TYPE OF INSTRUMENTS (INDICATE OR RECORD) VARY WITH PLANT DESIGN AND CUSTOMER PREFERENCE

Figure 2.3.2.2-4. Typical Reactor Water Level Indications in Control Room



NOTES: (1) CONTROL ROOM ARRANGEMENT AND INSTRUMENT LOCATION MAY VARY WITH PLANT DESIGN AND CUSTOMER PREFERENCE

(2) NON-NUCLENET PLANTS LOCATE THESE INSTRUMENTS ON THE REACTOR CONTROL CONSOLE (A)

(3) THE WIDE RANGE RECORDERS ALSO SERVE AS "POST ACCIDENT MONITORS"

Figure 2.3.2.2-4a. Typical BWR/6 Reactor Control Room

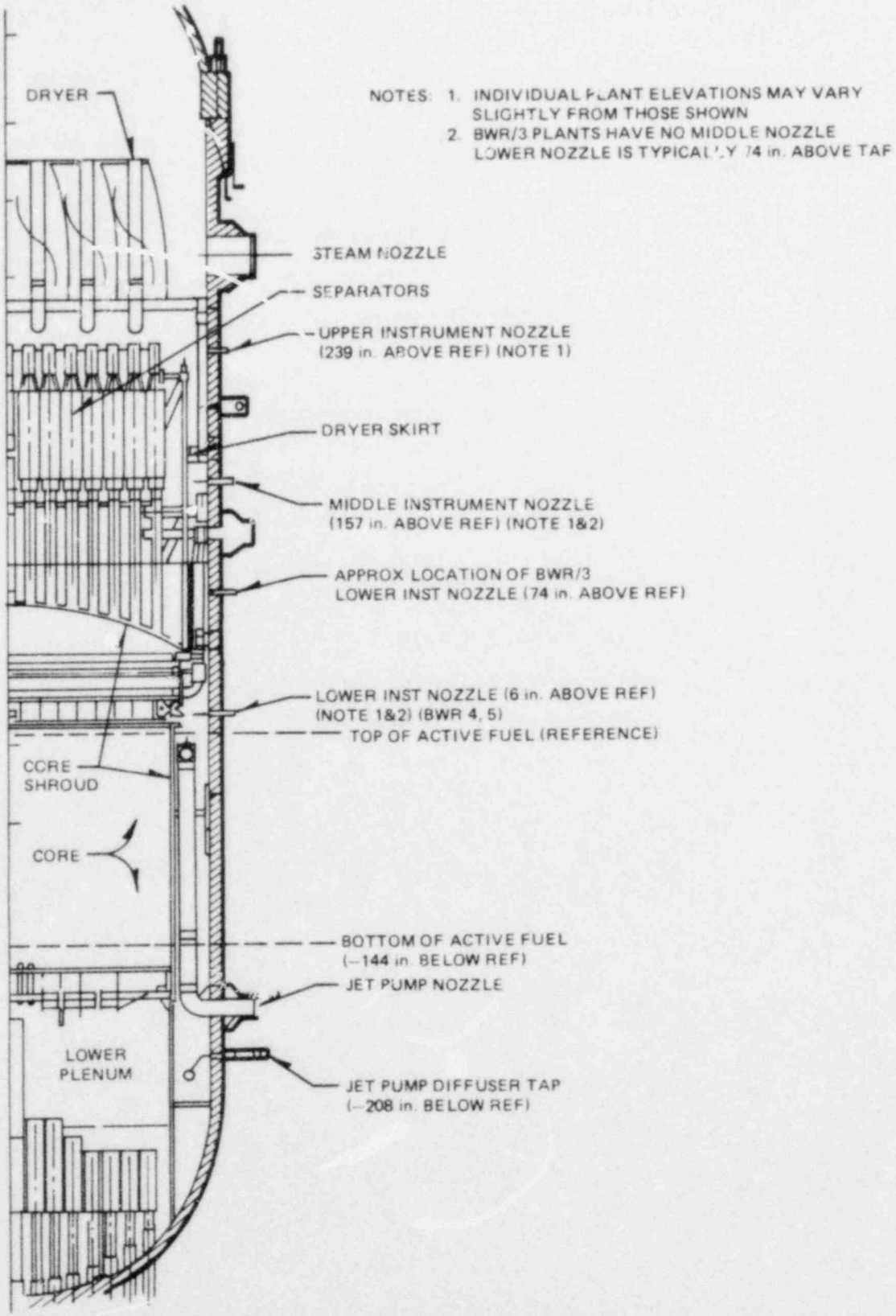


Figure 2.3.2.2-5. Typical Instrument Tap Locations BWR/3, 4, & 5 Plants

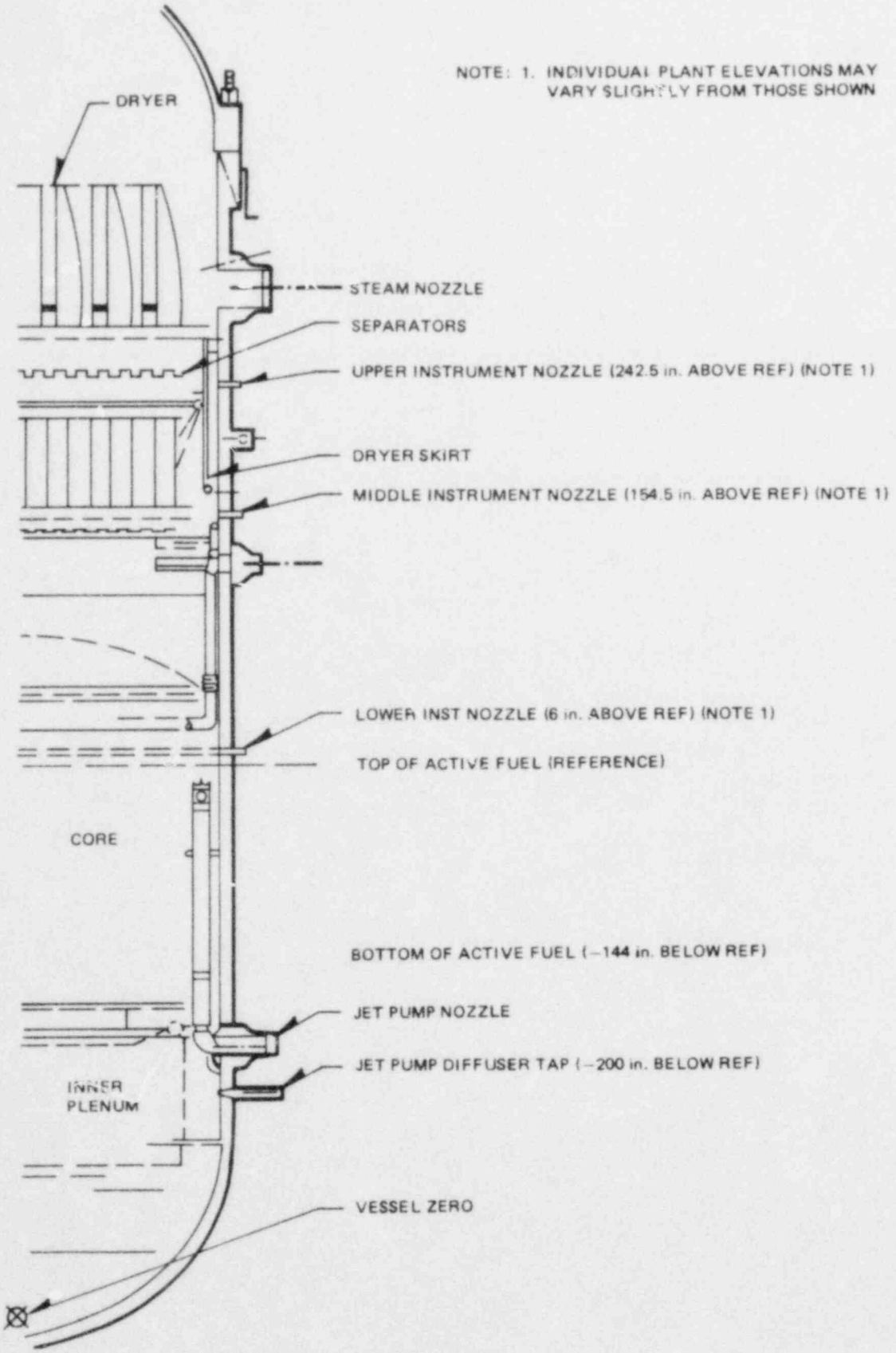


Figure 2.3.2.2-5a. BWR/6 Typical Instrument Tap Locations

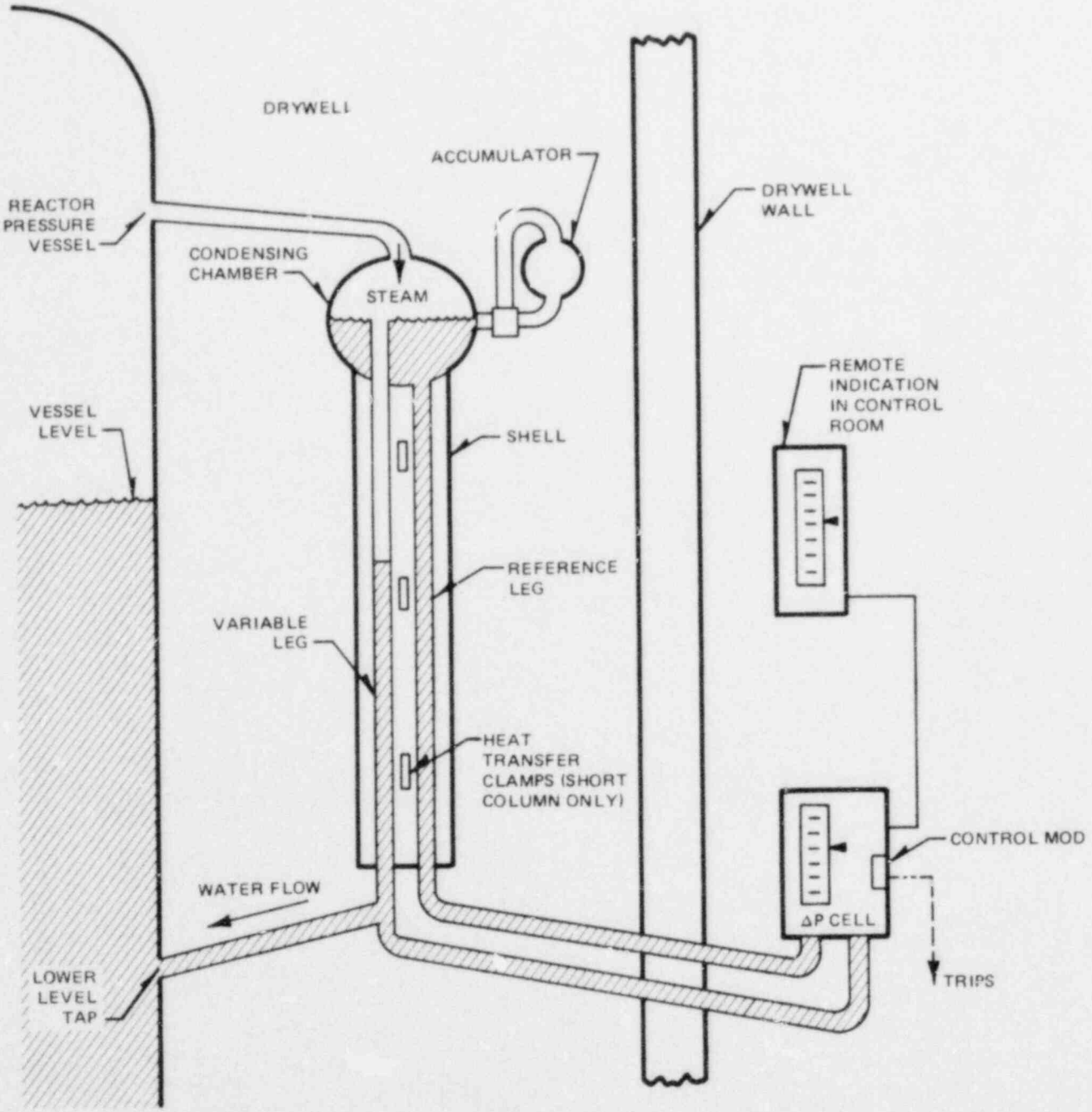


Figure 2.3.2.2-6. Yarway Level Measuring Instrument Schematic

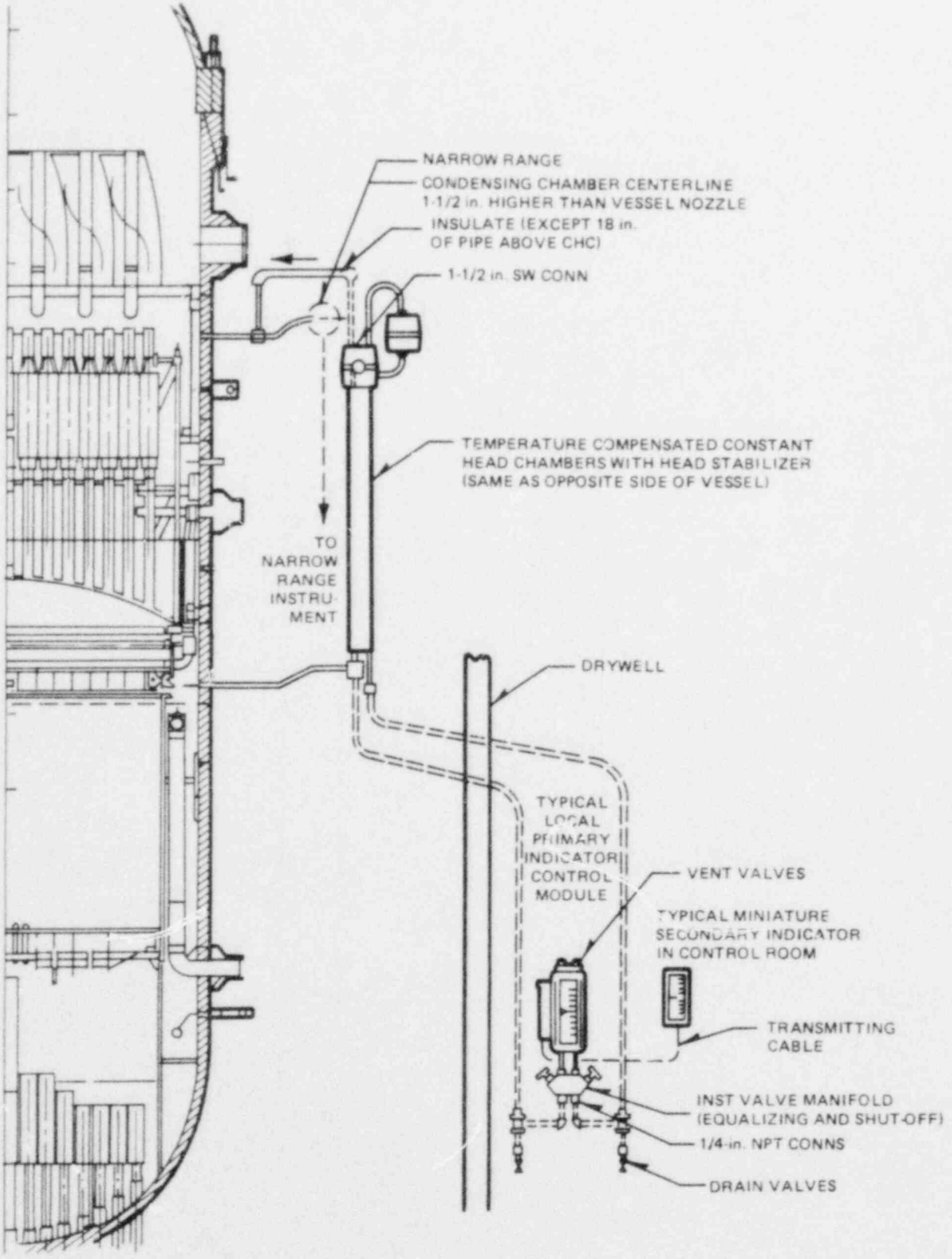


Figure 2.3.2.2-7. Typical 210" Yarway Piping Arrangement

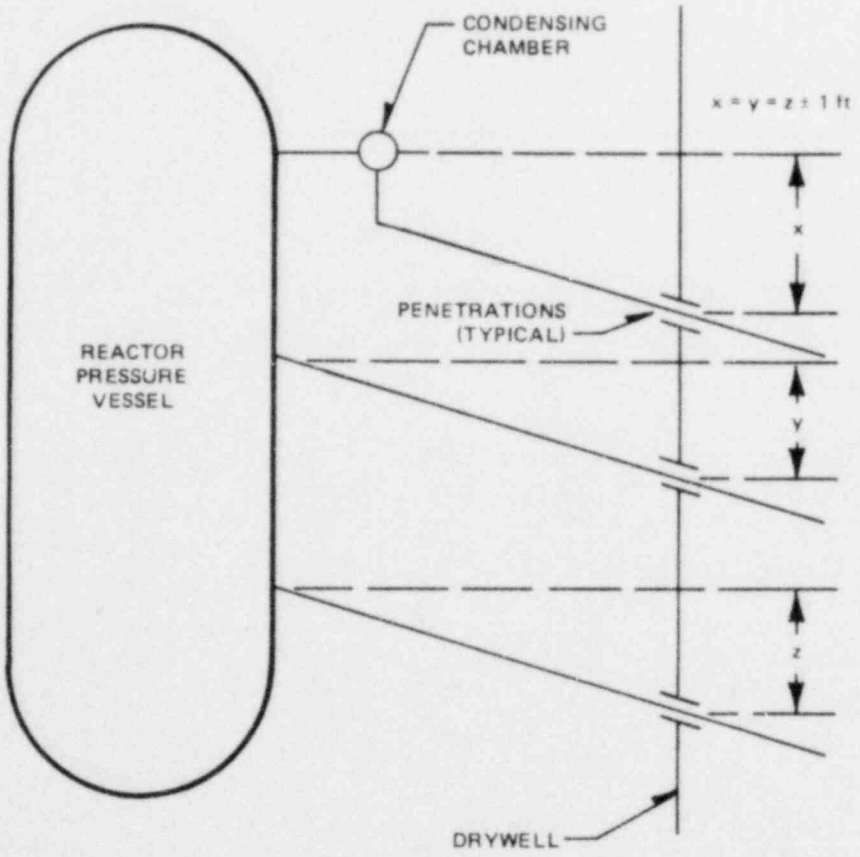


Figure 2.3.2.2-8. Requirements For Reactor Water Level Instrument Lines

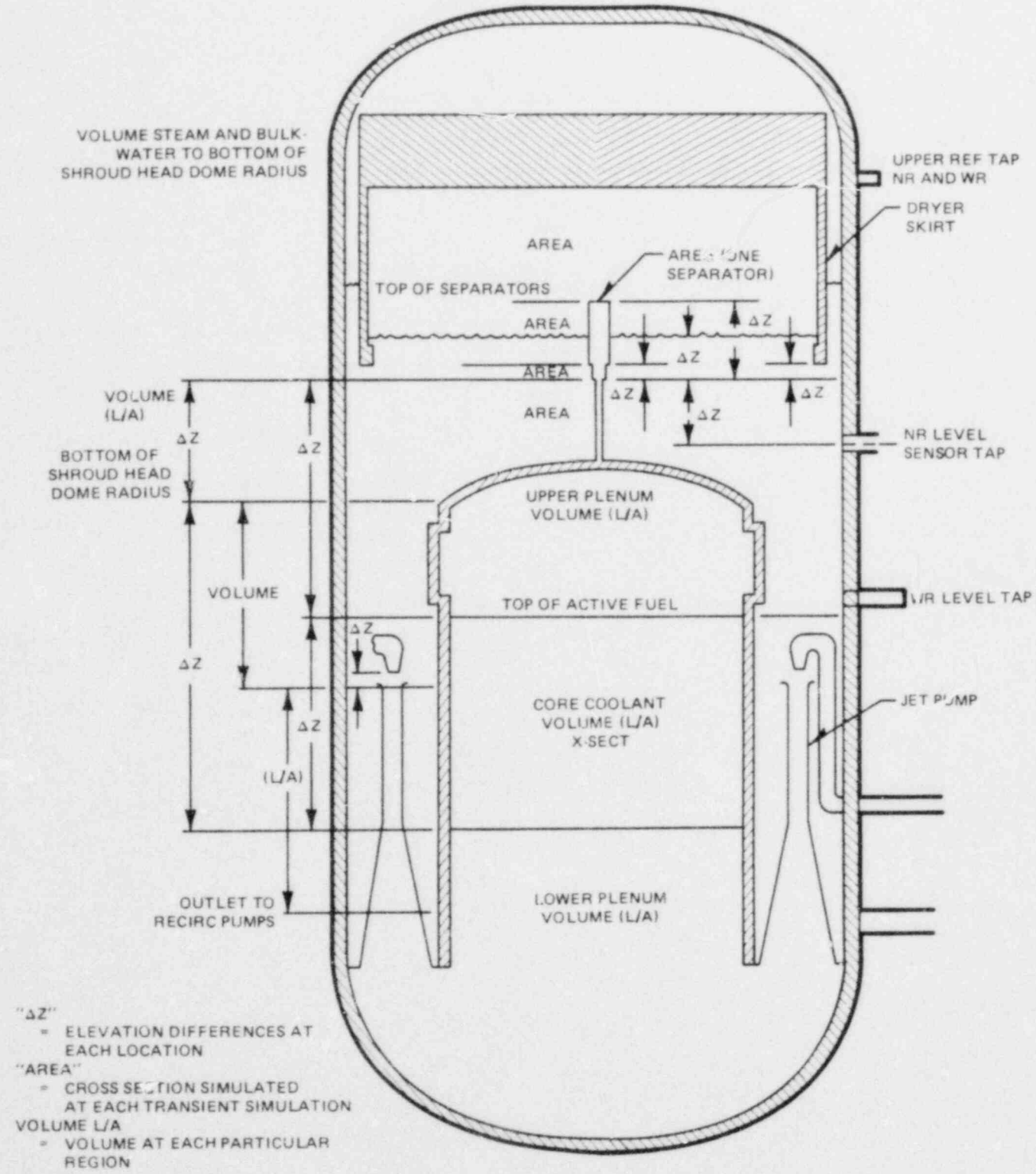


Figure 2.3.2.4-1. Reactor Vessel Geometry

Table 2.3.2.5-1

SUMMARY OF REACTOR VESSEL LEVELS - BWR/1-5

High Level - Vessel Runover Protection & Turbine Protection . . .	Level 8
High Level - Alarm	Level 6, 7
Operating reactor level is maintained somewhere below the high level alarm and above low level alarm.	
Low Level - Alarm	Level 4, 5
Low Level - Scram and Provide Certain Isolation Functions	Level 3
*Low Level - Initiate Vessel Inventory Control Systems such as HPCI, Trip Recirc Pumps, Close MSIV**	Level 2
*Low Level - Initiate LP Core Cooling Systems	Level 1
Top of Active Fuel	Level Ref
Low Level - Fuel Zone Level (Information)	Level 0

SUMMARY OF REACTOR VESSEL LEVELS - BWR/6

High Level - Vessel Runover Protection & Turbine Protection Scram	Level 8
High Level - Alarm	Level 6, 7
Operating reactor level is maintained somewhere below the high level alarm and above low level alarm.	
Low Level - Alarm	Level 4, 5
Low Level - Scram and Provide Certain Isolation Functions	Level 3
Low Level - Initiate Vessel Inventory Control Systems such as HPCS, Trip Recirc Pumps	Level 2
Low Level - Initiate LP Core Cooling Systems, Close MSIV's	Level 1
Top of Active Fuel	Level Ref
Low Level - Fuel Zone Level (Information)	Level 0

*Combined on BWR/2 and 3 Plants
**BWR/2,3,4 and 5 Plants

Table 3.1.1.1-1

SUMMARY OF CASES PRESENTED

ALL SYSTEMS OPERABLE

BWR/2	0.1 Ft^2 Suction Break
BWR/4	0.1 Ft^2 Suction Break
BWR/6	0.1 Ft^2 Suction Break
BWR/2	0.1 Ft^2 Steamline Break
BWR/4	0.1 Ft^2 Steamline Break
BWR/6	0.1 Ft^2 Steamline Break

RCIC + CRD AVAILABLE

BWR/4	0.0001 Ft^2 Suction Break
BWR/4	0.005 Ft^2 Suction Break
BWR/4	0.1 Ft^2 Suction Break With Low Pressure Systems
BWR/4	0.005 Ft^2 Discharge Break
BWR/4	0.005 Ft^2 Core Spray Line Break
BWR/4	0.005 Ft^2 Feedwater Line Break
BWR/4	0.0001 Ft^2 Steamline Break
BWR/4	0.05 Ft^2 Steamline Break
BWR/4	0.5 Ft^2 Steamline Break With Low Pressure Systems
BWR/4	0.001 Ft^2 Outside Steamline Break
BWR/4	0.1 Ft^2 Outside Steamline Break

HPCI/HPCS AVAILABLE

BWR/4	0.005 Ft^2 Suction Break
BWR/4	0.08 Ft^2 Suction Break
BWR/4	0.20 Ft^2 Suction Break With Low Pressure Systems
BWR/6	0.001 Ft^2 Suction Break
BWR/6	0.1 Ft^2 Suction Break With Low Pressure Systems
BWR/4	0.05 Ft^2 Steamline Break
BWR/4	0.2 Ft^2 Steamline Break With Low Pressure Systems
BWR/6	0.2 Ft^2 Steamline Break
BWR/6	0.2 Ft^2 Steamline Break With Low Pressure Systems
BWR/4	0.05 Ft^2 Outside Steamline Break

Table 3.1.1.1-1 (Continued)

FEEDWATER AVAILABLE

BWR/4	0.1 Ft^2 Suction Break With Low Pressure Systems
BWR/4	0.1 Ft^2 Steamline Break With Low Pressure Systems

LOW PRESSURE SYSTEMS AVAILABLE

BWR/4	0.001 Ft^2 Suction Break
BWR/4	0.1 Ft^2 Suction Break
BWR/2	0.1 Ft^2 Suction Break
BWR/4	0.1 Ft^2 Steamline Break
BWR/4	0.5 Ft^2 Outside Steamline Break

STUCK OPEN RELIEF VALVE

BWR/4	0.005 Ft^2 Suction Break - RCIC + Low Pressure Systems
BWR/4	0.001 Ft^2 Suction Break - Low Pressure Systems Only
BWR/4	0.1 Ft^2 Outside Steamline Break - Low Pressure Systems Only

NO BREAK

BWR/4	HPCI + Low Pressure
BWR/4	Low Pressure Systems Only - ADS at 10 Minutes
BWR/4	Low Pressure Systems Only - ADS at Water Level 1

ADDITIONAL BWR/6 CASES

BWR/6	0.005 ft^2 Suction Break - RCIC + CRD
BWR/6	0.001 ft^2 Suction Break - HPCS only
BWR/6	0.1 ft^2 Suction Break - Low Pressure Systems Only
BWR/6	Scram & Isolation with Stuck Open Relief Valve - RCIC + CRD

Table 3.1.1.3-1

COMPARISON OF SMALL BREAK vs. LARGE BREAK PARAMETERS

Parameter	Small Break	Large Break
Timing of Events	Relatively Slow	Relatively Fast
Depressurization Rate	Slow (May Require ADS)	Fast (No ADS Required)
Core Uncovery	Dependent on Break Size, Location And ECCS Availability	Always
Boiling Transition (Hot Bundle)	Dependent on Core Uncovery Time As Calculated by SAFE (Initial Flow Decay Adequate To Maintain Nucleate Boiling Until Core Uncovery)	Dependent on Core Flow Rate (Calculated With LAMB And SCAT Computer Codes)
Core Flow Rate	Secondary Importantce	Important For Core Heat Transfer
Core Temperatures	Controlled by Decay Heat	Stored Energy and Decay Heat Important
Reflood Time	No Core Uncovery For Many Cases	Important for Limiting Peak Clad Temperature
Reactor System Response	Dependent on ECC System Availability	Dependent on Break Size and Location

There are no Figures 3.1.1.1-1 through 3.1.1.1-18

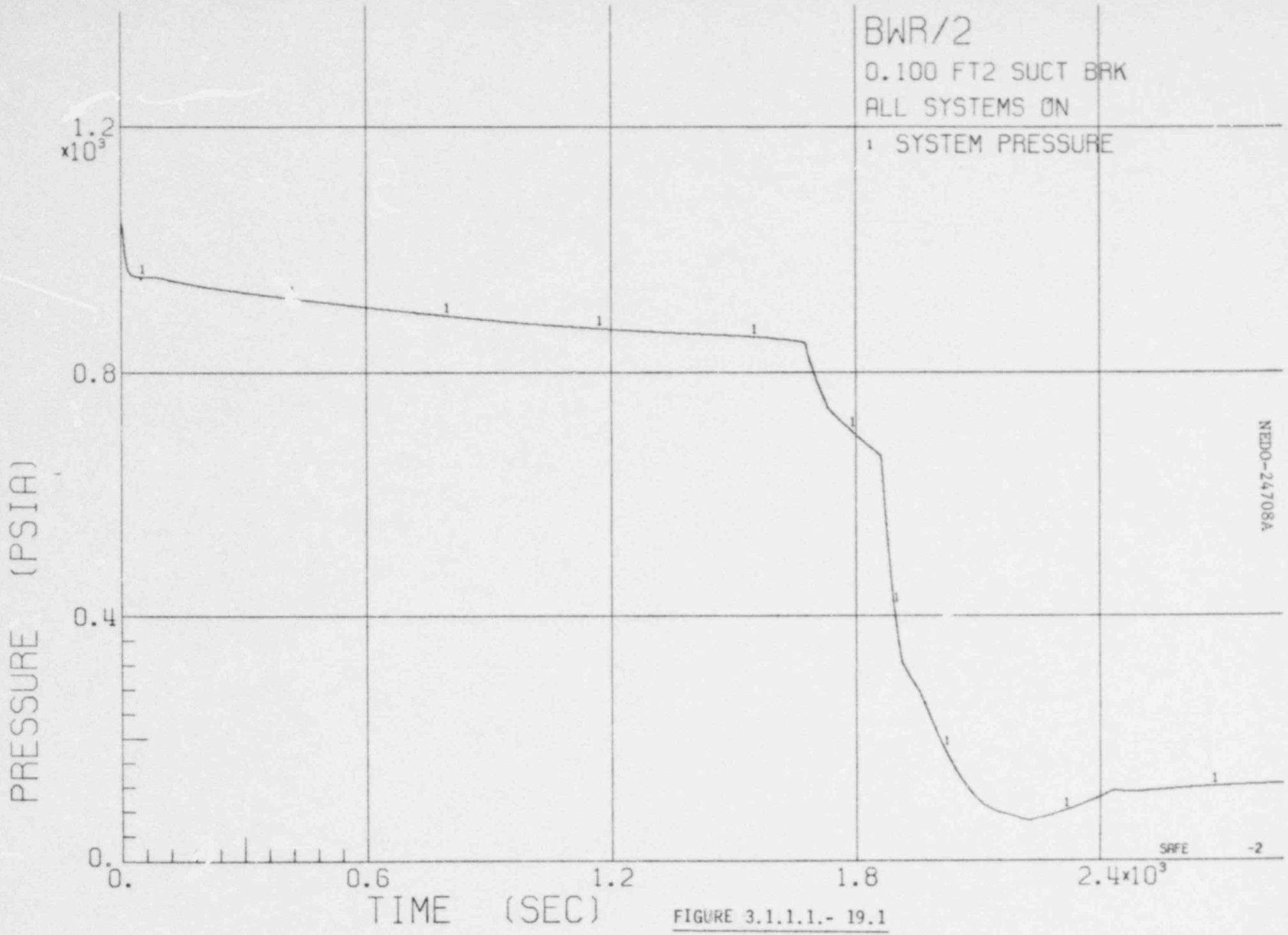


FIGURE 3.1.1.1.- 19.1

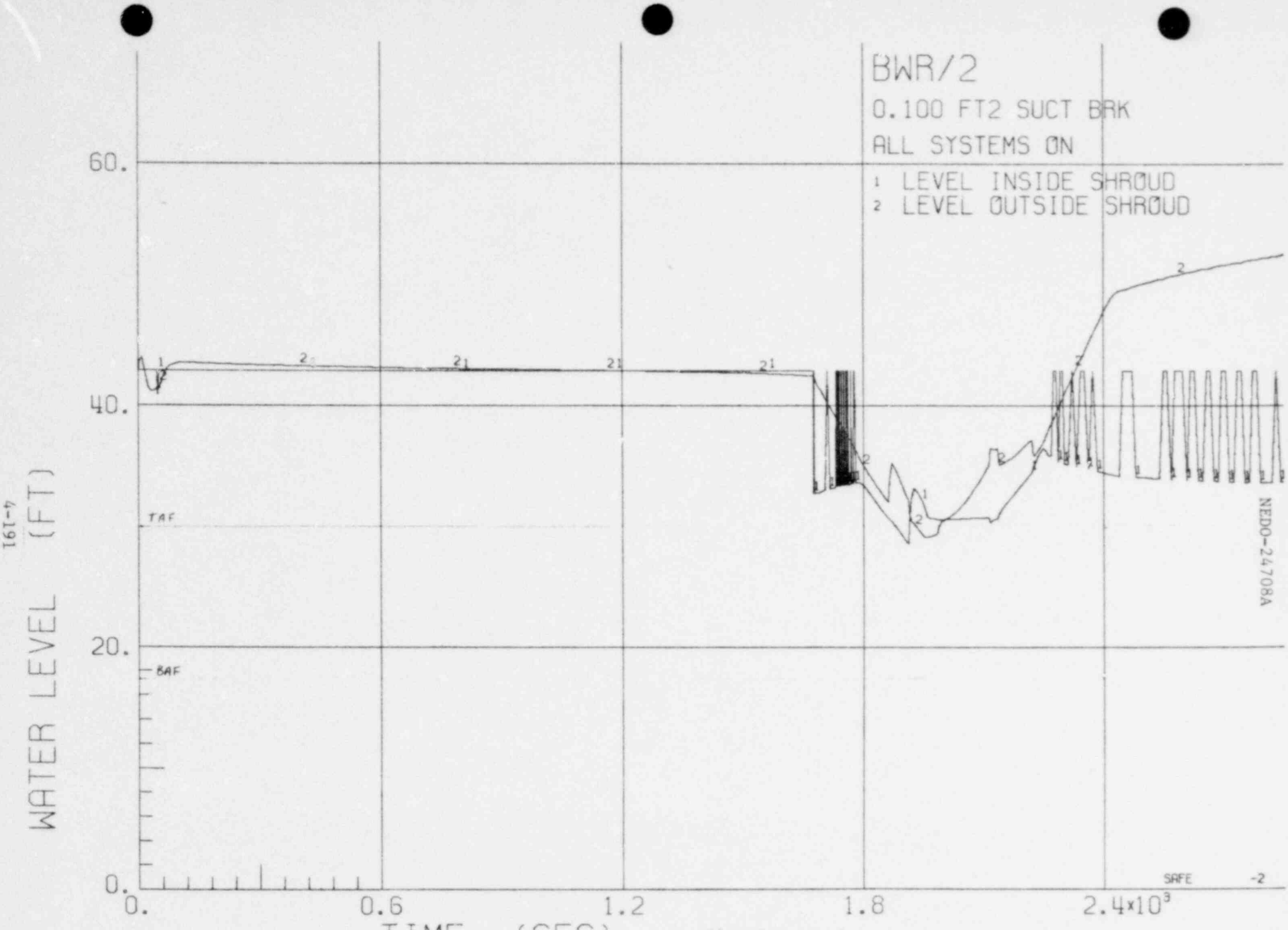


FIGURE 3.1.1.1 - 19.2

FIGURE 3.1.1.1 - 19.3

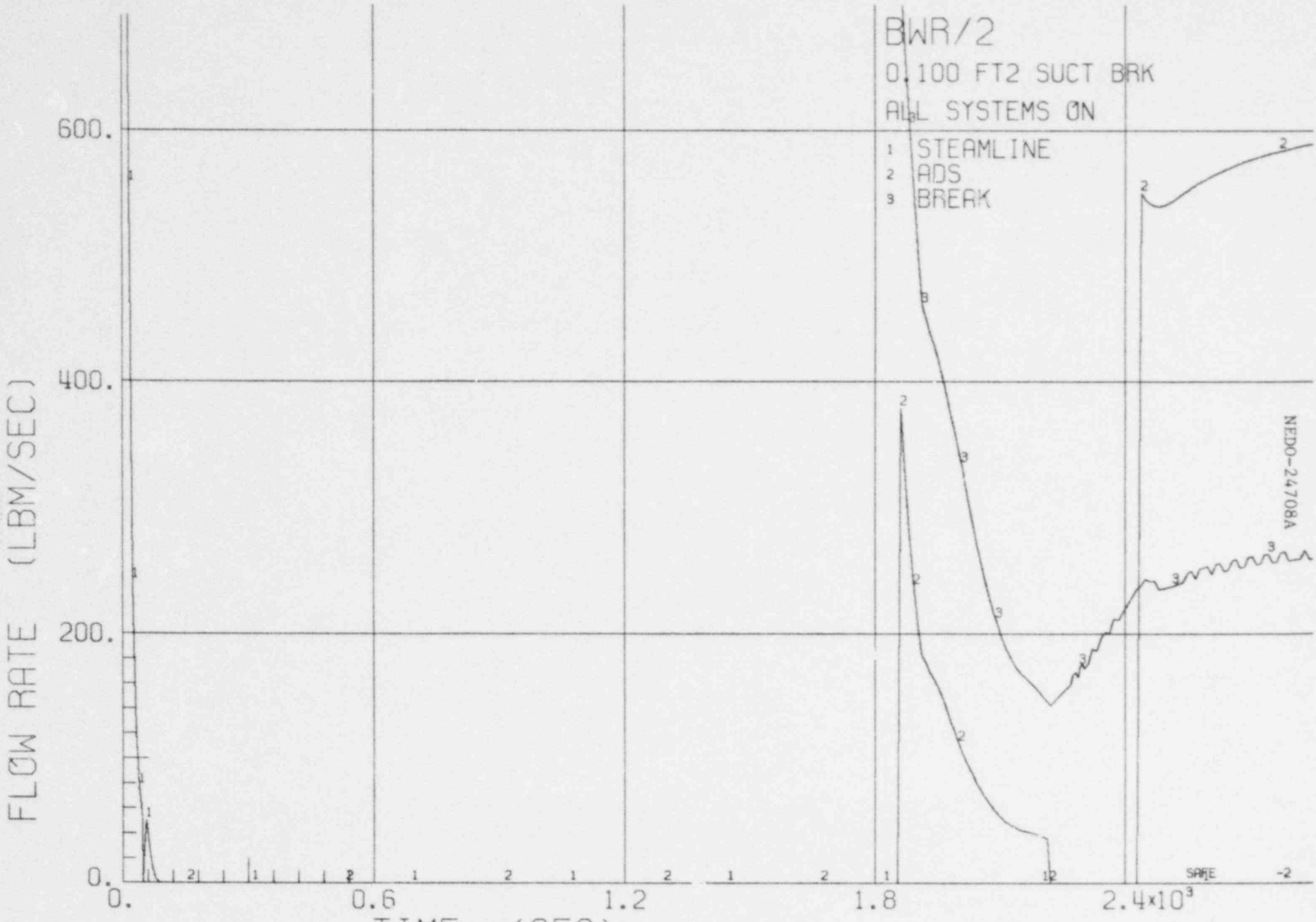


FIGURE 3.1.1.1 - 19.4

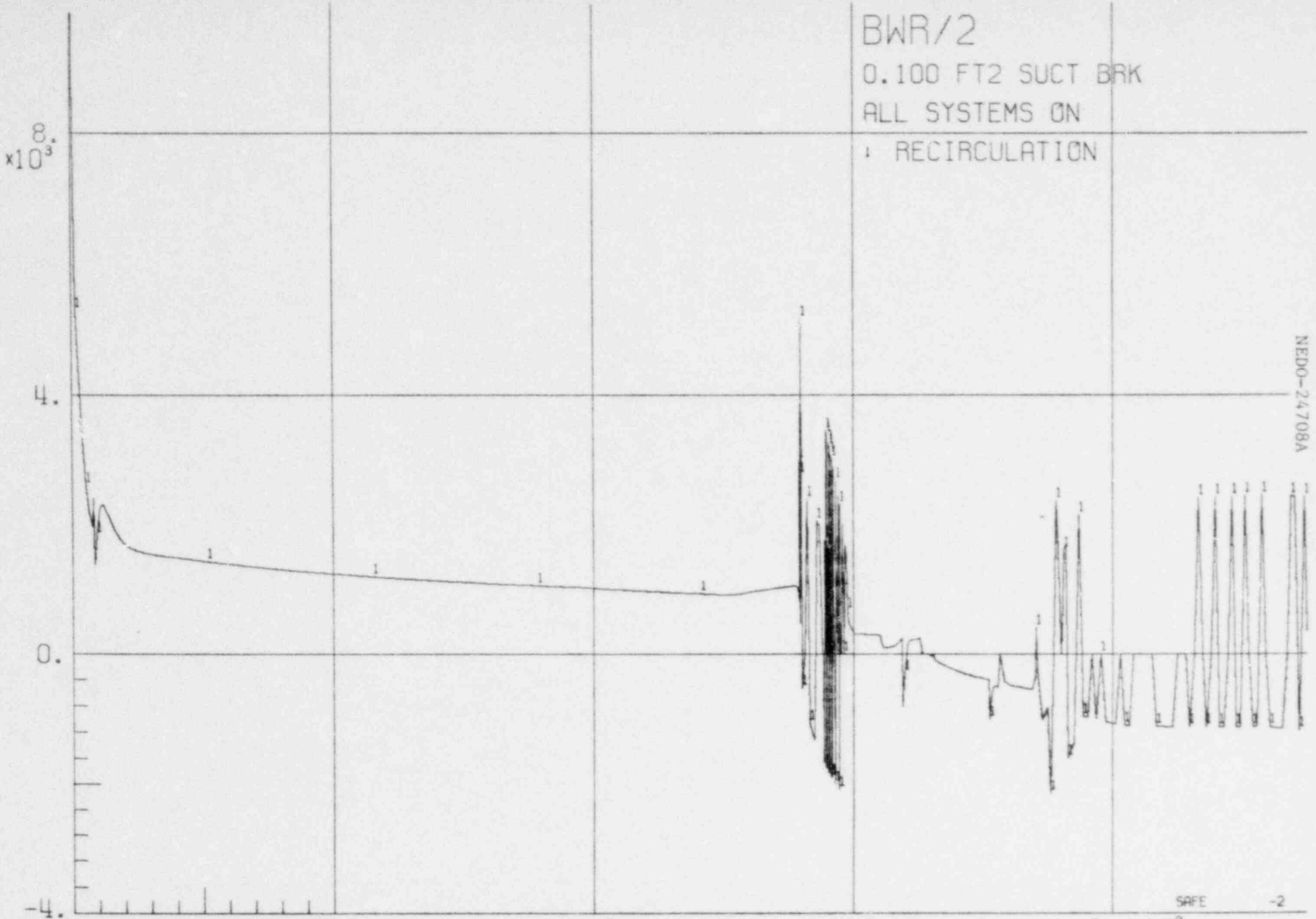


FIGURE 3.1.1.1 - 19.5

FIGURE 3.1.1.1 - 19.6

FIGURE 3.1.1.1 - 19.7

FIGURE 3.1.1.1 - 19.8

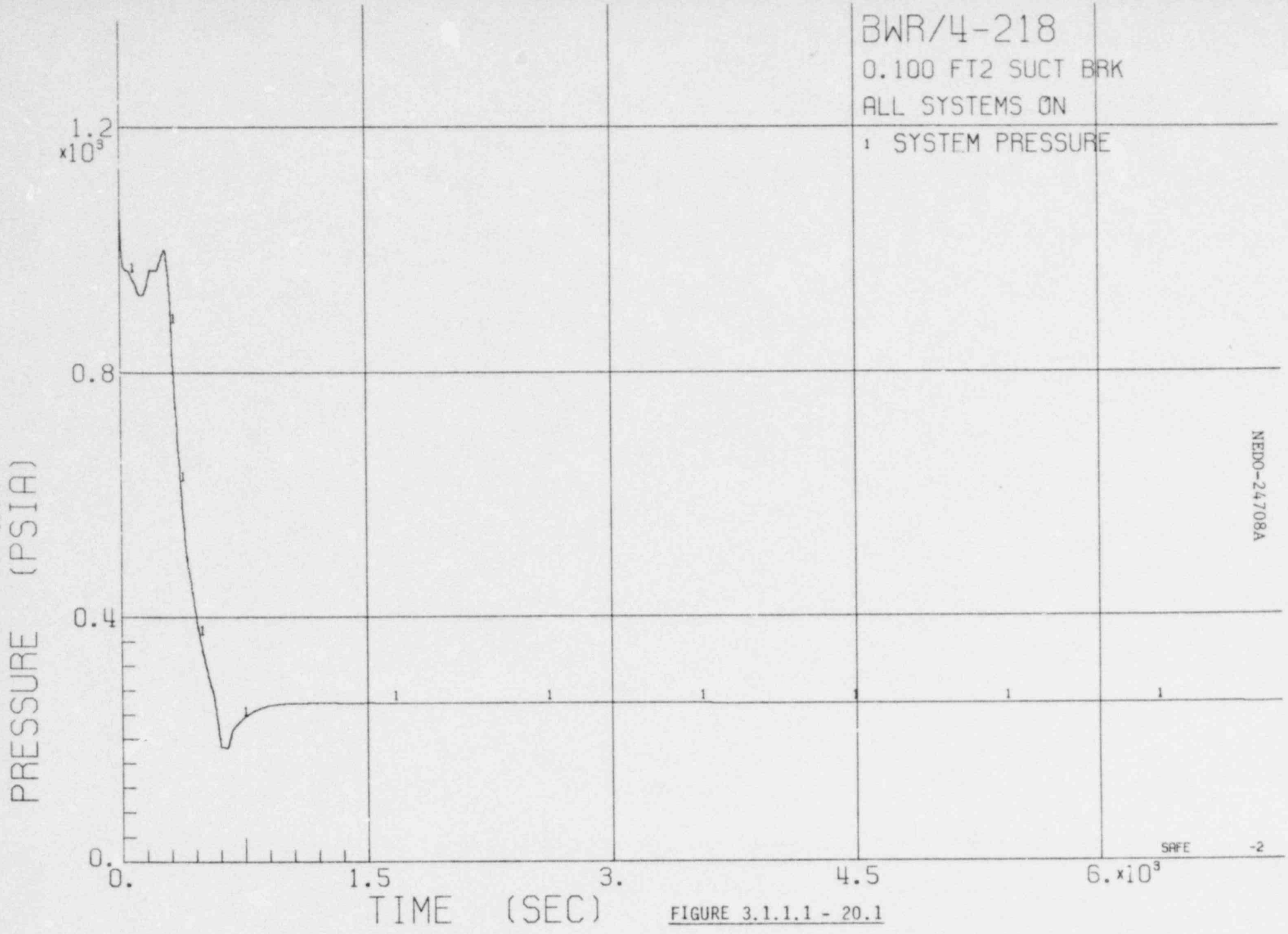


FIGURE 3.1.1.1 - 20.1

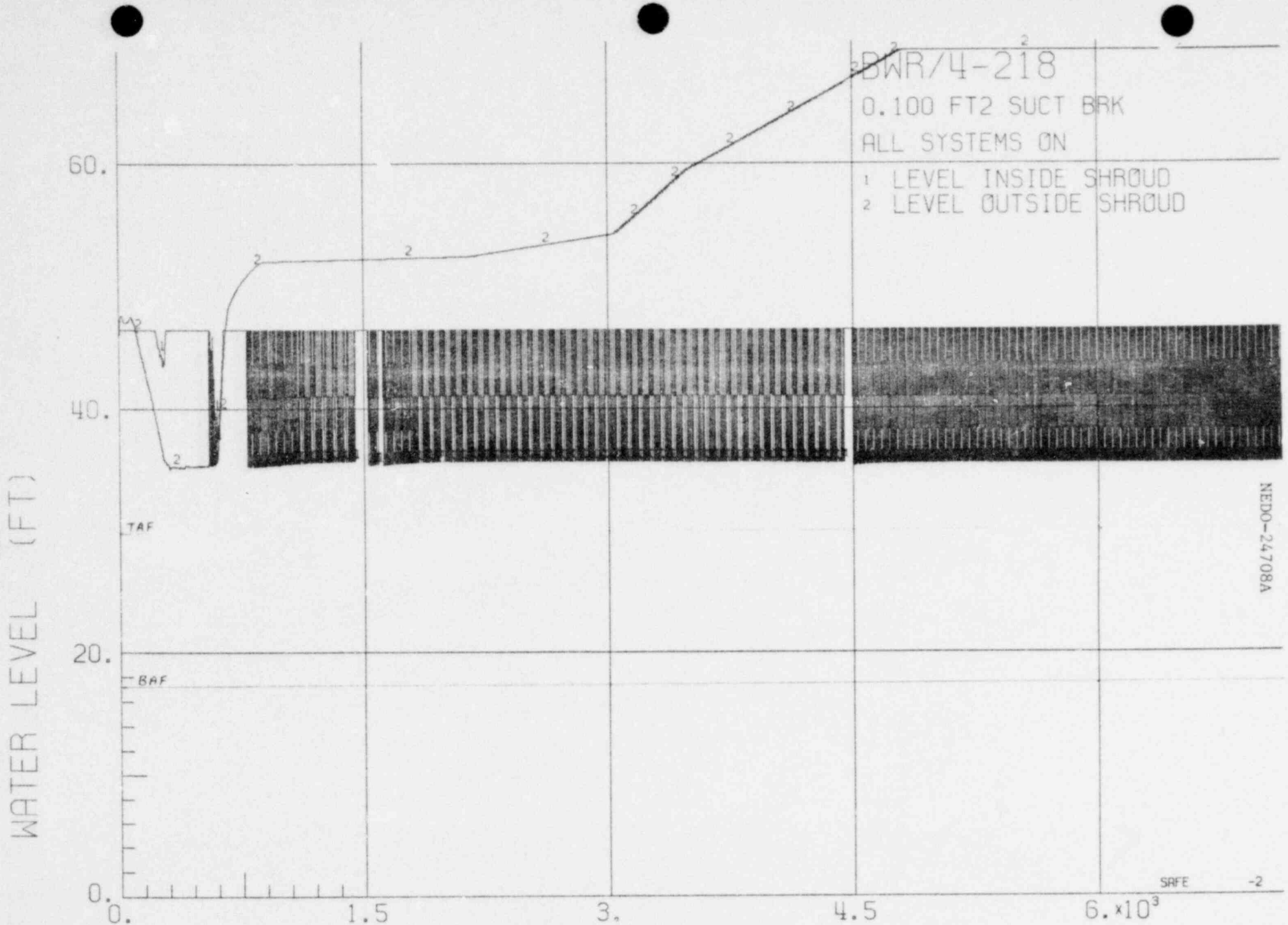
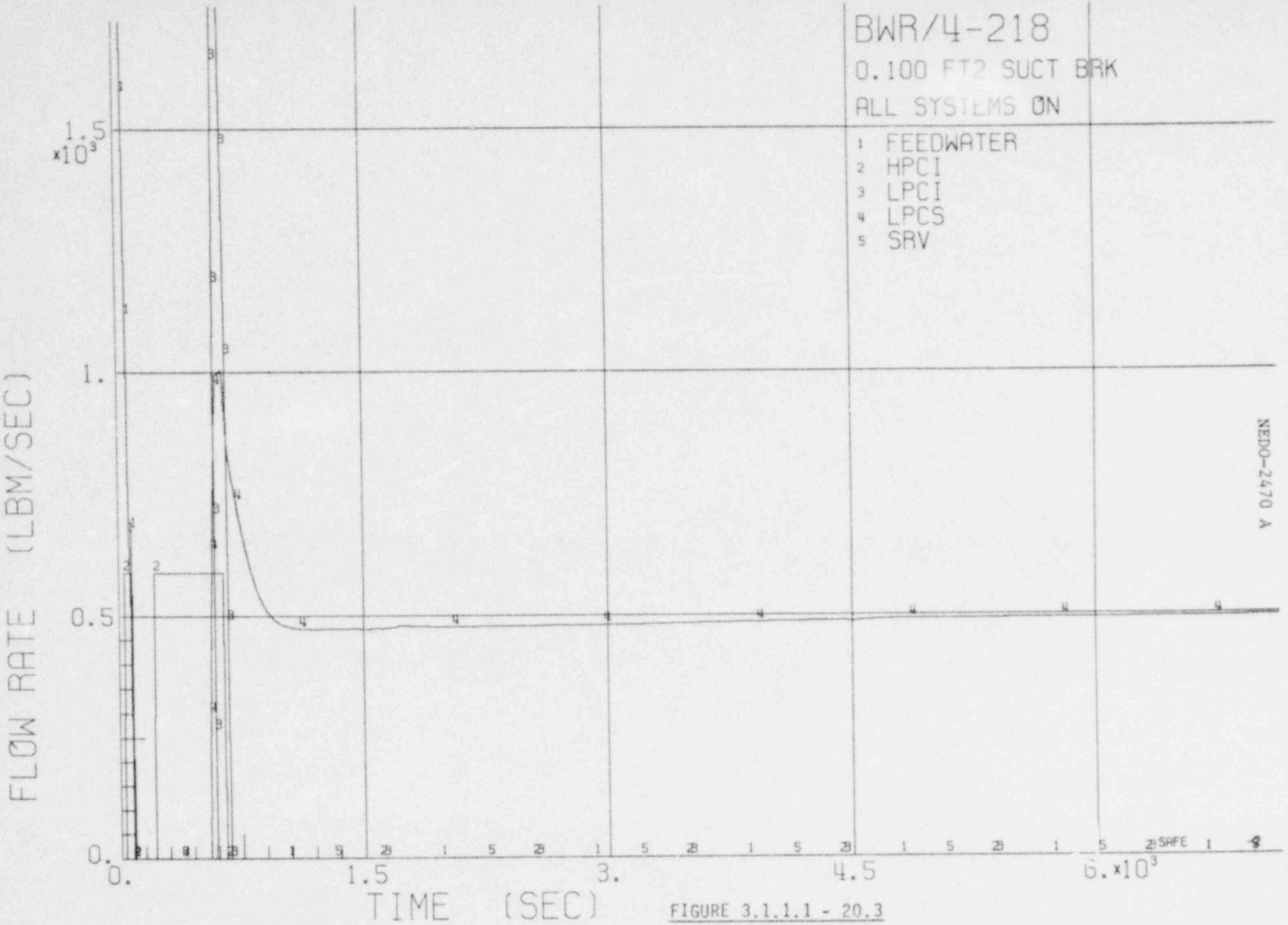


FIGURE 3.1.1.1 - 20.2



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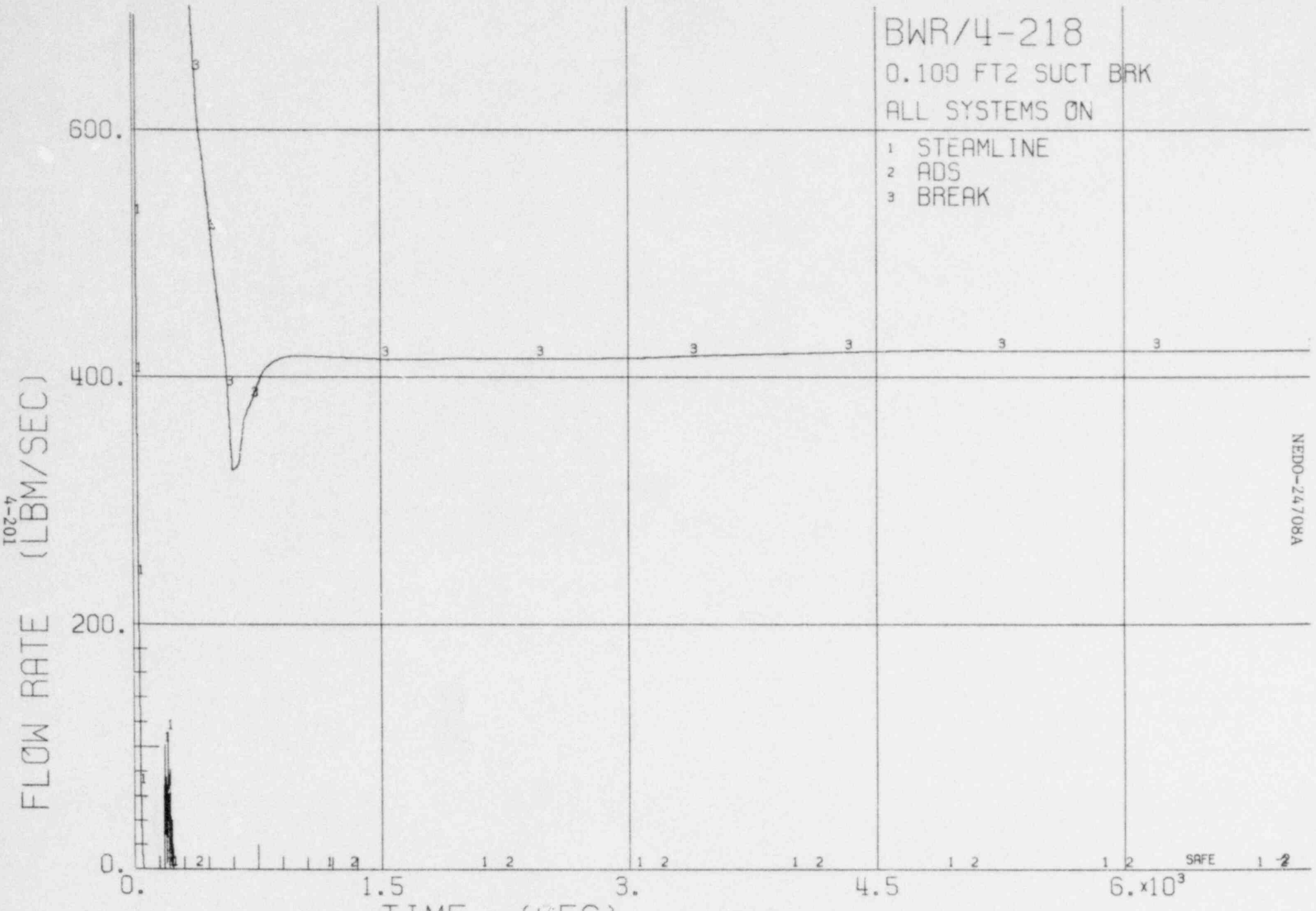
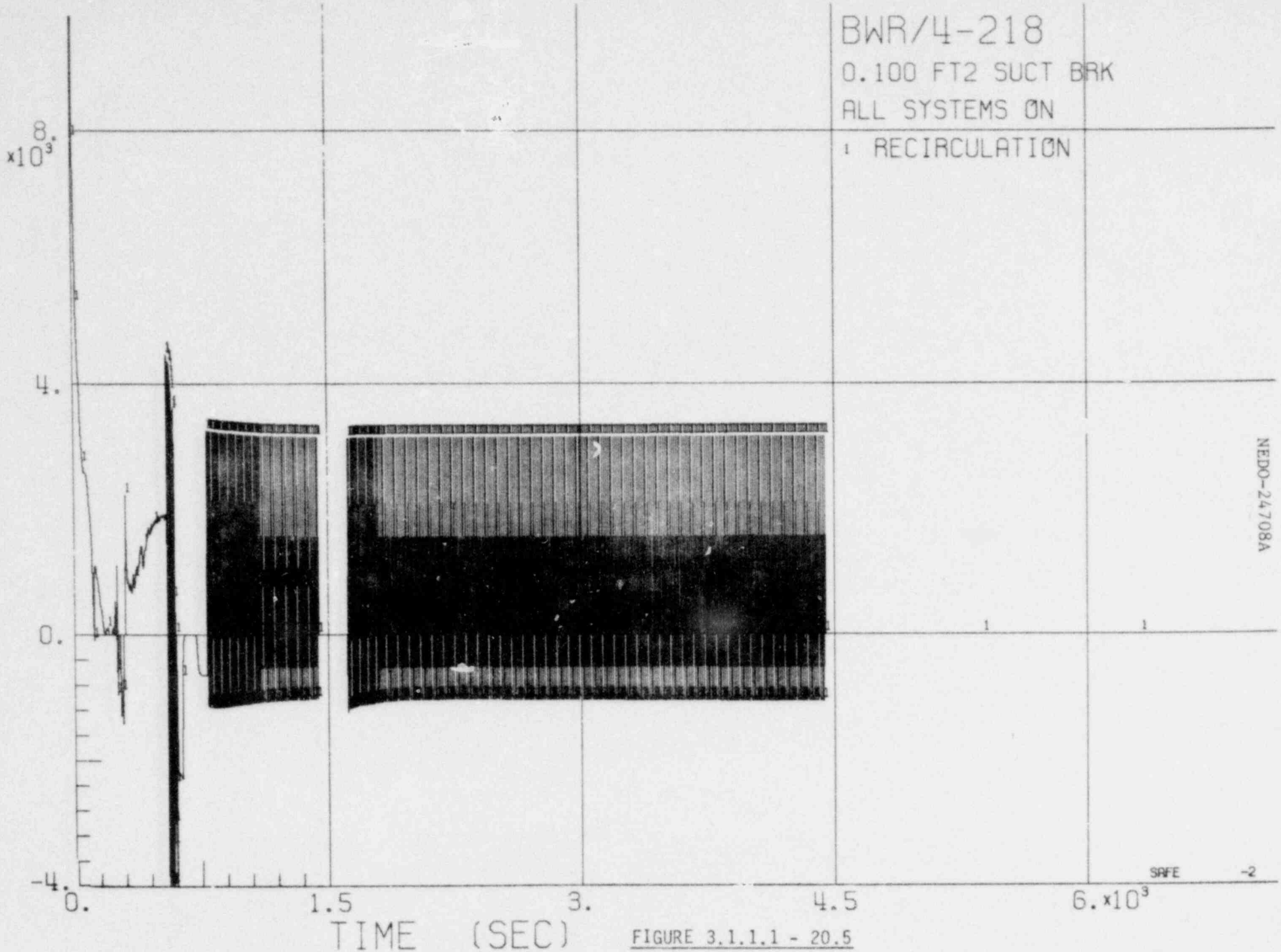


FIGURE 3.1.1.1 - 20.4



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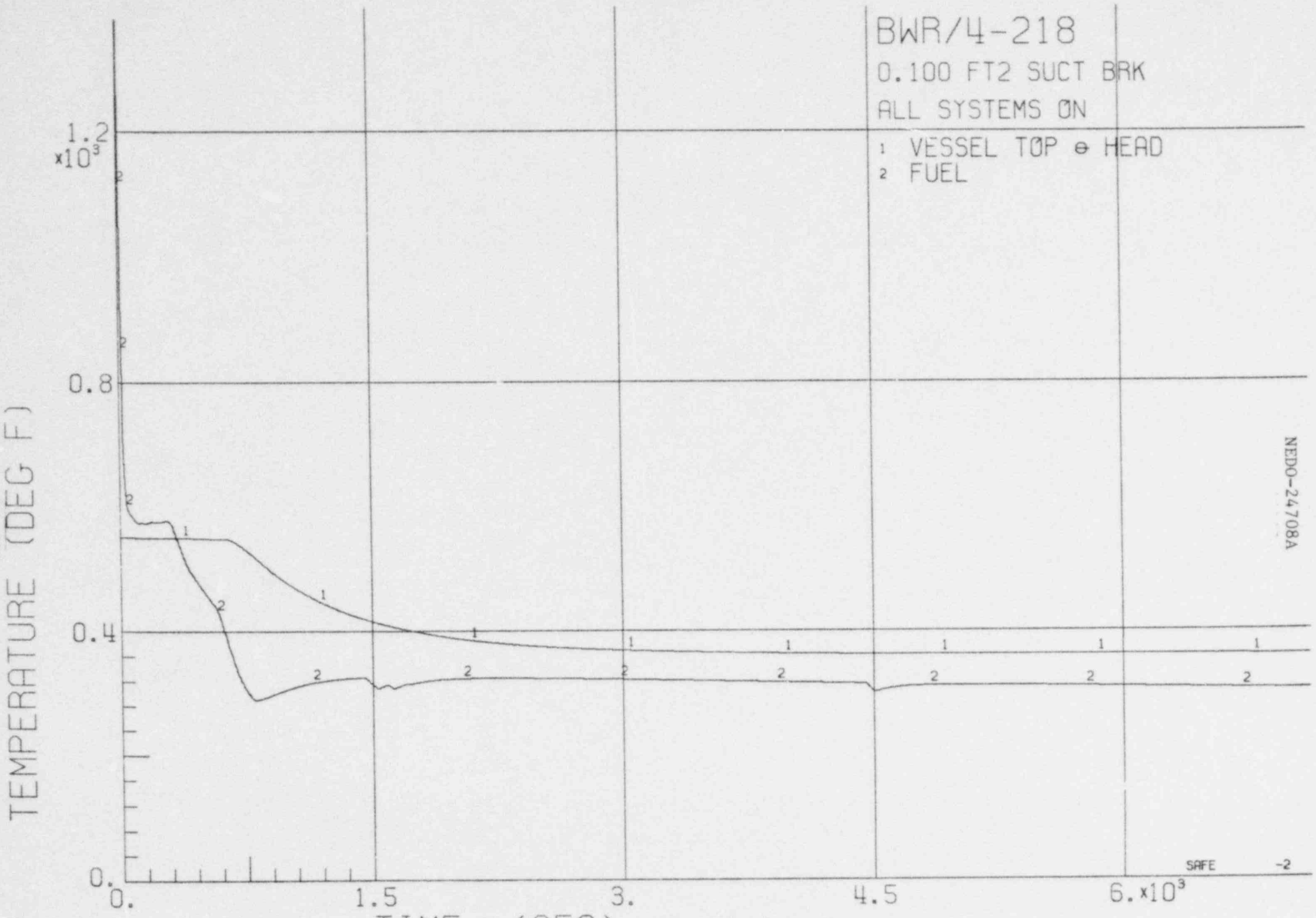
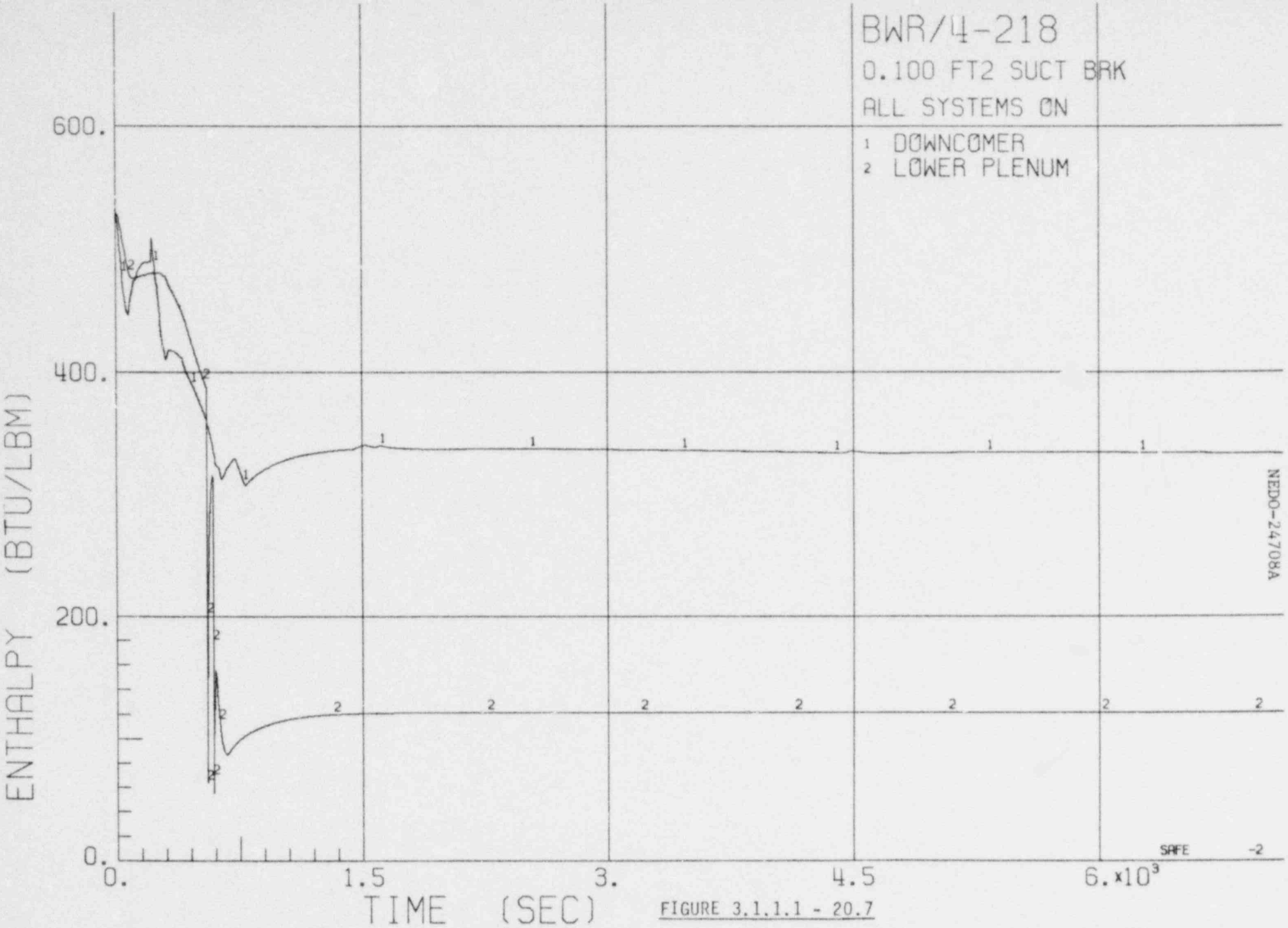


FIGURE 3.1.1.1 - 20.6



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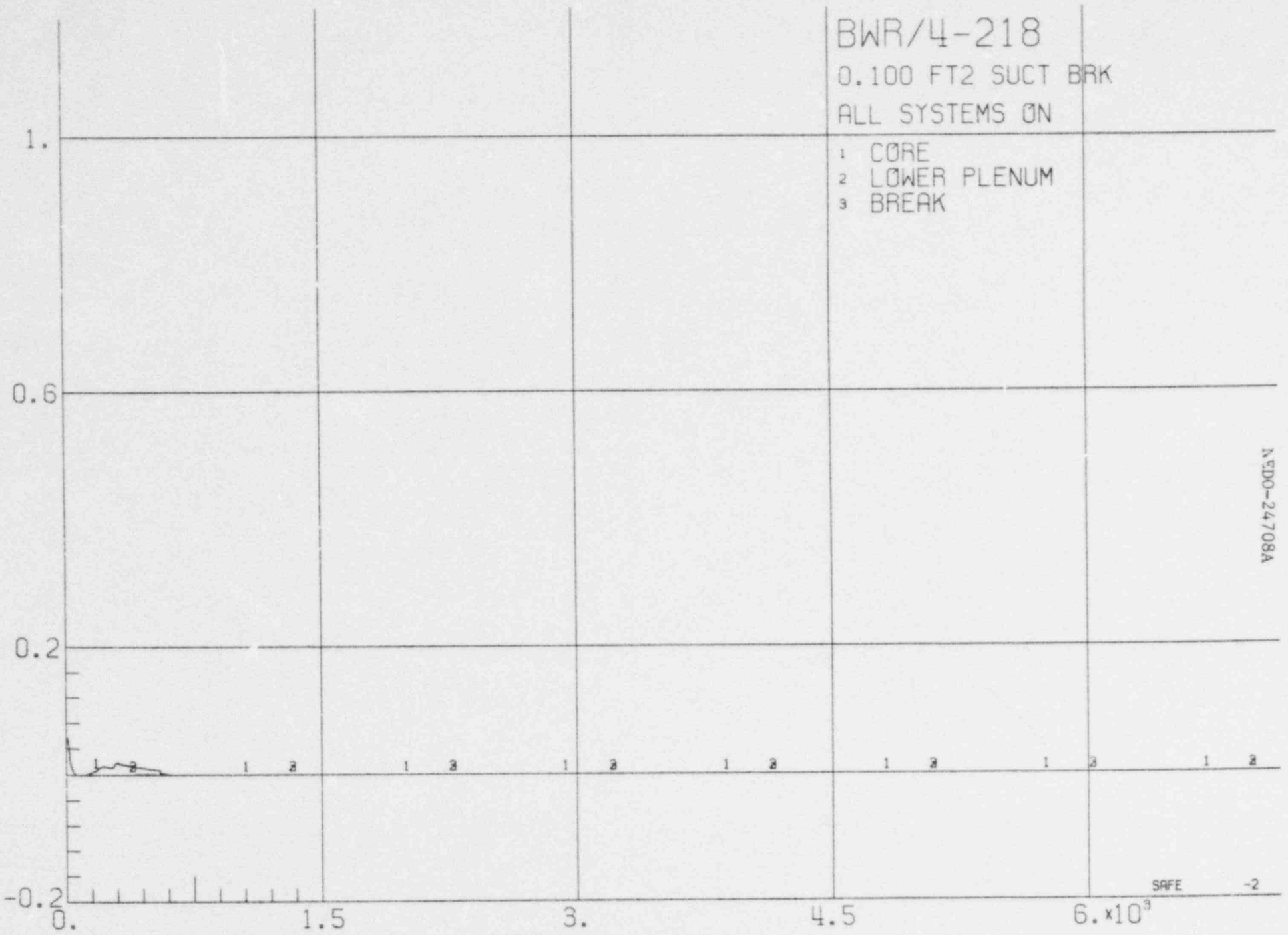

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FIGURE 3.1.1.1 - 20.8

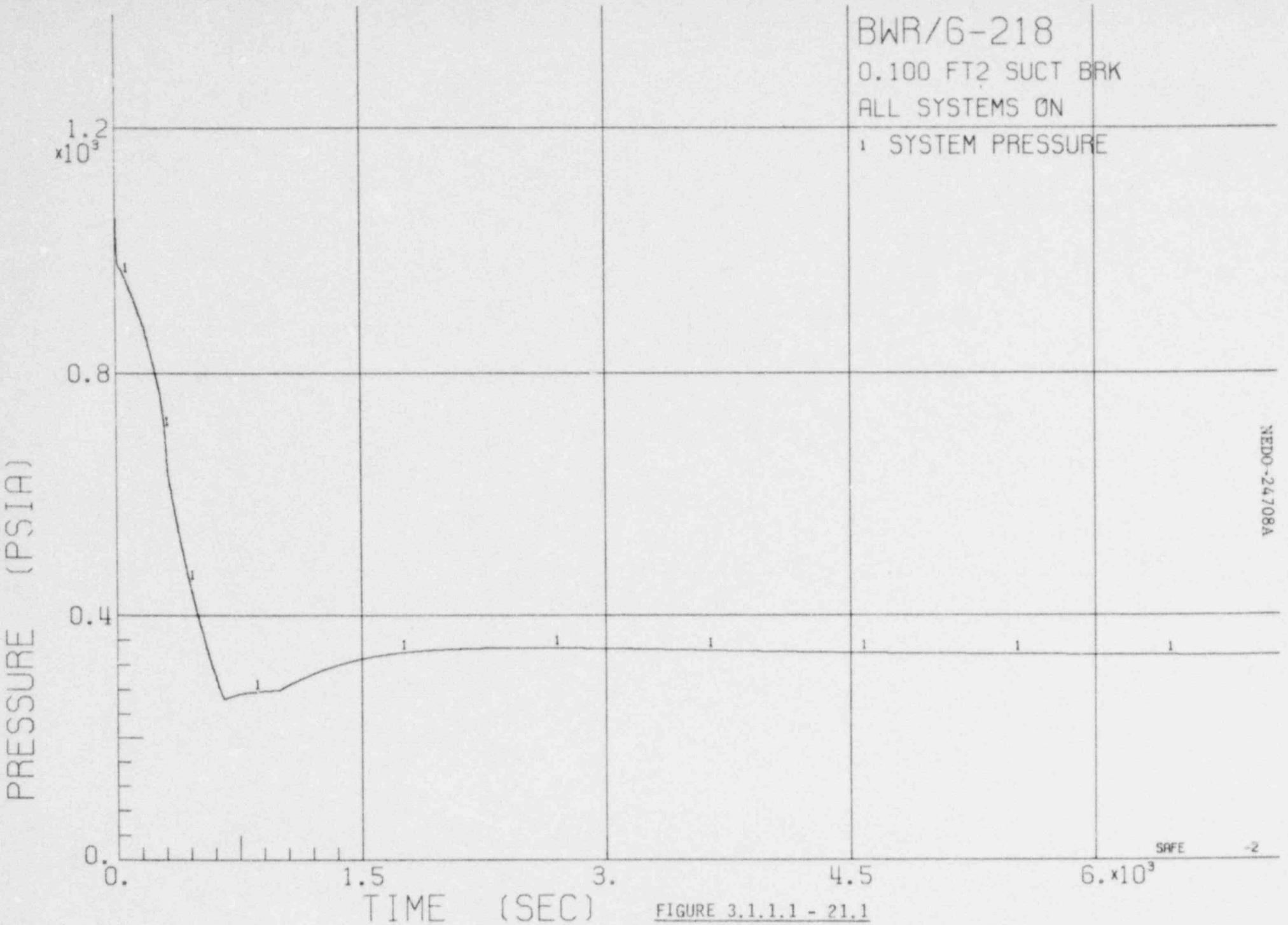
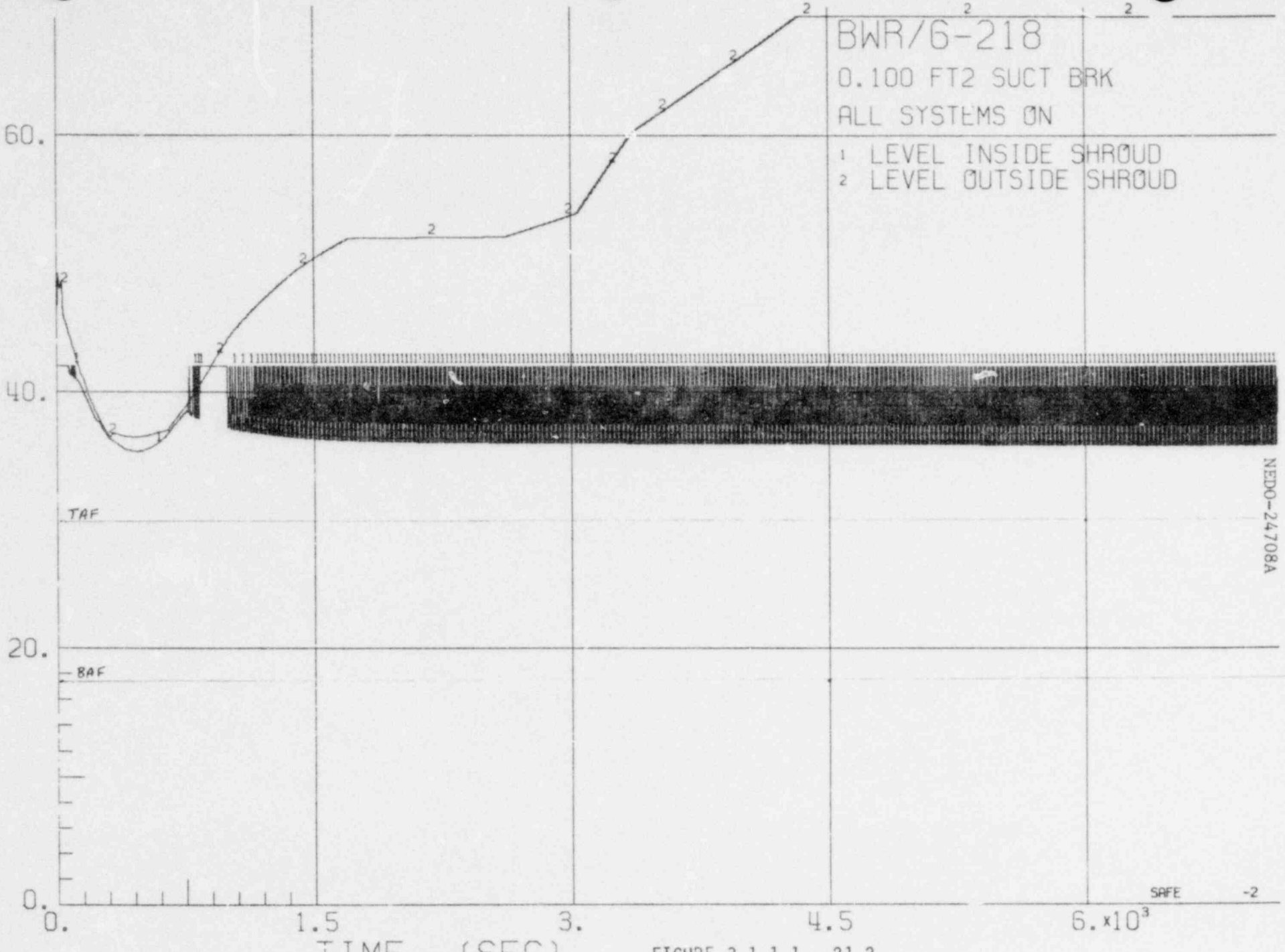


FIGURE 3.1.1.1 - 21.1



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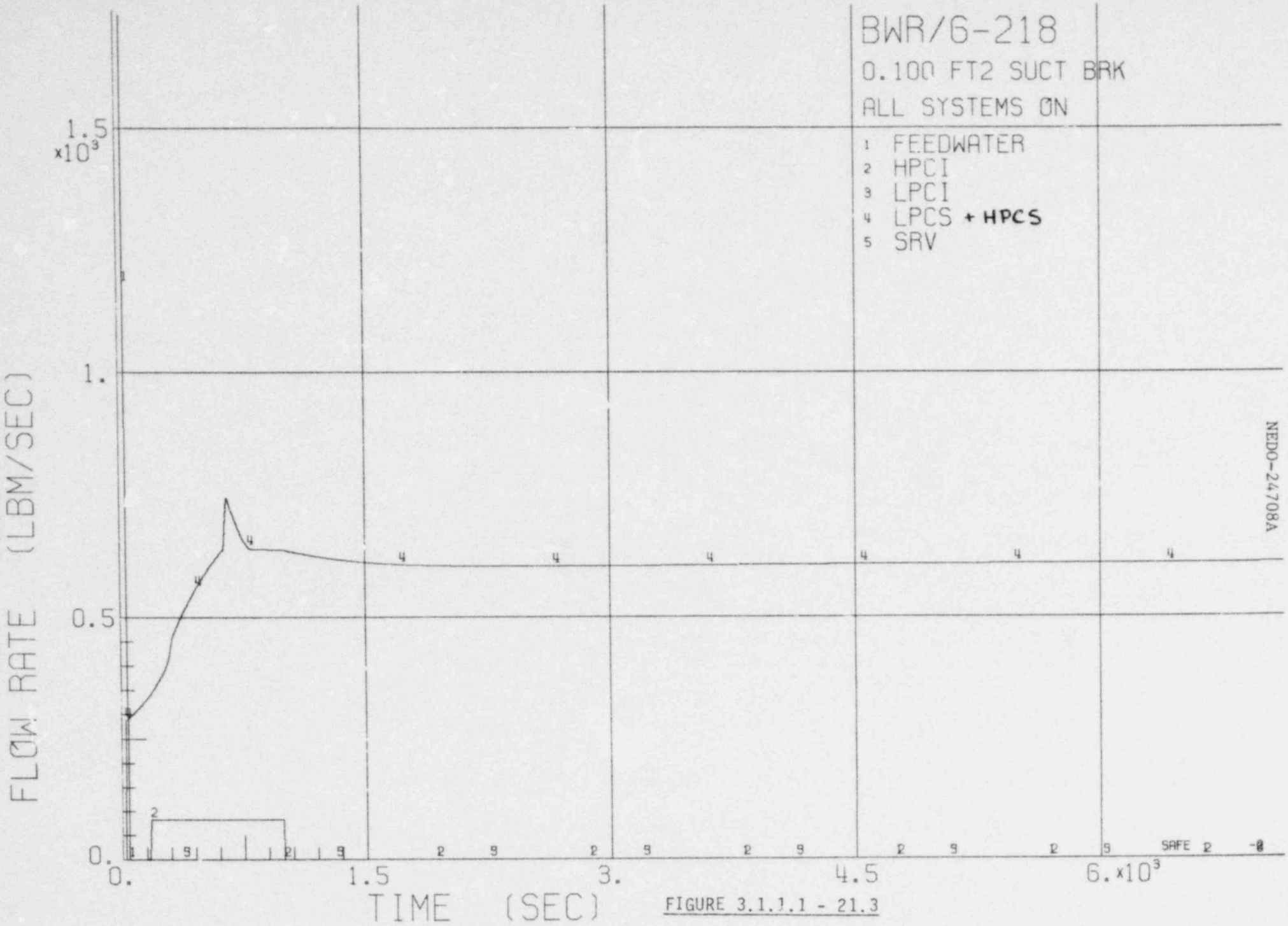
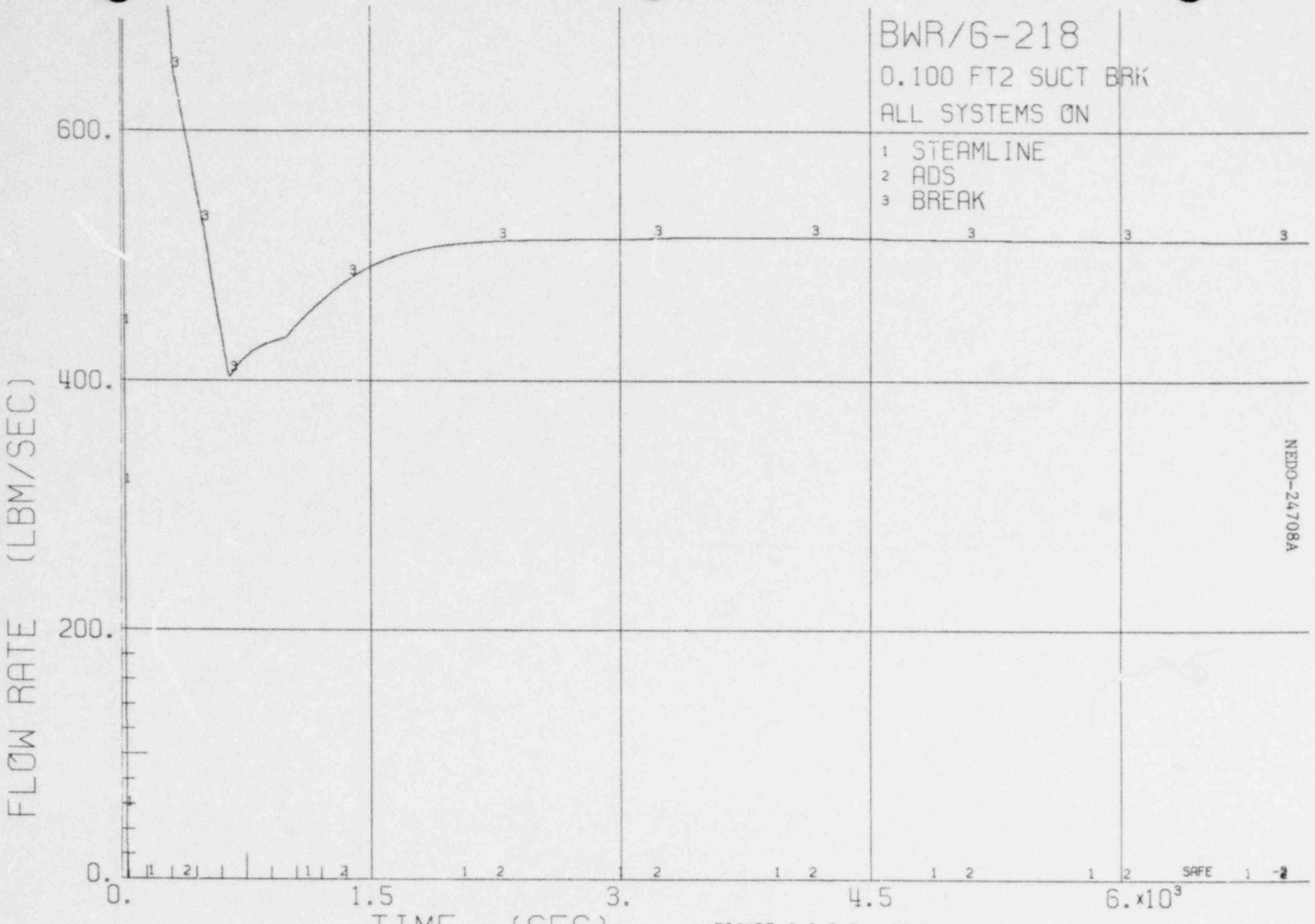


FIGURE 3.1.1.1 - 21.3



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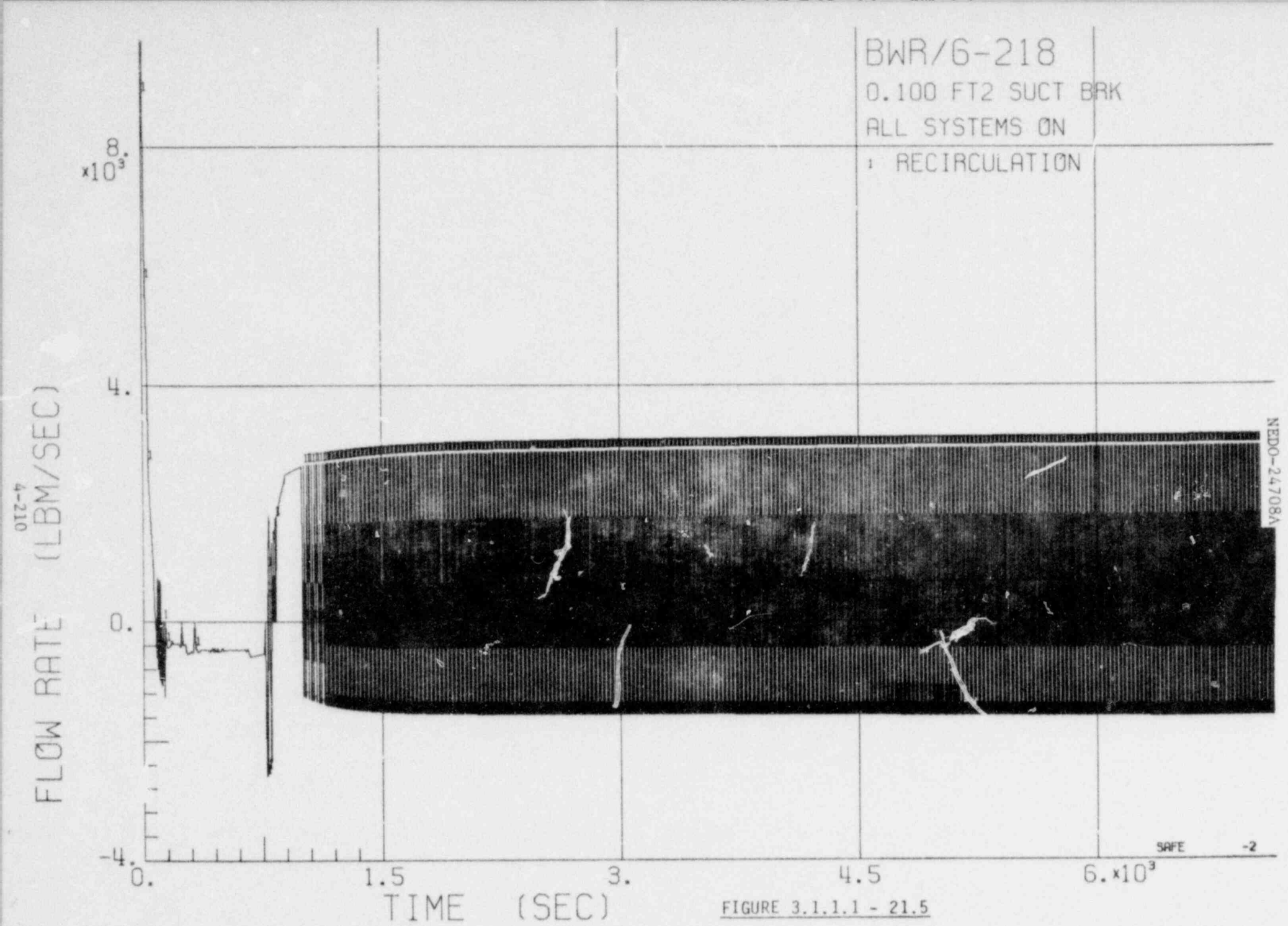

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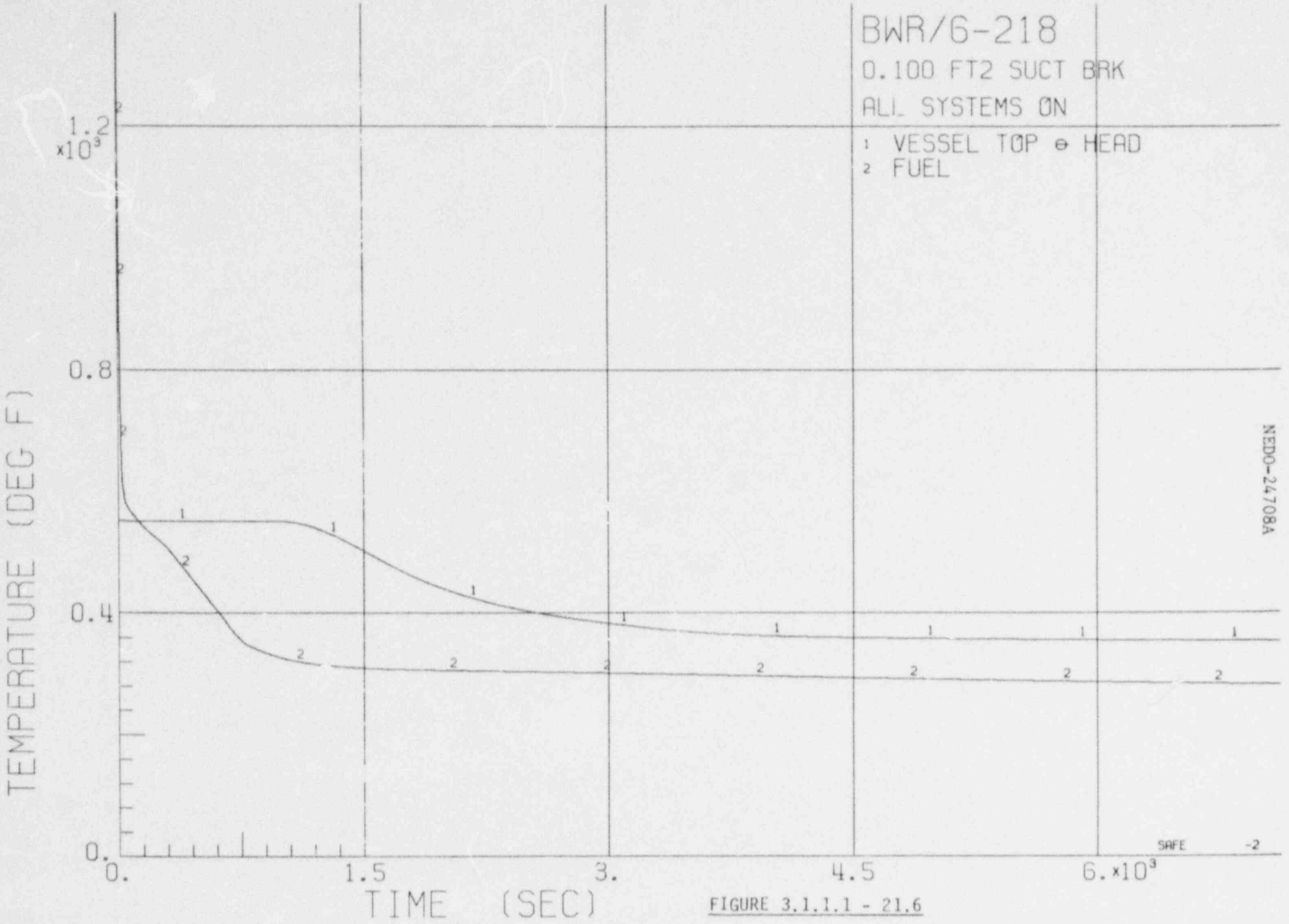
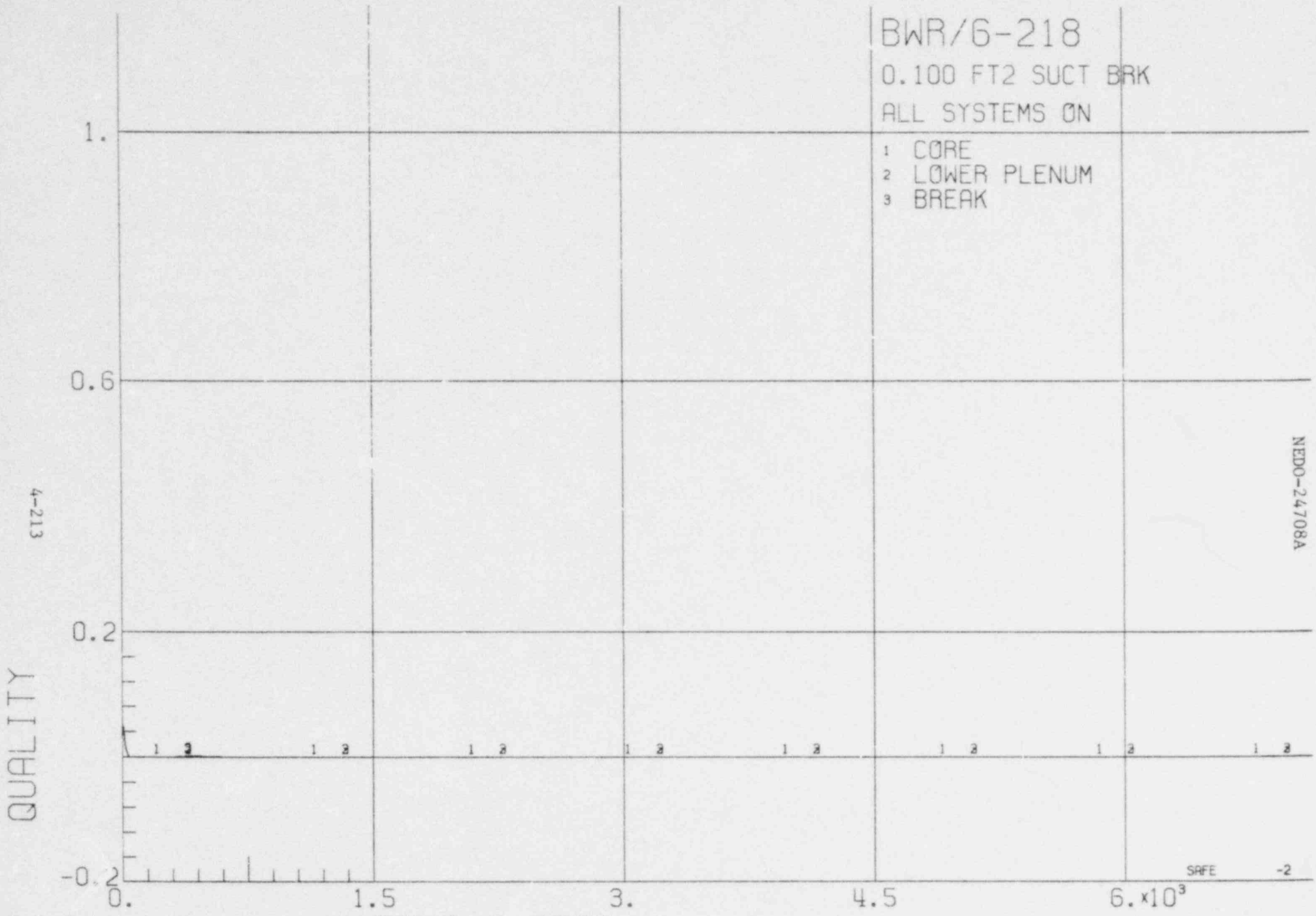


FIGURE 3.1.1.1 - 21.6

FIGURE 3.1.1.1 - 21.7



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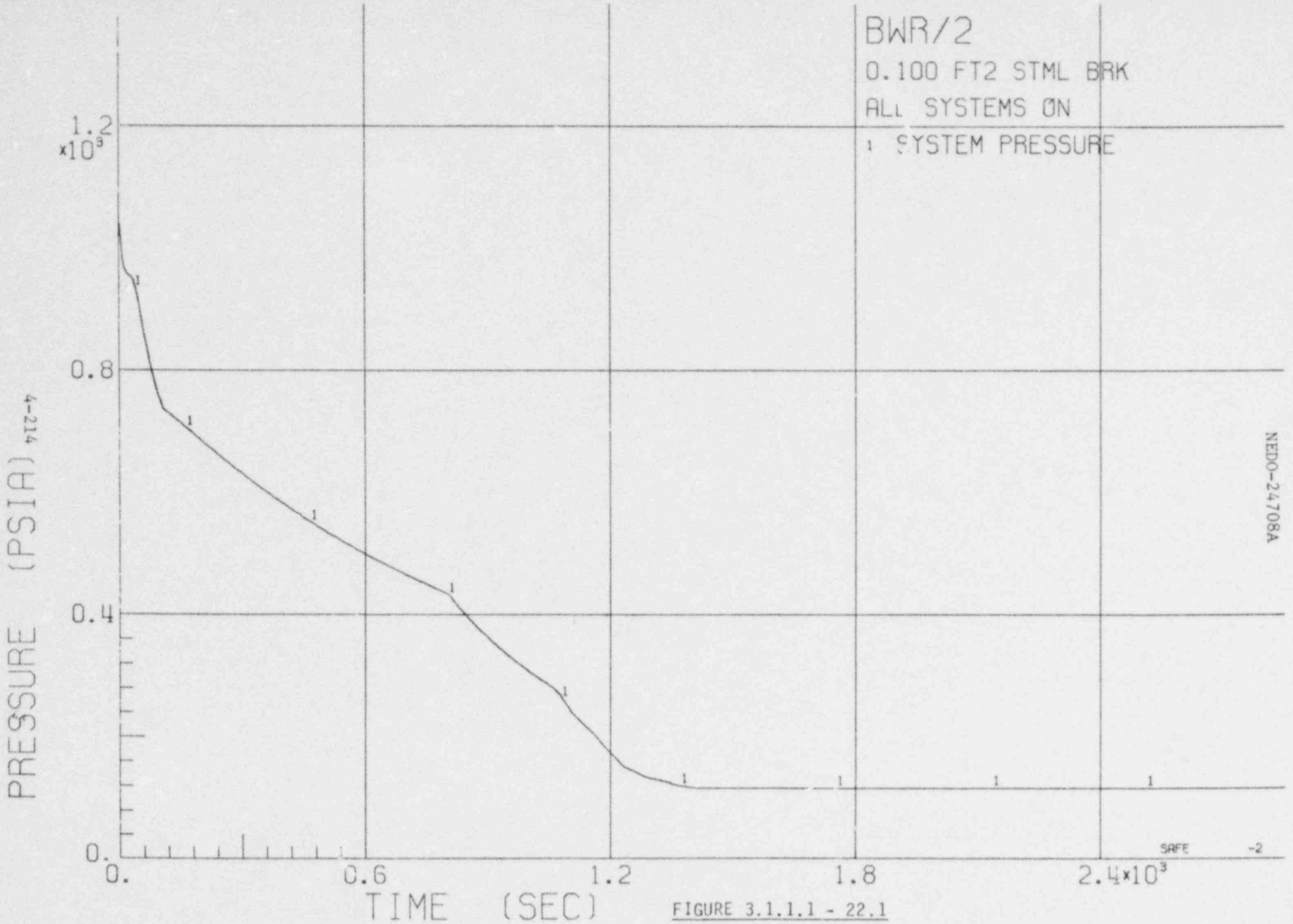


FIGURE 3.1.1.1 - 22.1

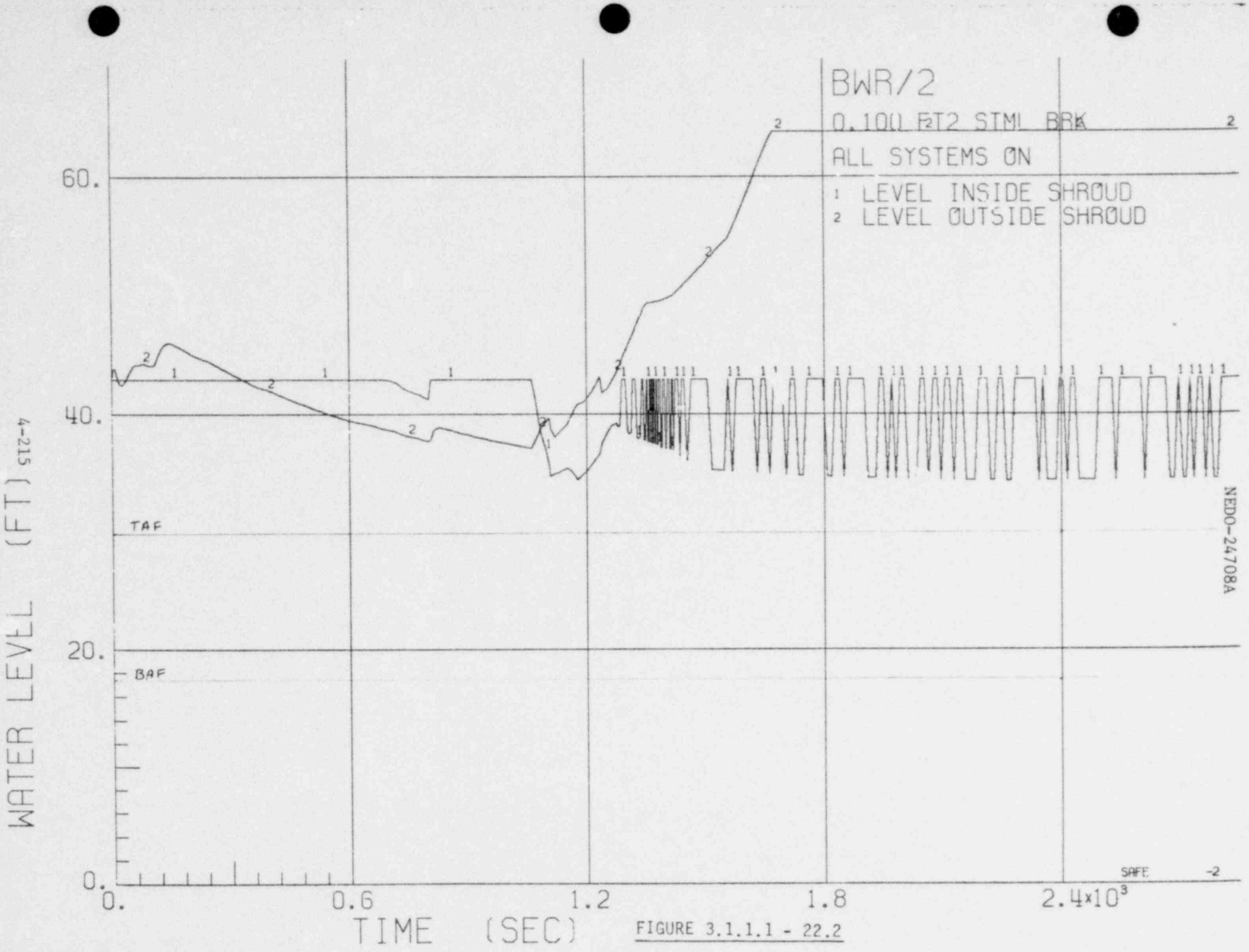


FIGURE 3.1.1.1 - 22.2

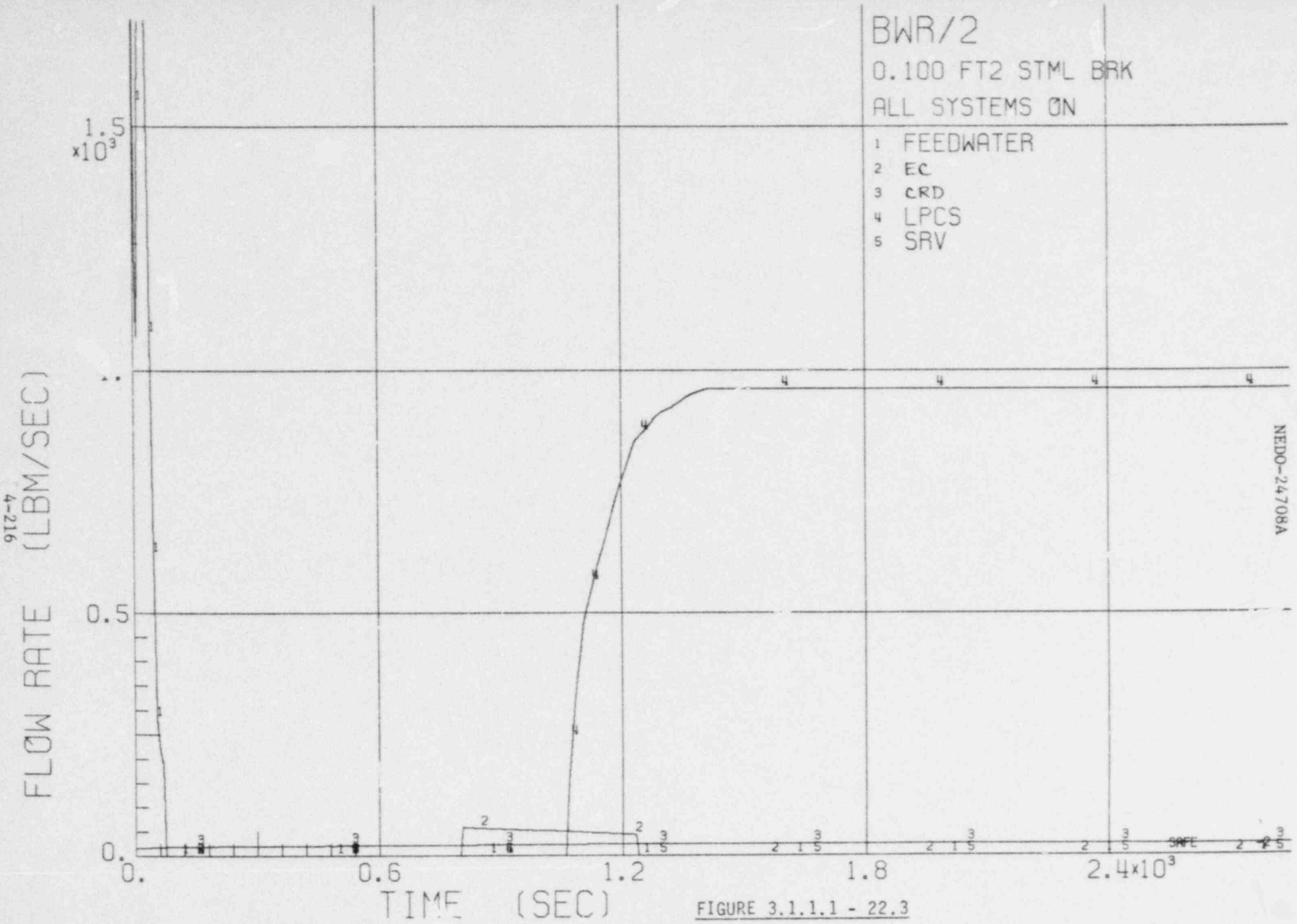
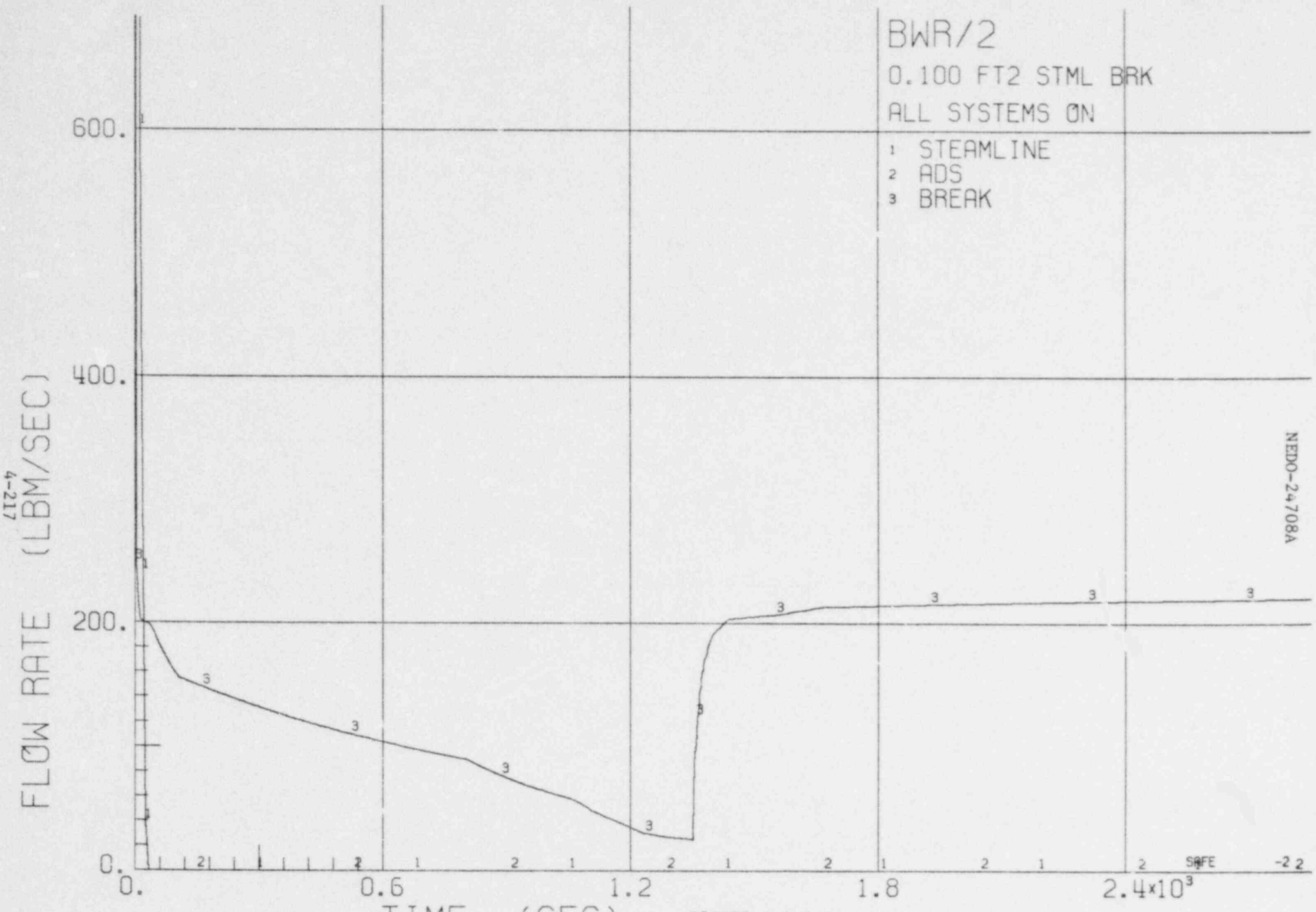


FIGURE 3.1.1.1 - 22.3



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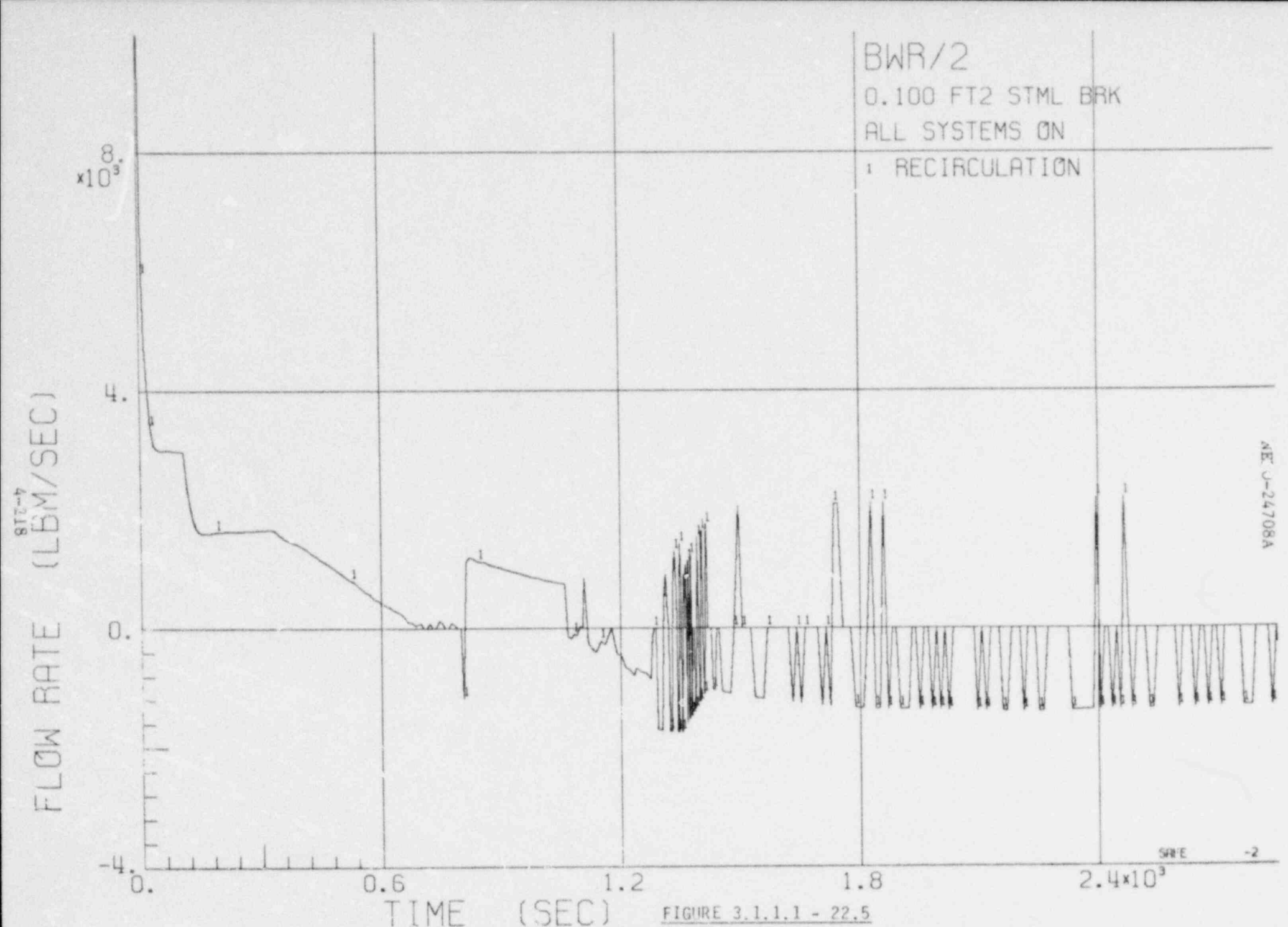

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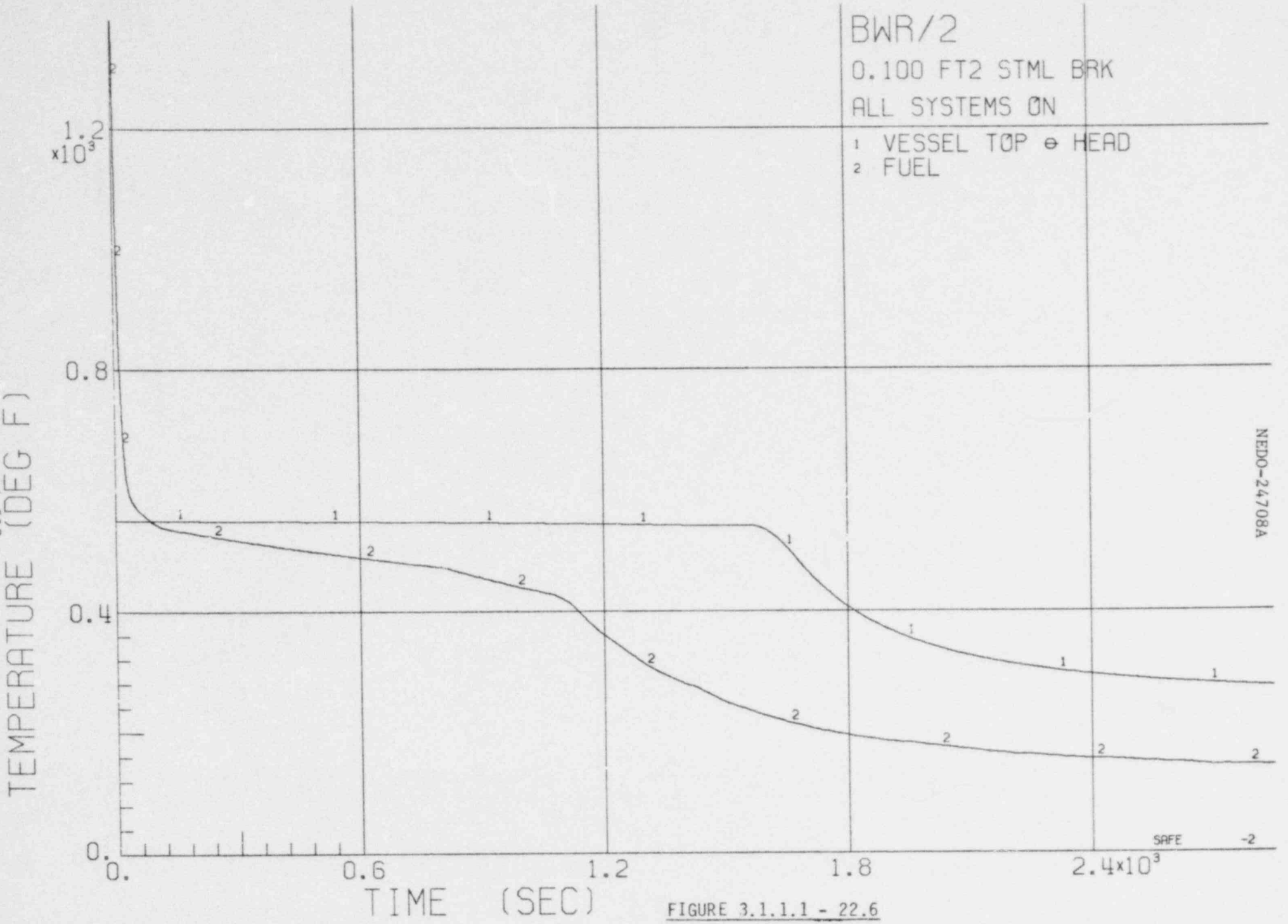

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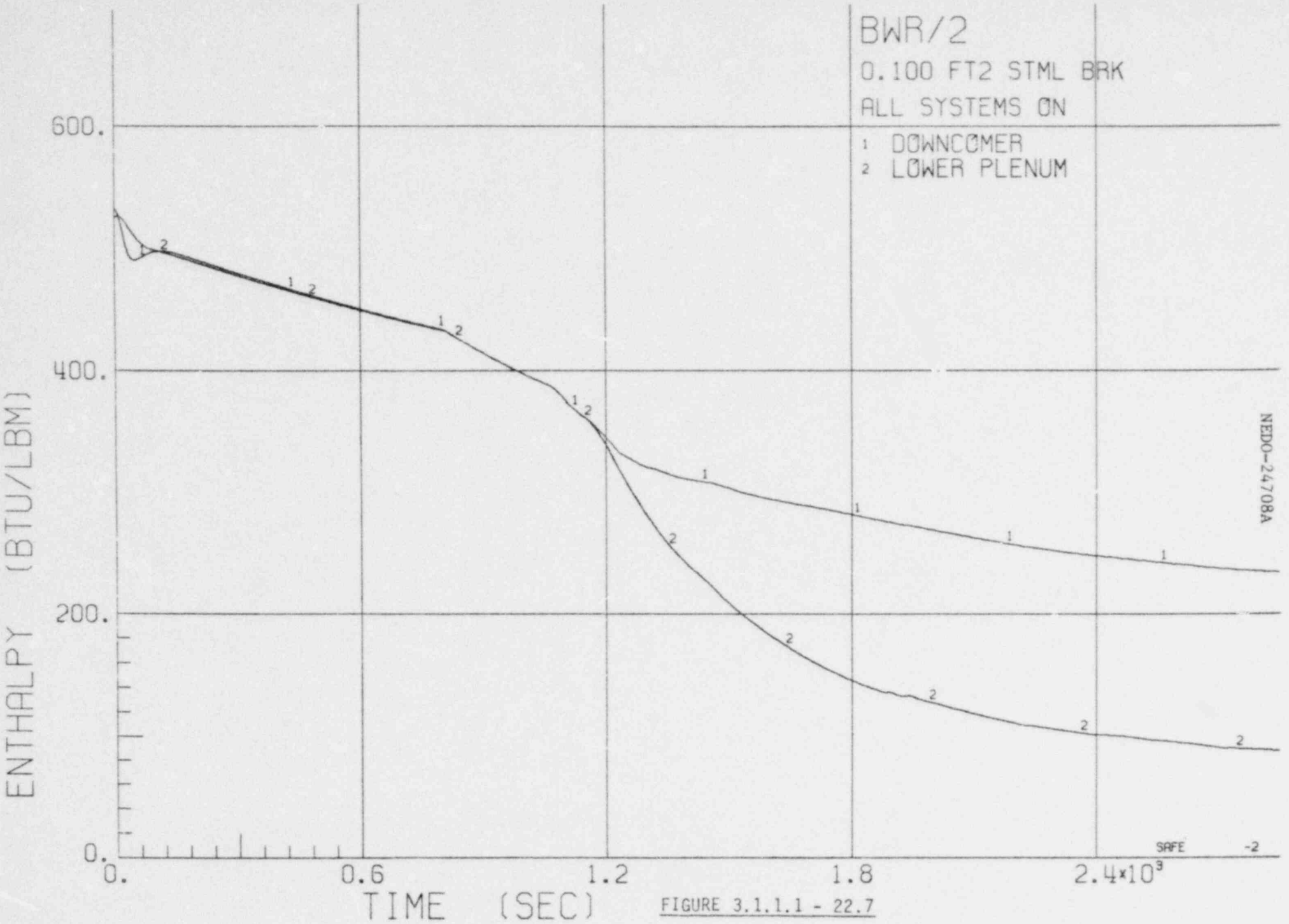

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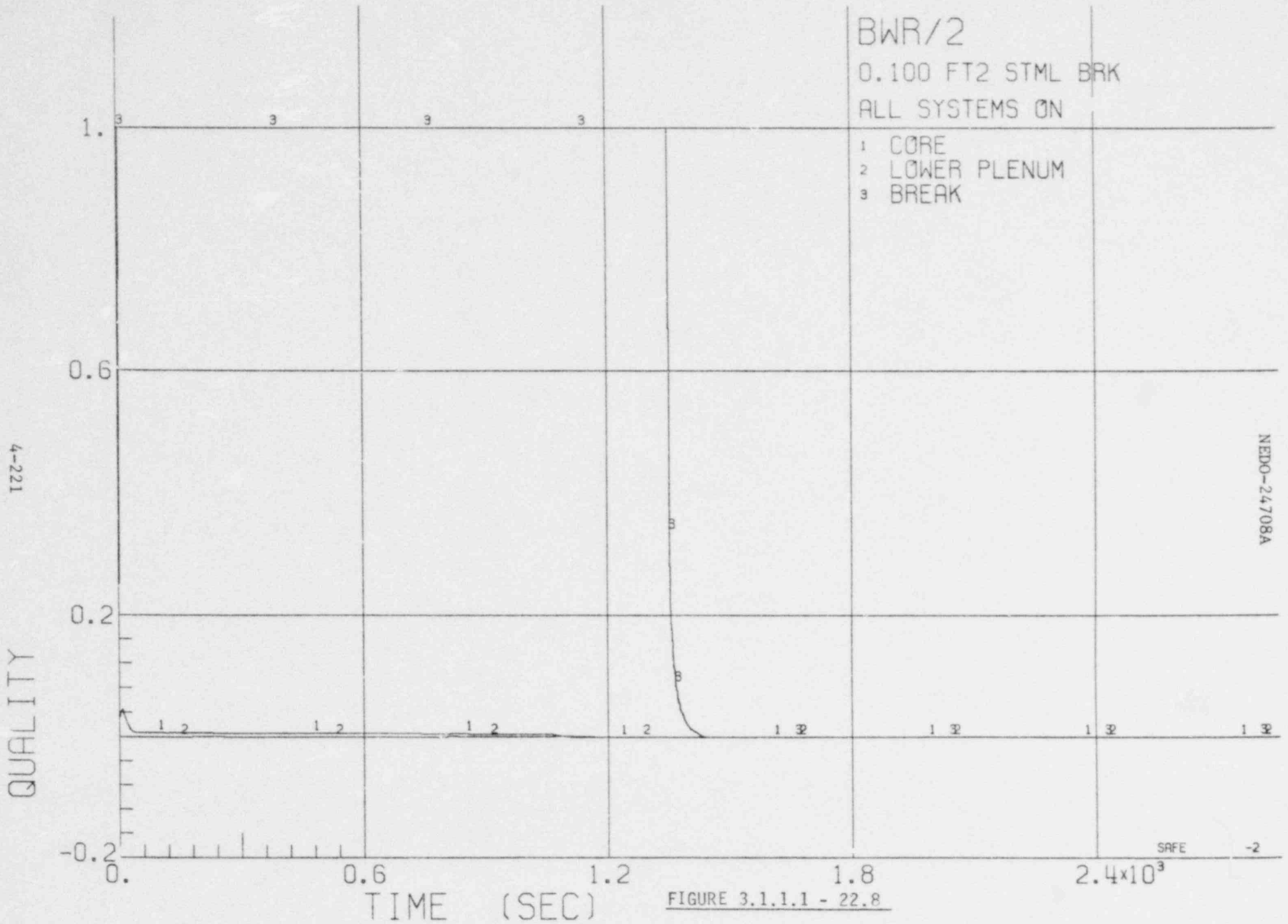

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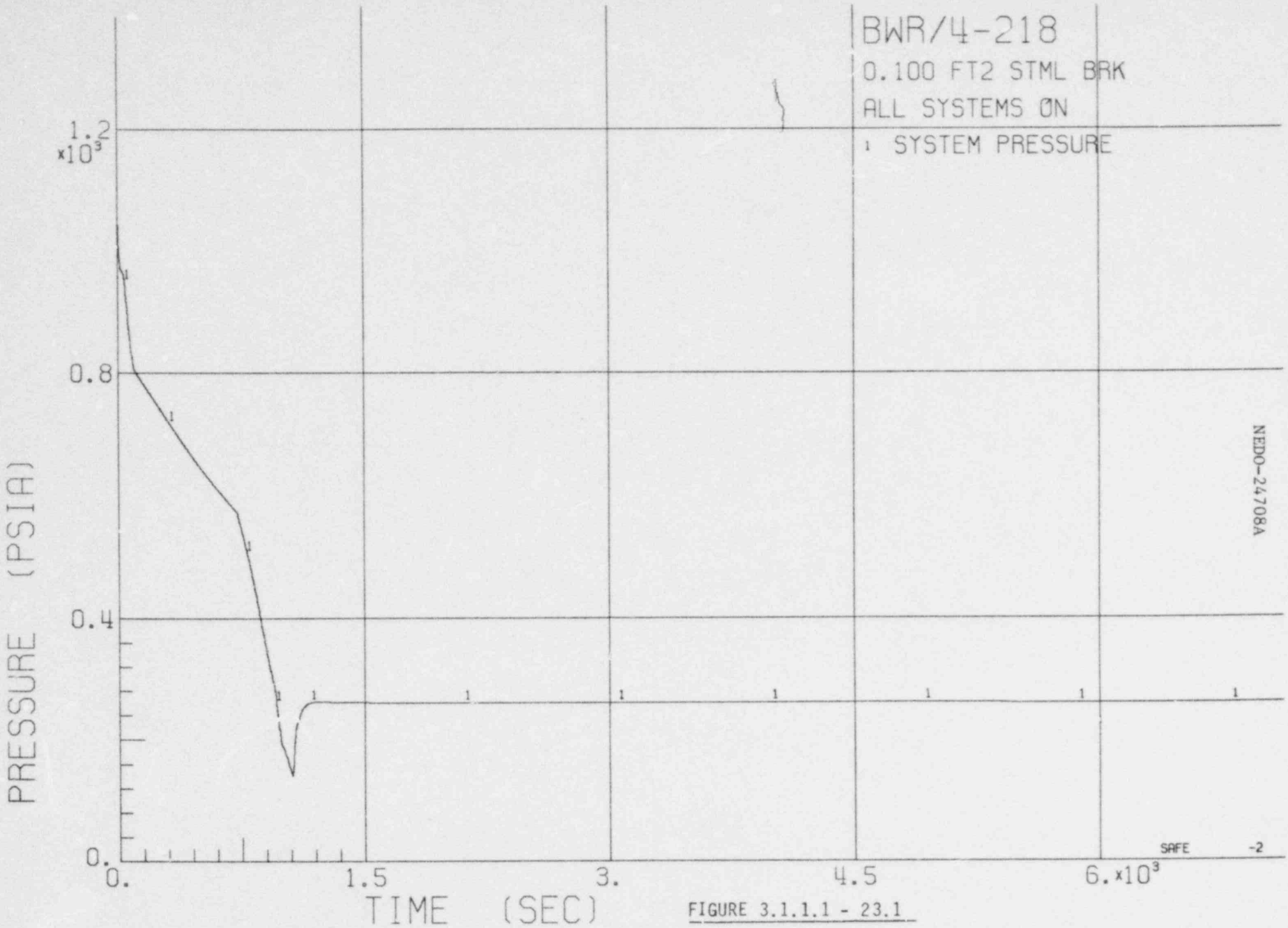
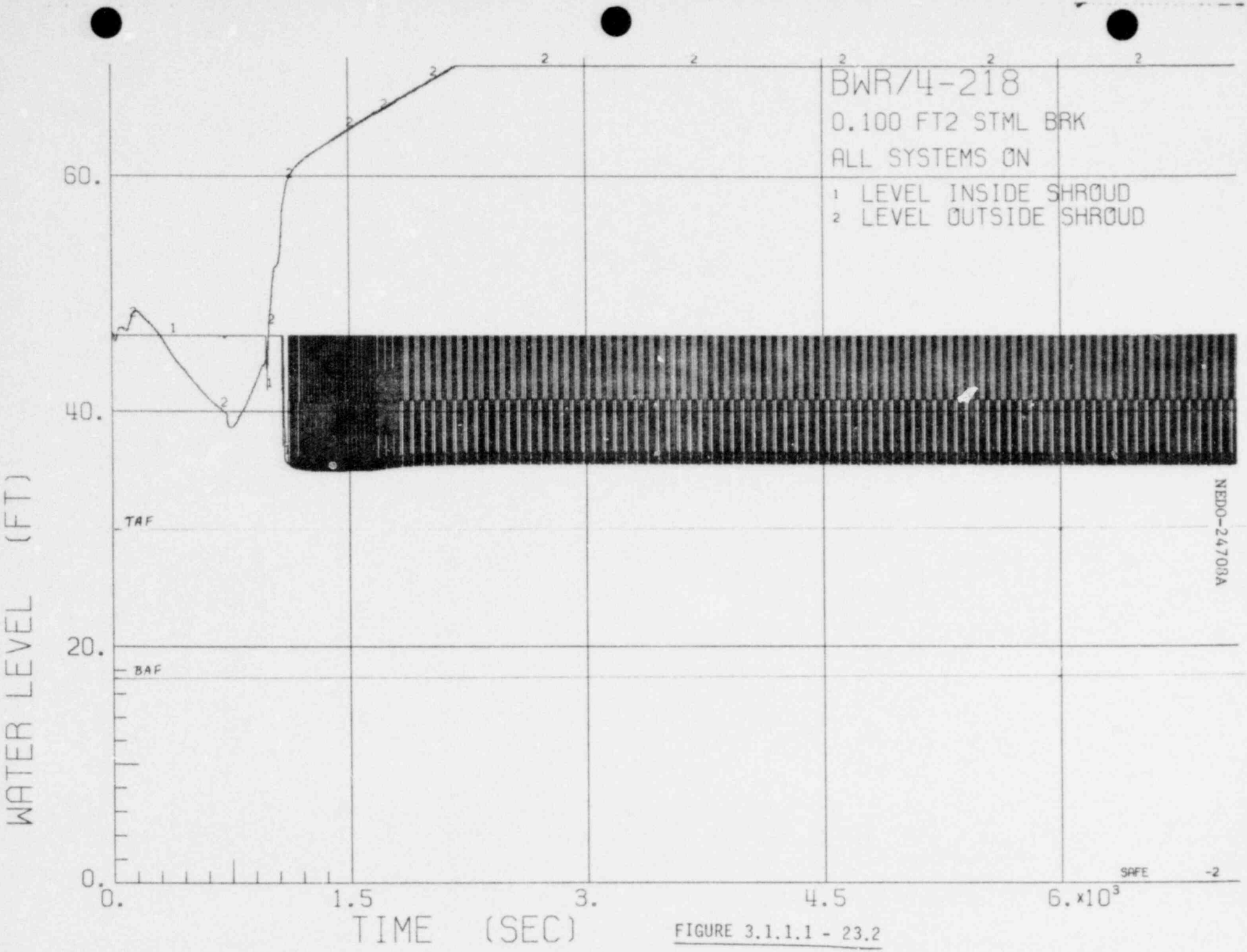


FIGURE 3.1.1.1 - 23.1



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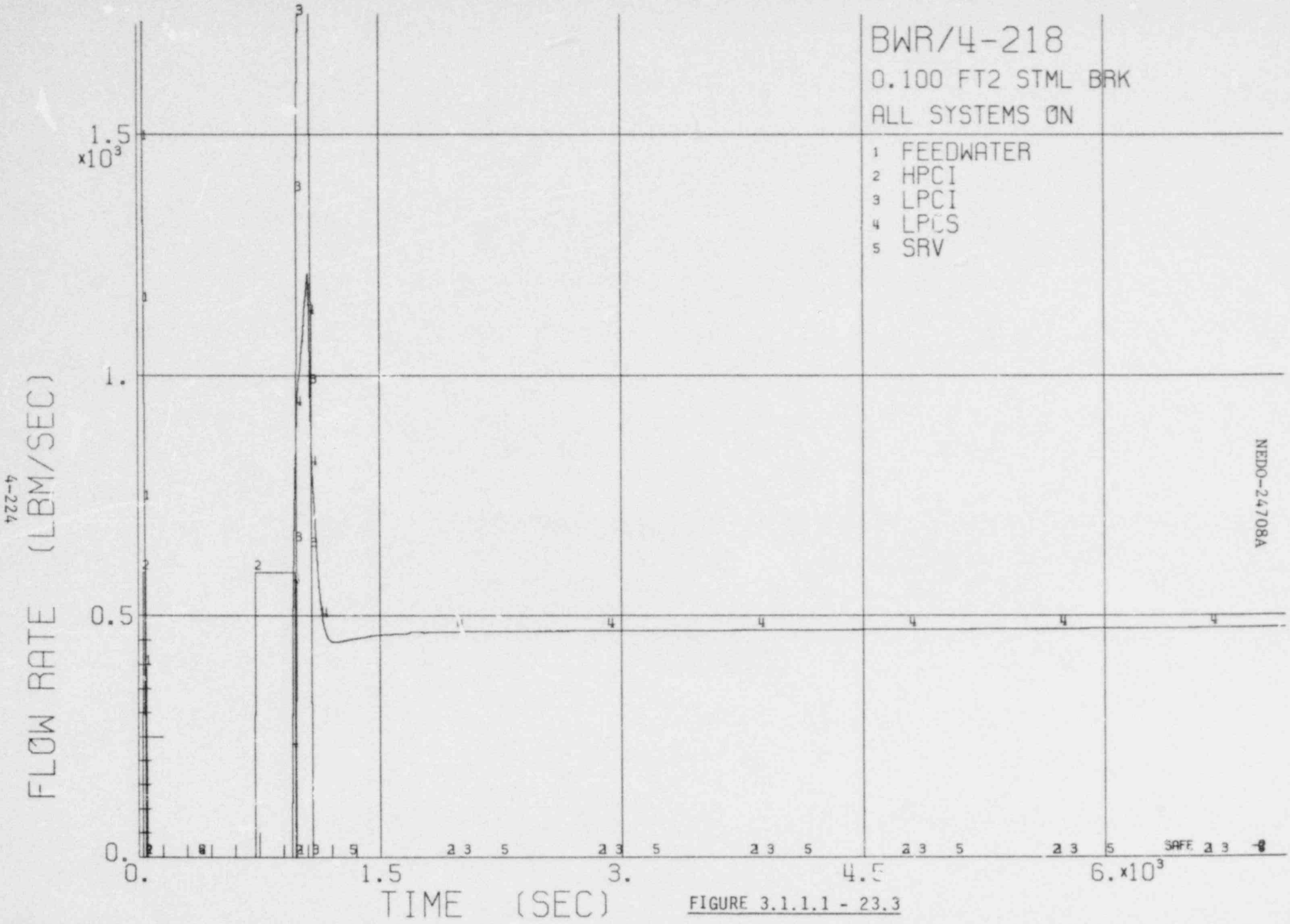

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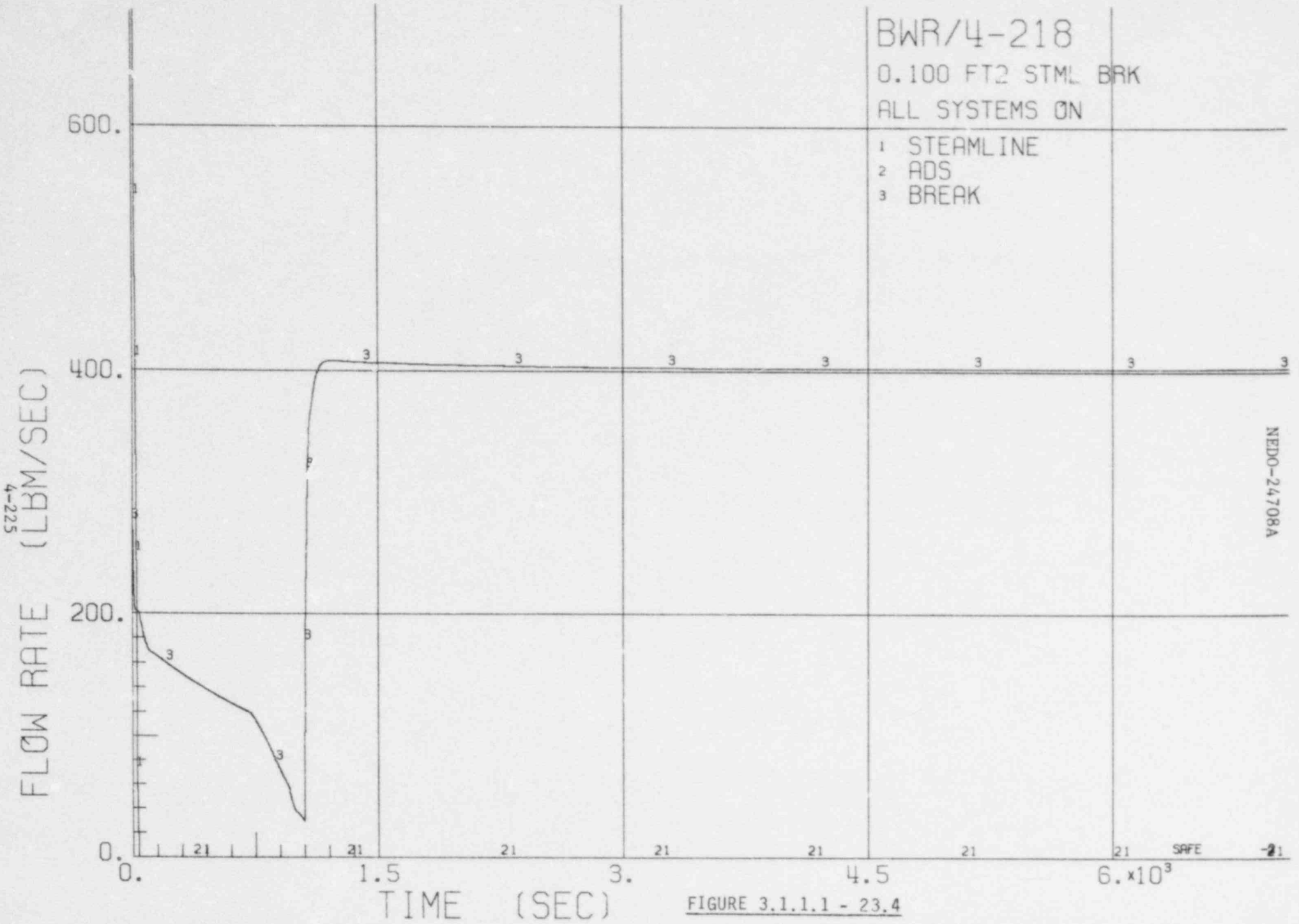

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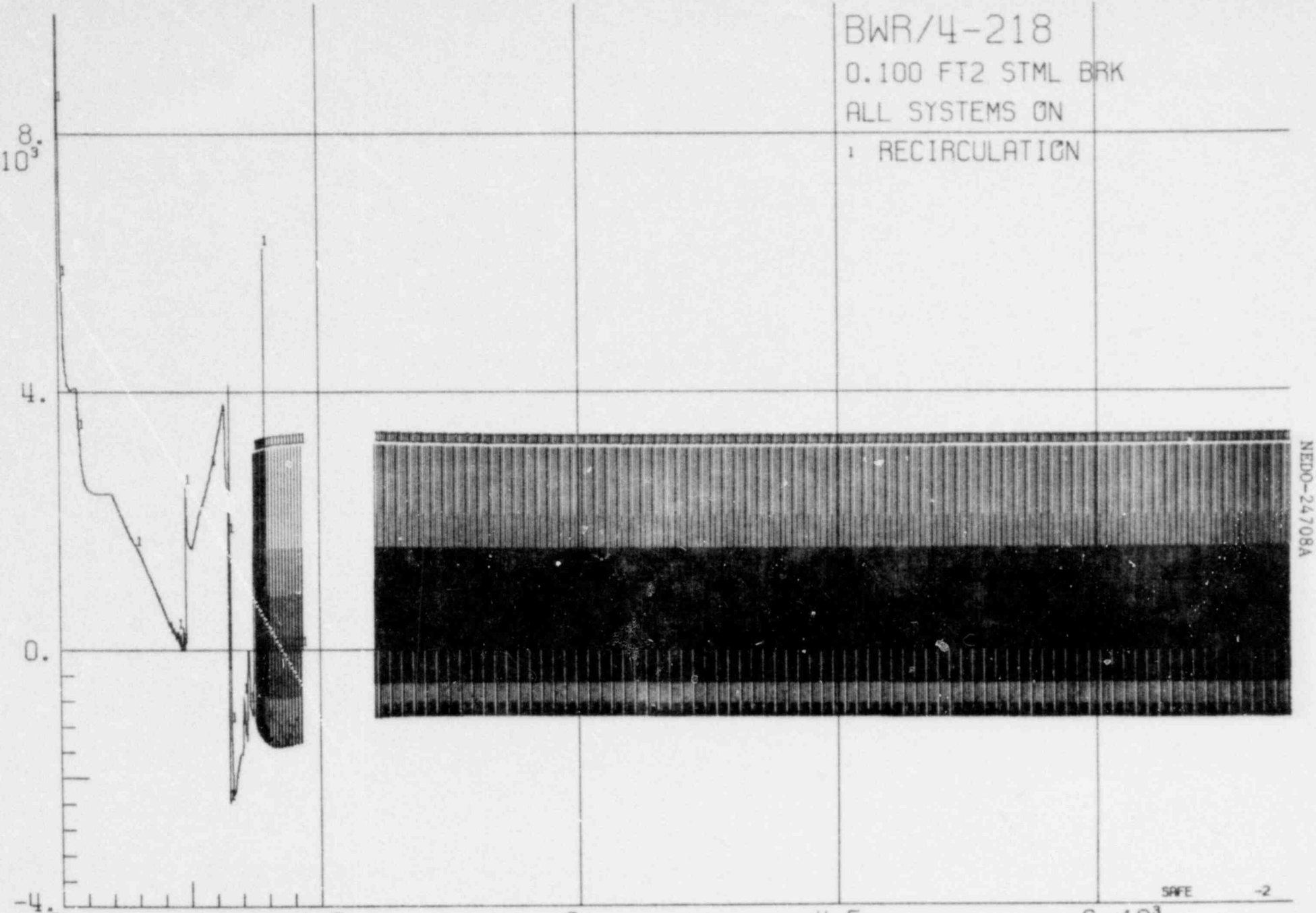

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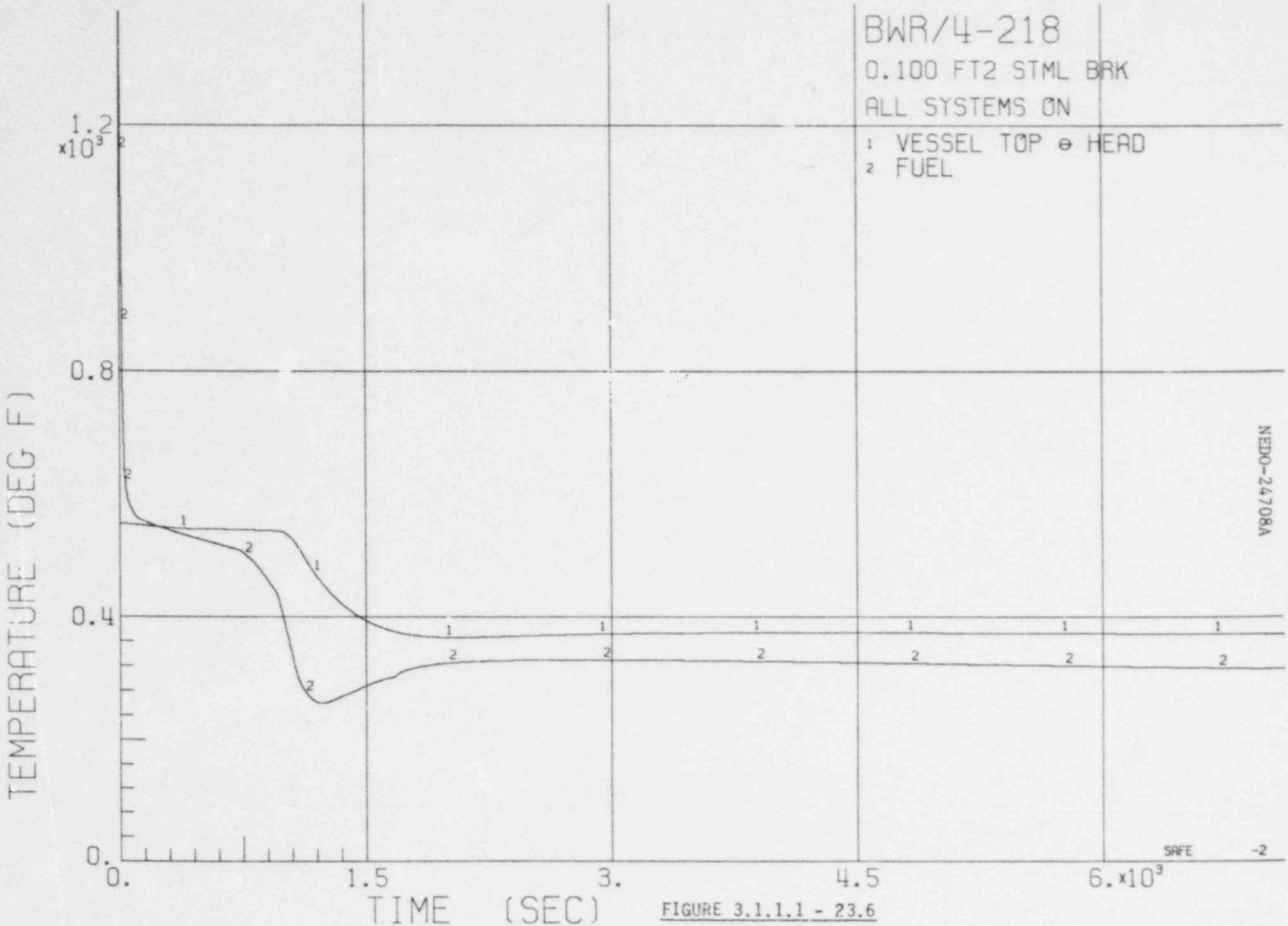

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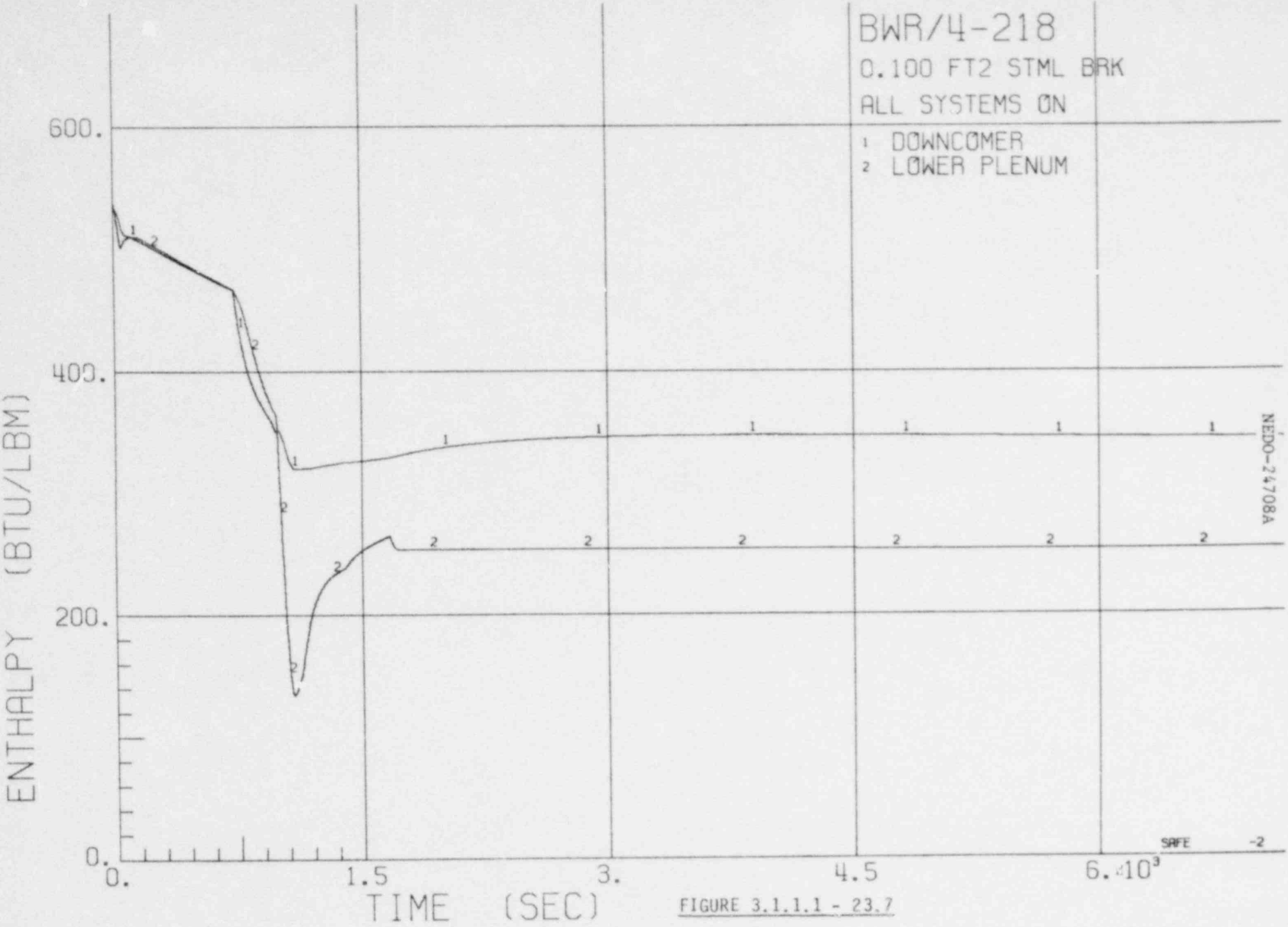

FIGURE 3.1.1.1 - 23.7

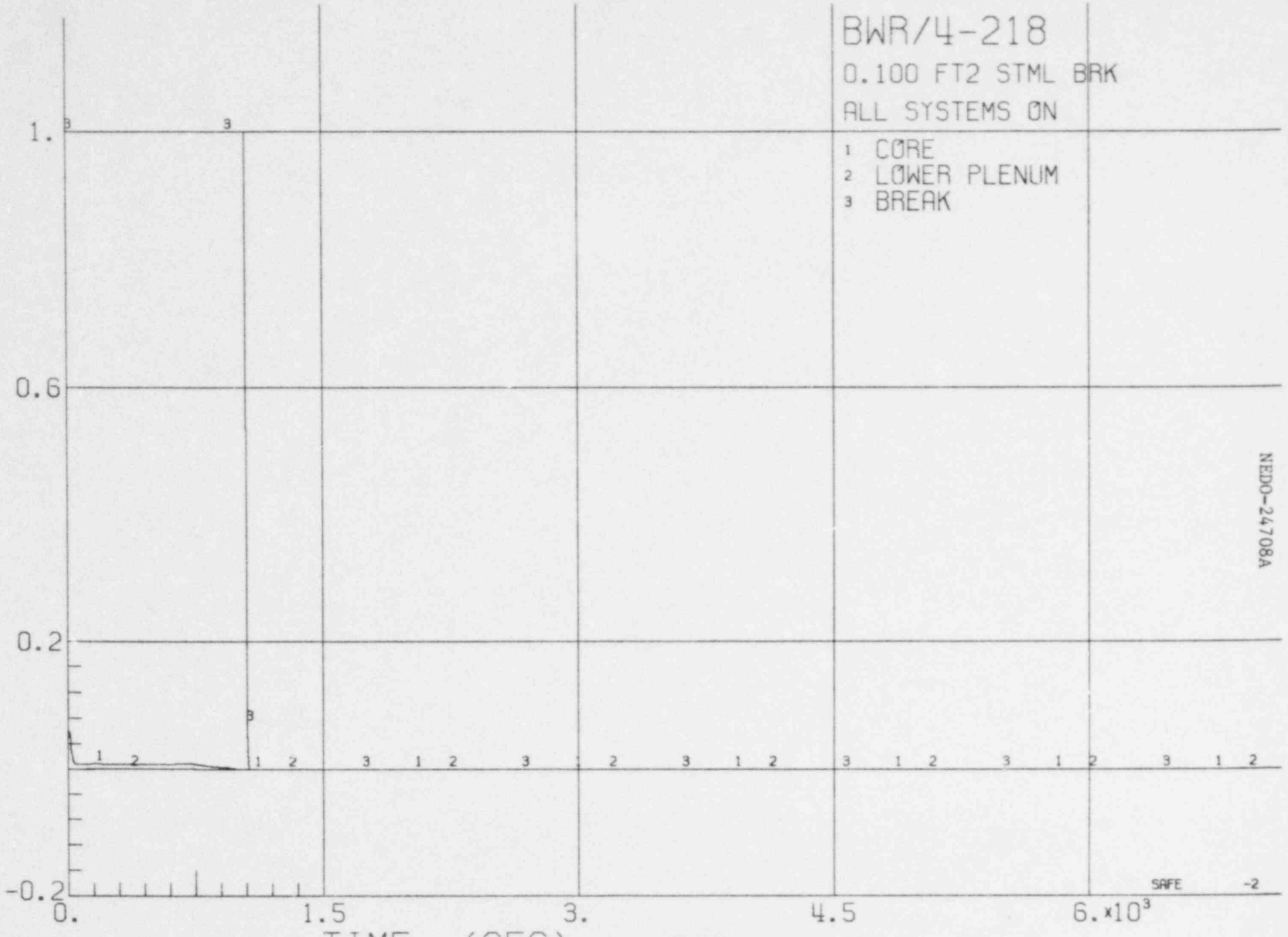

FIGURE 3.1.1.1 - 23.8

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FIGURE 3.1.1.1 - 24.1

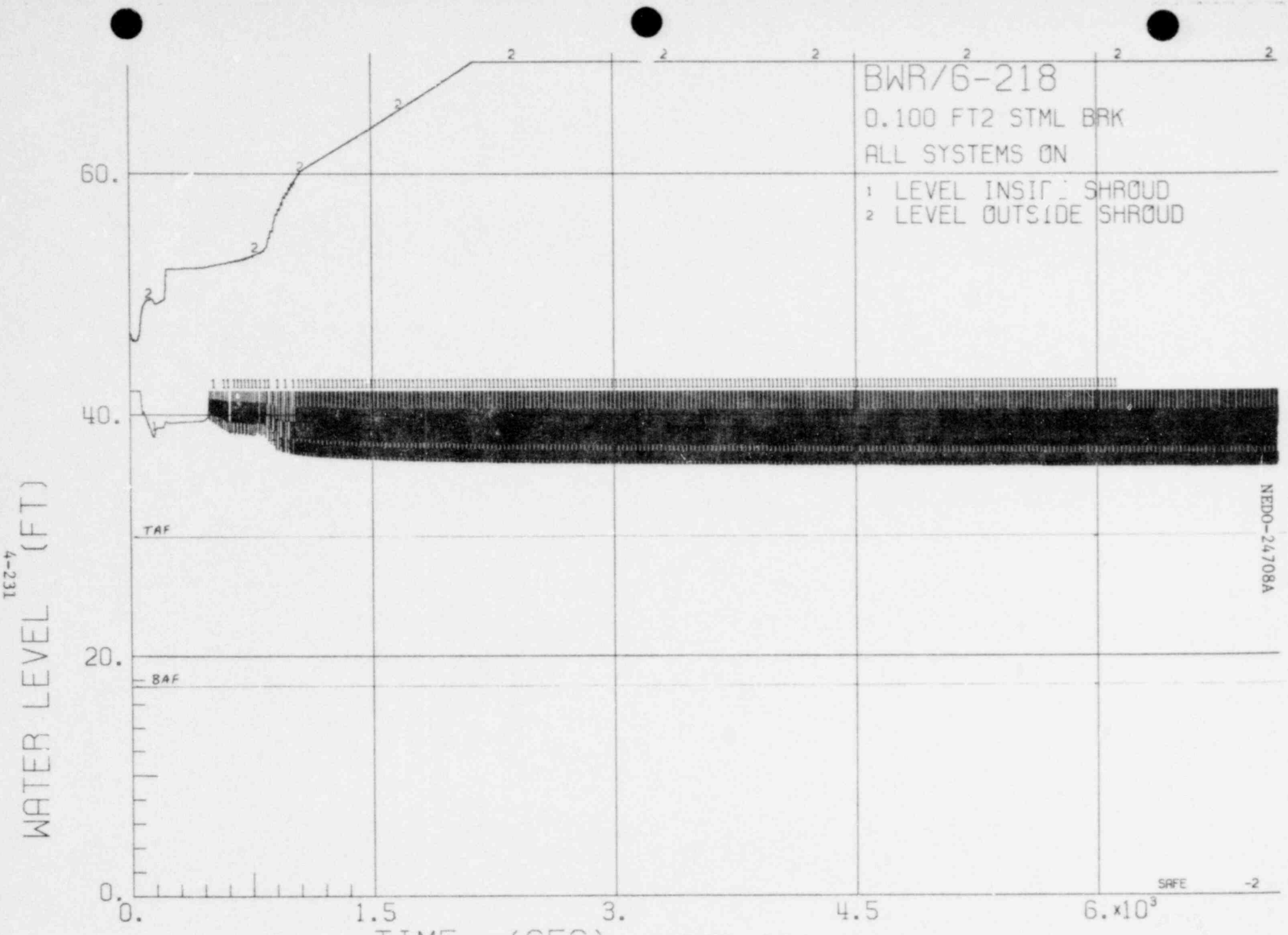

FIGURE 3.1.1.1 - 24.2

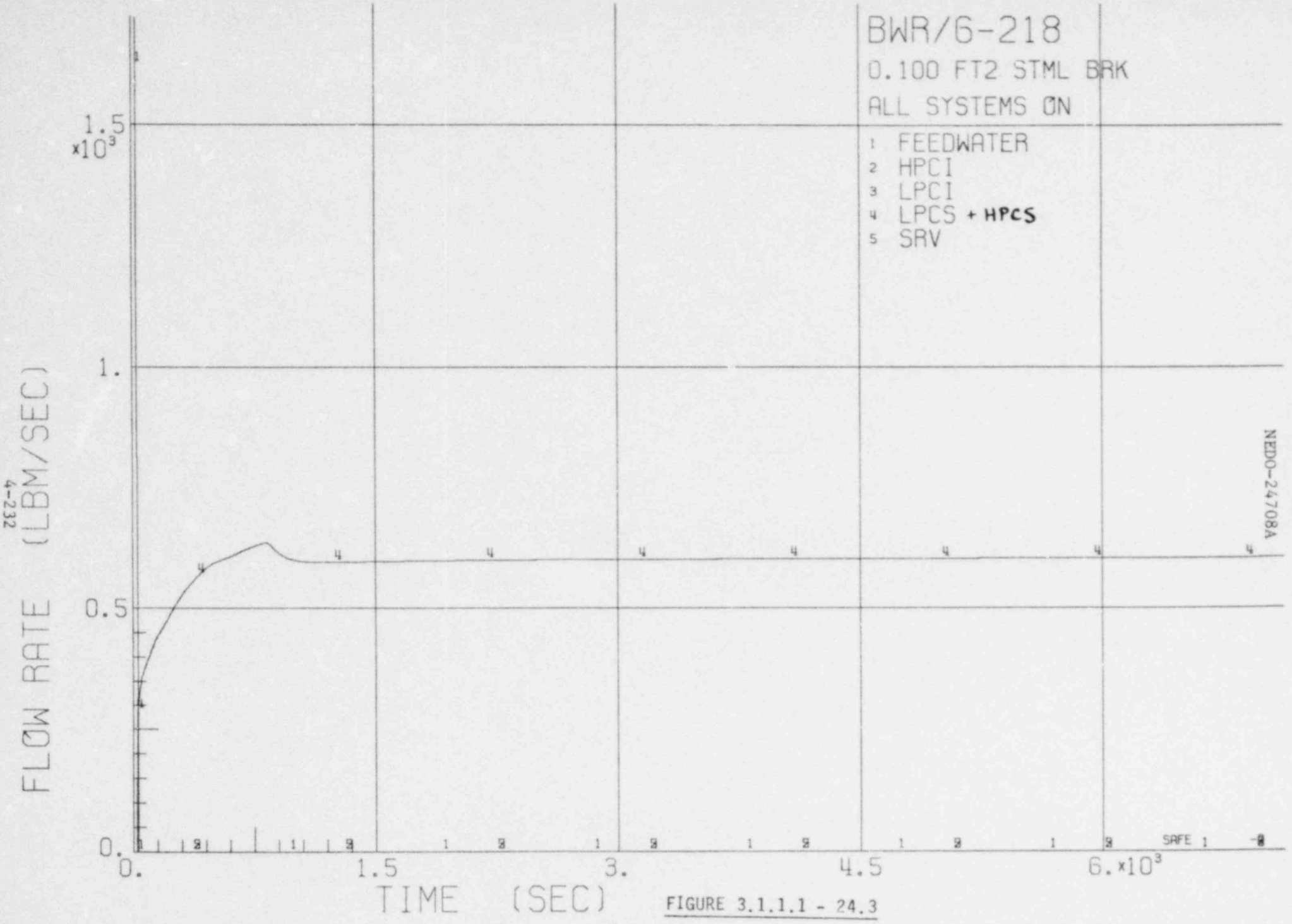

FIGURE 3.1.1.1 - 24.3

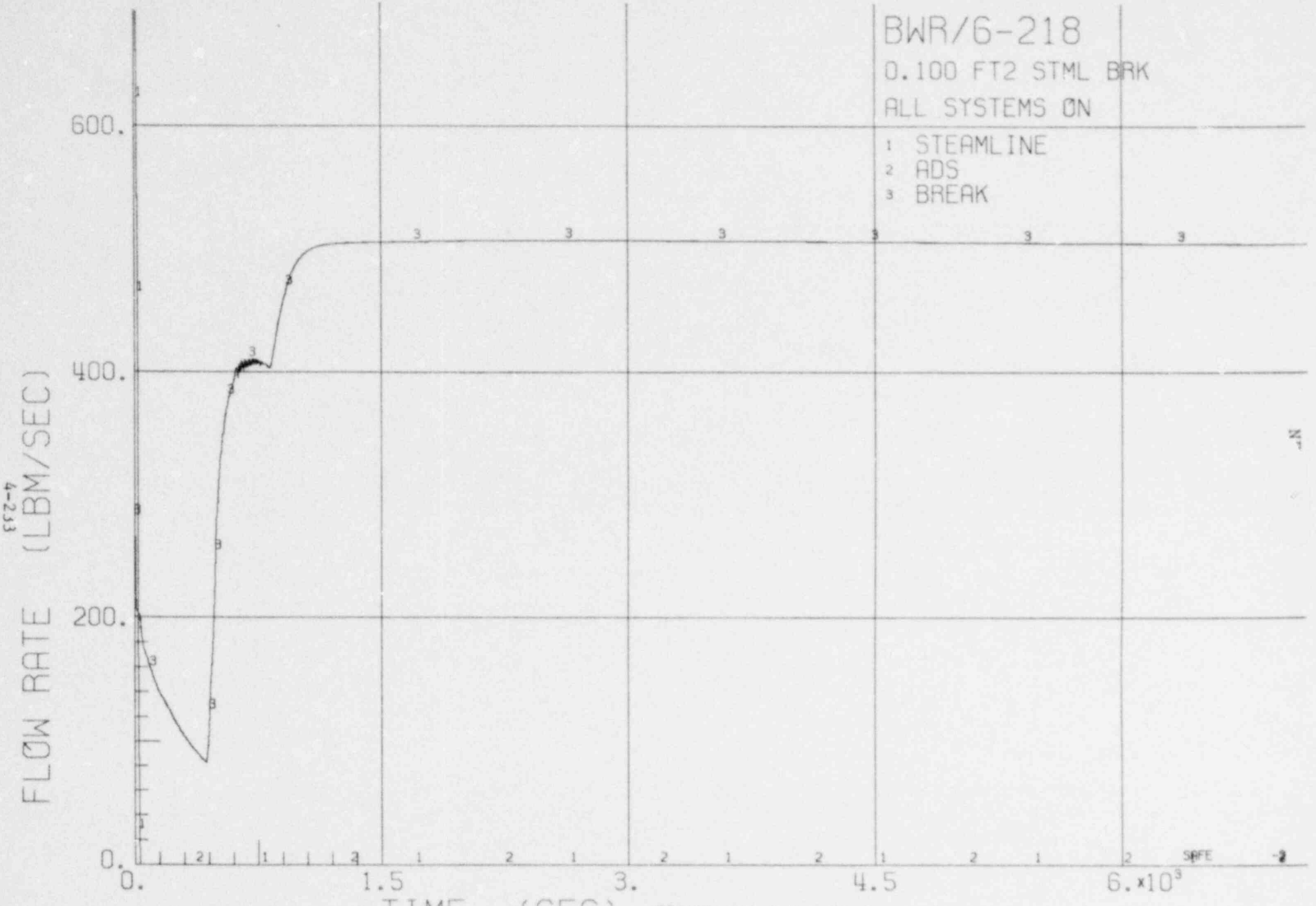

FIGURE 3.1.1.1 - 24.4

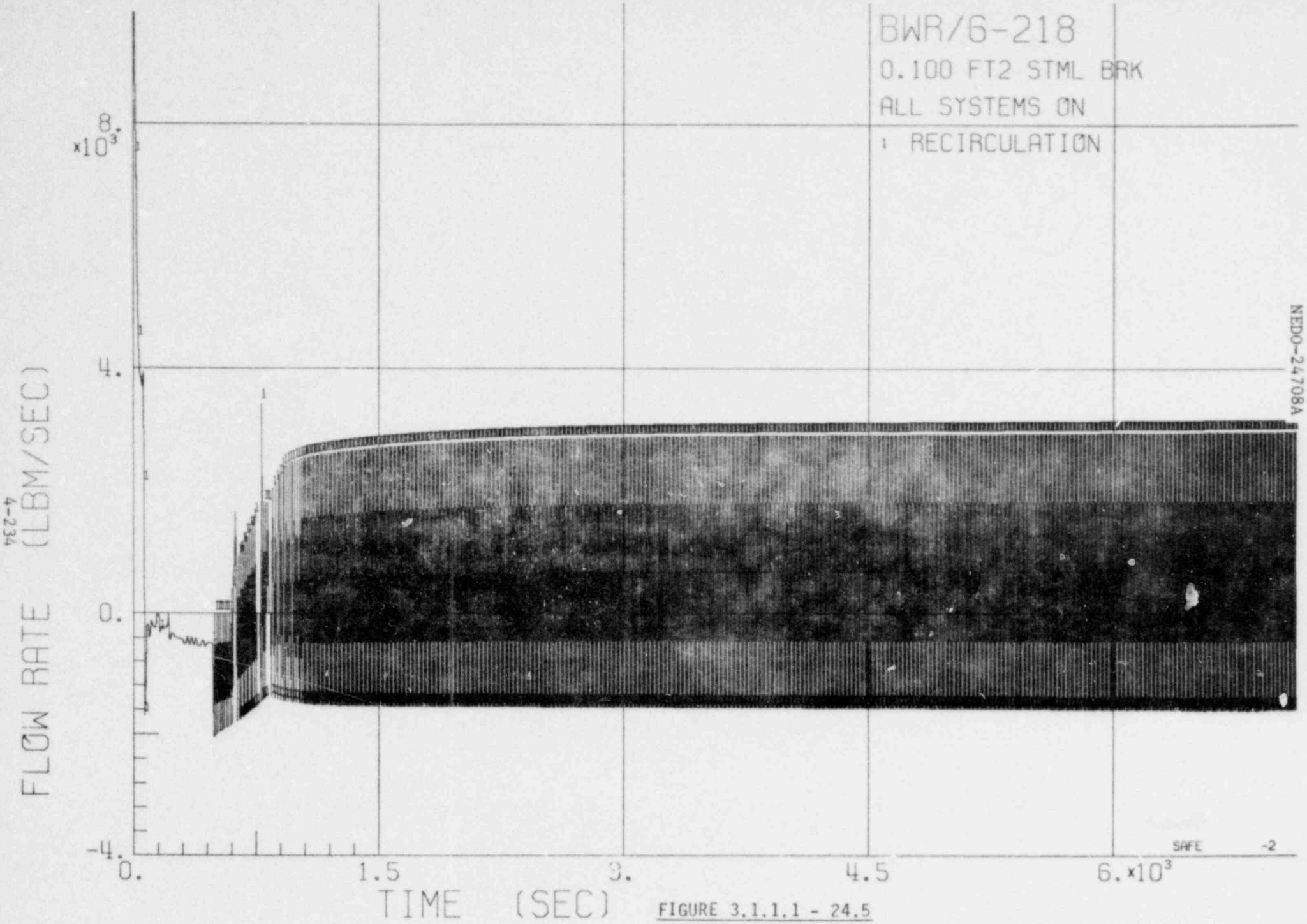

FIGURE 3.1.1.1 - 24.5

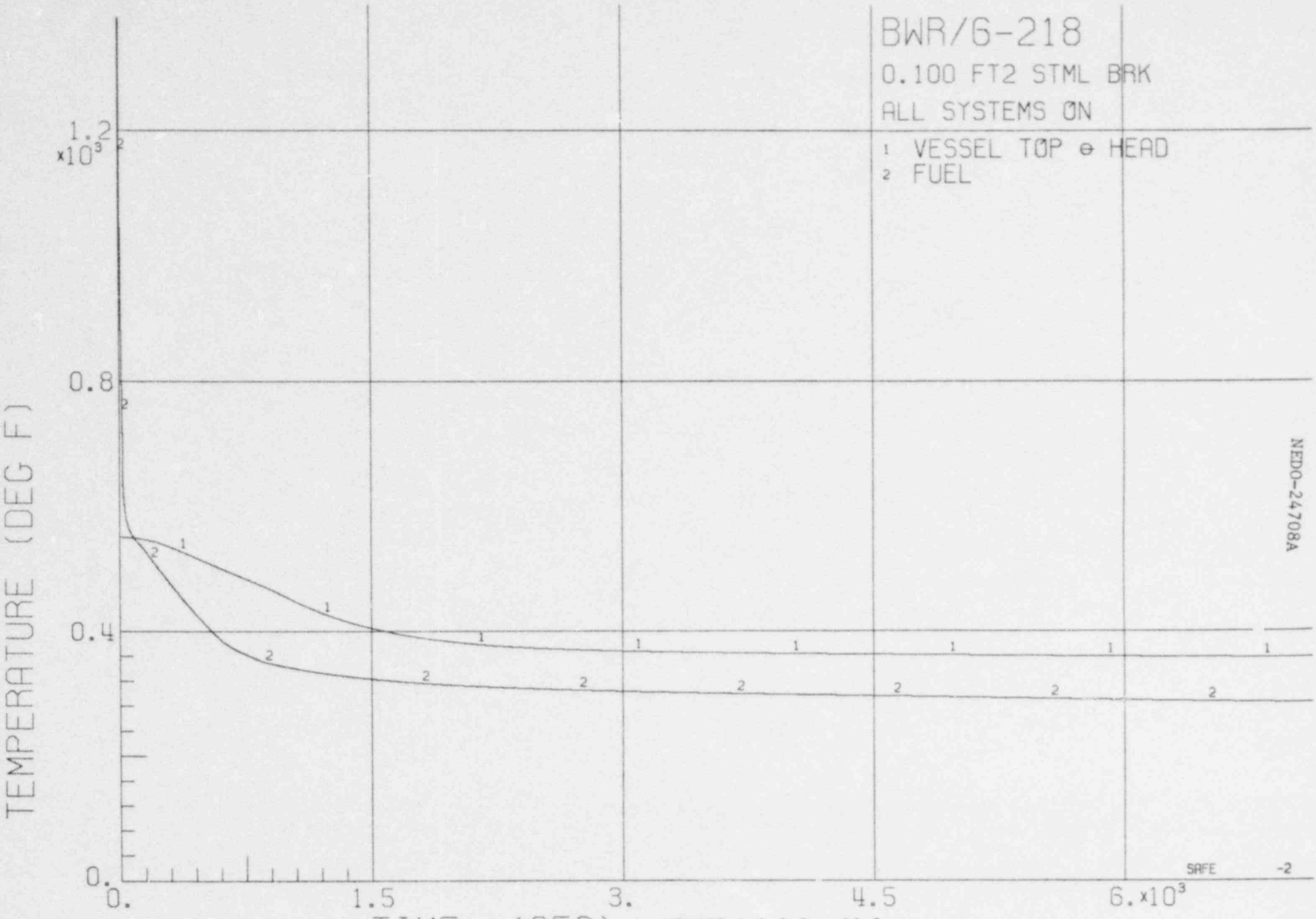

FIGURE 3.1.1.1 - 24.6

FIGURE 3.7.1.1 - 24.7

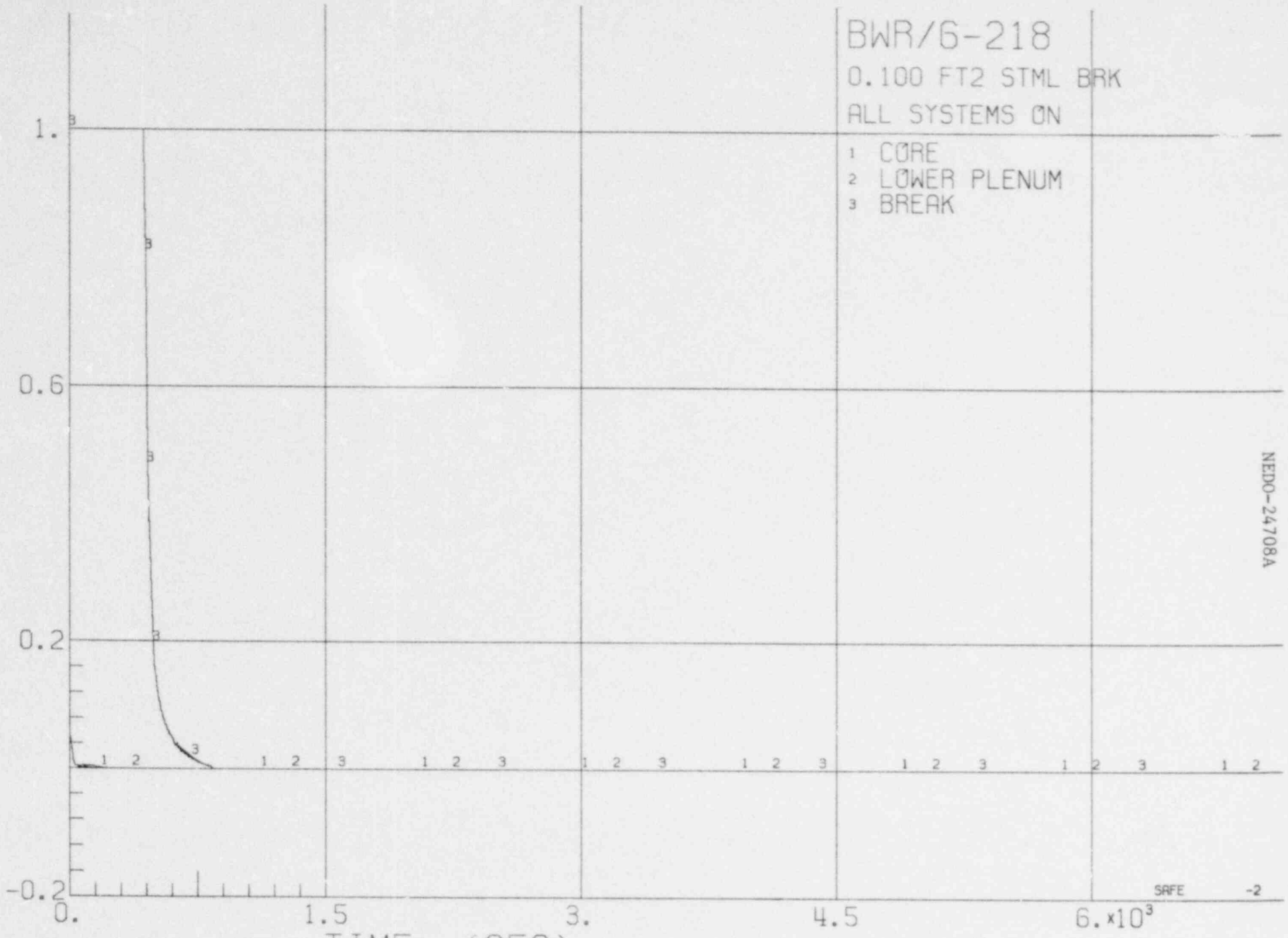

FIGURE 3.1.1.1 - 24.8

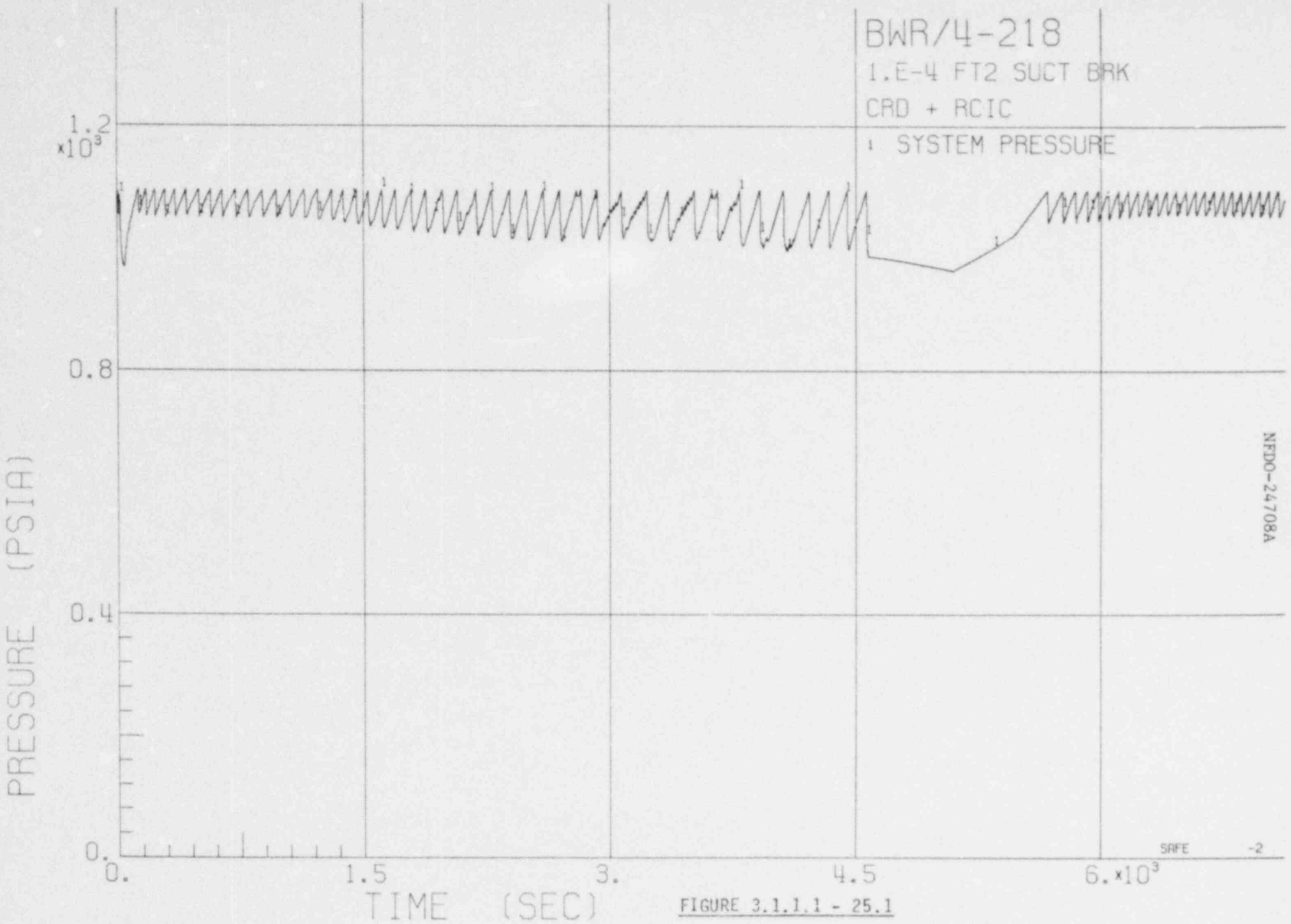

FIGURE 3.1.1.1 - 25.1

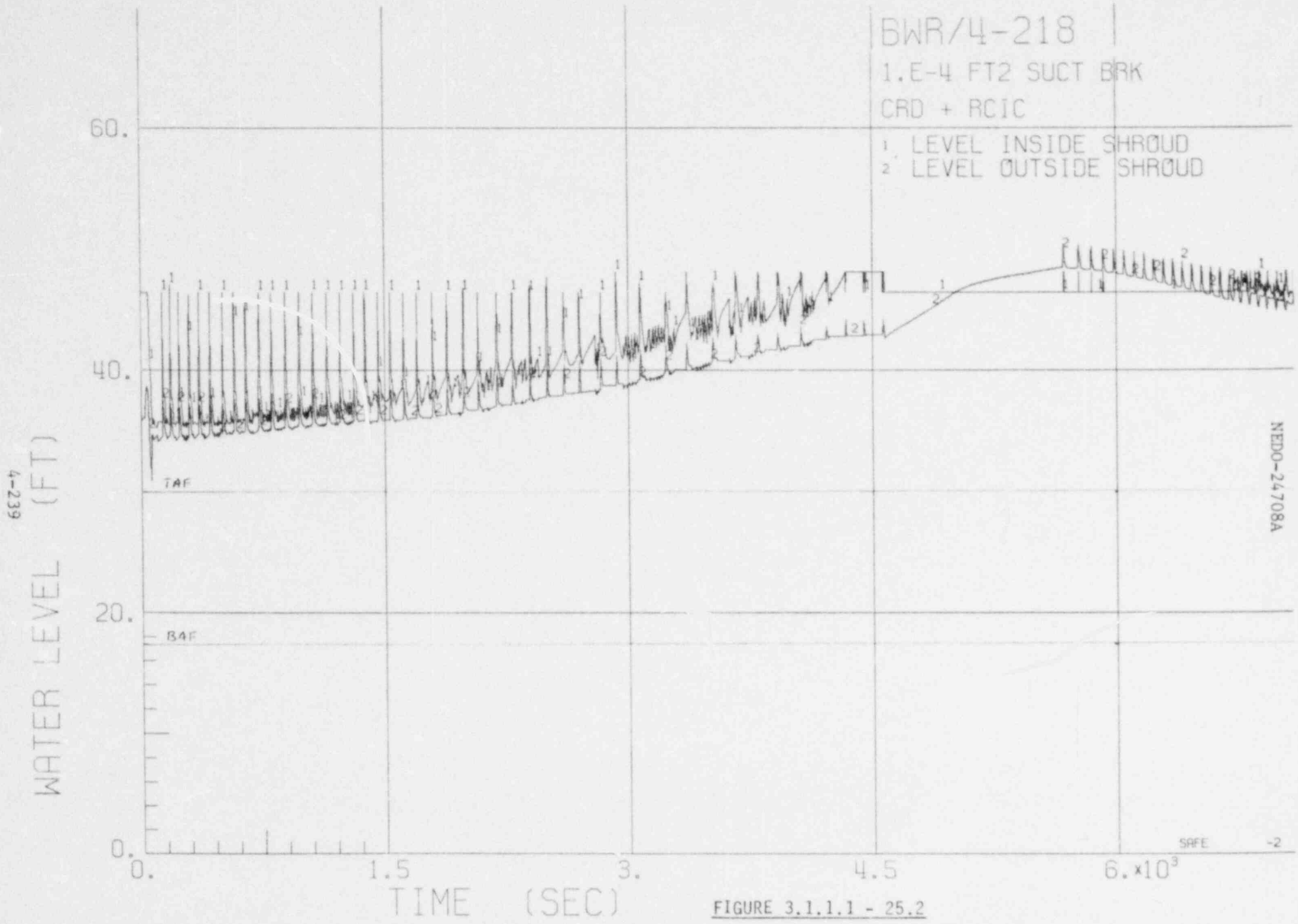

FIGURE 3.1.1.1 - 25.2

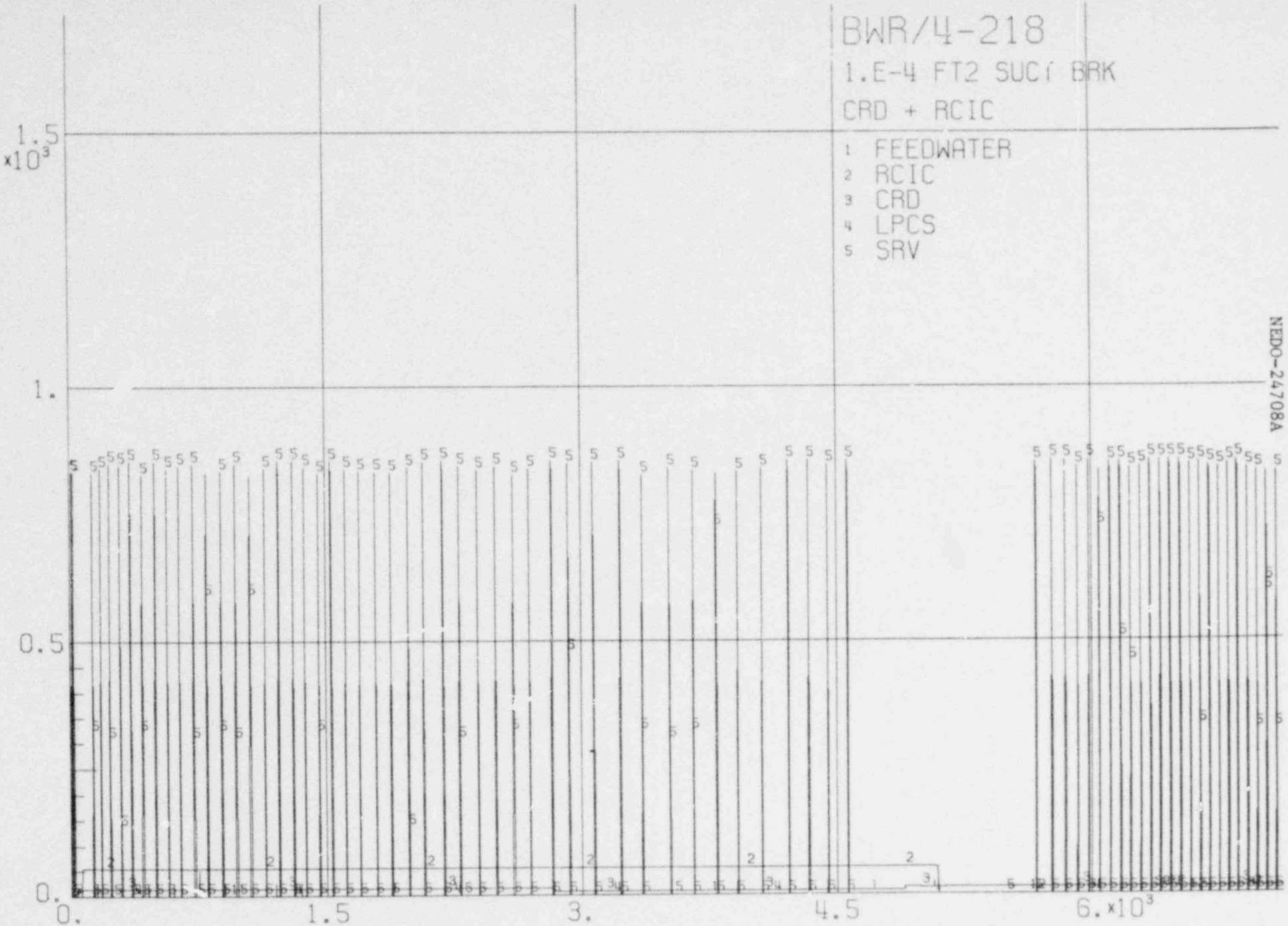

FIGURE 3.1.1.1 - 25.3

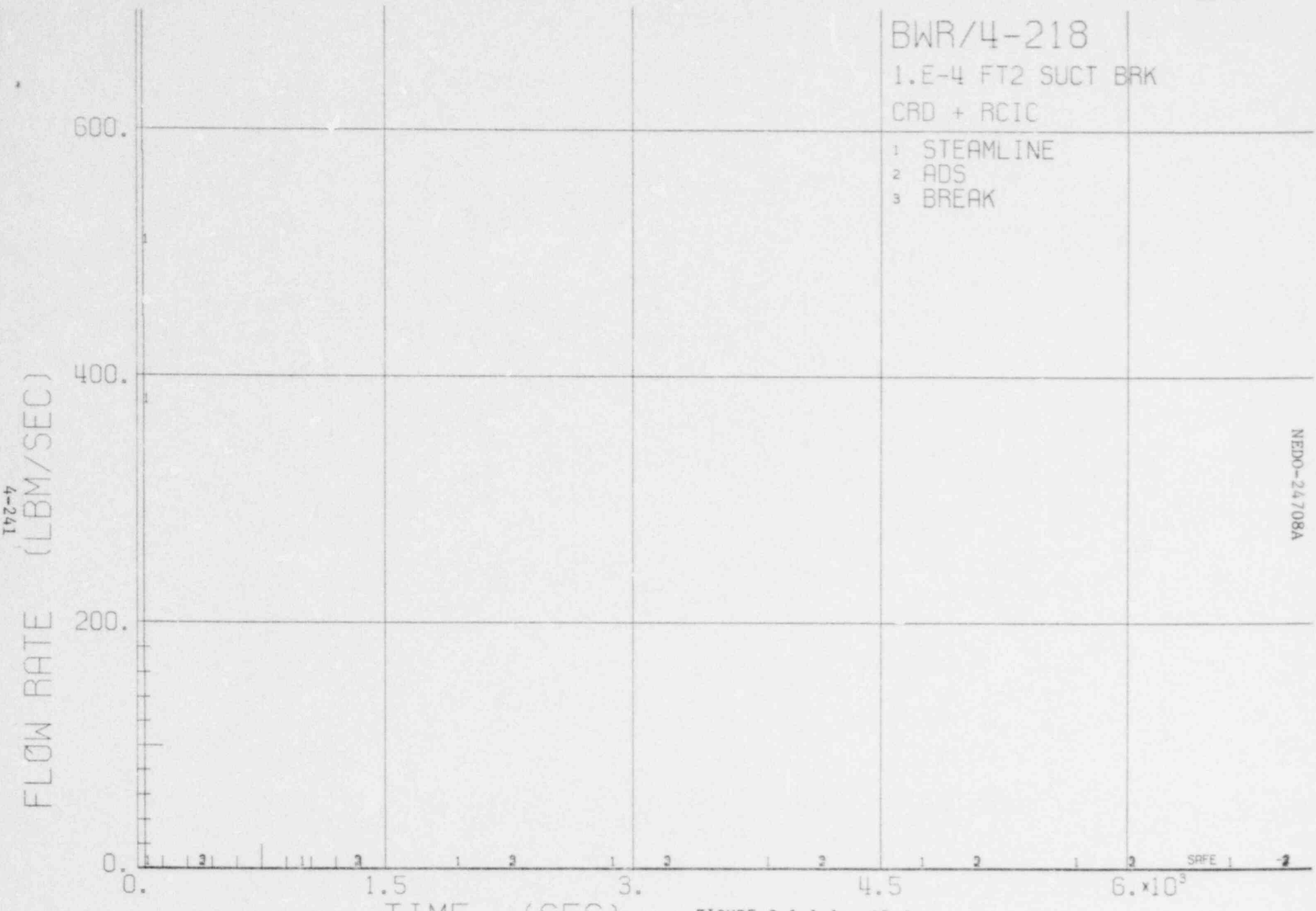

FIGURE 3.1.1.1 - 25.4

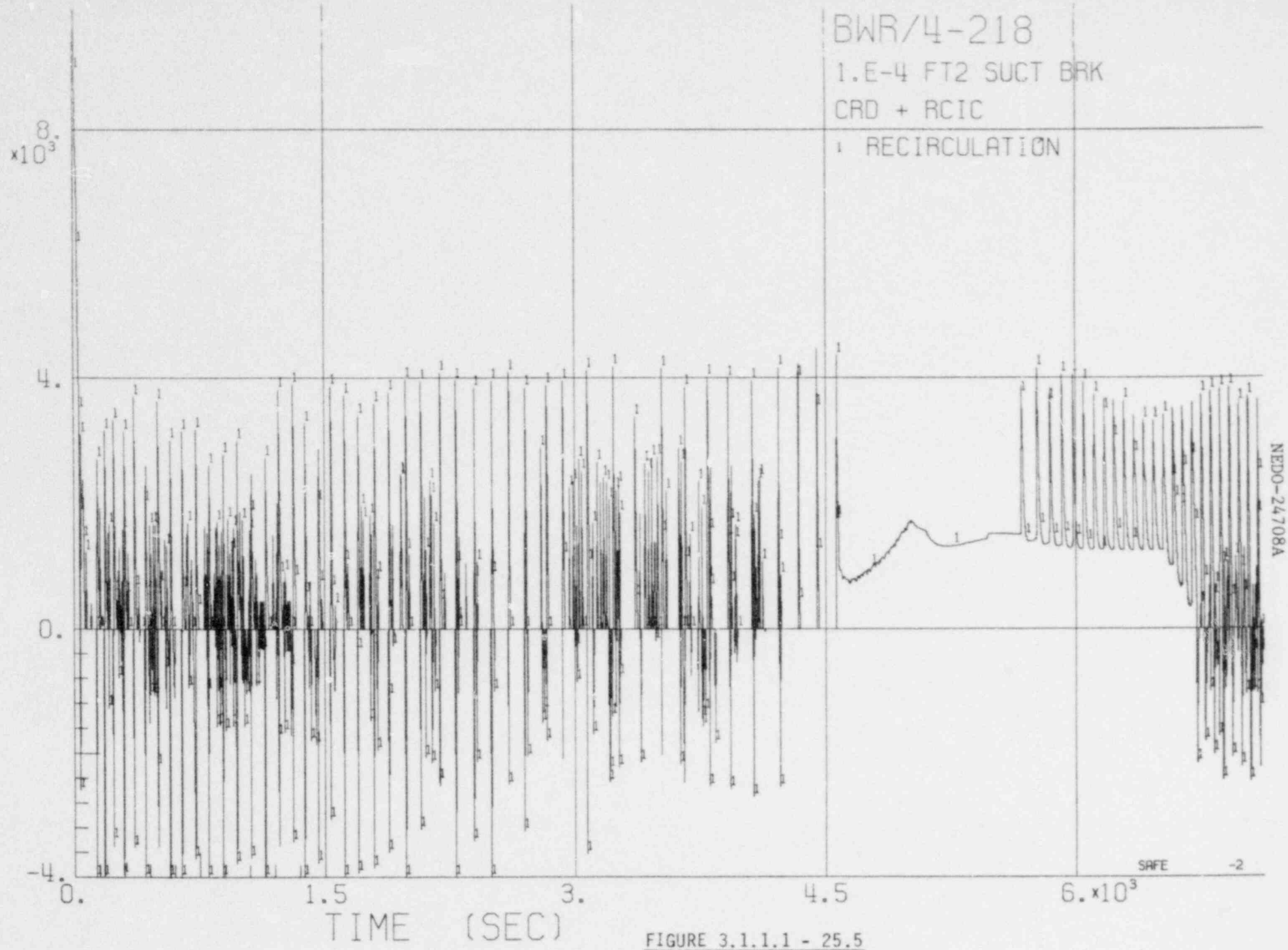

FIGURE 3.1.1.1 - 25.5

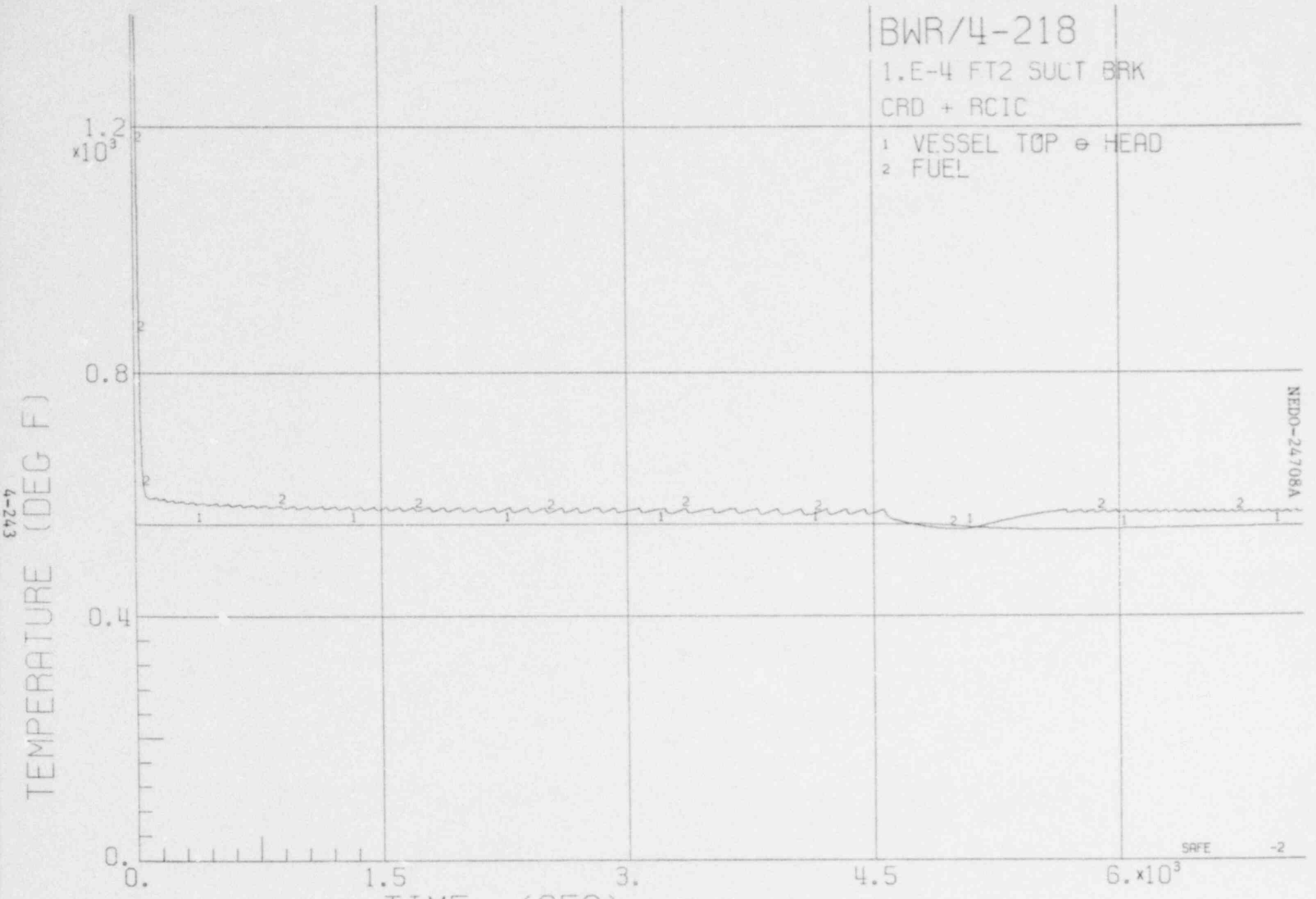

FIGURE 3.1.1.1 - 25.6

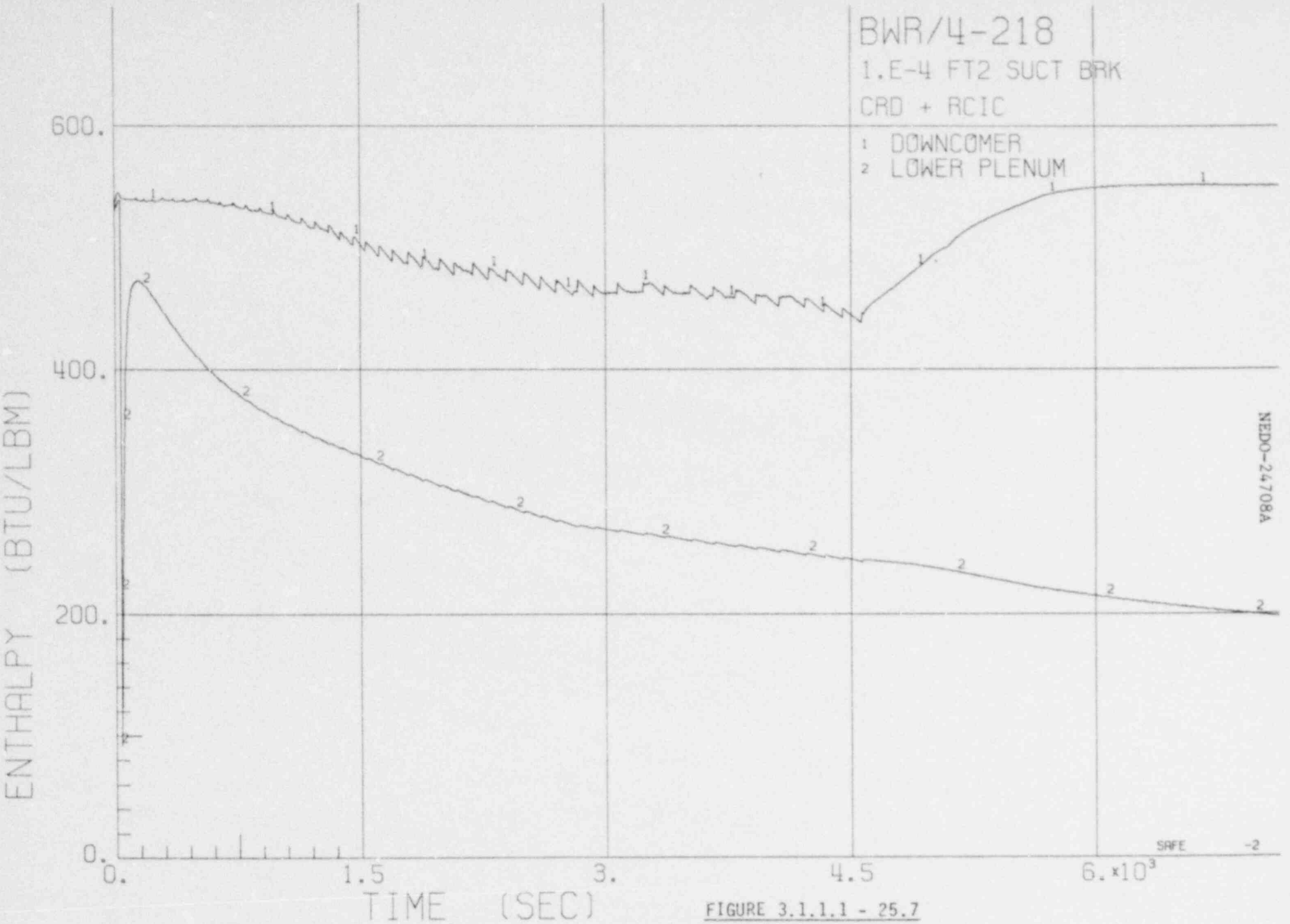

FIGURE 3.1.1.1 - 25.7

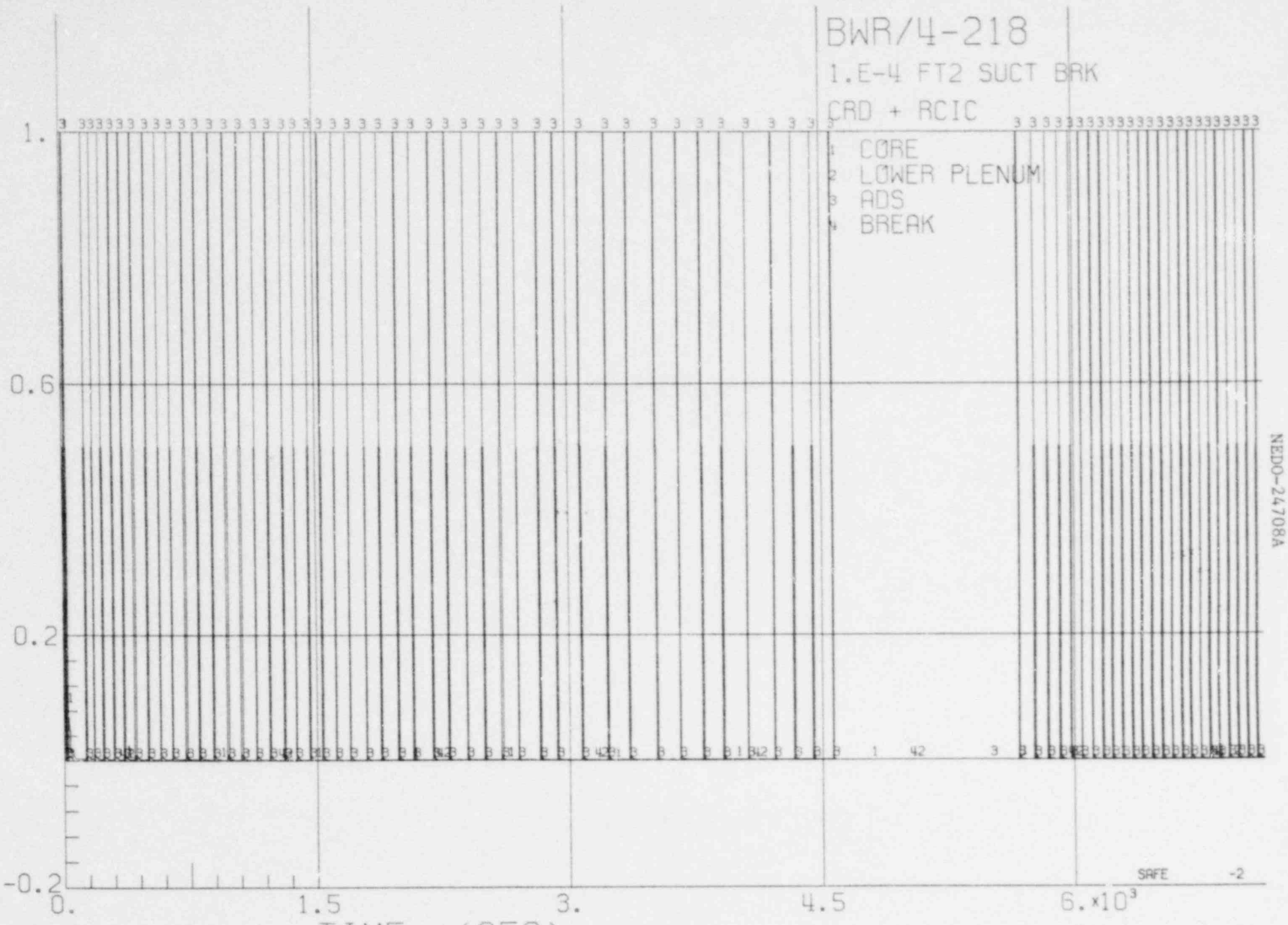

FIGURE 3.1.1.1 - 25.8

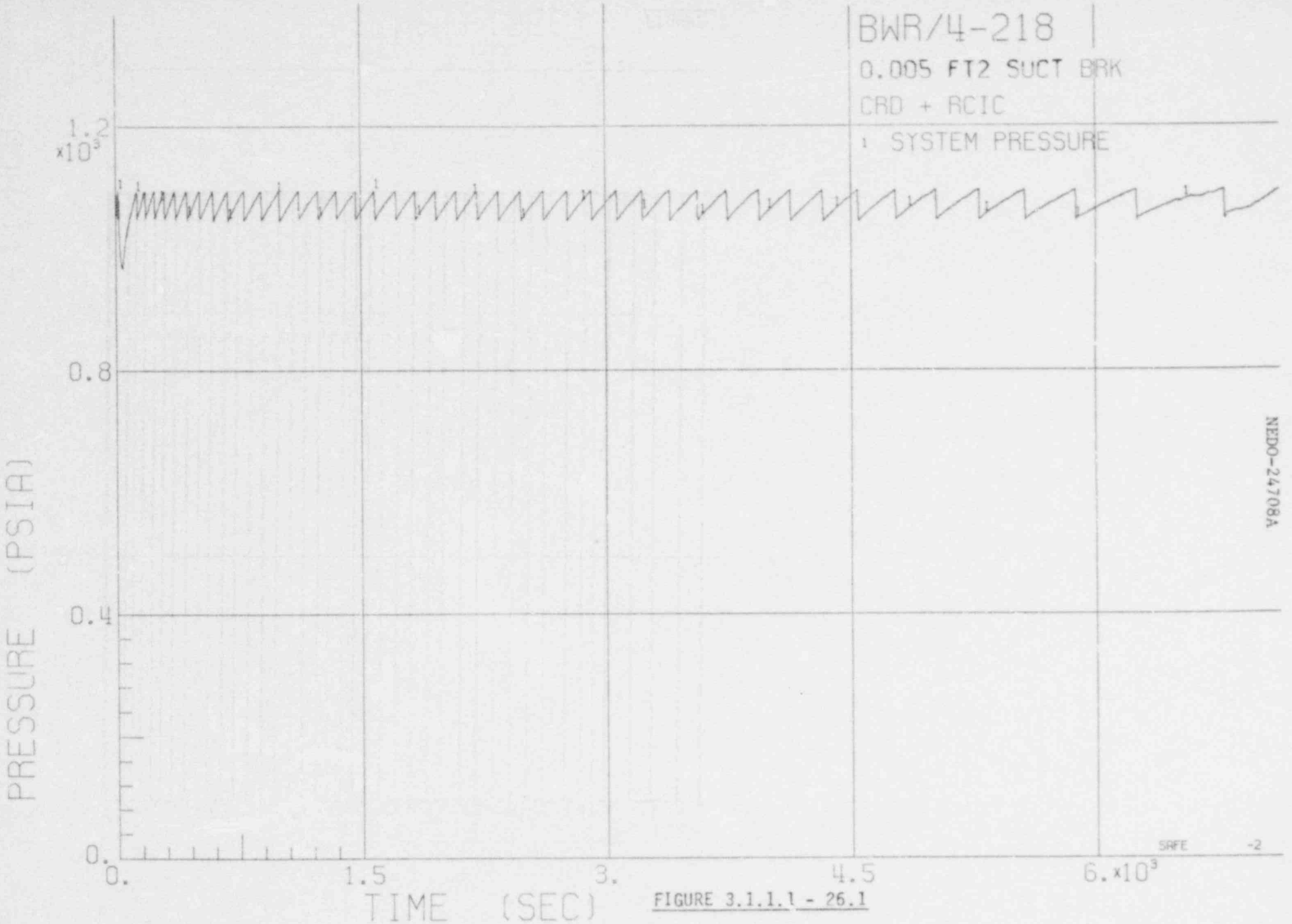

FIGURE 3.1.1.1 - 26.1

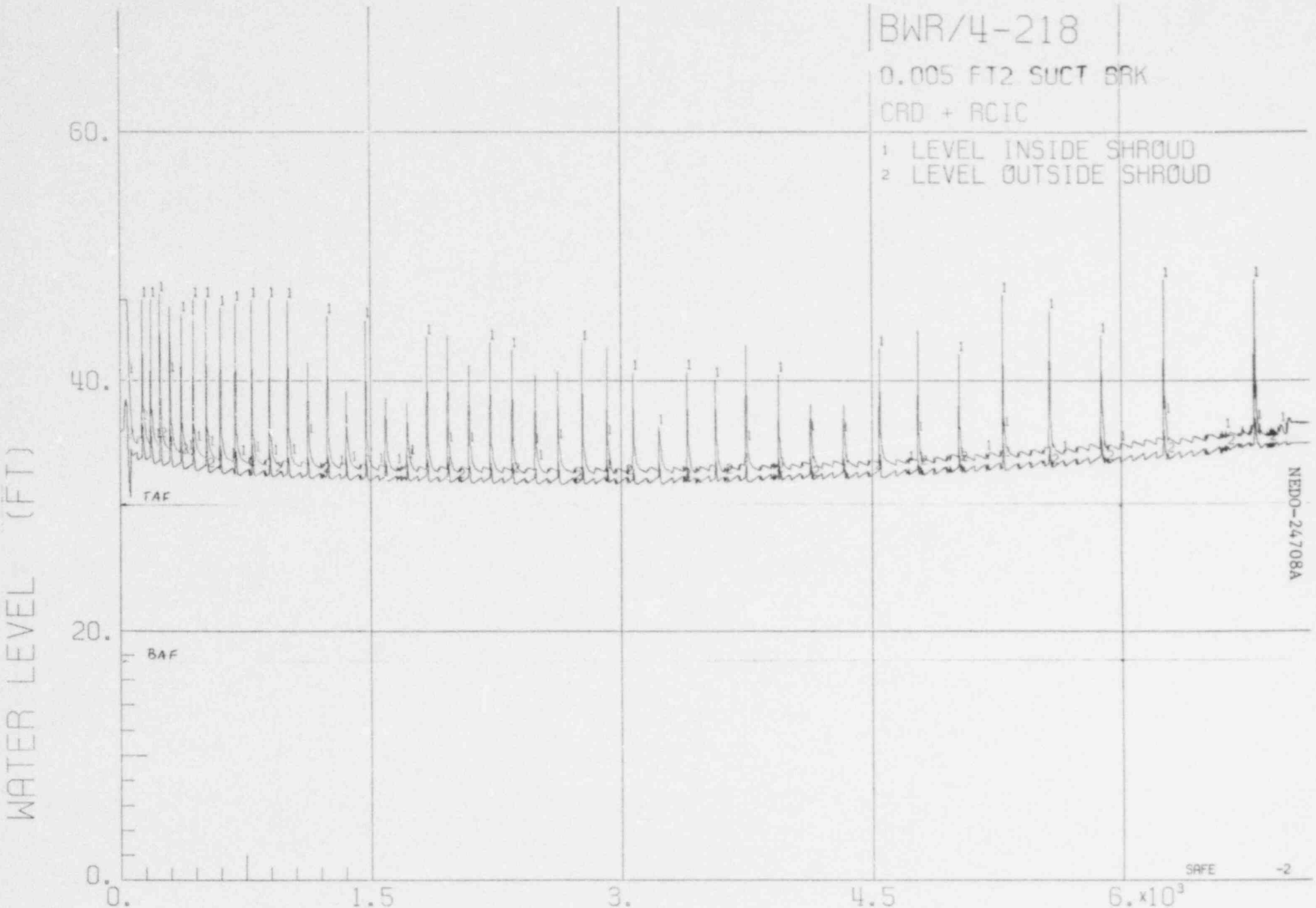

FIGURE 3.1.1.1 - 26.2

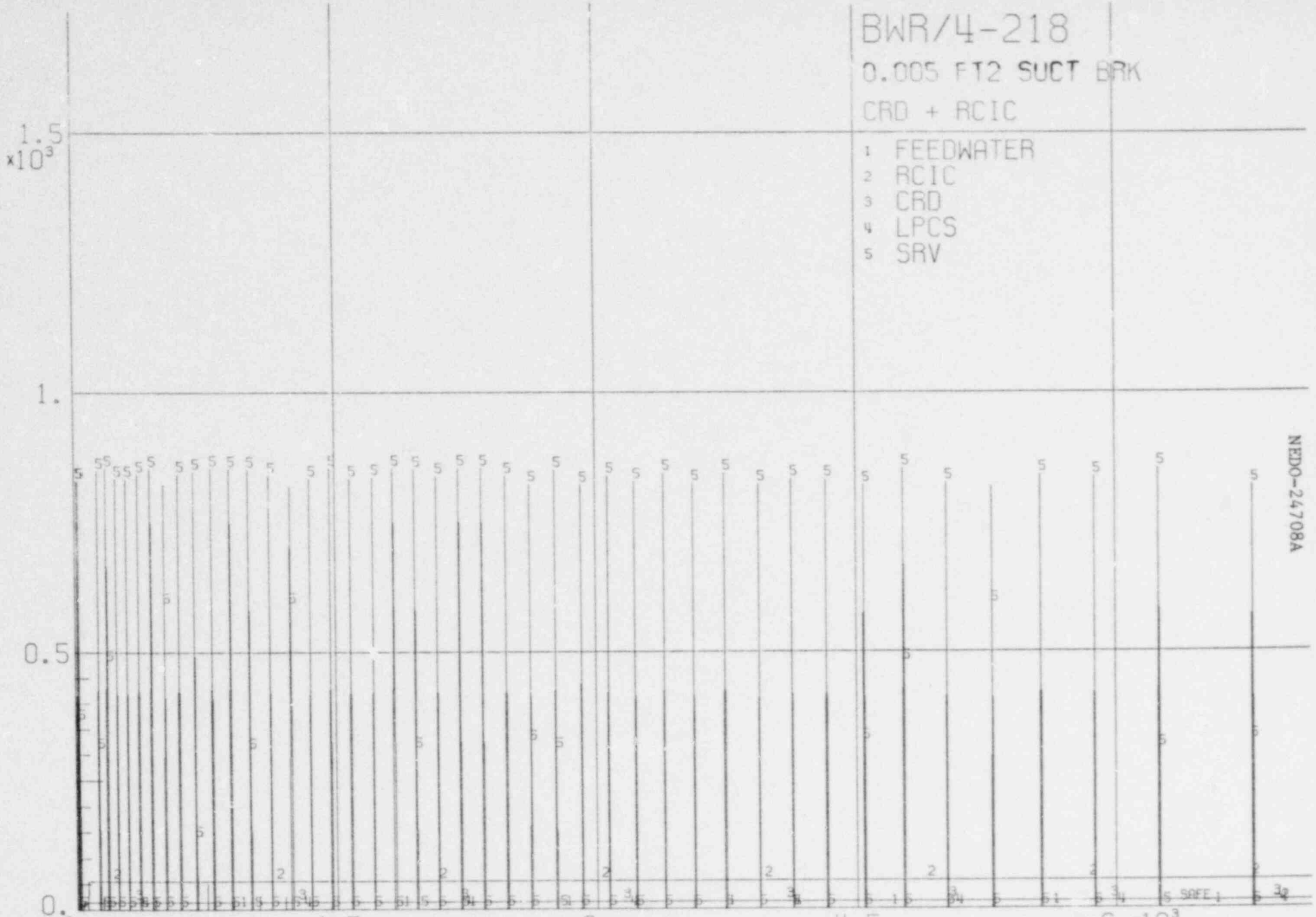

FIGURE 3.1.1.1 - 26.3

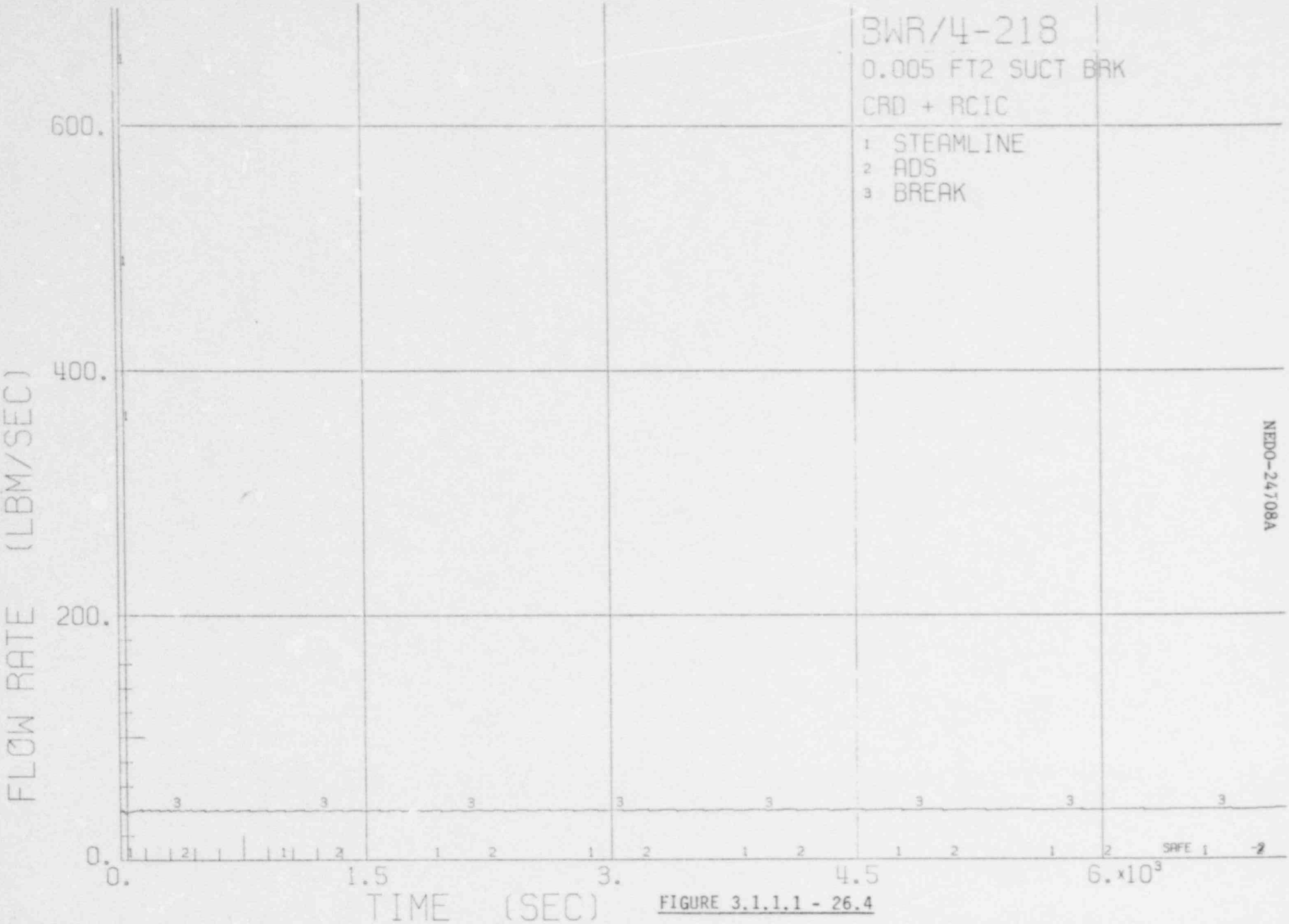

FIGURE 3.1.1.1 - 26.4

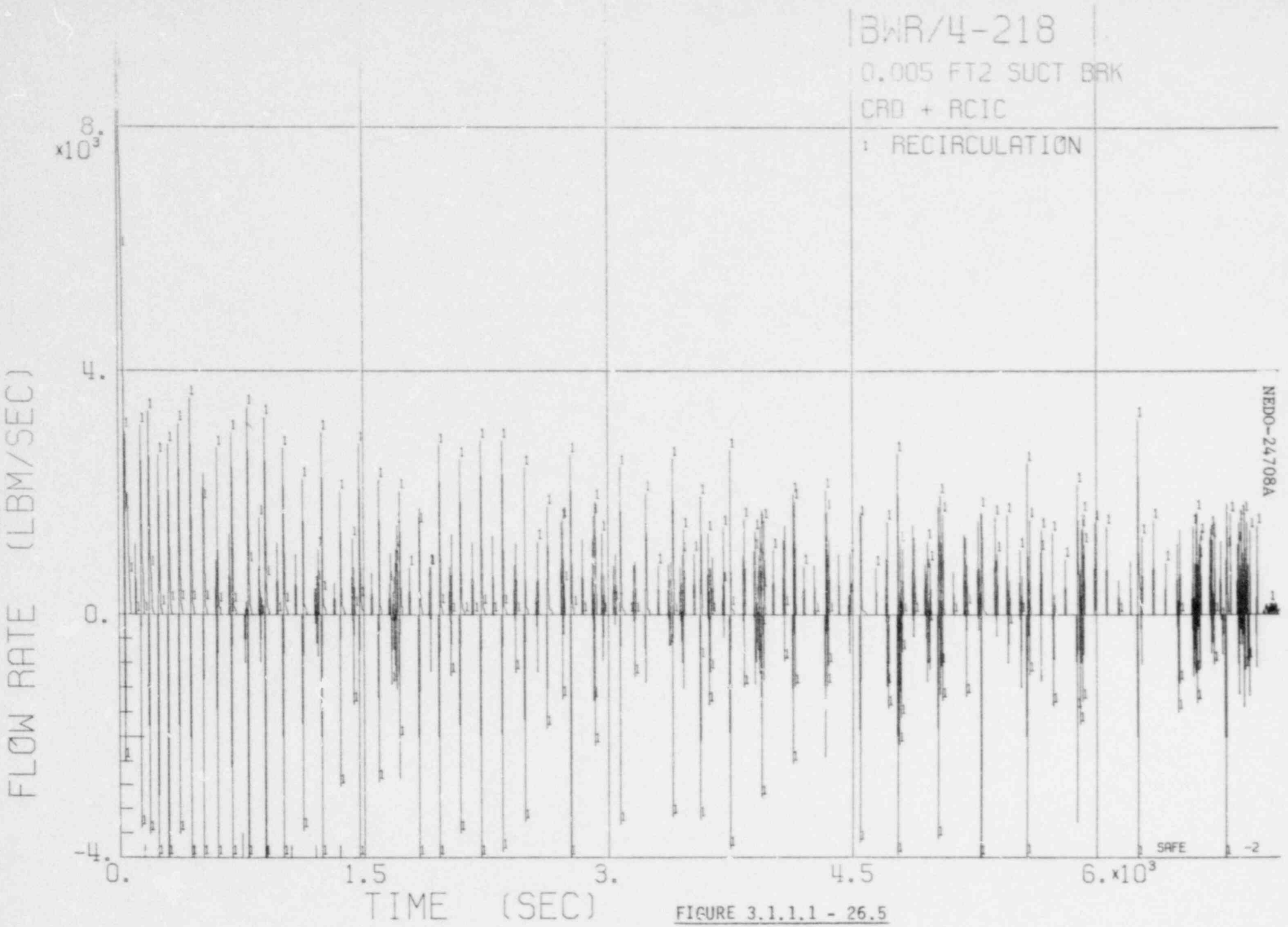

FIGURE 3.1.1.1 - 26.5

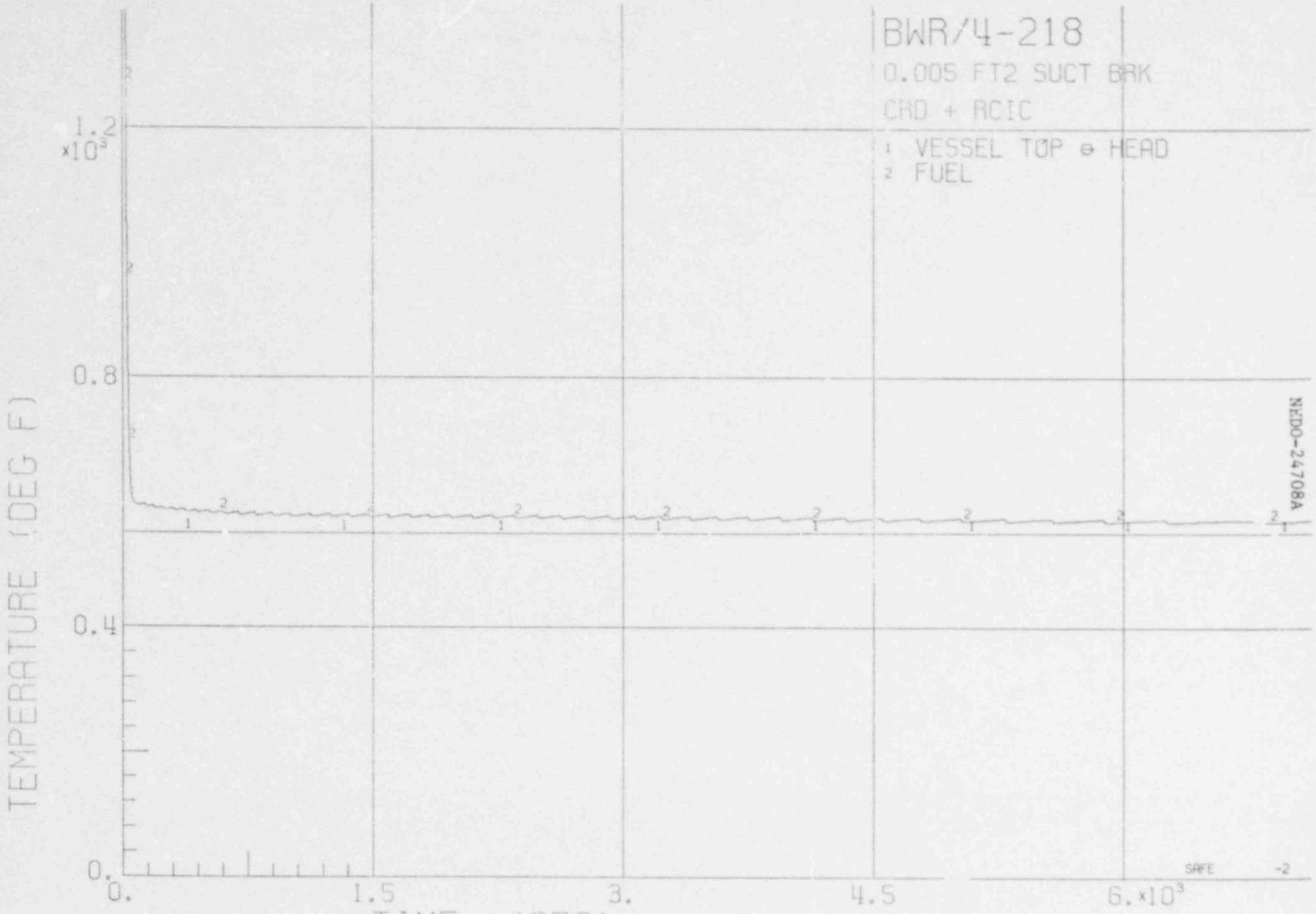

FIGURE 3.1.1.1 - 26.6

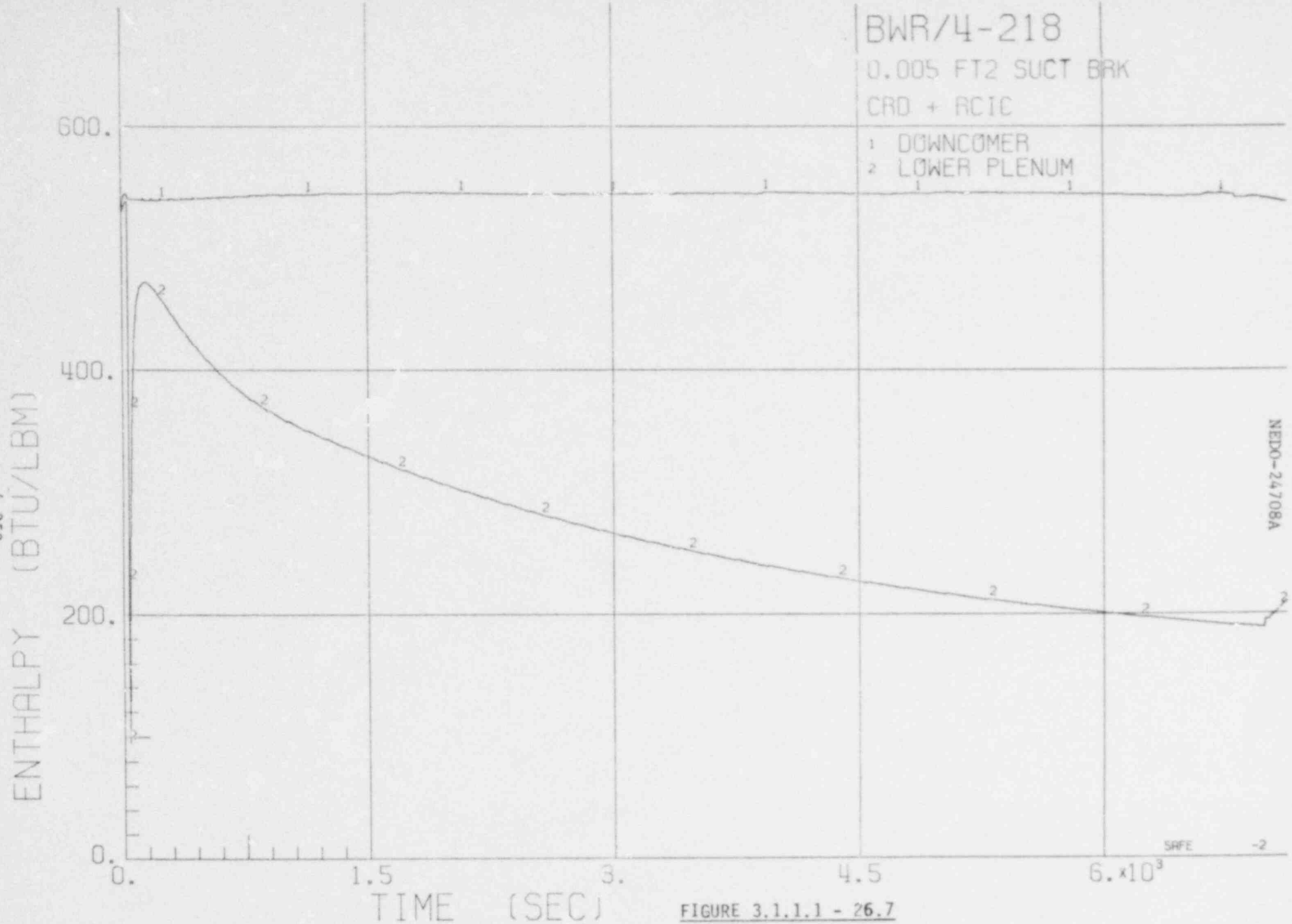

FIGURE 3.1.1.1 - 26.7

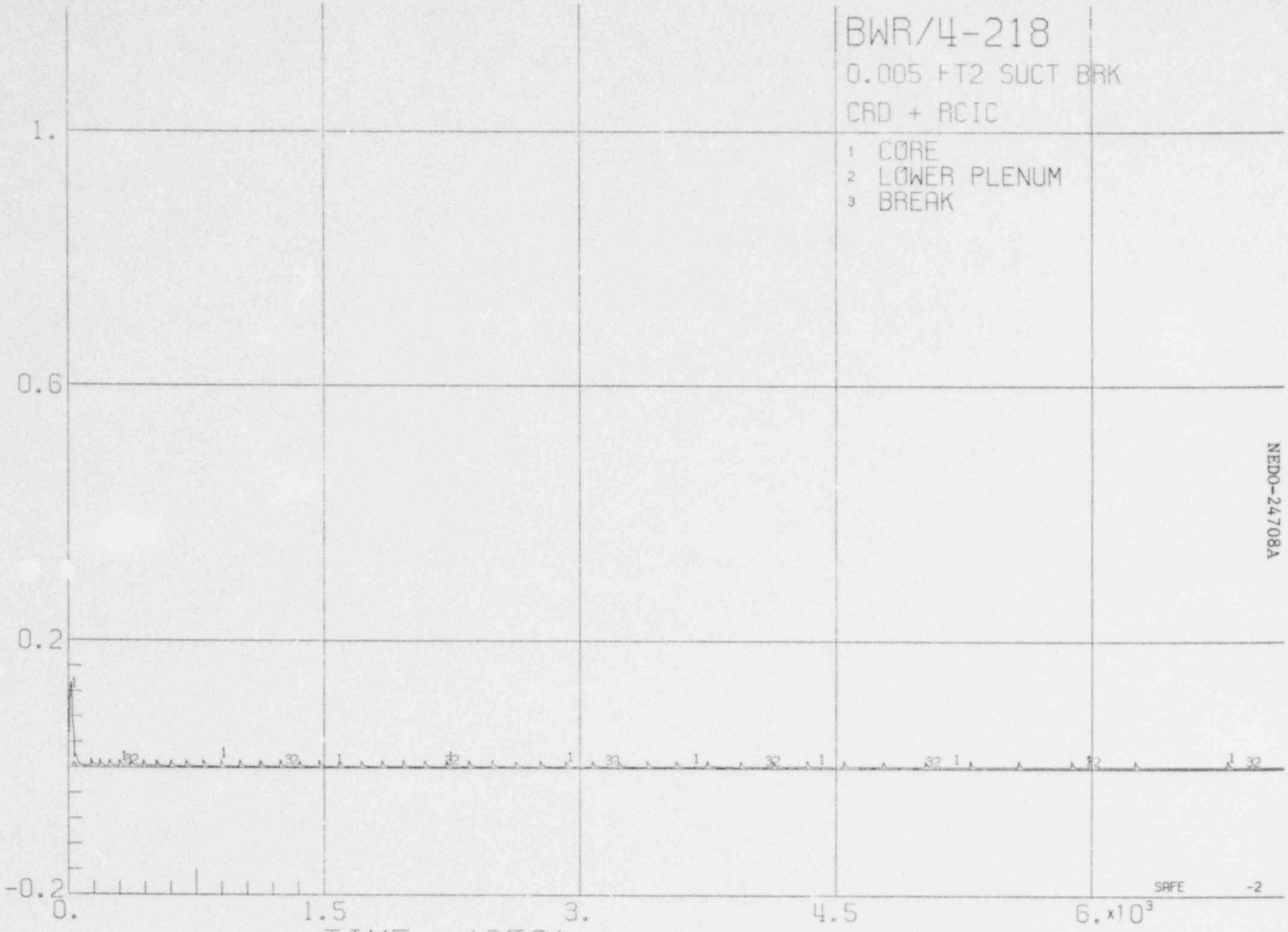

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FIGURE 3.1.1.1 - 26.8

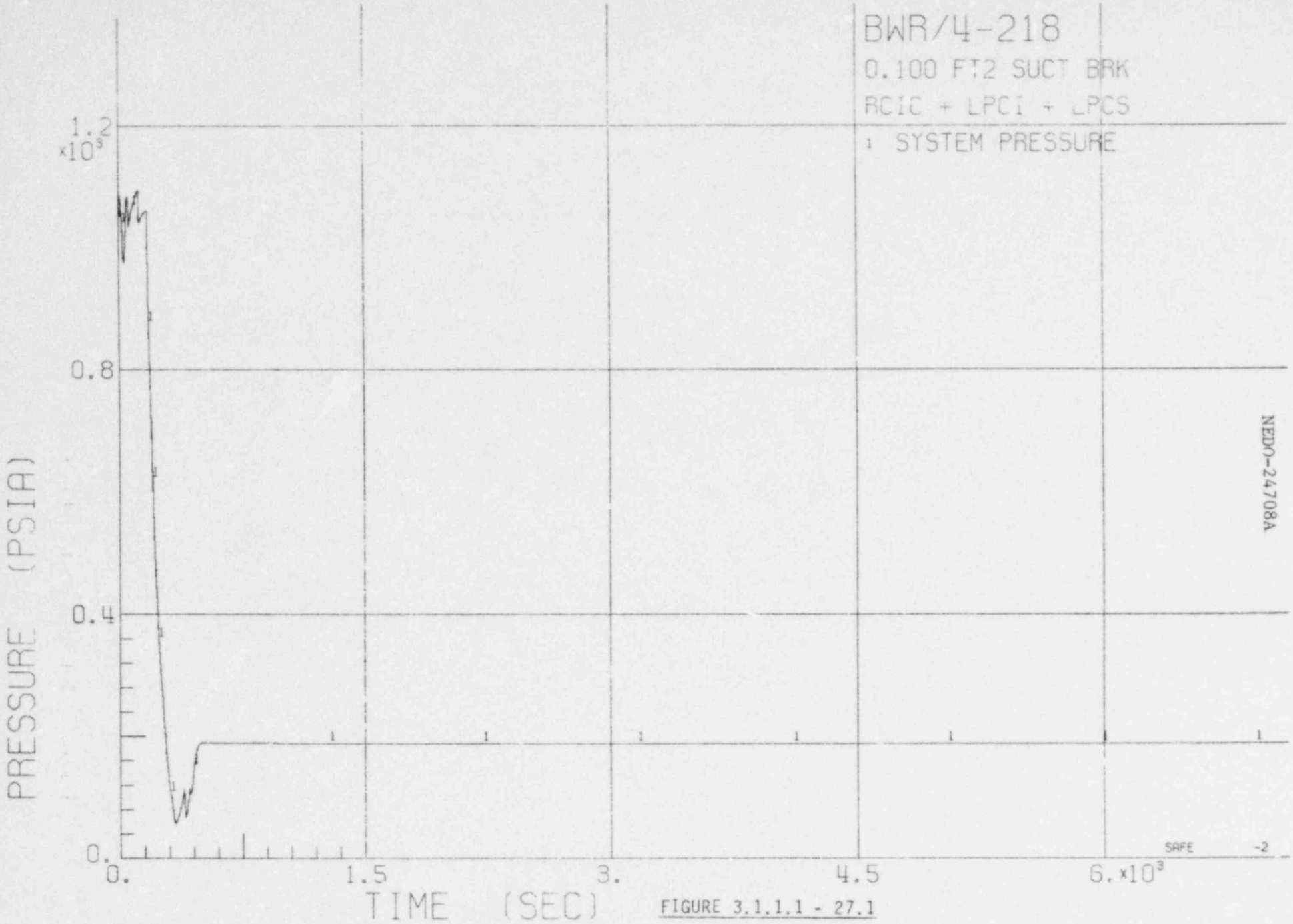

FIGURE 3.1.1.1 - 27.1

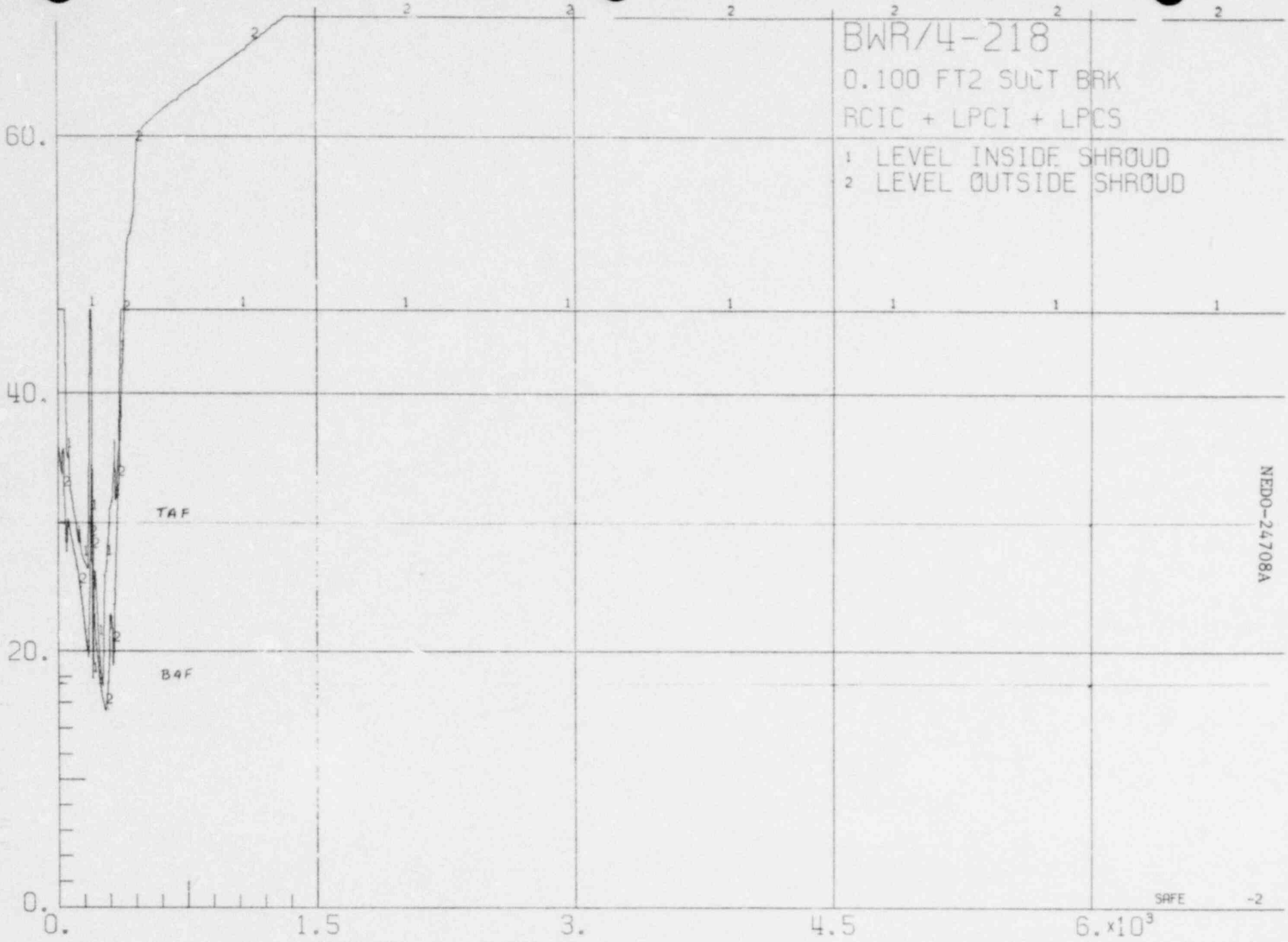

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FIGURE 3.1.1.1 - 27.2

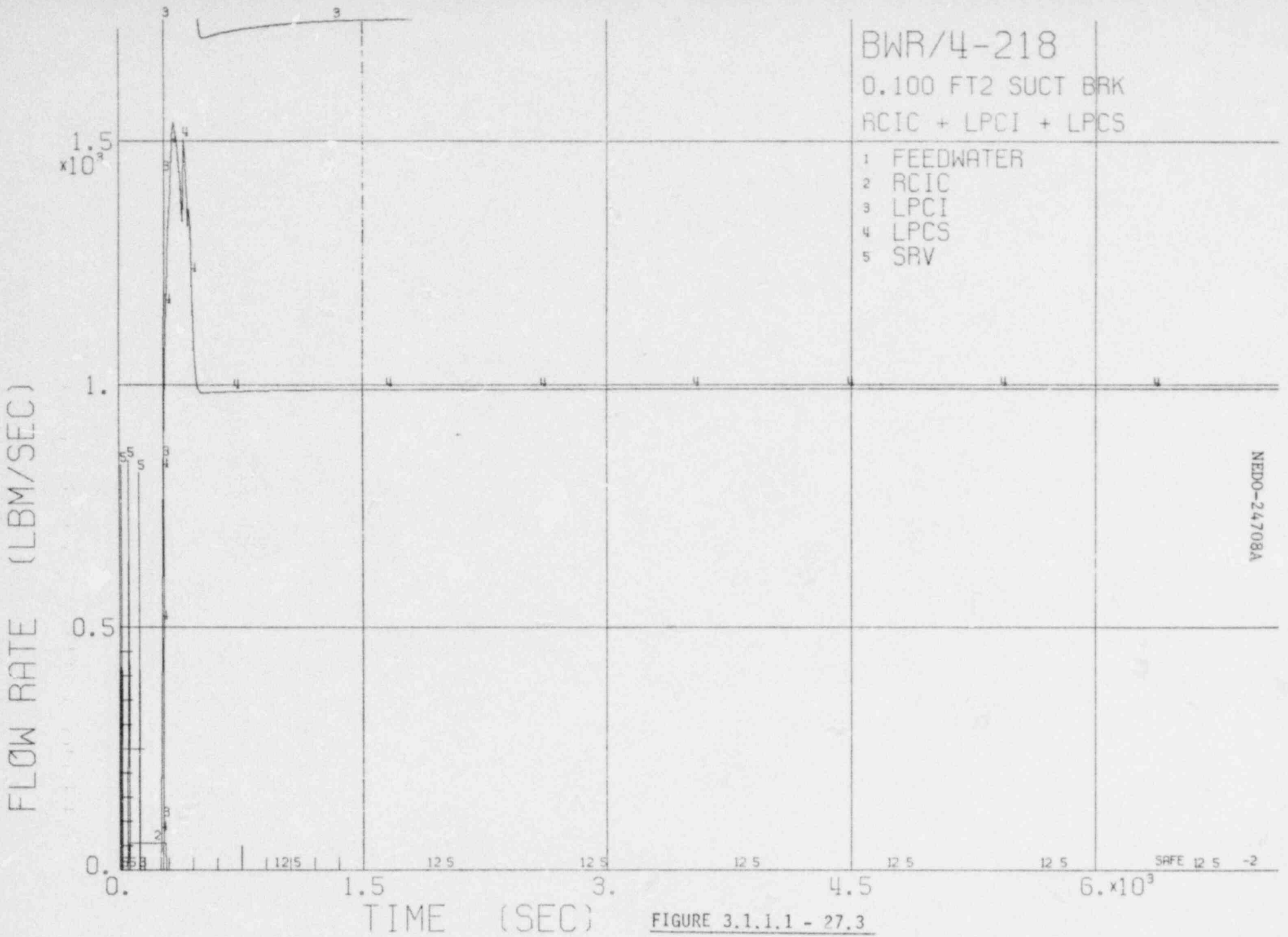

FIGURE 3.1.1.1 - 27.3

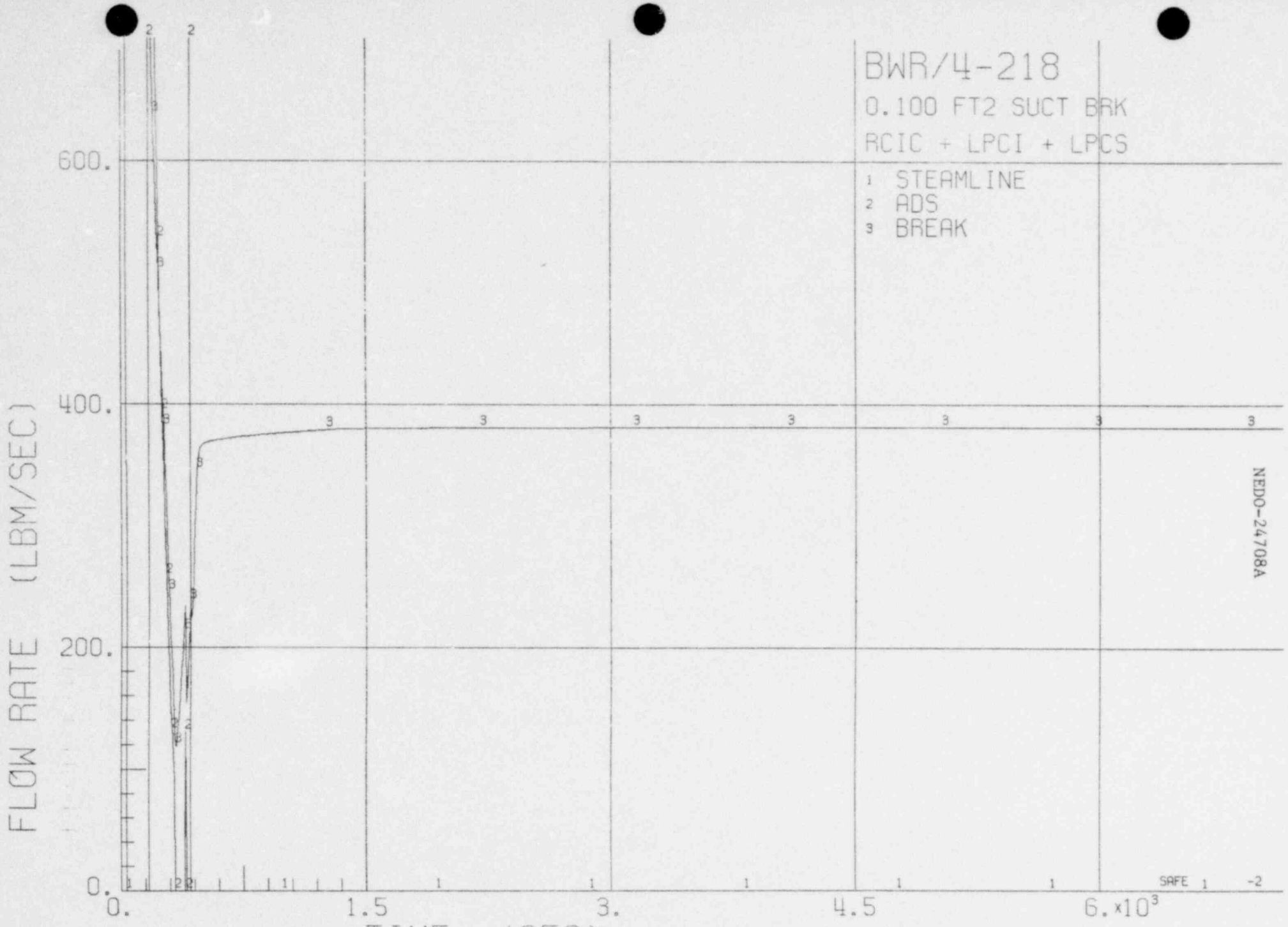

FIGURE 3.1.1.1 - 27.4

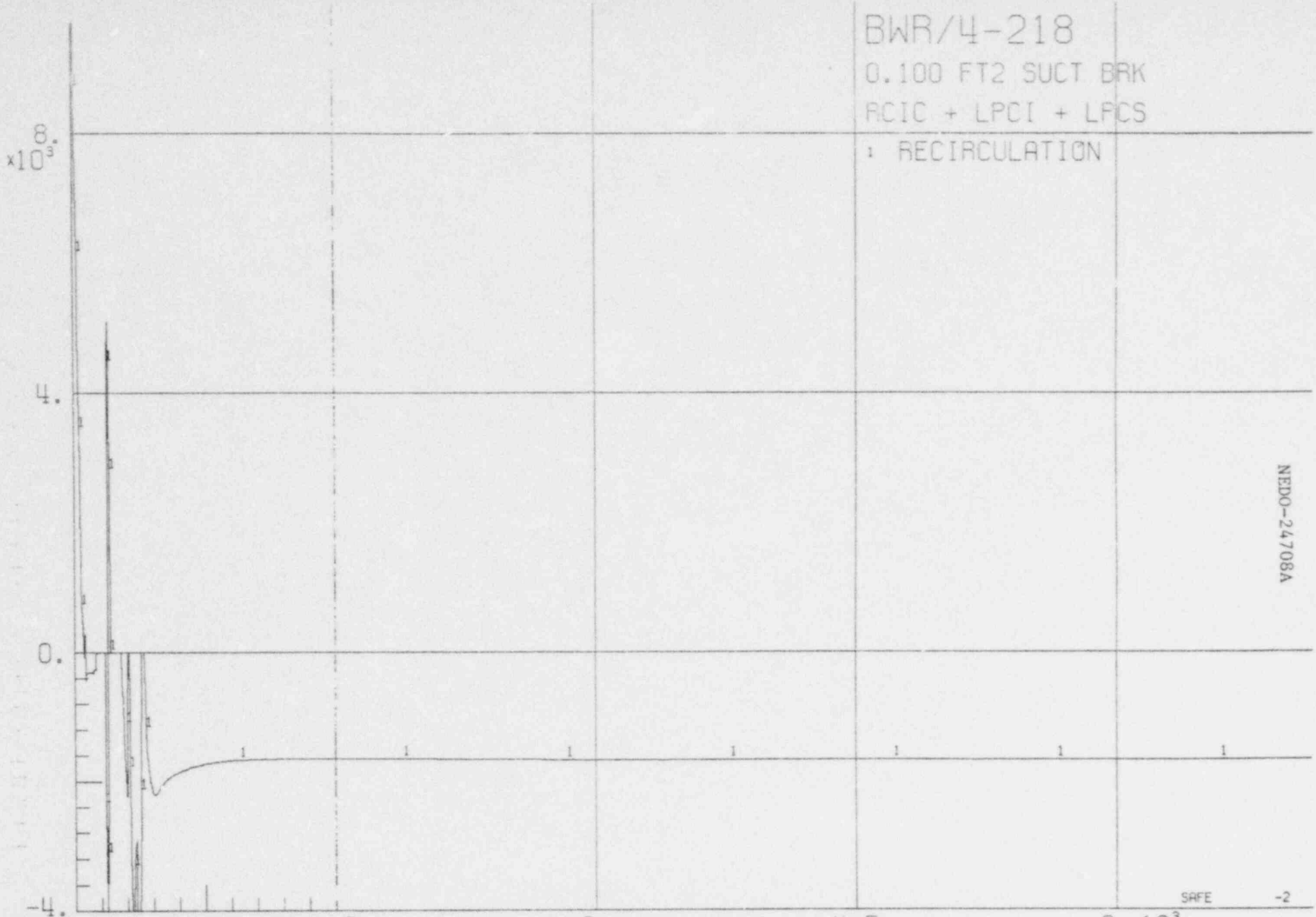

FIGURE 3.1.1.1 - 27.5

FIGURE 3.1.1.1 - 27.6

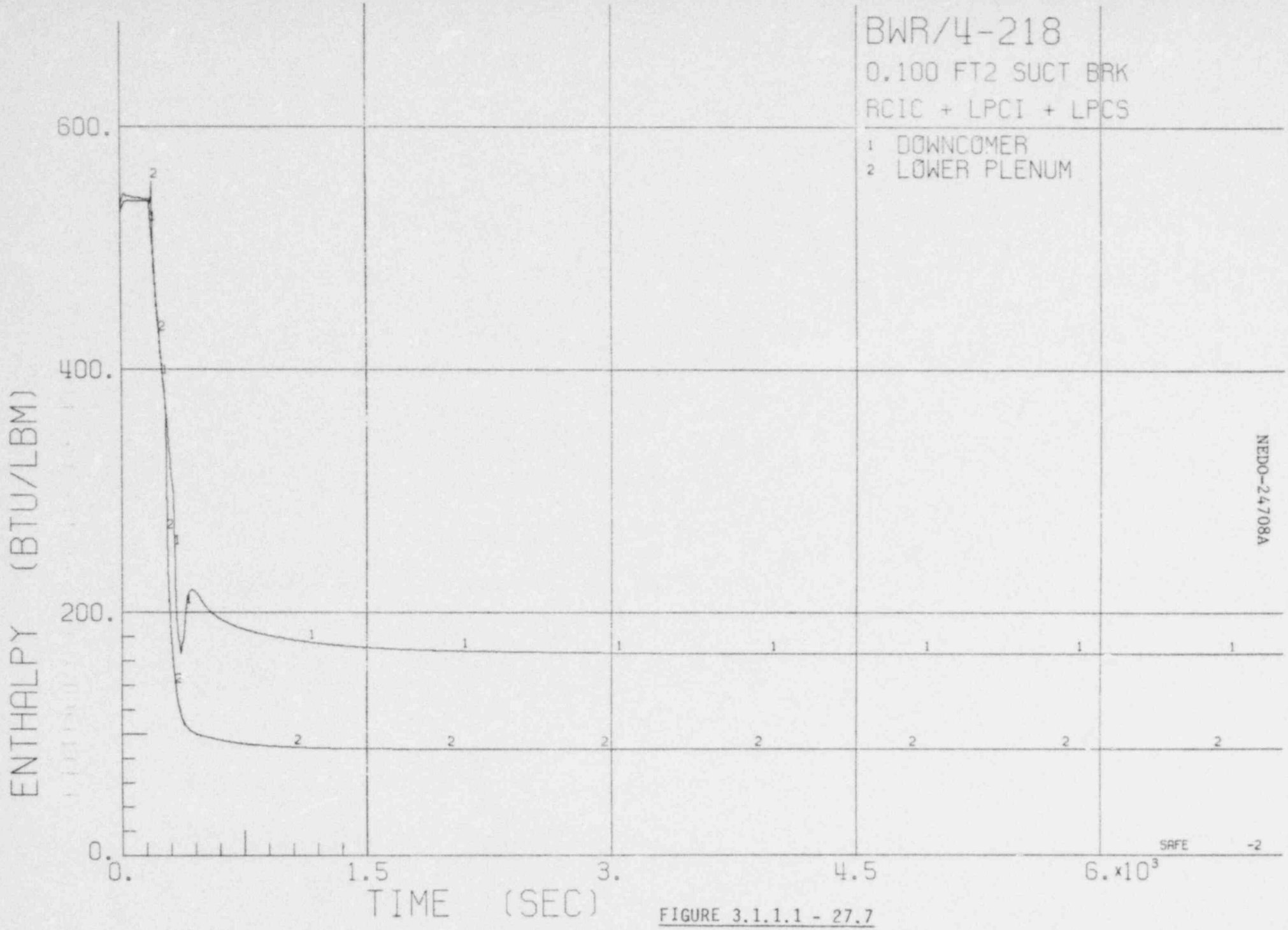

FIGURE 3.1.1.1 - 27.7

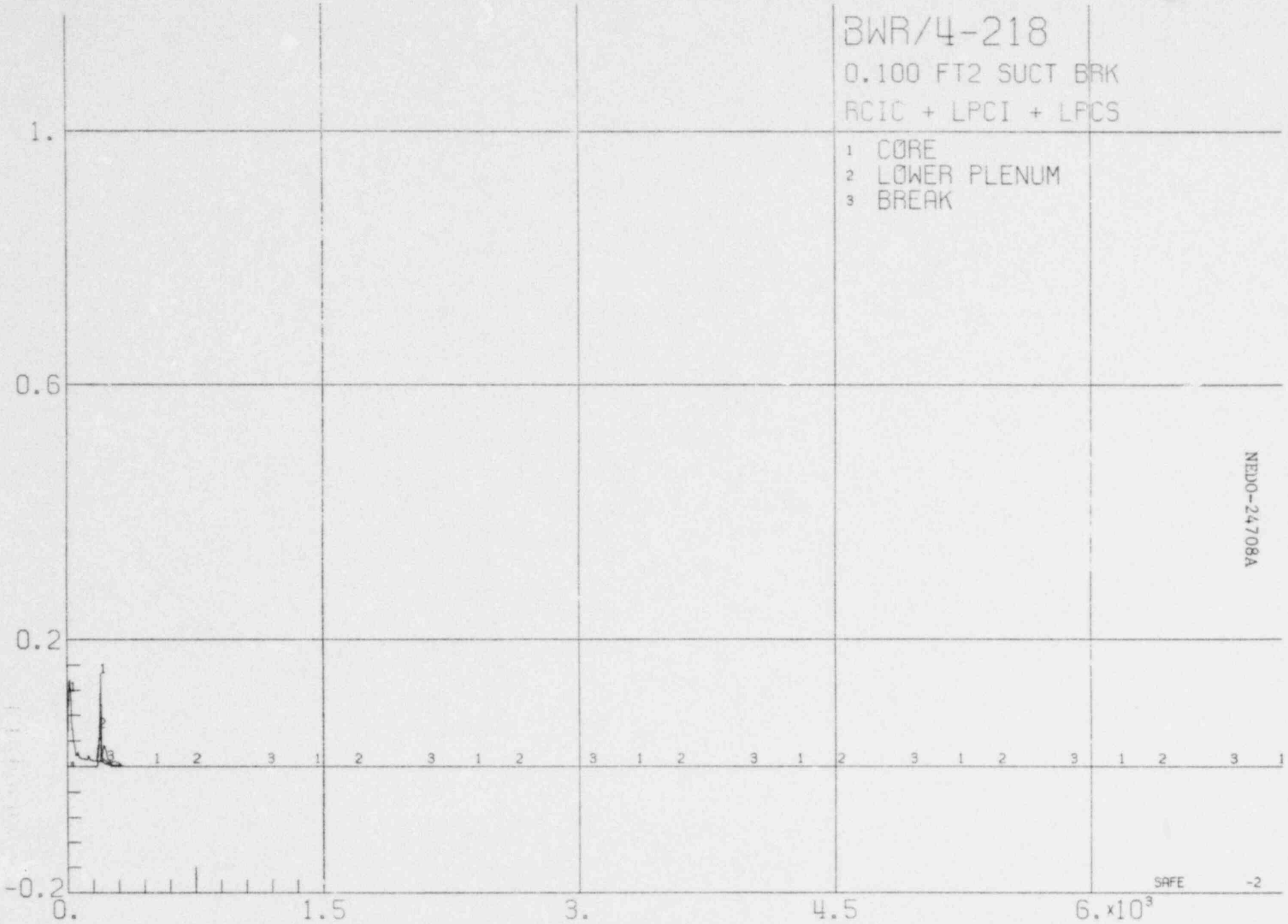

FIGURE 3.1.1.1 - 27.8

FIGURE 3.1.1.1 - 28.1

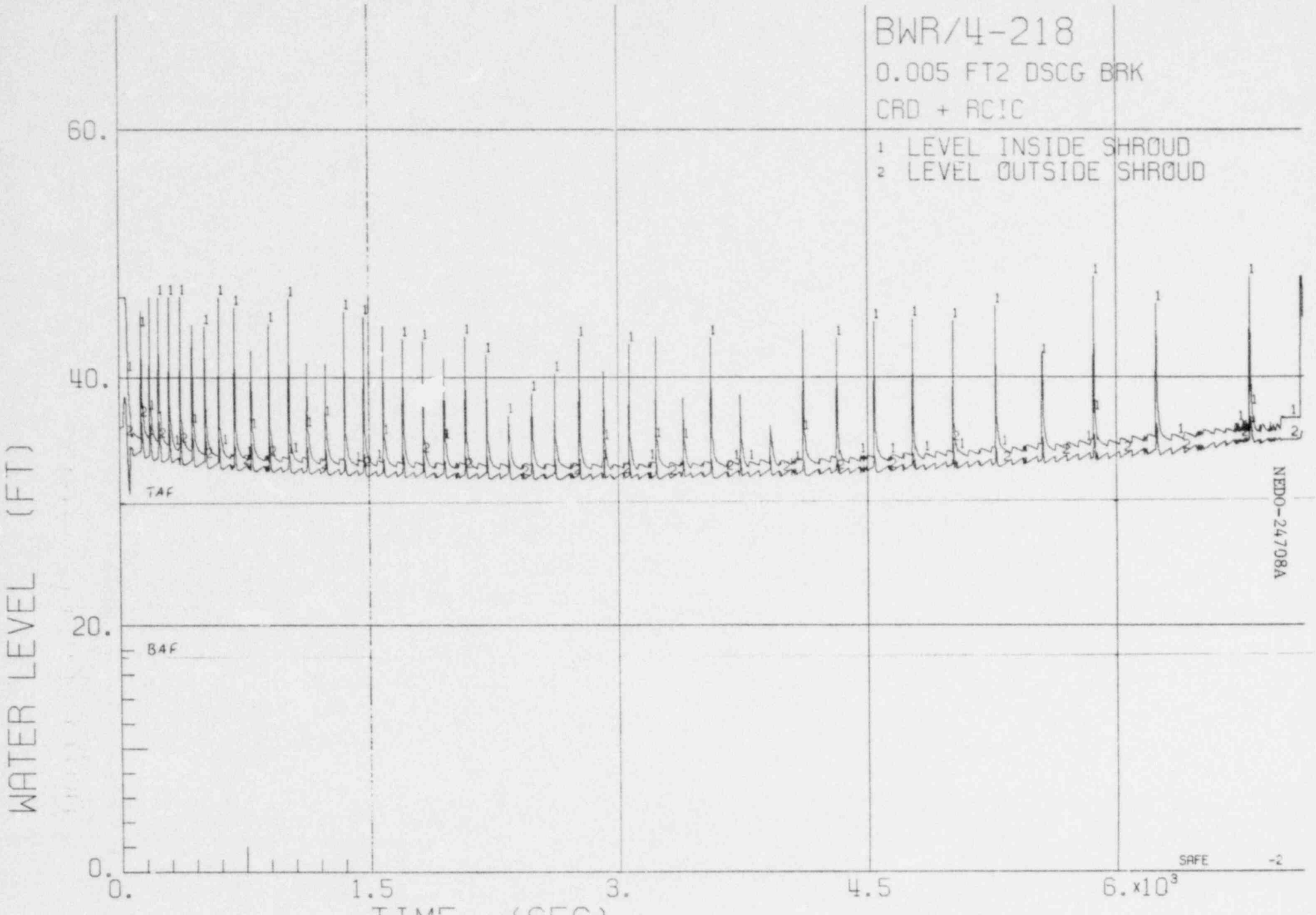

FIGURE 3.1.1.1 - 28.2

FIGURE 3.1.1.1 - 28.3

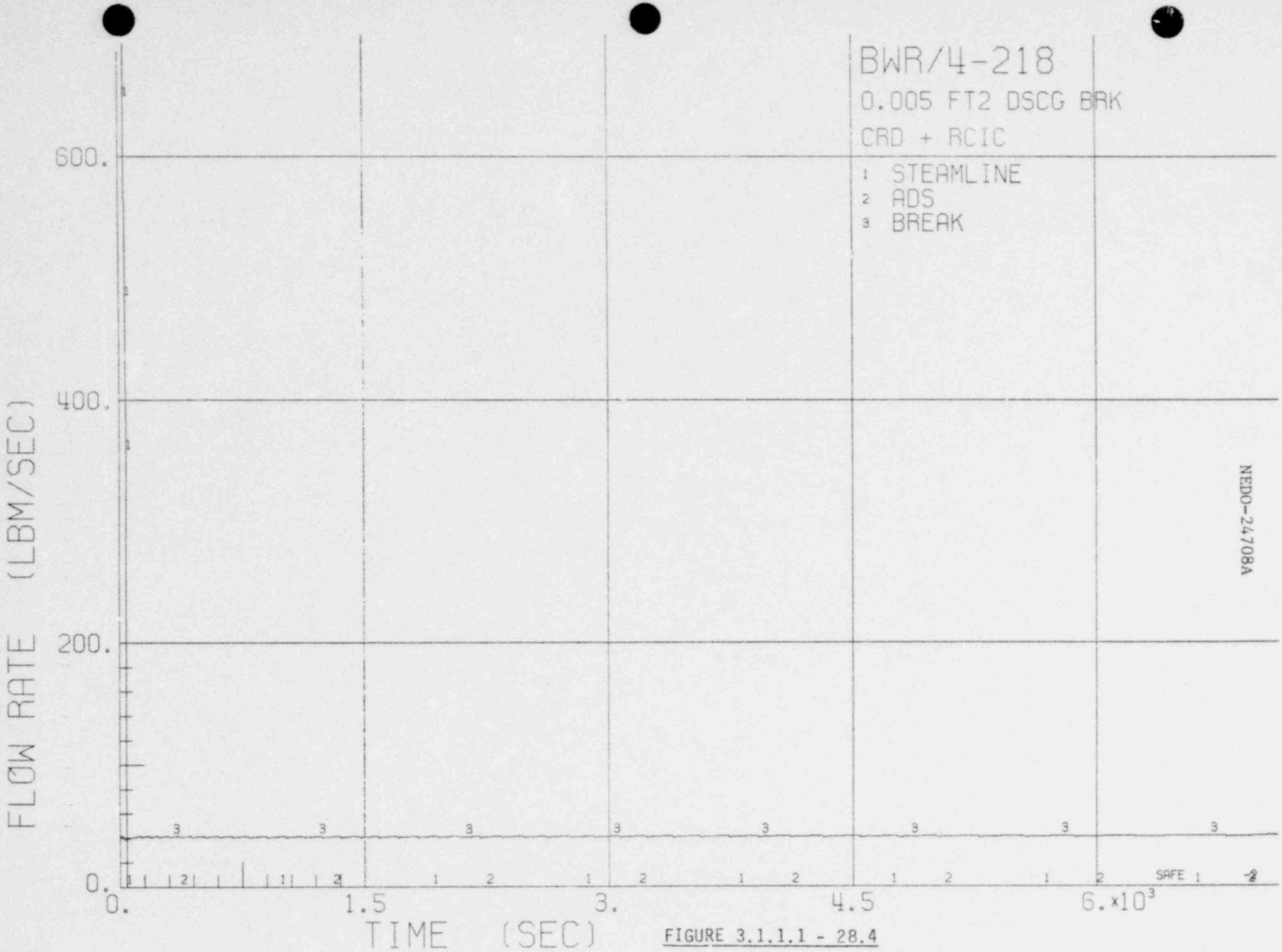

FIGURE 3.1.1.1 - 28.4

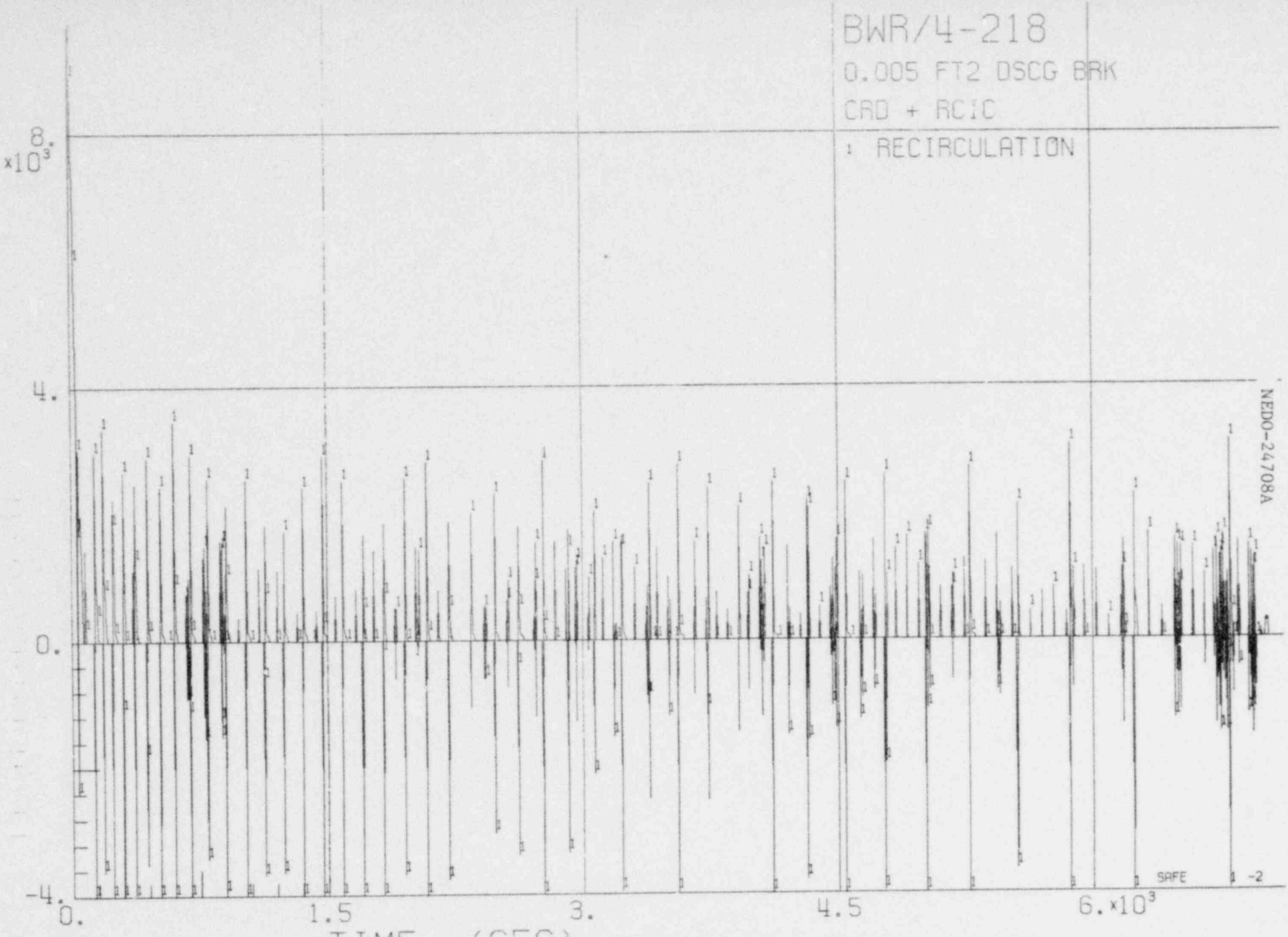

FIGURE 3.1.1.1 - 28.5

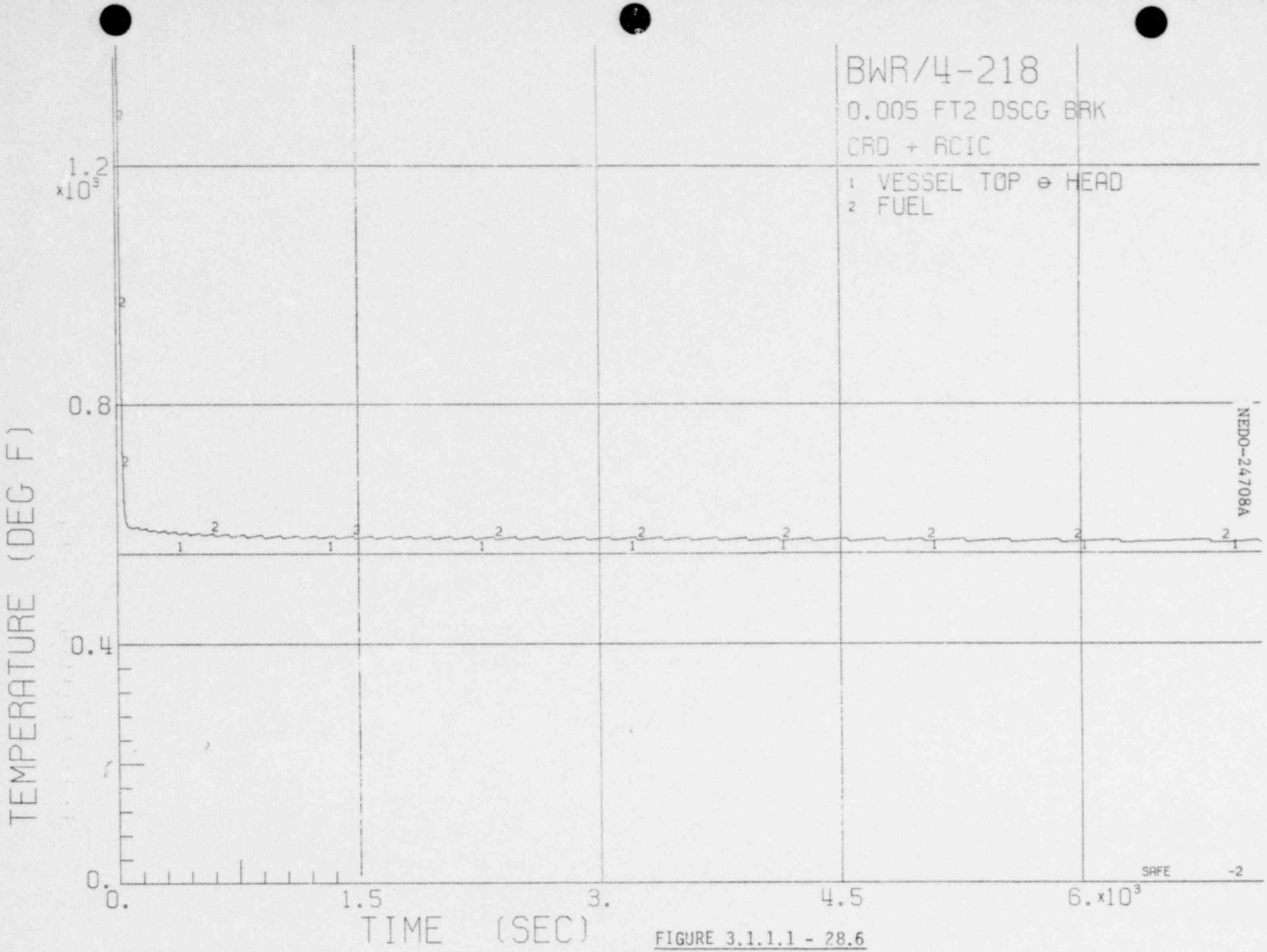

FIGURE 3.1.1.1 - 28.6

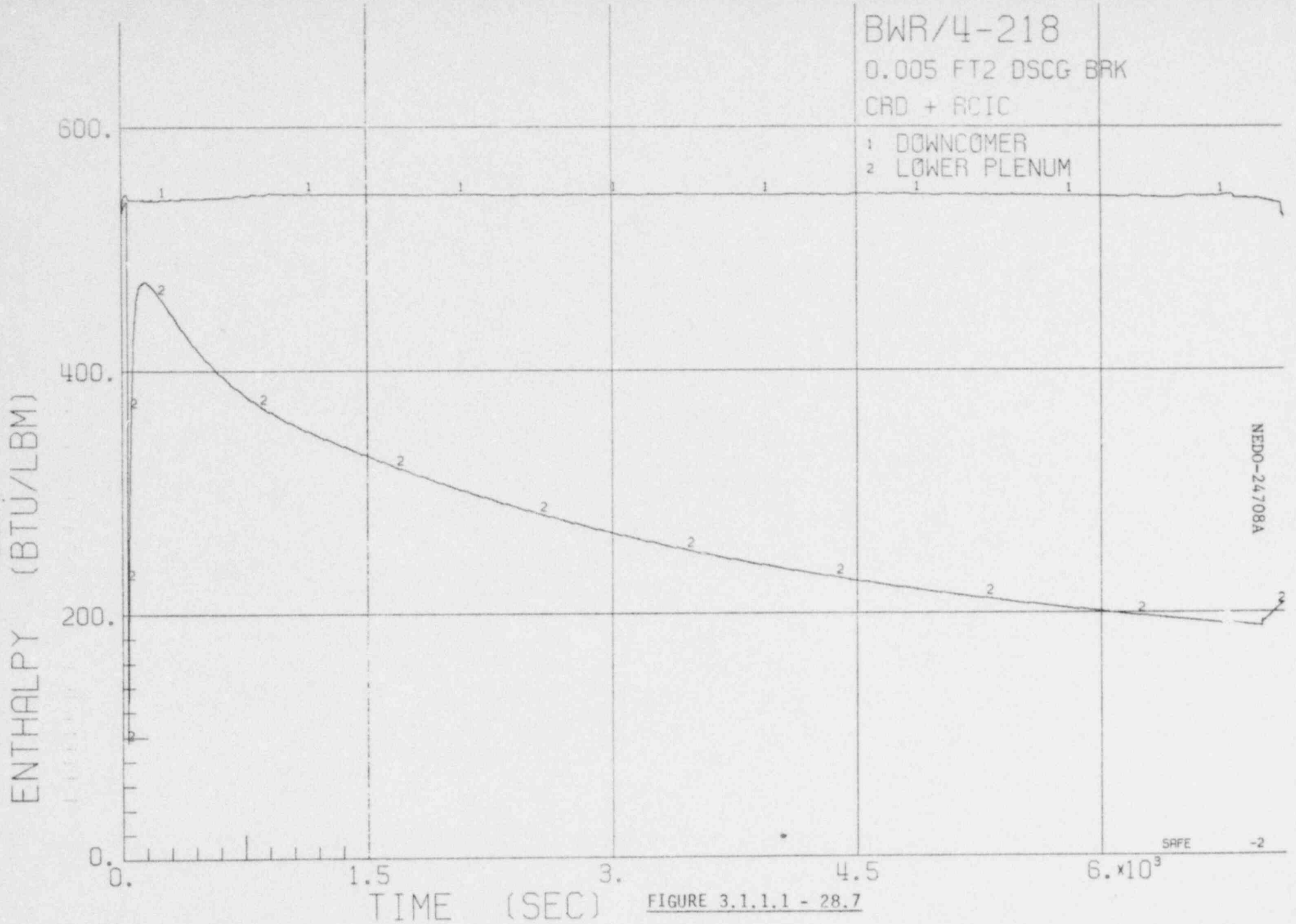

FIGURE 3.1.1.1 - 28.7

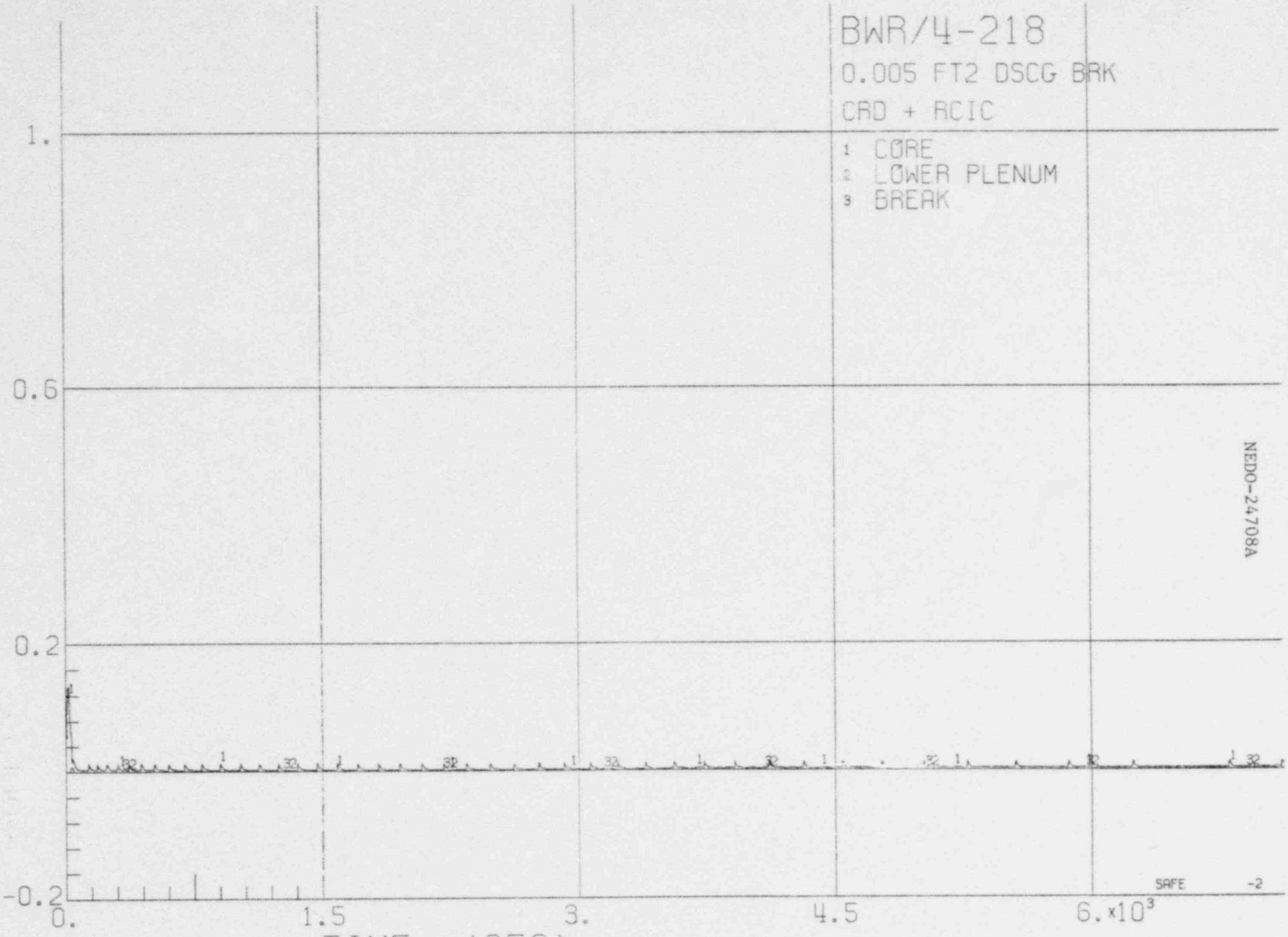

FIGURE 3.1.1.1 - 28.8

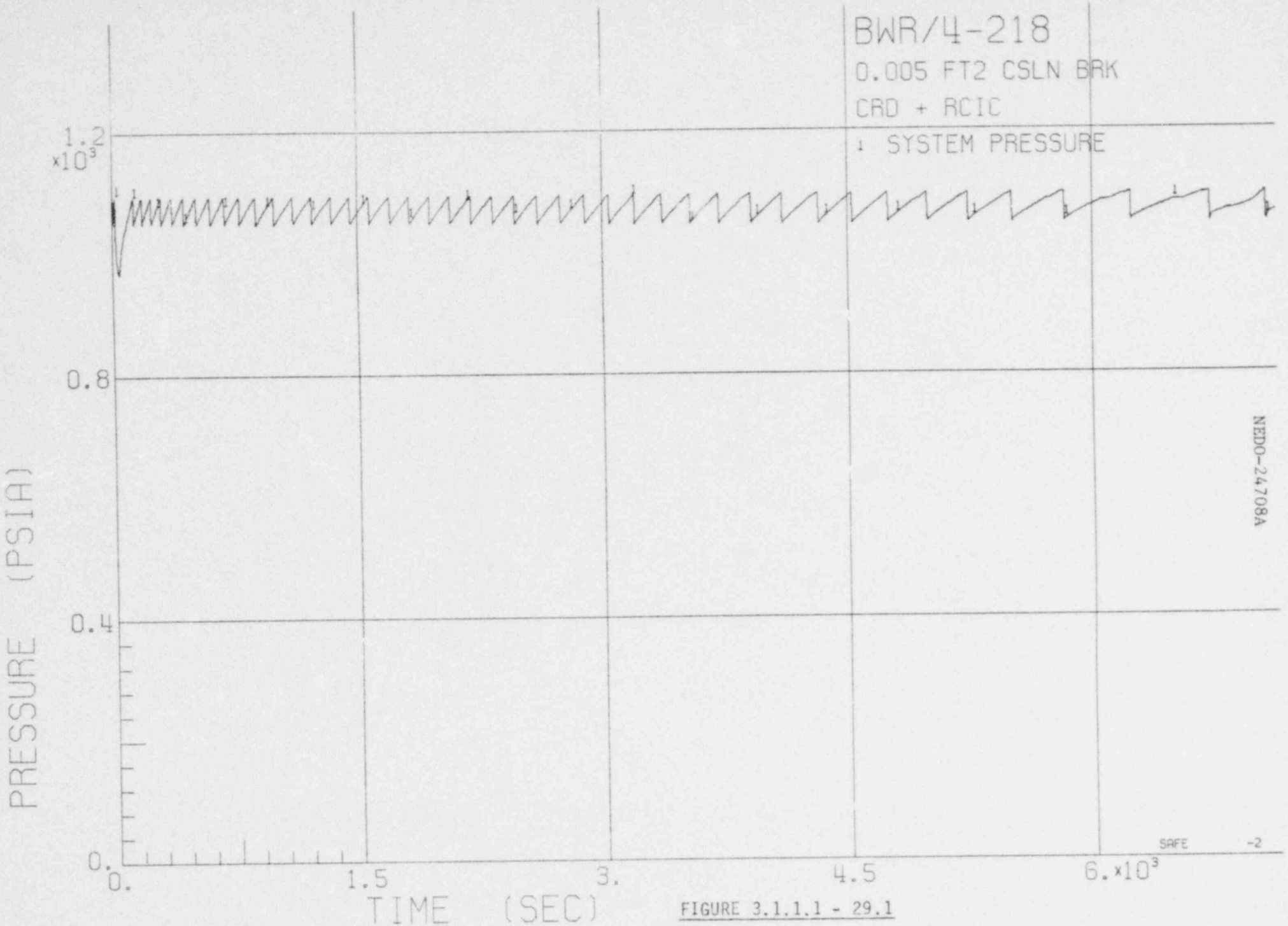

FIGURE 3.1.1.1 - 29.1

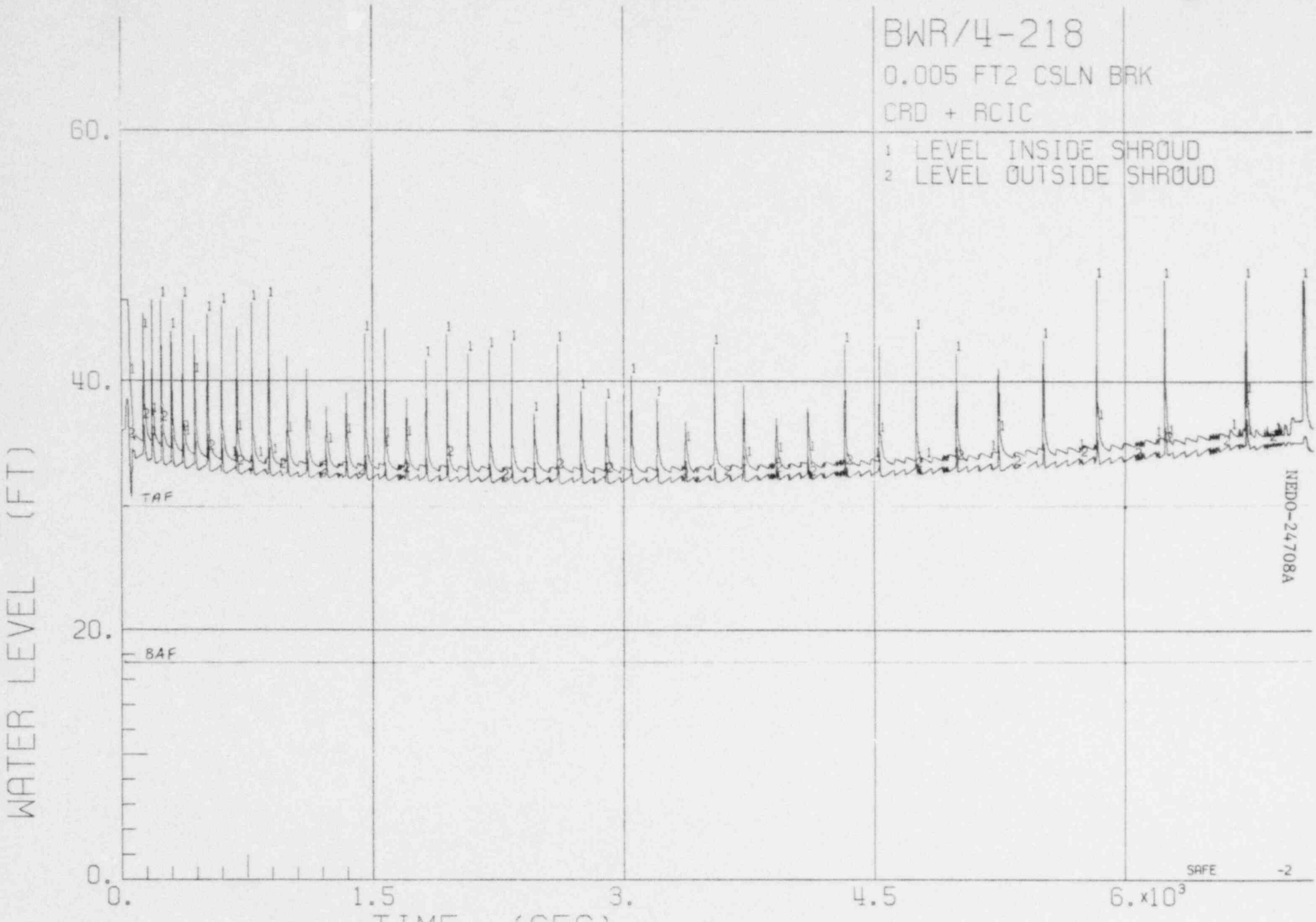

FIGURE 3.1.1.1 - 29.2

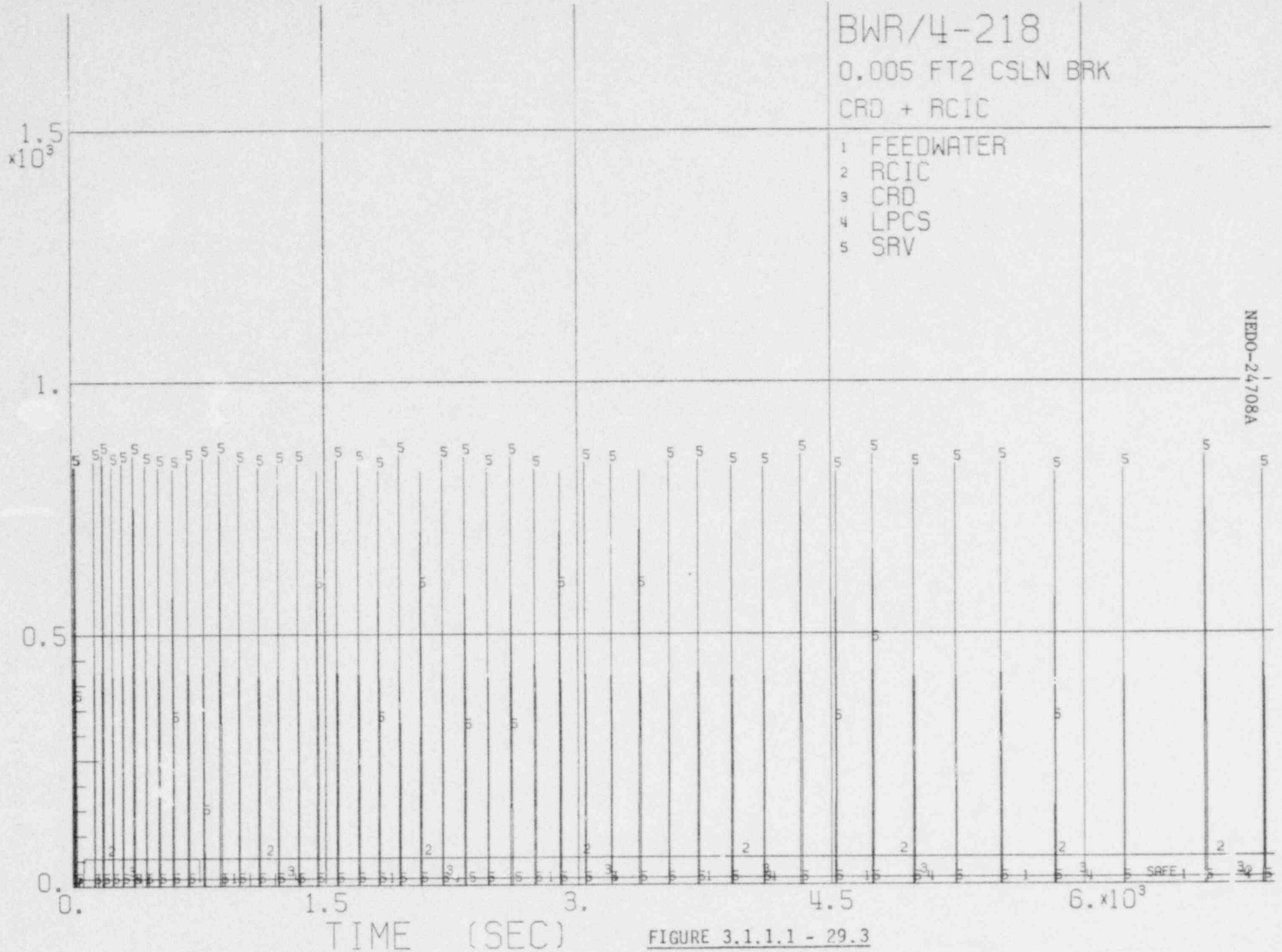

FIGURE 3.1.1.1 - 29.3

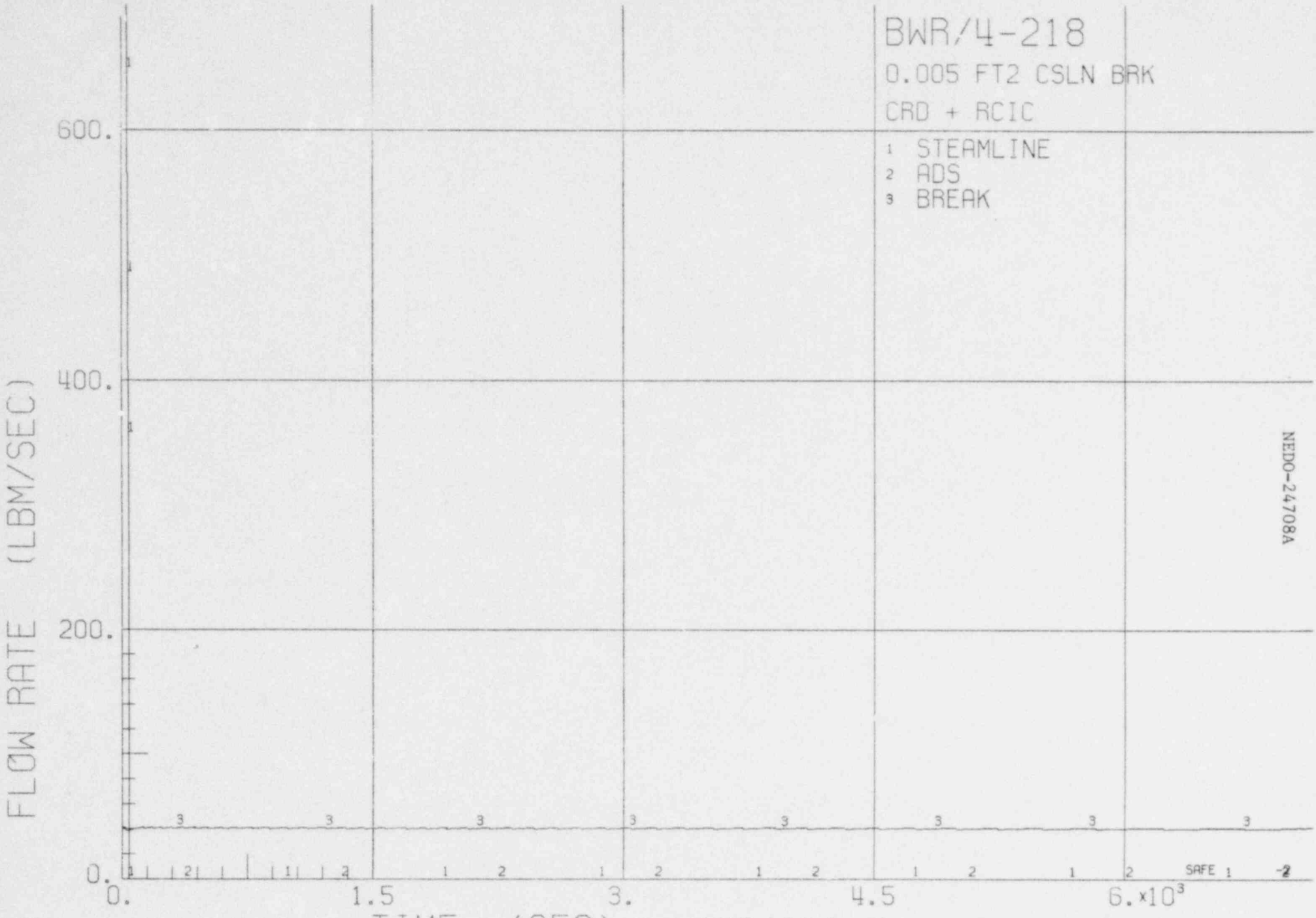

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FIGURE 3.1.1.1 - 29.4

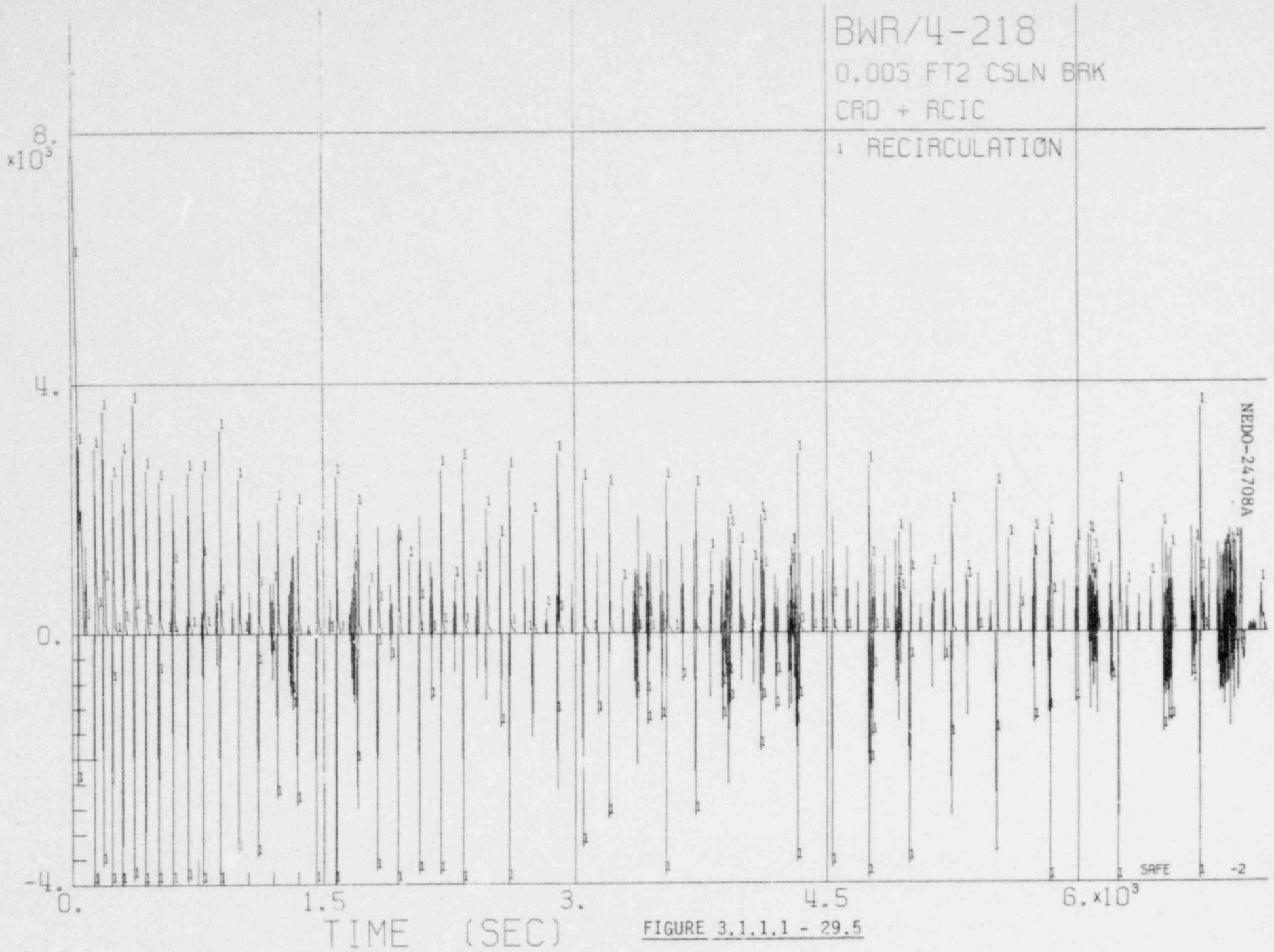

FIGURE 3.1.1.1 - 29.5

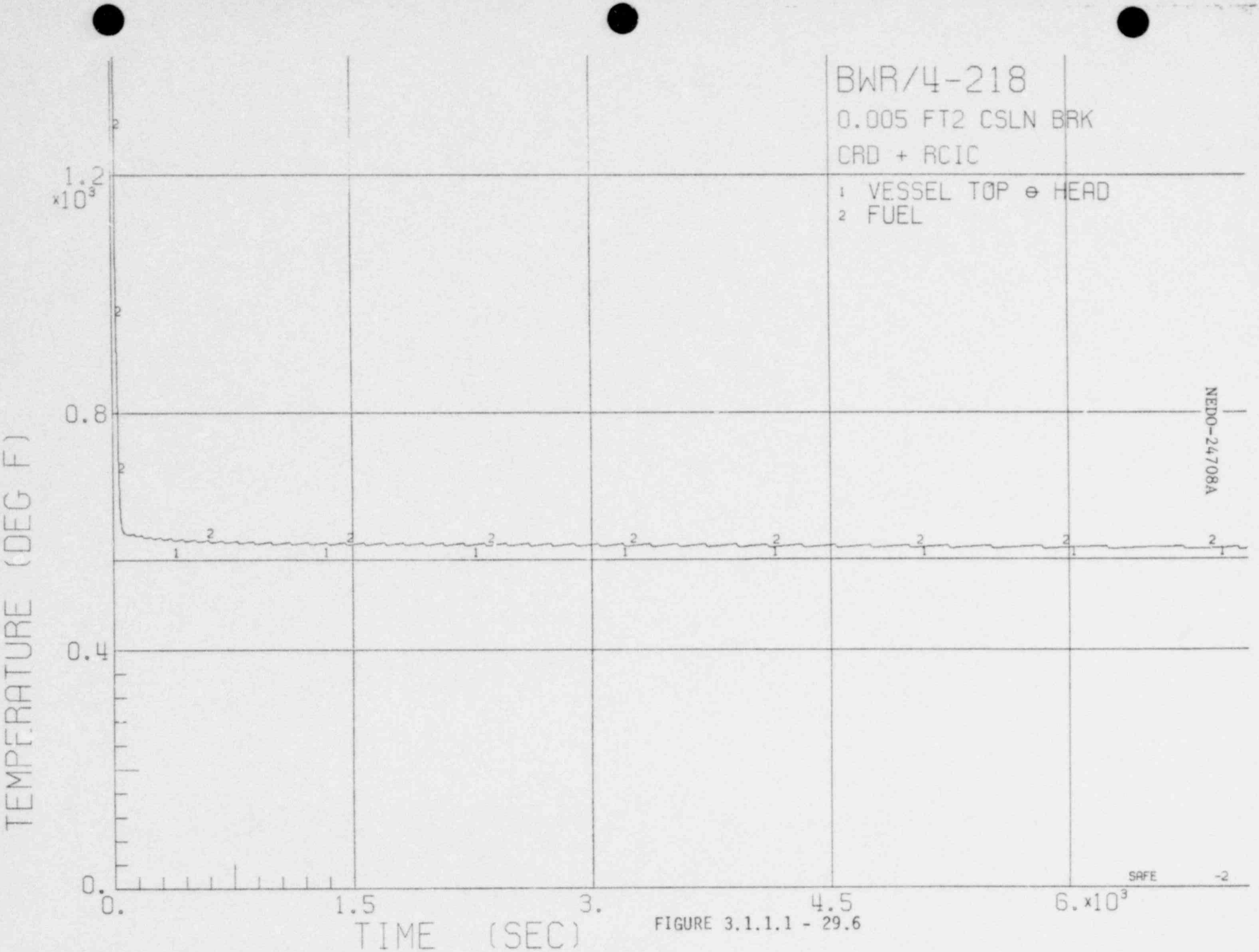

FIGURE 3.1.1.1 - 29.6

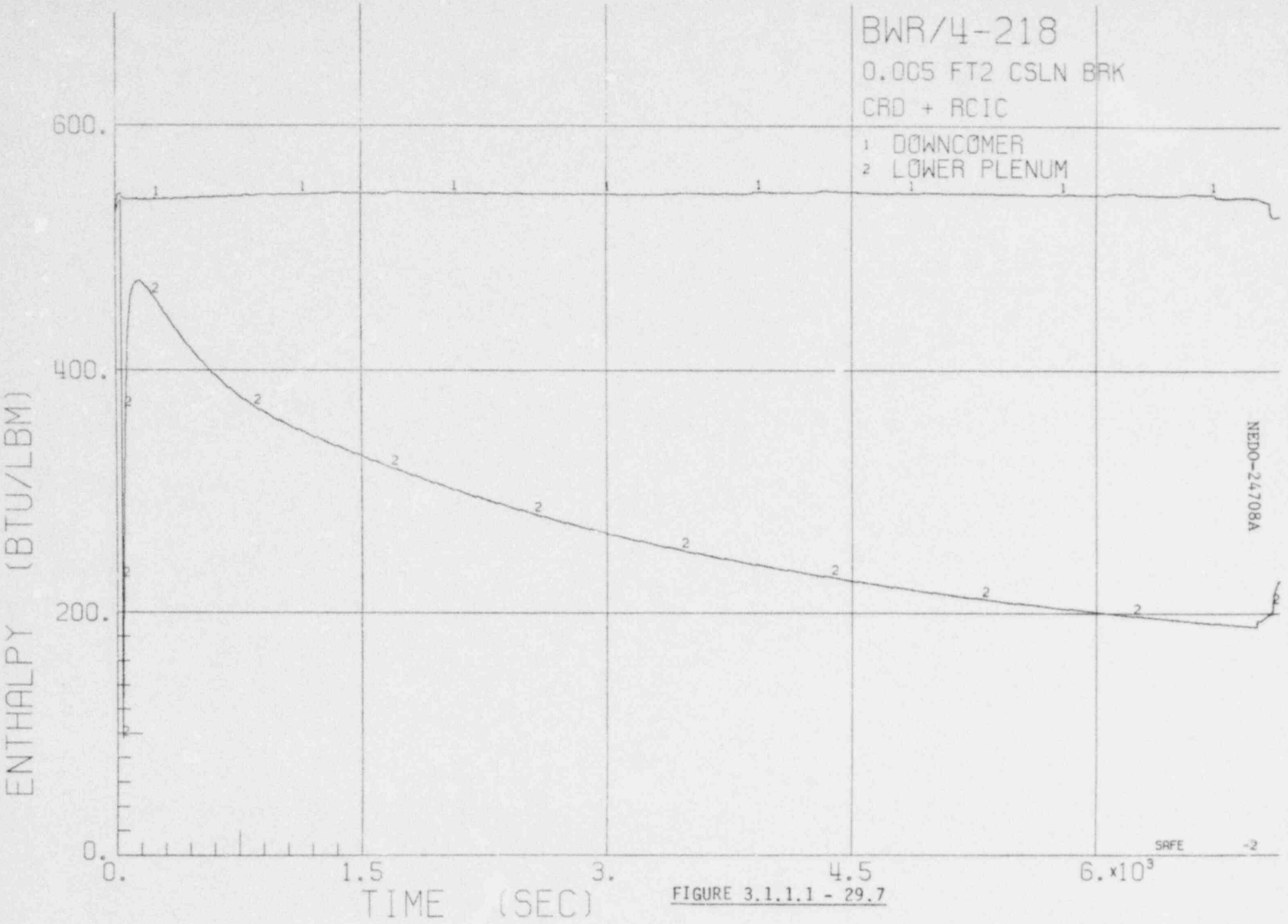

FIGURE 3.1.1.1 - 29.7

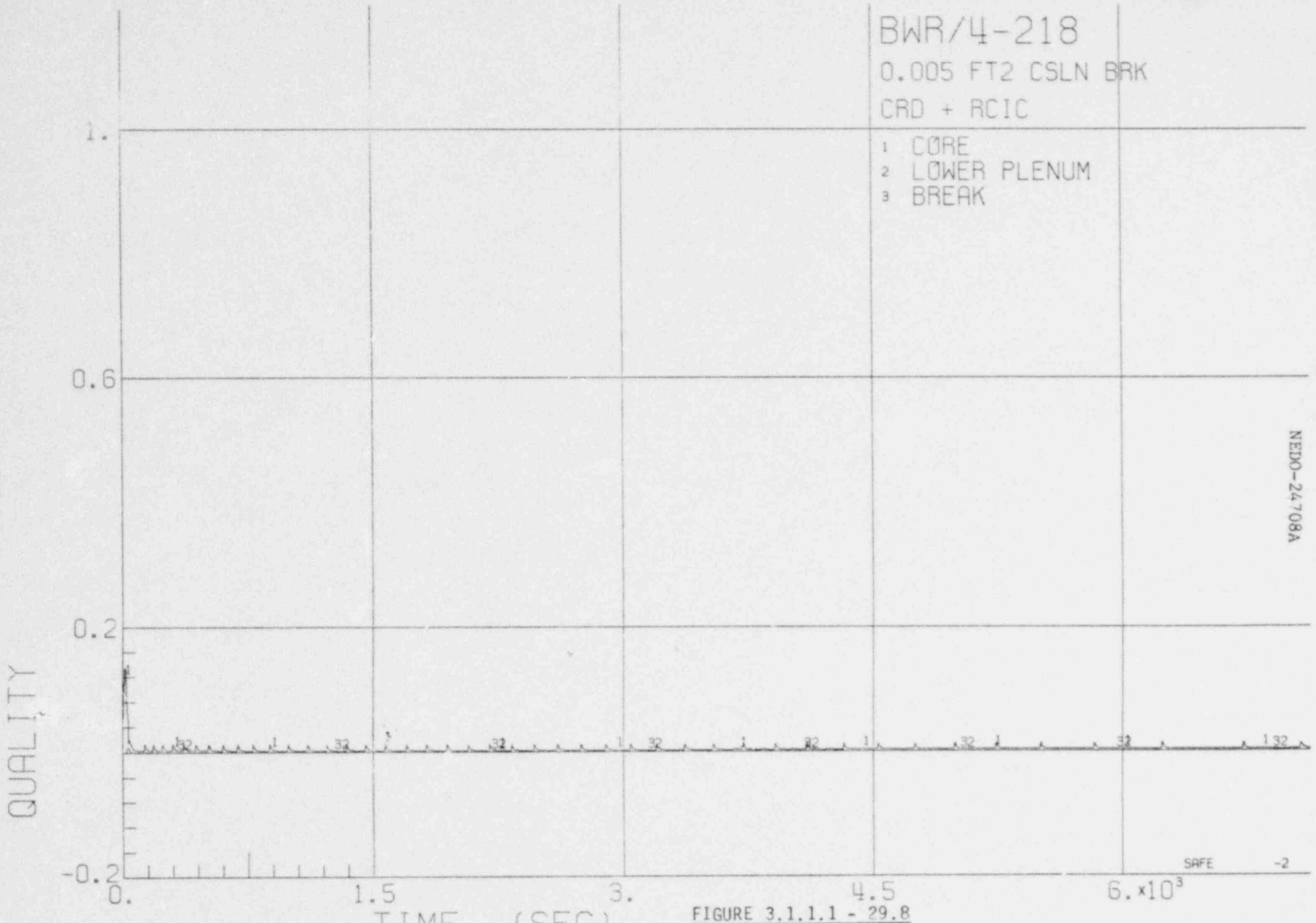

FIGURE 3.1.1.1 - 29.8

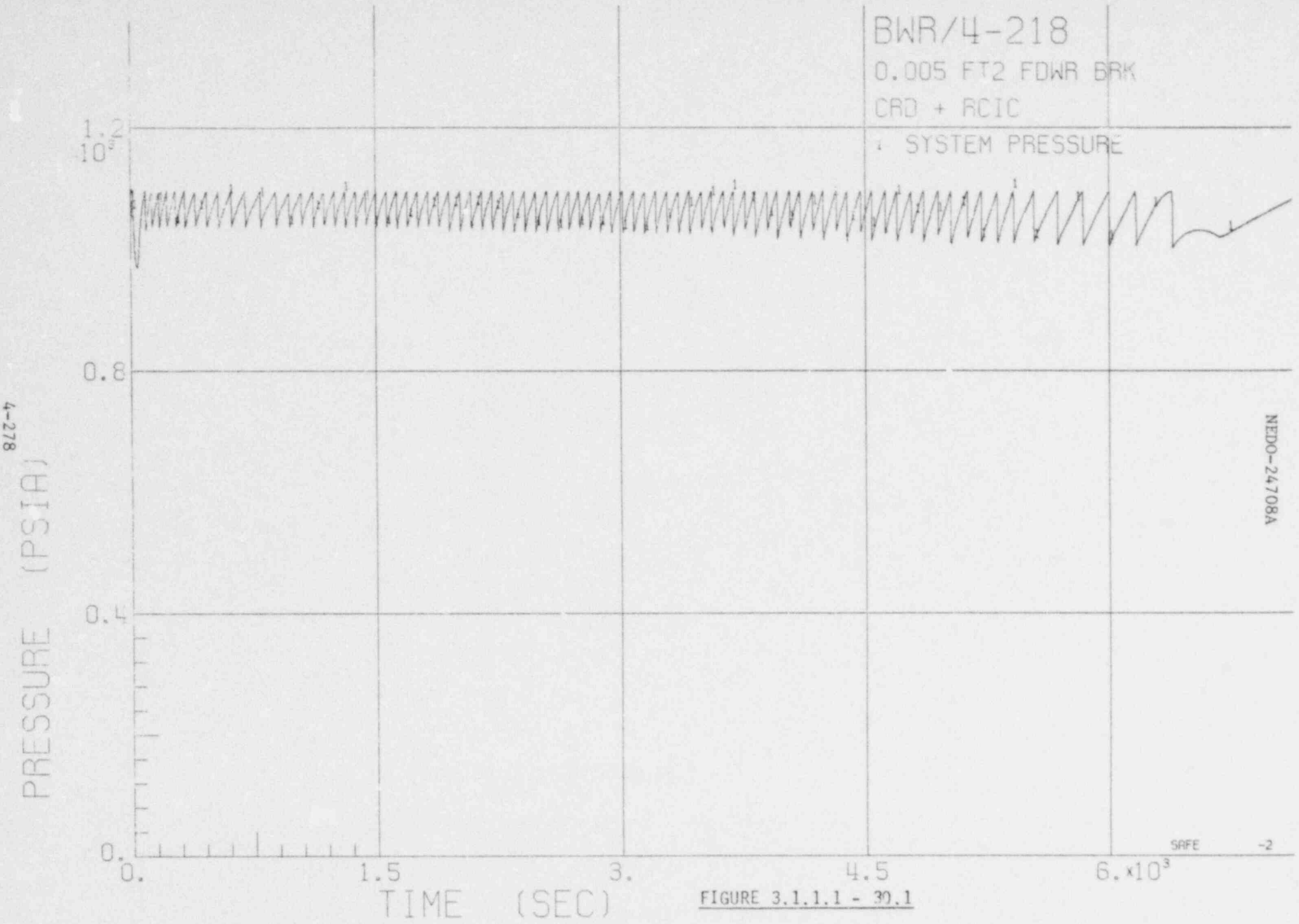

FIGURE 3.1.1.1 - 30.1

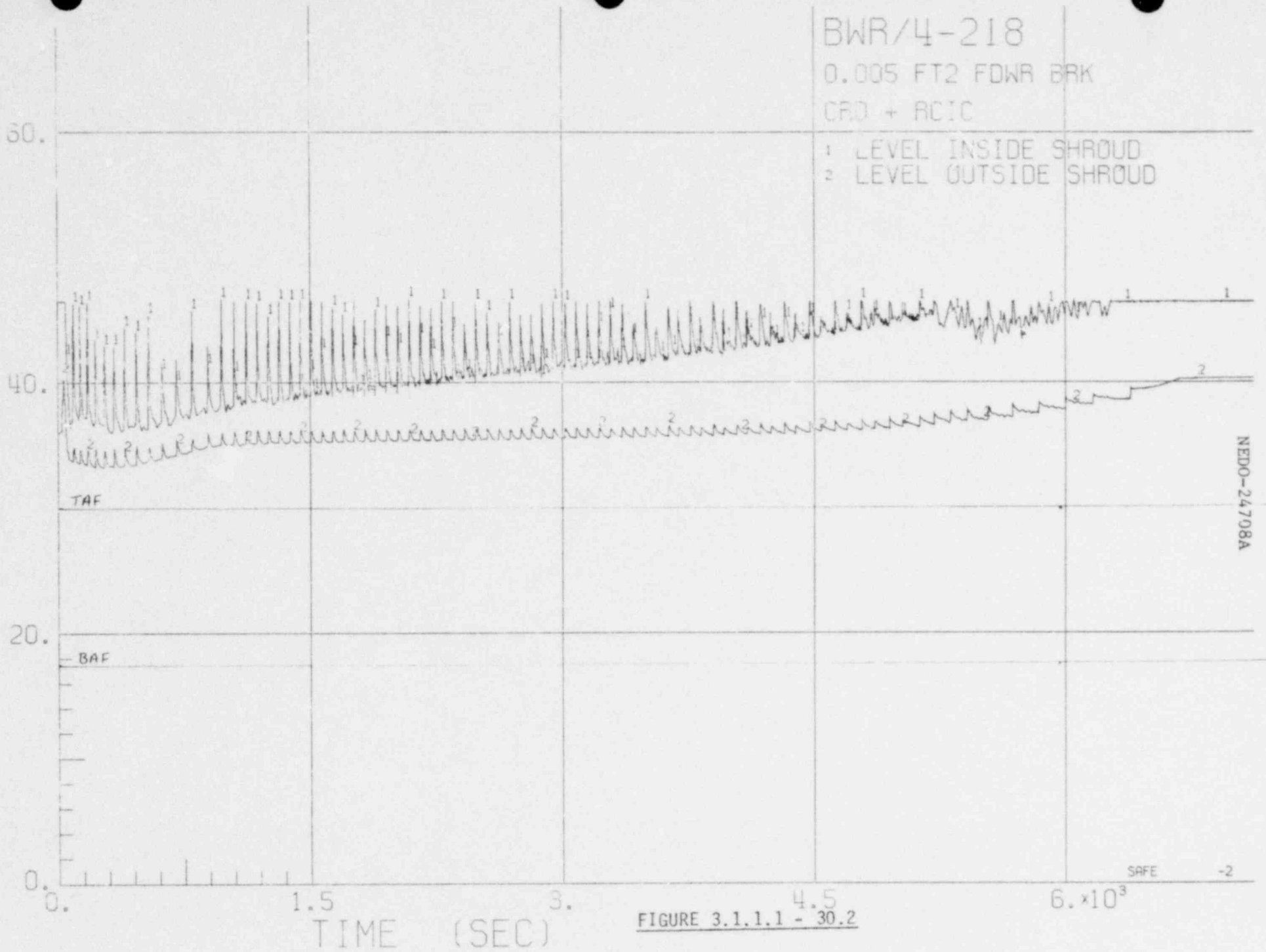

FIGURE 3.1.1.1 - 30.2

FIGURE 3.1.1.1 - 30.3

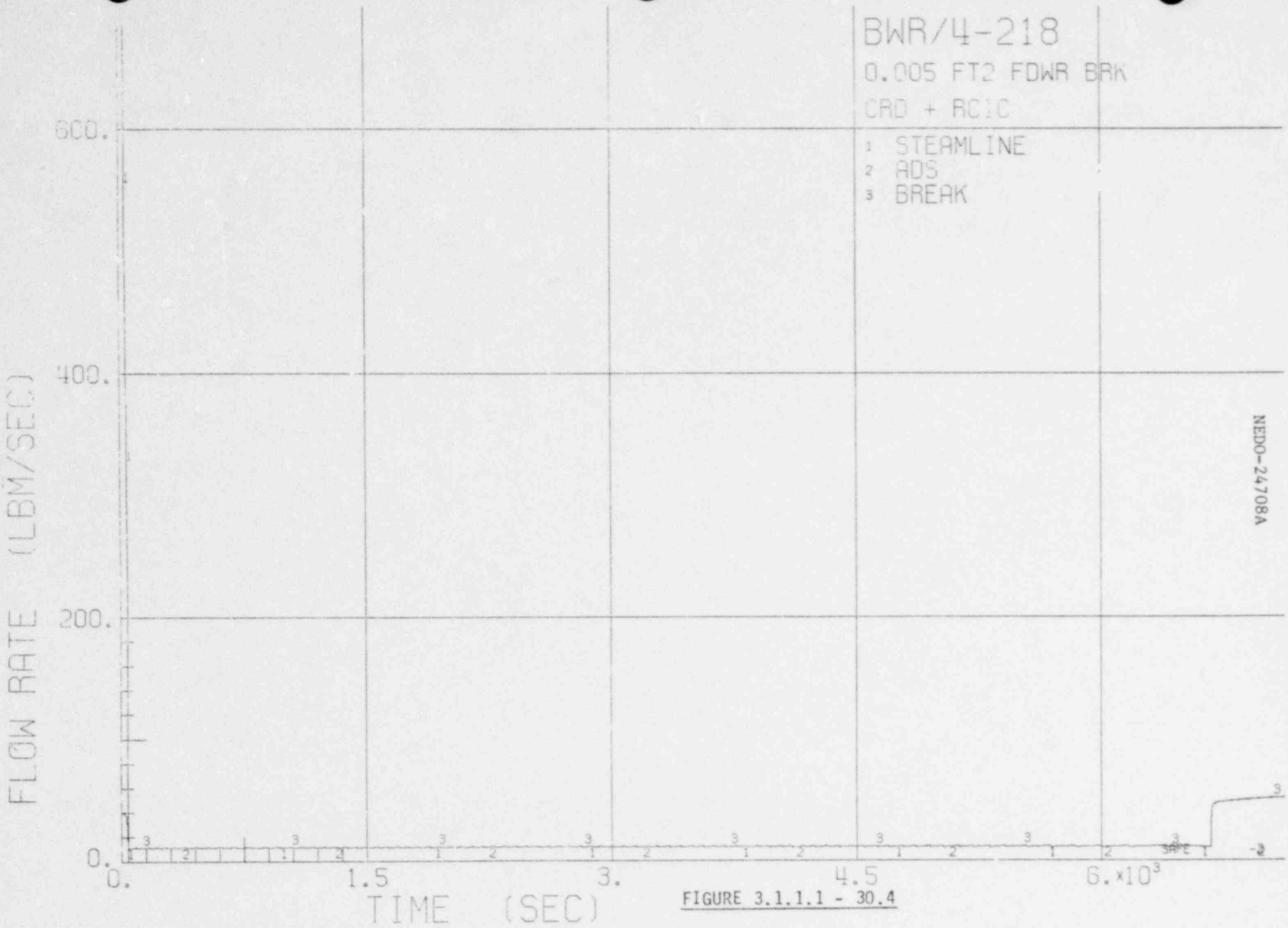

FIGURE 3.1.1.1 - 30.4

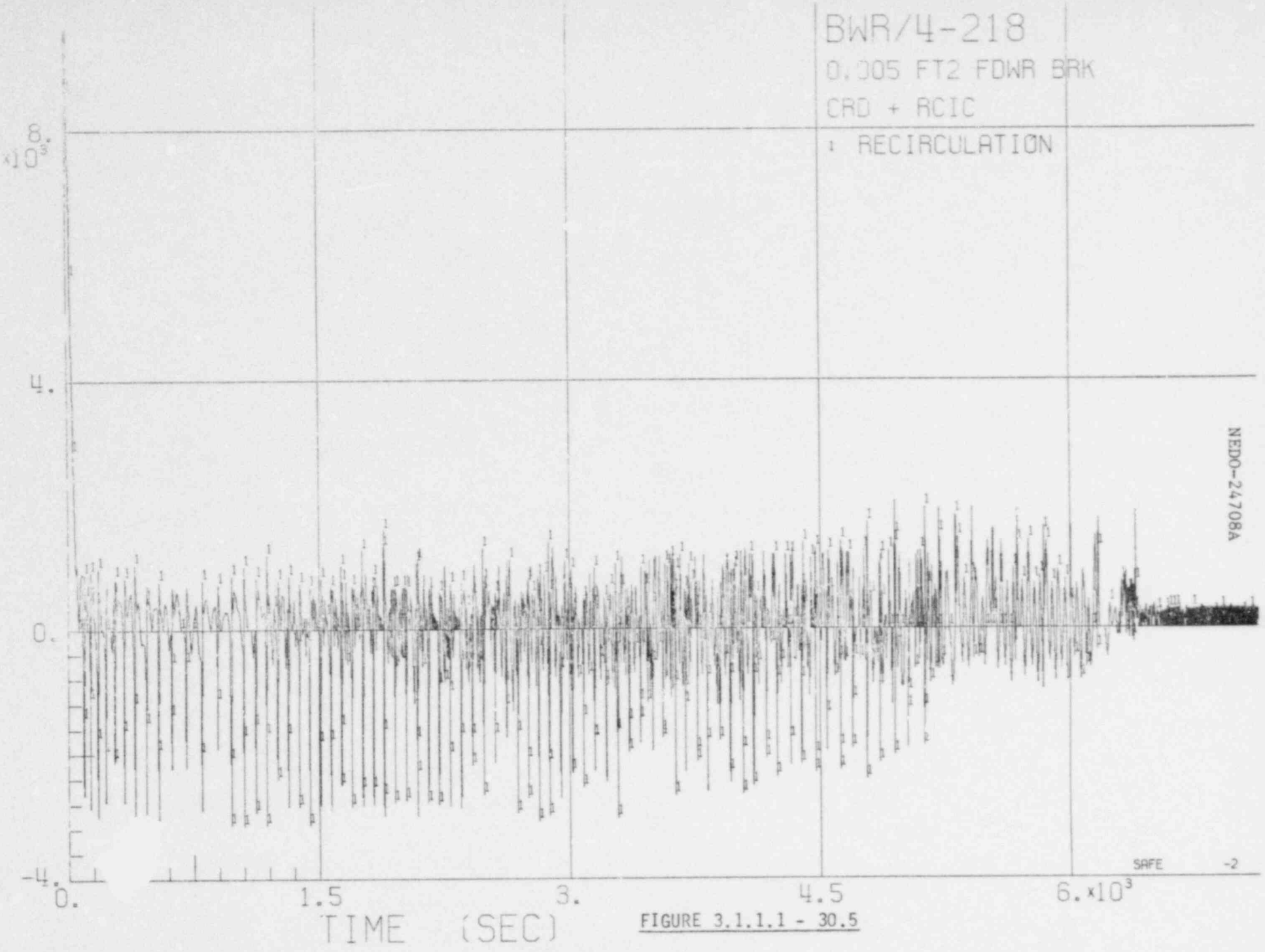

FIGURE 3.1.1.1 - 30.5

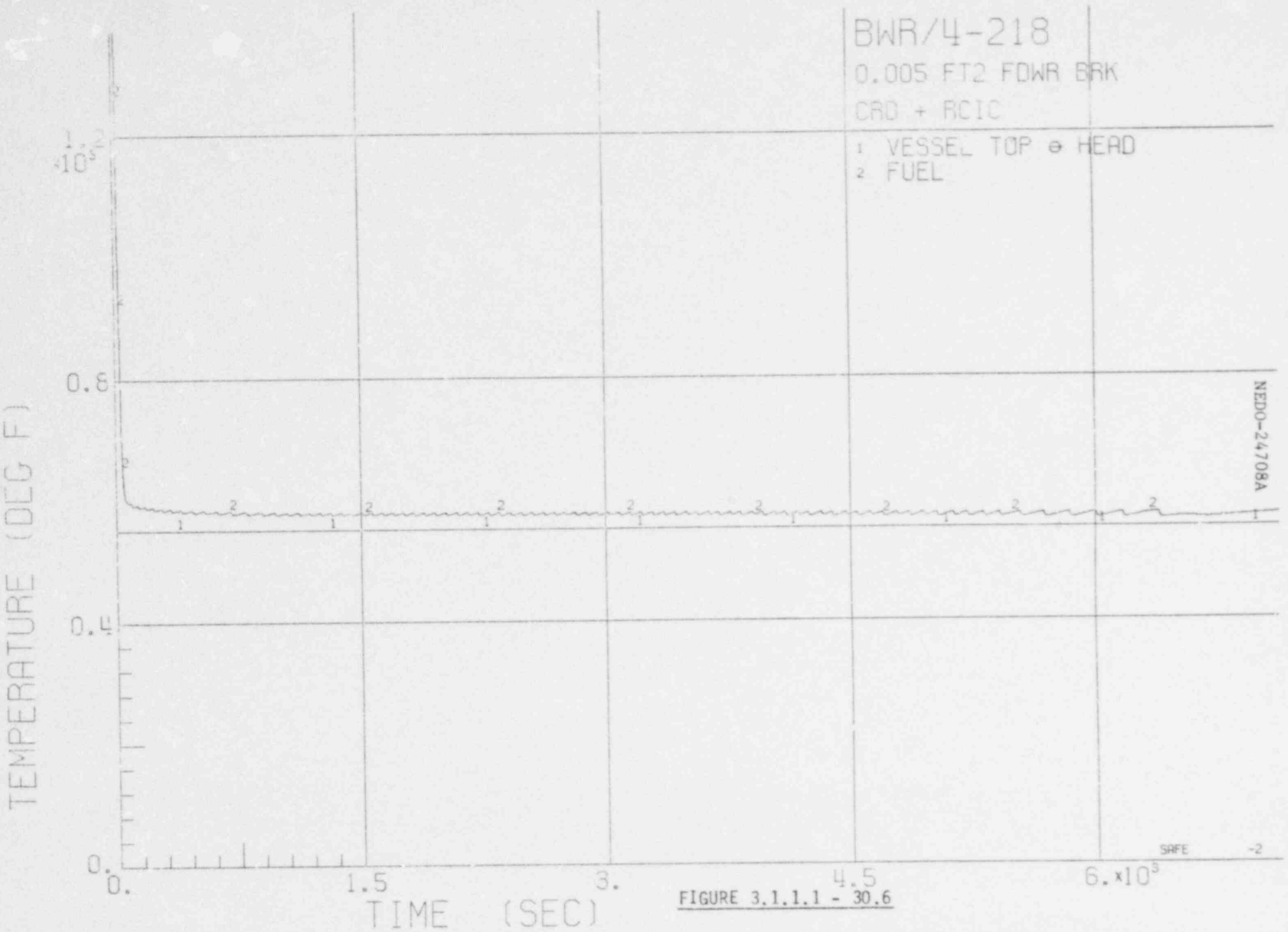

FIGURE 3.1.1.1 - 30.6

FIGURE 3.1.1.1 - 30.7

FIGURE 3.1.1.1 - 30.8

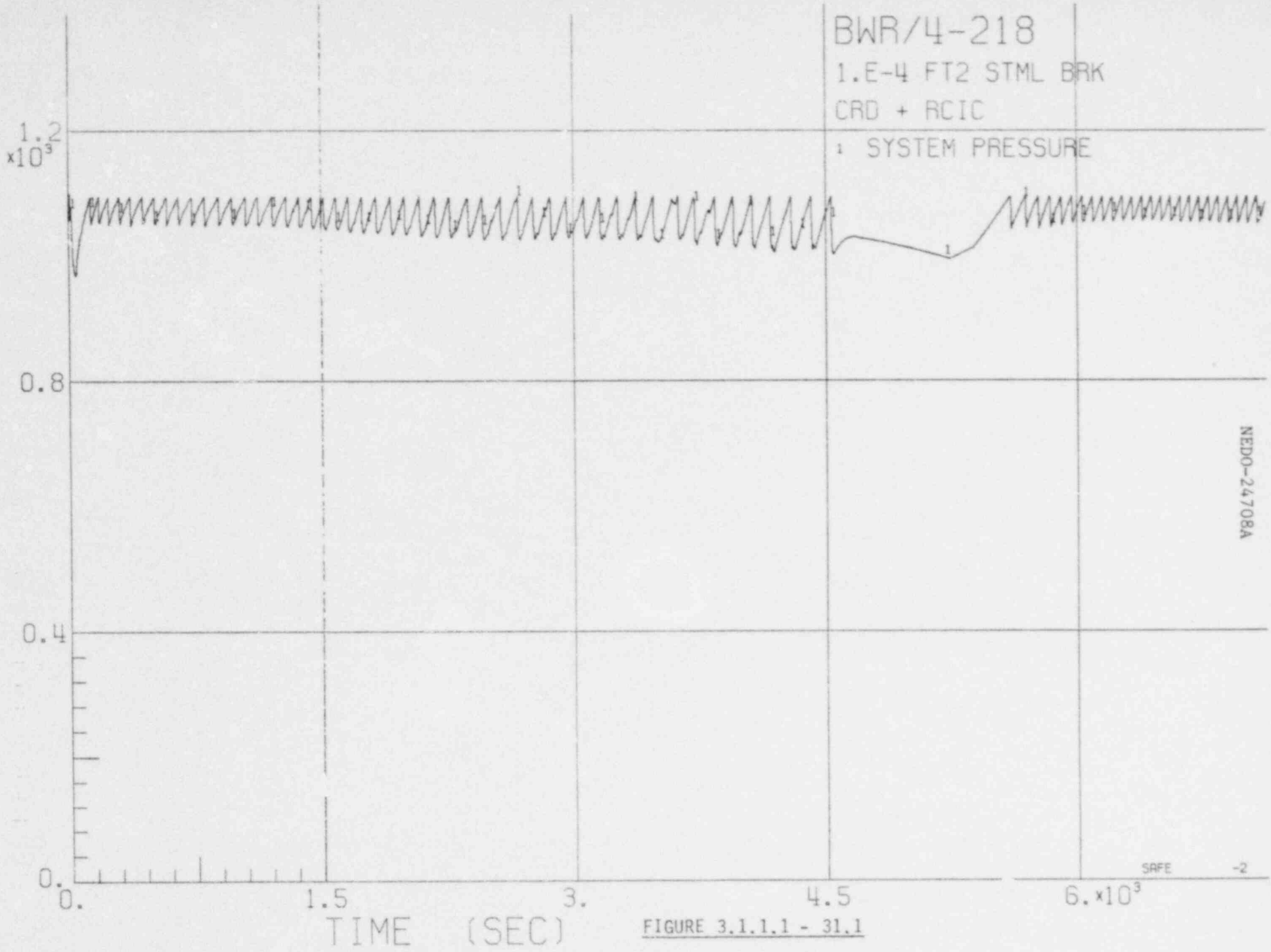

FIGURE 3.1.1.1 - 31.1

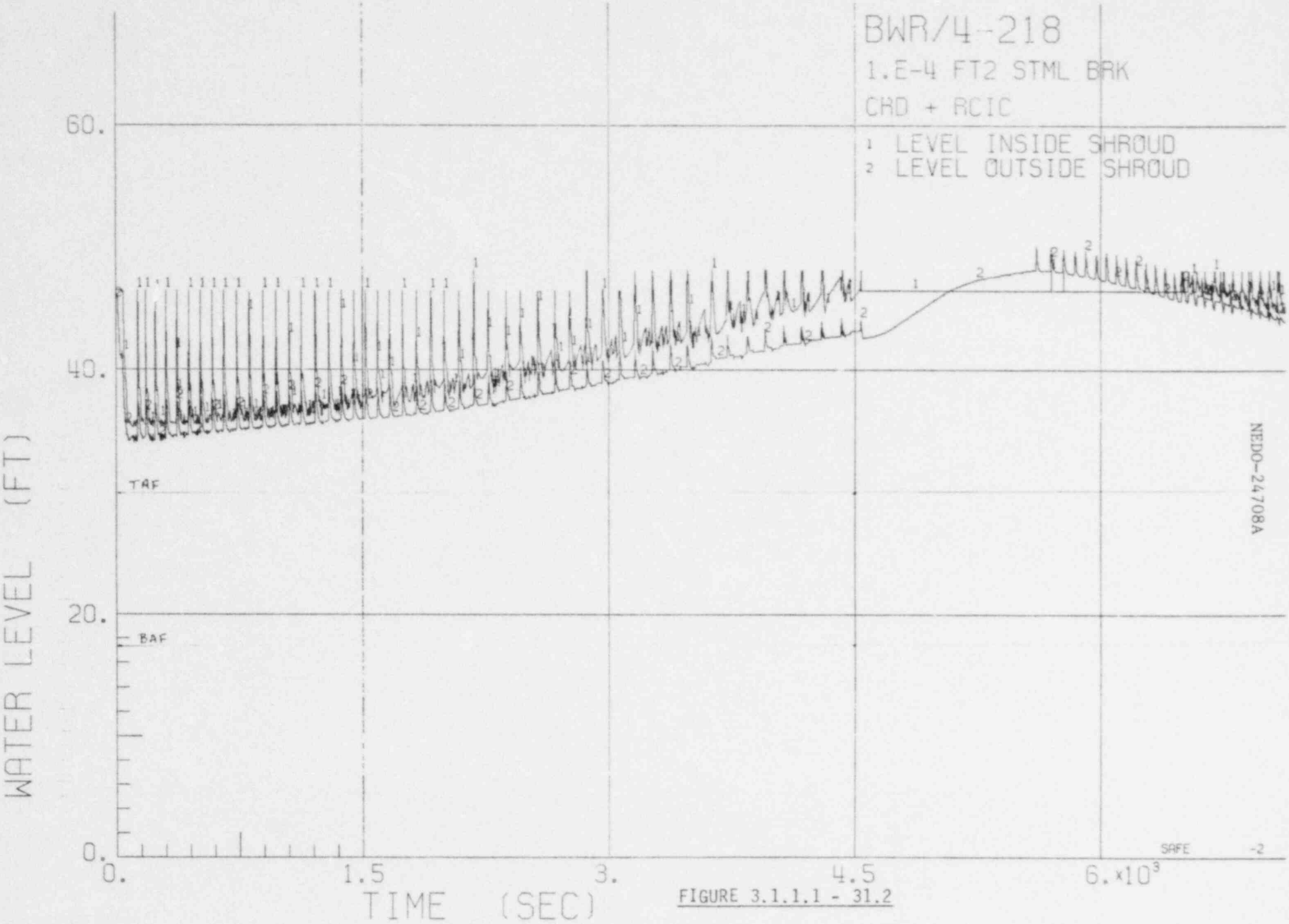

FIGURE 3.1.1.1 - 31.2

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FIGURE 3.1.1.1 - 31.3

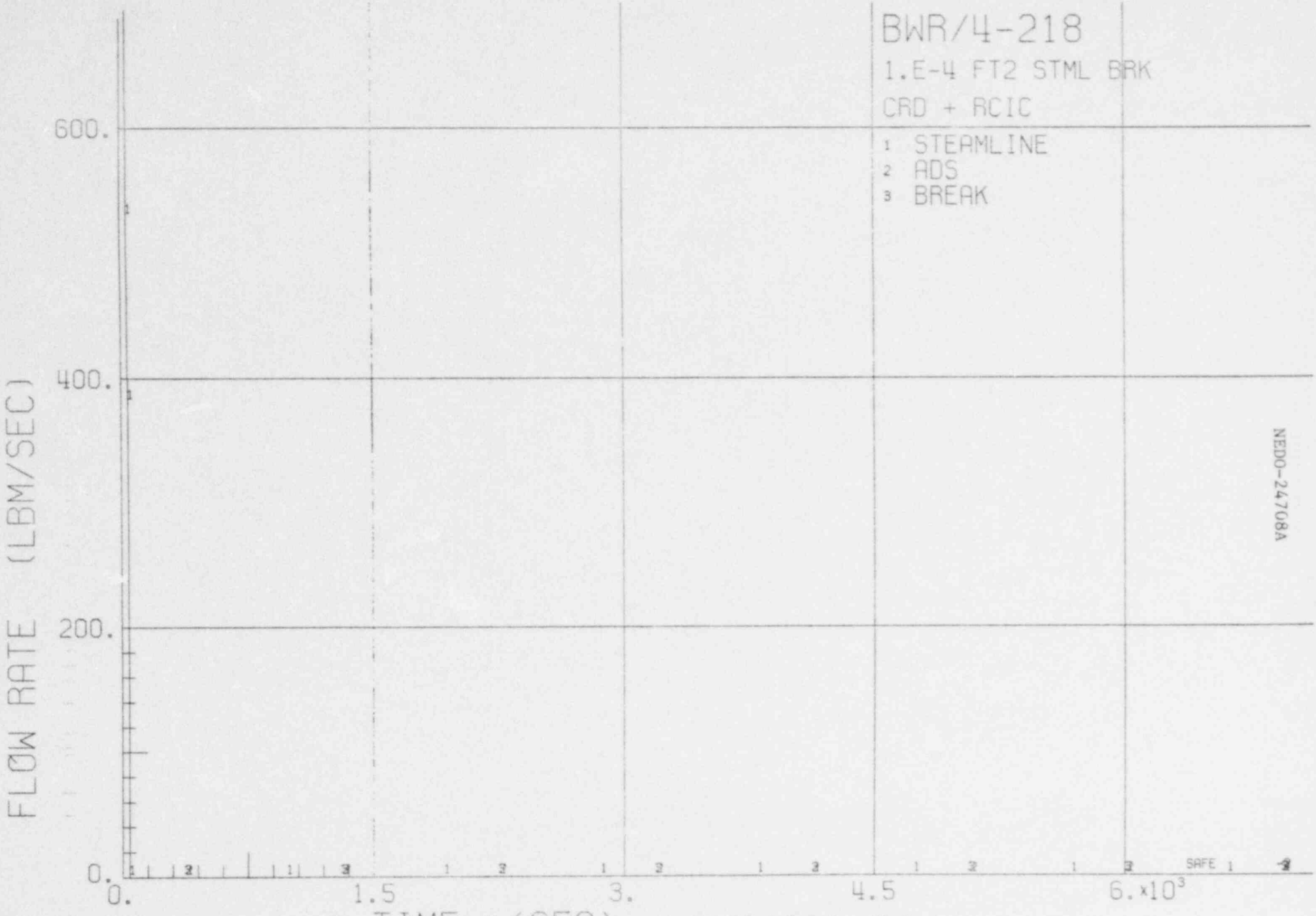

FIGURE 3.1.1.1 - 31.4

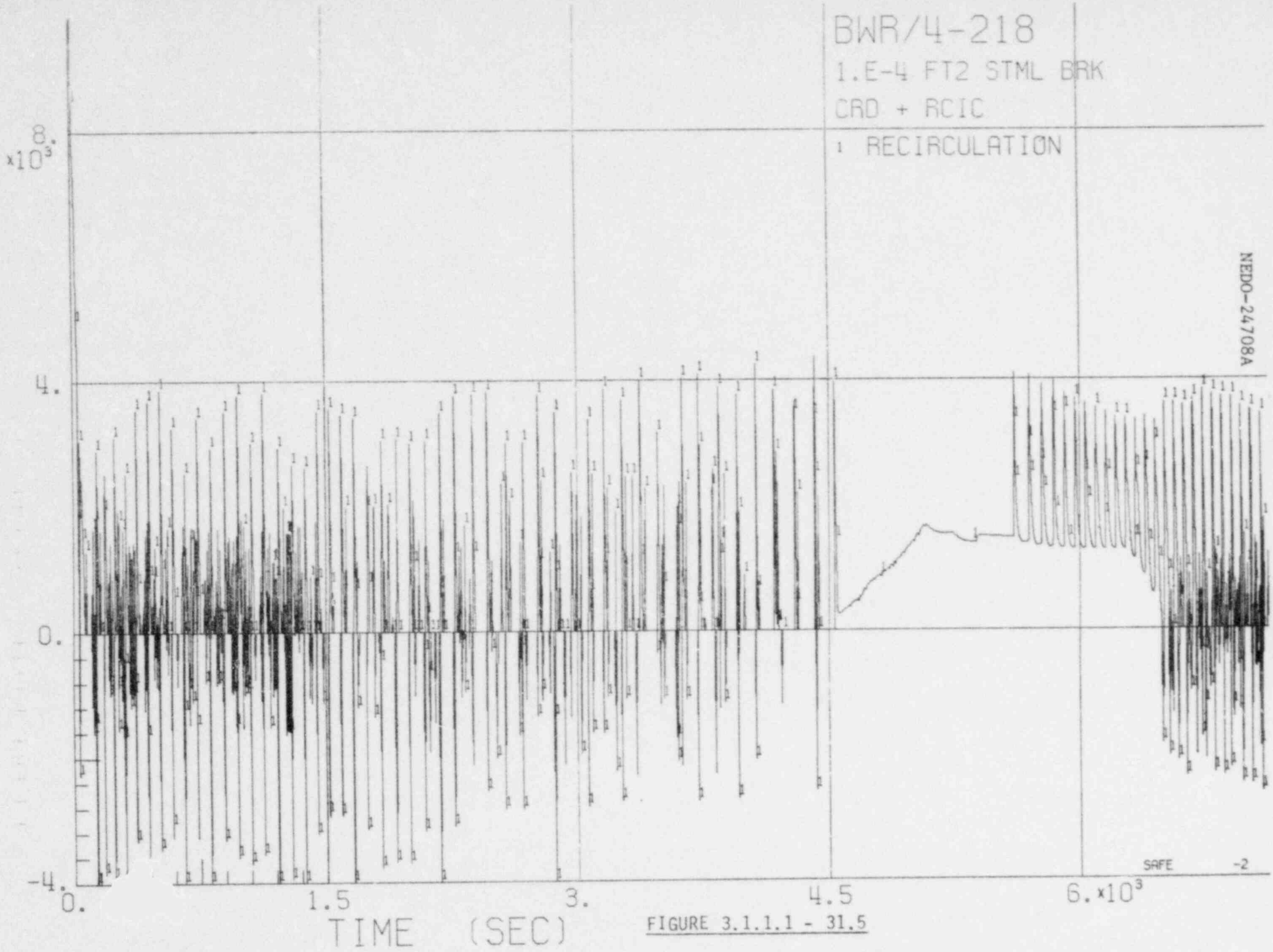

FIGURE 3.1.1.1 - 31.5

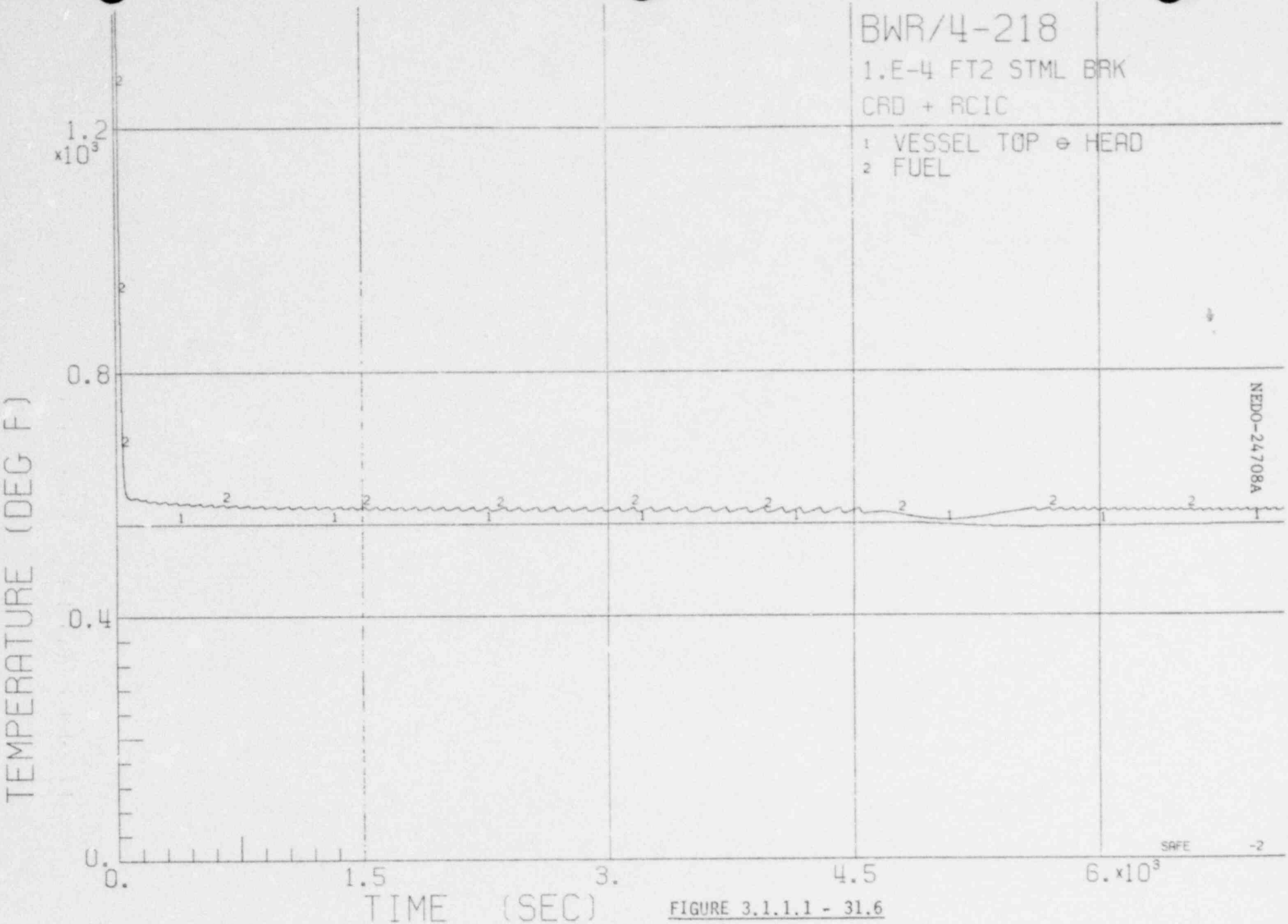

FIGURE 3.1.1.1 - 31.6

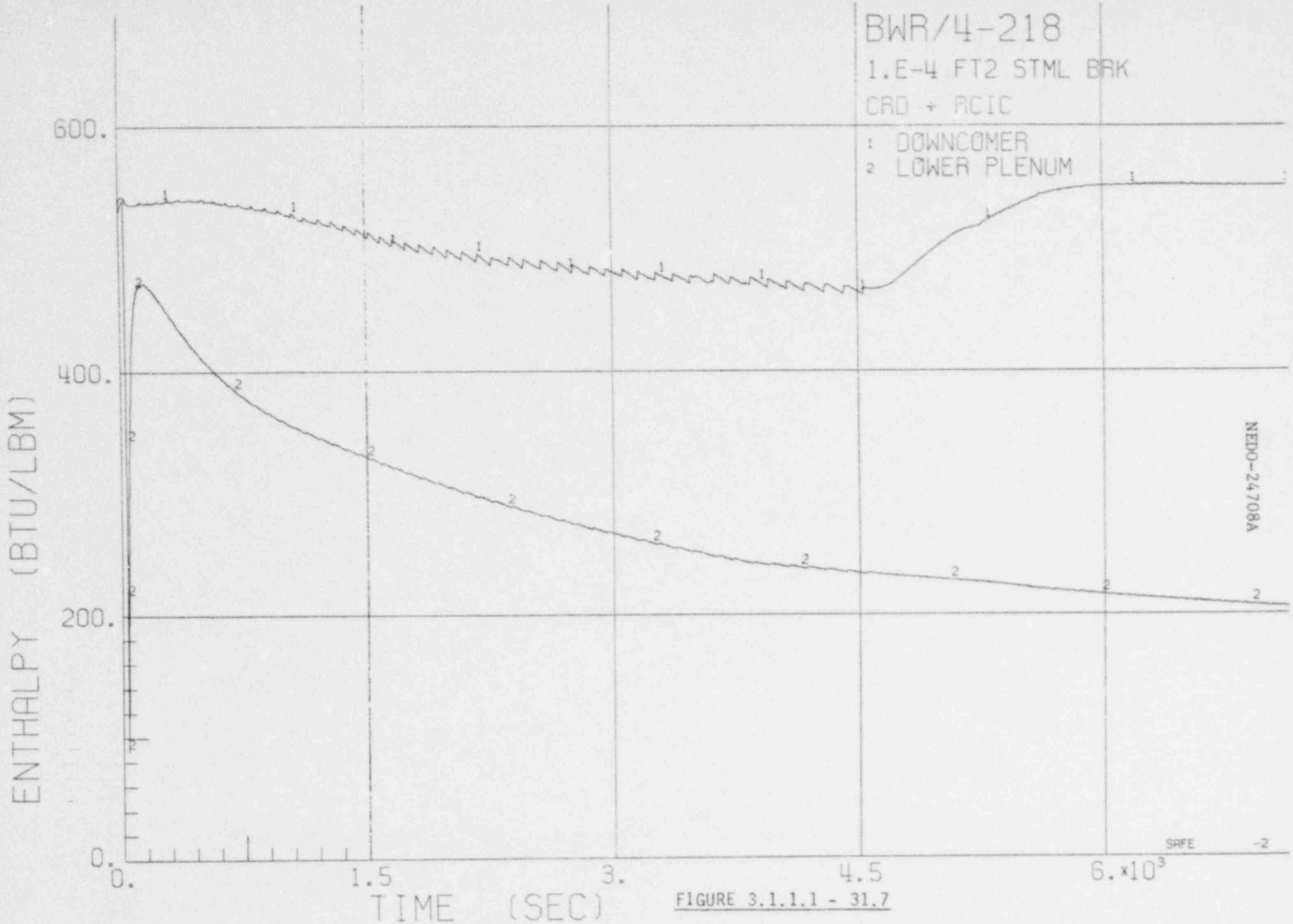

FIGURE 3.1.1.1 - 31.7

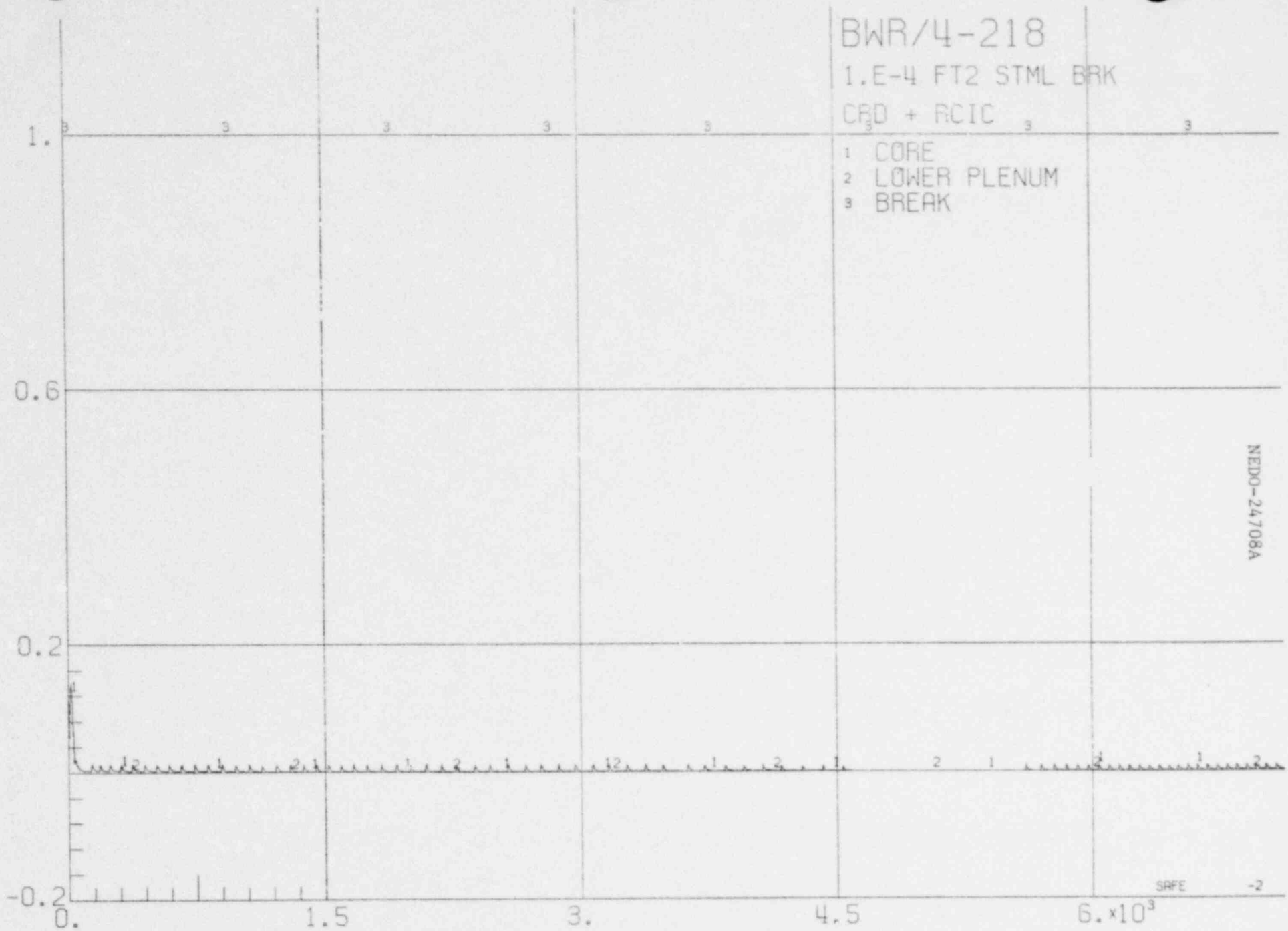

FIGURE 3.1.1.1 - 31.8

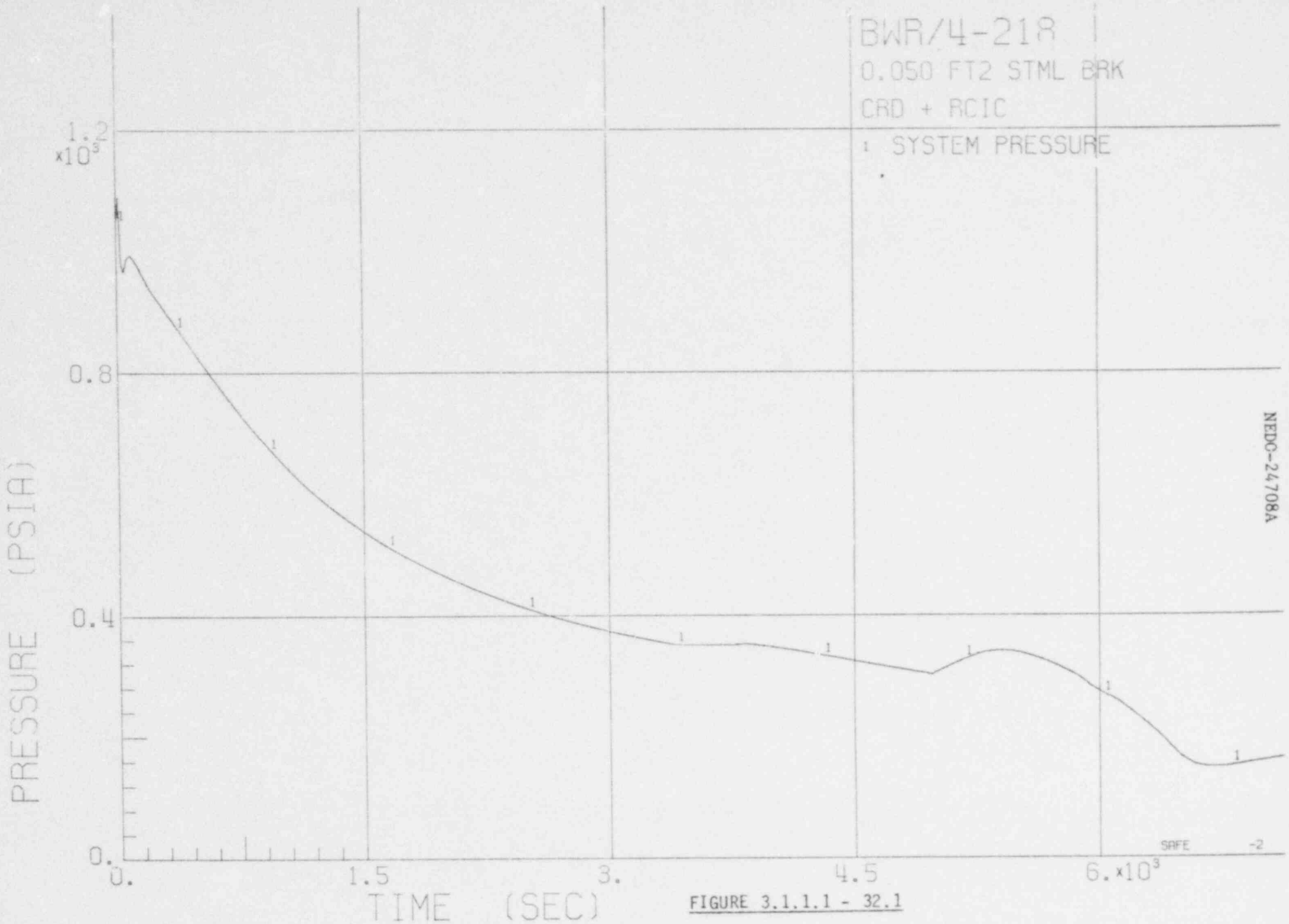

FIGURE 3.1.1.1 - 32.1

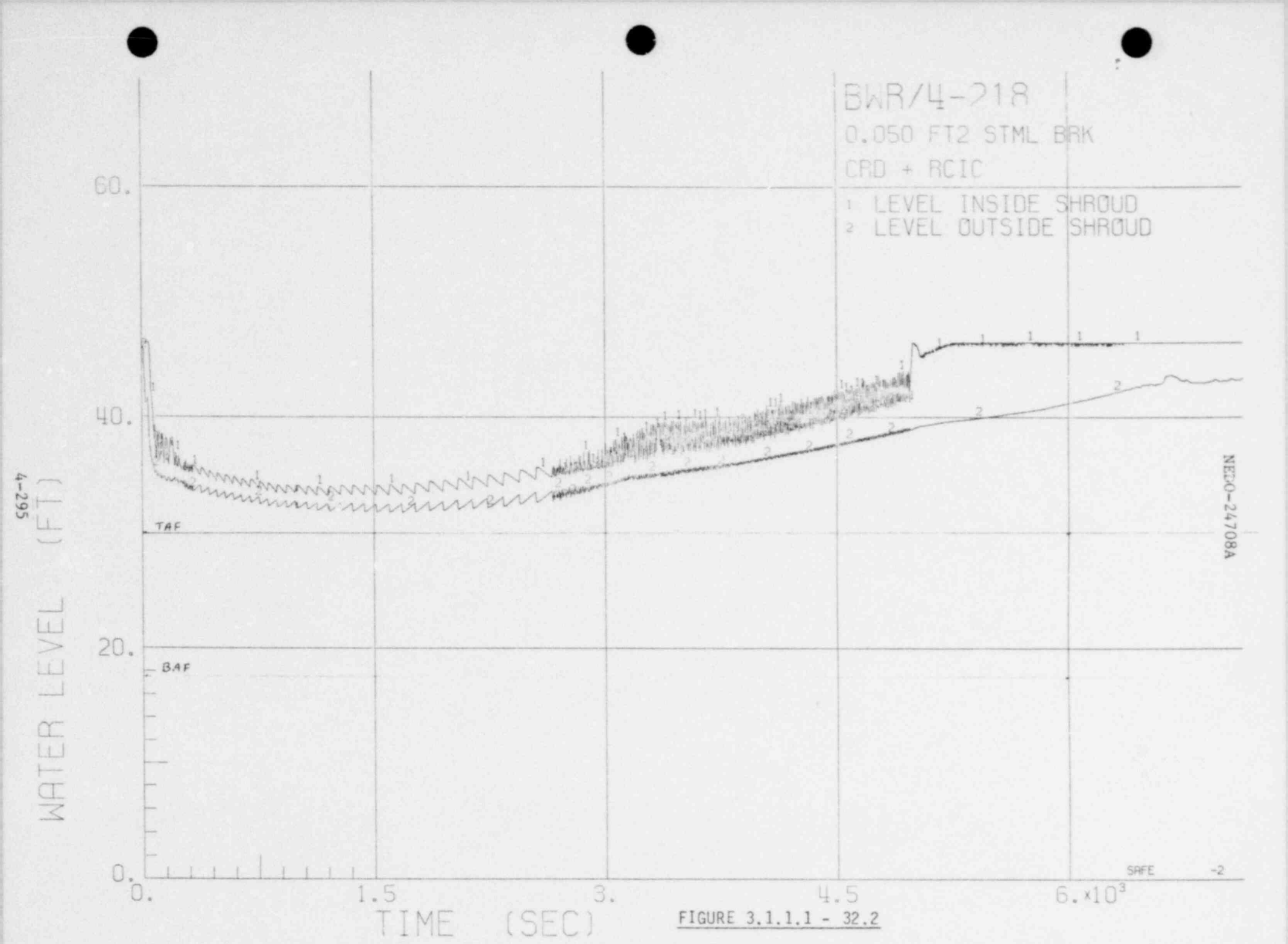

FIGURE 3.1.1.1 - 32.2

FIGURE 3.1.1.1 - 32.3

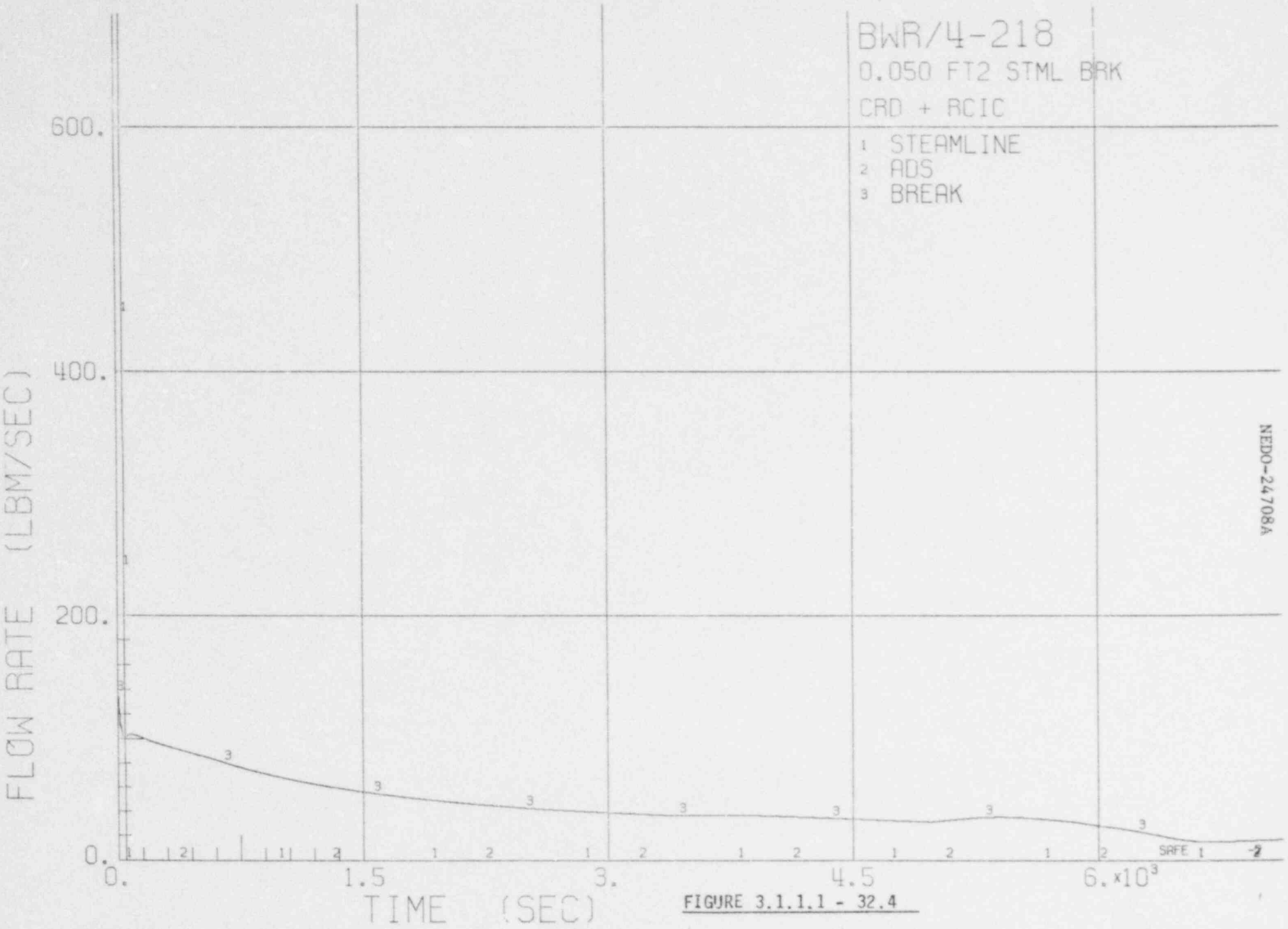

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FIGURE 3.1.1.1 - 32.4

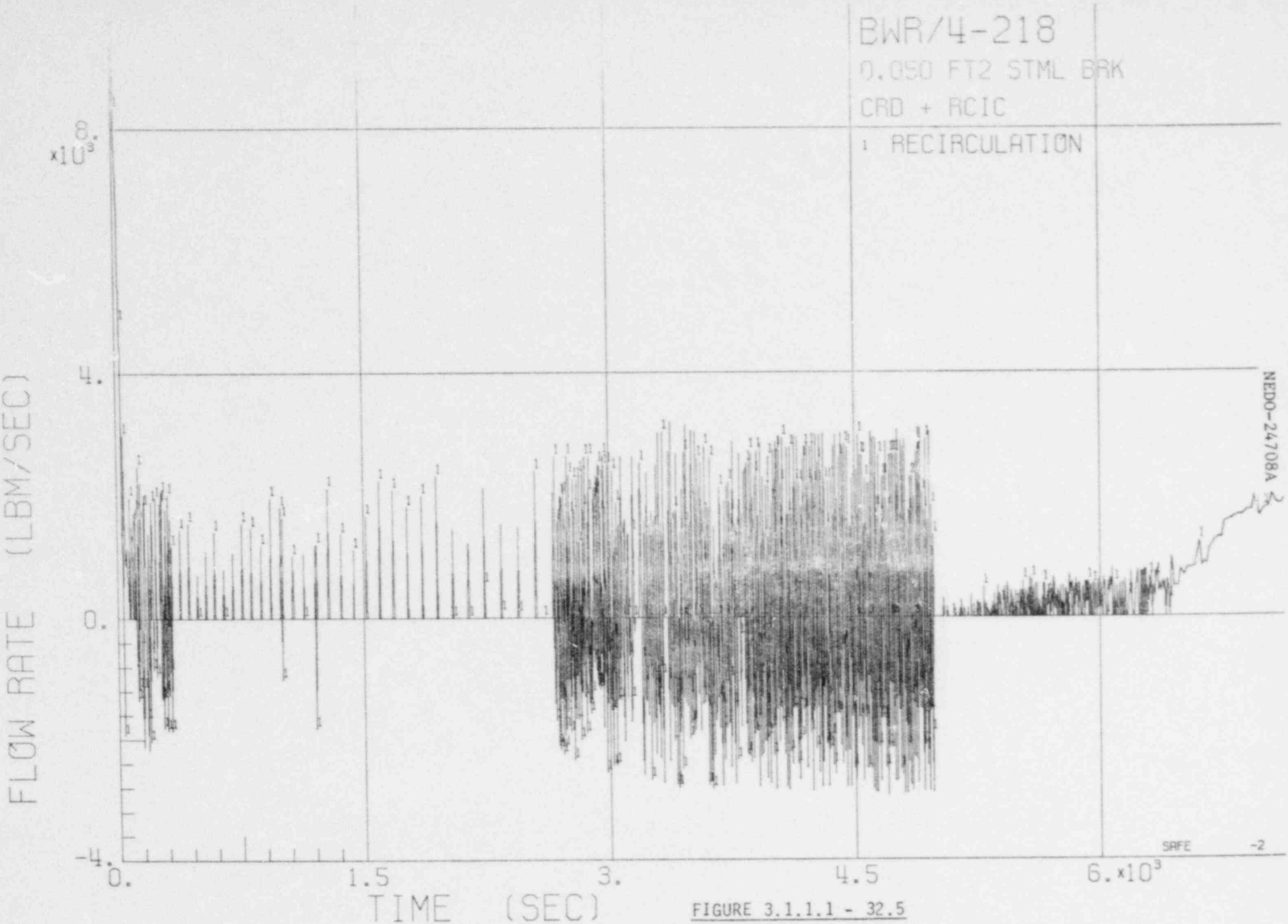

FIGURE 3.1.1.1 - 32.5

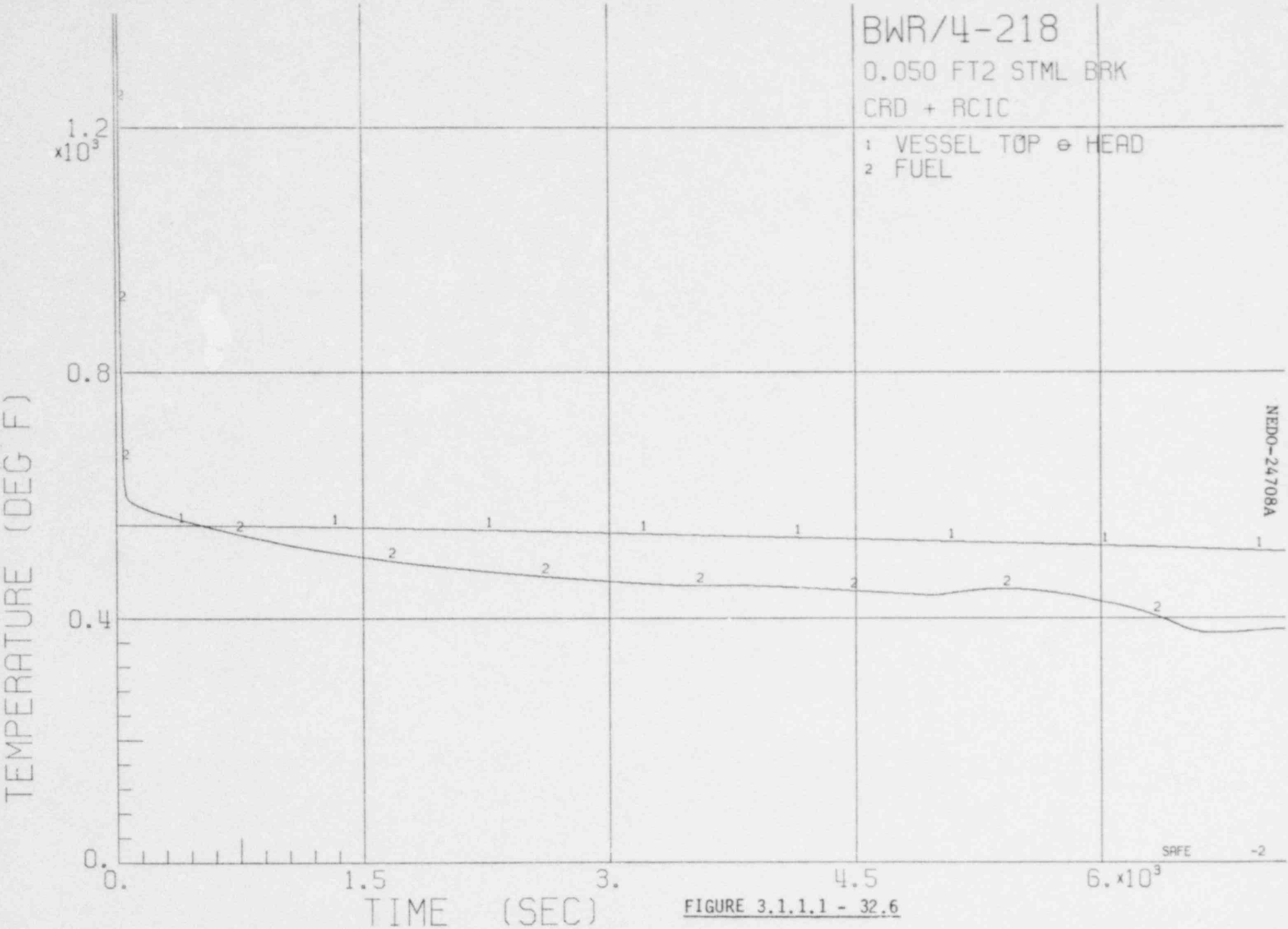

FIGURE 3.1.1.1 - 32.6

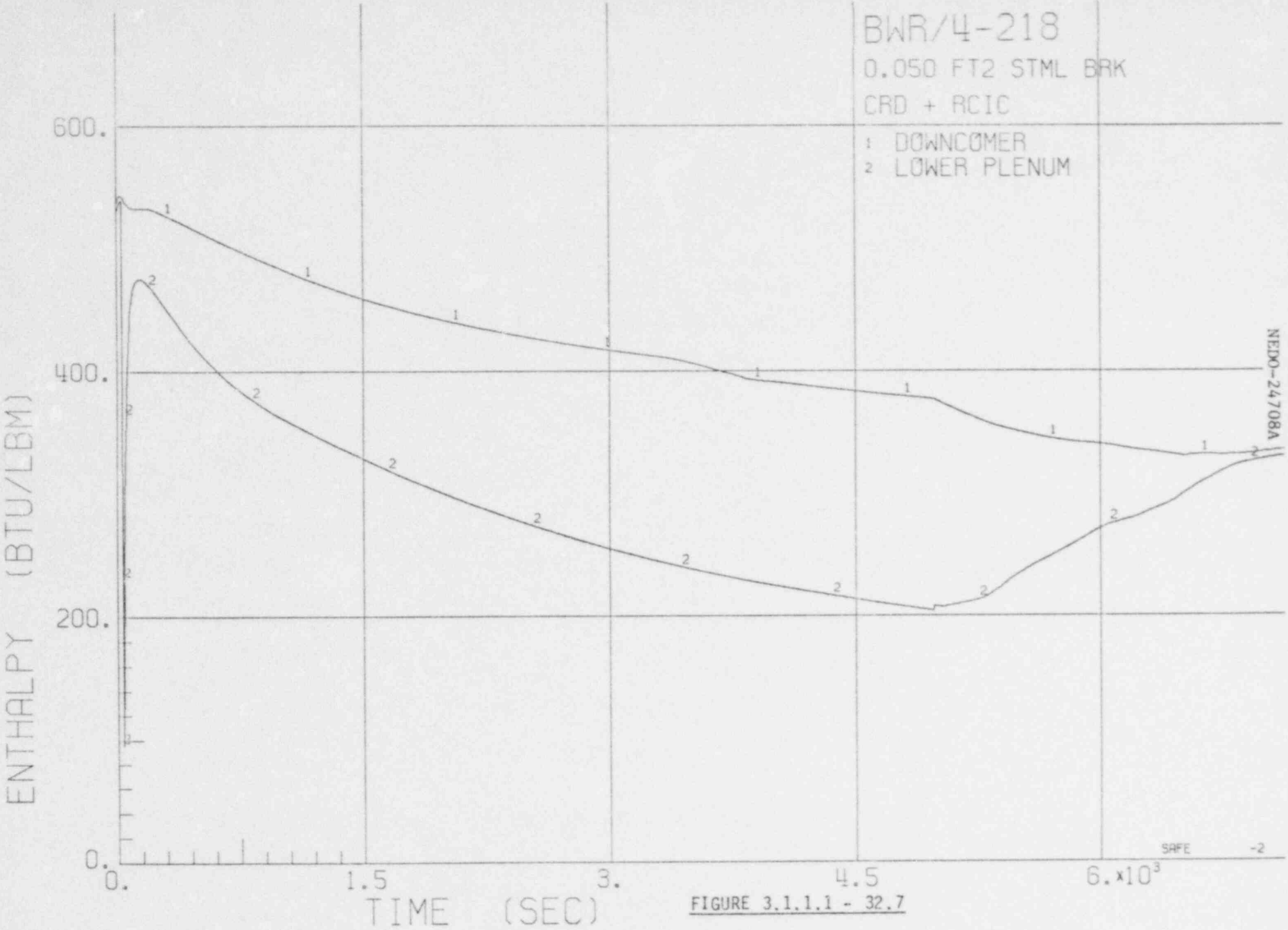

FIGURE 3.1.1.1 - 32.7

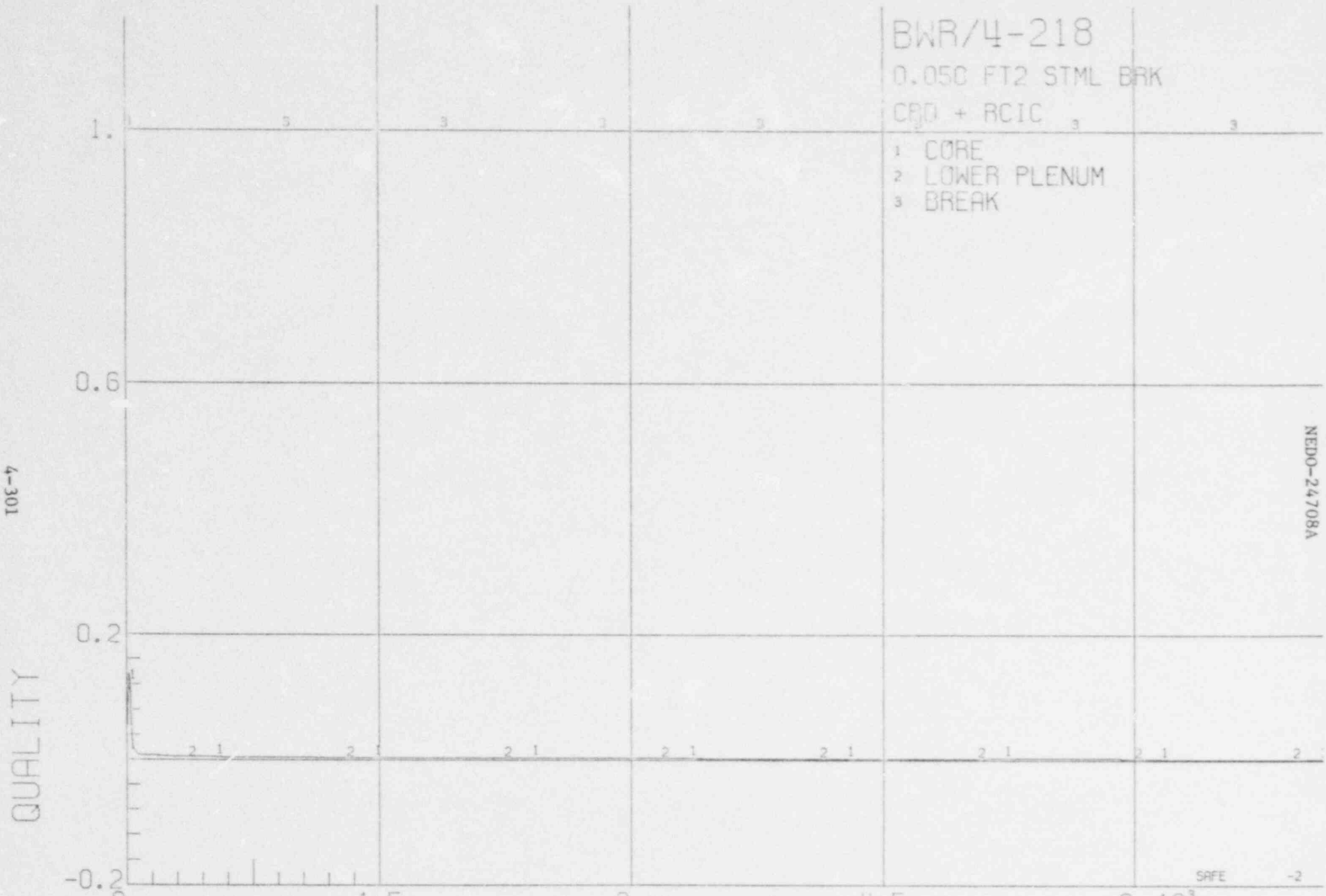

FIGURE 3.1.1.1 - 32.8

FIGURE 3.1.1.1 - 33.1

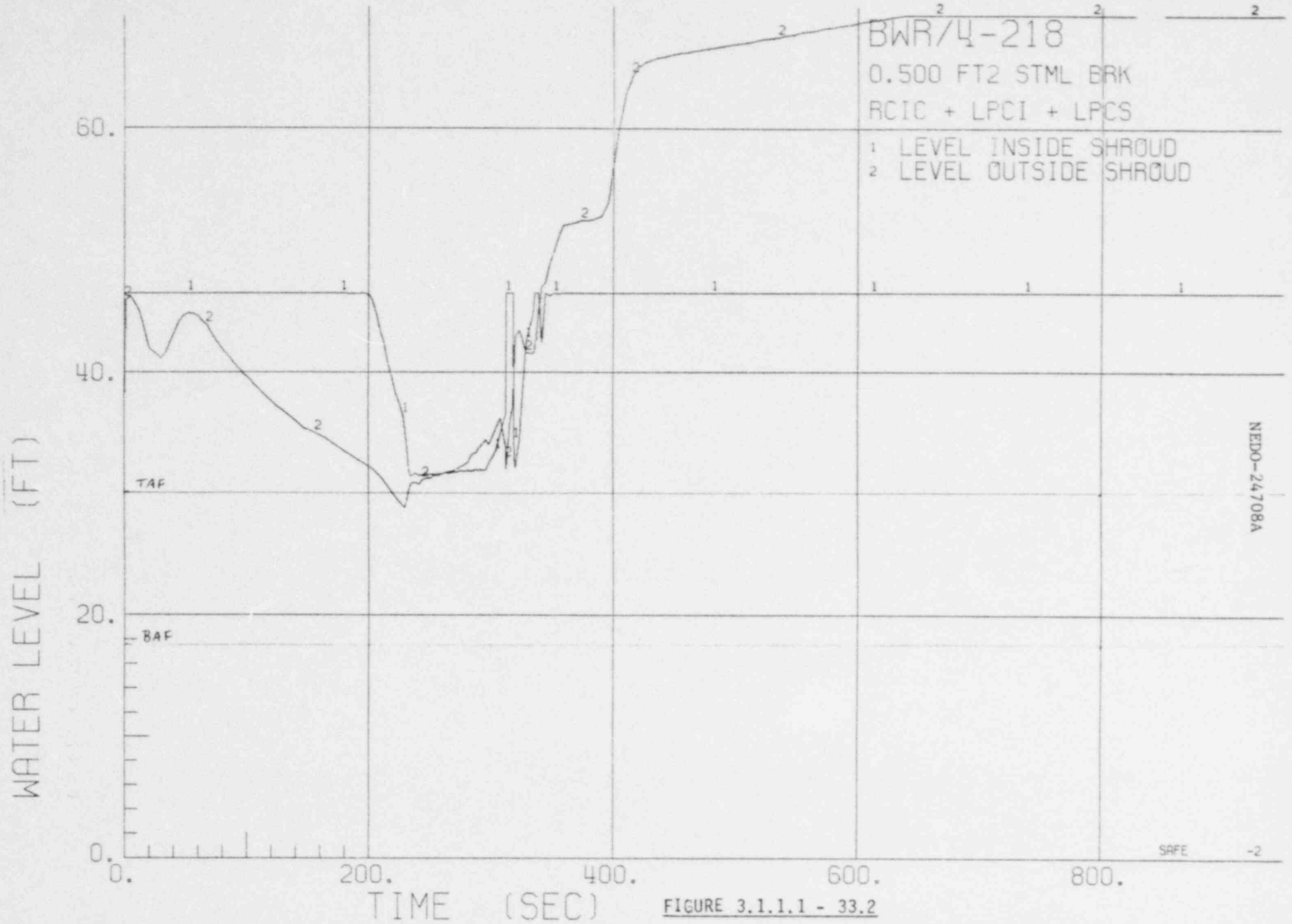

FIGURE 3.1.1.1 - 33.2

FIGURE 3.1.1.1 - 33.3

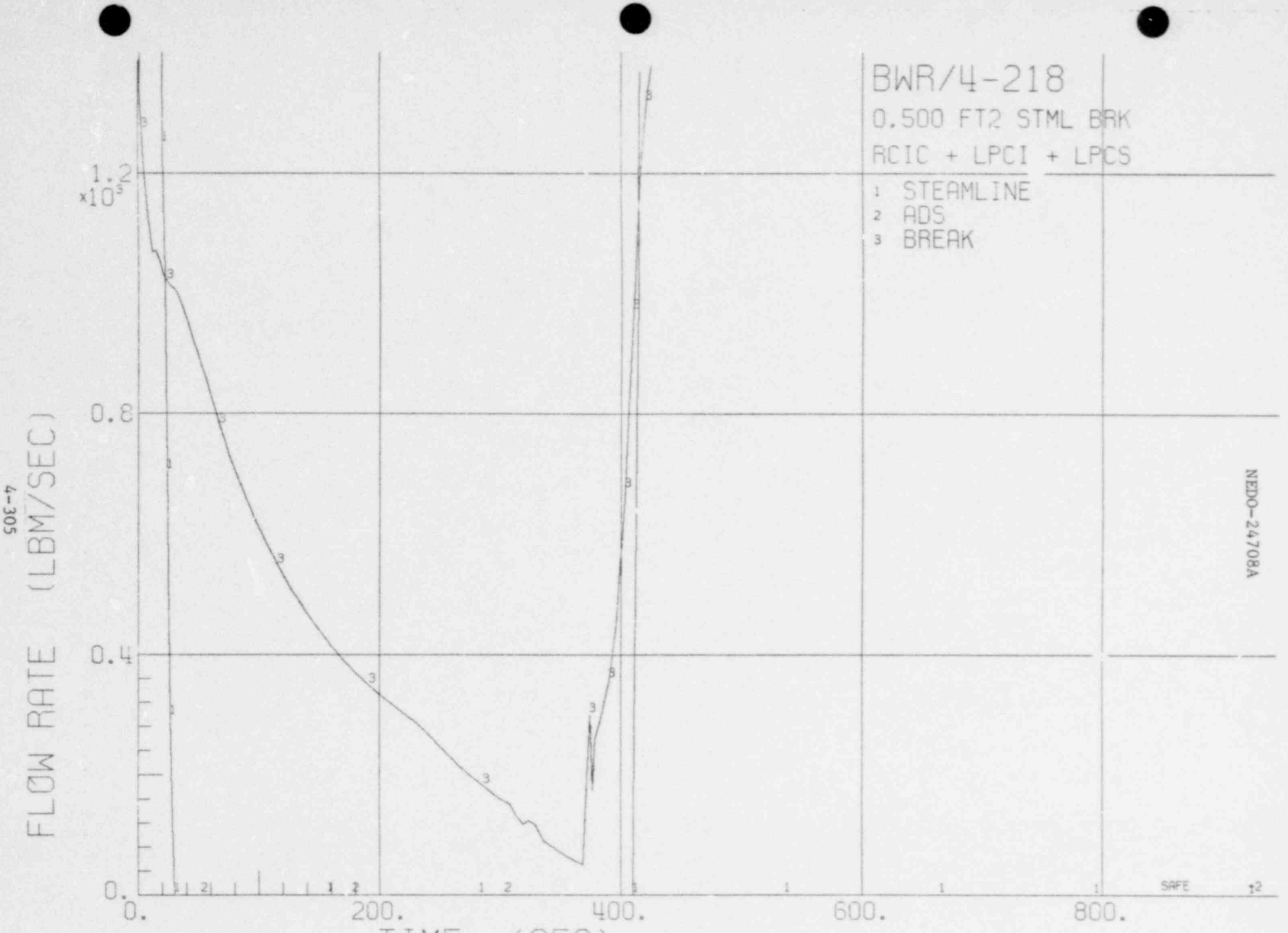

FIGURE 3.1.1.1 - 33.4

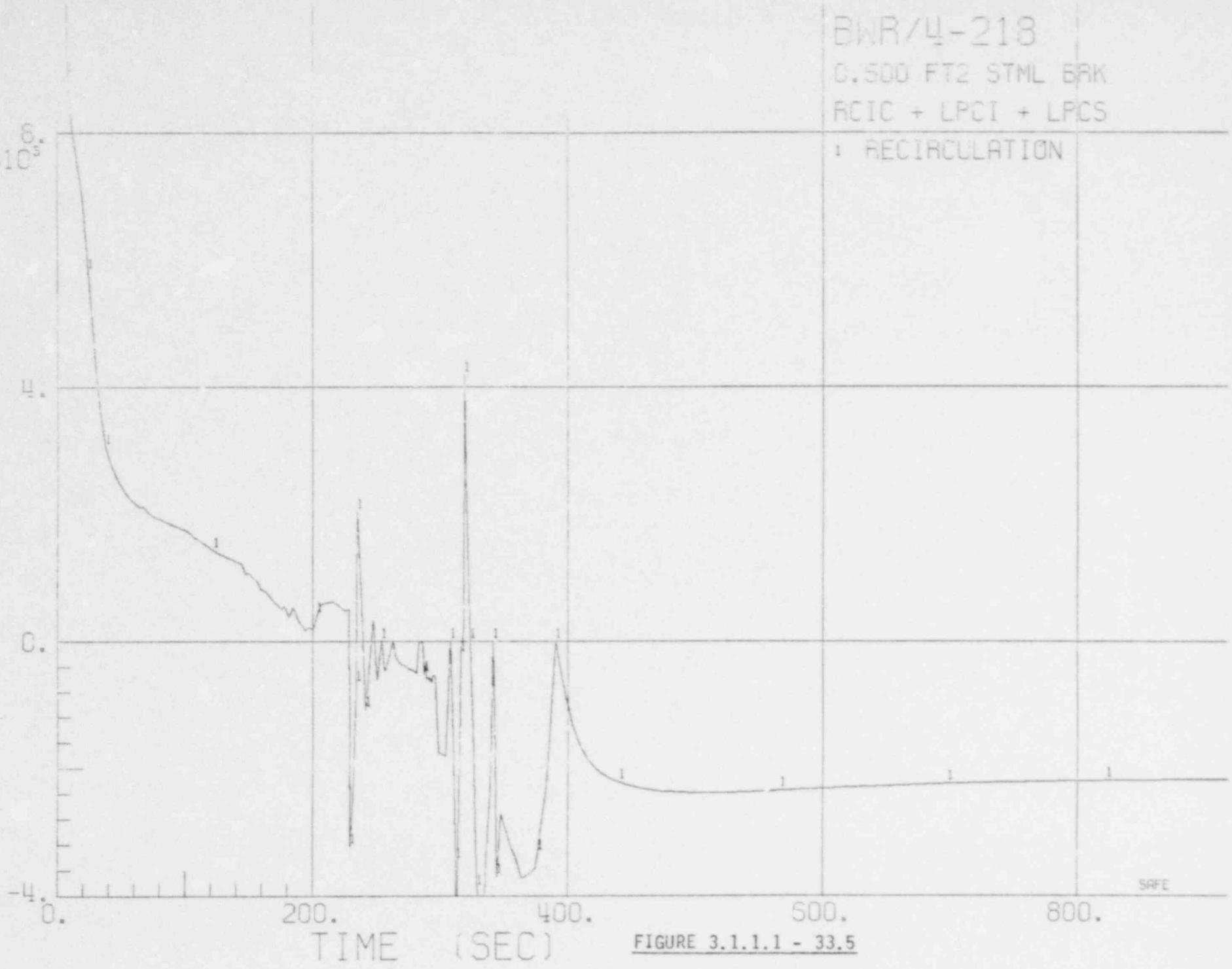

FIGURE 3.1.1.1 - 33.5

FIGURE 3.1.1.1 - 33.6

FIGURE 3.1.1.1 - 33.7

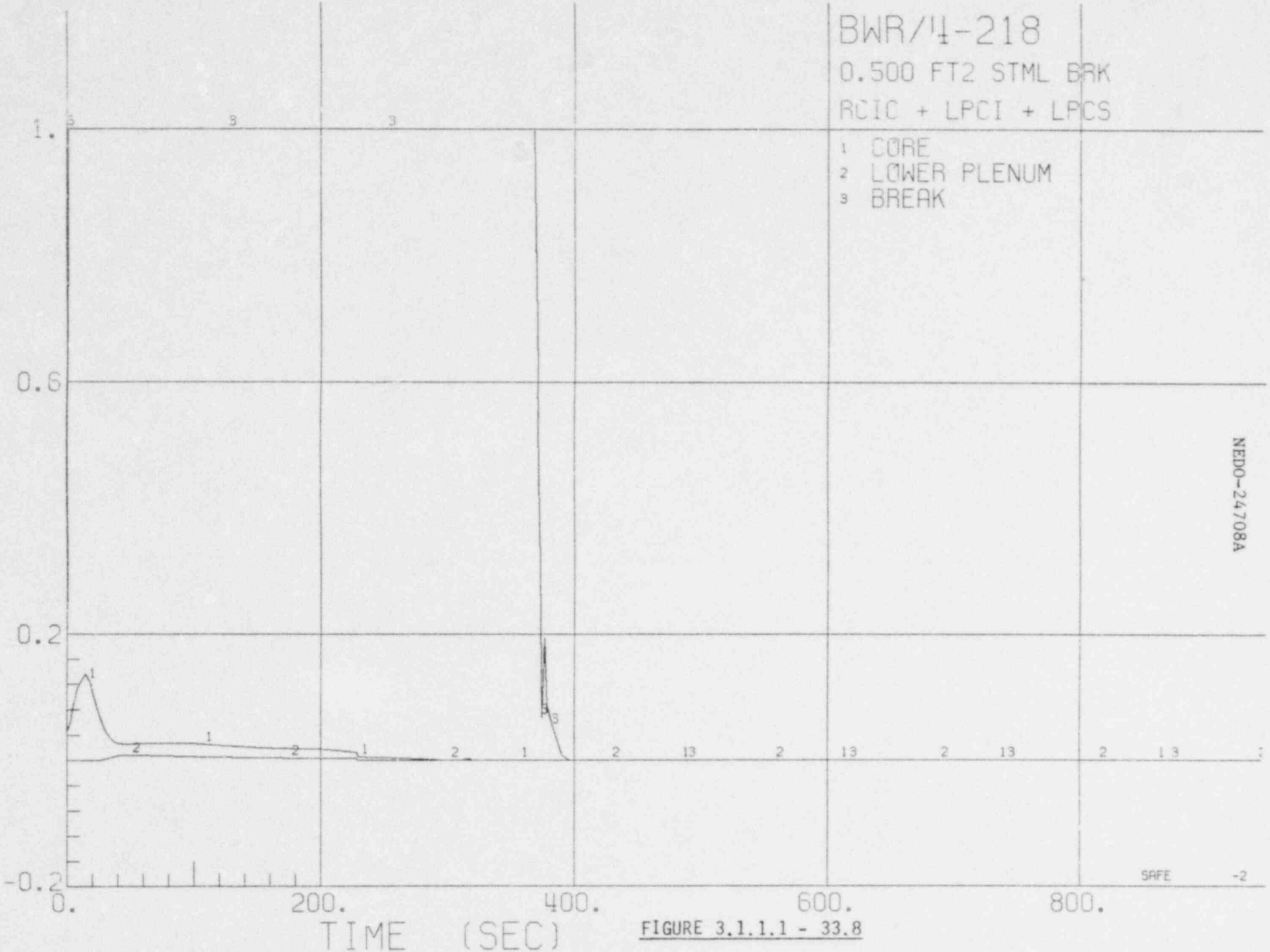

FIGURE 3.1.1.1 - 33.8

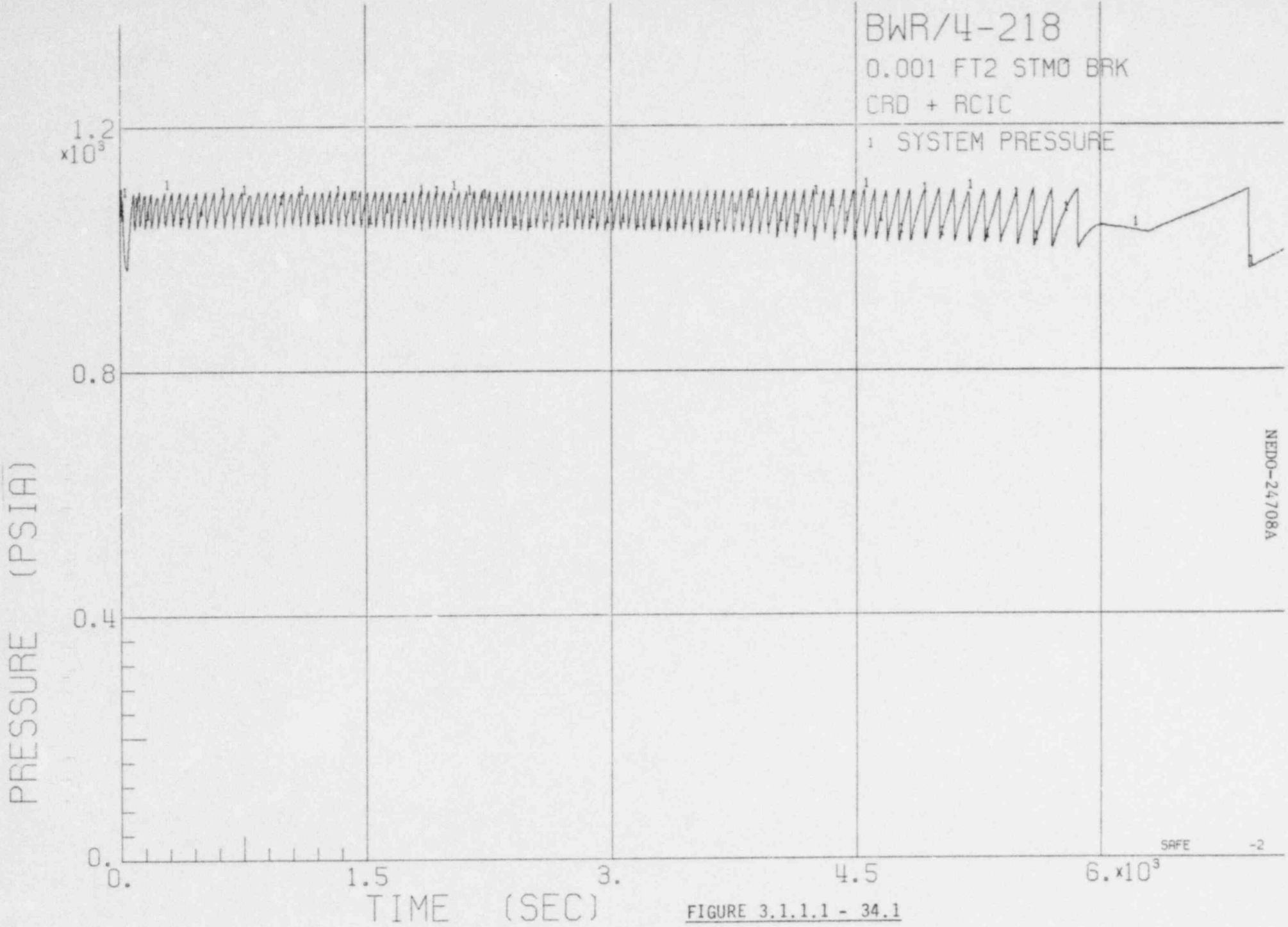

FIGURE 3.1.1.1 - 34.1

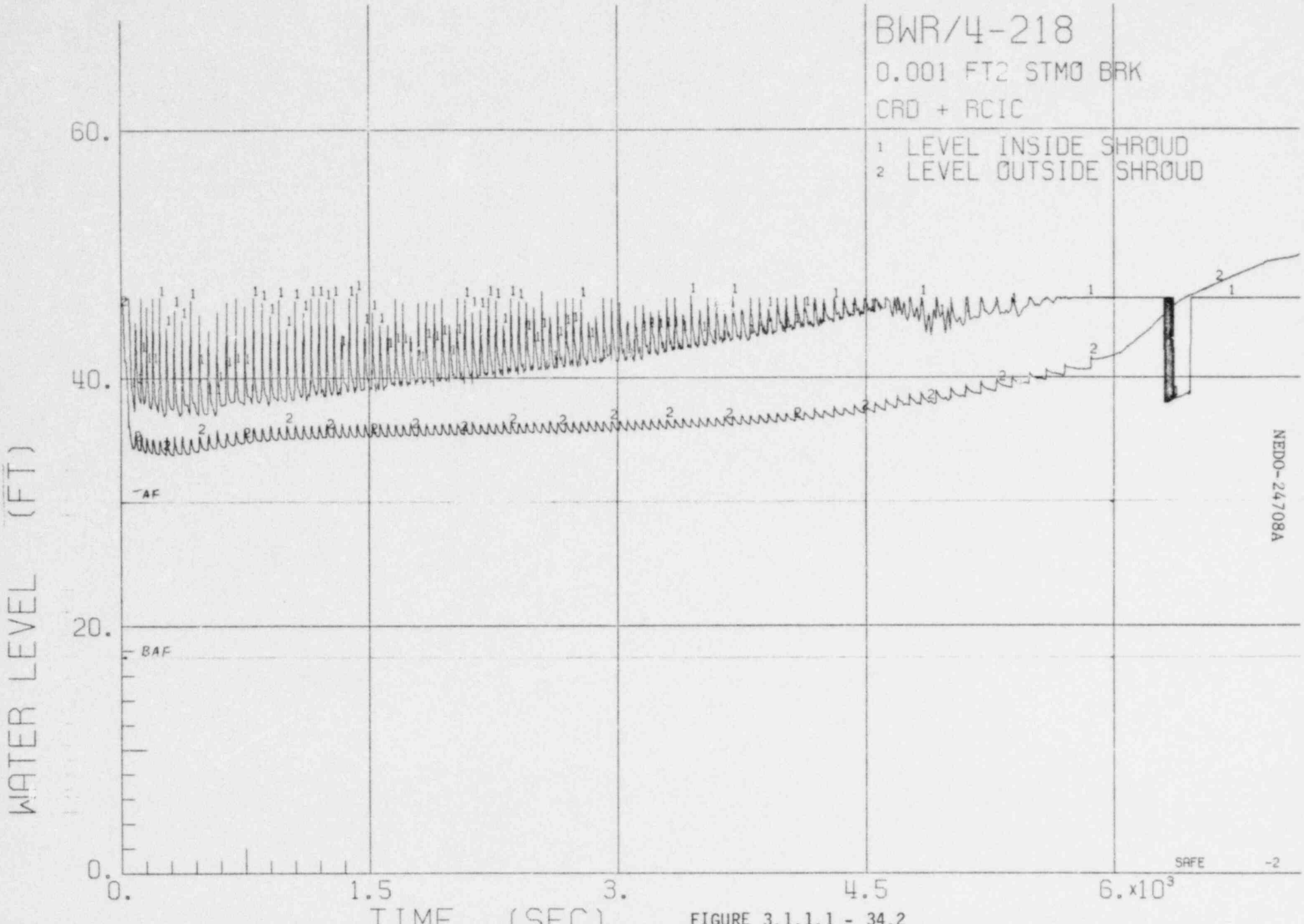

FIGURE 3.1.1.1 - 34.2

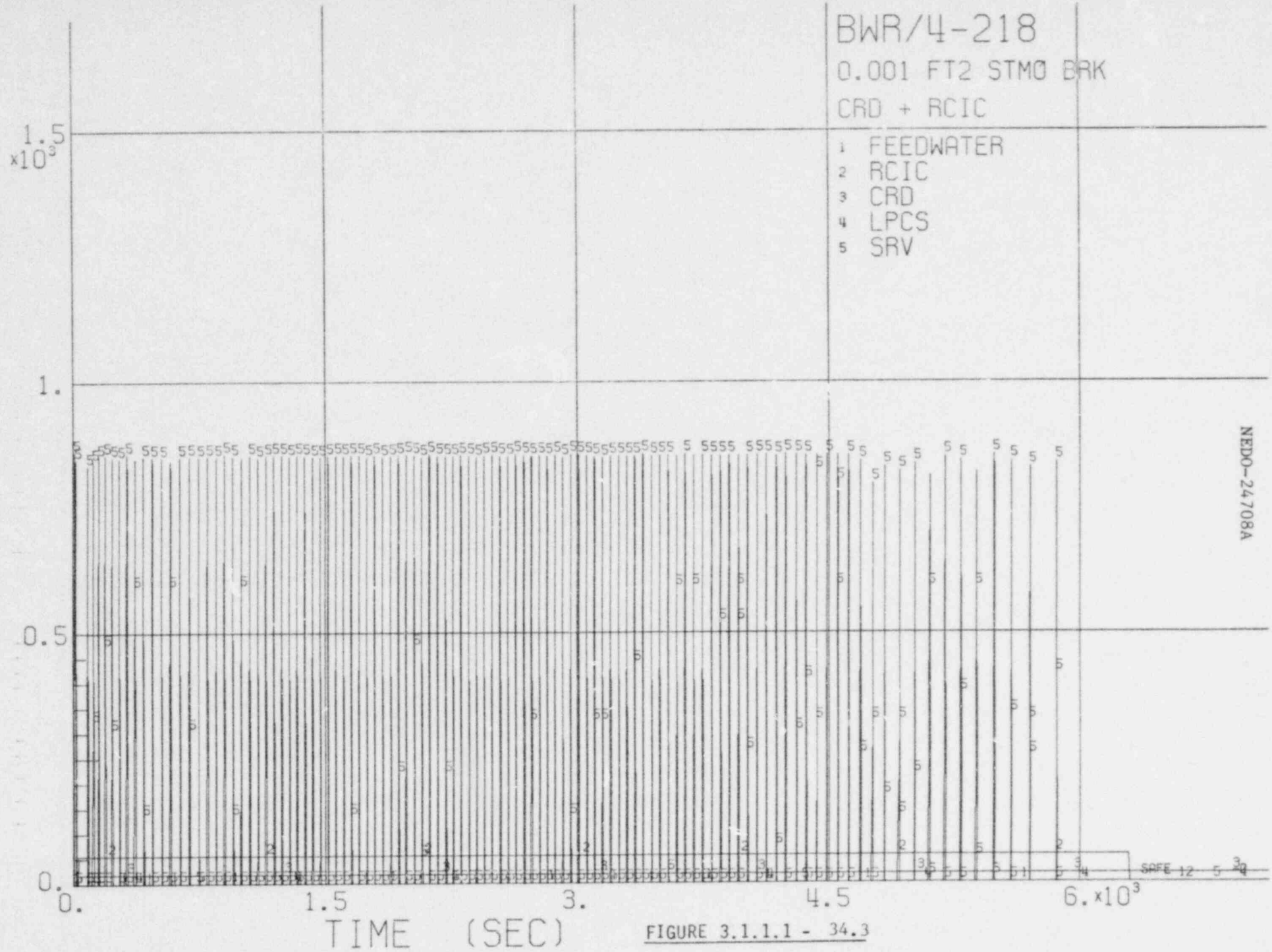

FIGURE 3.1.1.1 - 34.3

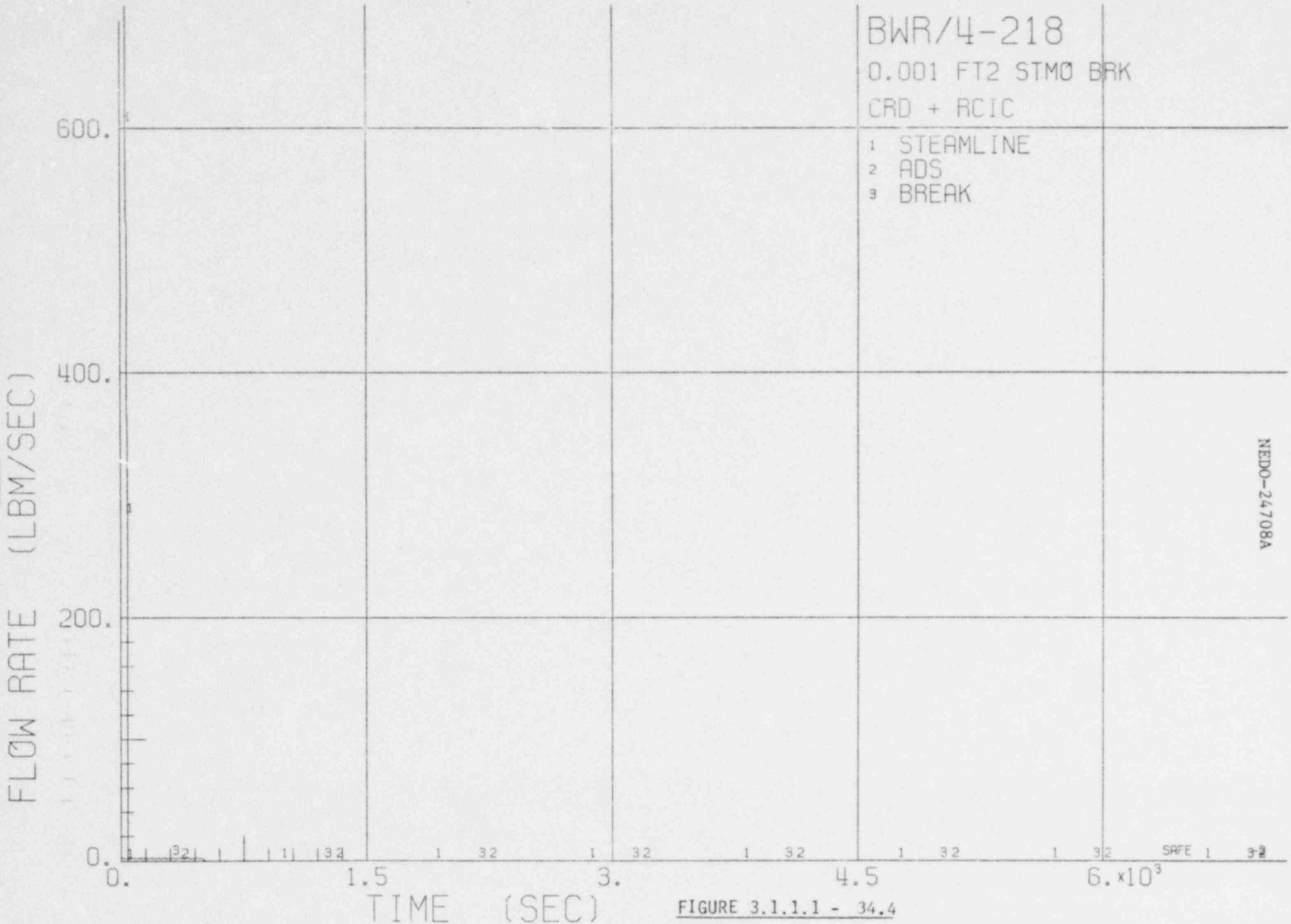

FIGURE 3.1.1.1 - 34.4

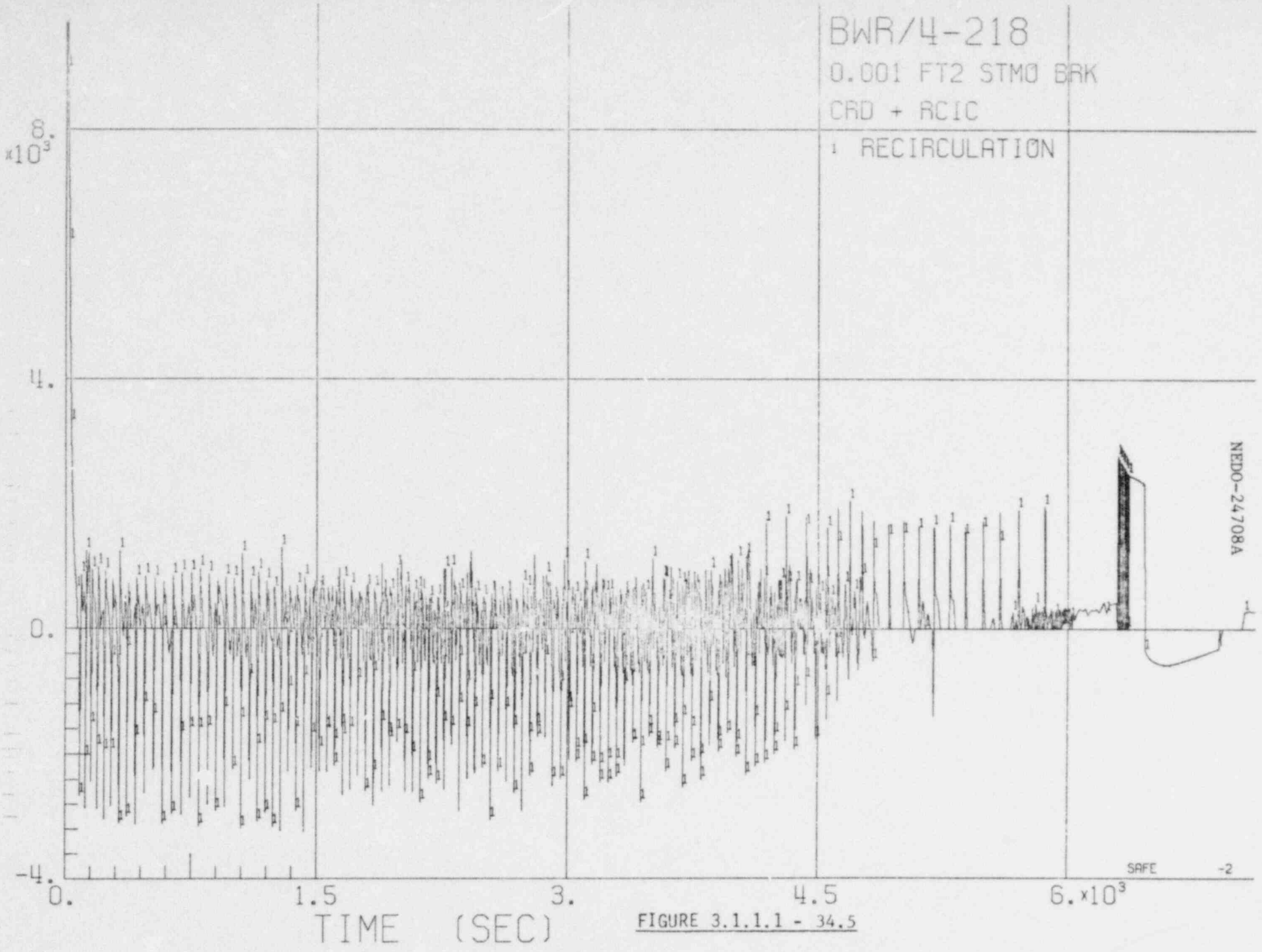

FIGURE 3.1.1.1 - 34.5

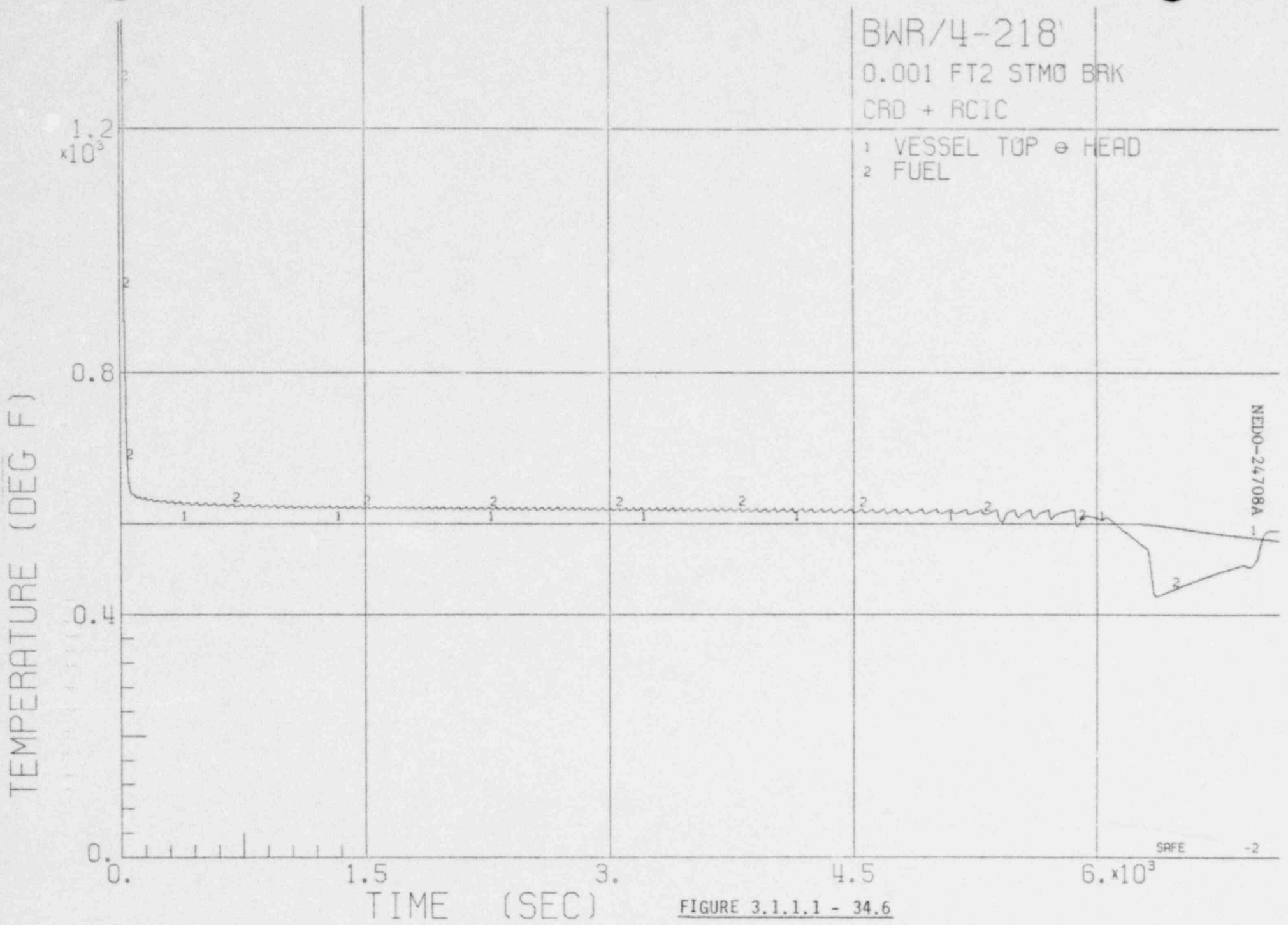

FIGURE 3.1.1.1 - 34.6

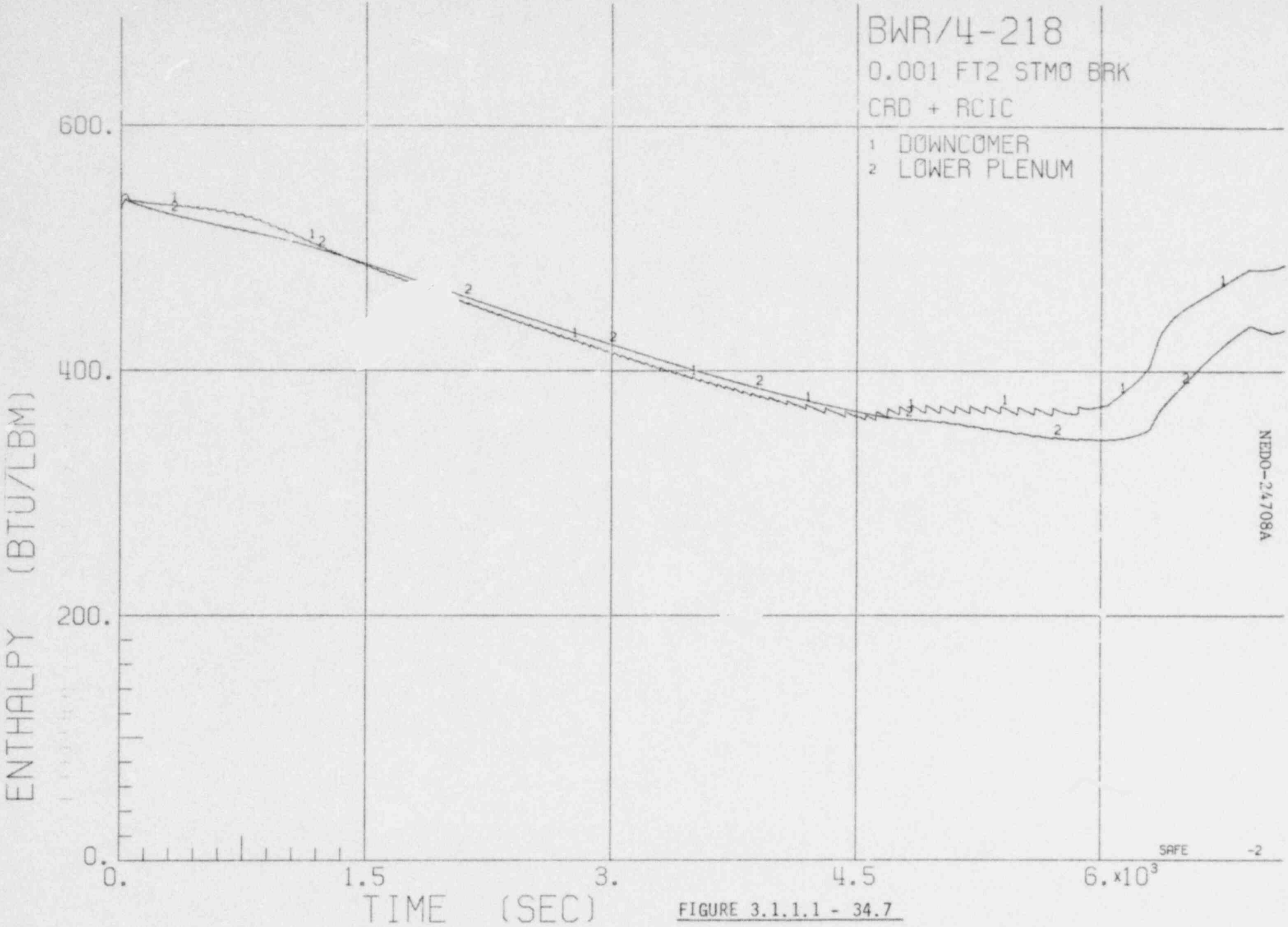

FIGURE 3.1.1.1 - 34.7

FIGURE 3.1.1.1 - 34.8

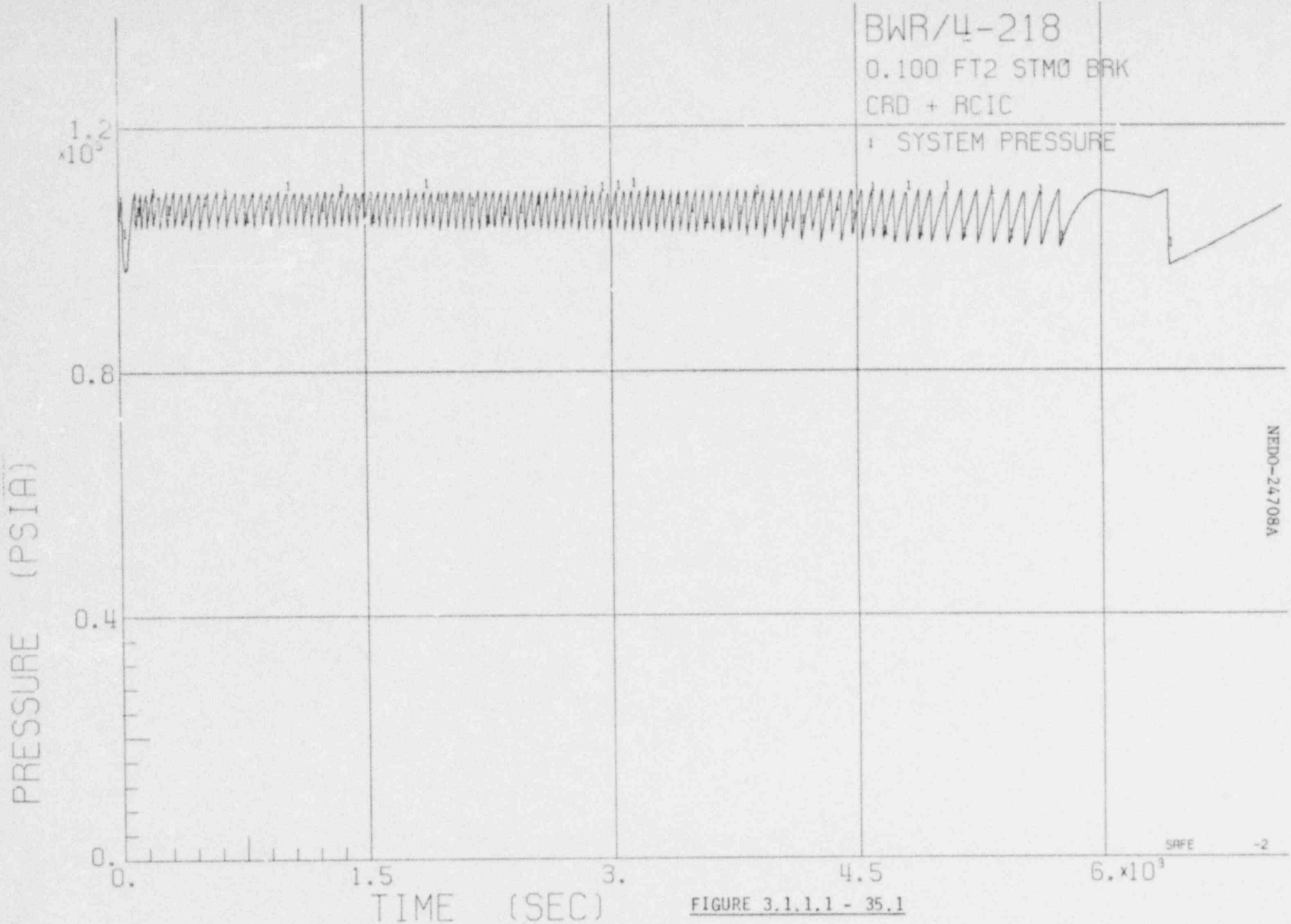

FIGURE 3.1.1.1 - 35.1

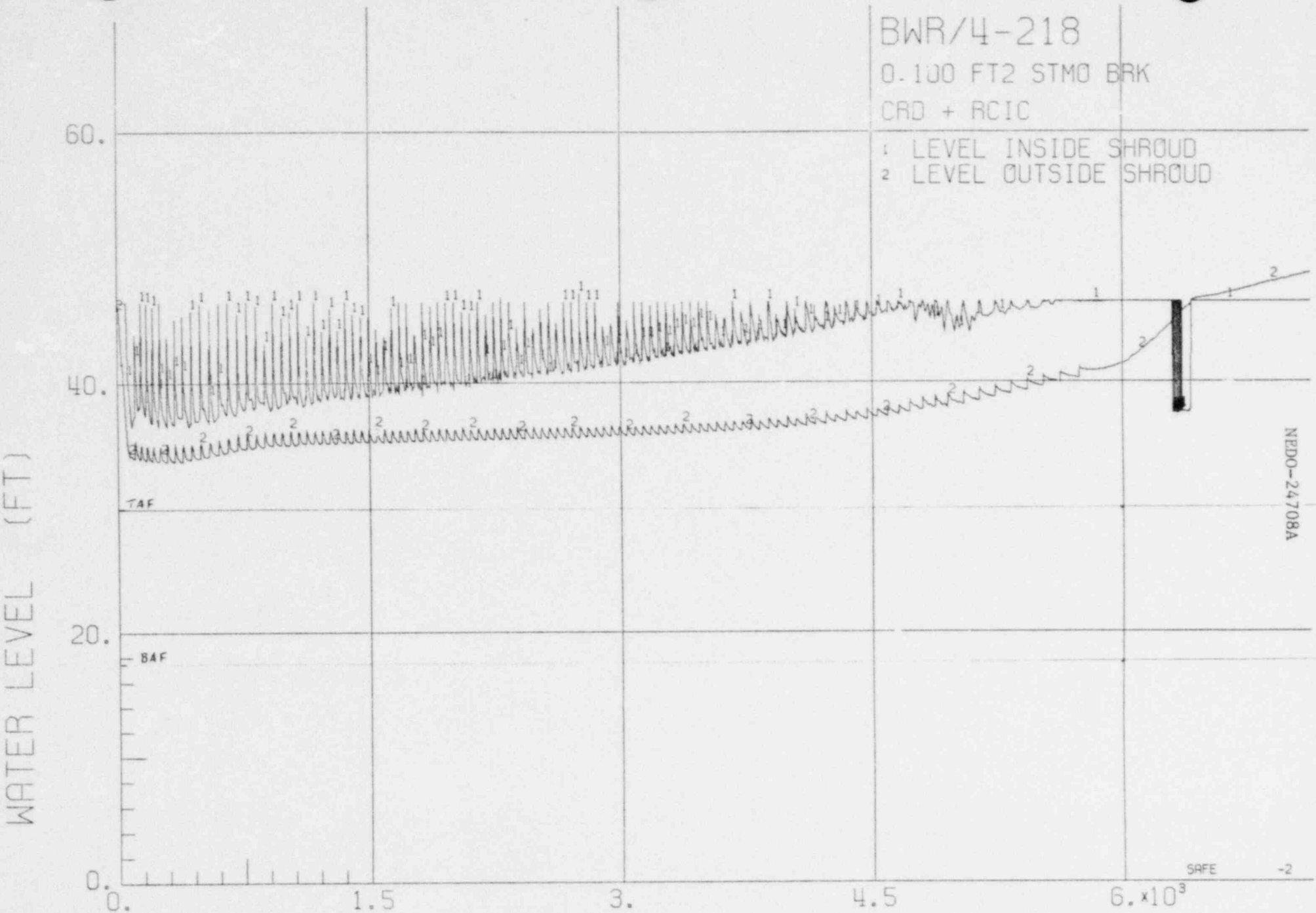

FIGURE 3.1.1.1 - 35.2

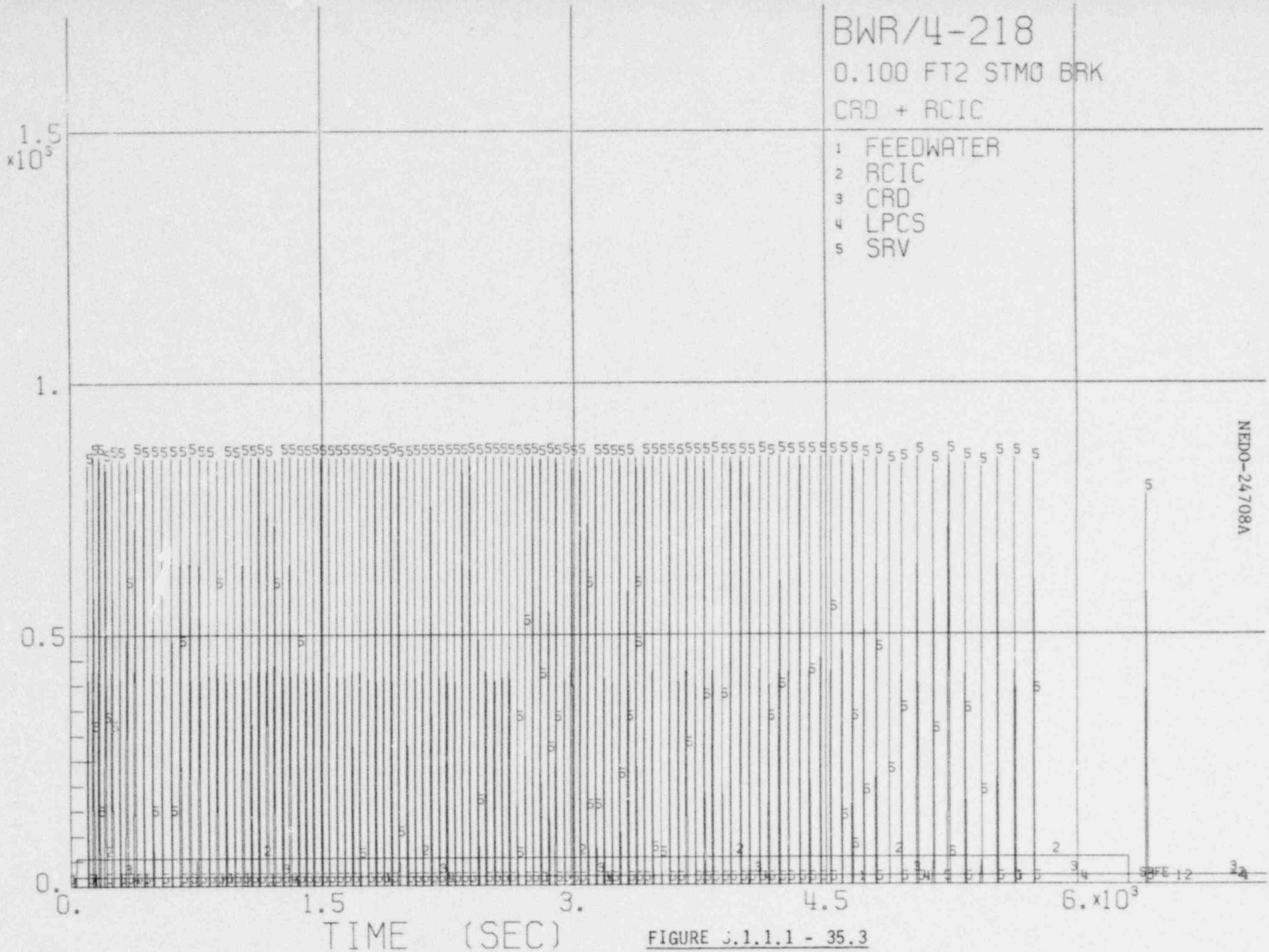

FIGURE 3.1.1.1 - 35.3

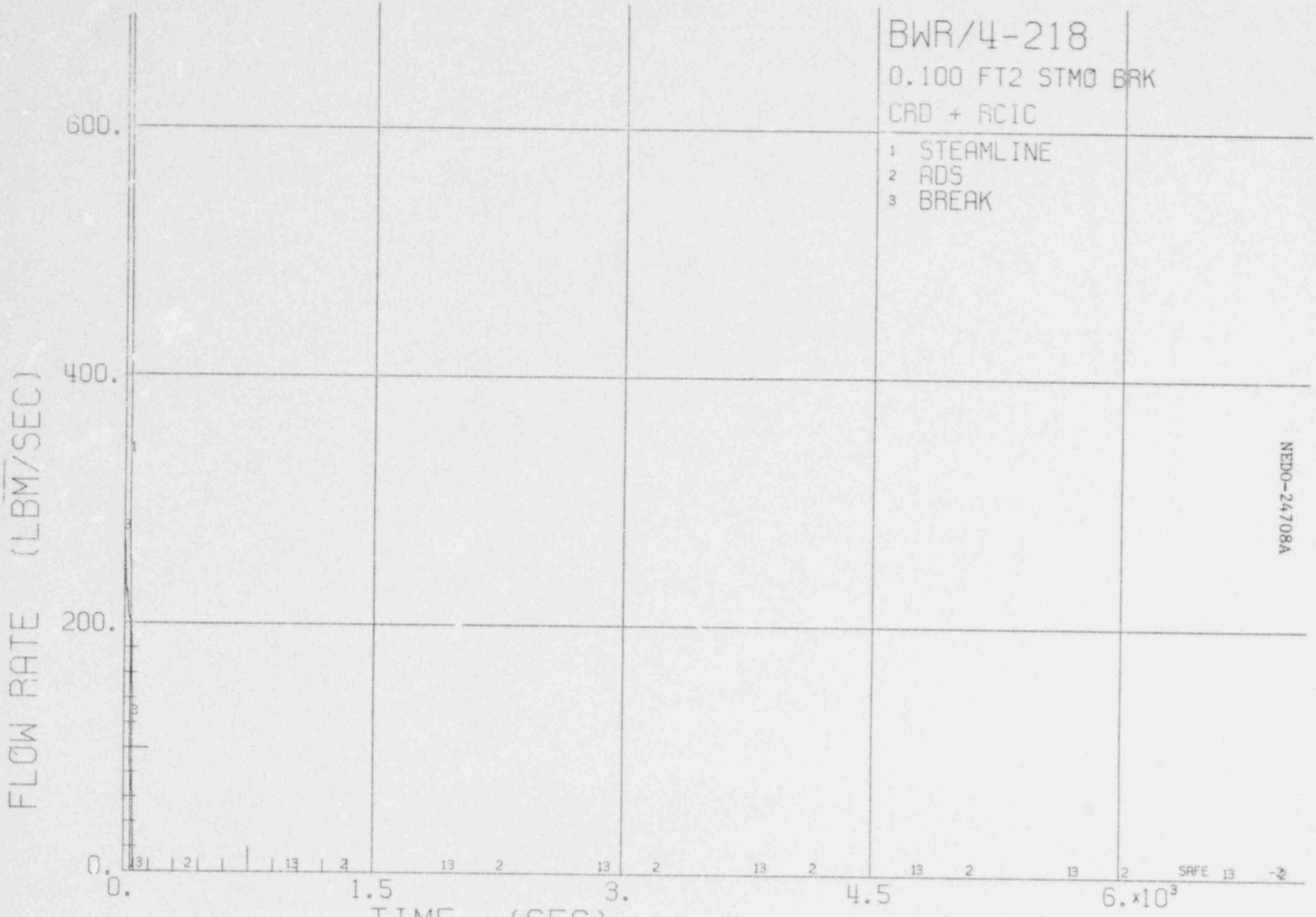

FIGURE 3.1.1.1 - 35.4

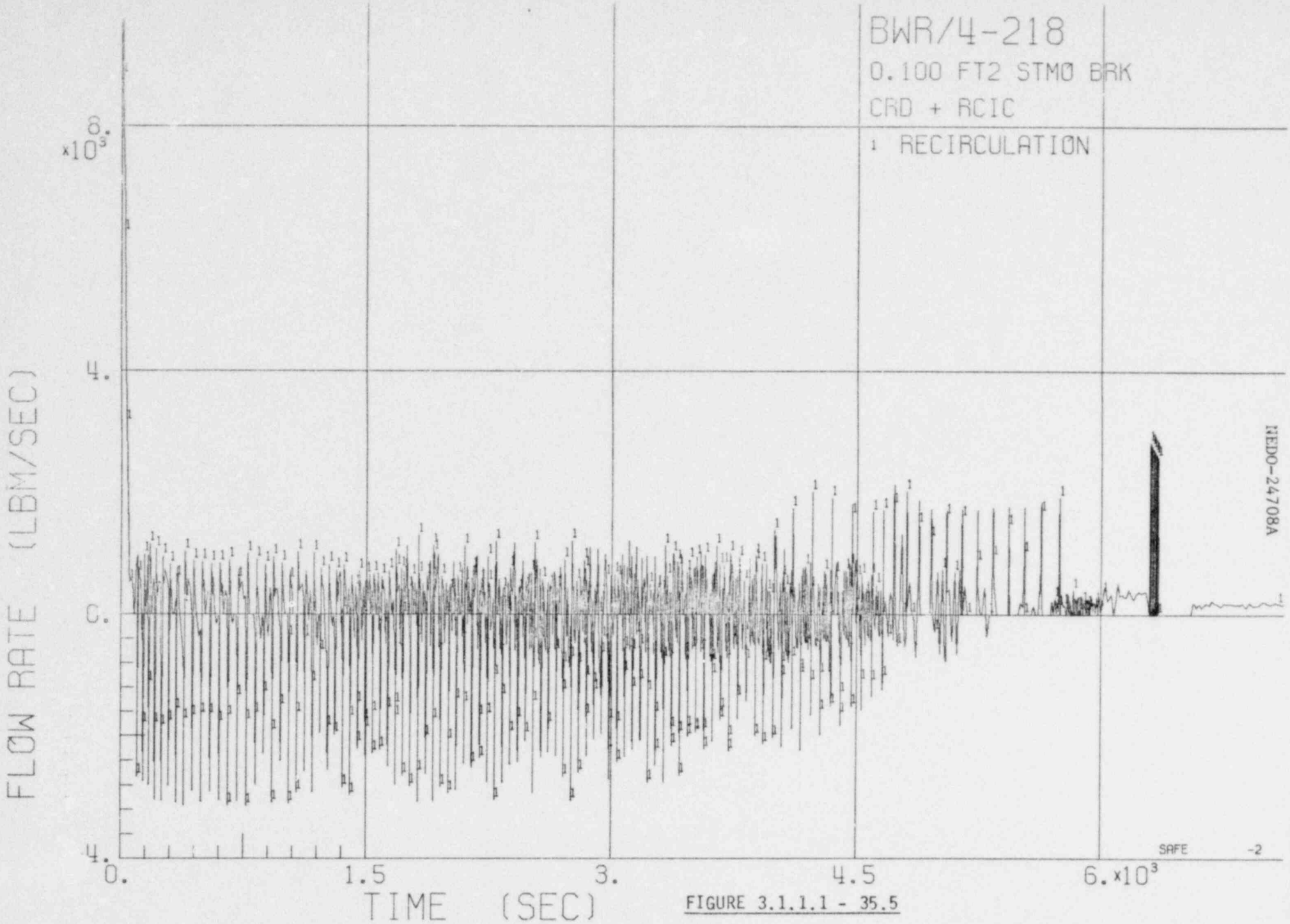

FIGURE 3.1.1.1 - 35.5

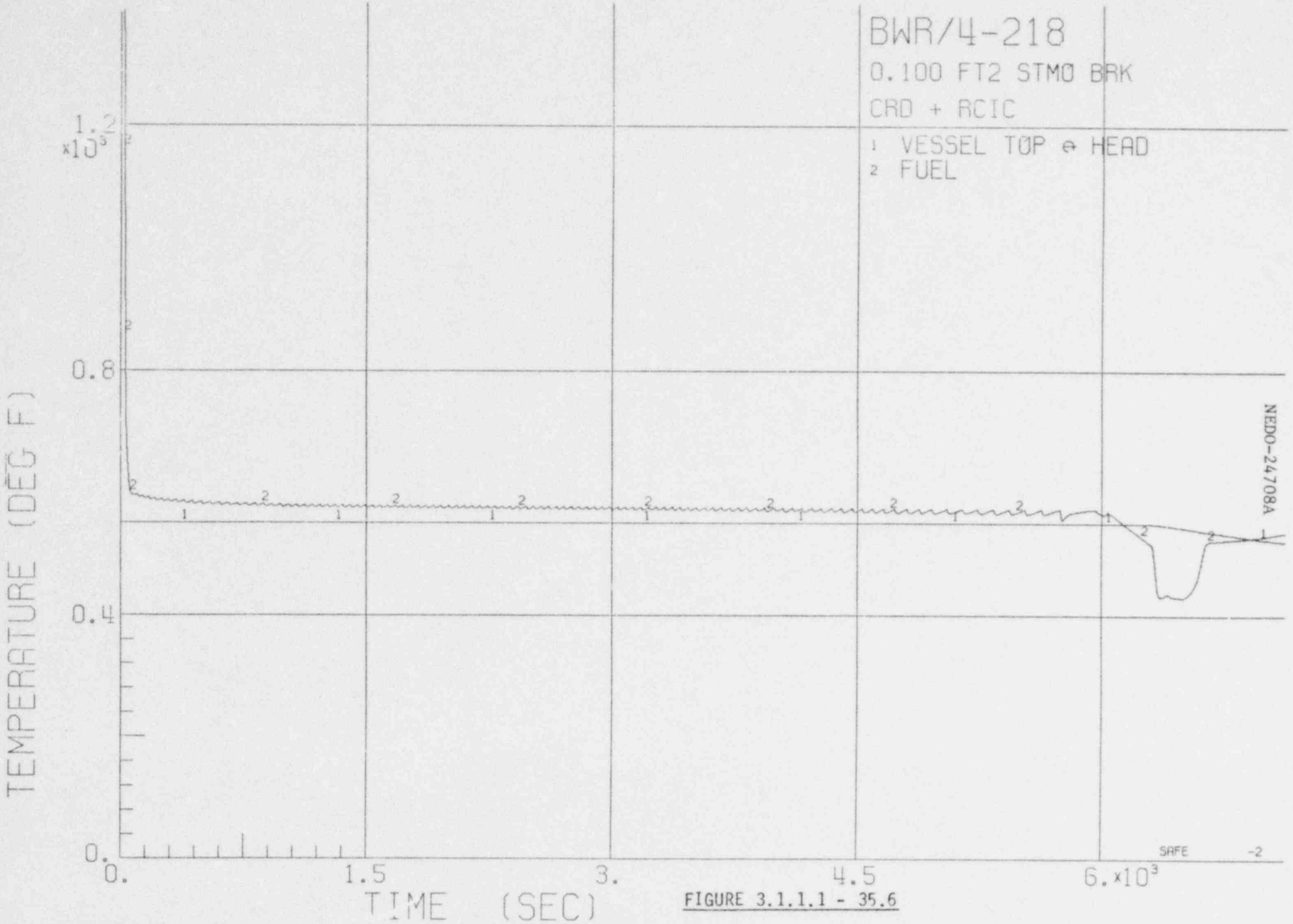

FIGURE 3.1.1.1 - 35.6

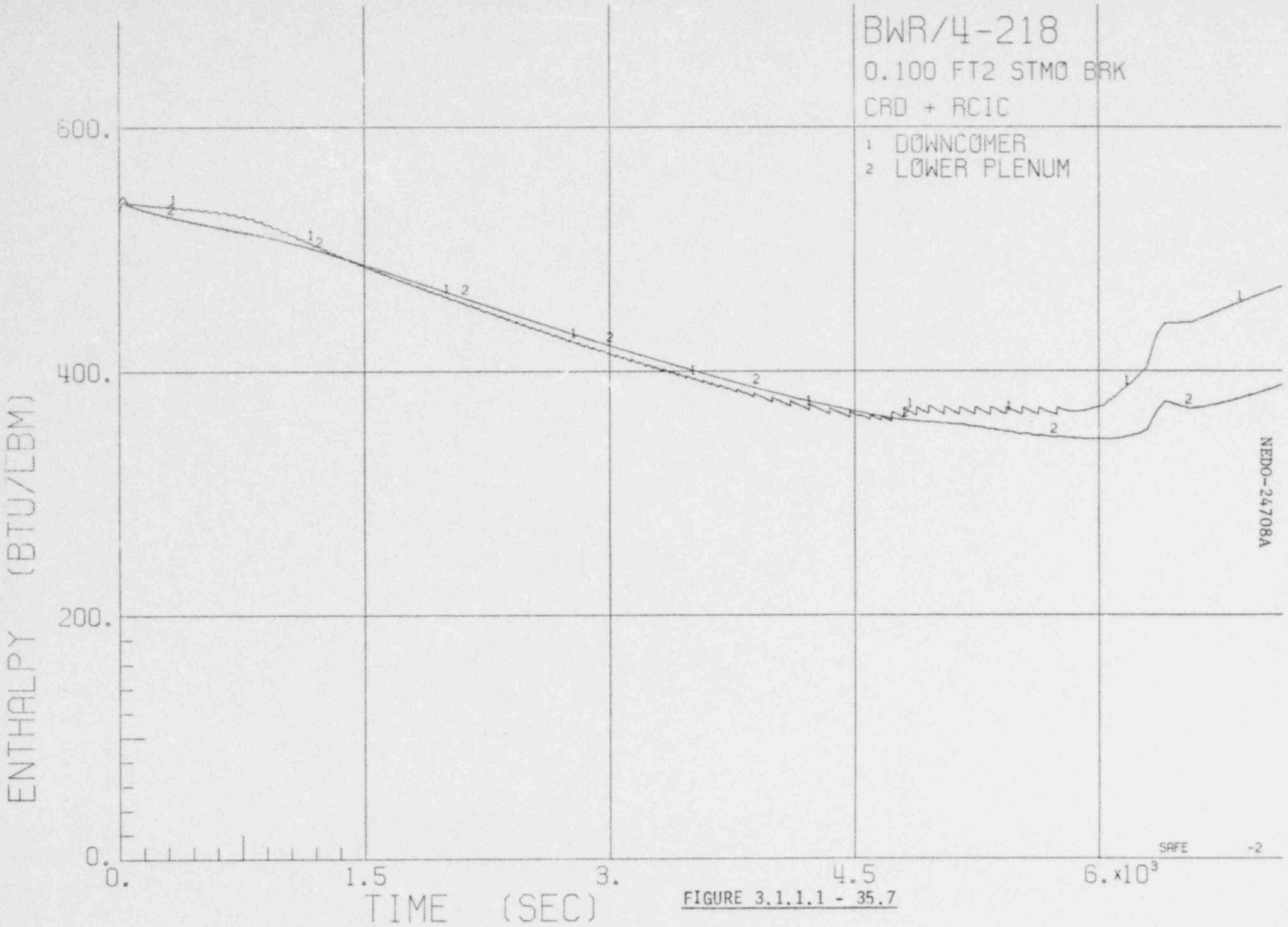

FIGURE 3.1.1.1 - 35.7

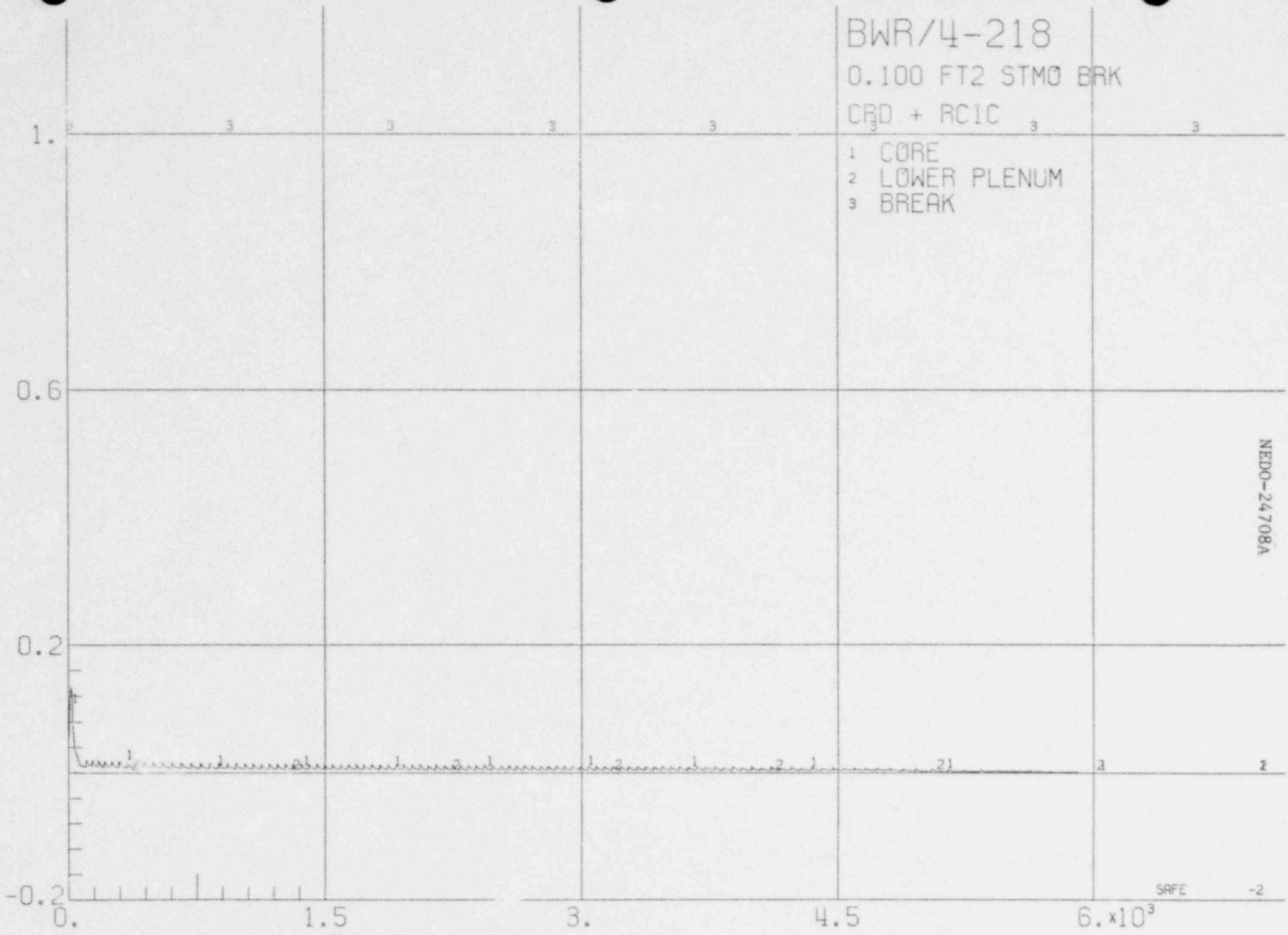

FIGURE 3.1.1.1 - 35.8

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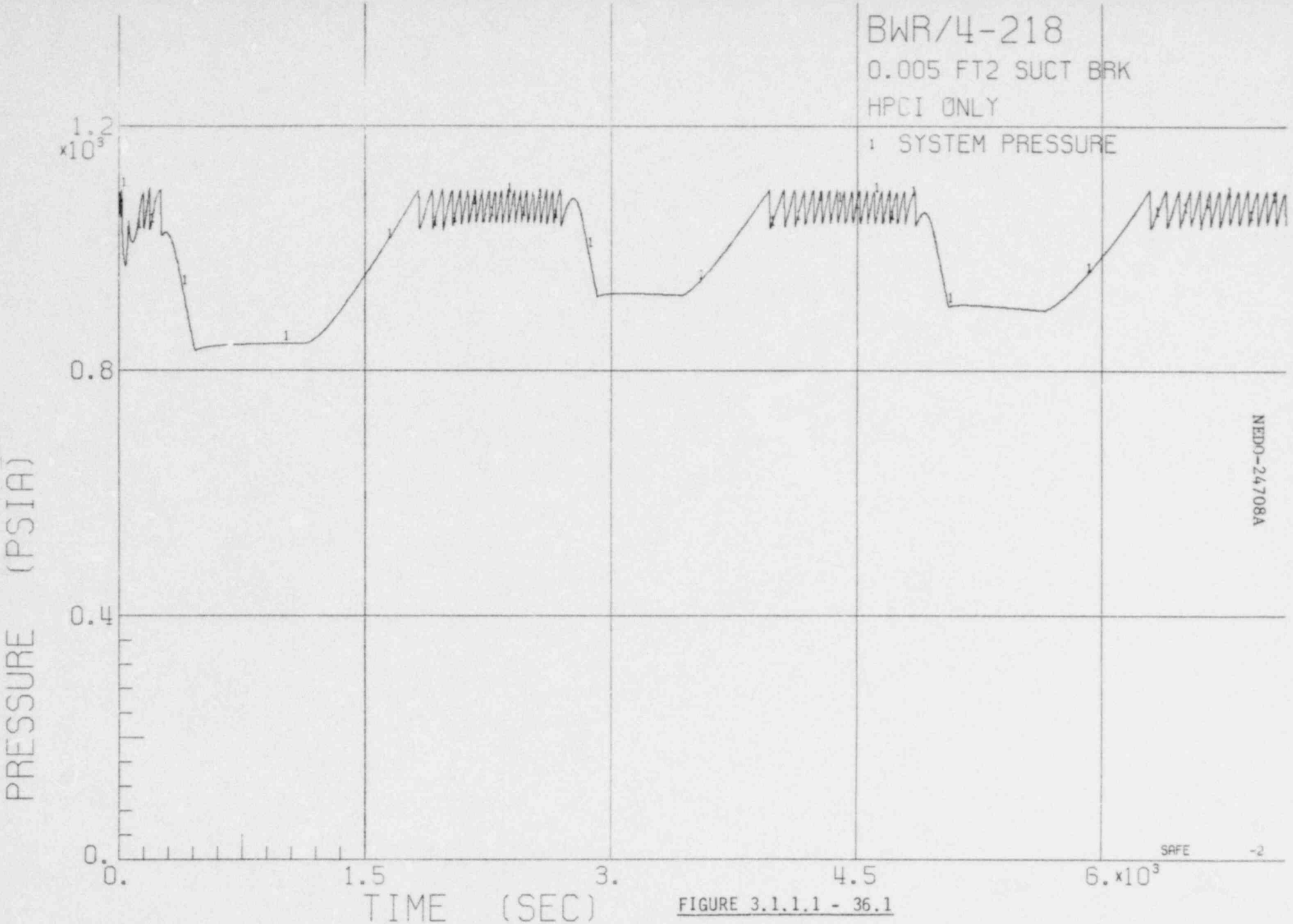

FIGURE 3.1.1.1 - 36.1

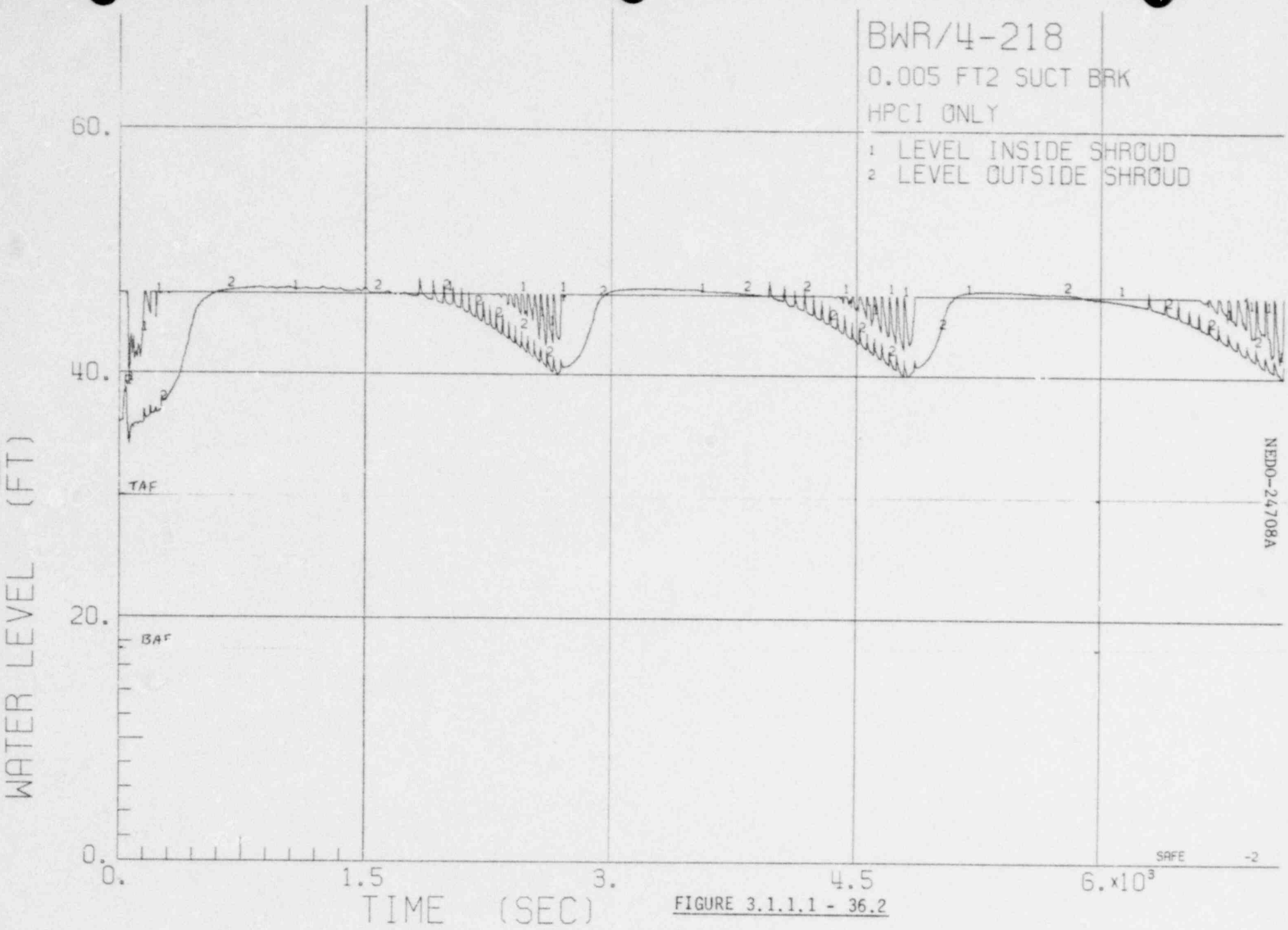

FIGURE 3.1.1.1 - 36.2

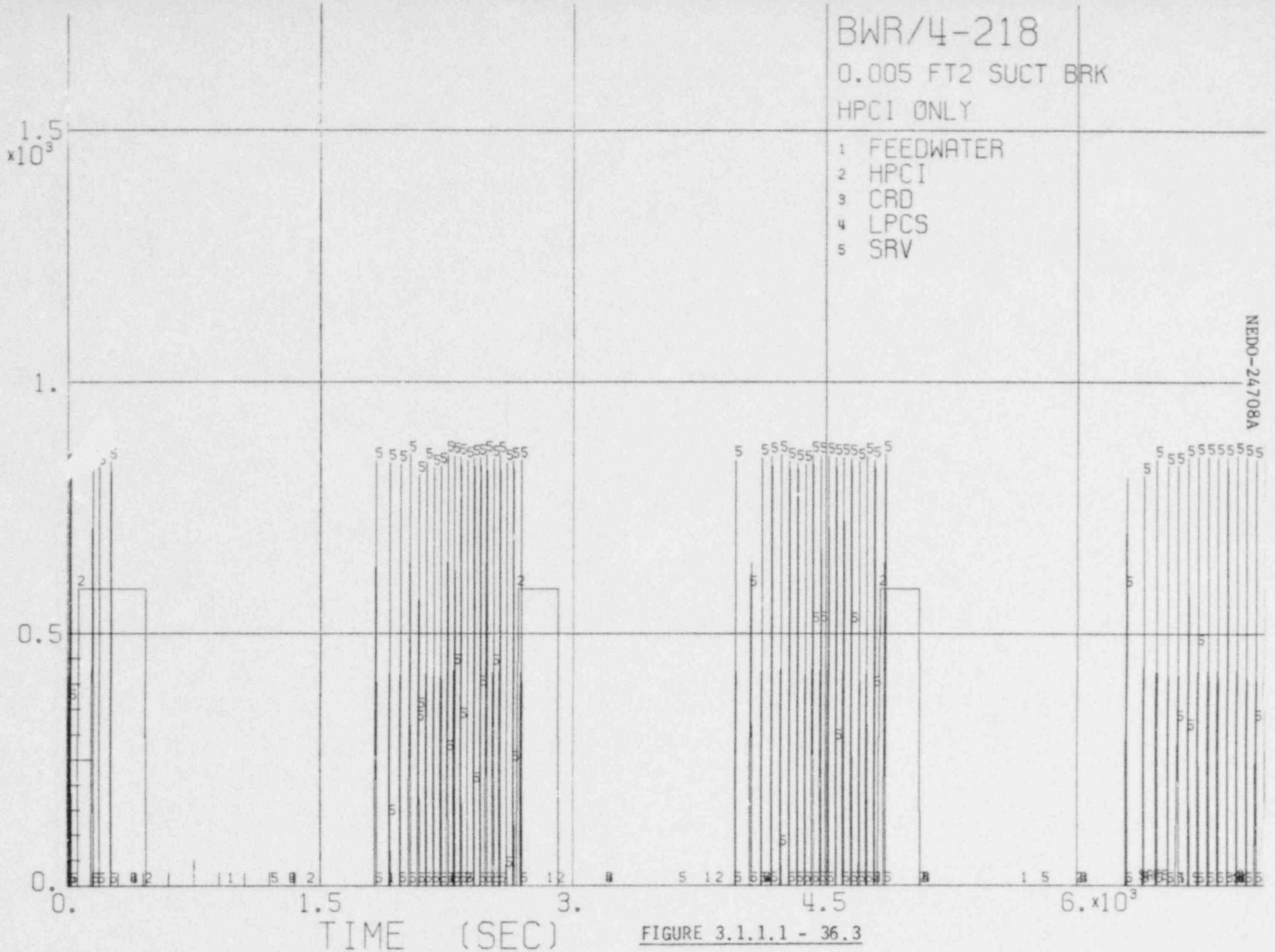

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FIGURE 3.1.1.1 - 36.3

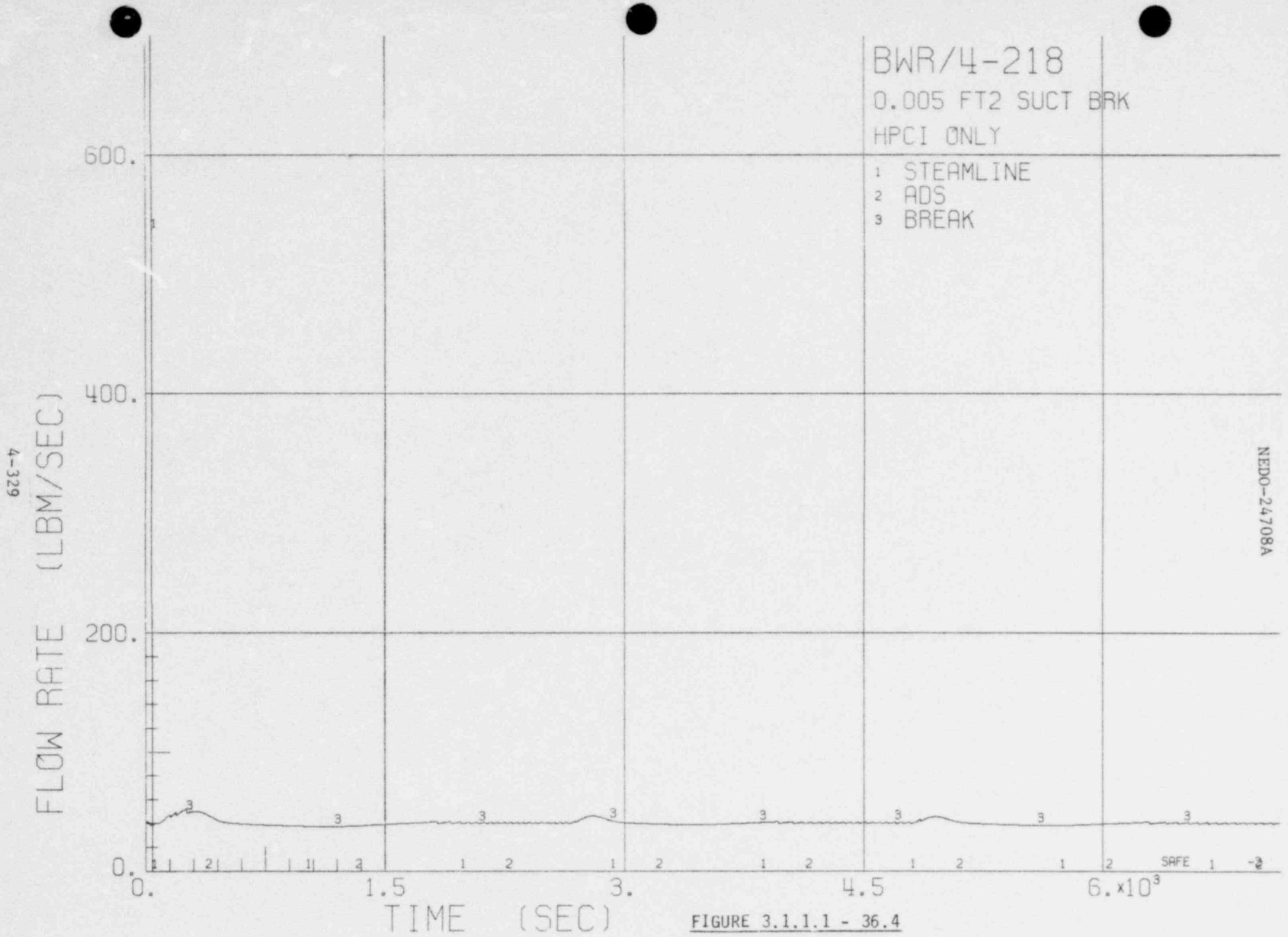

FIGURE 3.1.1.1 - 36.4

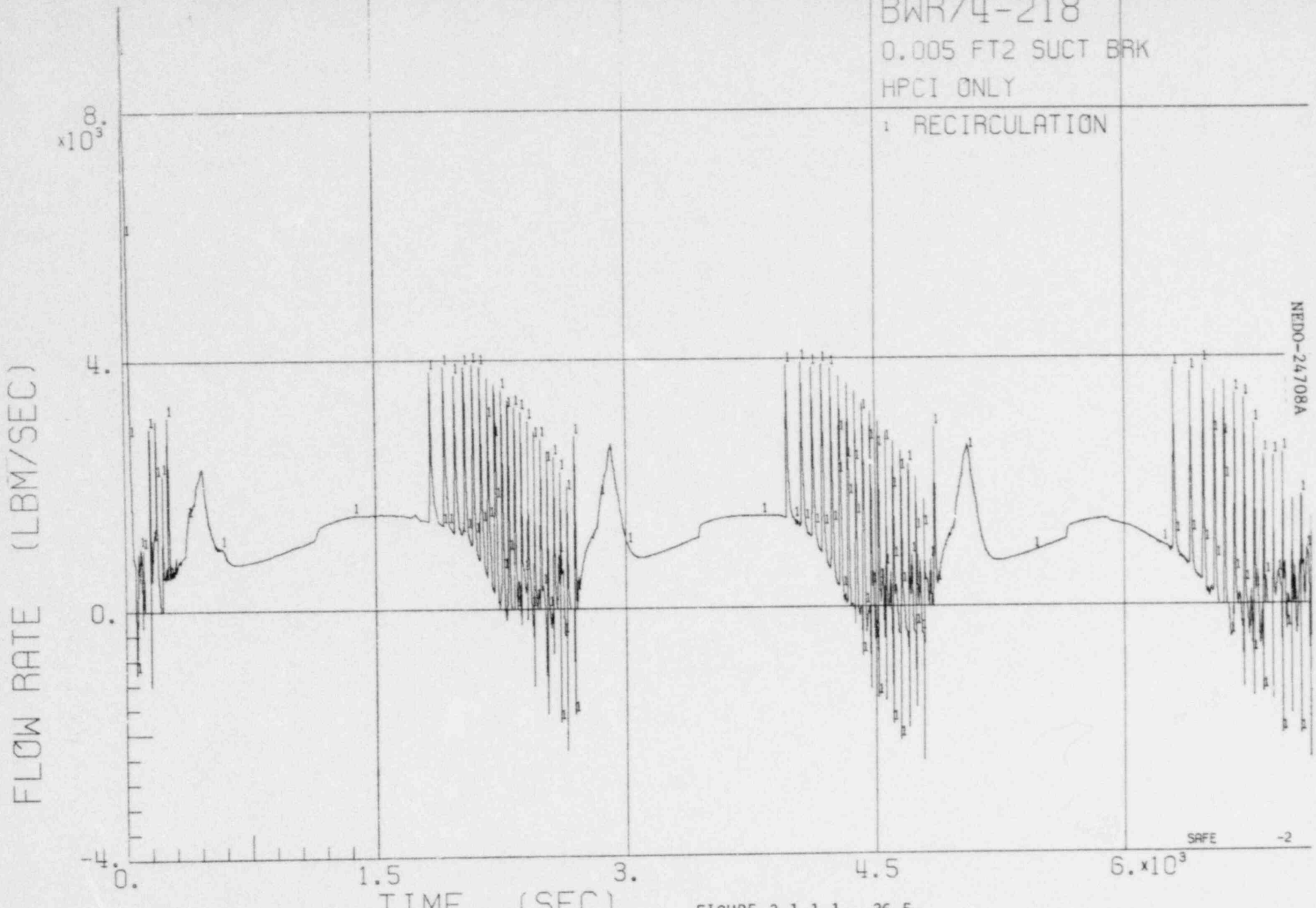

FIGURE 3.1.1.1 - 36.5

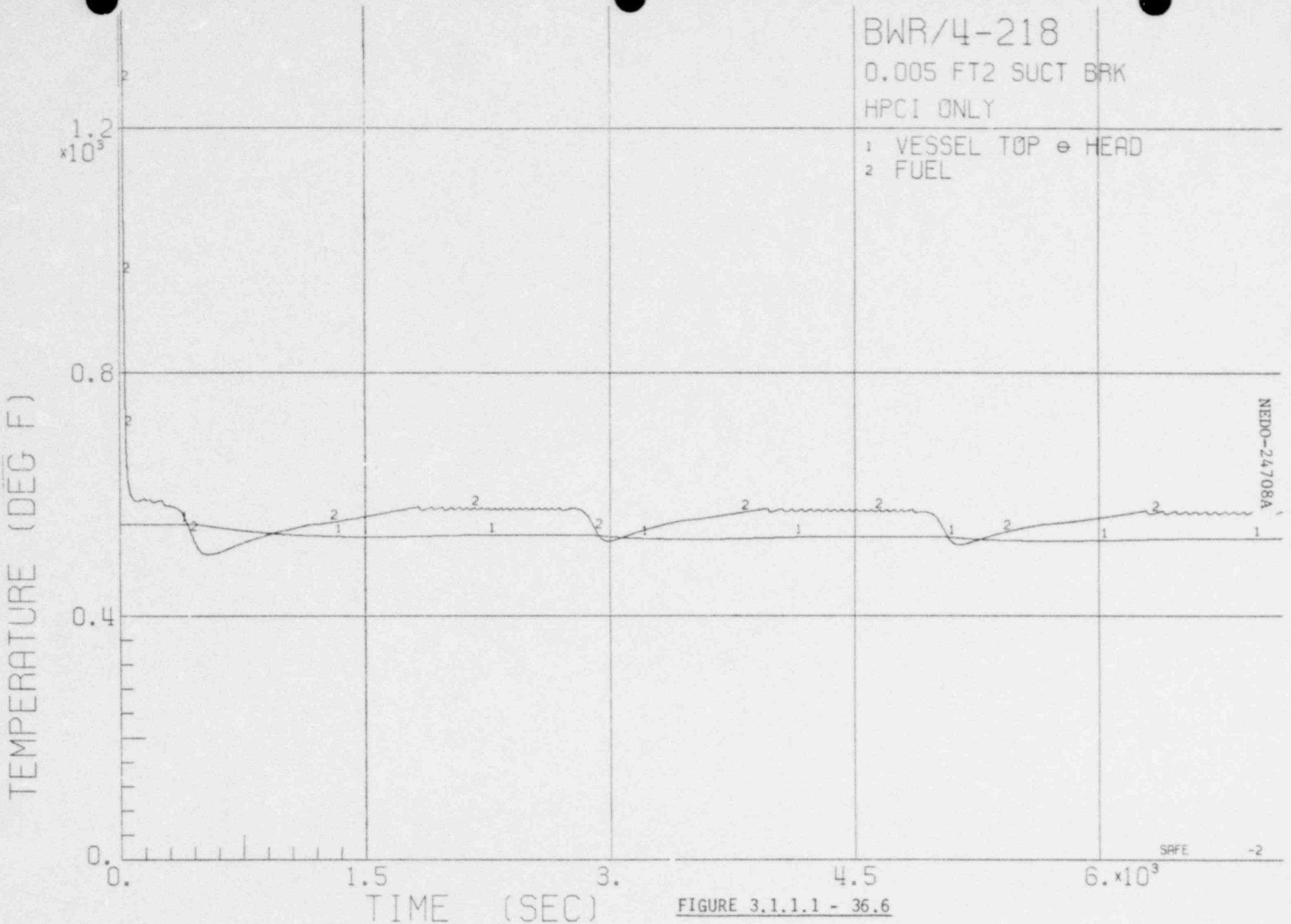

FIGURE 3.1.1.1 - 36.6

FIGURE 3.1.1.1 - 36.7

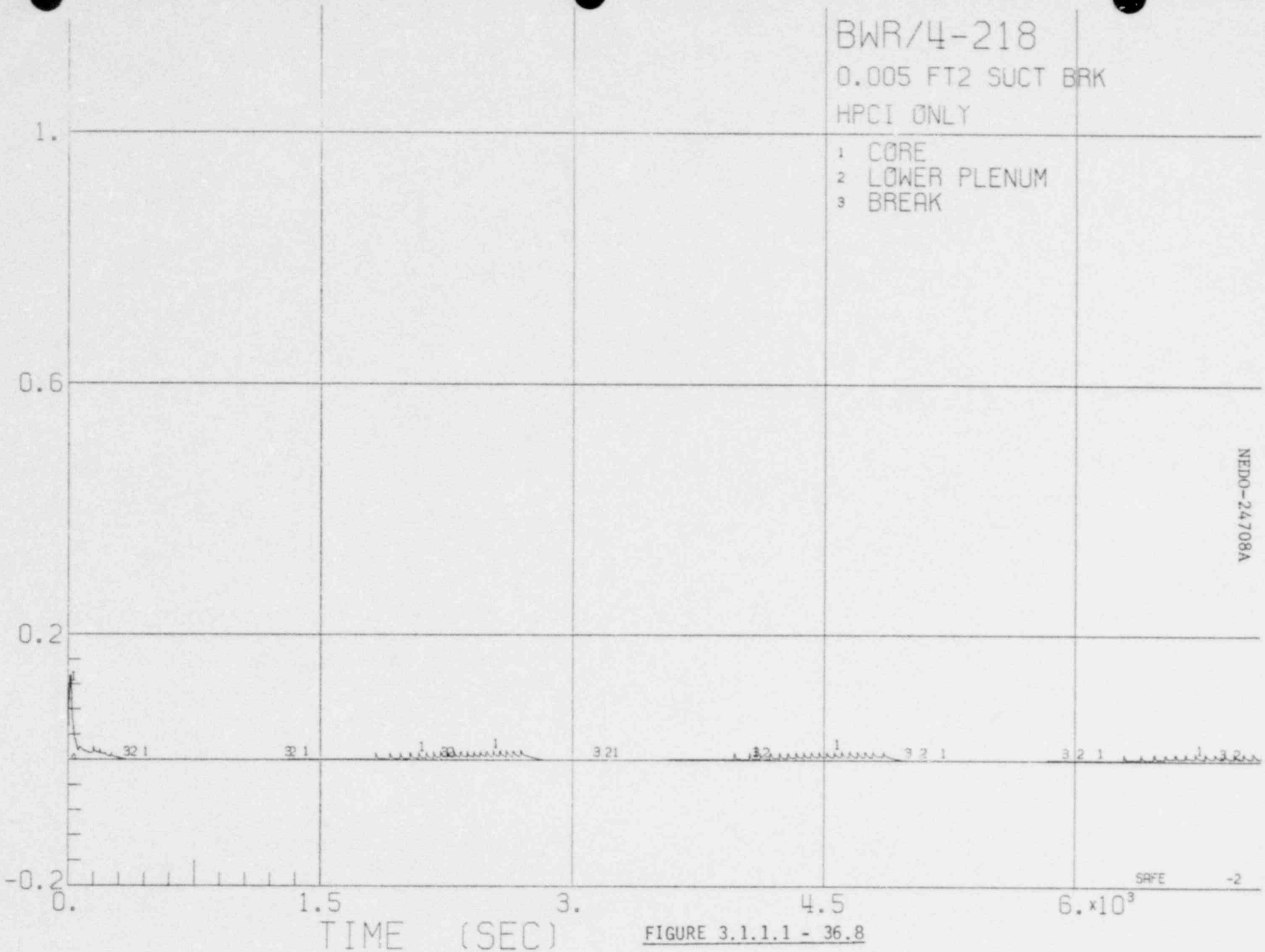

FIGURE 3.1.1.1 - 36.8

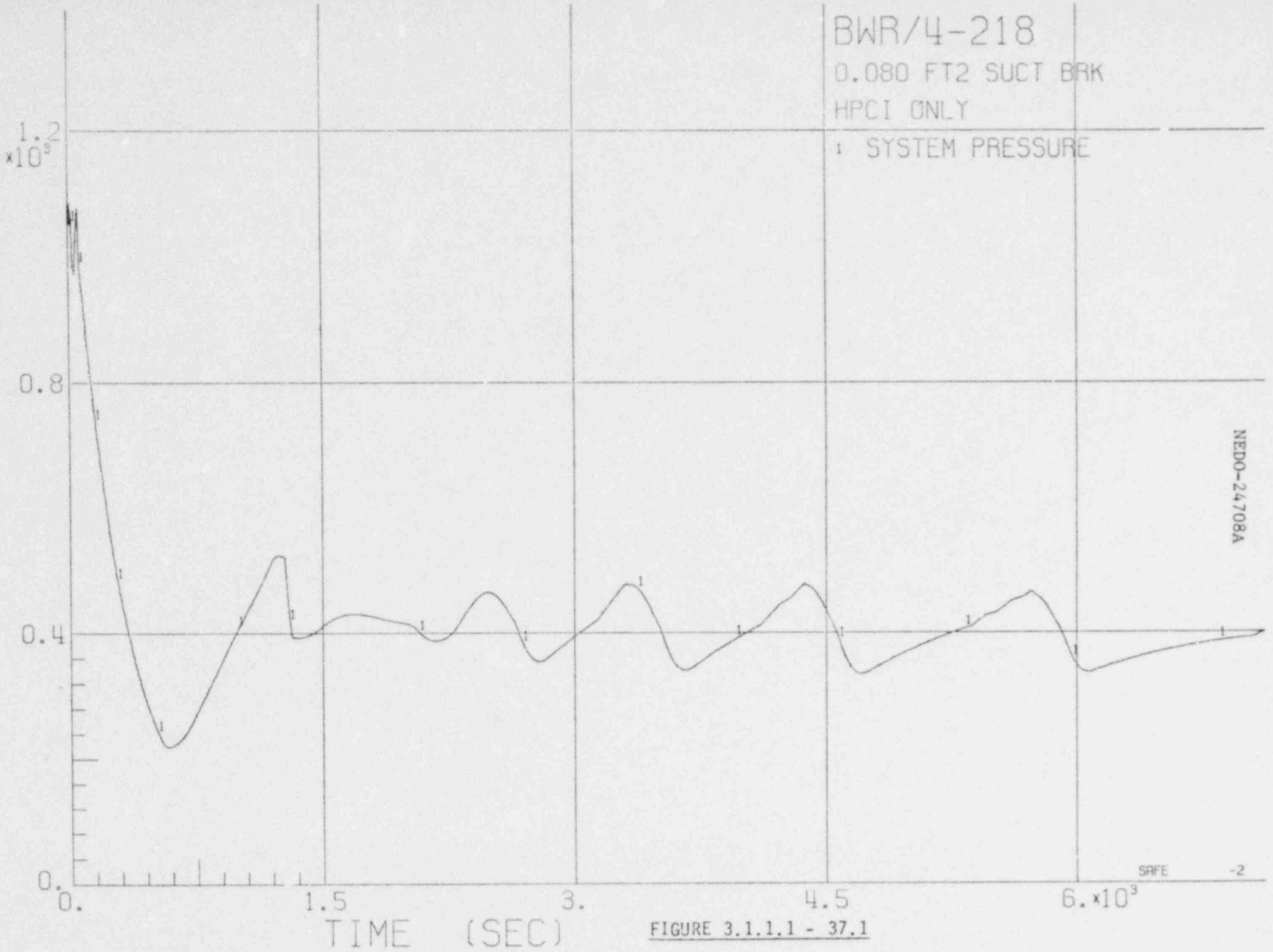

FIGURE 3.1.1.1 - 37.1

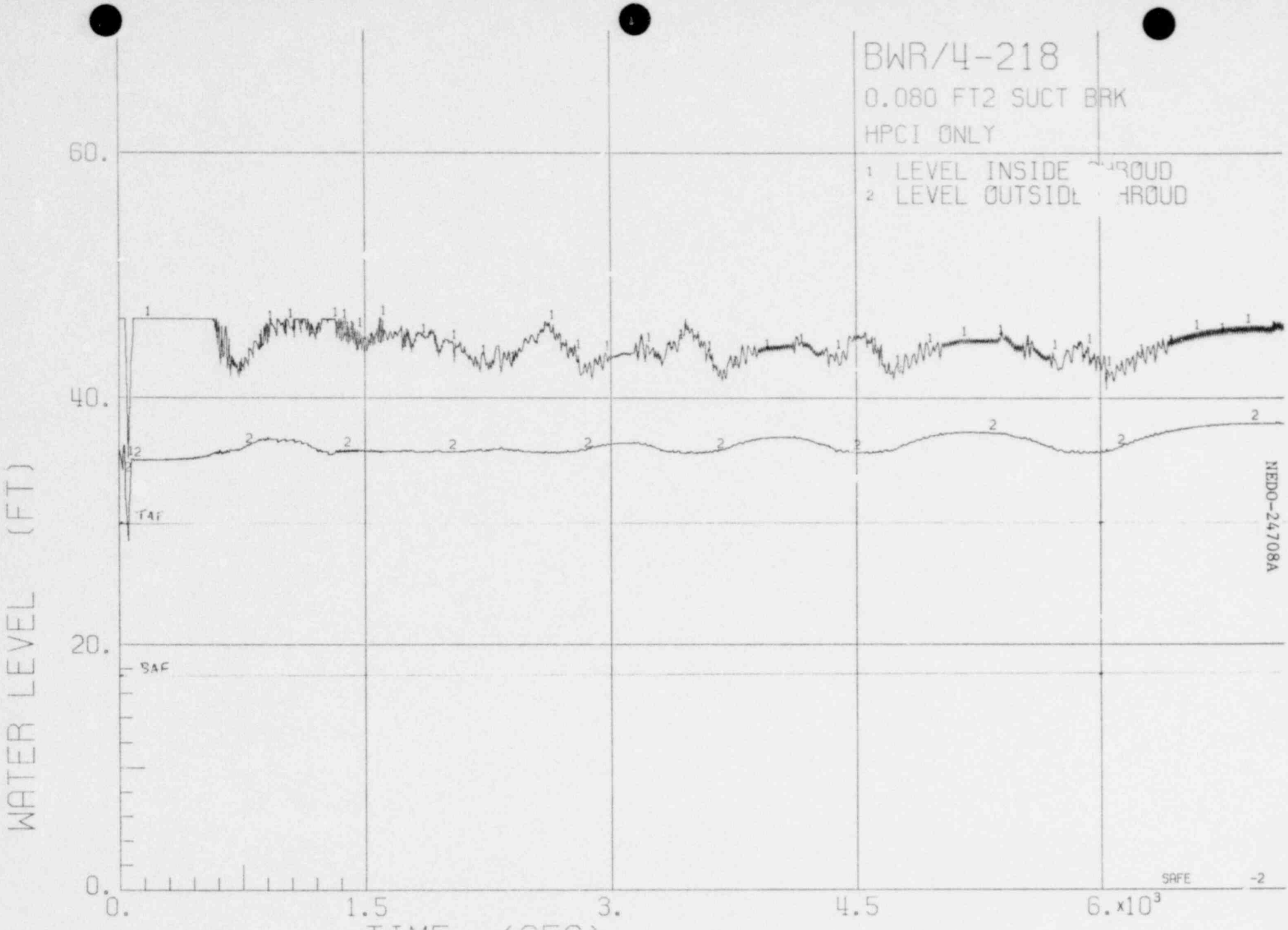

FIGURE 3.1.1.1 - 37.2

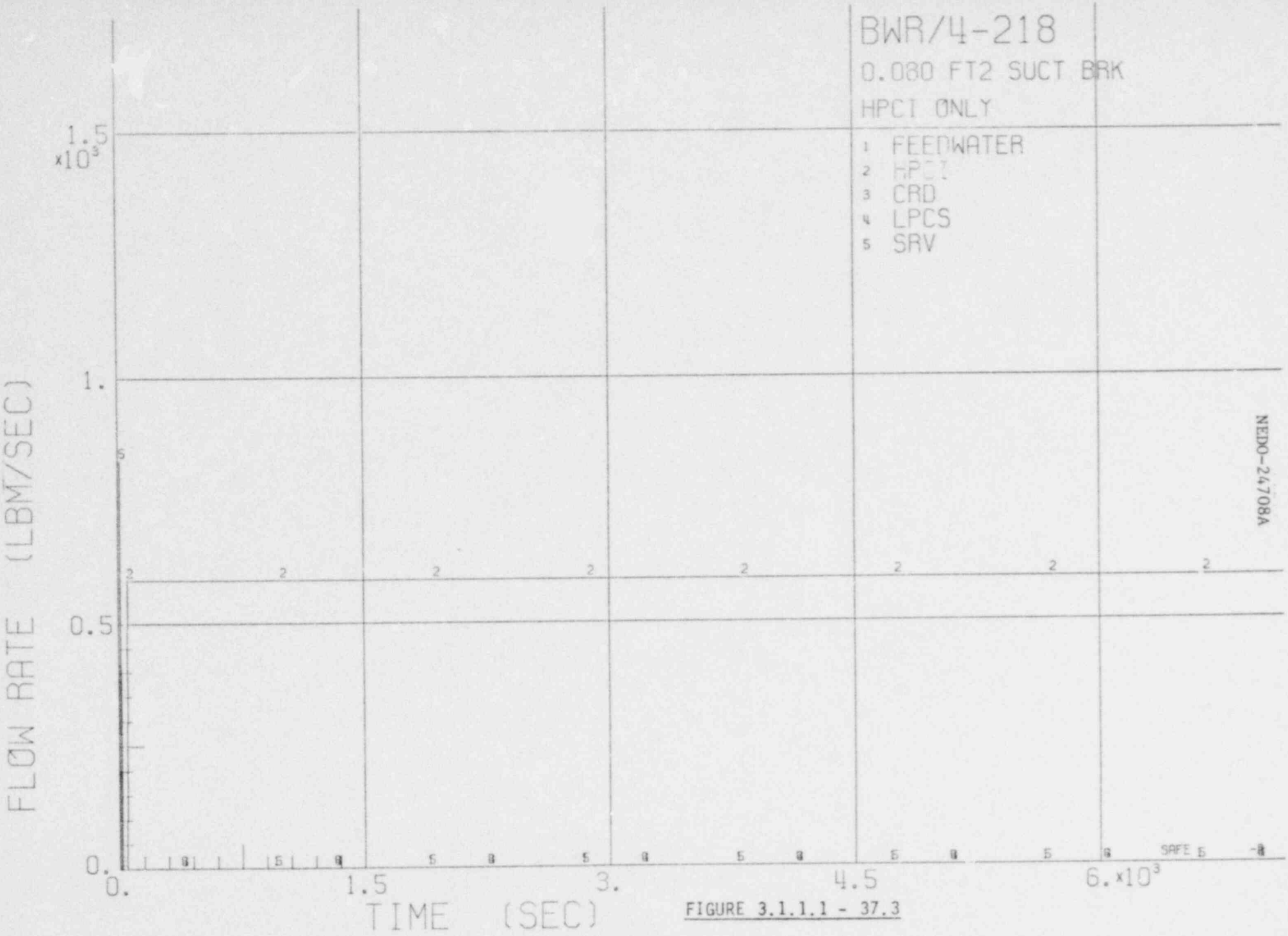

FIGURE 3.1.1.1 - 37.3

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FIGURE 3.1.1.1 - 37.4

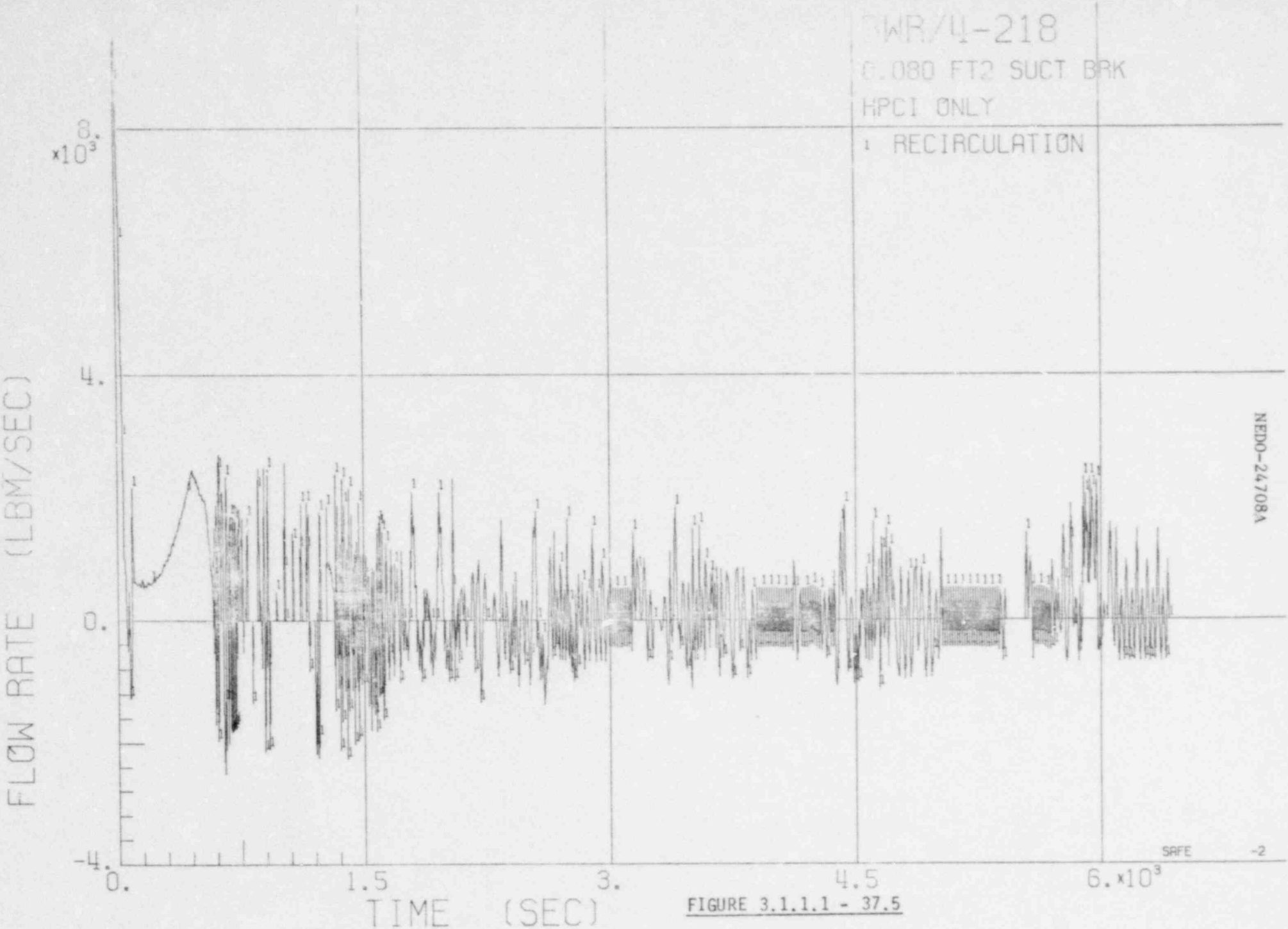

FIGURE 3.1.1.1 - 37.5

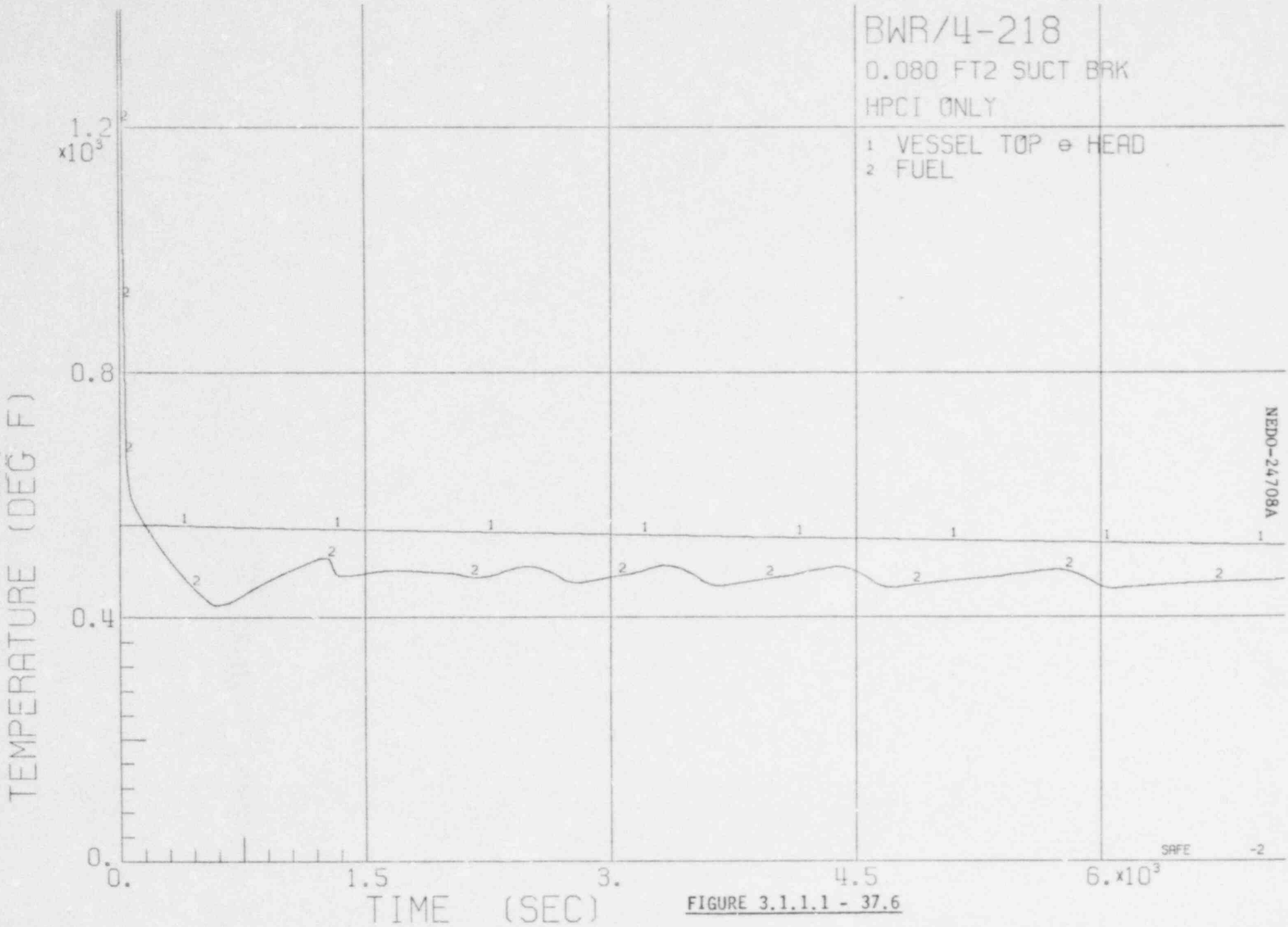

FIGURE 3.1.1.1 - 37.6

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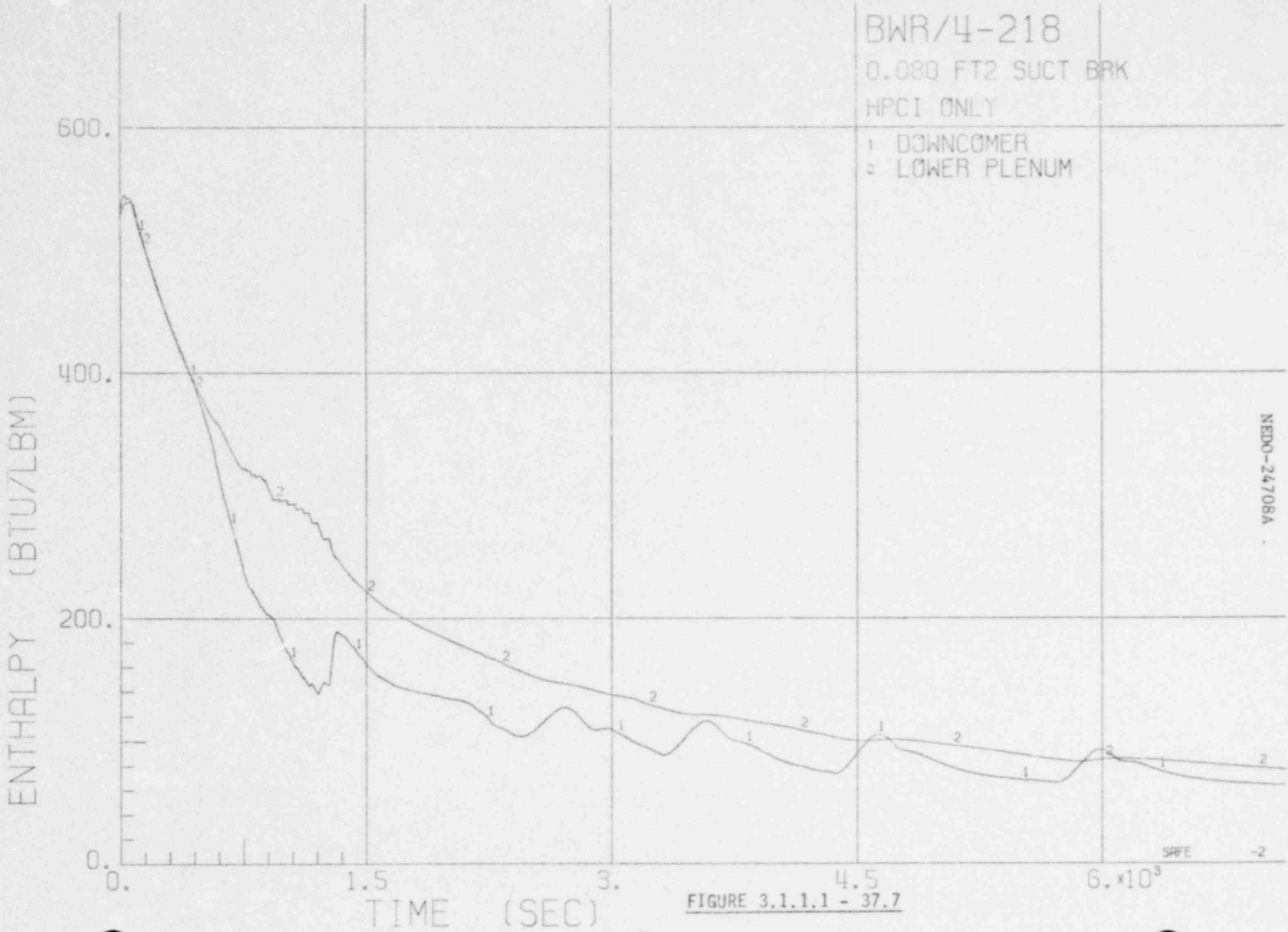

FIGURE 3.1.1.1 - 37.7

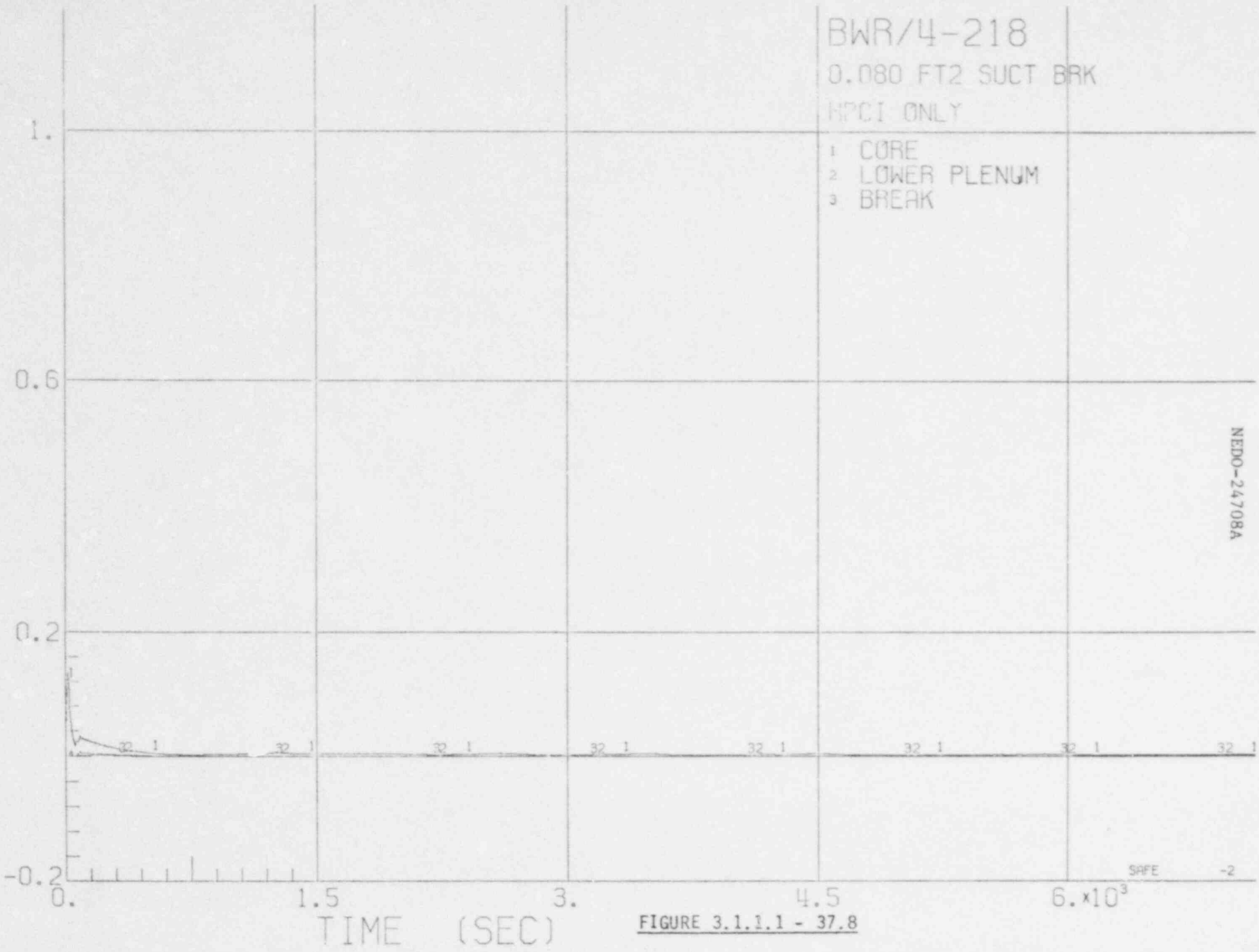

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FIGURE 3.1.1.1 - 37.8

FIGURE 3.1.1.1 - 38.1

FIGURE 3.1.1.1 - 38.2

FIGURE 3.1.1.1 - 38.3

FIGURE 3.1.1.1 - 38.4

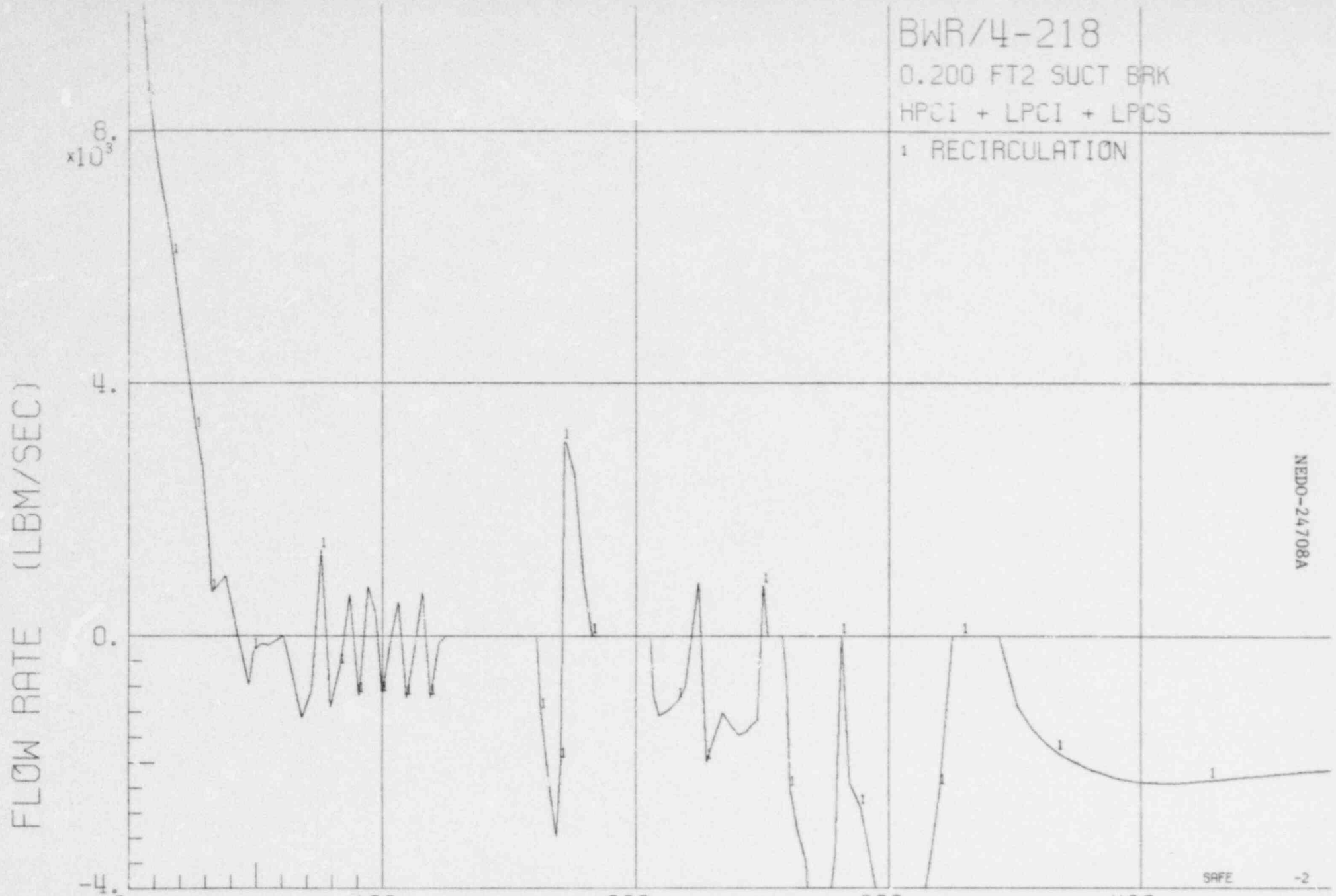

FIGURE 3.1.1.1 - 38.5

FIGURE 3.1.1.1 - 38.6

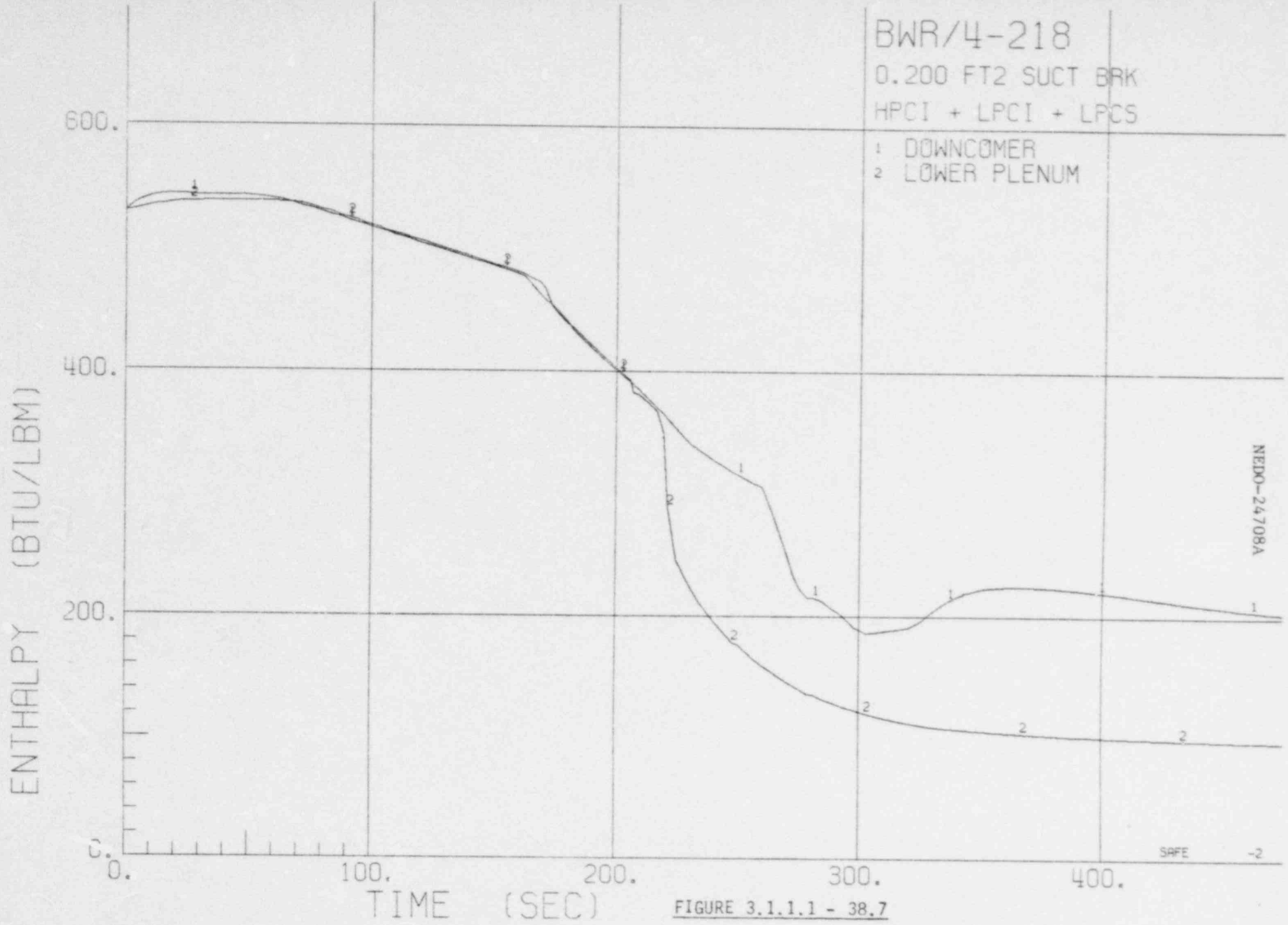

FIGURE 3.1.1.1 - 38.7

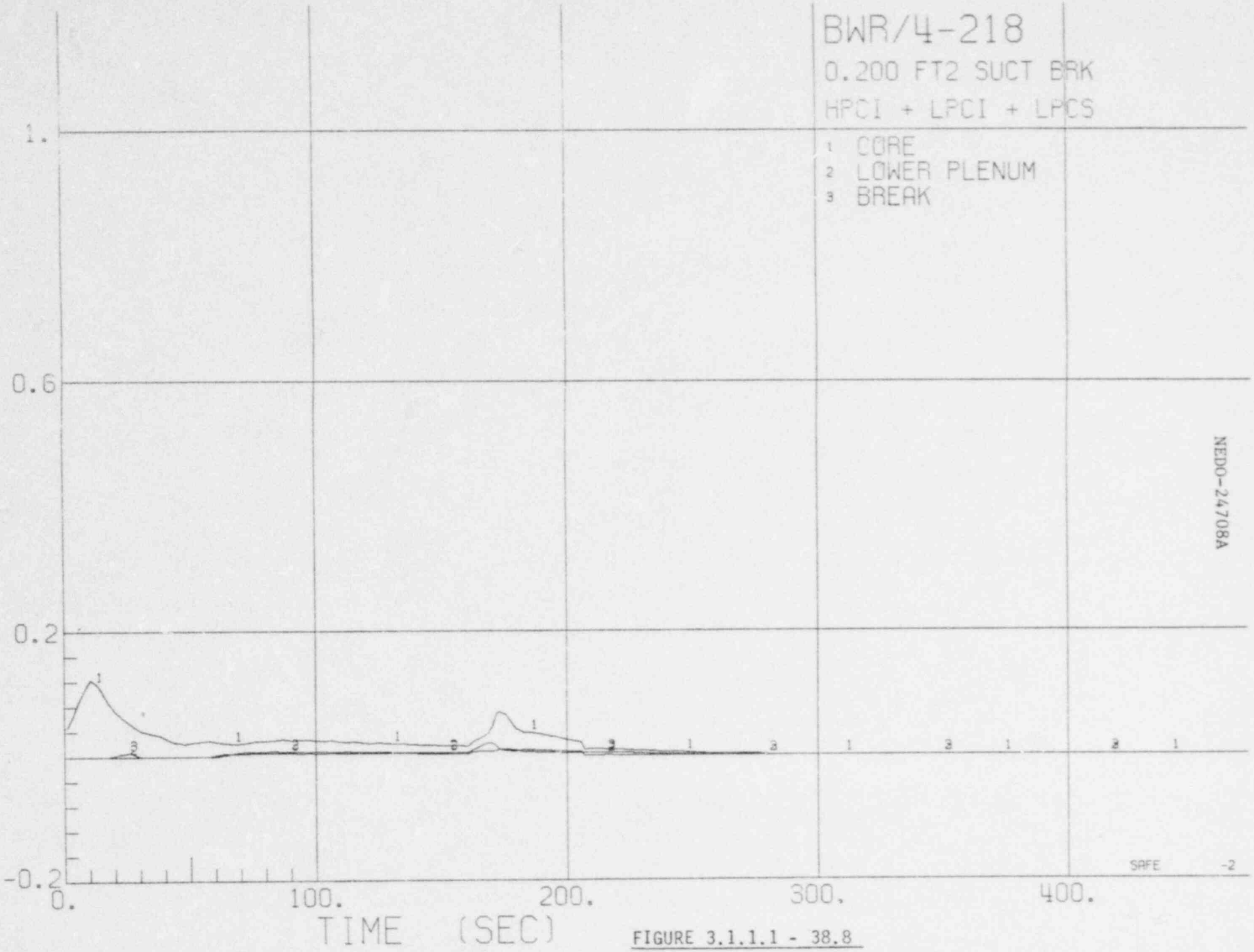

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FIGURE 3.1.1.1 - 38.8

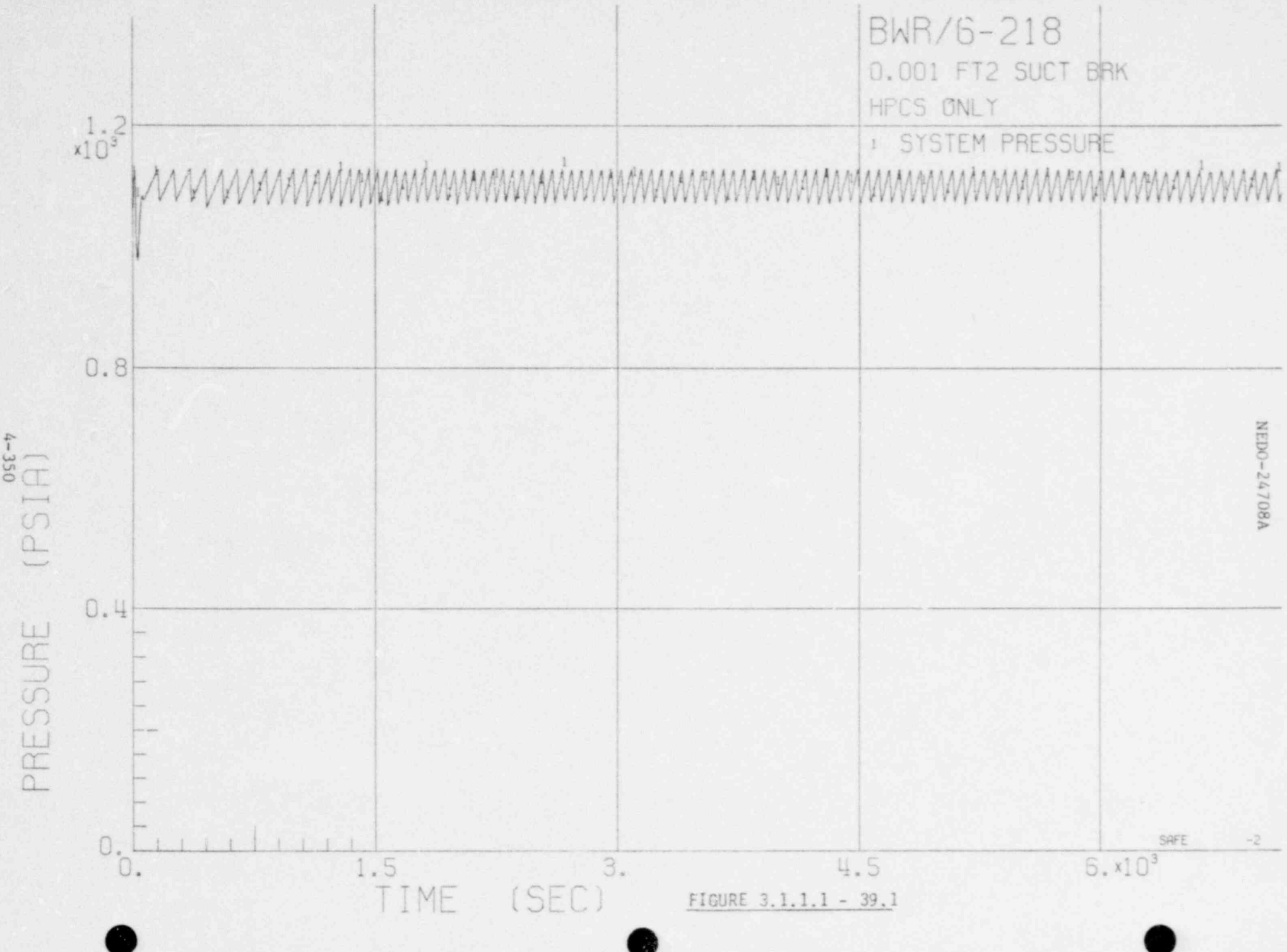

FIGURE 3.1.1.1 - 39.1

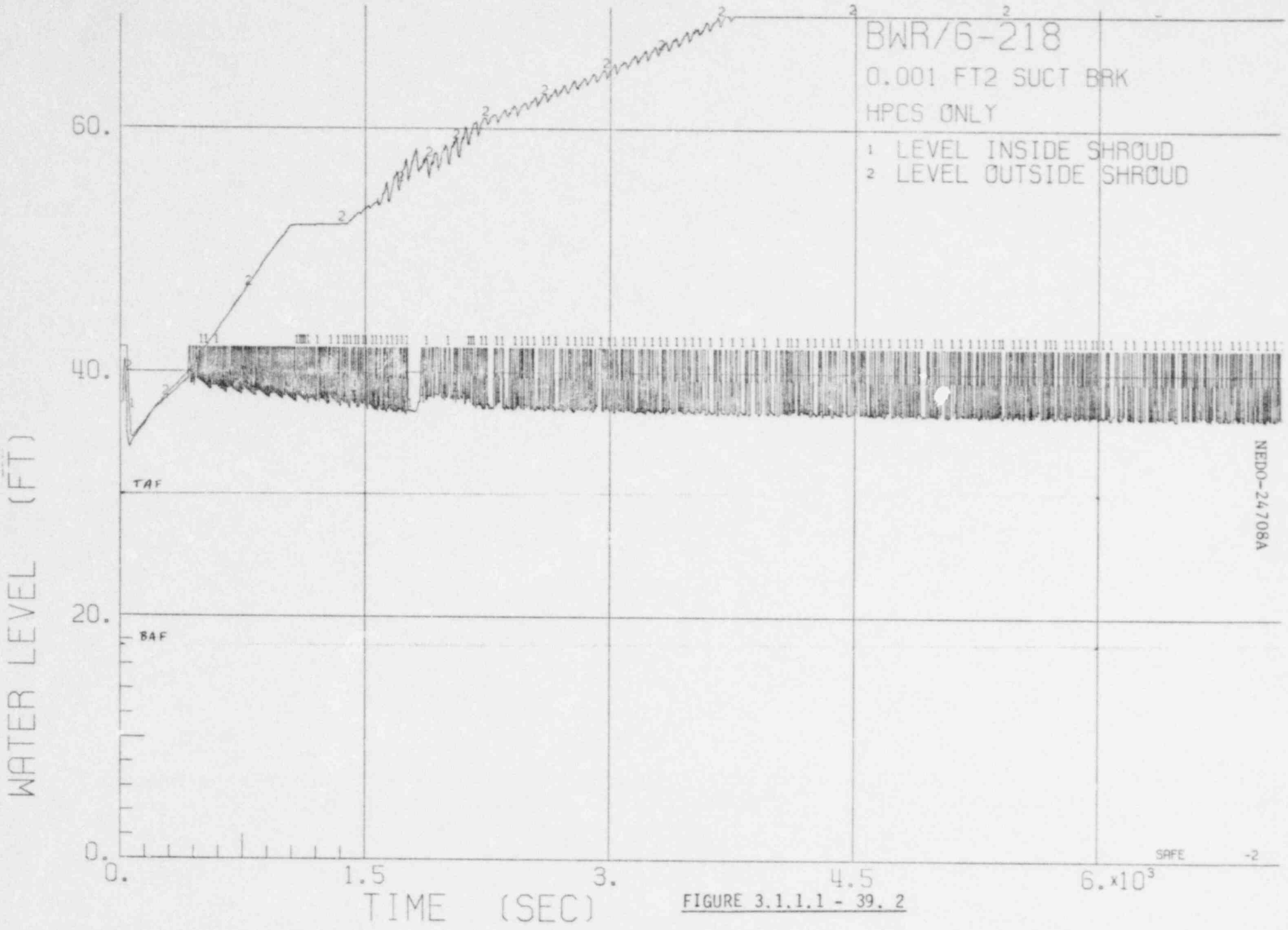

FIGURE 3.1.1.1 - 39. 2

FIGURE 3.1.1.1 - 39.3

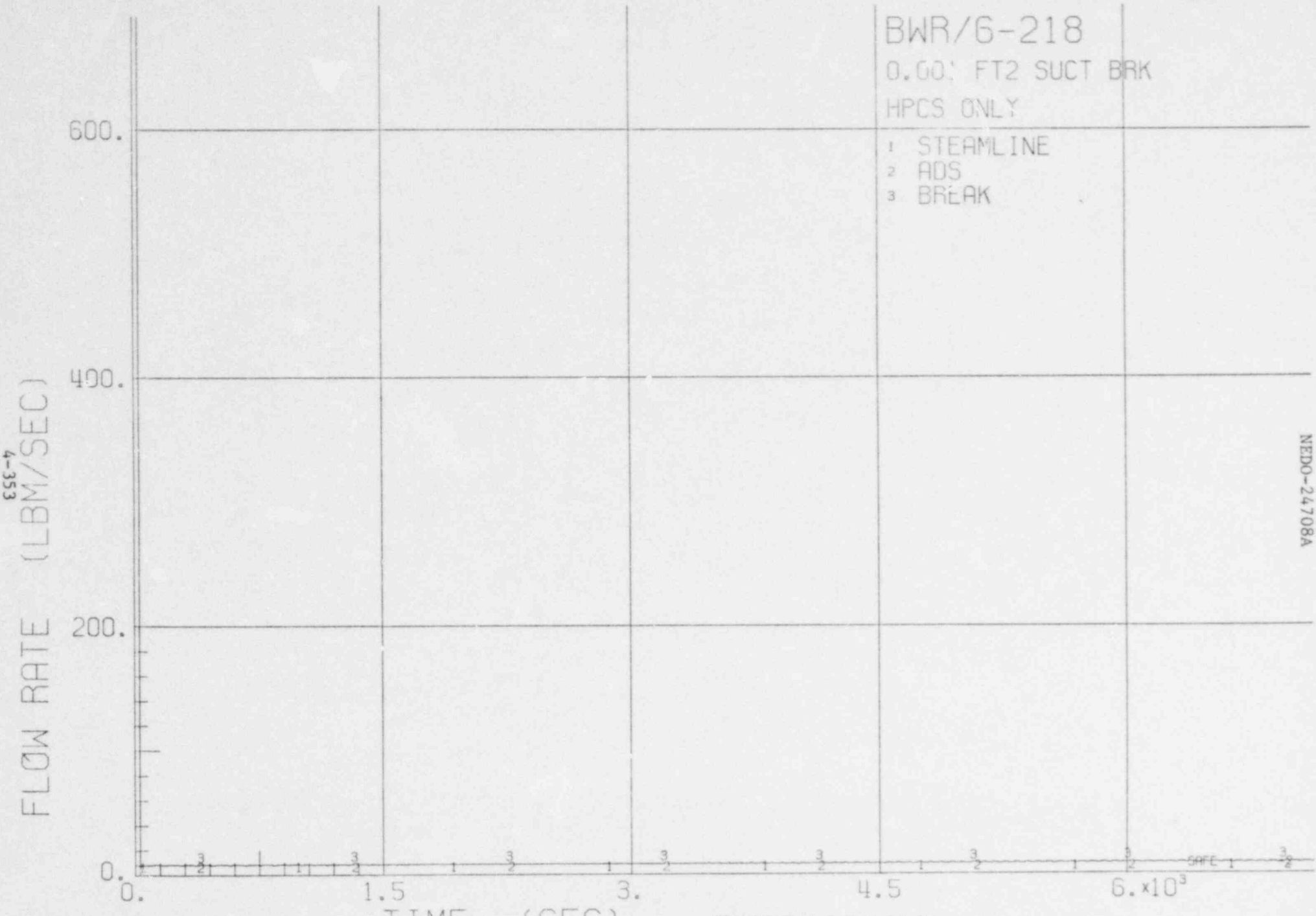

FIGURE 3.1.1.1 - 39.4

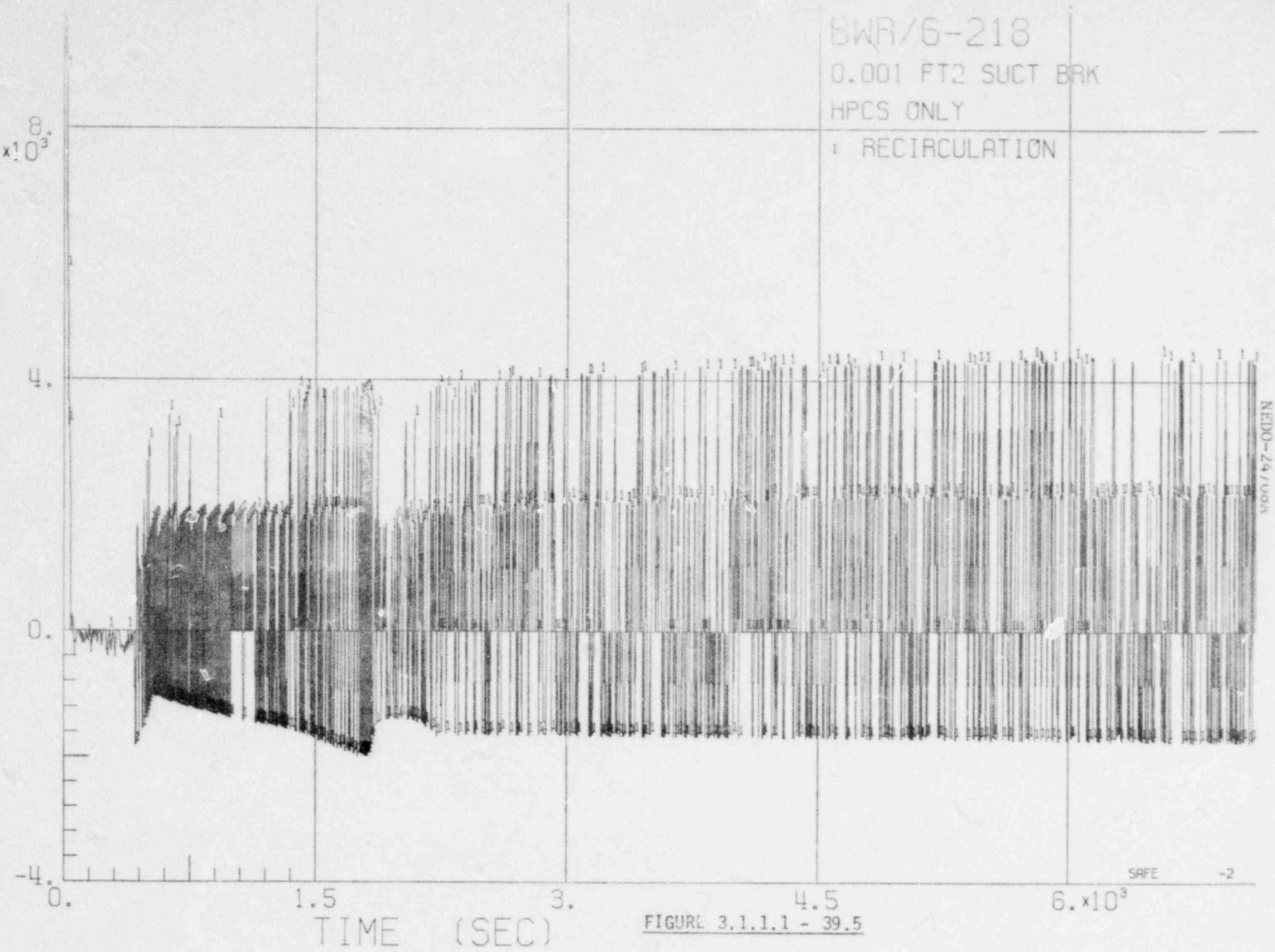

FIGURE 3.1.1.1 - 39.5

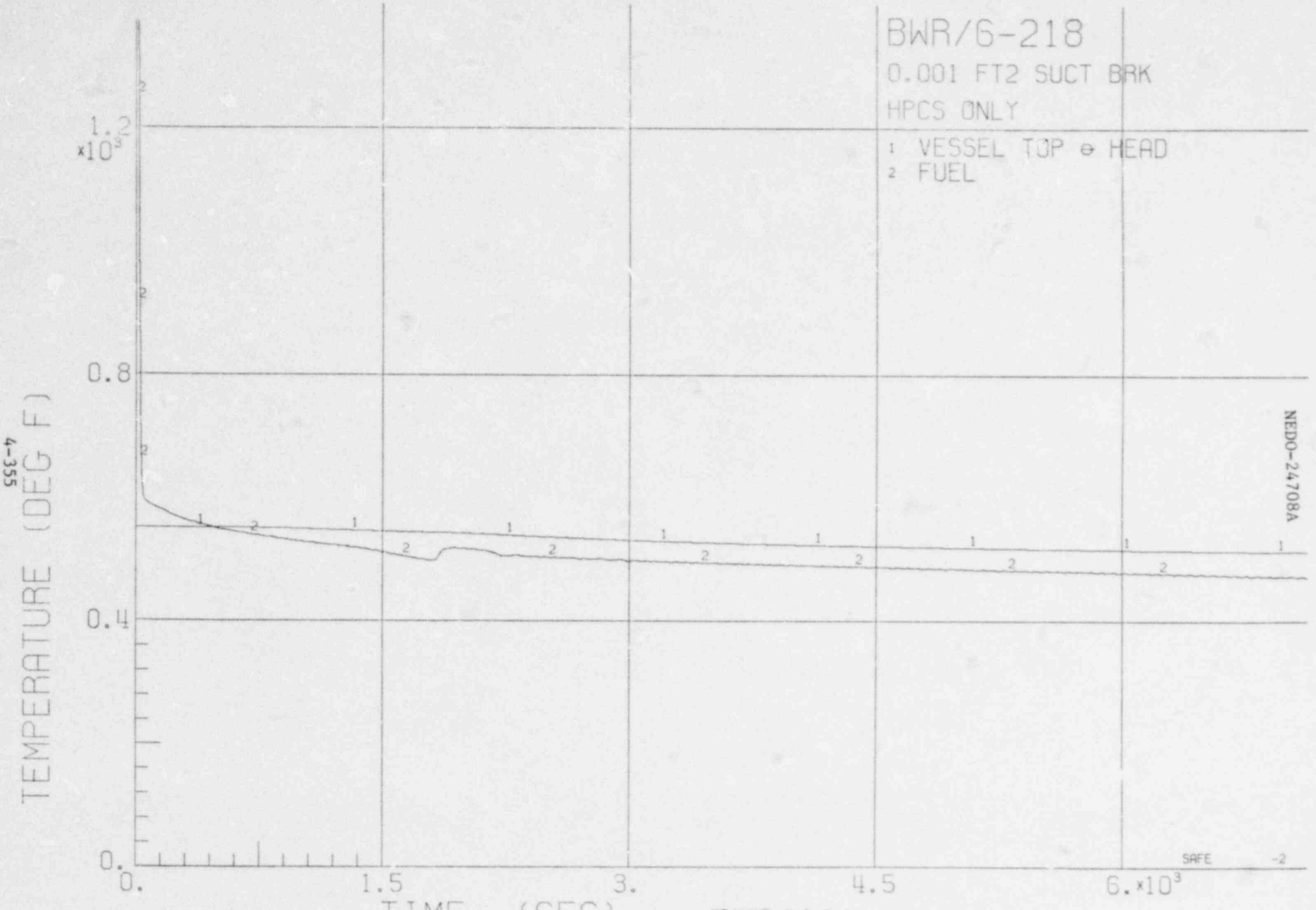

FIGURE 3.1.1.1 - 39.6

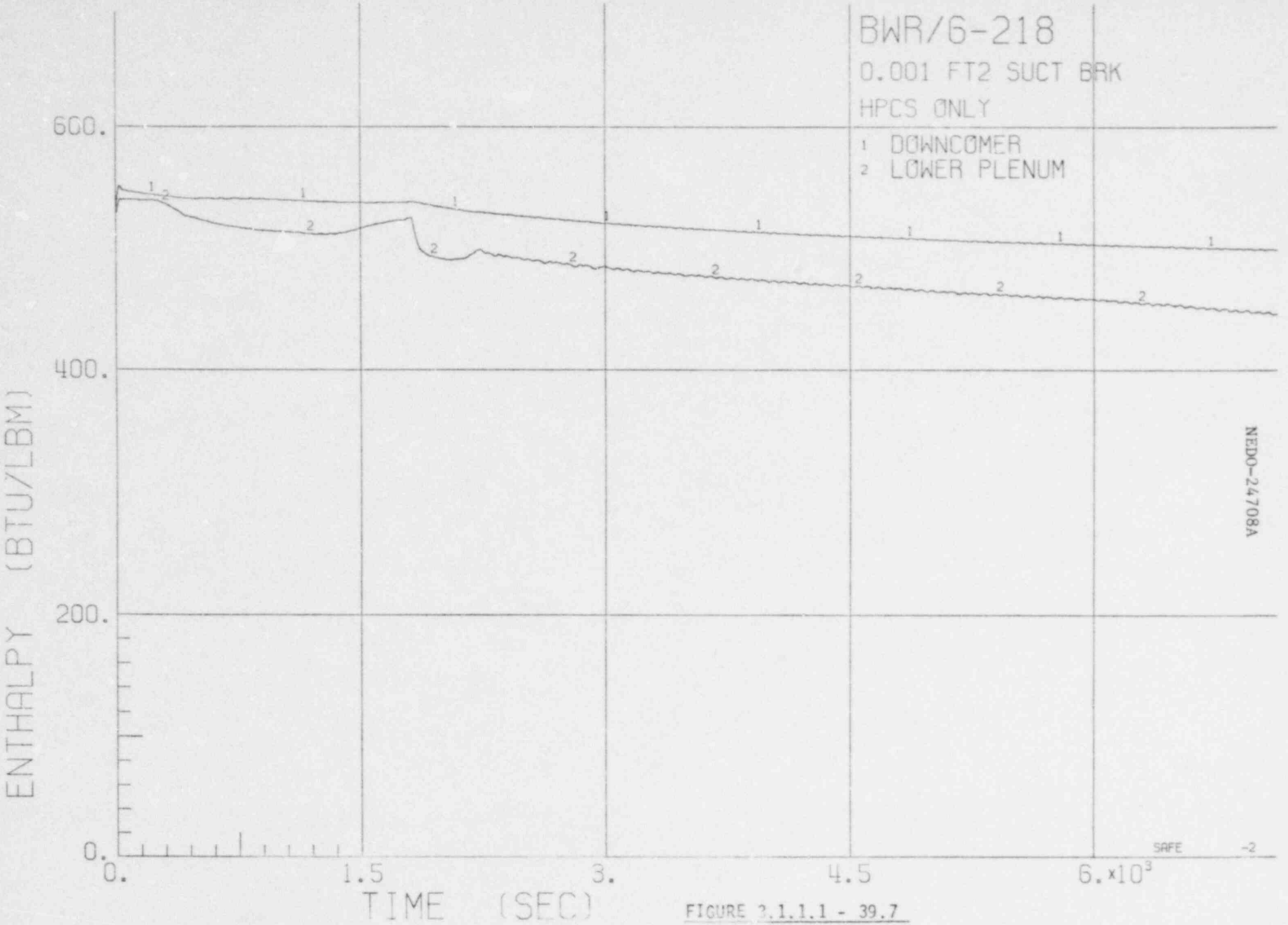

FIGURE 3.1.1.1 - 39.7

FIGURE 3.1.1.1 - 39.8

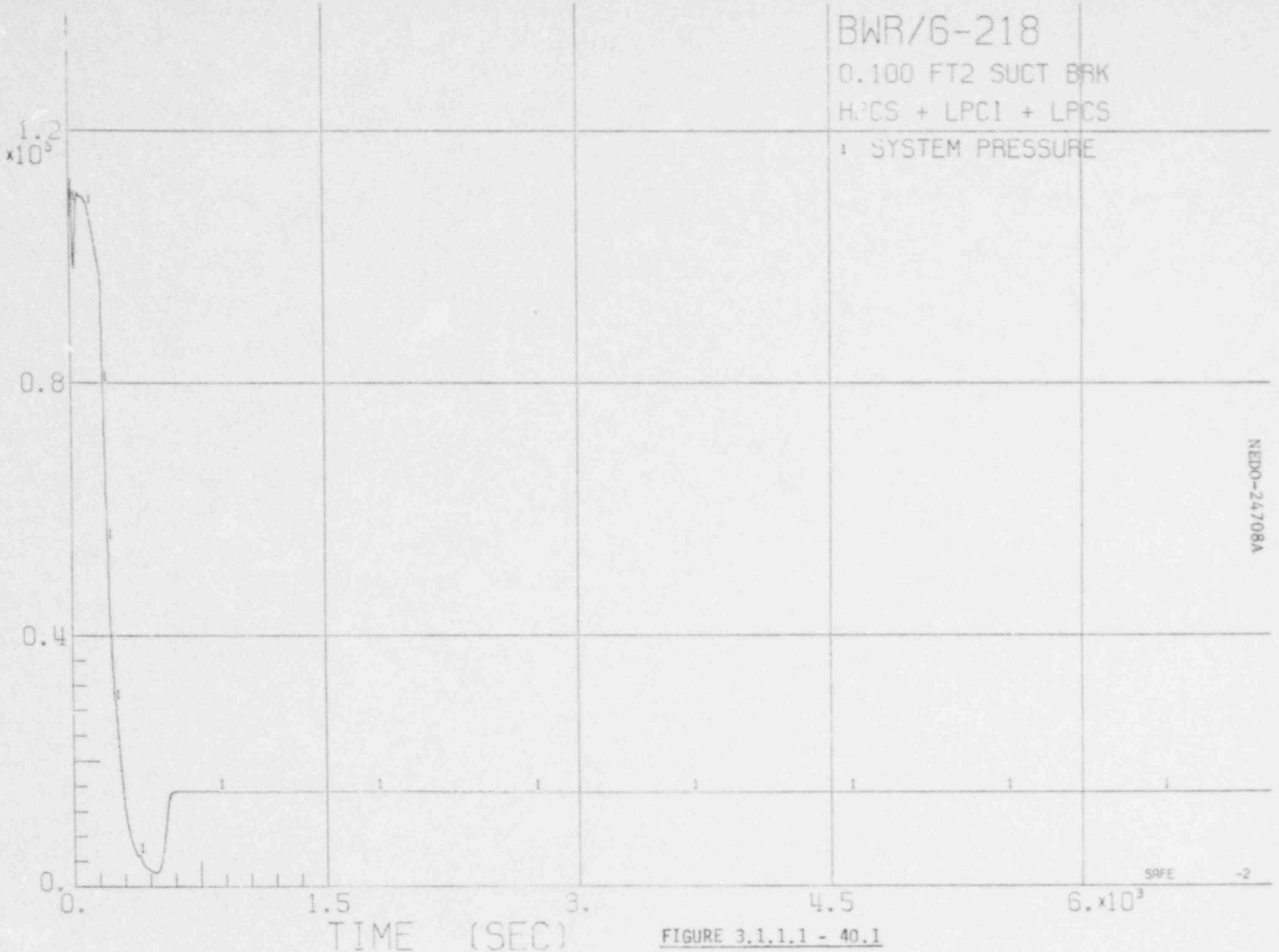

FIGURE 3.1.1.1 - 40.1

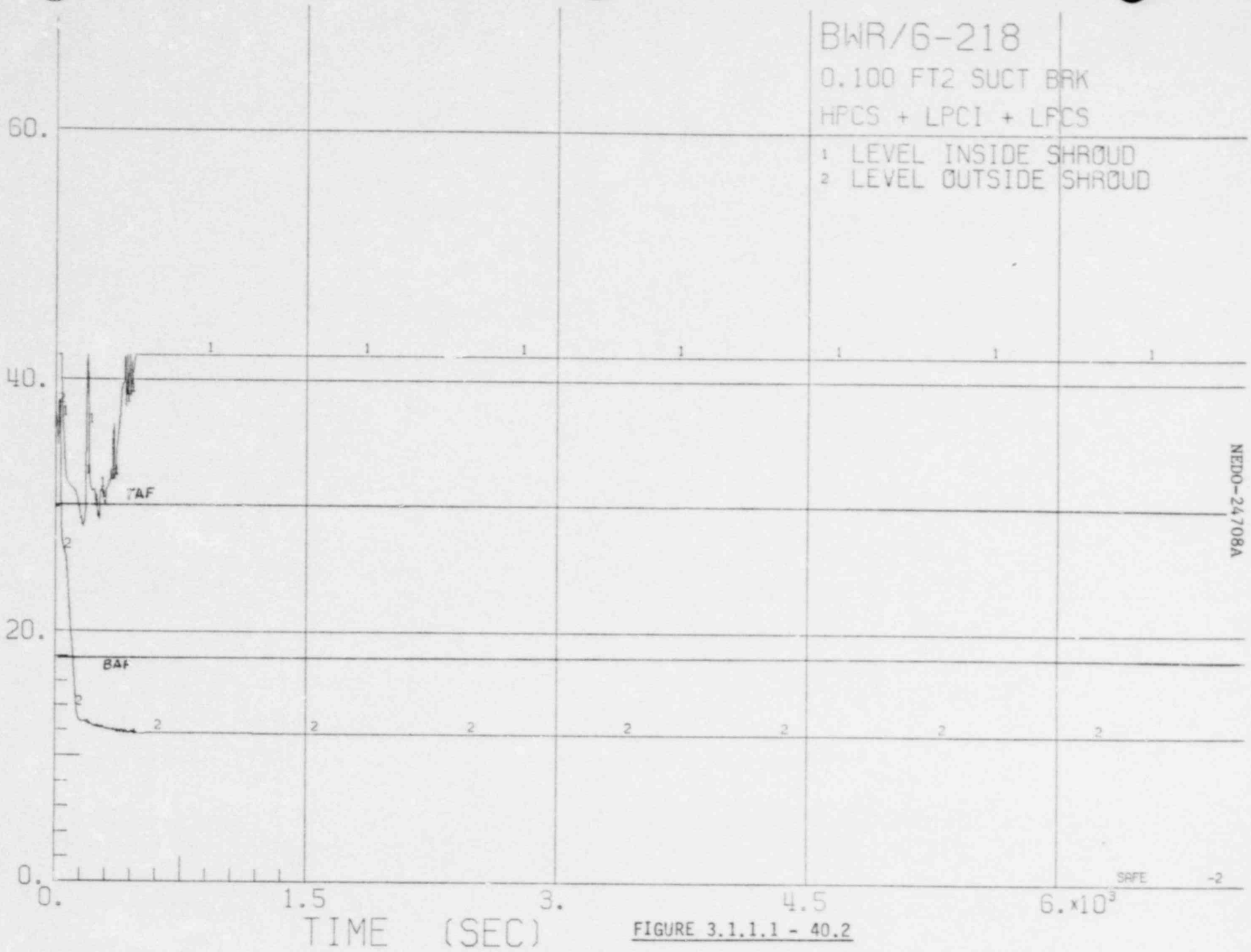

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FIGURE 3.1.1.1 - 40.2

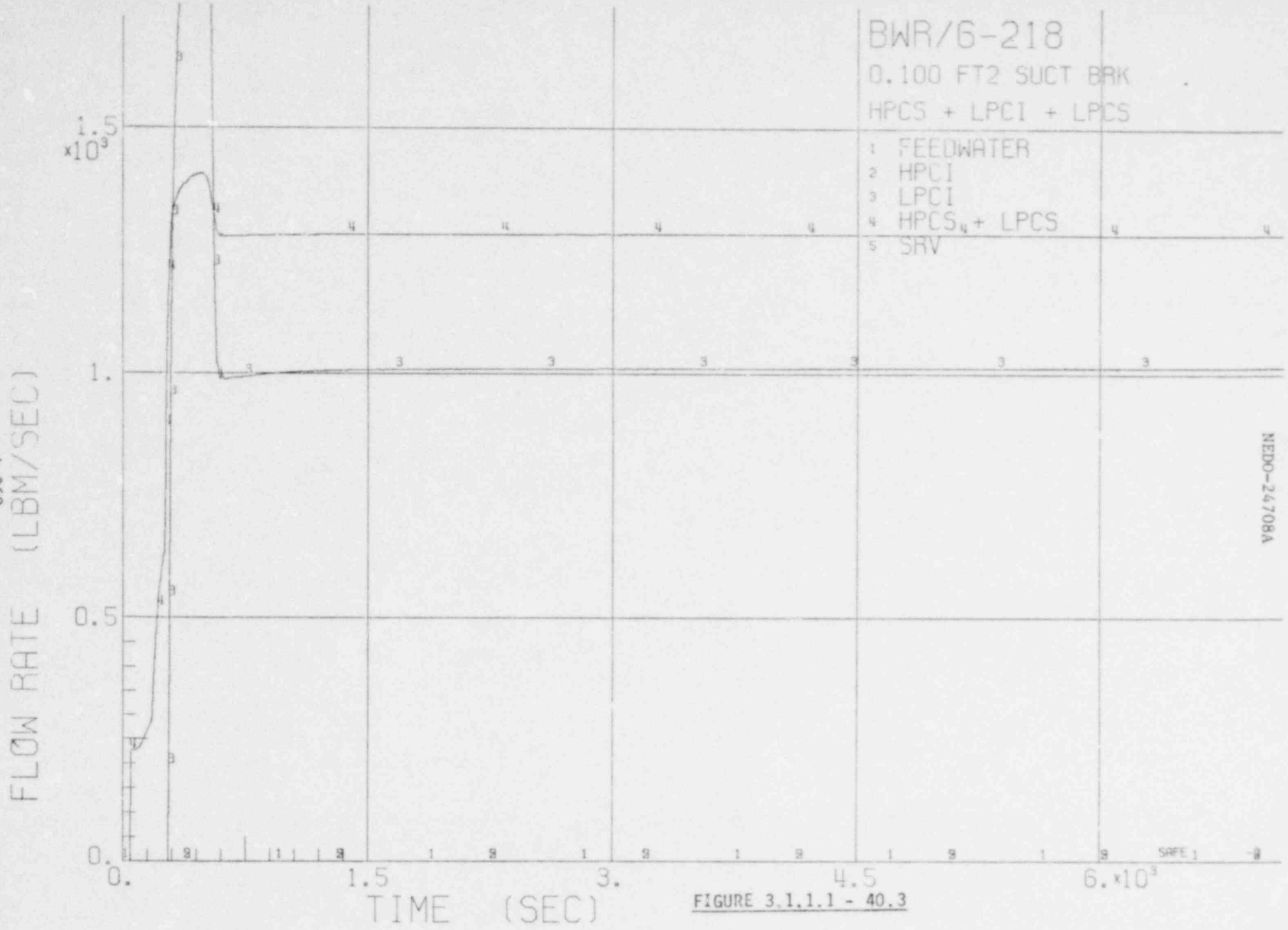

FIGURE 3.1.1.1 - 40.3

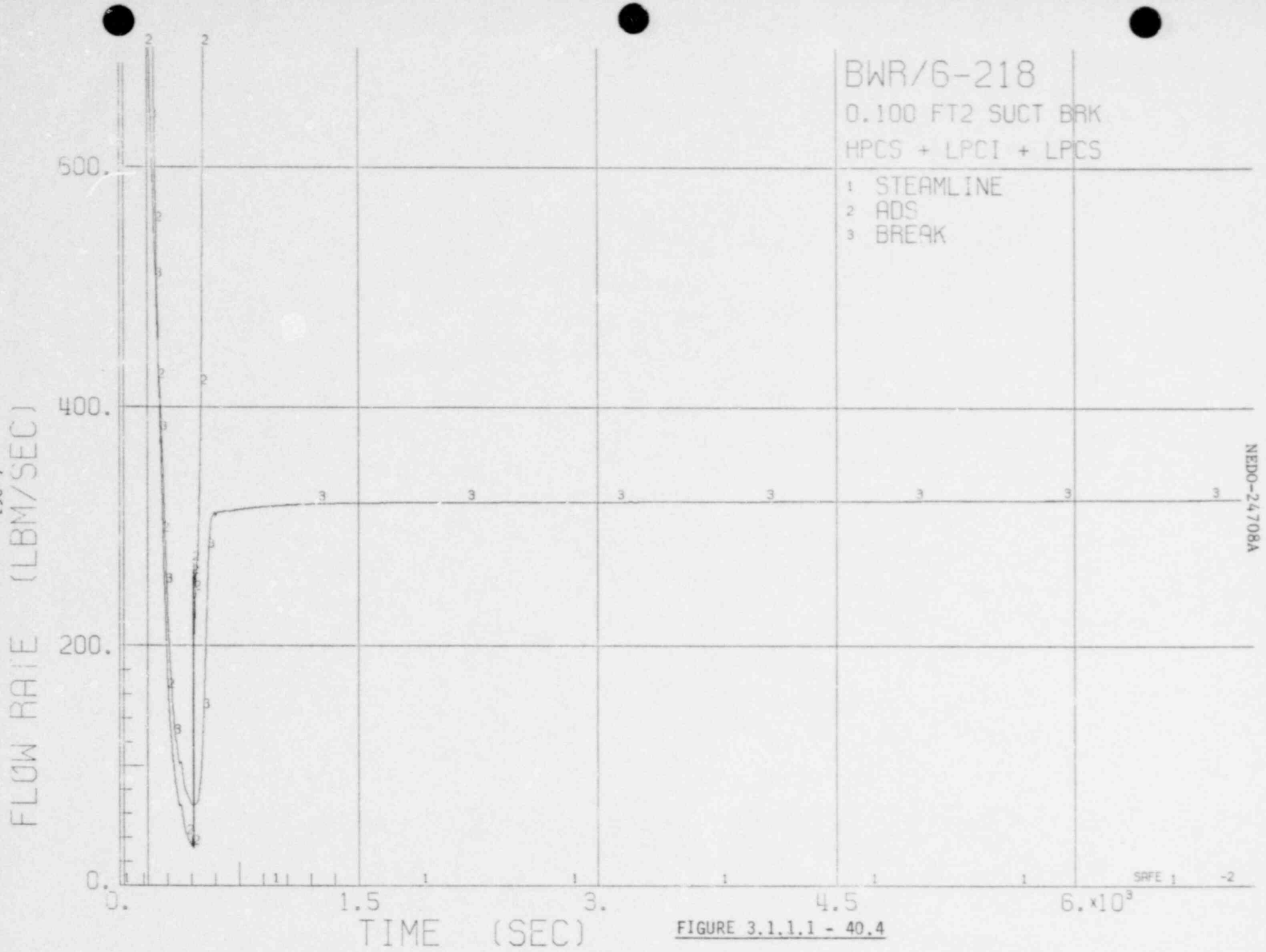

FIGURE 3.1.1.1 - 40.4

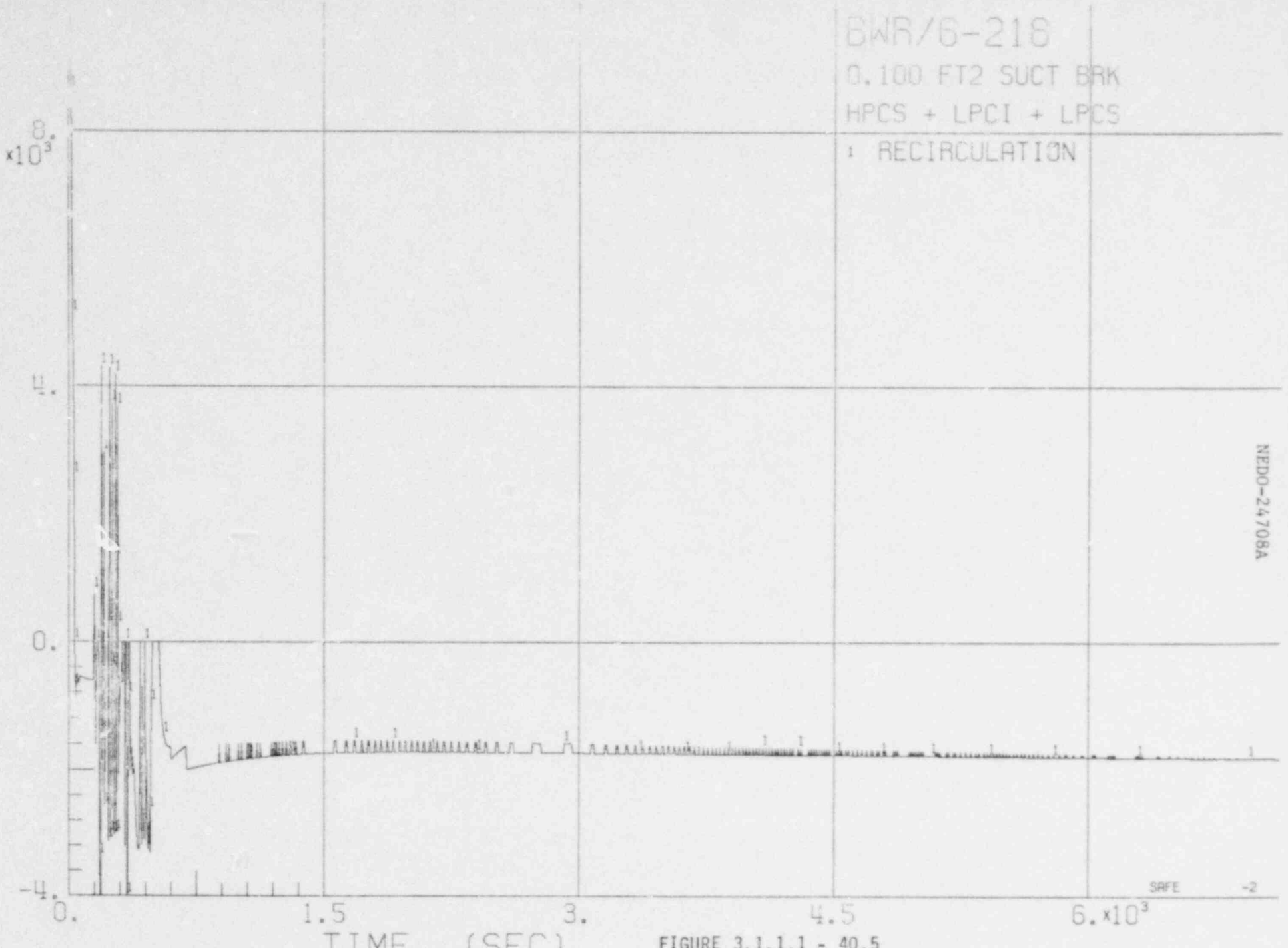

FIGURE 3.1.1.1 - 40.5

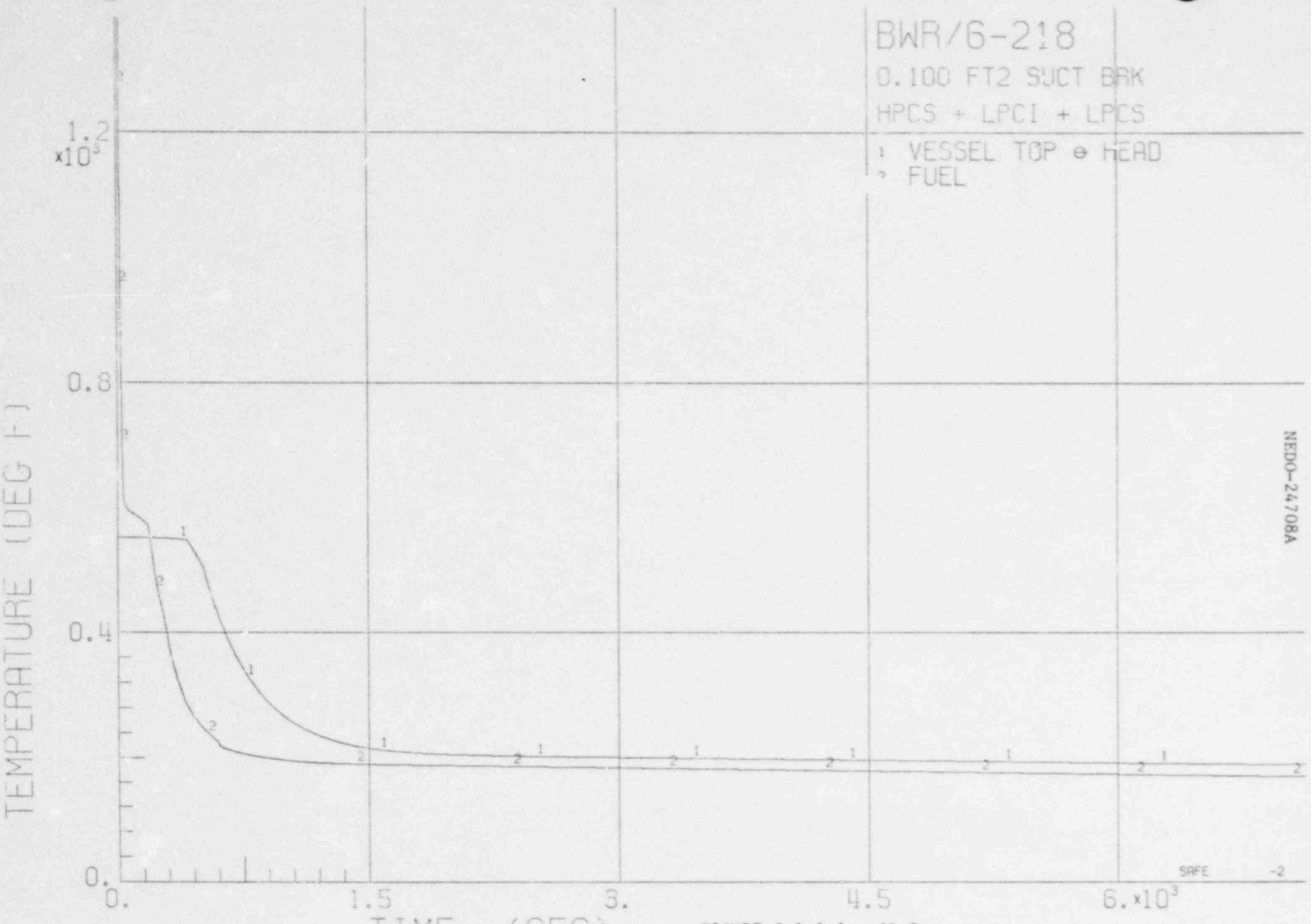

FIGURE 3.1.1.1 - 40.6

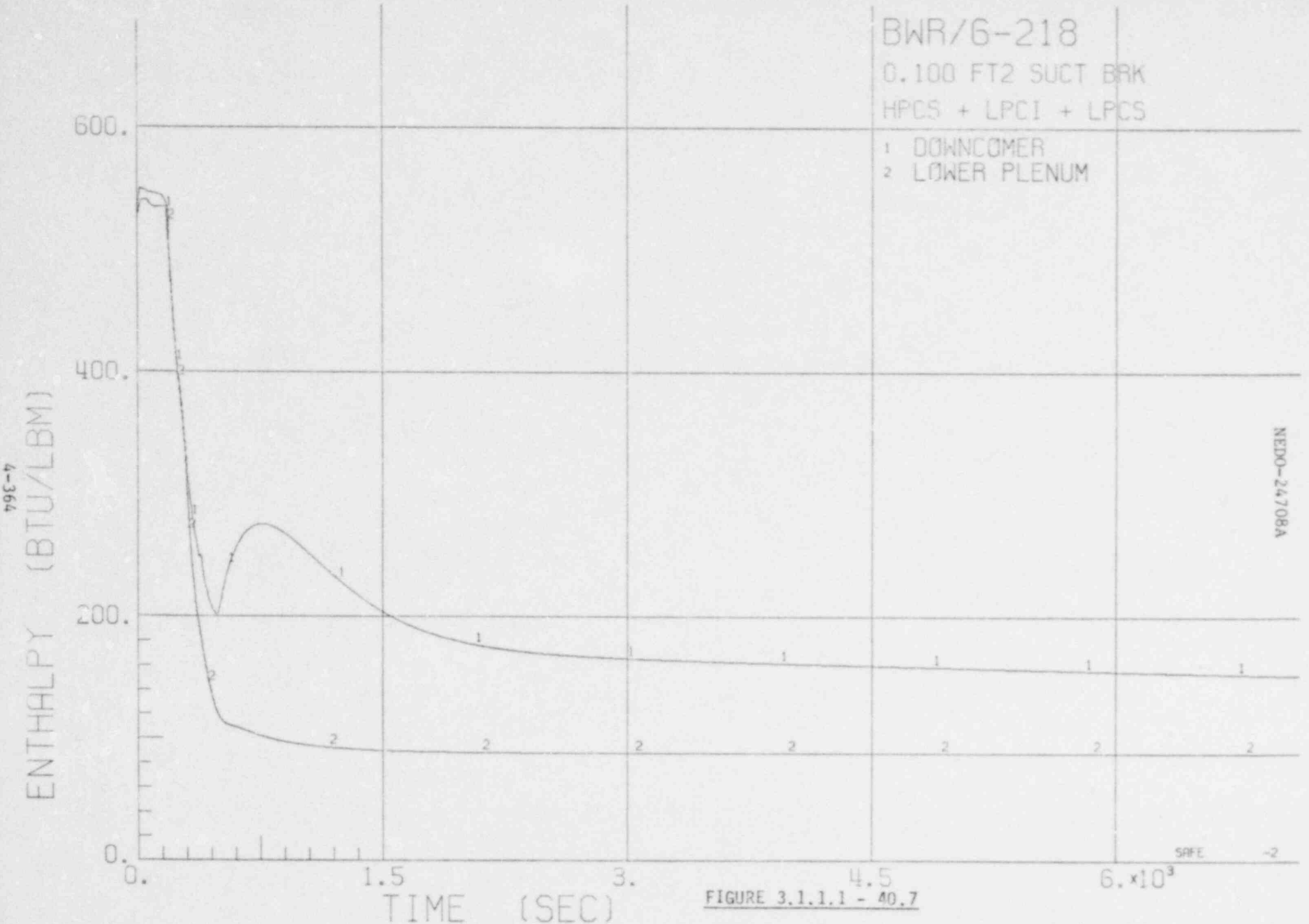

FIGURE 3.1.1.1 - 40.7

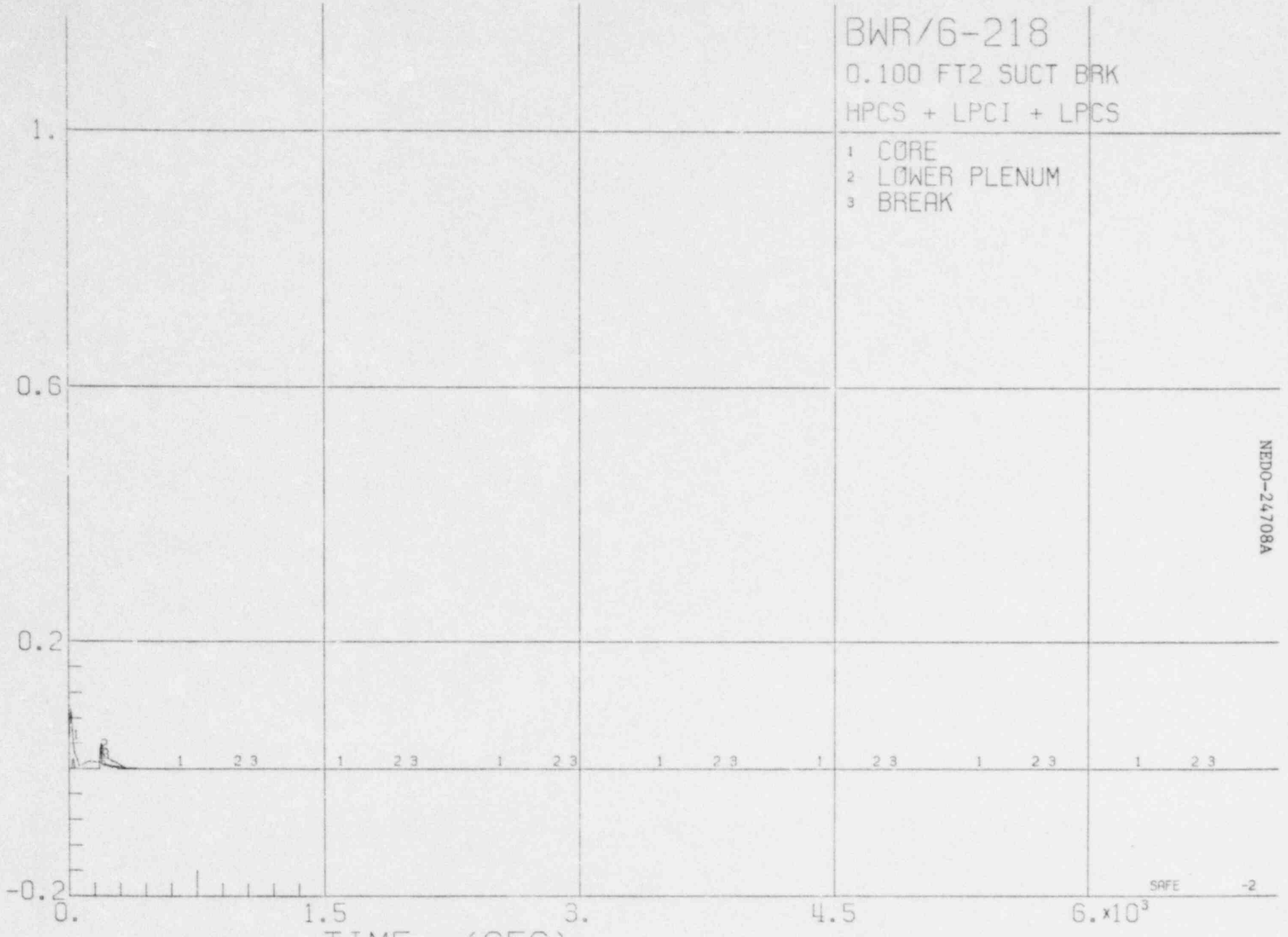

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FIGURE 3.1.1.1 - 40.8

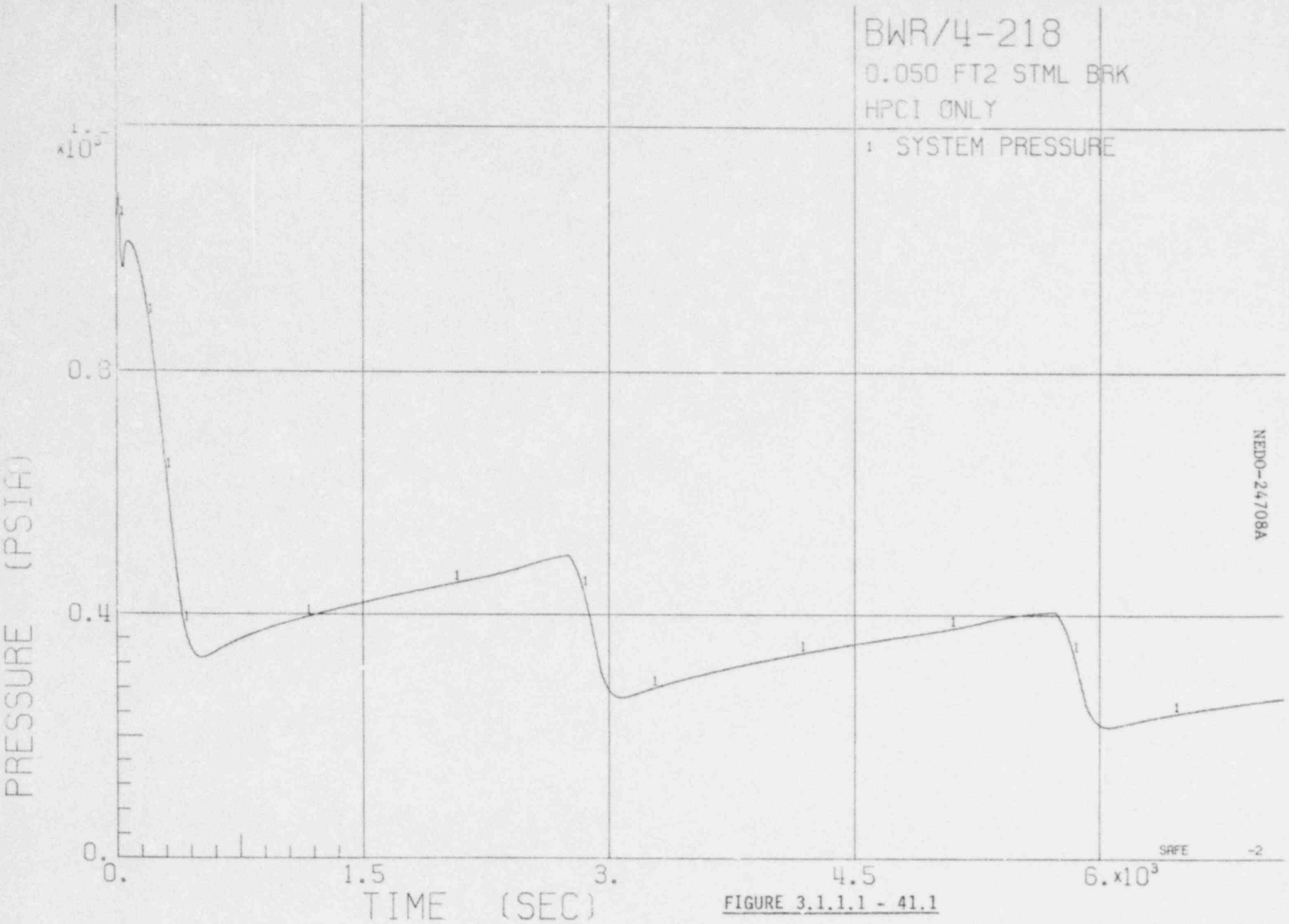

FIGURE 3.1.1.1 - 41.1

FIGURE 3.1.1.1 - 41.2

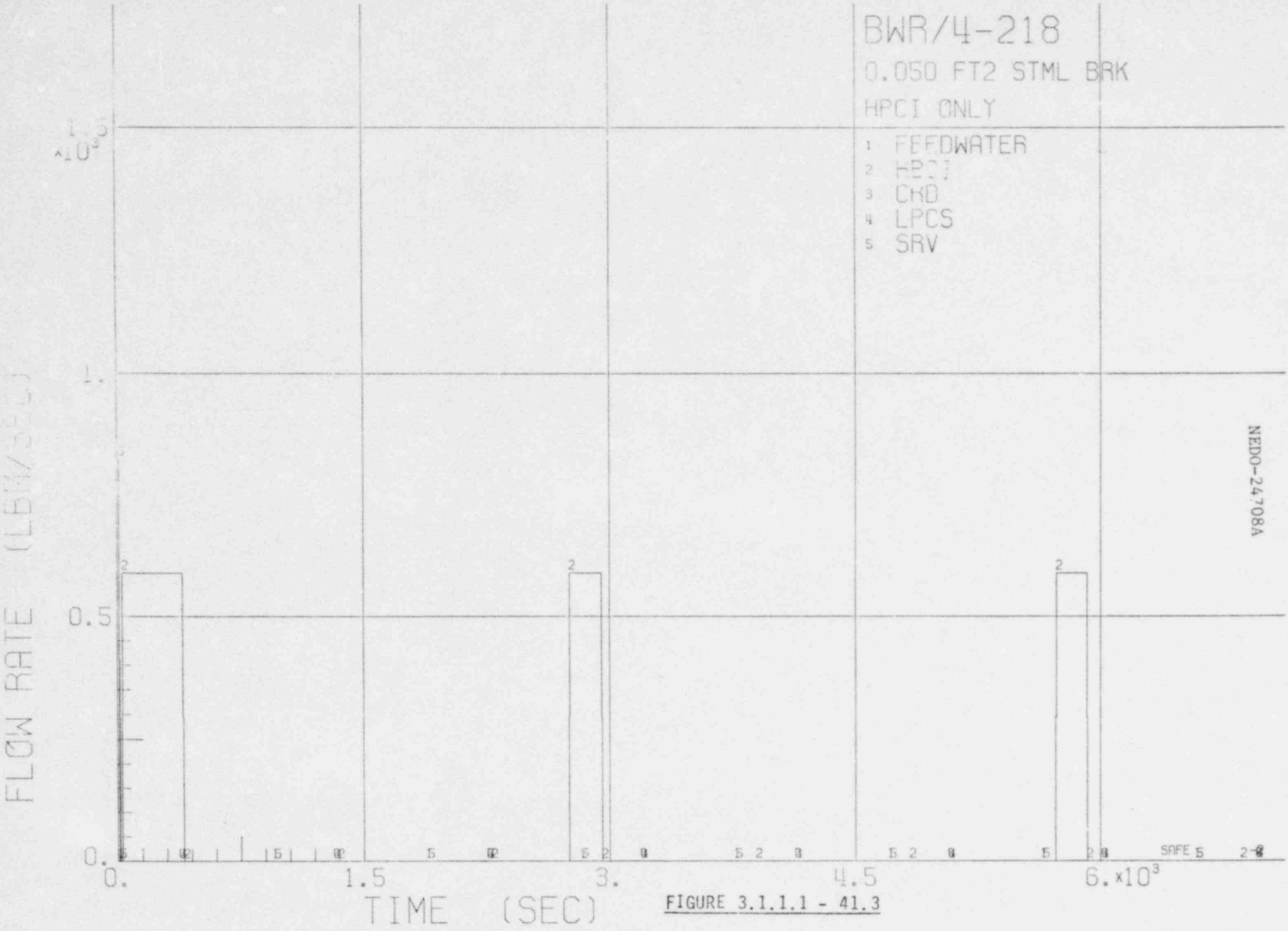

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FIGURE 3.1.1.1 - 41.3

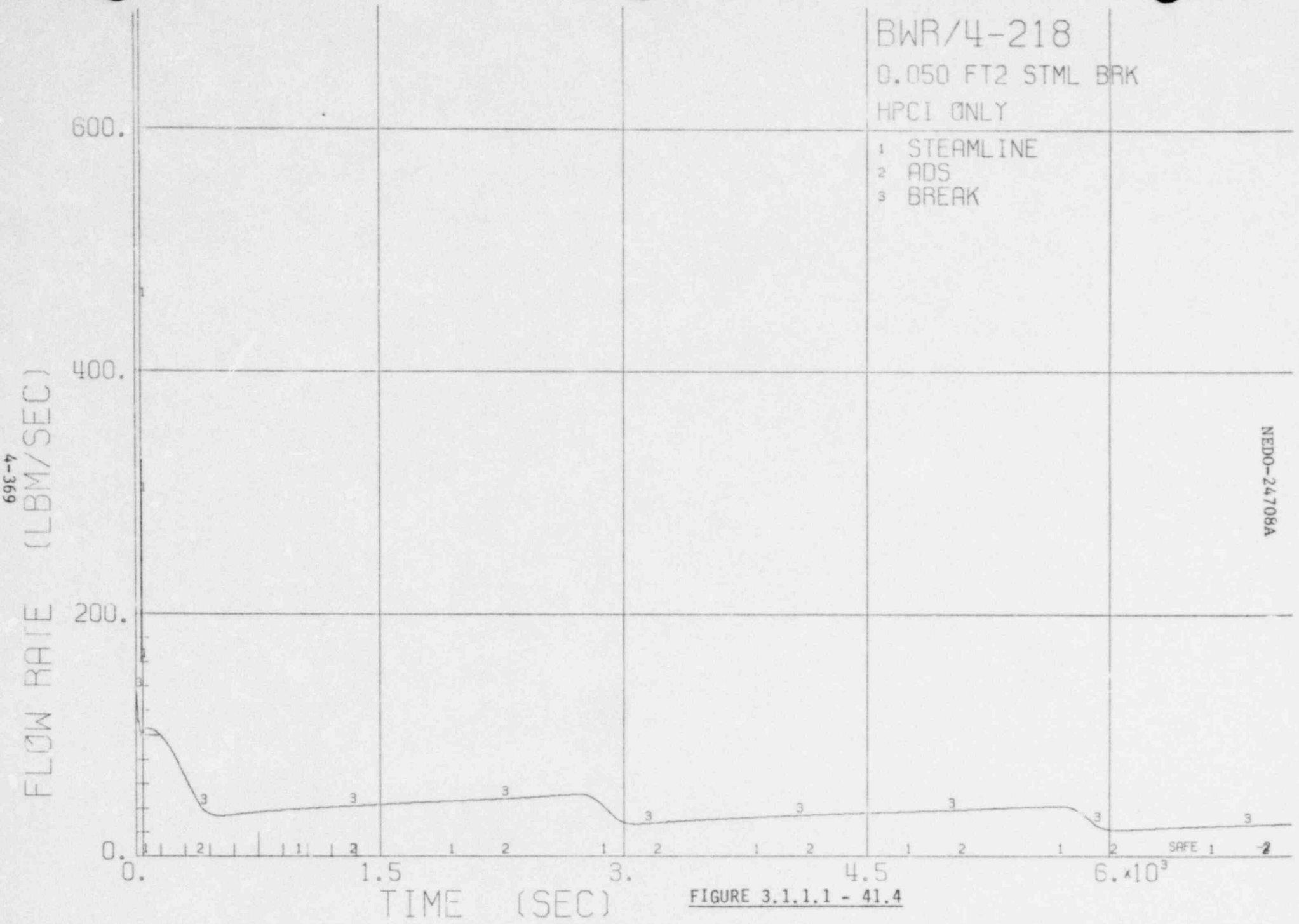

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FIGURE 3.1.1.1 - 41.4

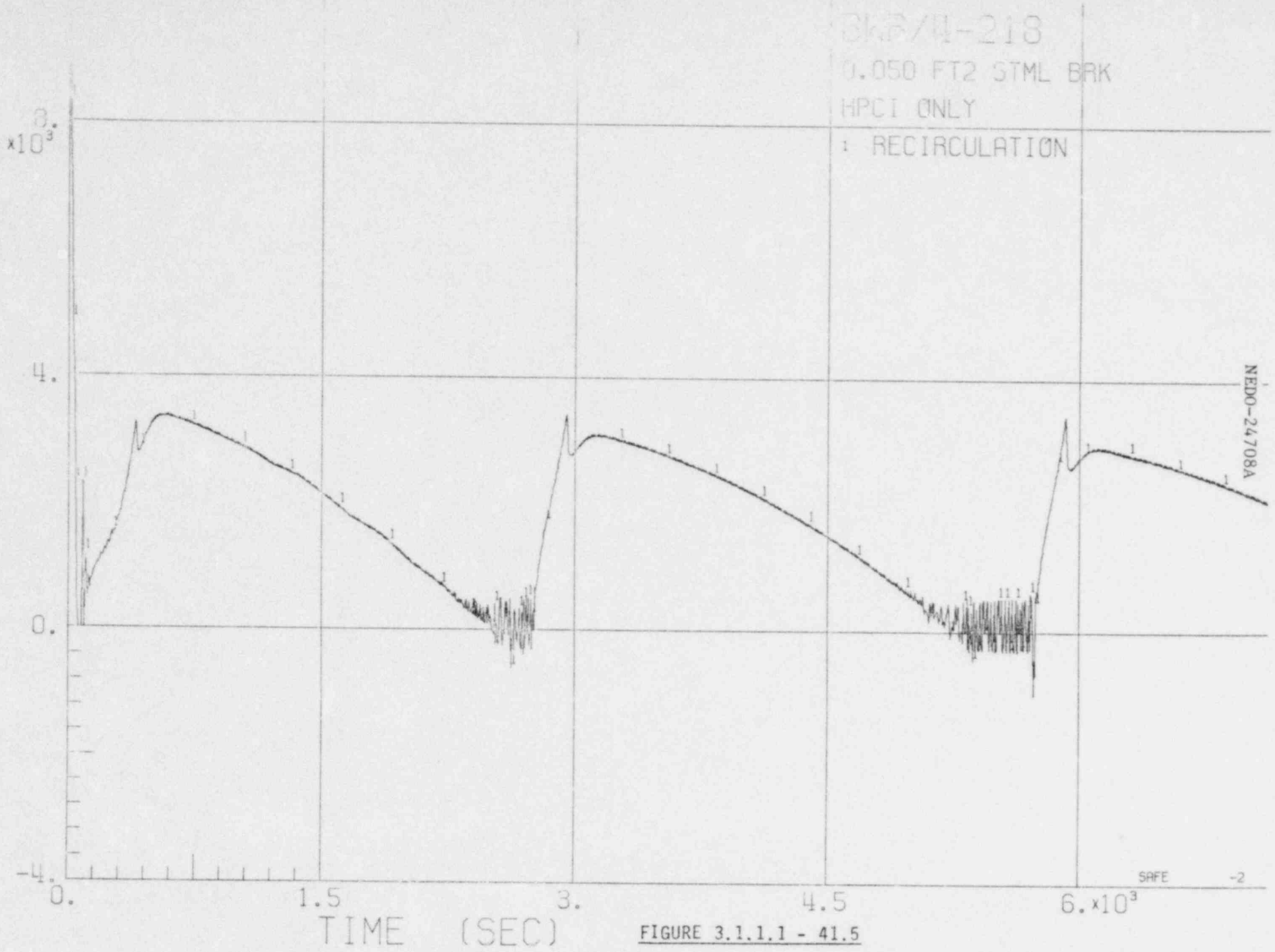


FIGURE 3.1.1.1 - 41.5

FIGURE 3.1.1.1 - 41.6

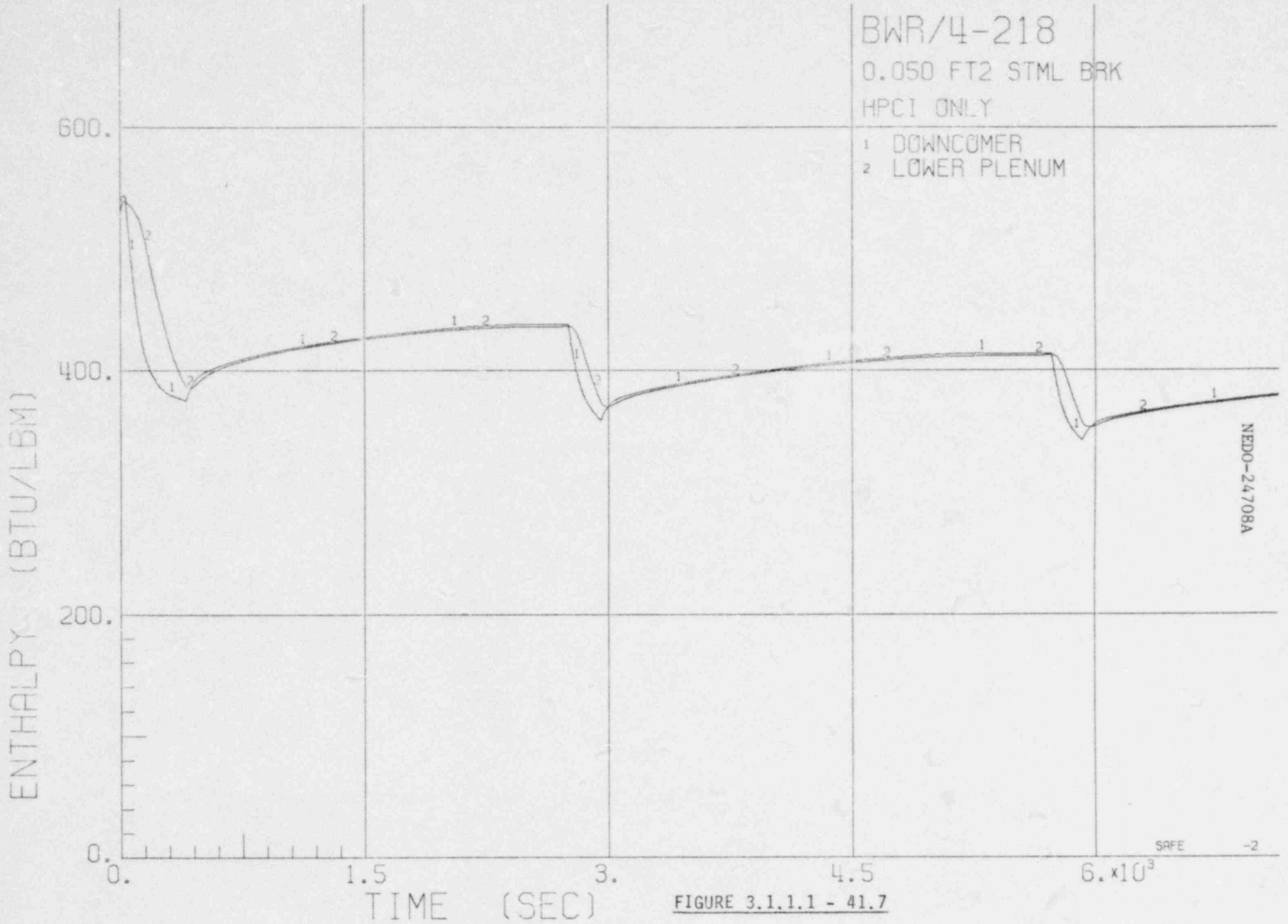


FIGURE 3.1.1.1 - 41.7

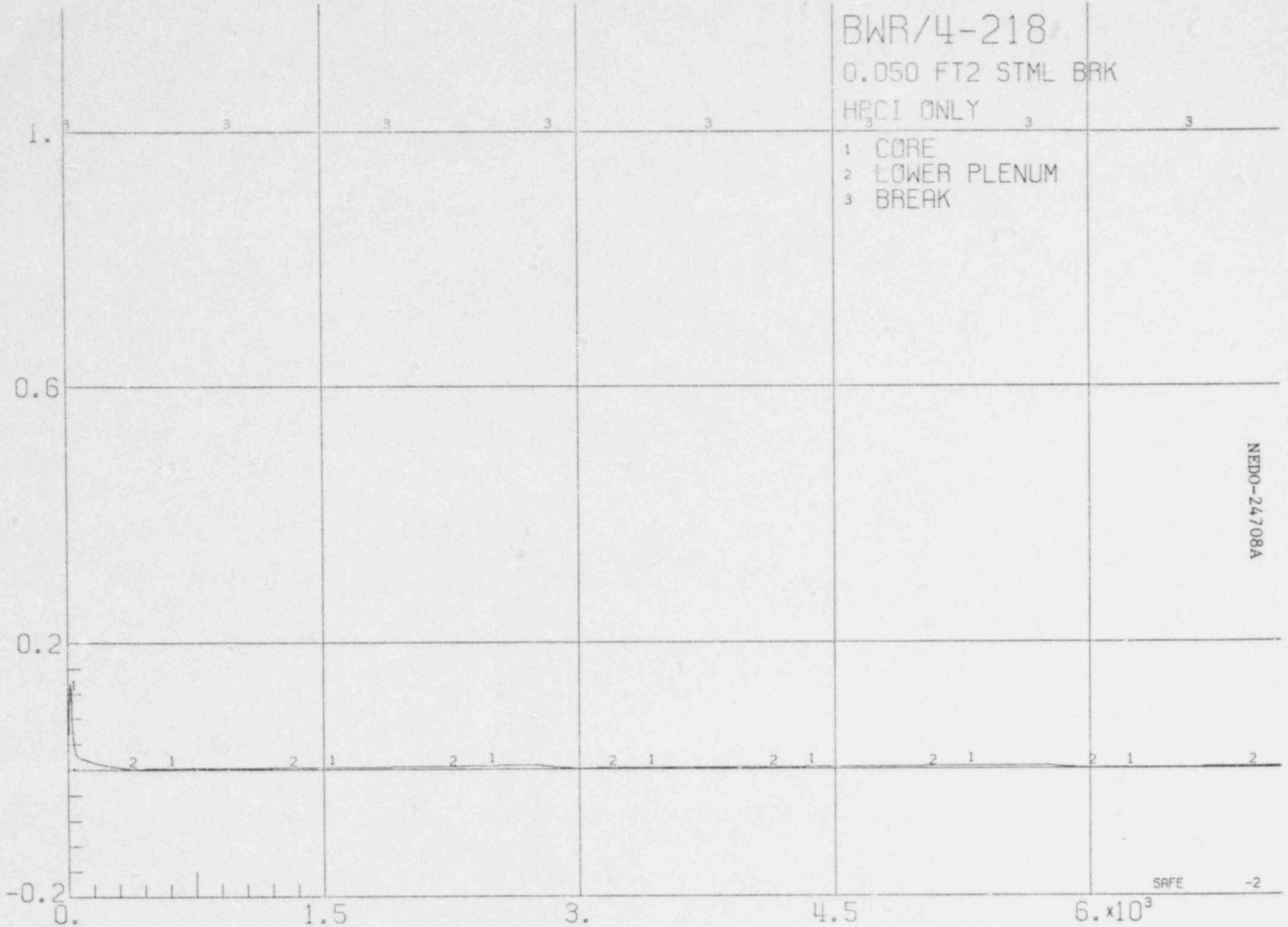


FIGURE 3.1.1.1 - 41.8

FIGURE 3.1.1.1 - 42.1

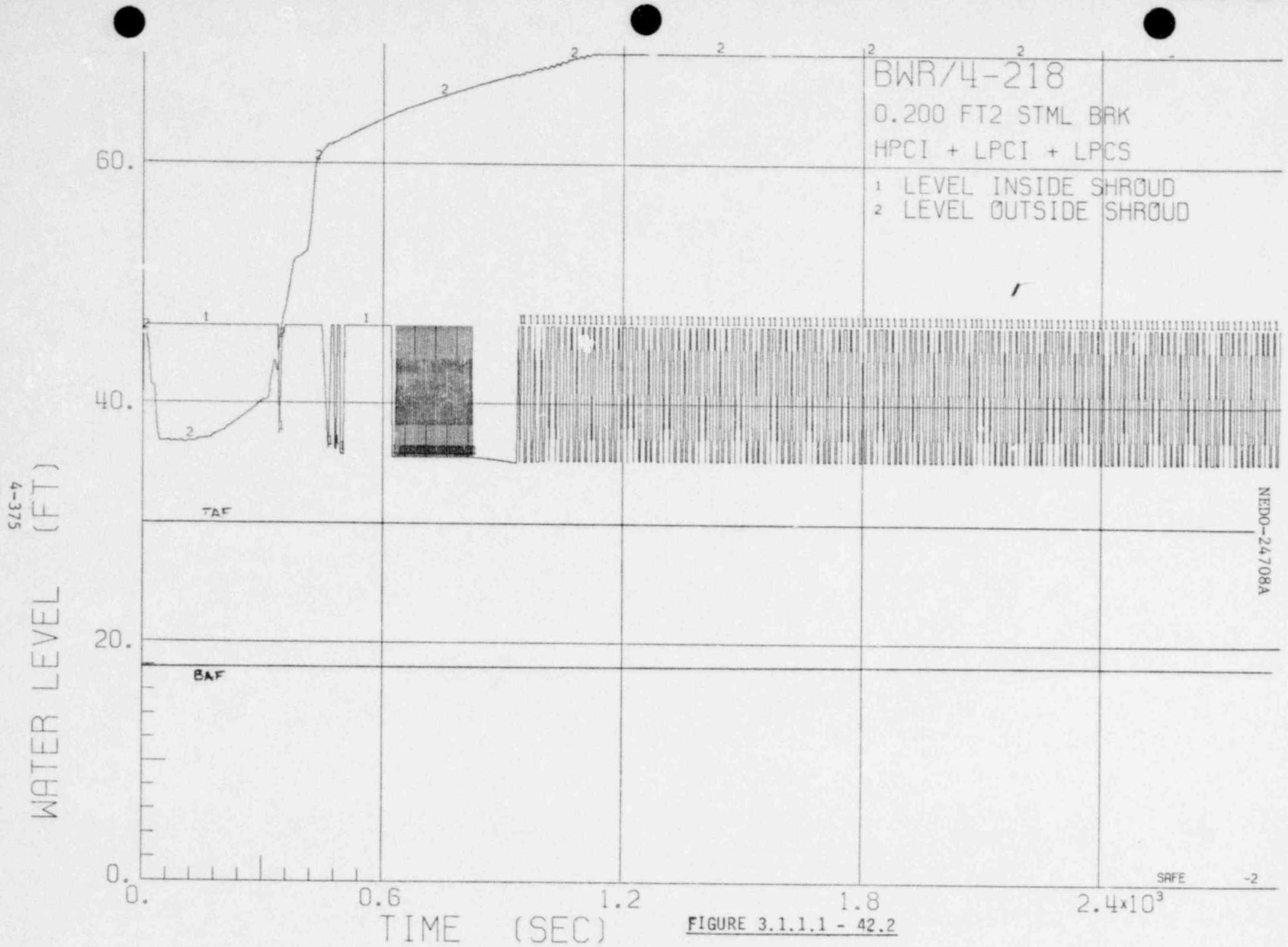


FIGURE 3.1.1.1 - 42.2

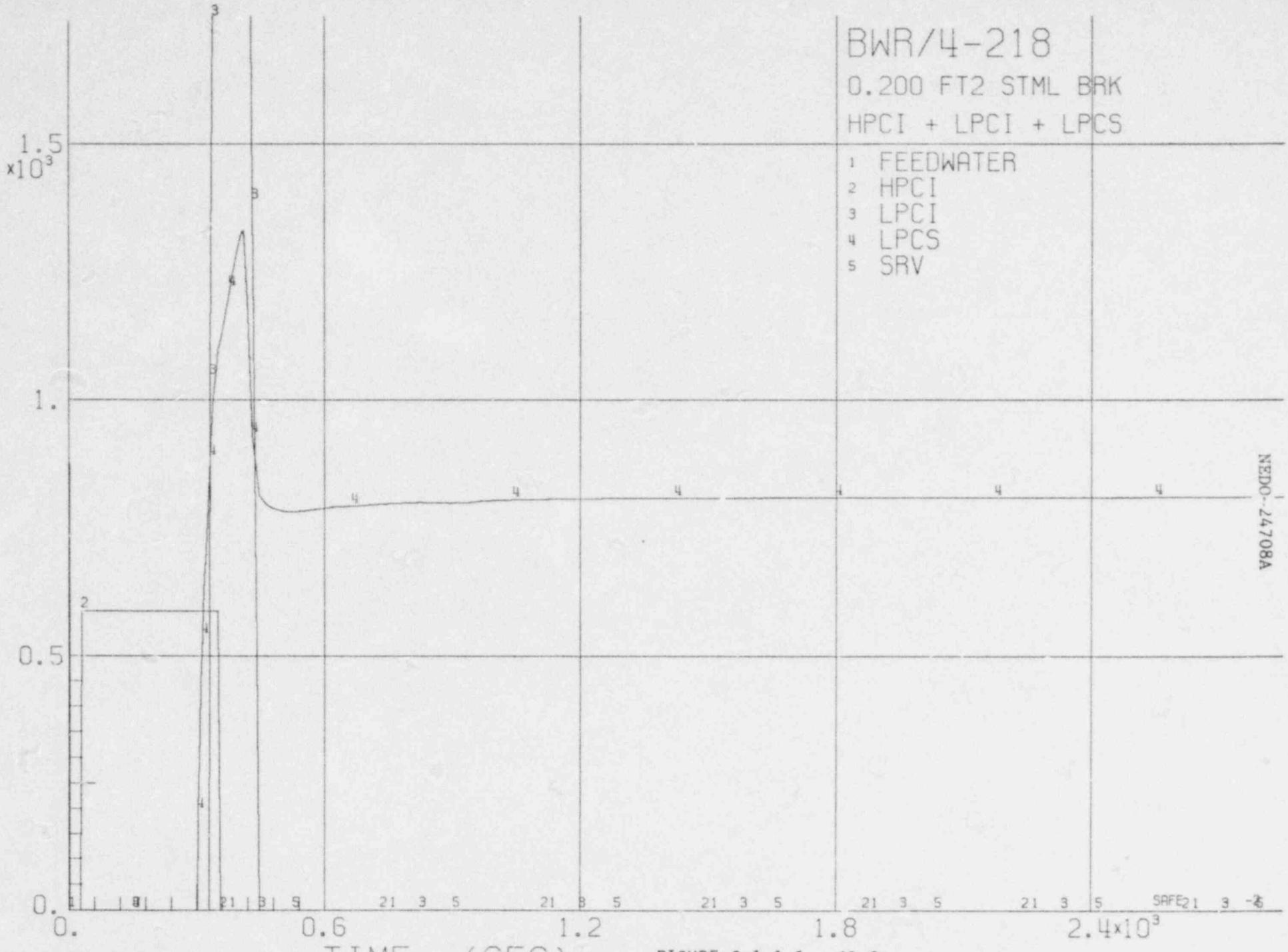


FIGURE 3.1.1.1 - 42.3

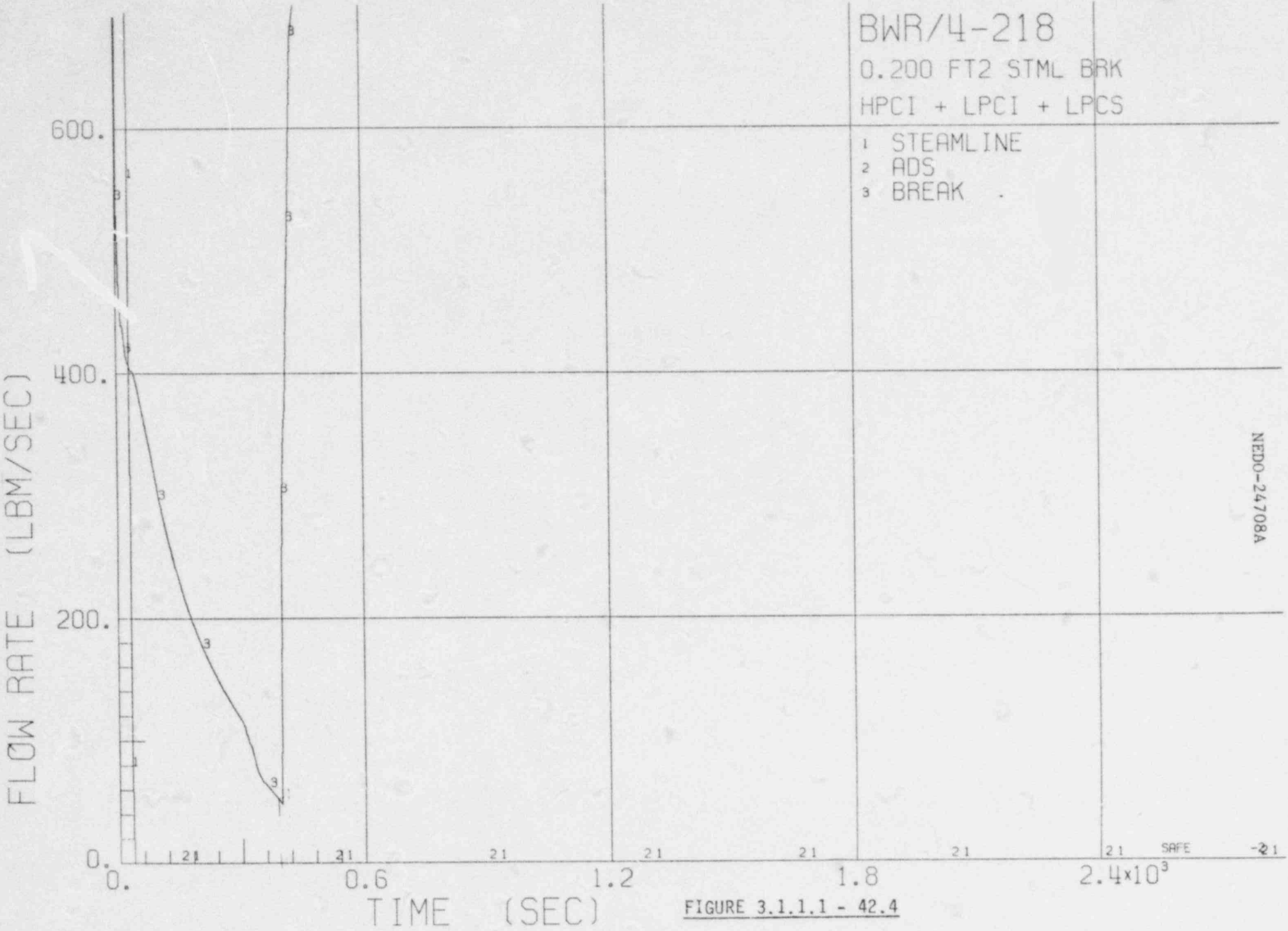


FIGURE 3.1.1.1 - 42.4

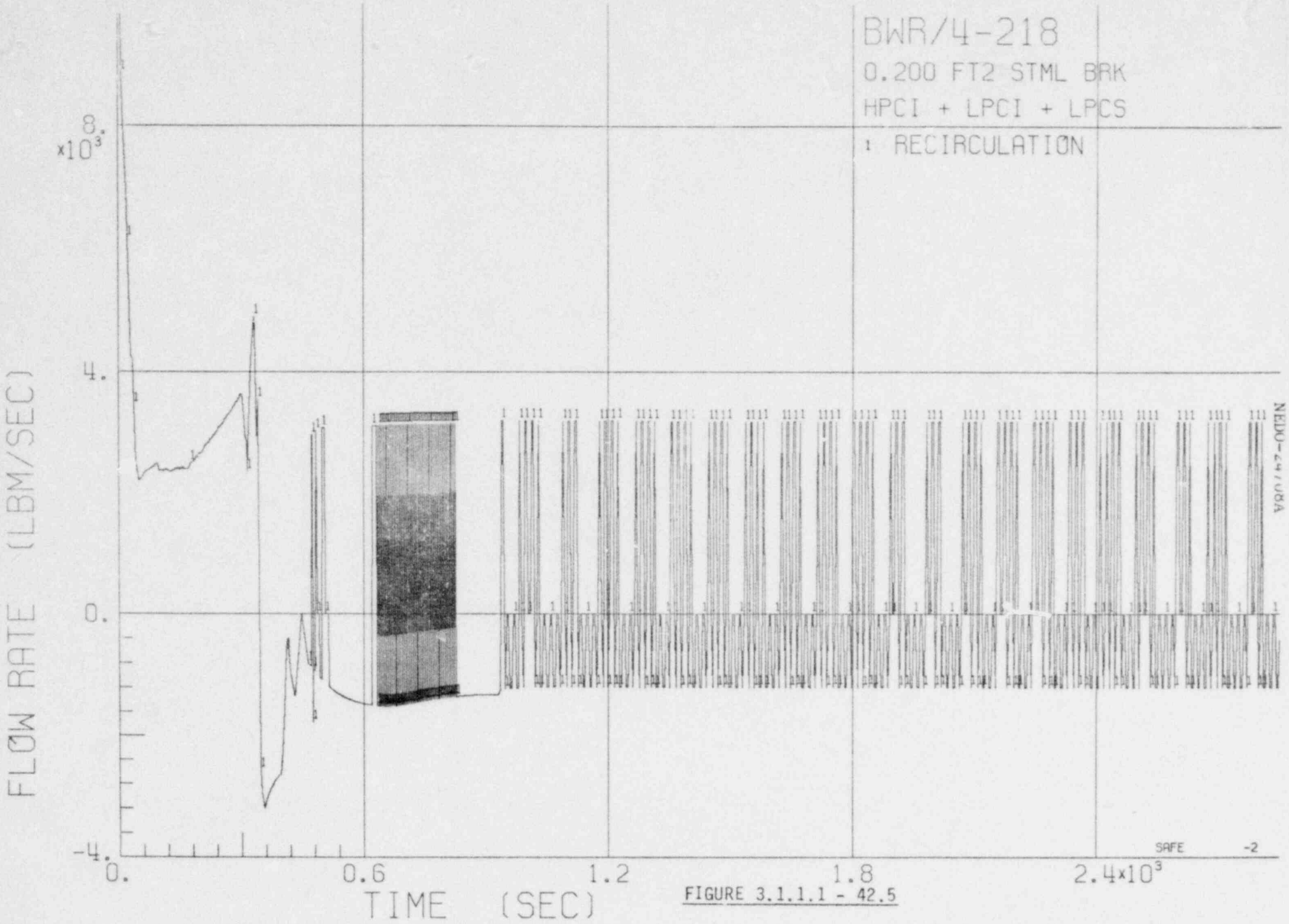


FIGURE 3.1.1.1 - 42.5

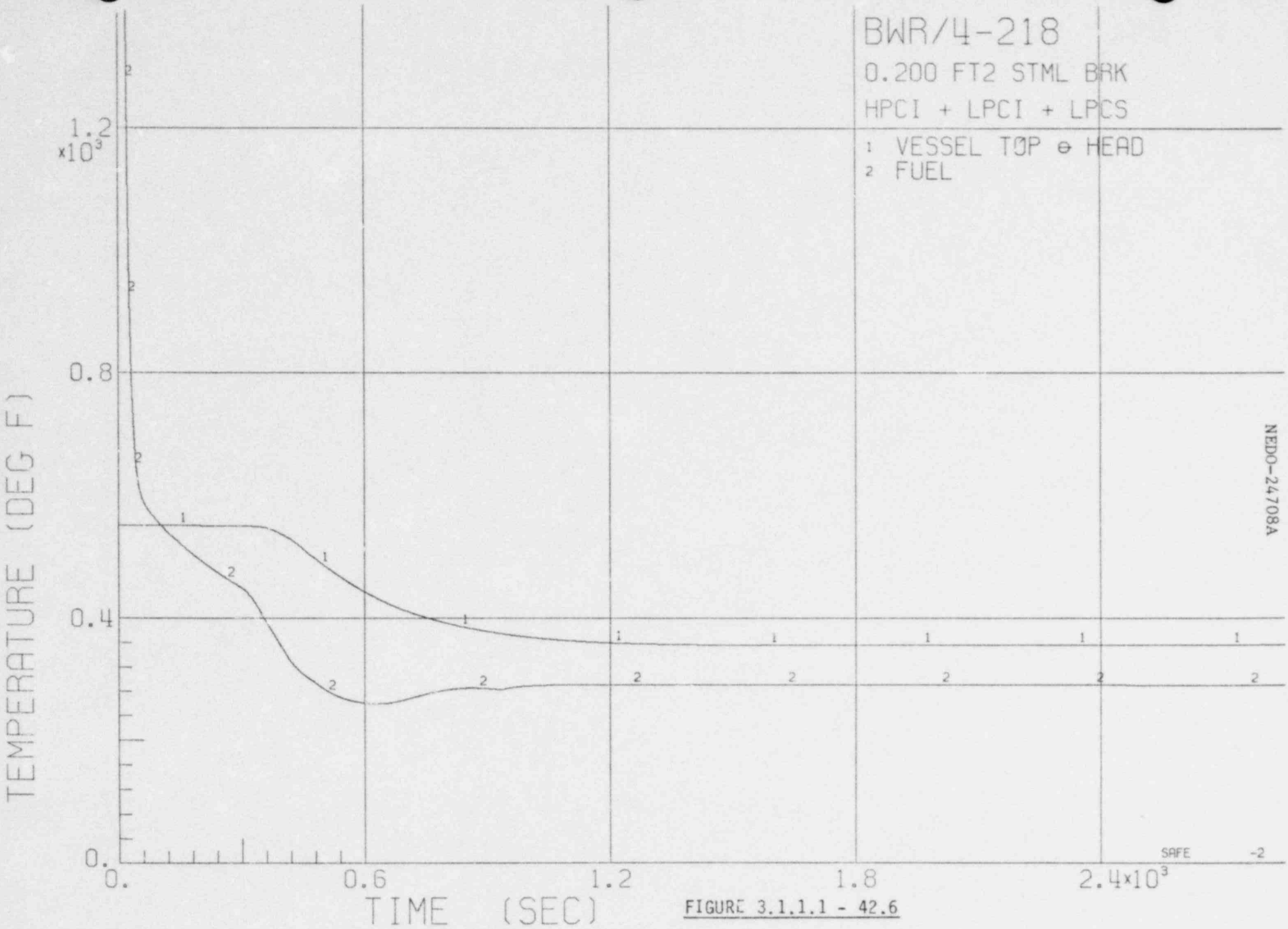


FIGURE 3.1.1.1 - 42.6

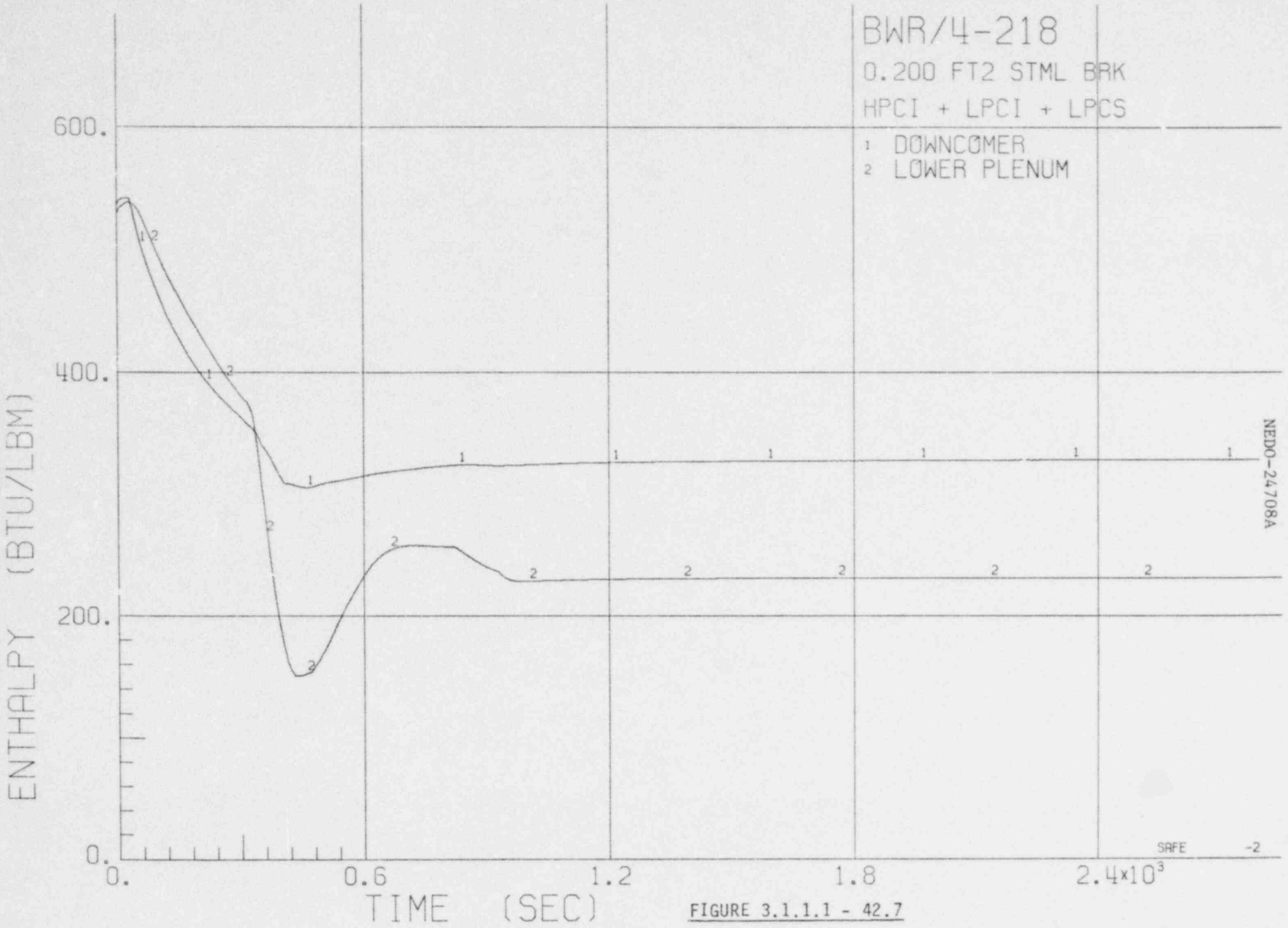


FIGURE 3.1.1.1 - 42.7

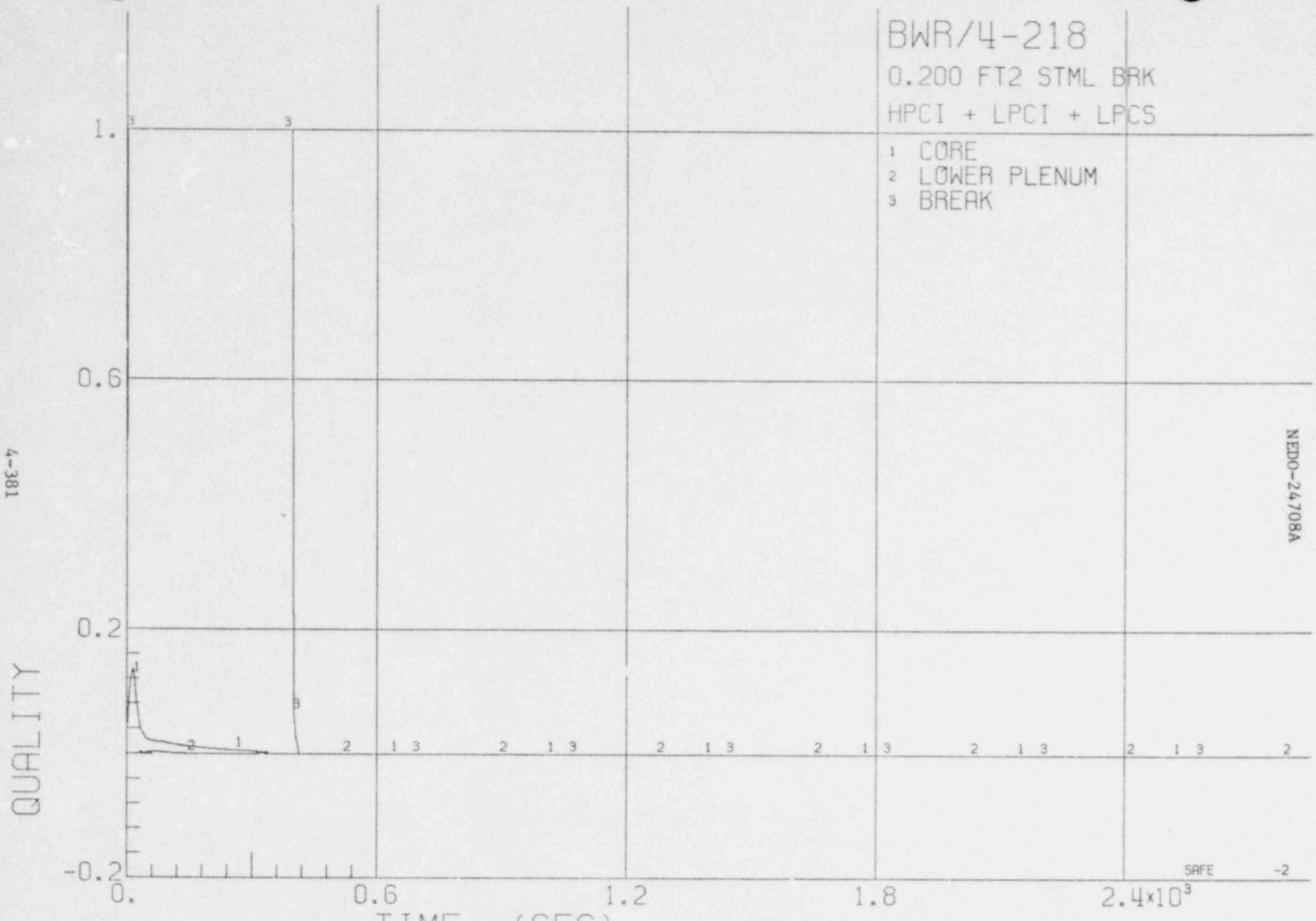


FIGURE 3.1.1.1 - 42.8

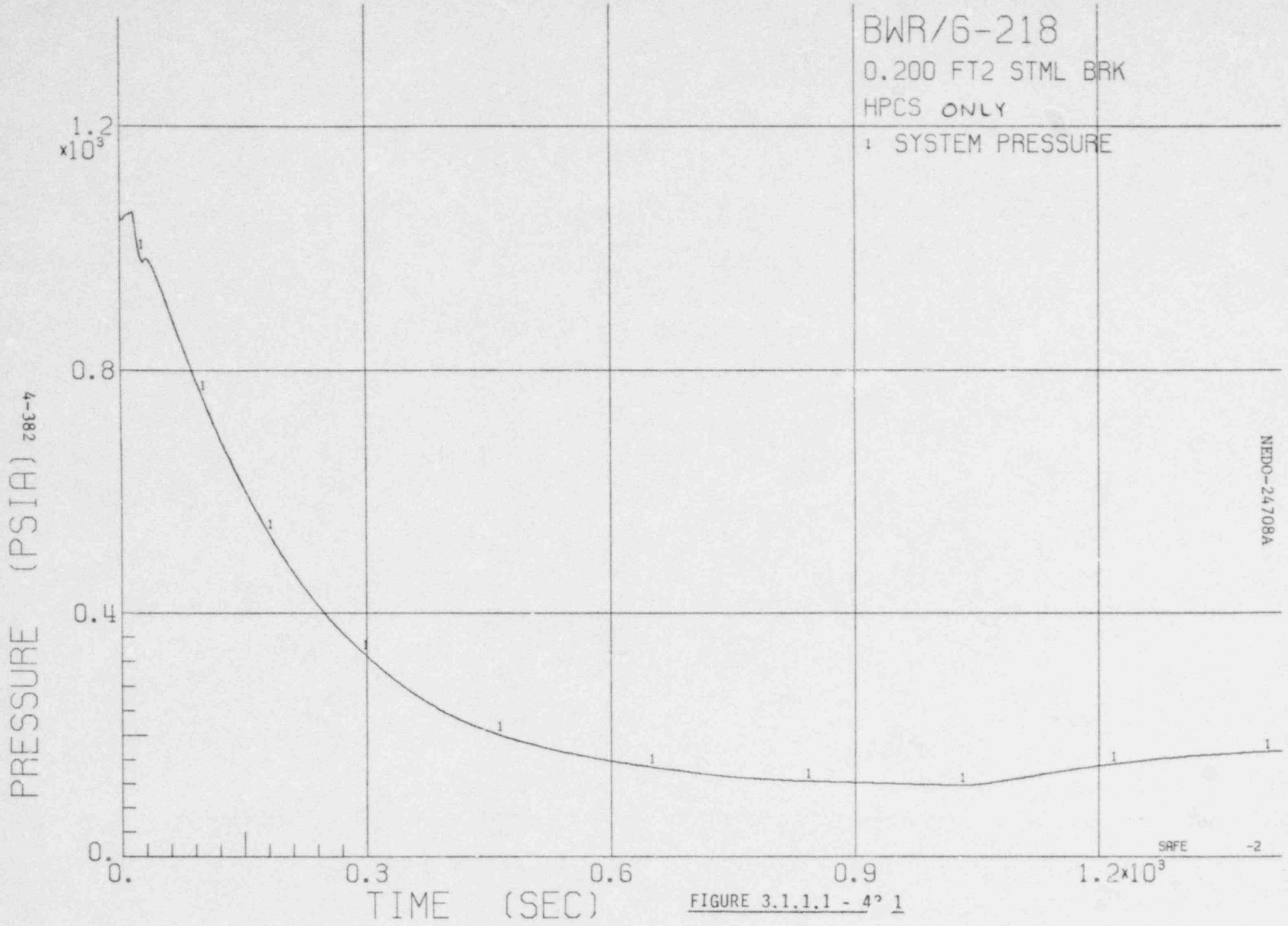


FIGURE 3.1.1.1 - 4° 1

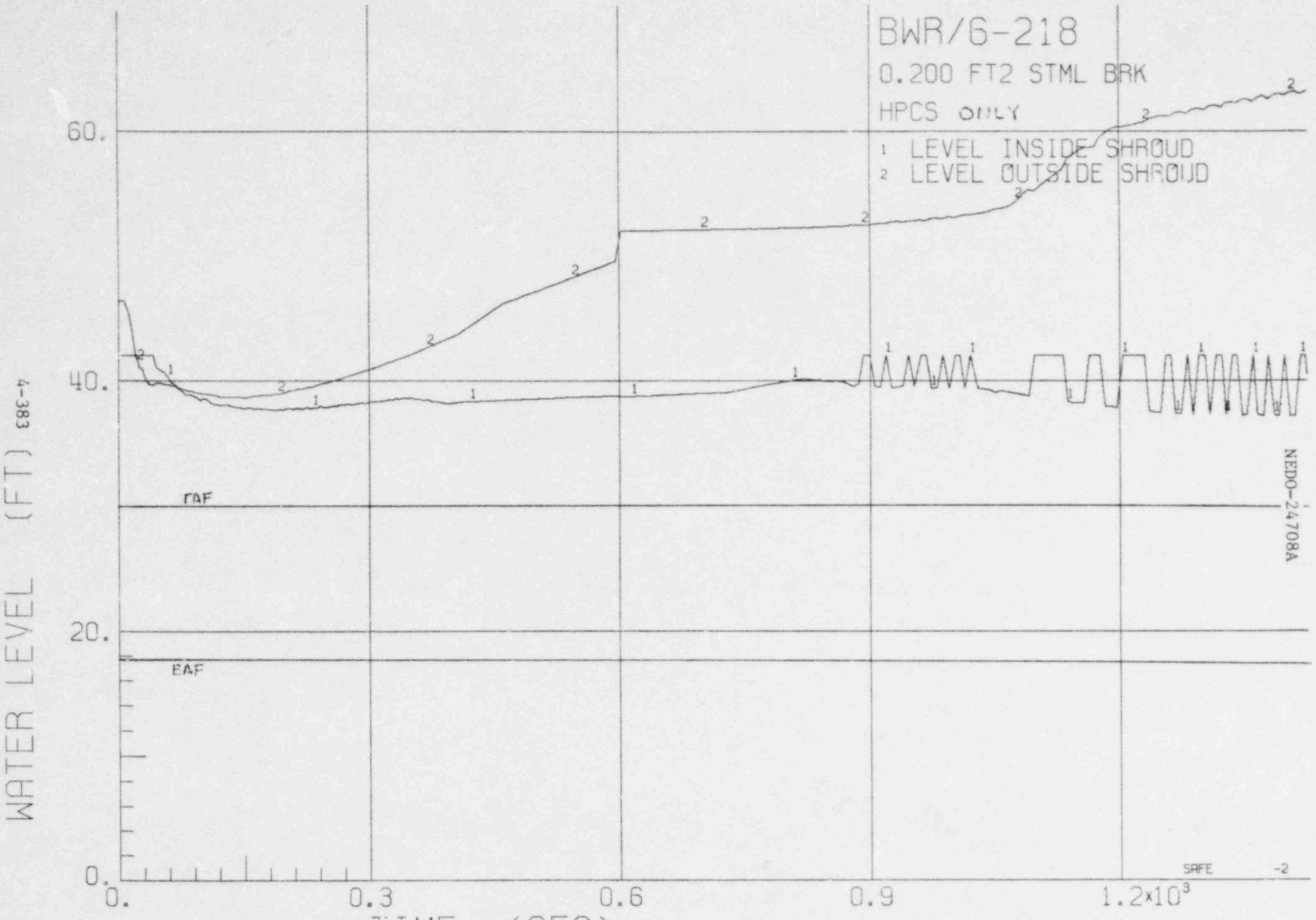


FIGURE 3.1.1.1 - 43.2

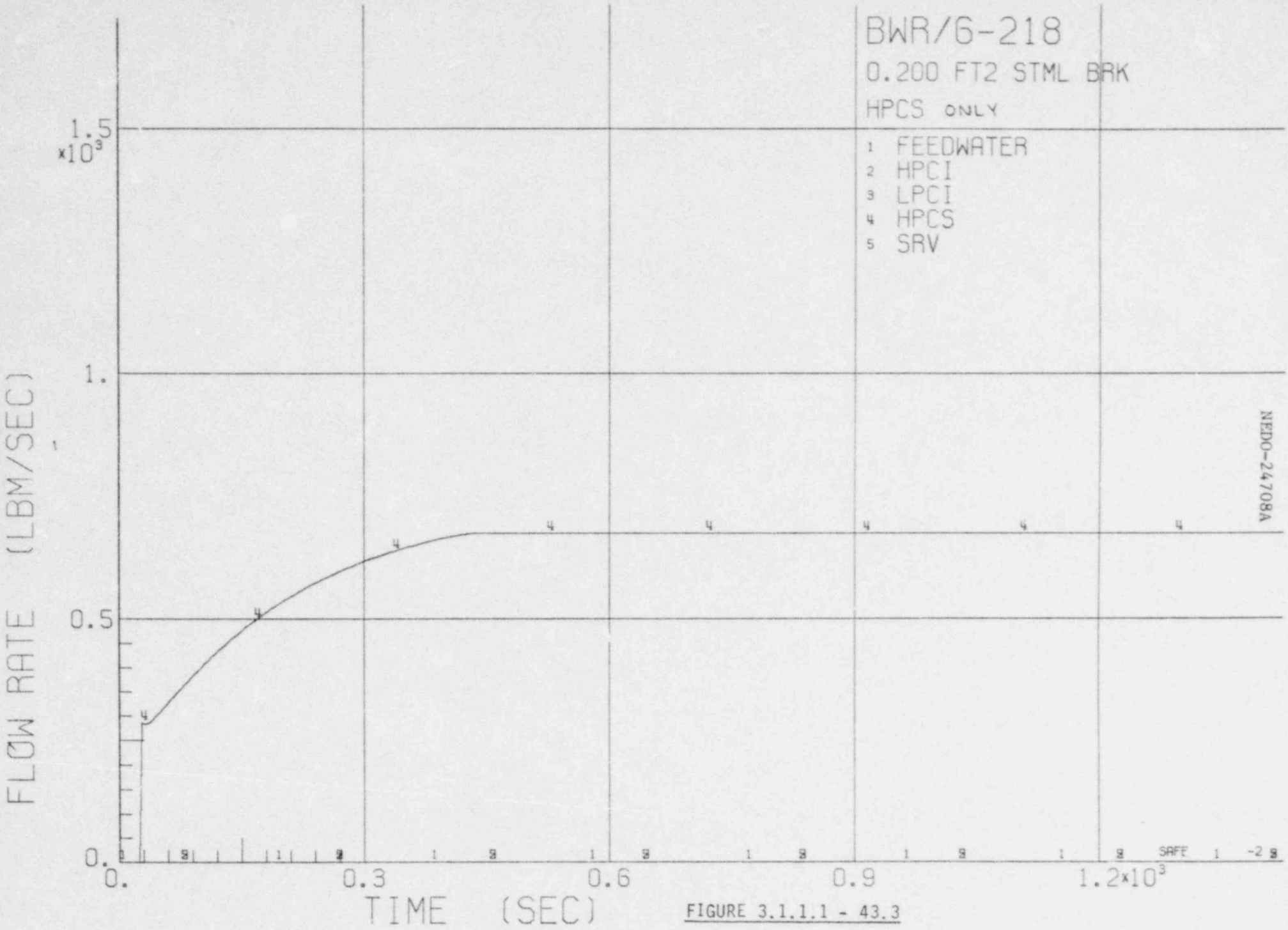


FIGURE 3.1.1.1 - 43.3

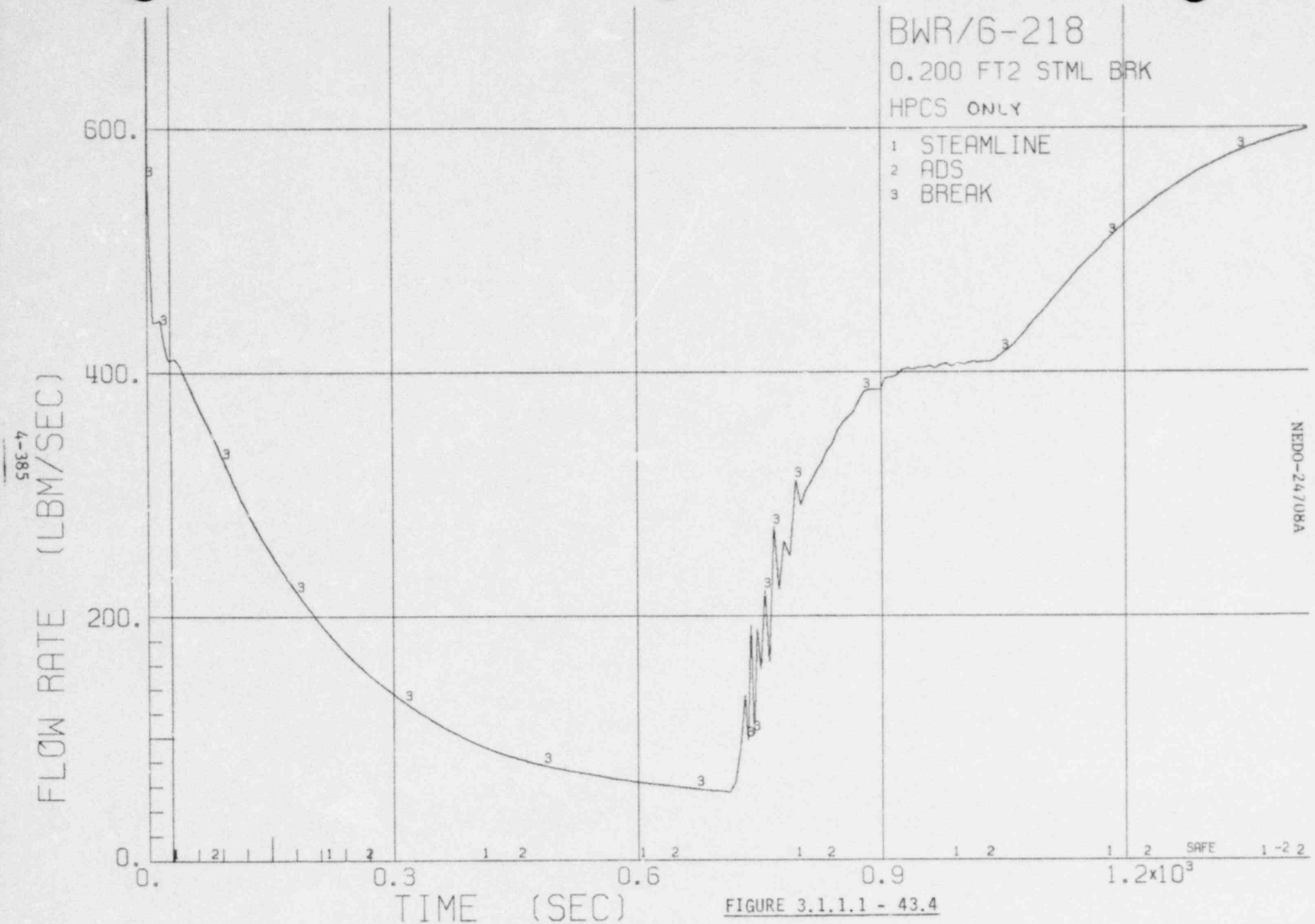


FIGURE 3.1.1.1 - 43.4

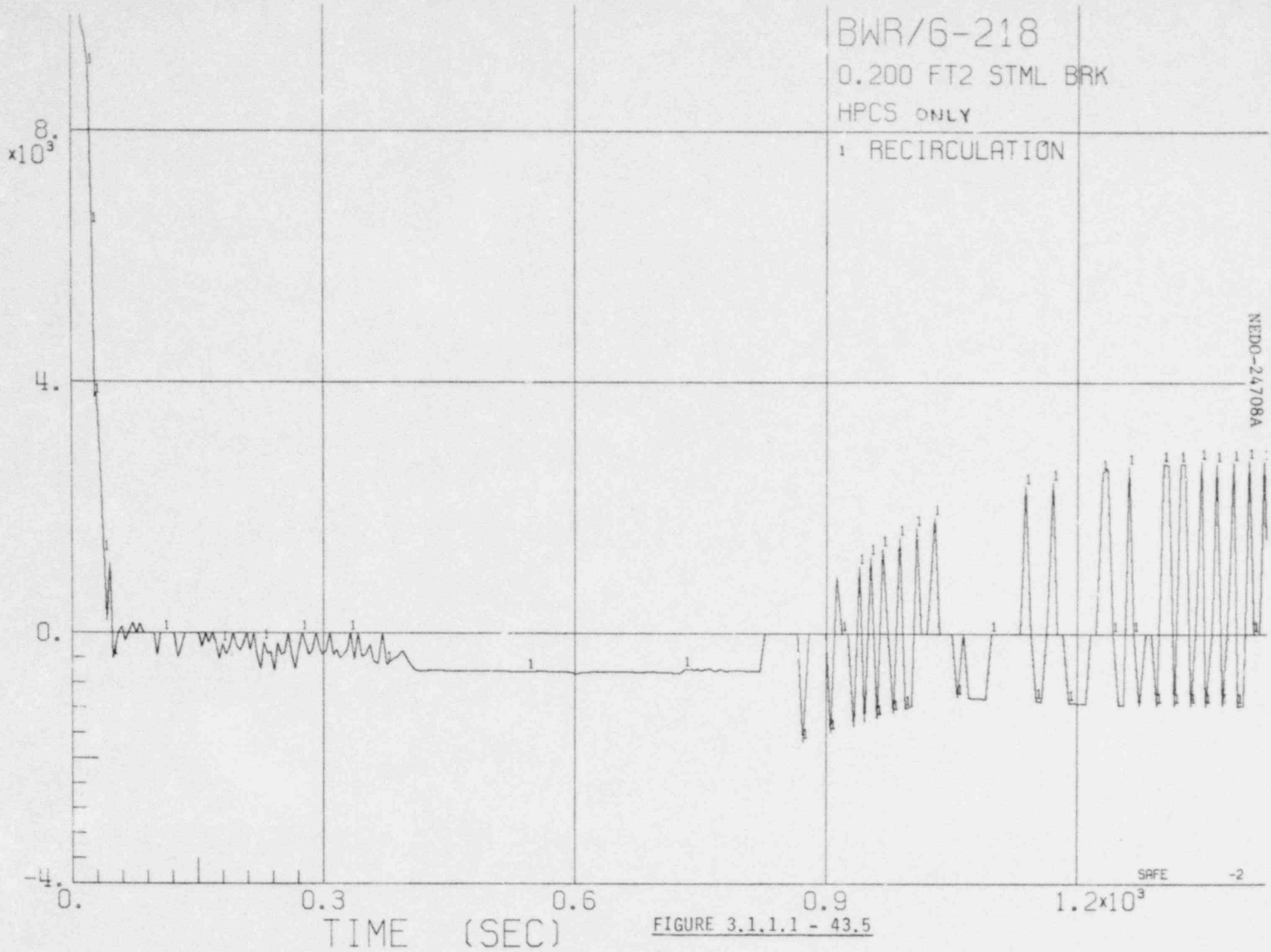


FIGURE 3.1.1.1 - 43.5

FIGURE 3.1.1.1 - 43.6

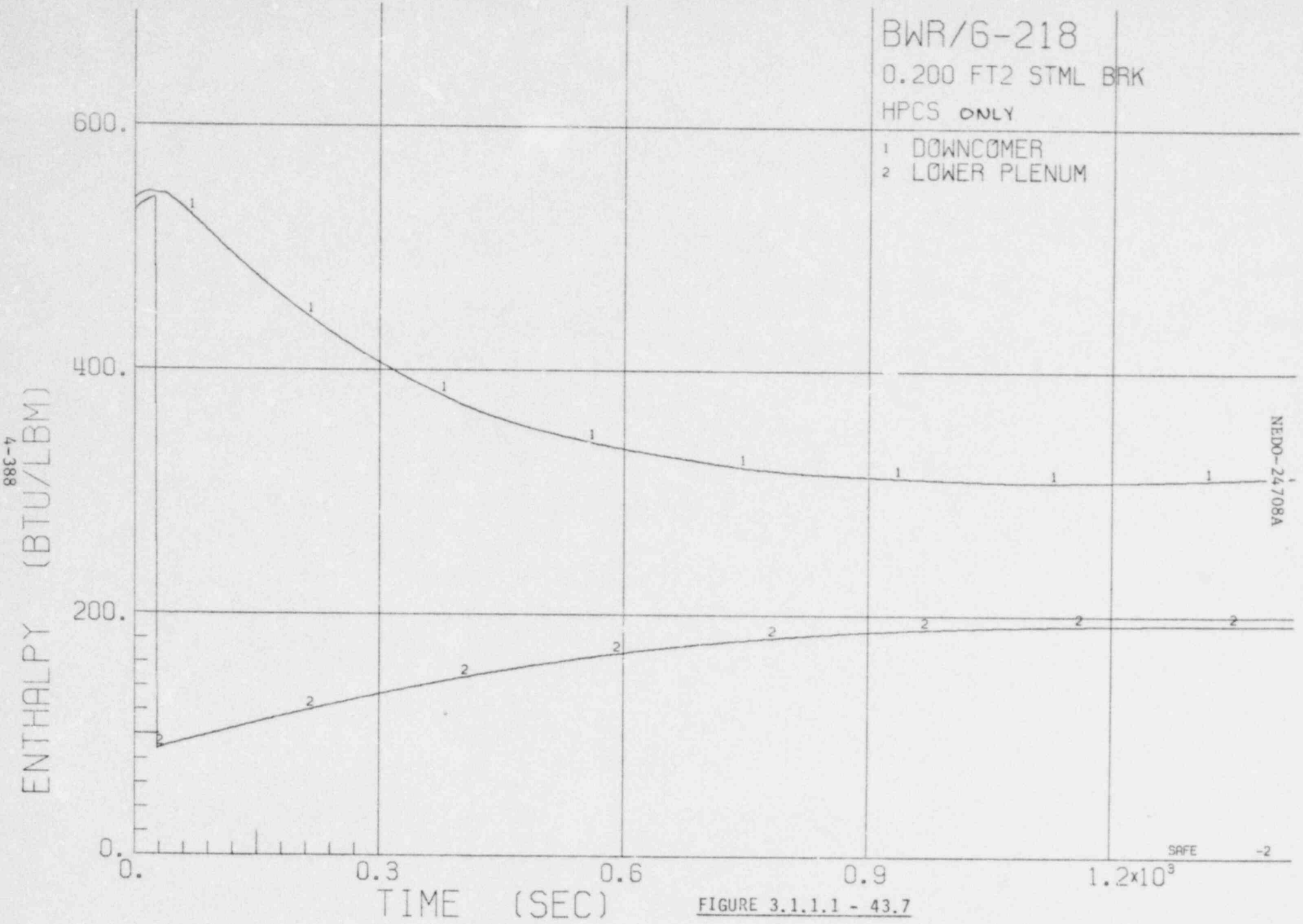


FIGURE 3.1.1.1 - 43.7

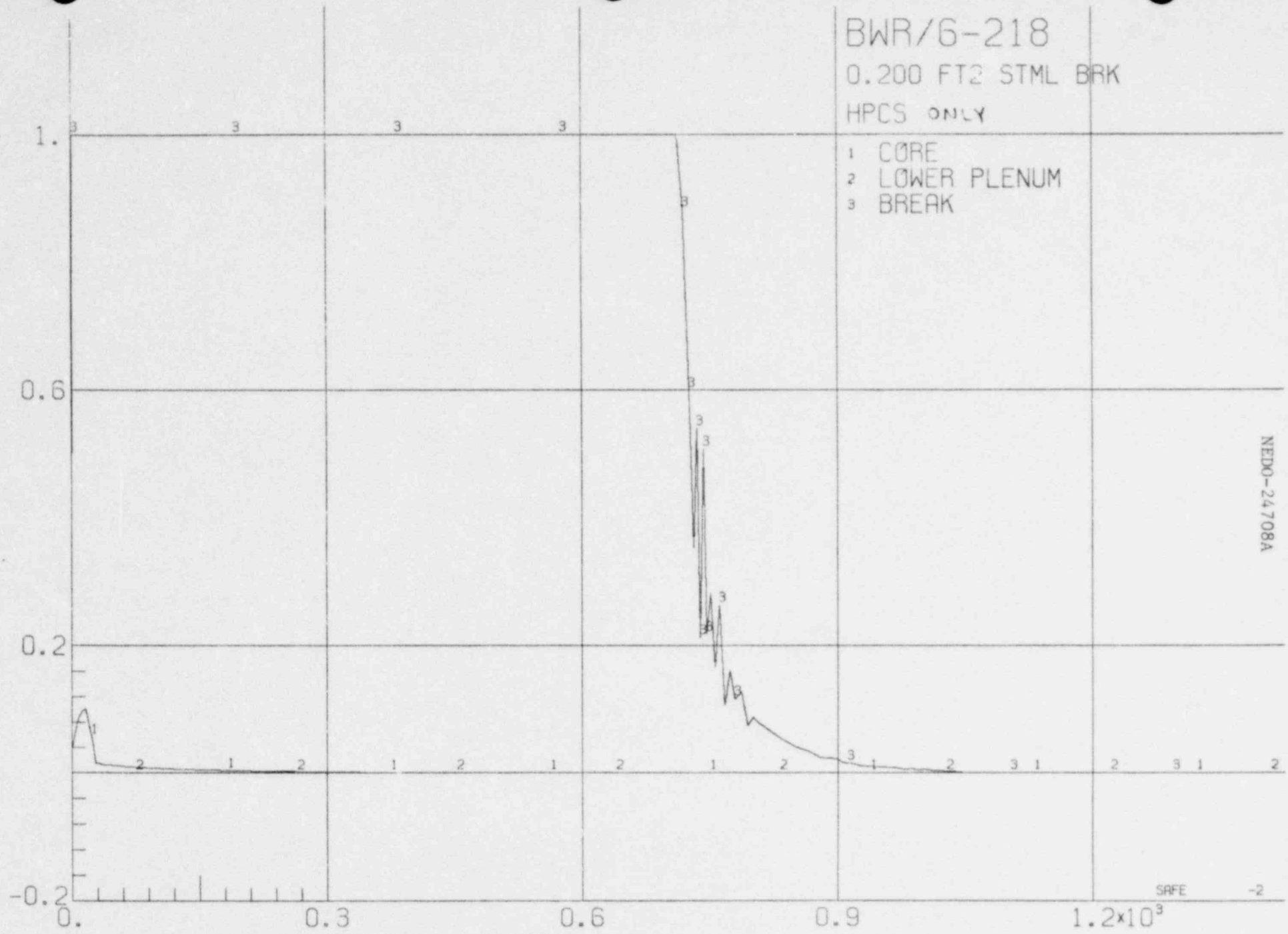


FIGURE 3 1.1.1 - 43.8

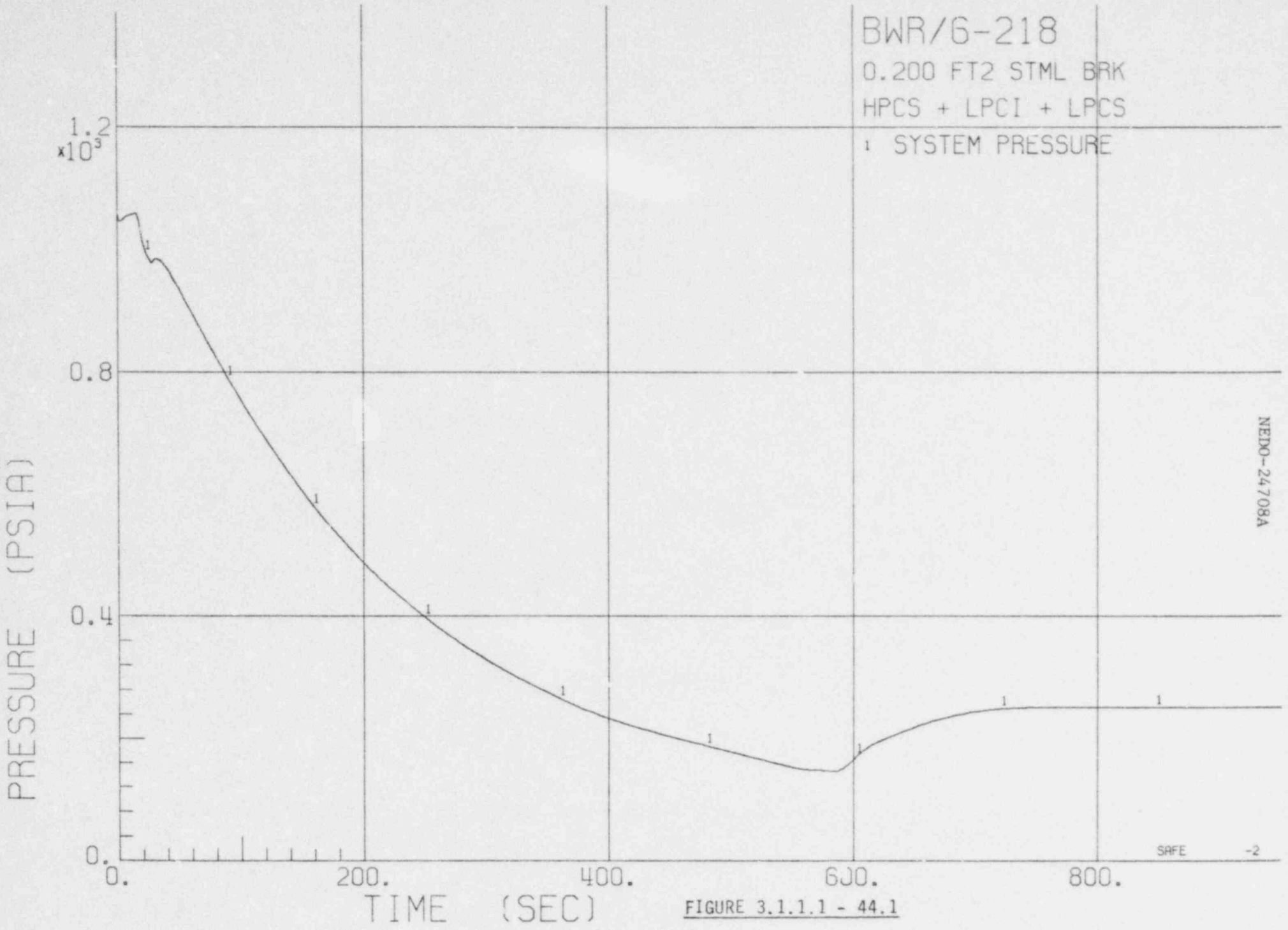
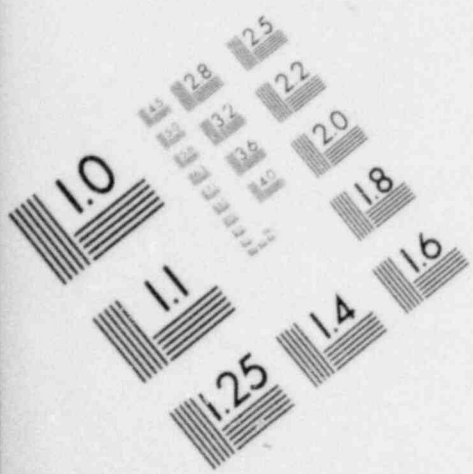


FIGURE 3.1.1.1 - 44.1



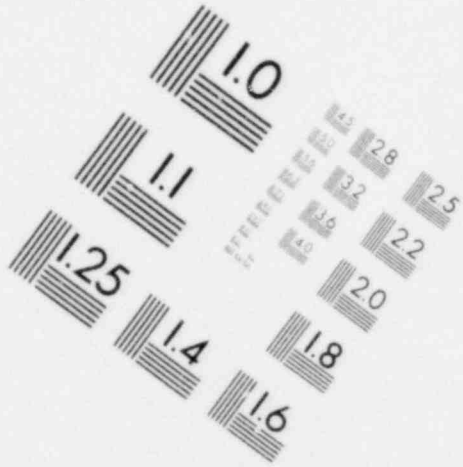
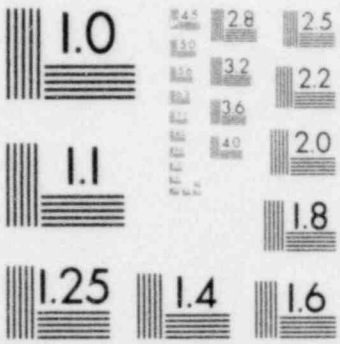
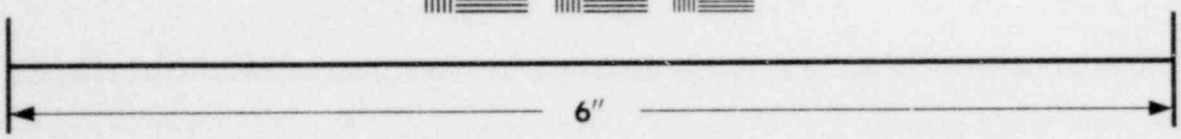
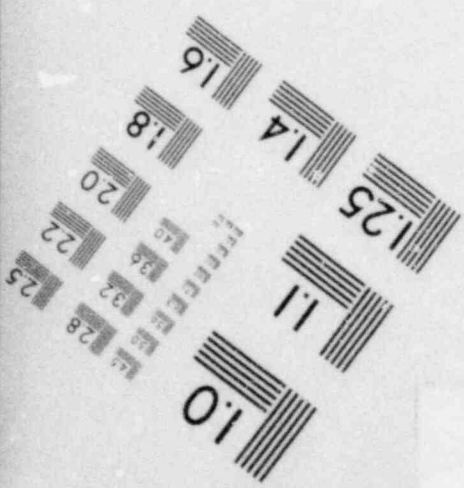
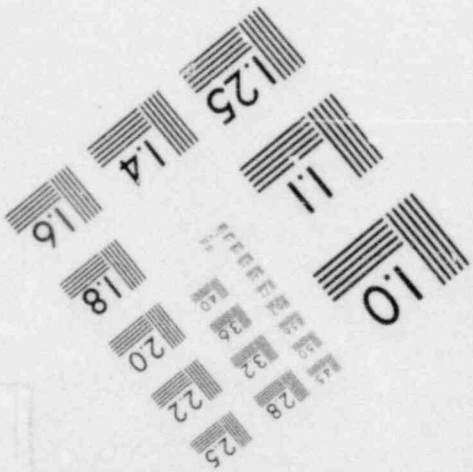


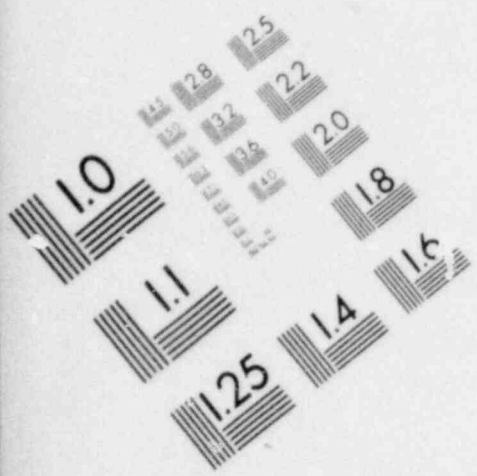
IMAGE EVALUATION TEST TARGET (MT-3)











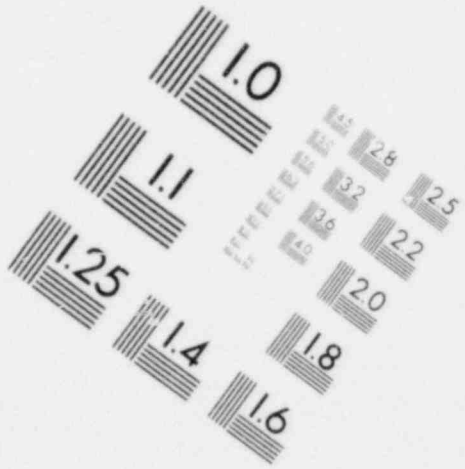
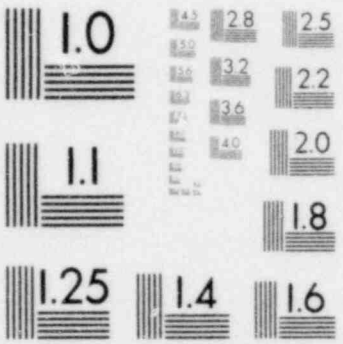
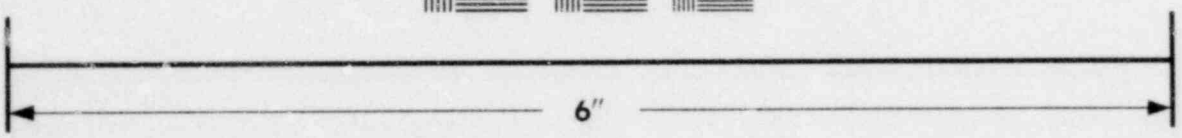
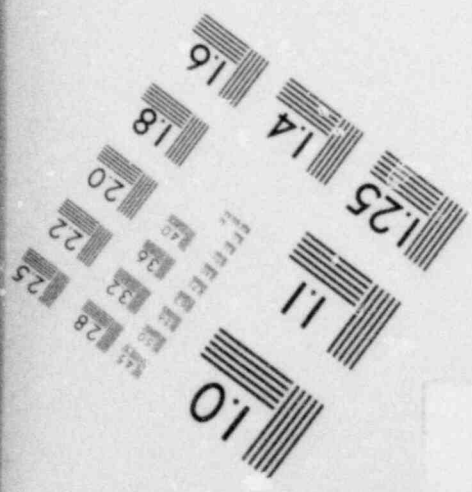
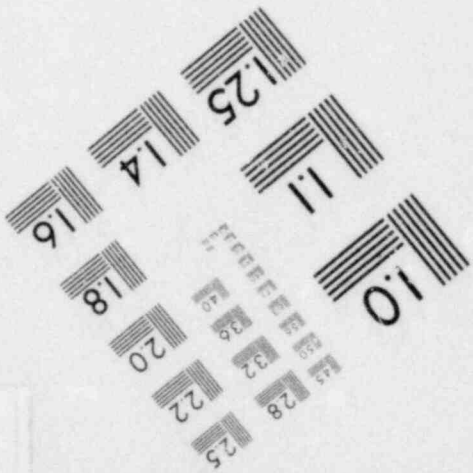


IMAGE EVALUATION TEST TARGET (MT-3)









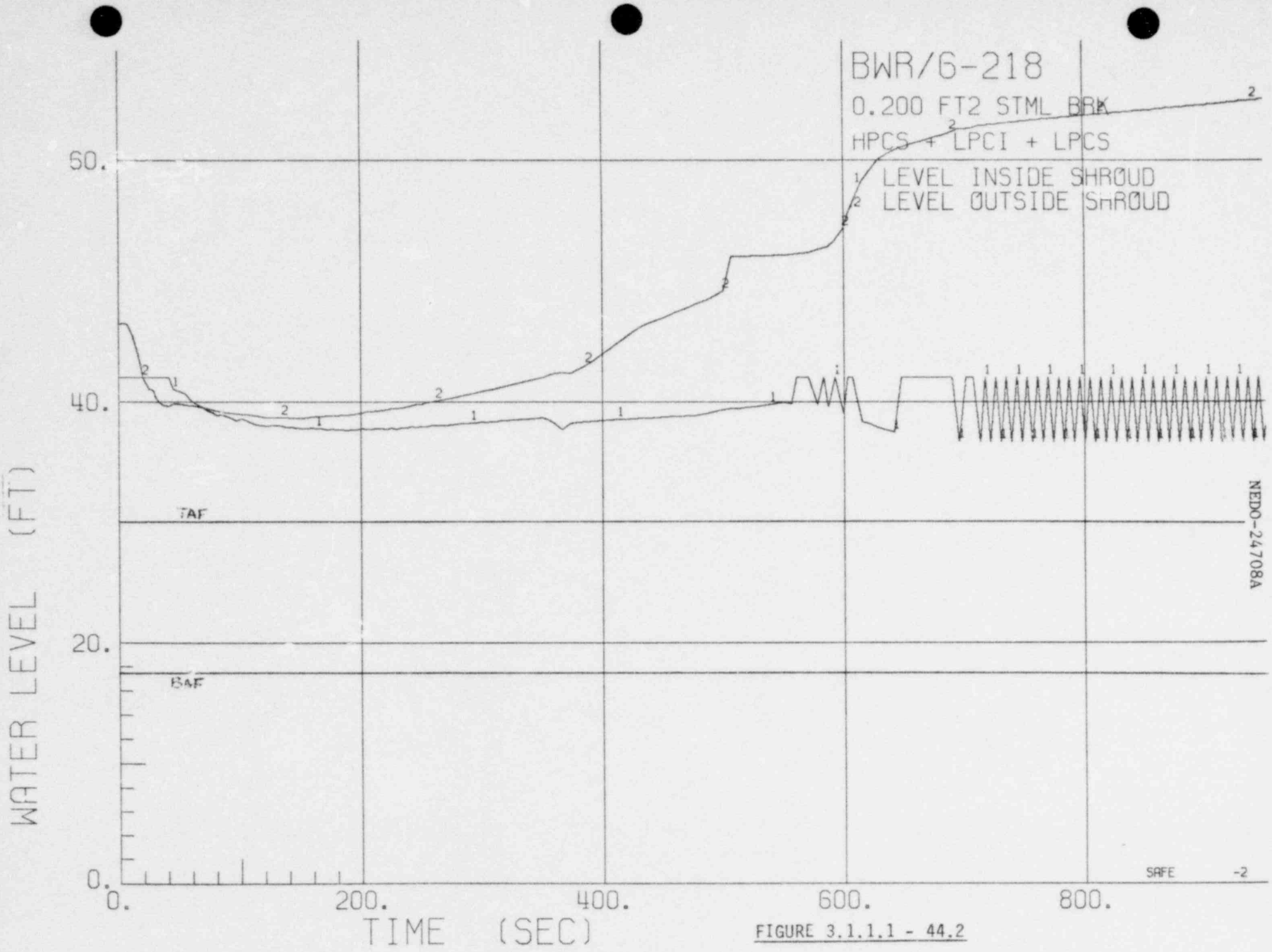


FIGURE 3.1.1.1 - 44.2

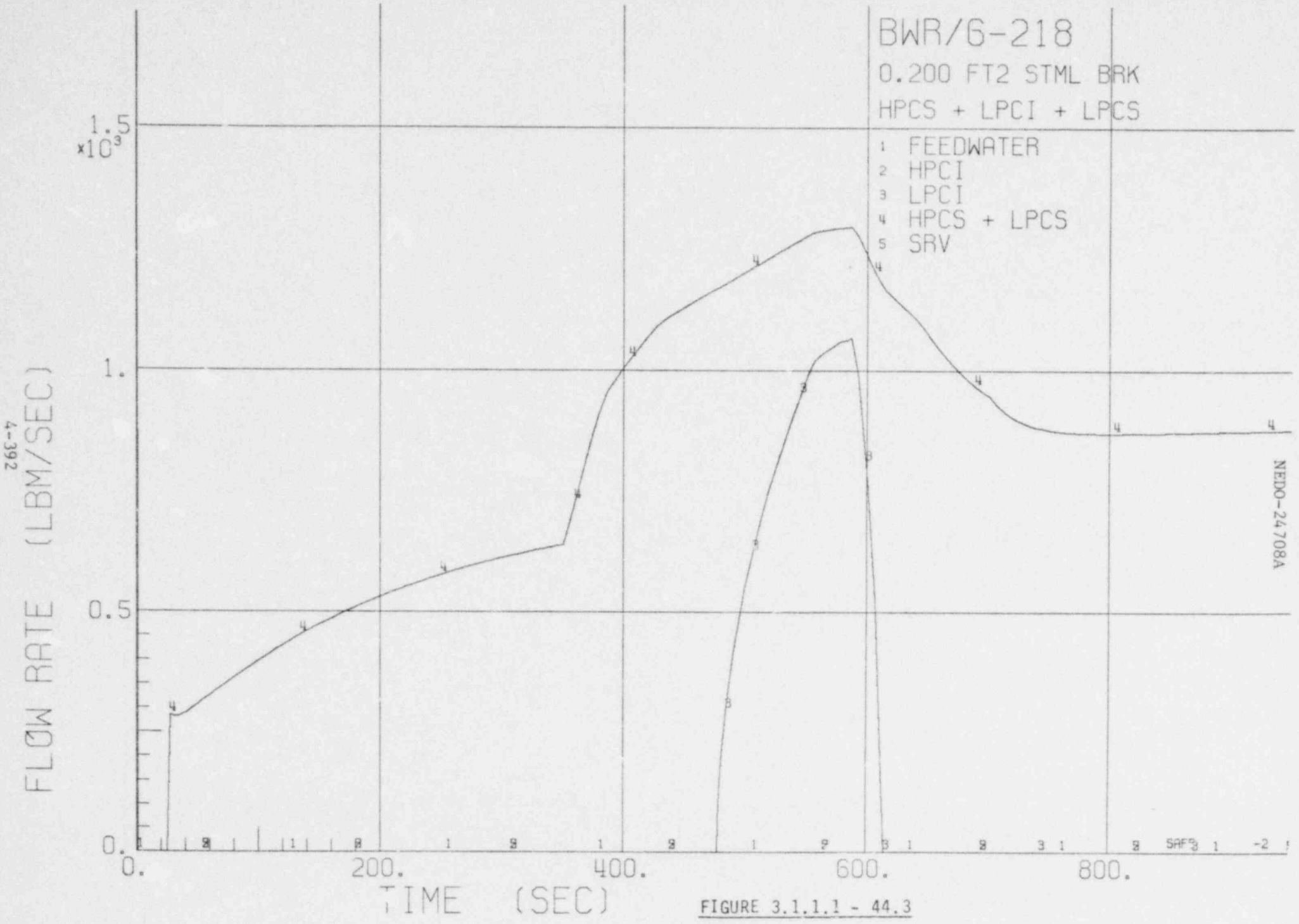


FIGURE 3.1.1.1 - 44.3

FIGURE 3.1.1.1 - 44.4

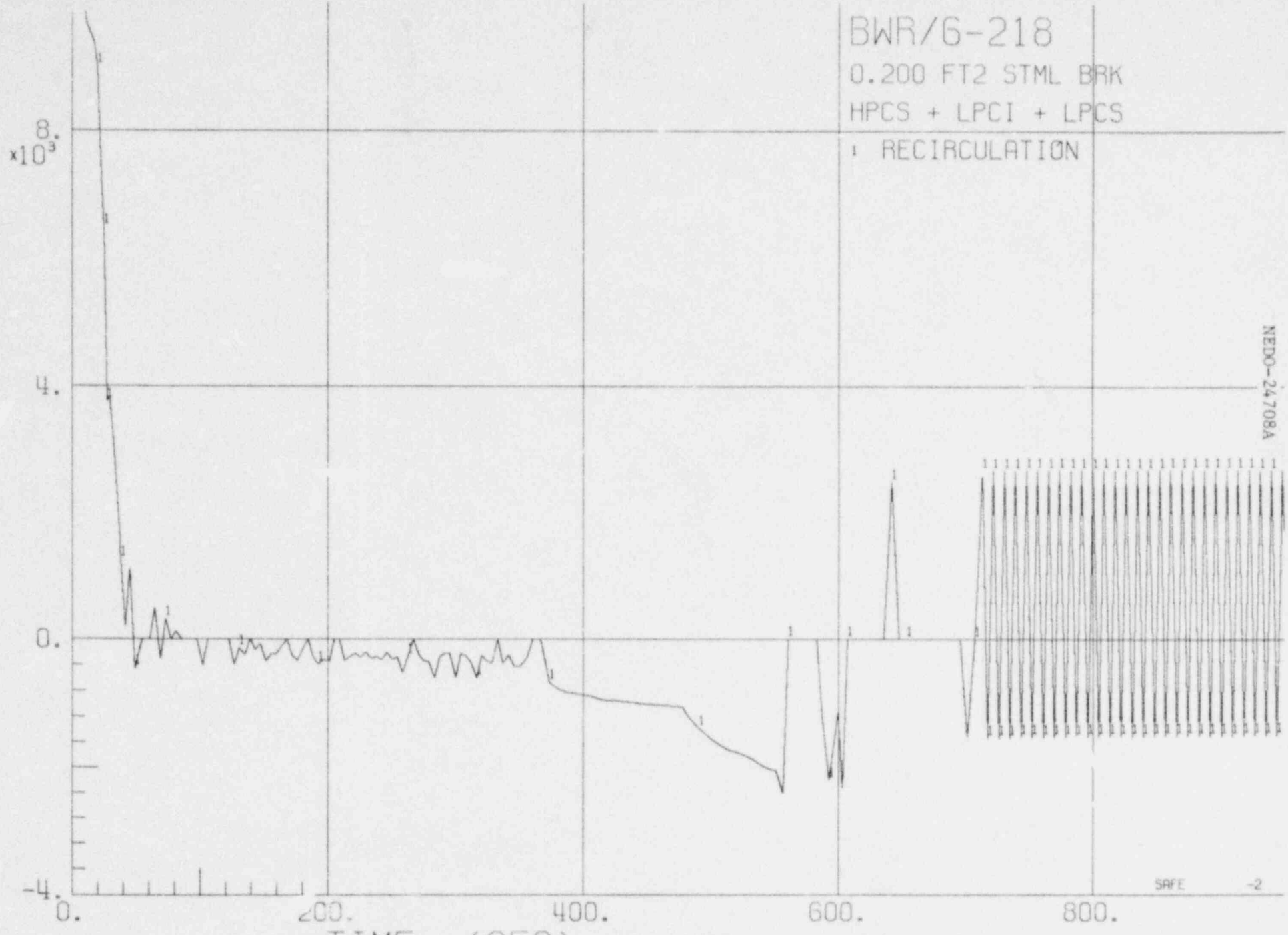


FIGURE 3.1.1.1 - 44.5

FIGURE 3.1.1.1 - 44.6

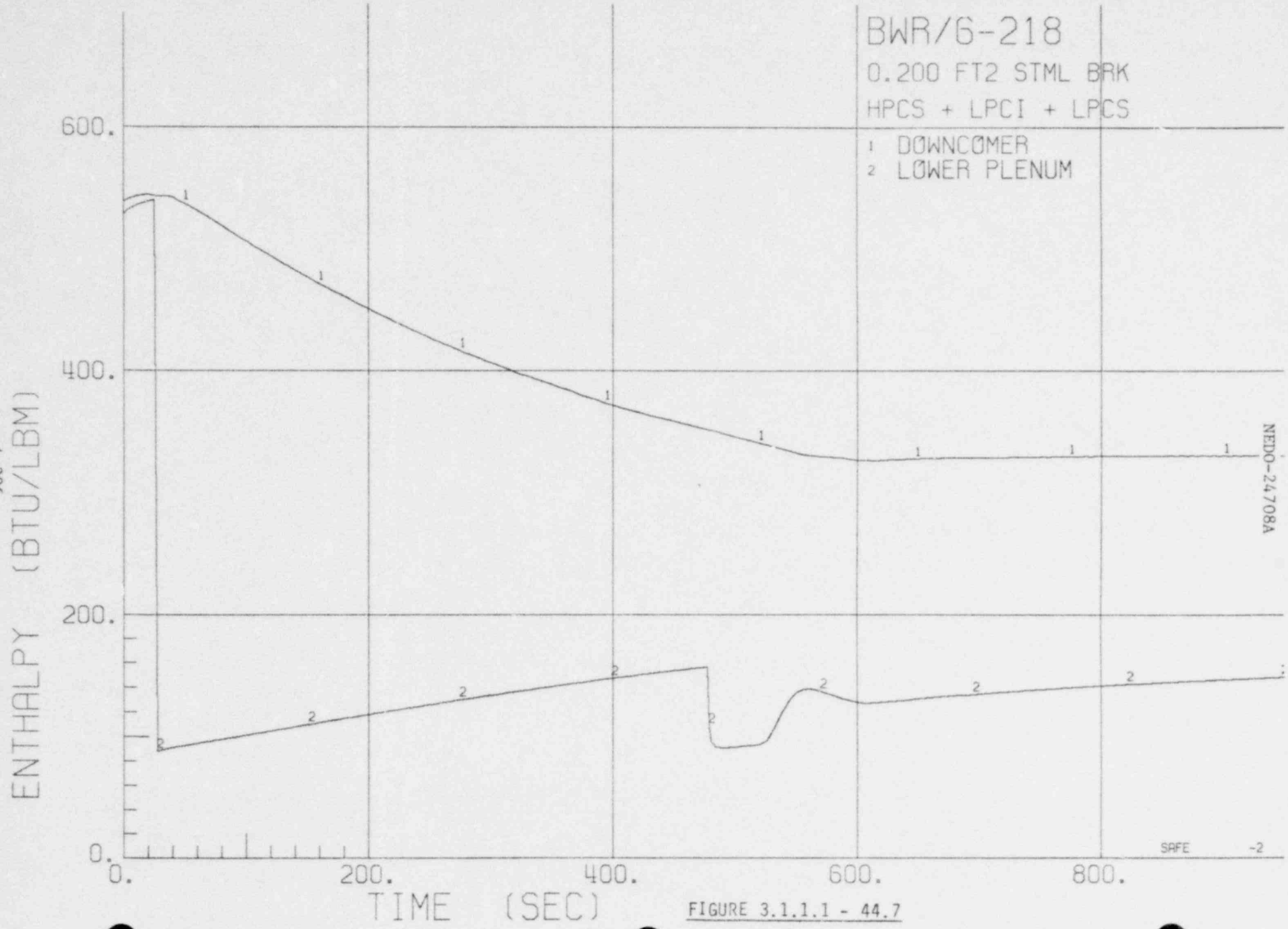


FIGURE 3.1.1.1 - 44.7

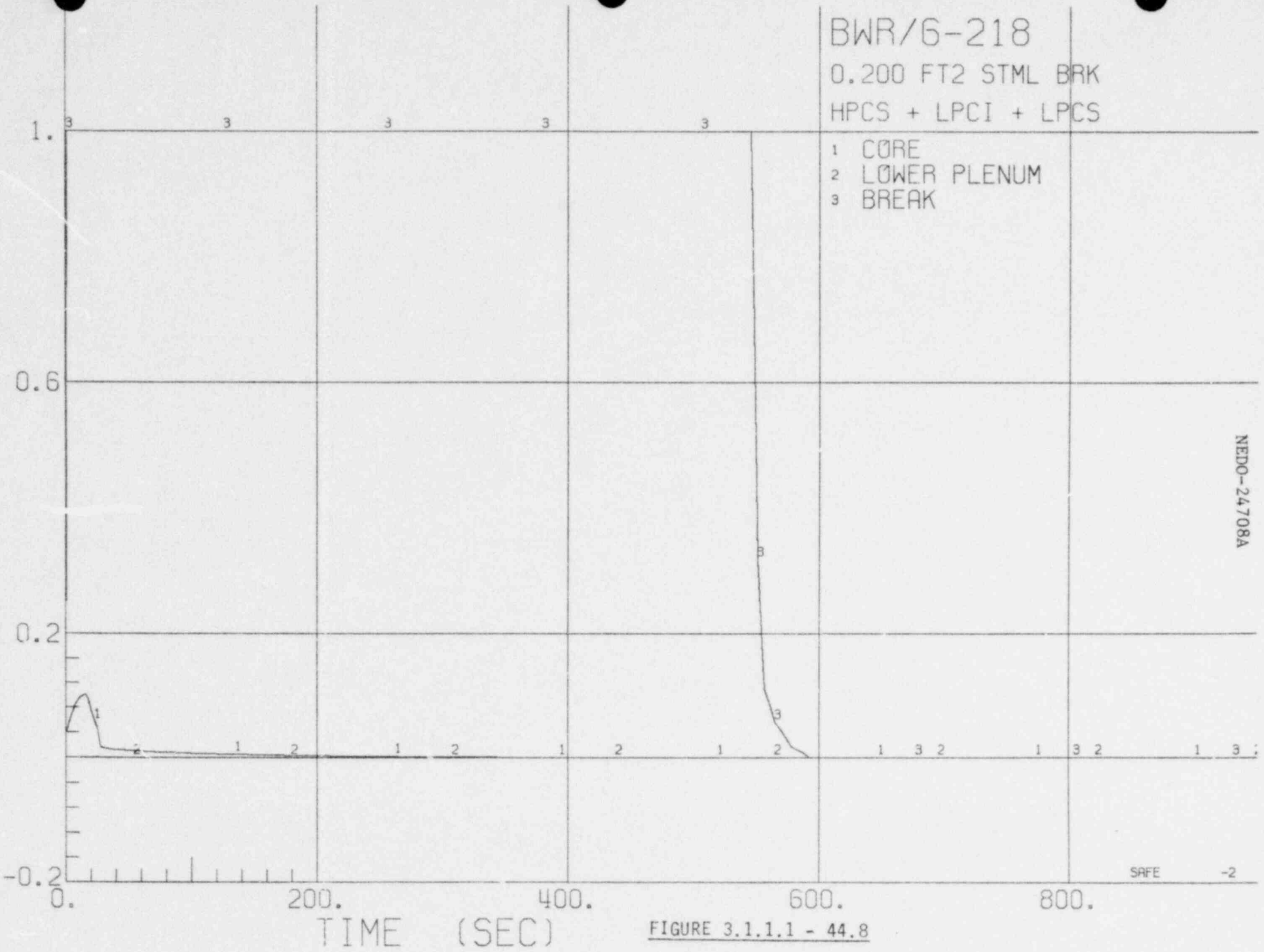


FIGURE 3.1.1.1 - 44.8

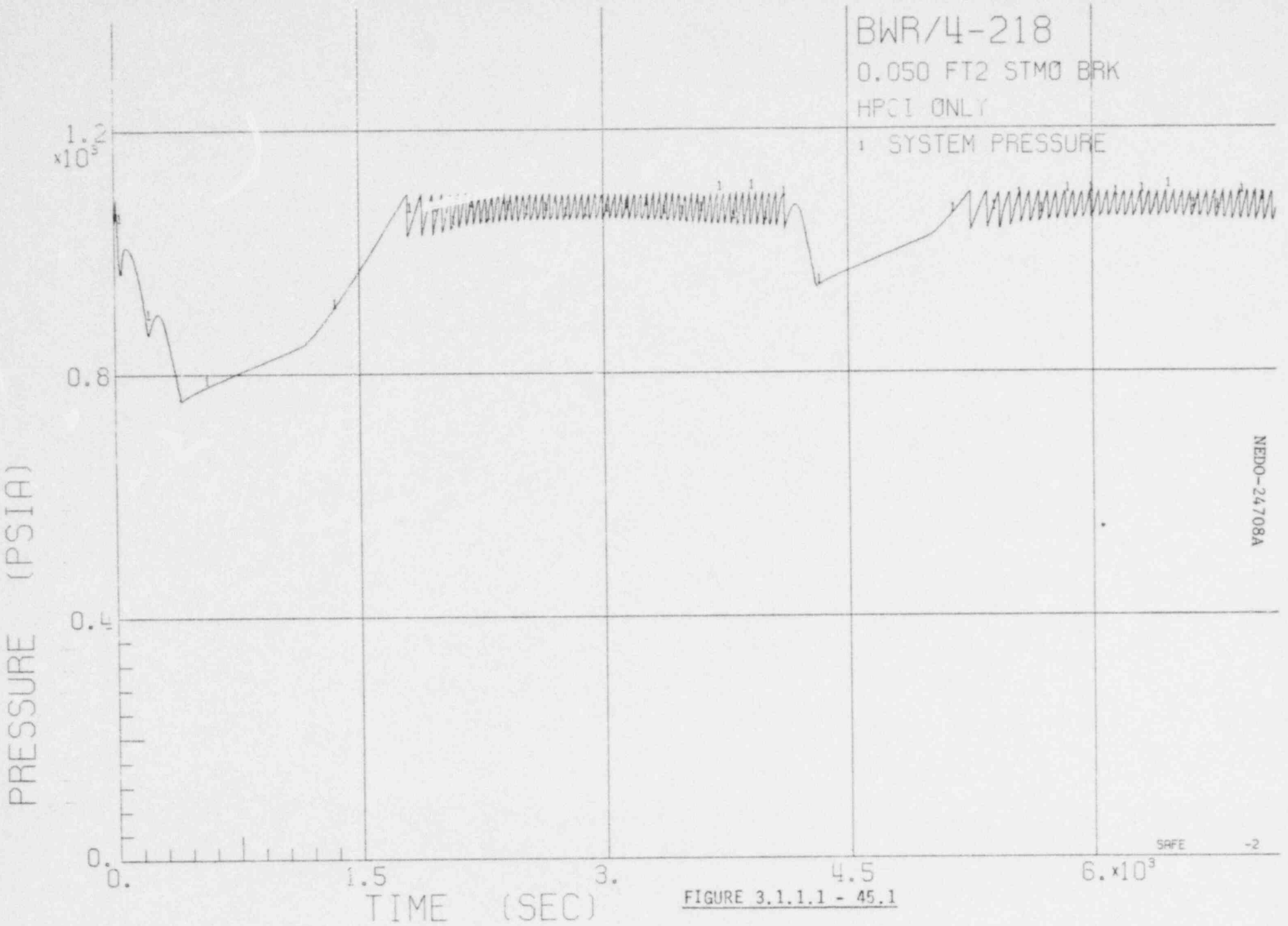


FIGURE 3.1.1.1 - 45.1

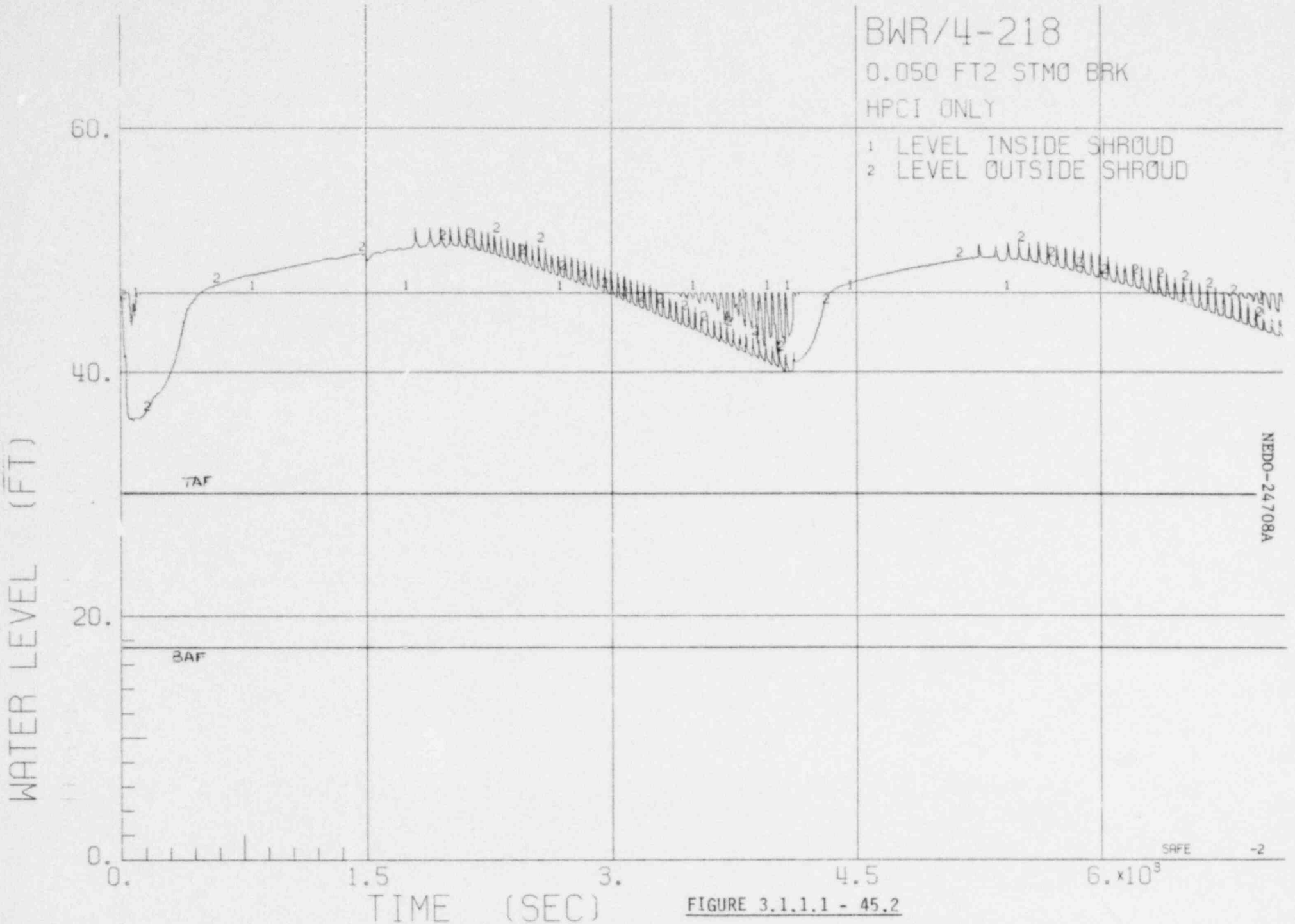


FIGURE 3.1.1.1 - 45.2

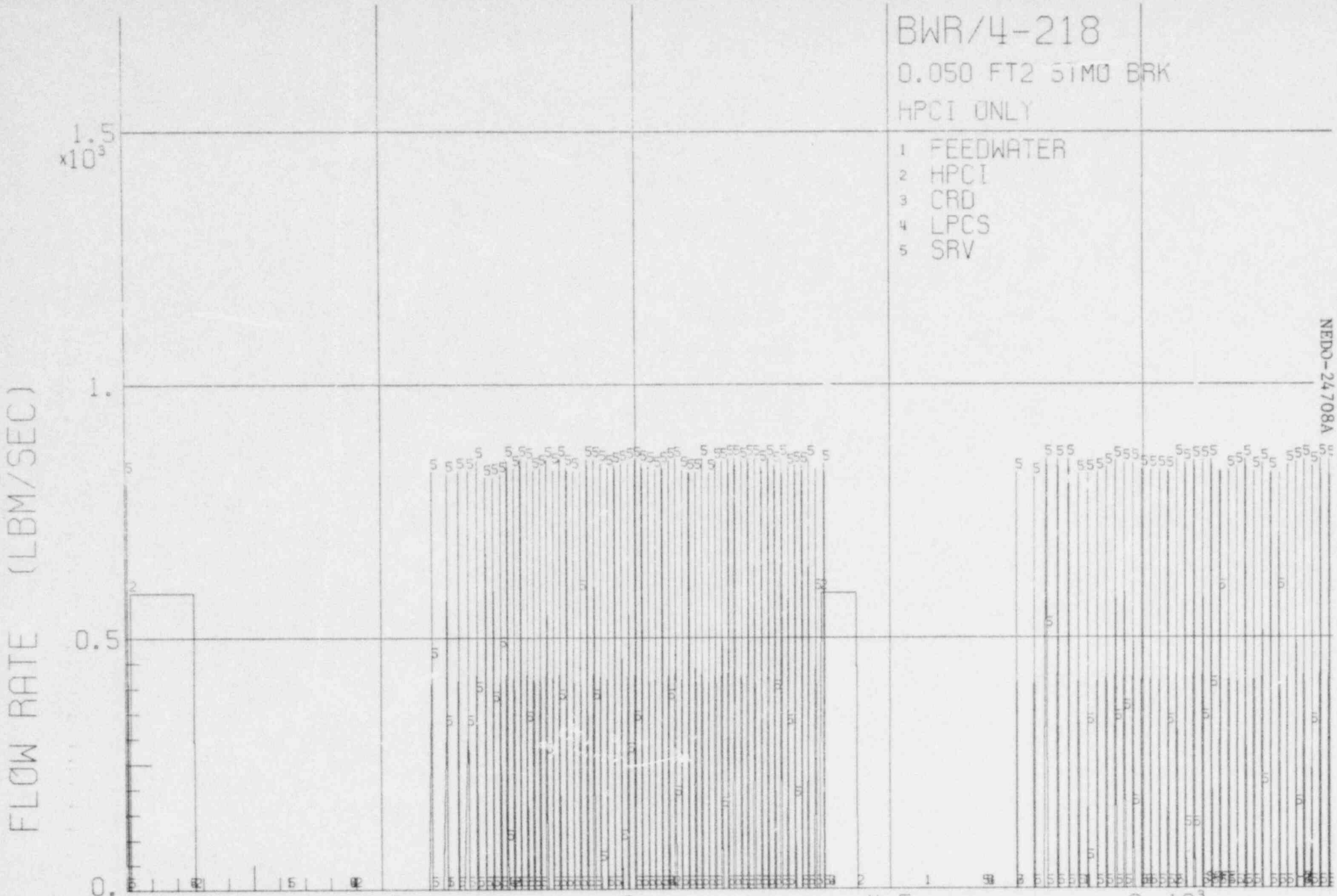


FIGURE 3.1.1.1 - 45.3

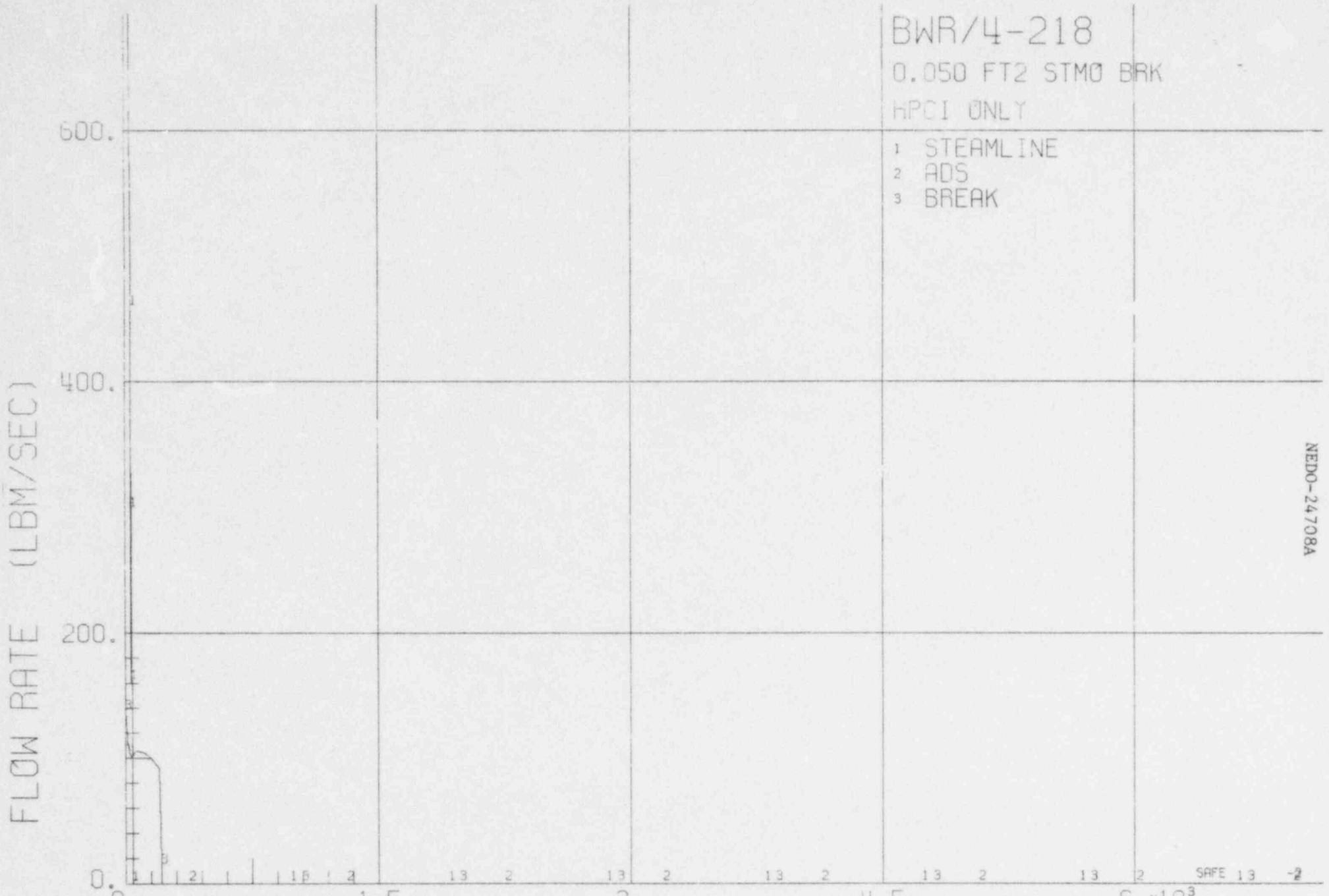


FIGURE 3.1.1.1 - 45.4

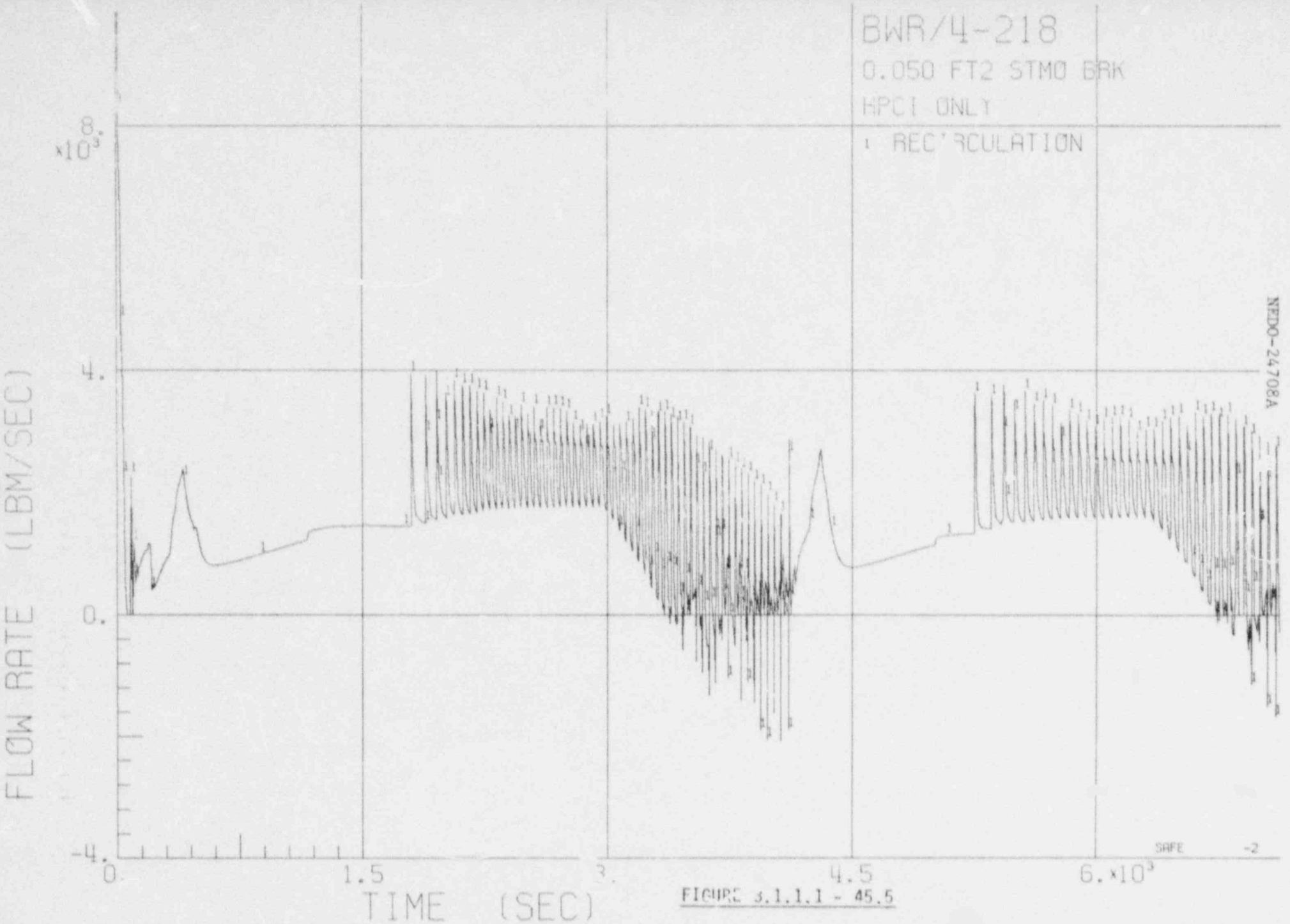


FIGURE 3.1.1.1 - 45.5

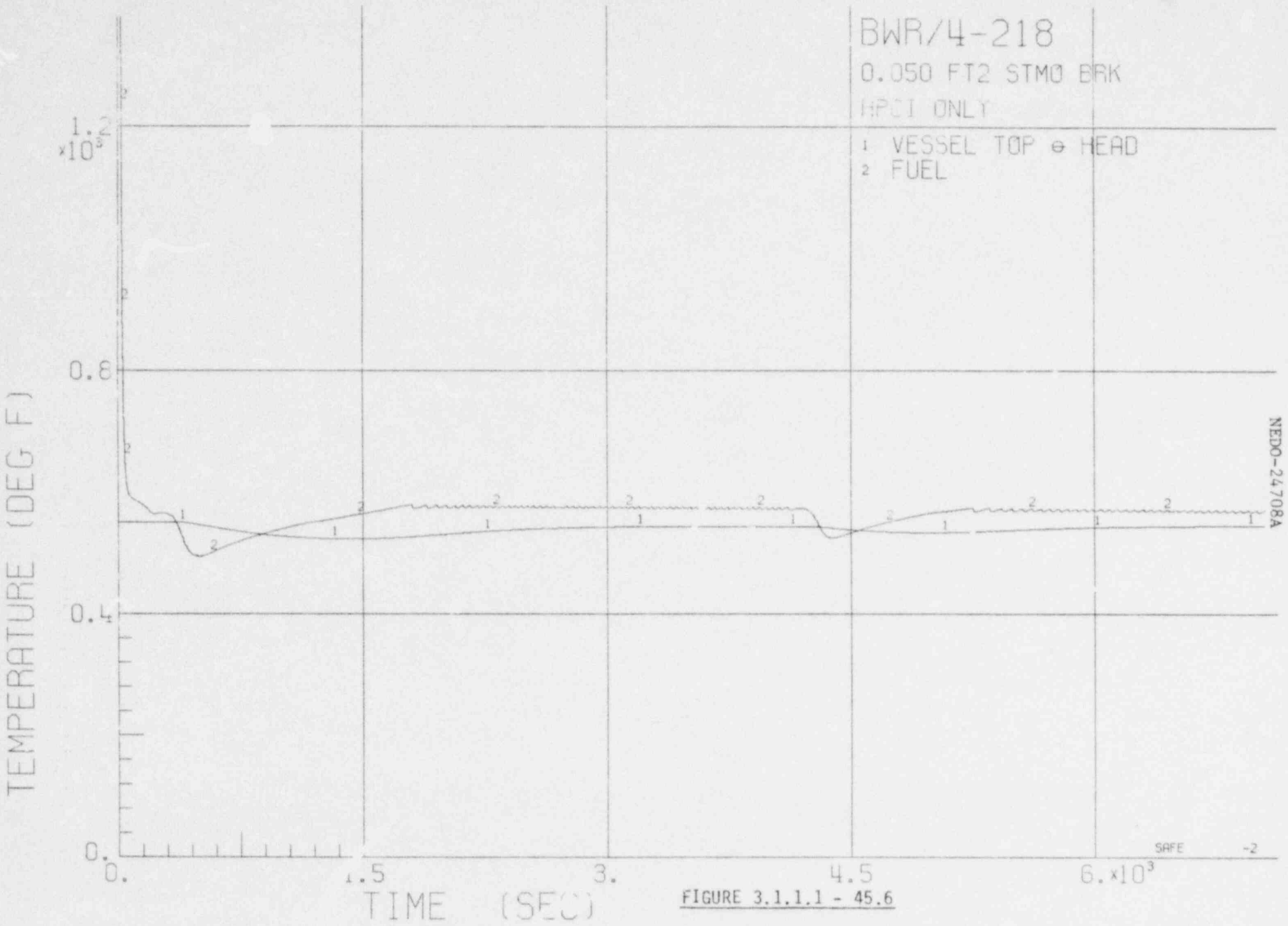


FIGURE 3.1.1.1 - 45.6

FIGURE 3.1.1.1 - 45.7

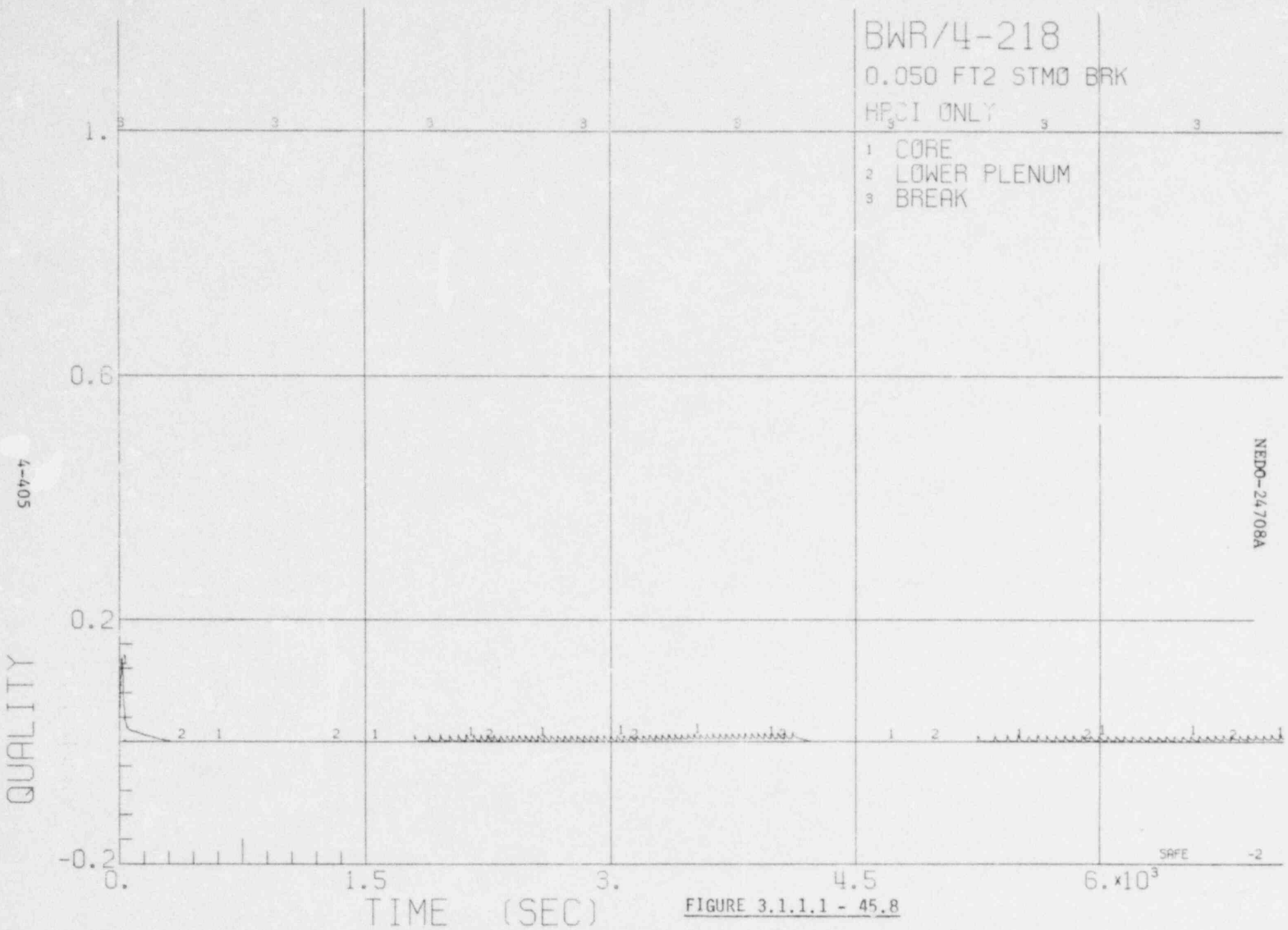


FIGURE 3.1.1.1 - 45.8

FIGURE 3.1.1.1 - 46.1

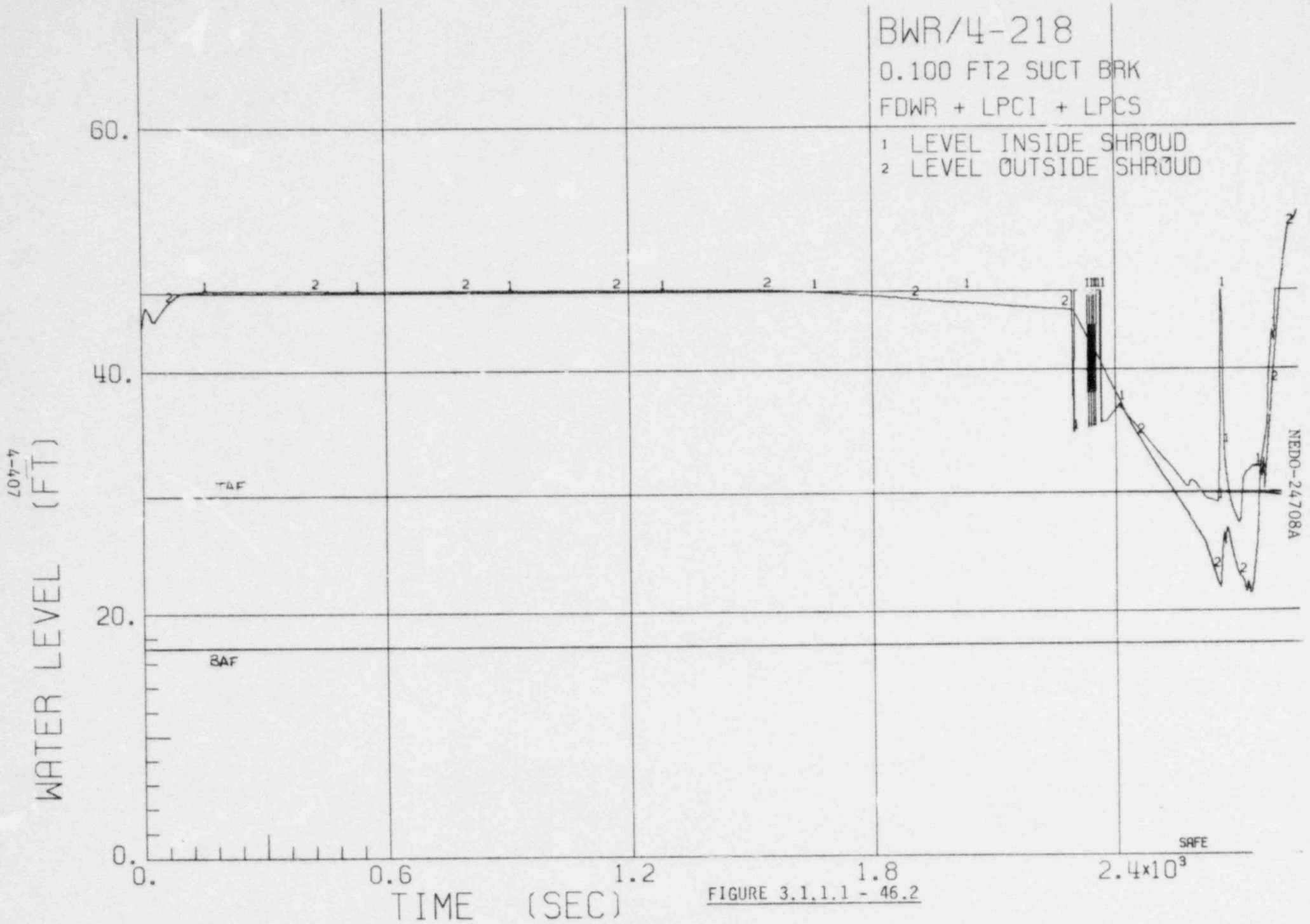


FIGURE 3.1.1.1 - 46.2

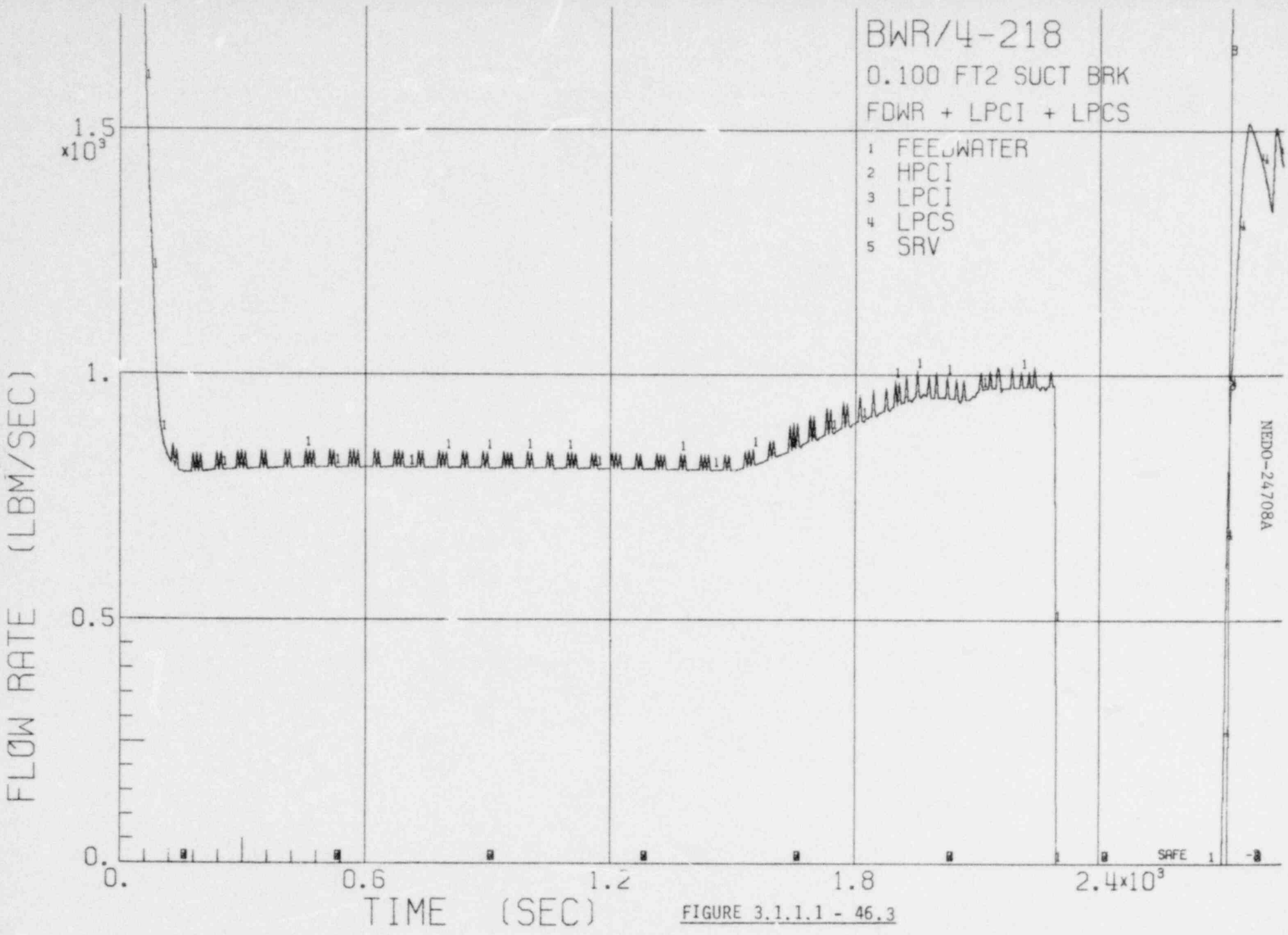


FIGURE 3.1.1.1 - 46.3

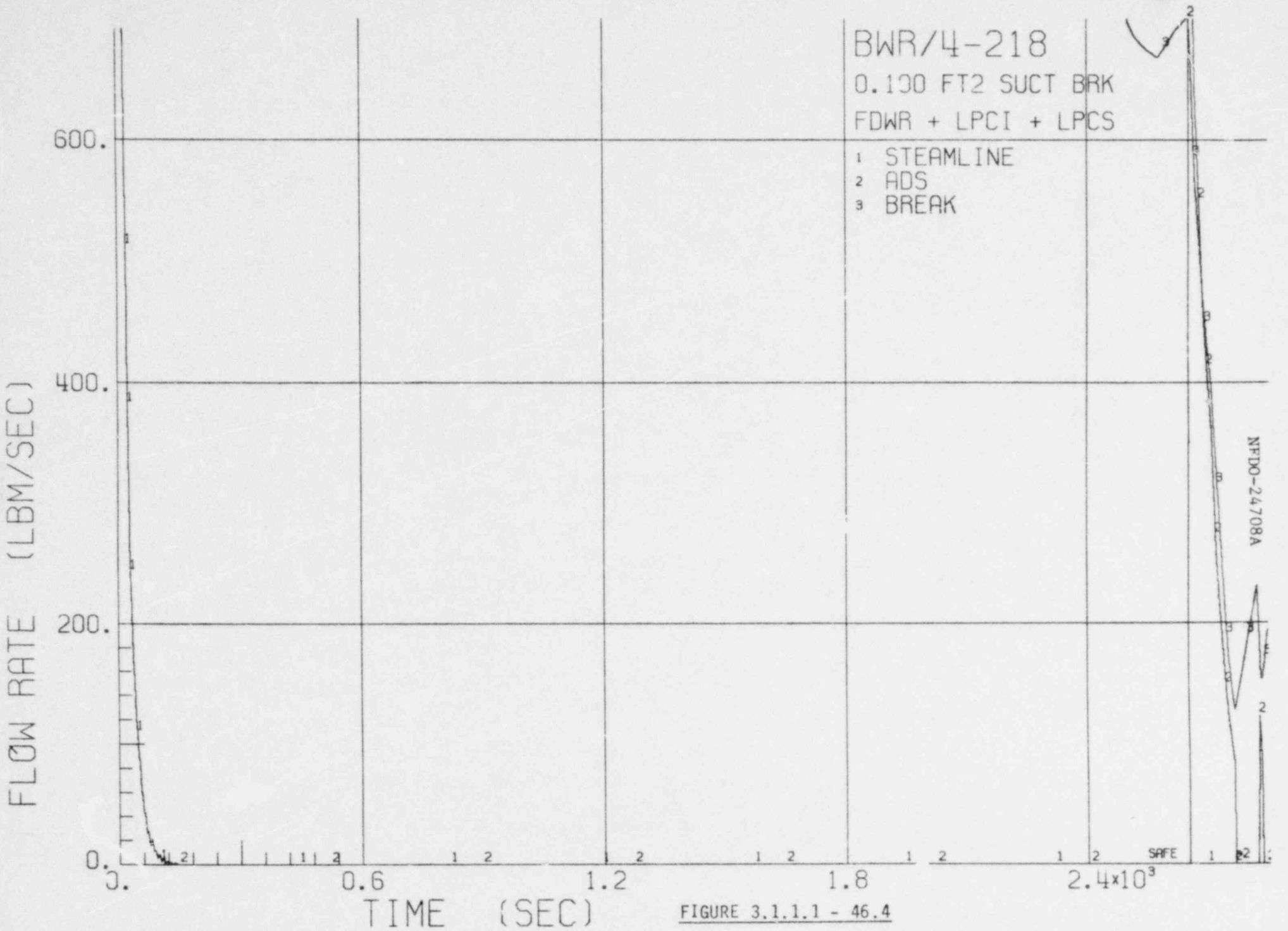


FIGURE 3.1.1.1 - 46.4

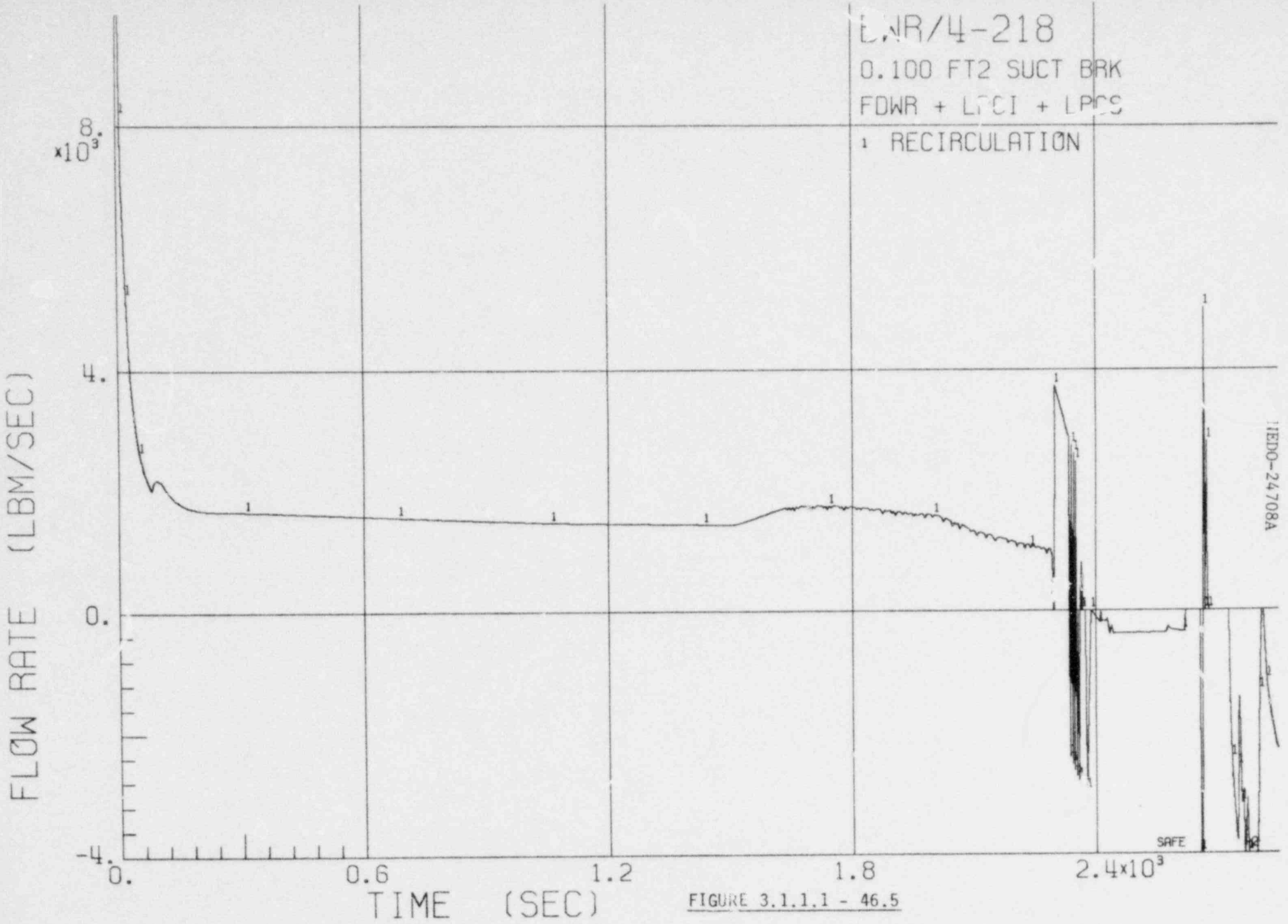


FIGURE 3.1.1.1 - 46.5

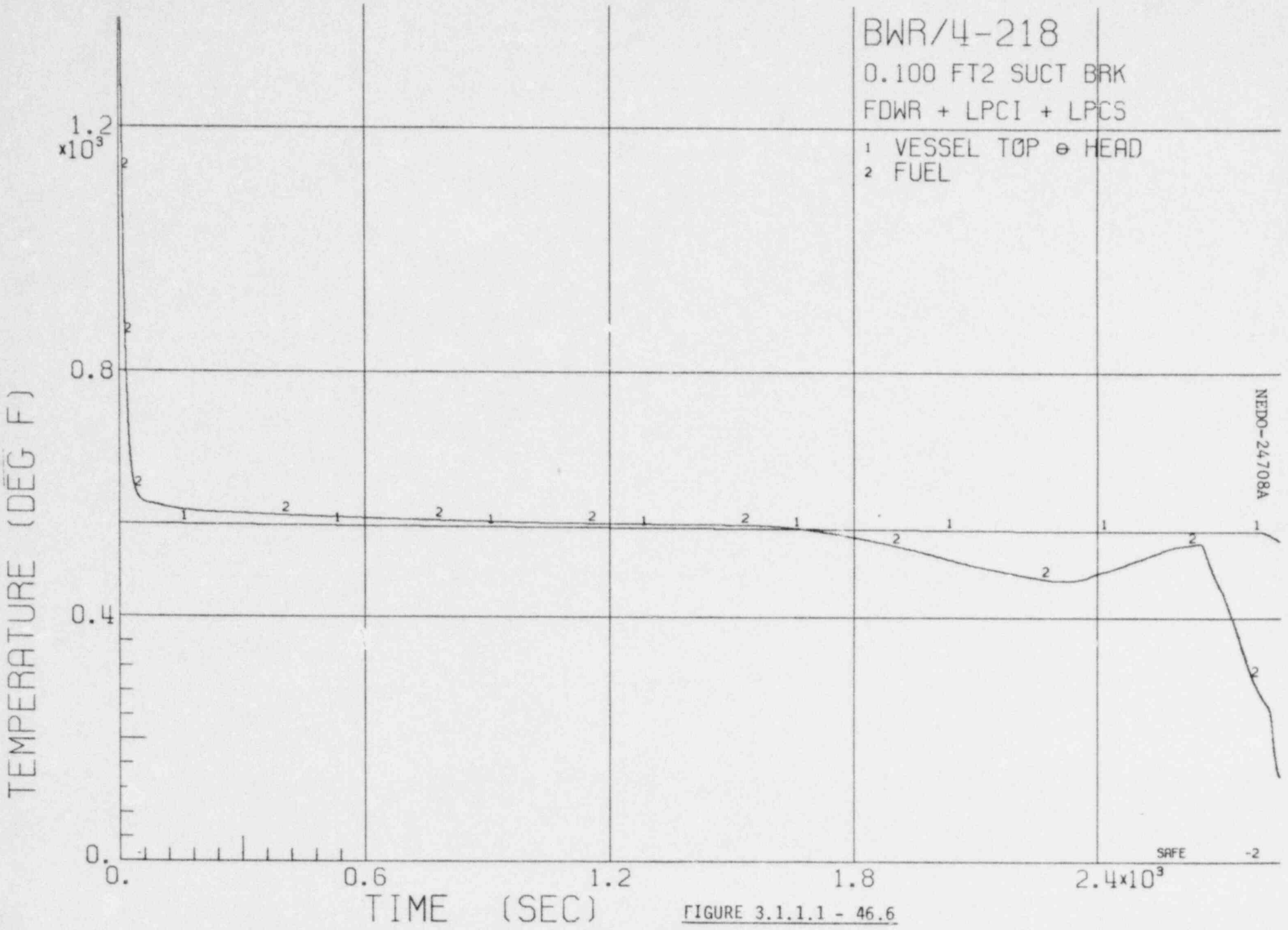


FIGURE 3.1.1.1 - 46.6

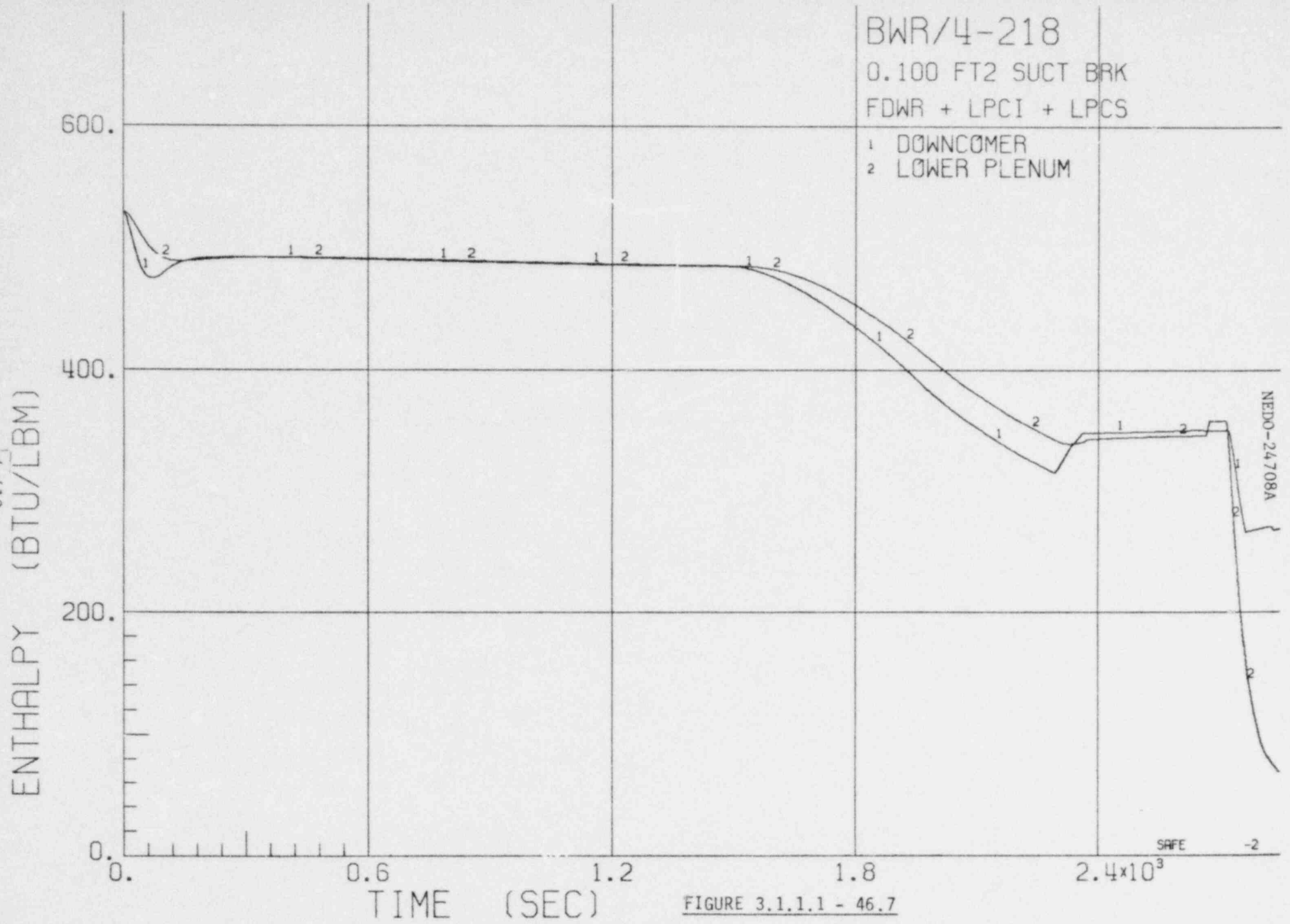


FIGURE 3.1.1.1 - 46.7

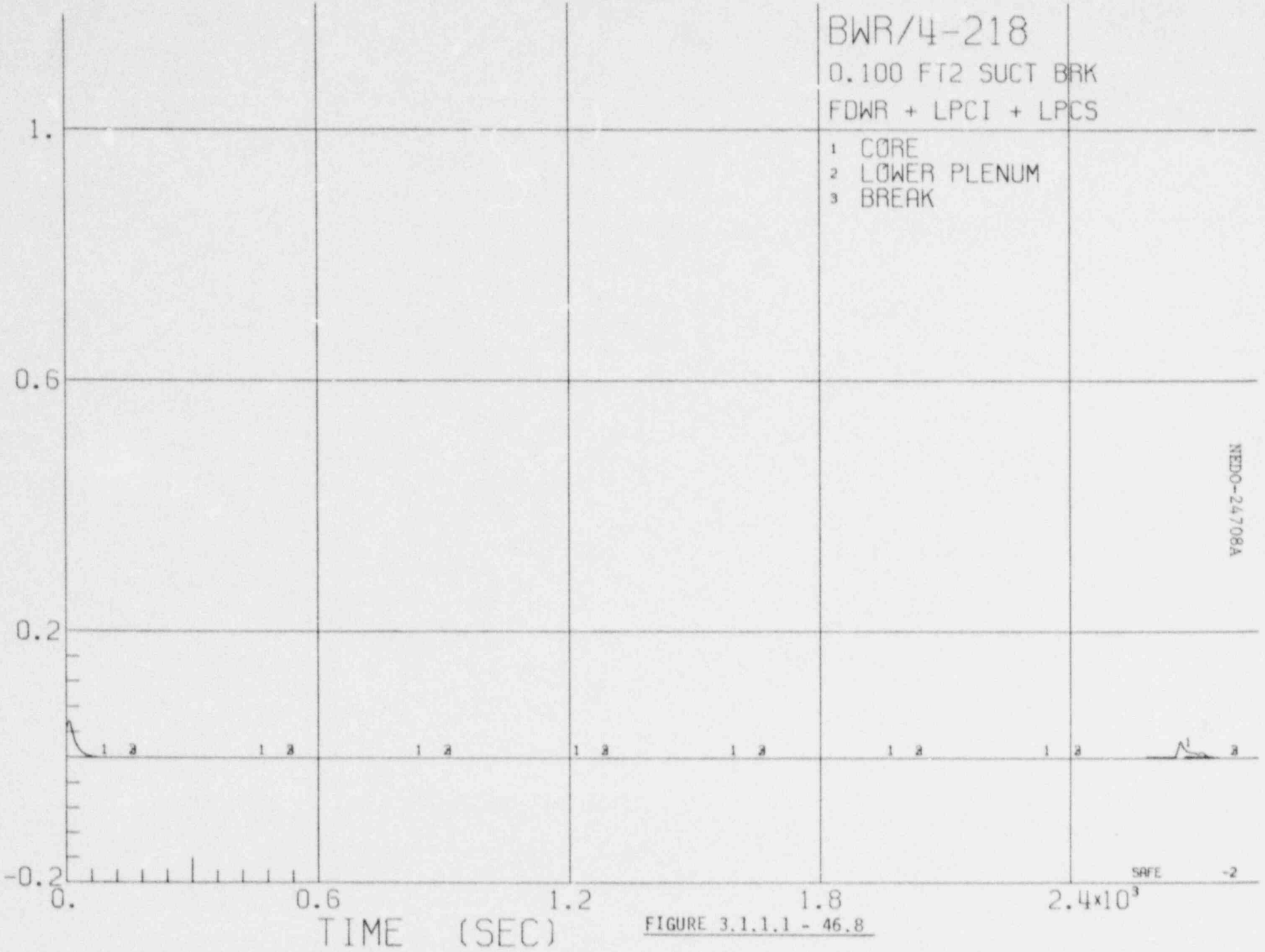


FIGURE 3.1.1.1 - 46.8

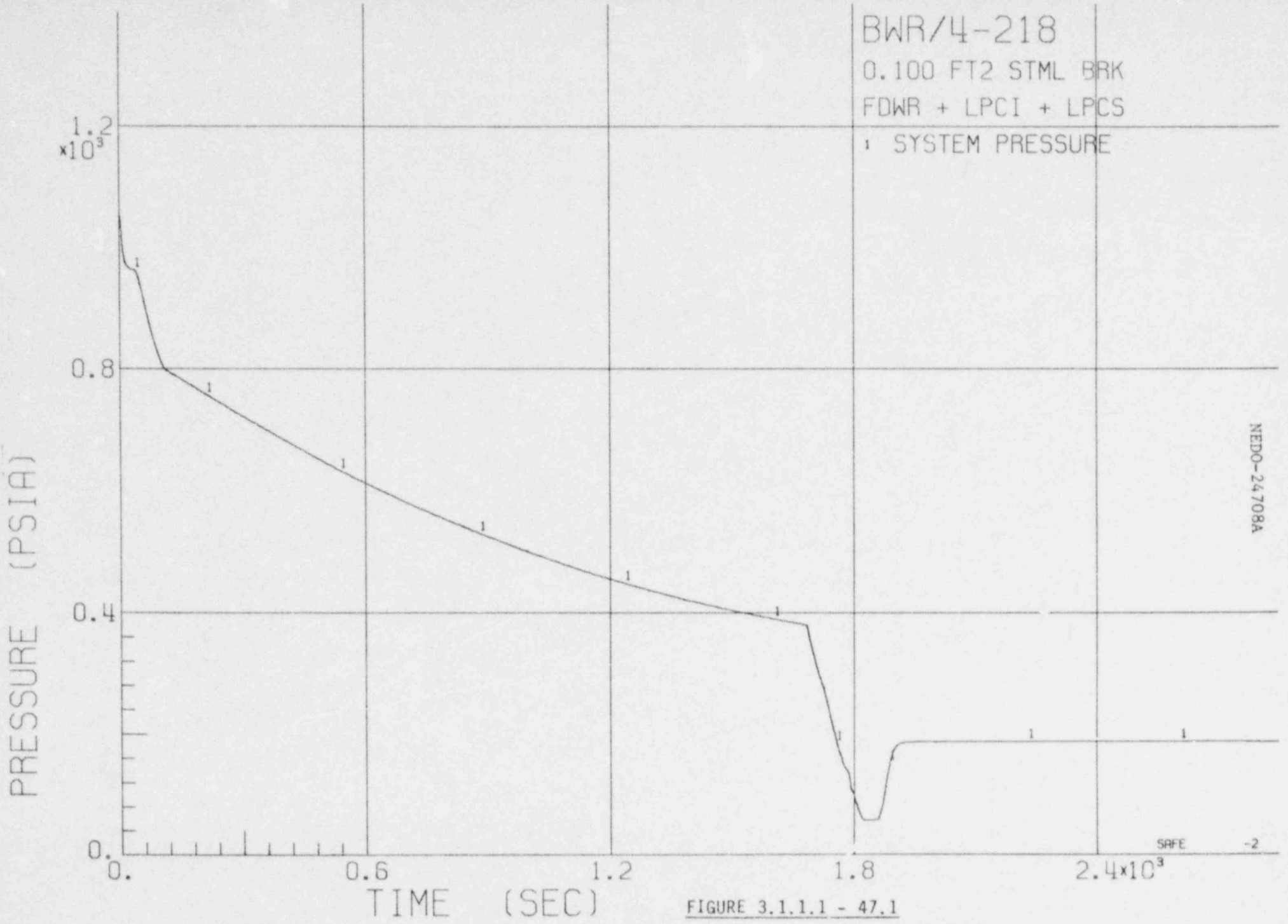


FIGURE 3.1.1.1 - 47.1

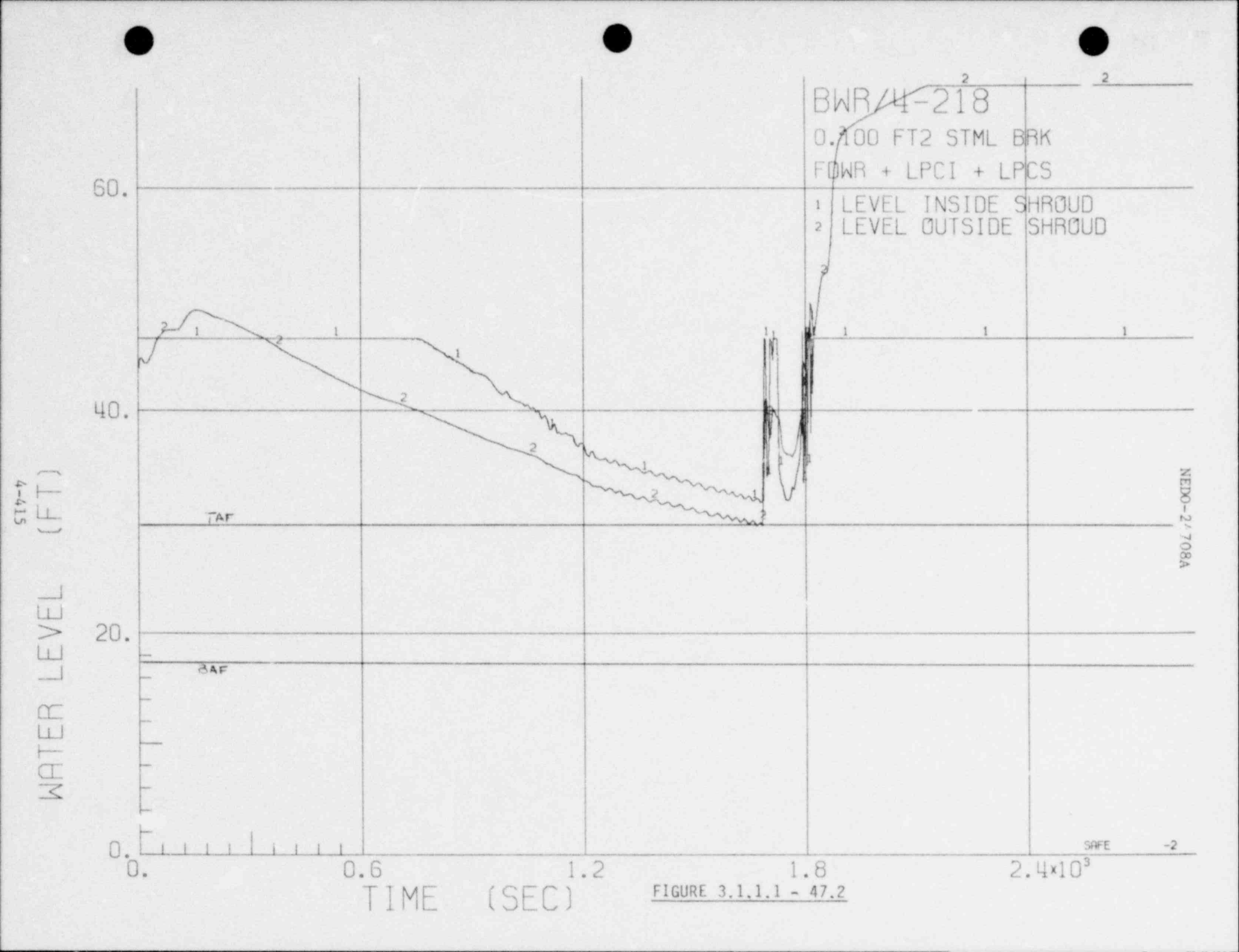


FIGURE 3.1.1.1 - 47.2

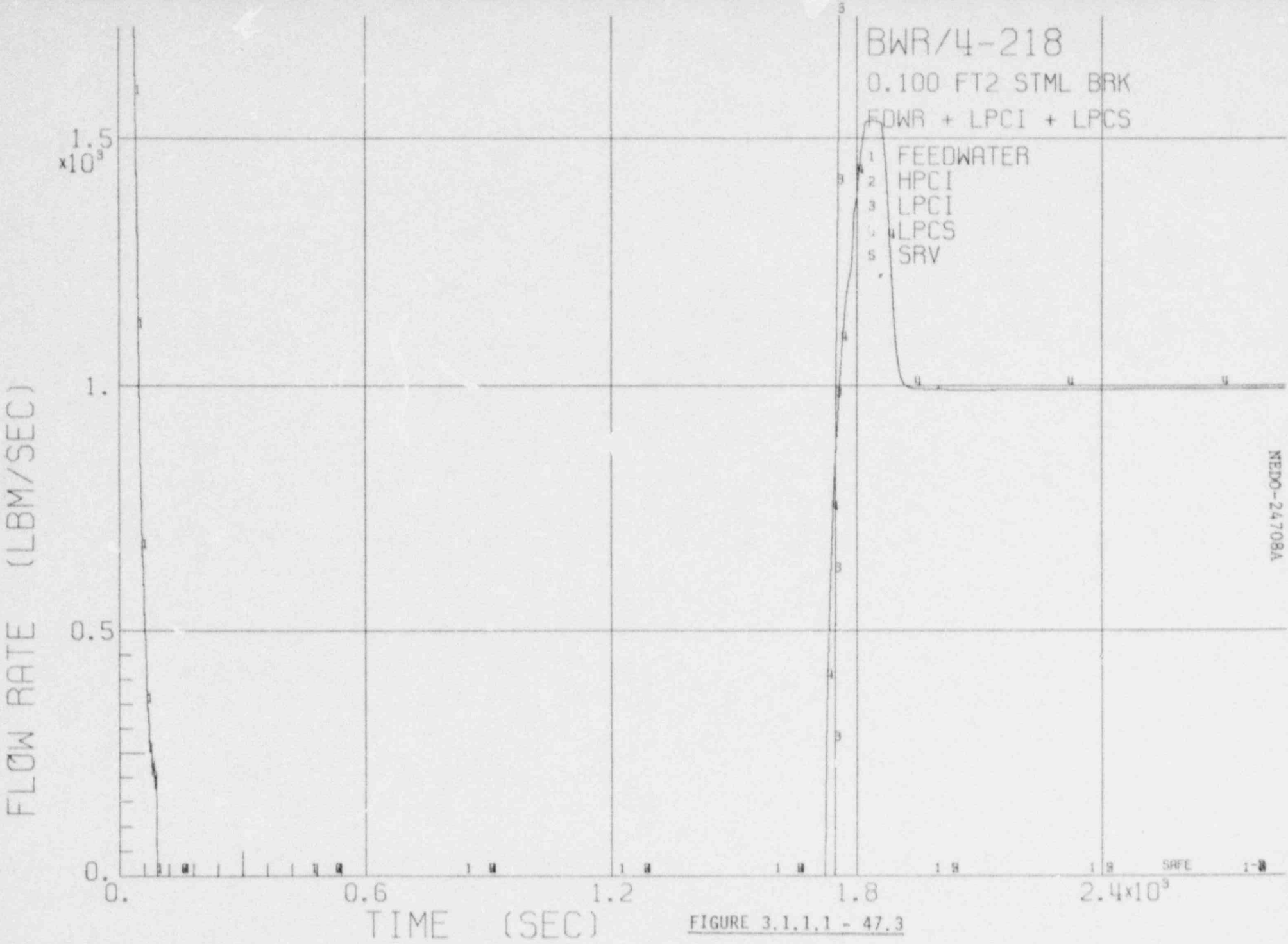
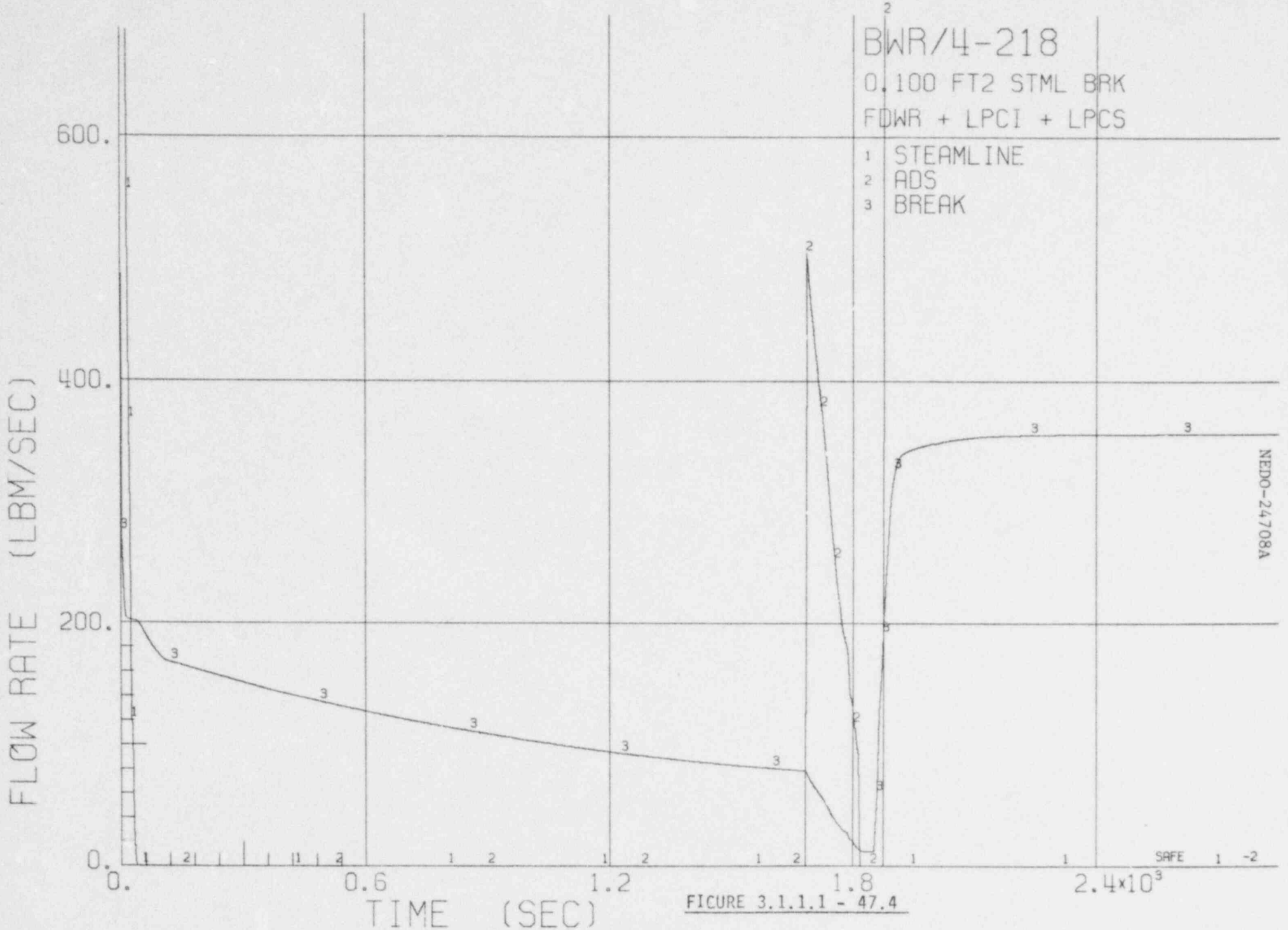


FIGURE 3.1.1.1 - 47.3



FICURE 3.1.1.1 - 47.4

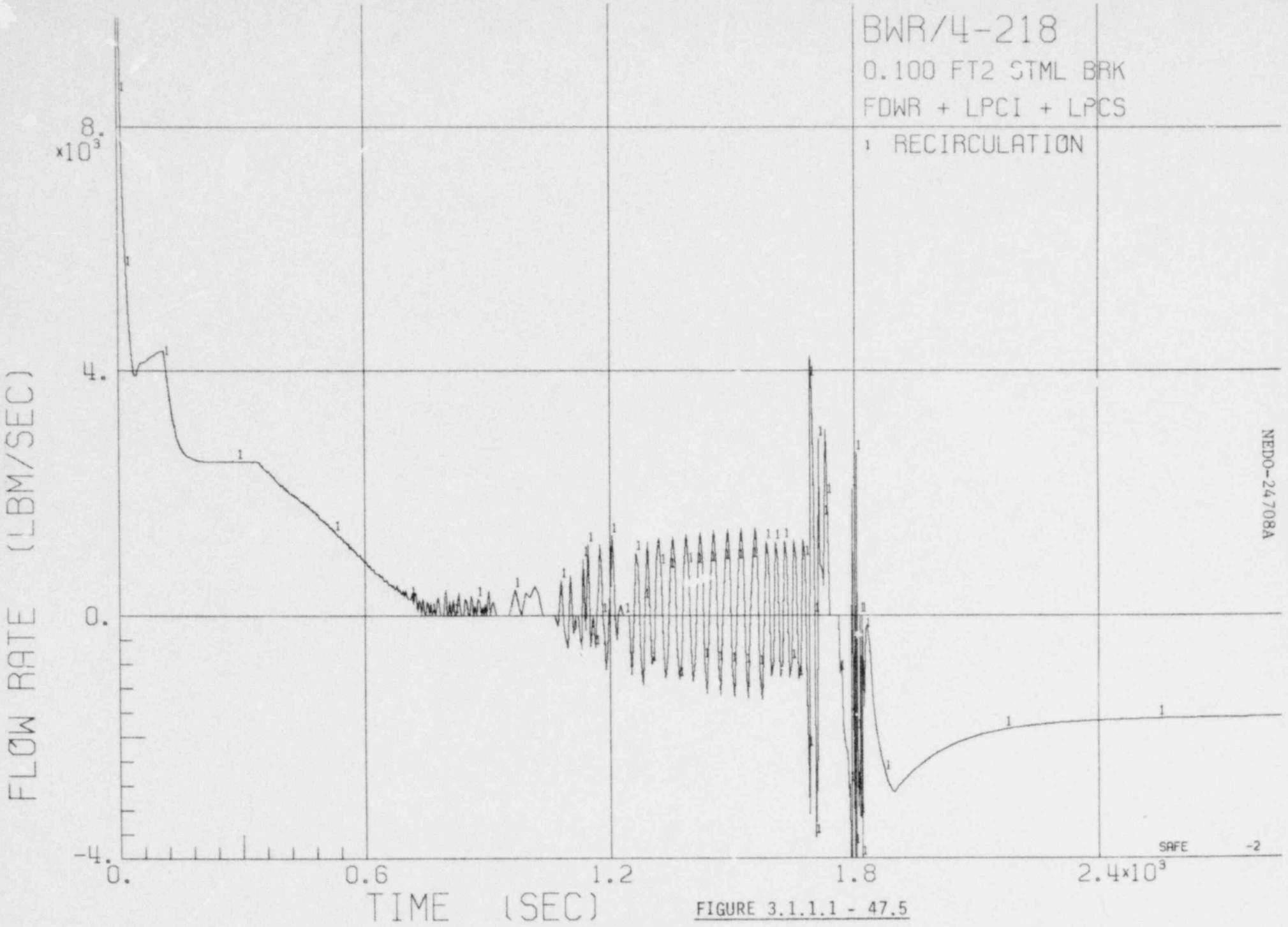


FIGURE 3.1.1.1 - 47.5

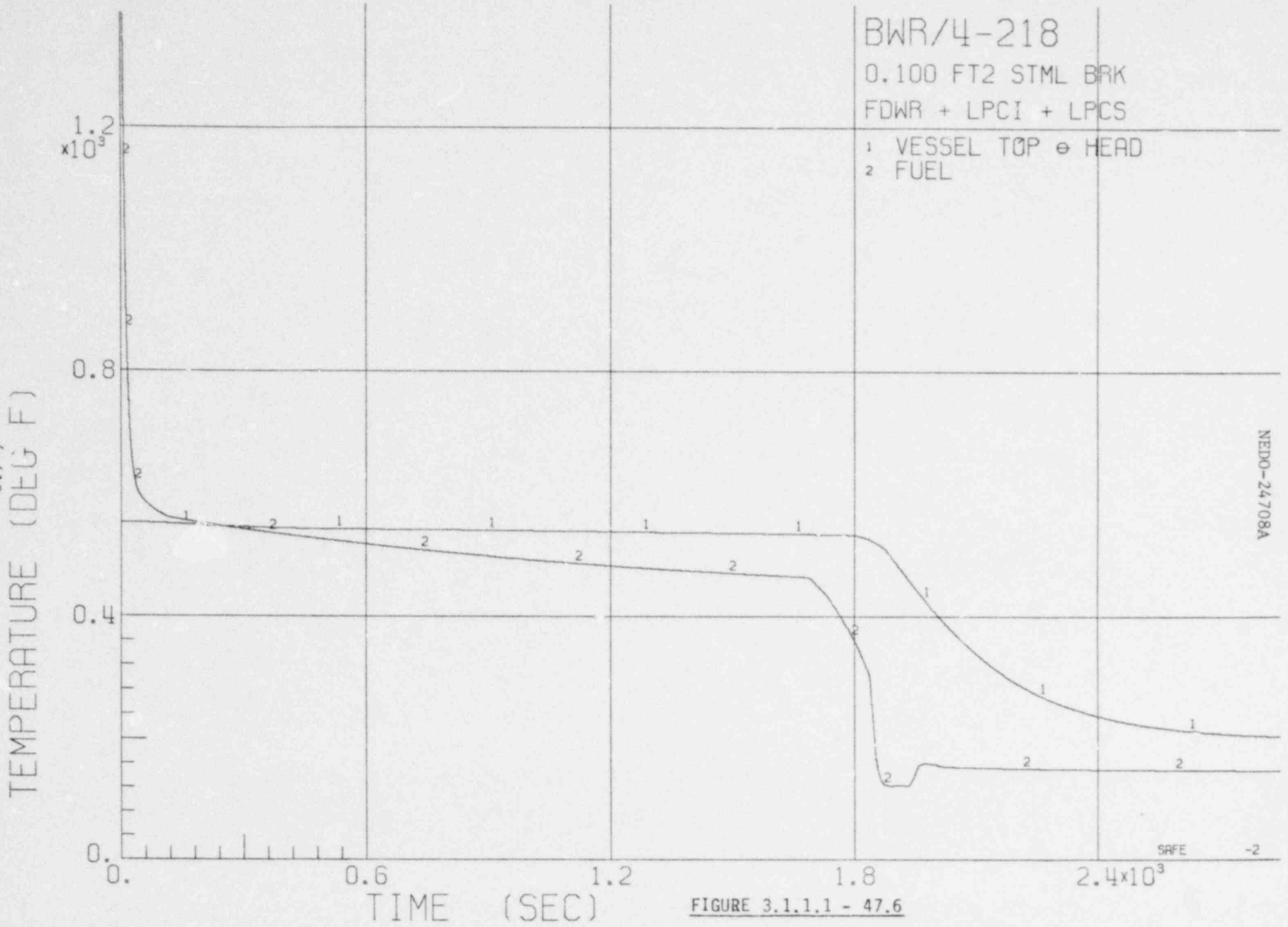


FIGURE 3.1.1.1 - 47.6

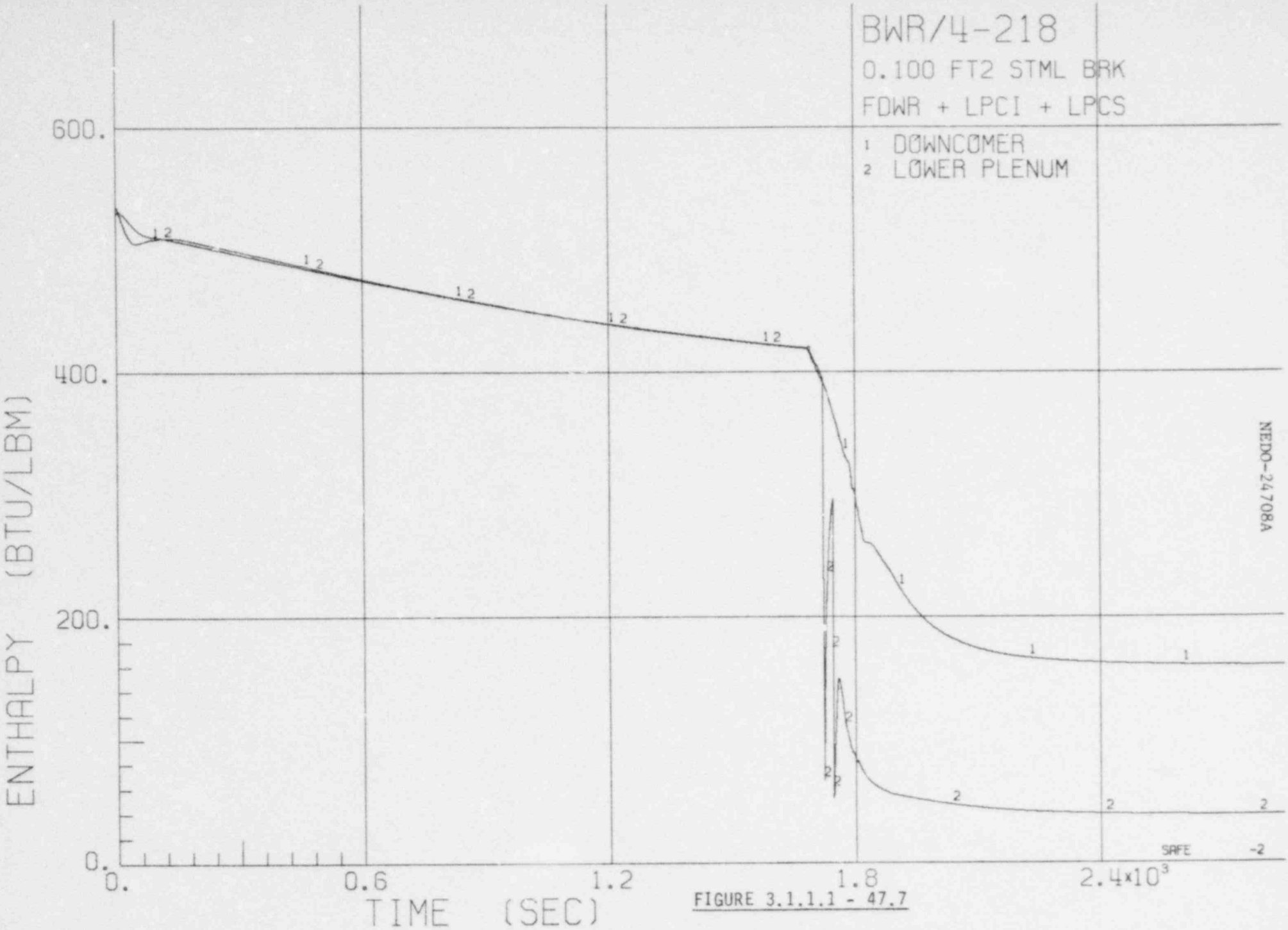


FIGURE 3.1.1.1 - 47.7

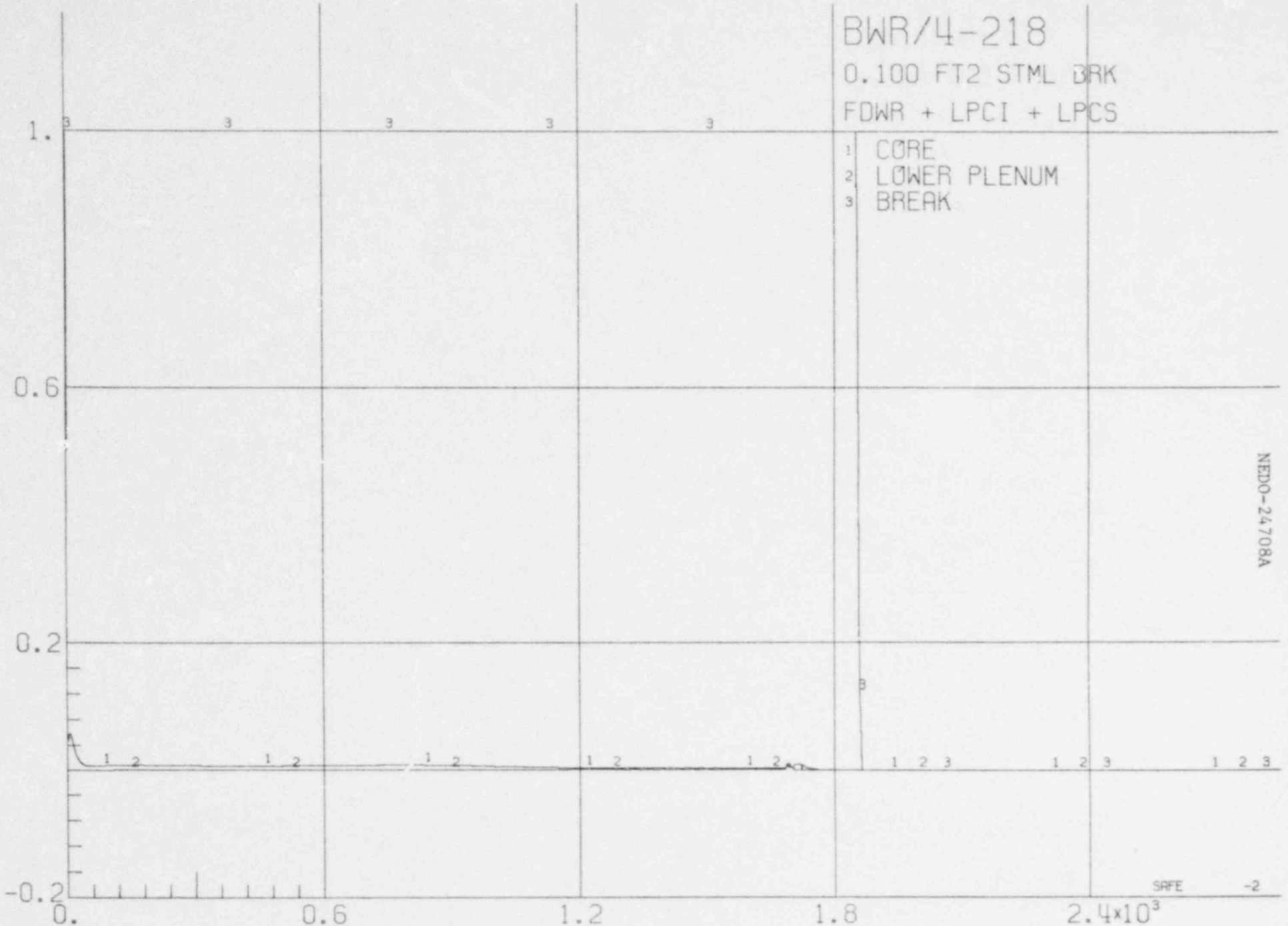


FIGURE 3.1.1.1 - 47.8

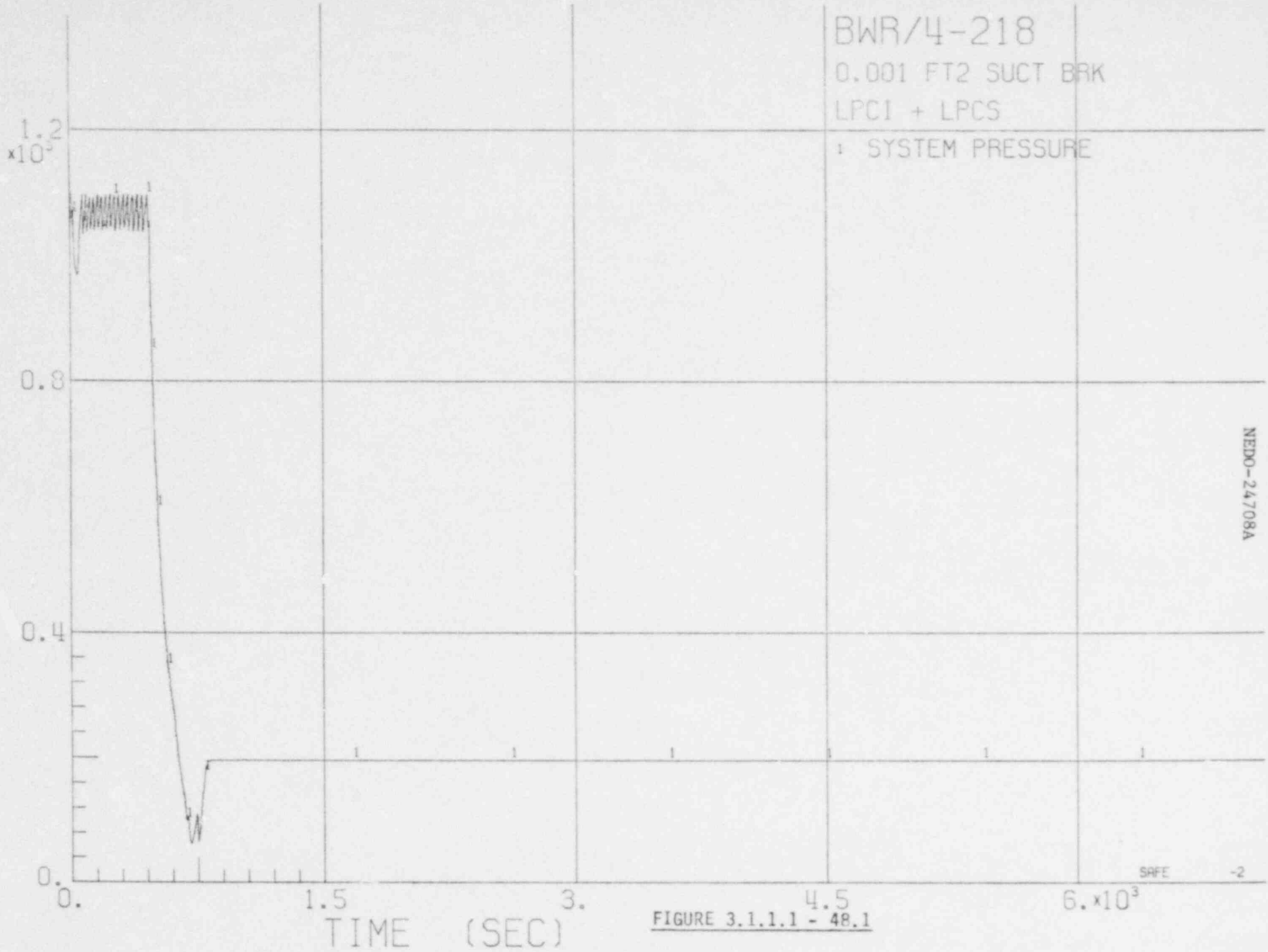


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FIGURE 3.1.1.1 - 48.1

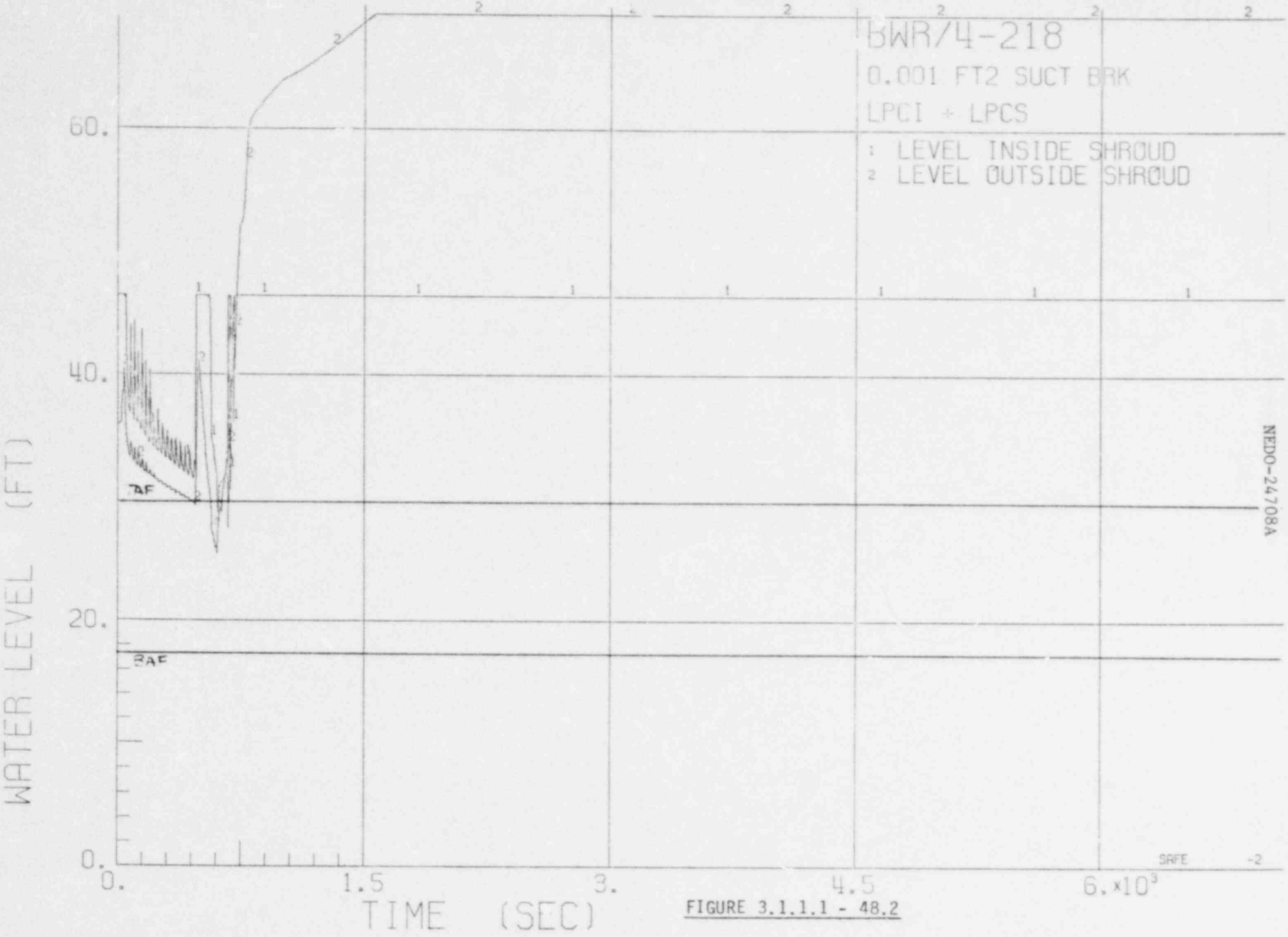

FIGURE 3.1.1.1 - 48.2

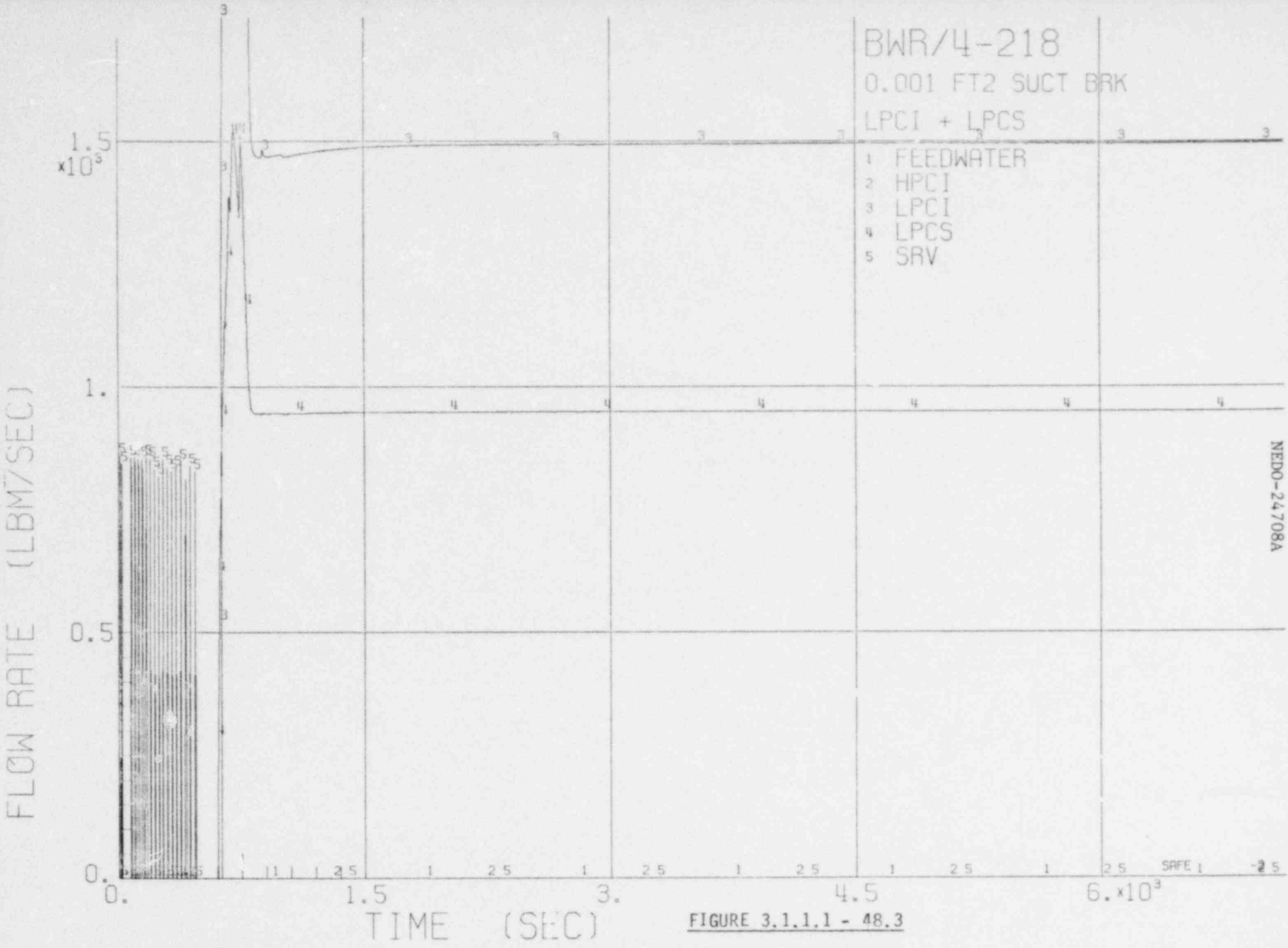

FIGURE 3.1.1.1 - 48.3

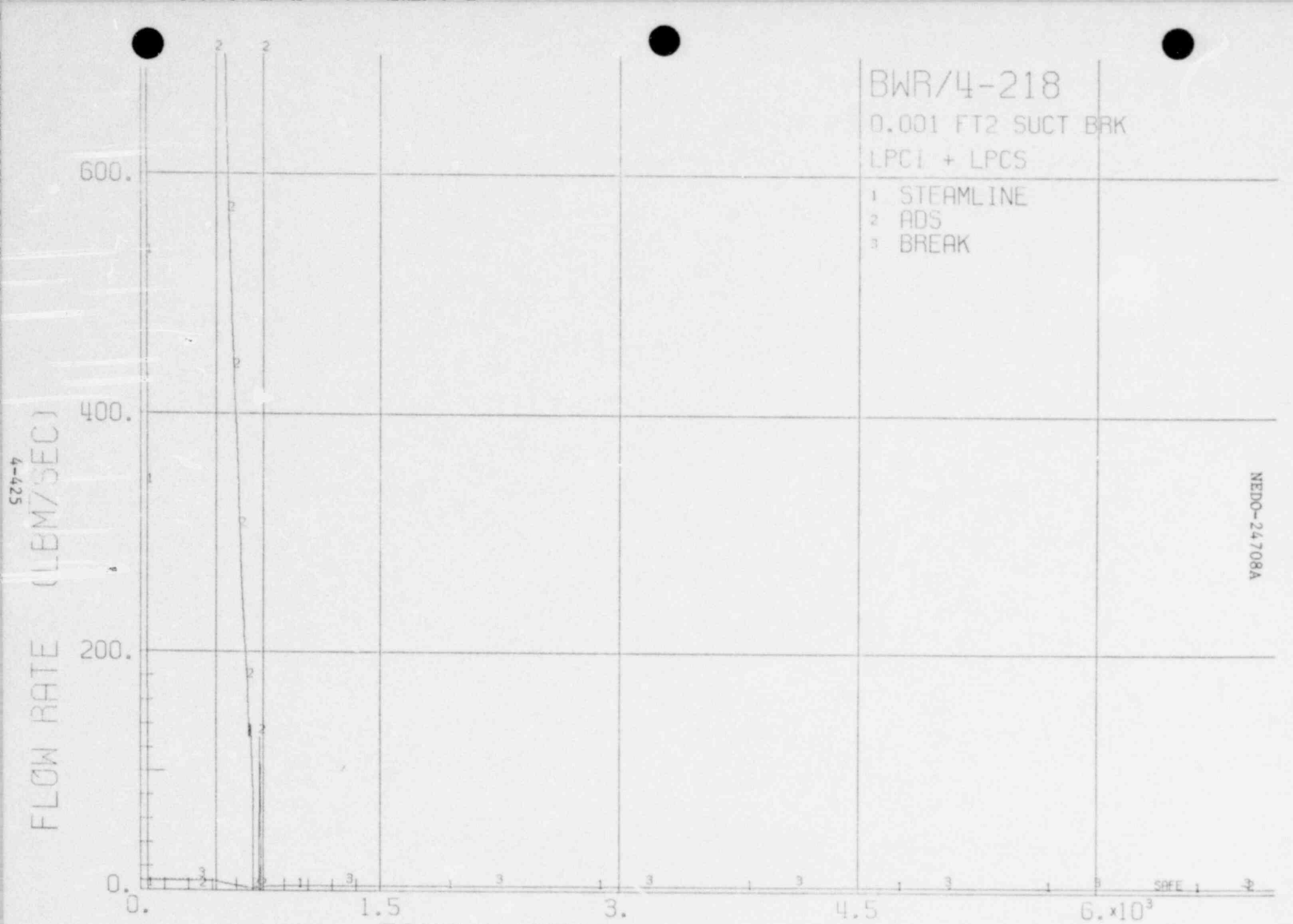

FIGURE 3.1.1.1 - 48 A

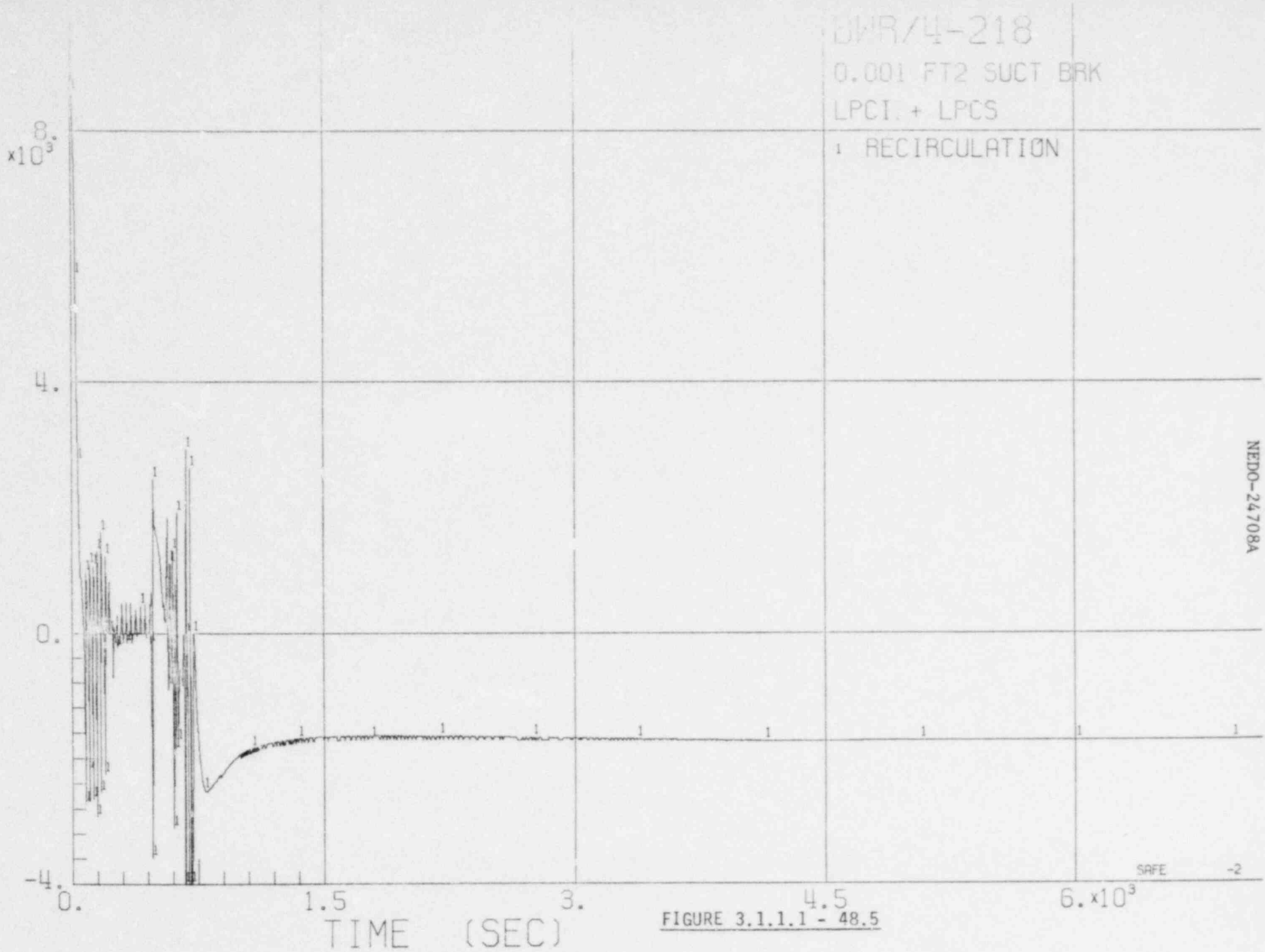

FIGURE 3.1.1.1 - 48.5

FIGURE 3.1.1.1 - 48.6

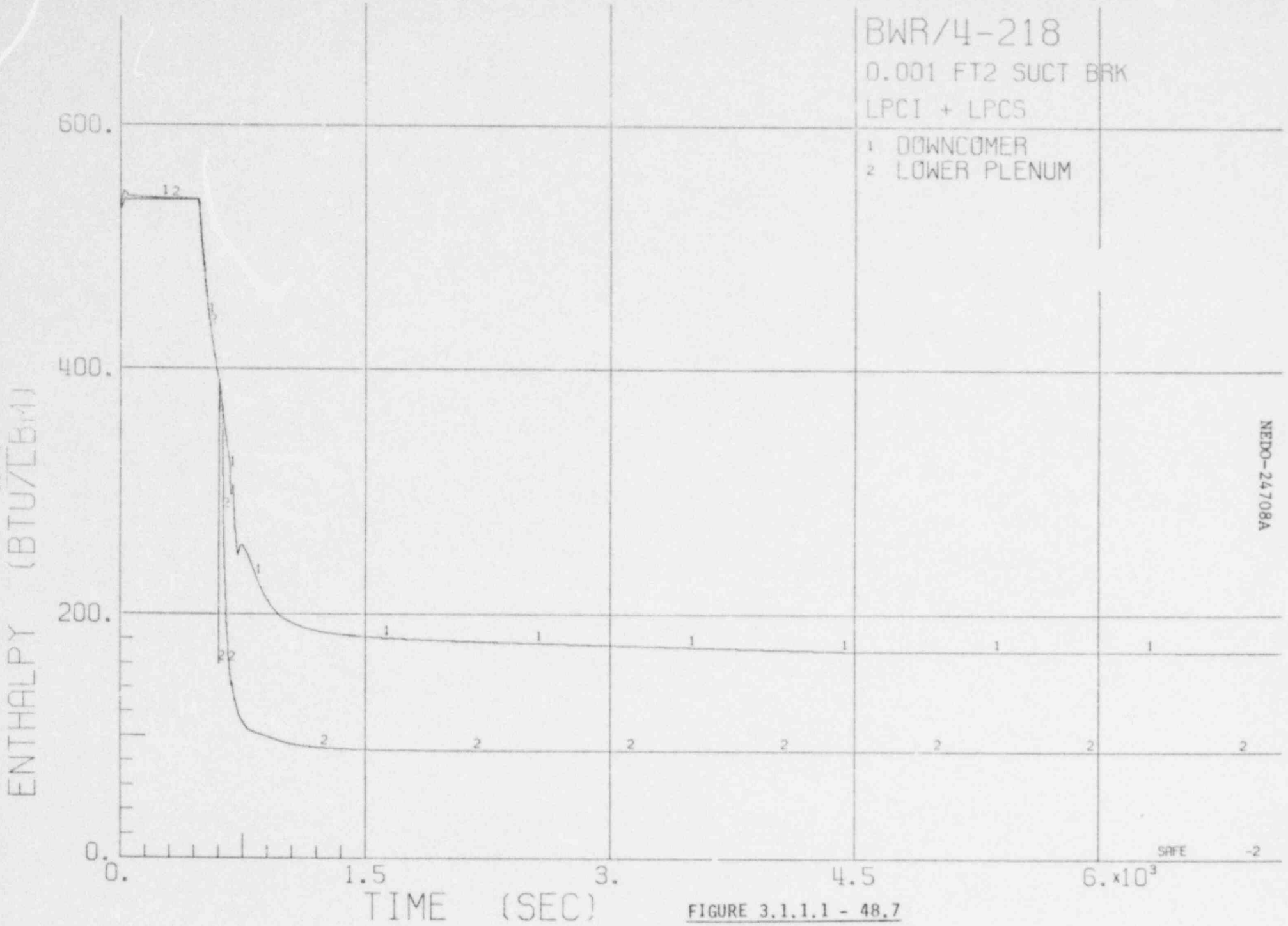

FIGURE 3.1.1.1 - 48.7

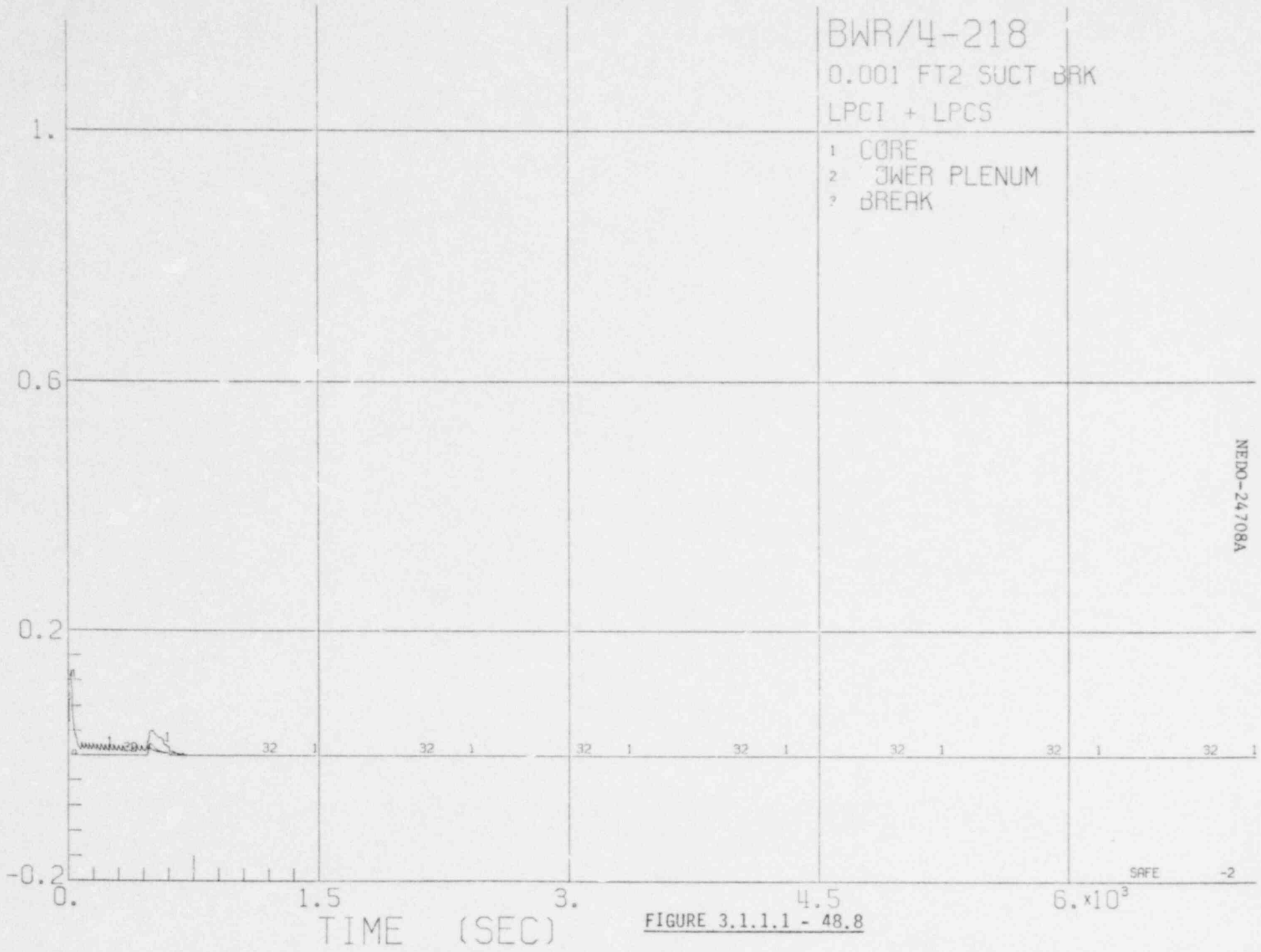

FIGURE 3.1.1.1 - 48.8

FIGURE 3.1.1.1 - 49.1

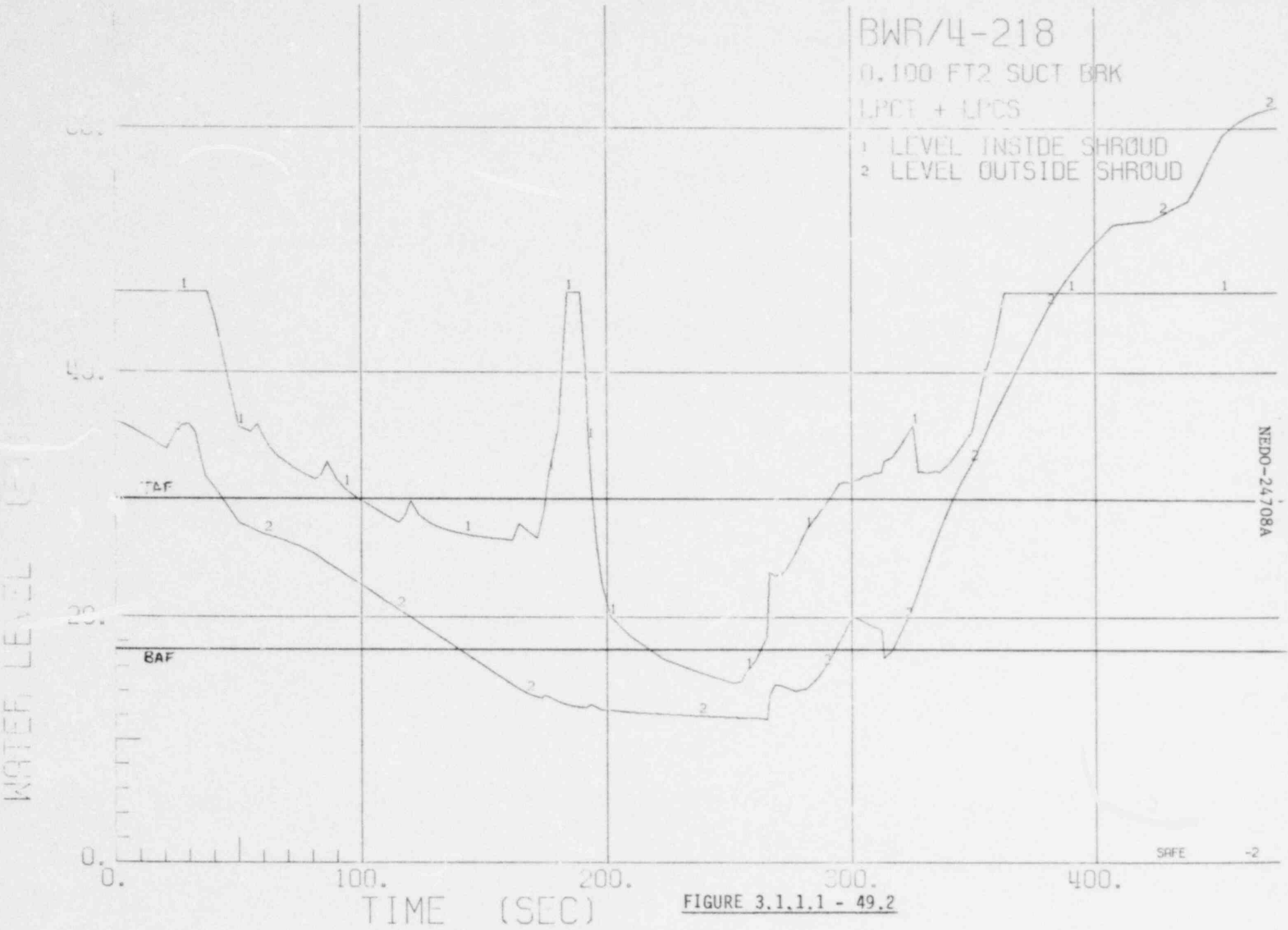

FIGURE 3.1.1.1 - 49.2

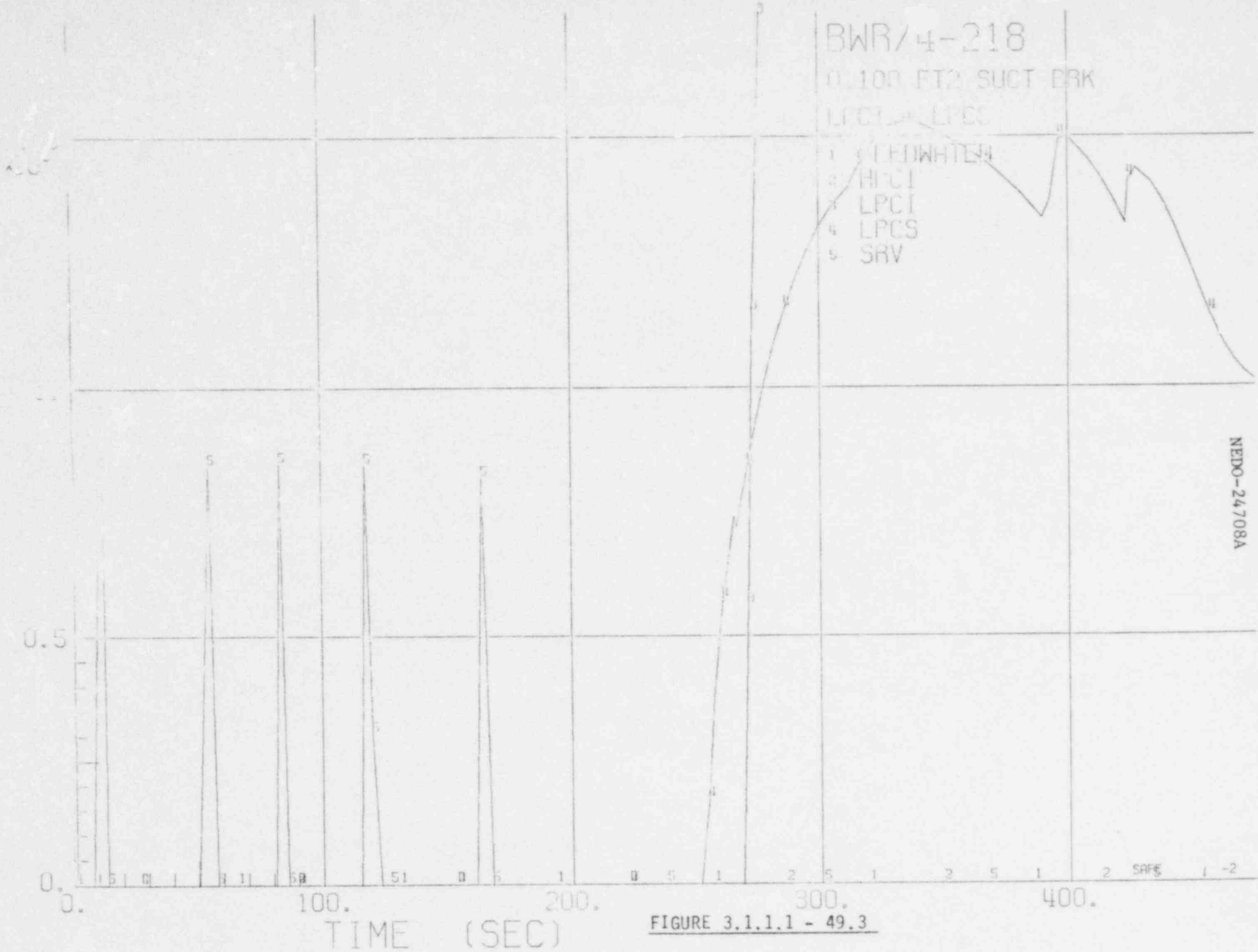

FIGURE 3.1.1.1 - 49.3

FIGURE 3.1.1.1 - 49.4

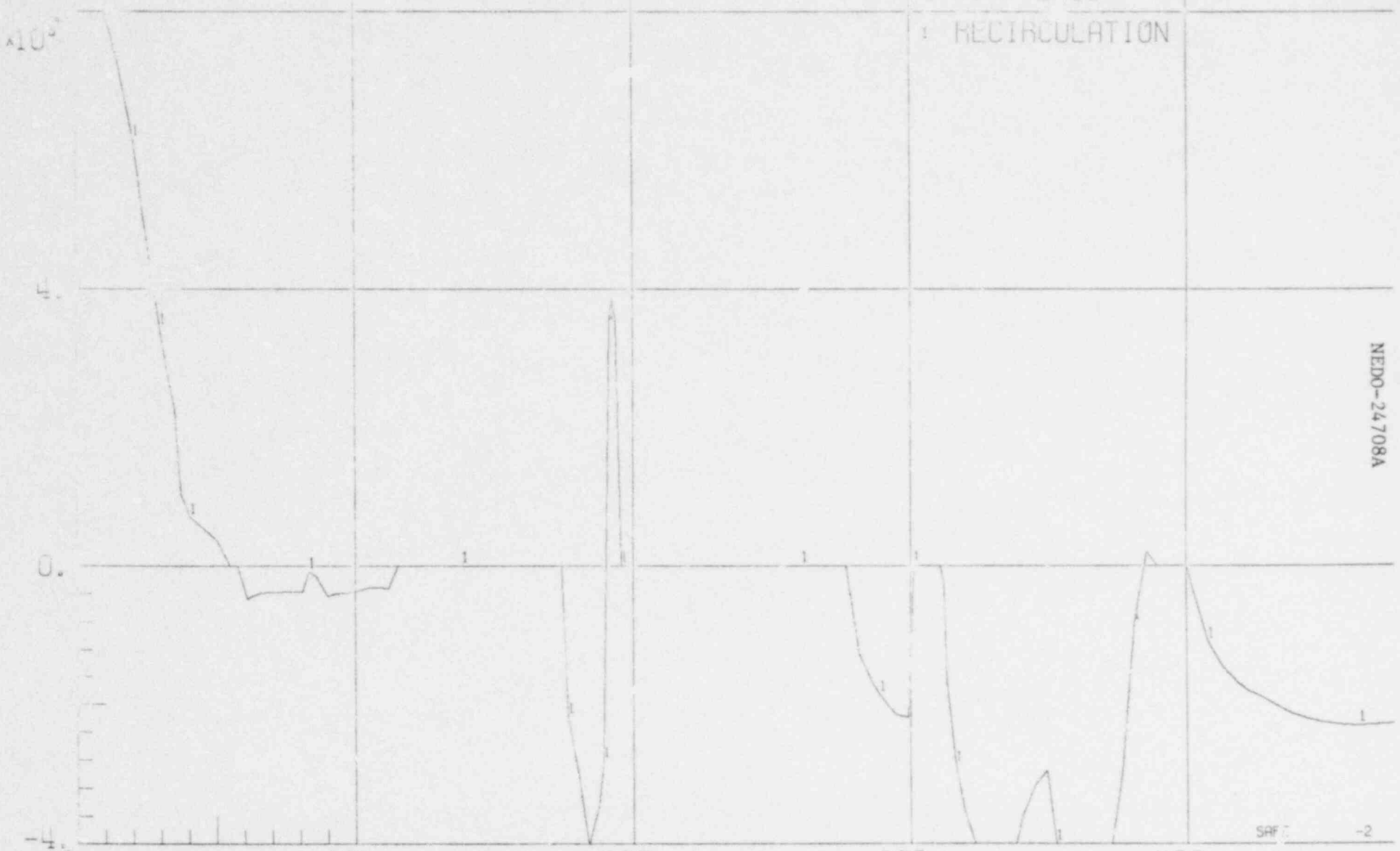

FIGURE 3.1.1.1 - 49.5

FIGURE 3.1.1.1 - 49.6

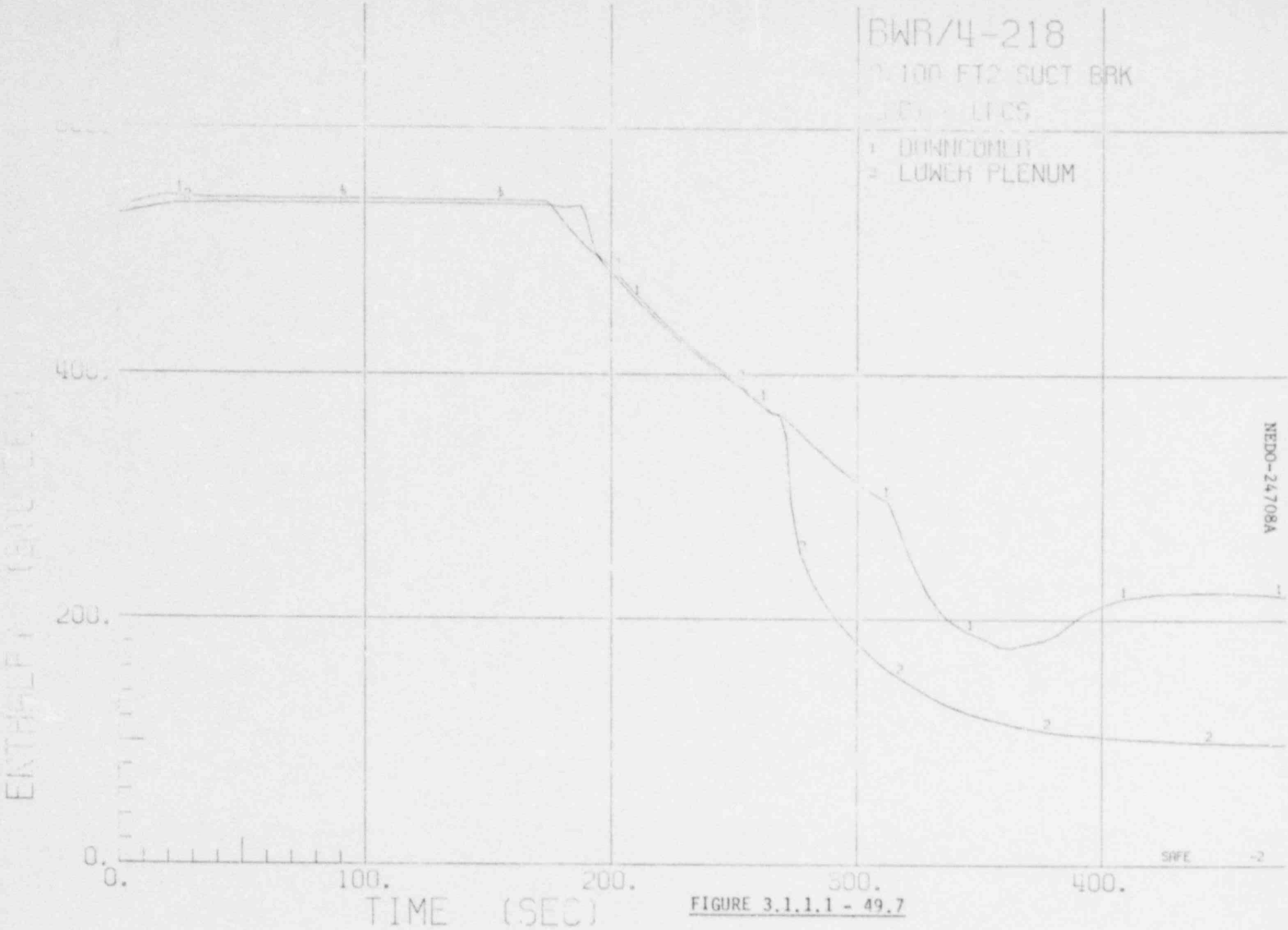

FIGURE 3.1.1.1 - 49.7

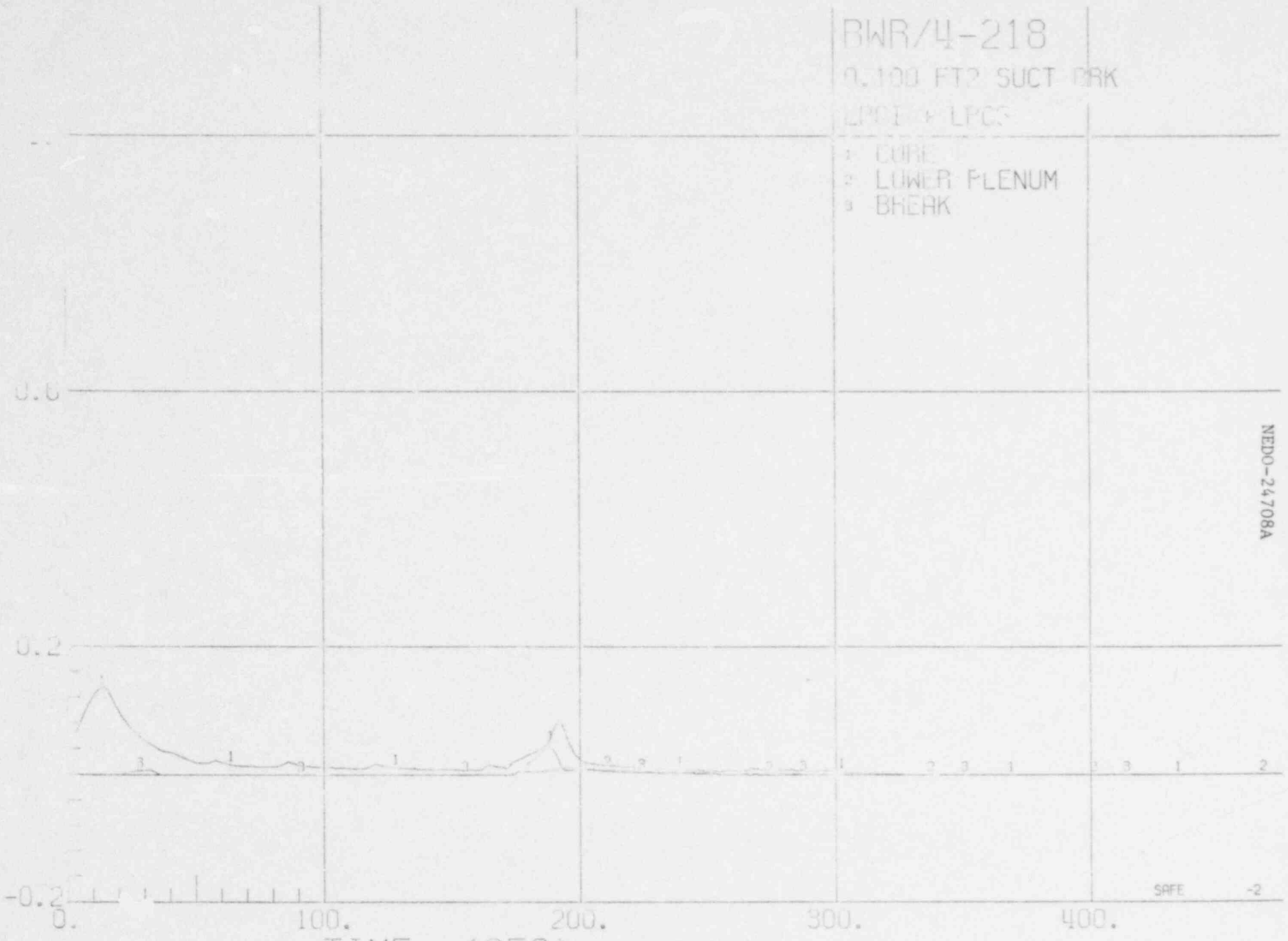

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FIGURE 3.1.1.1 - 49.8

FIGURE 3.1.1.1 - 50.1

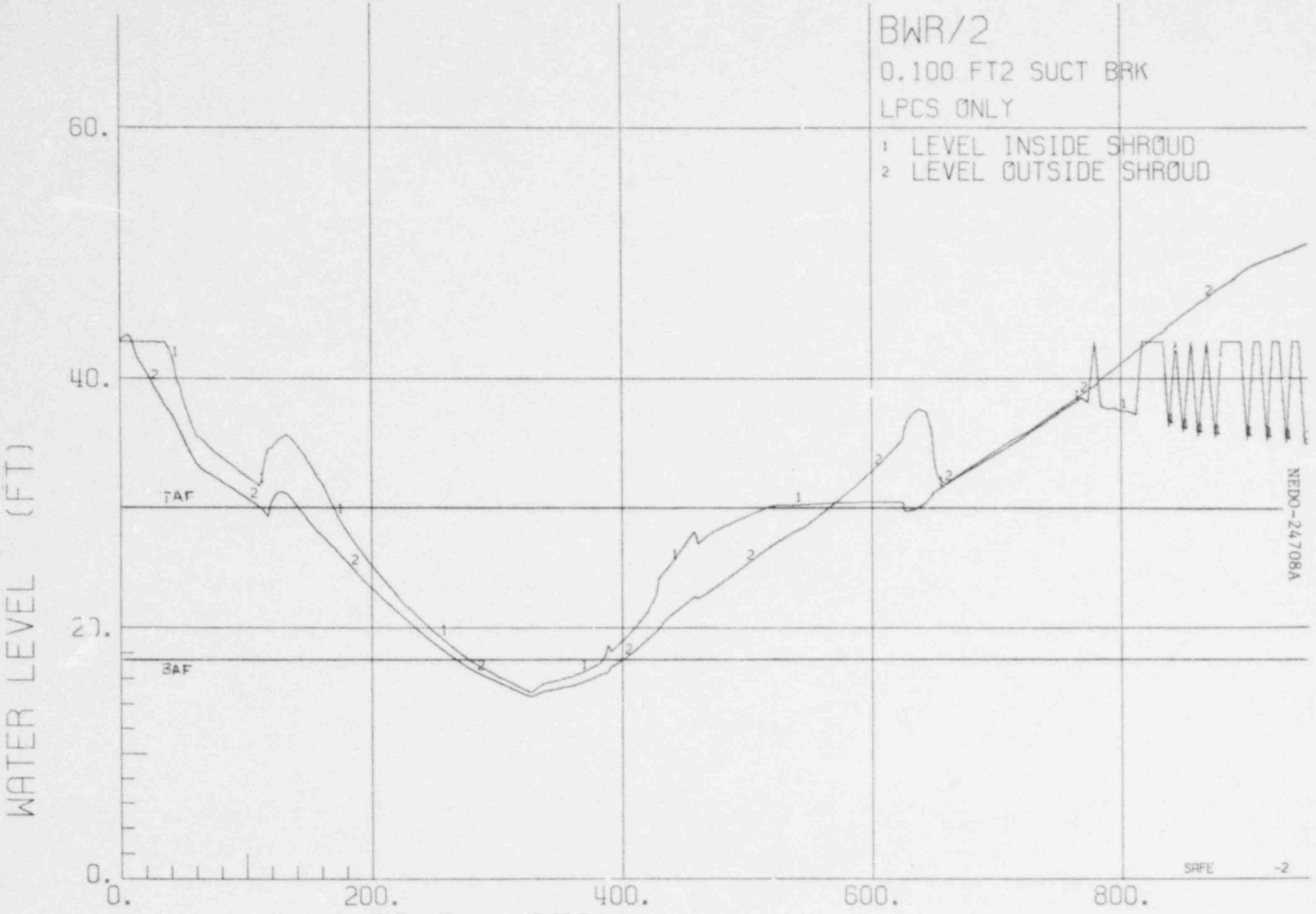

FIGURE 3.1.1.1 - 50.2

FIGURE 3.1.1.1 - 50.3

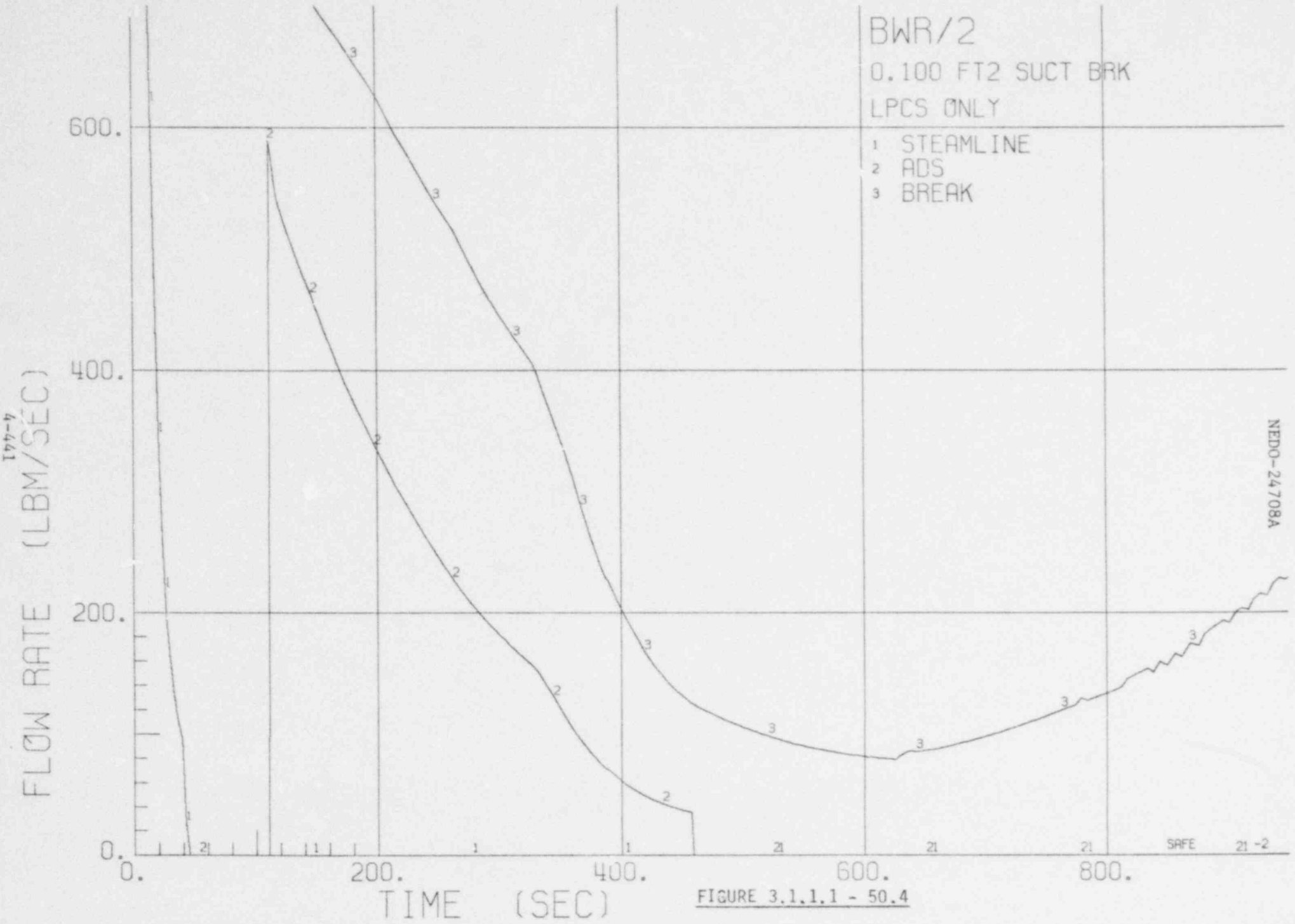

FIGURE 3.1.1.1 - 50.4

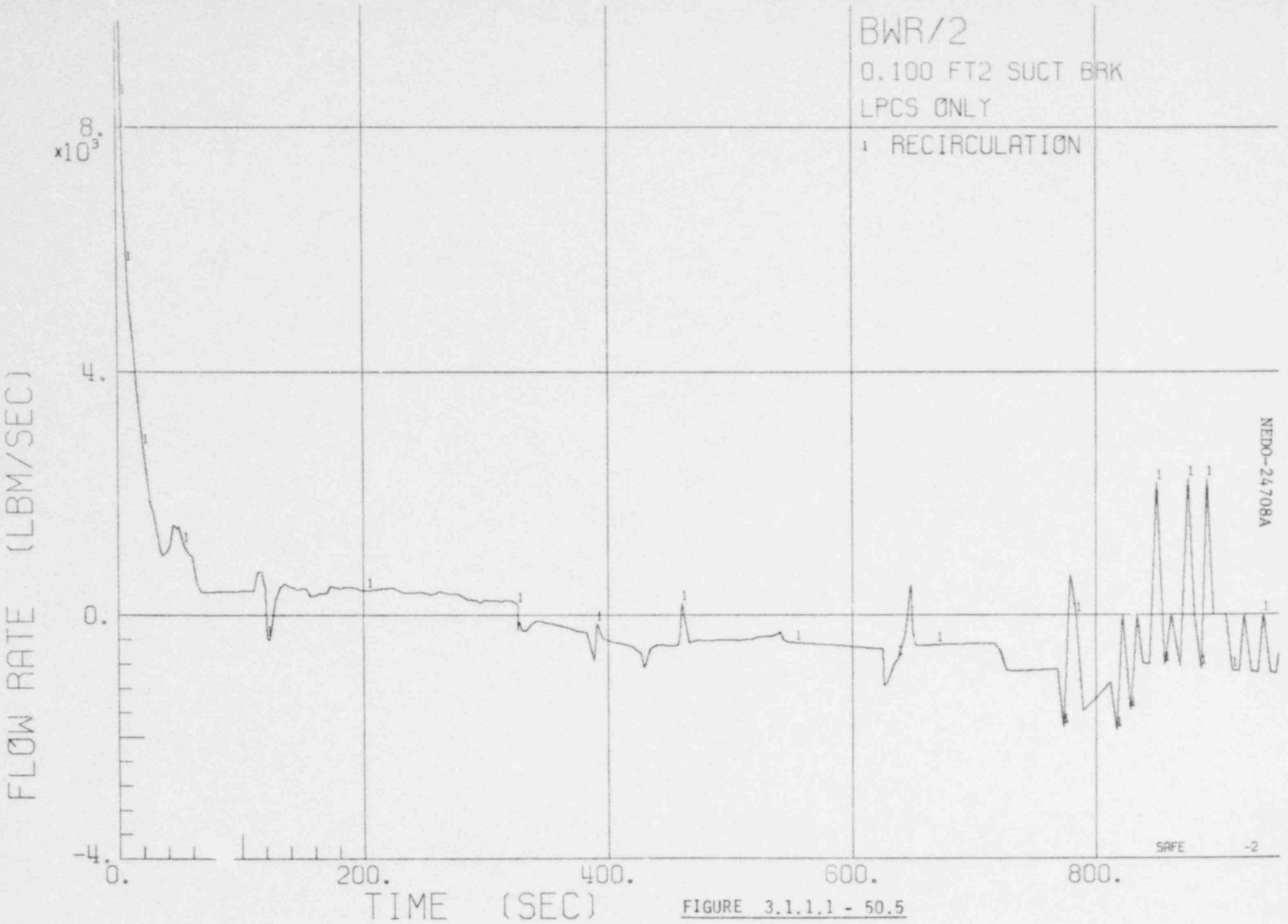

FIGURE 3.1.1.1 - 50.5

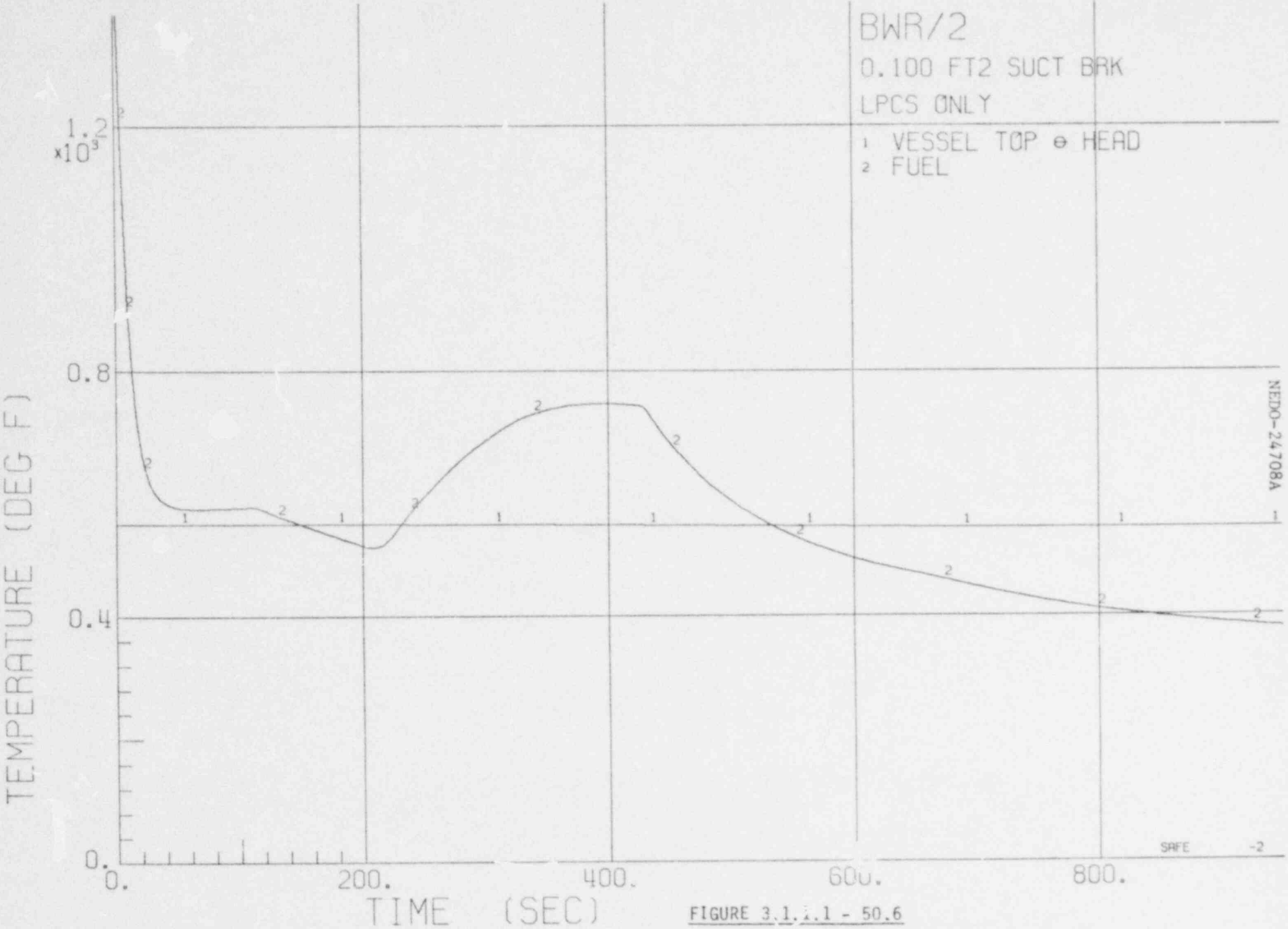

FIGURE 3.1.1.1 - 50.6

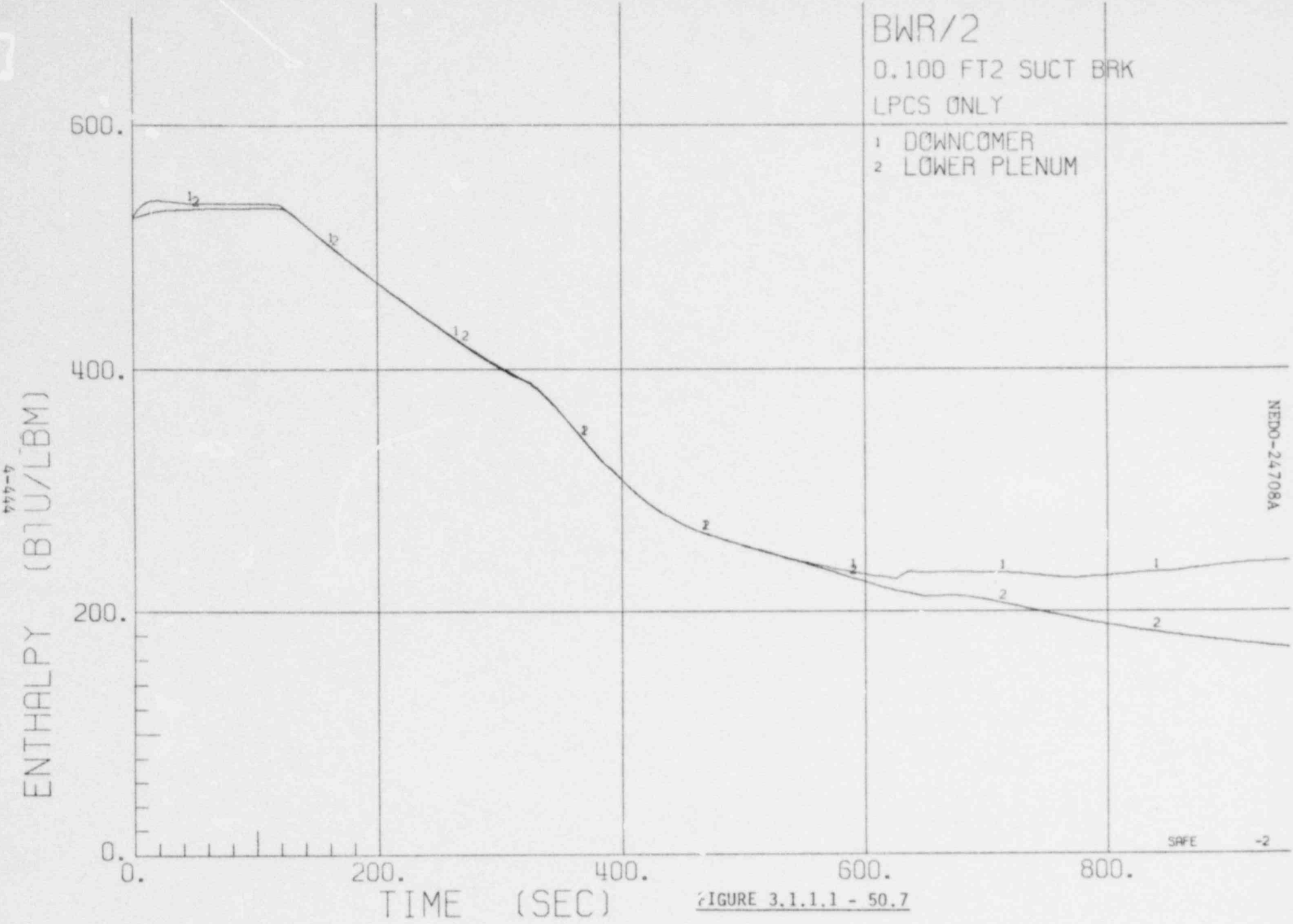

FIGURE 3.1.1.1 - 50.7

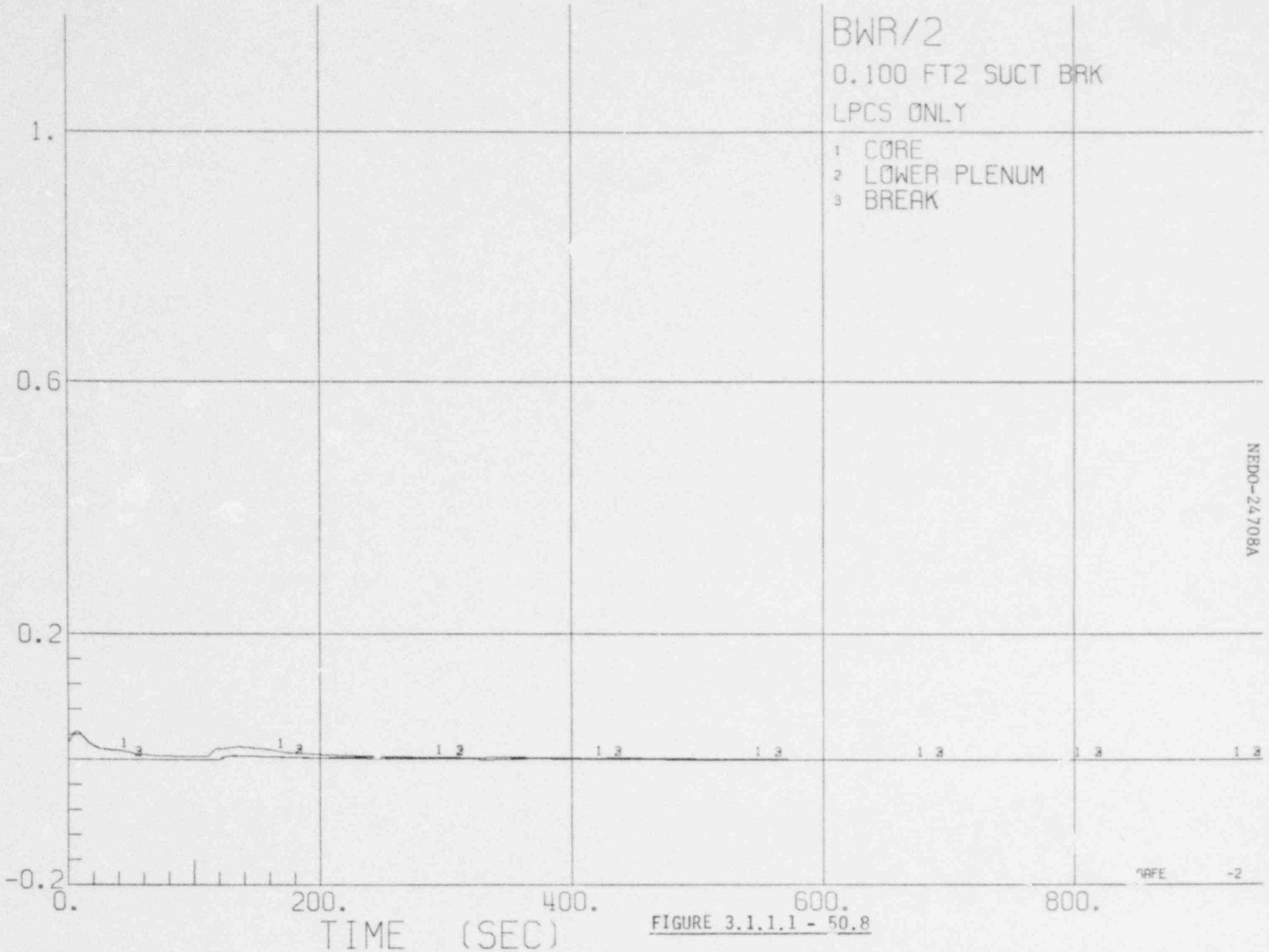

FIGURE 3.1.1.1 - 50.8

FIGURE 3.1.1.1 - 51.1

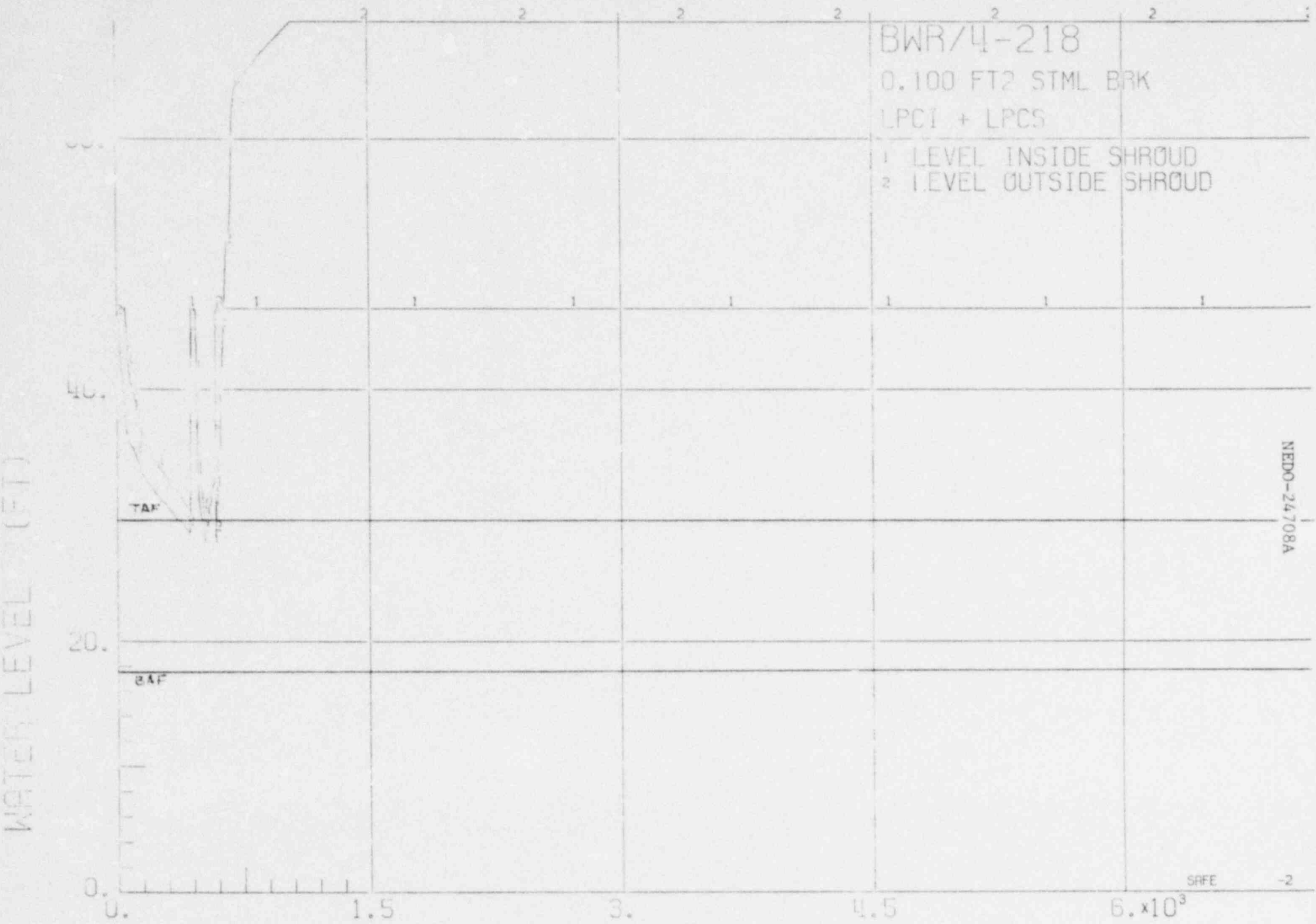

FIGURE 3.1.1.1 - 51.2

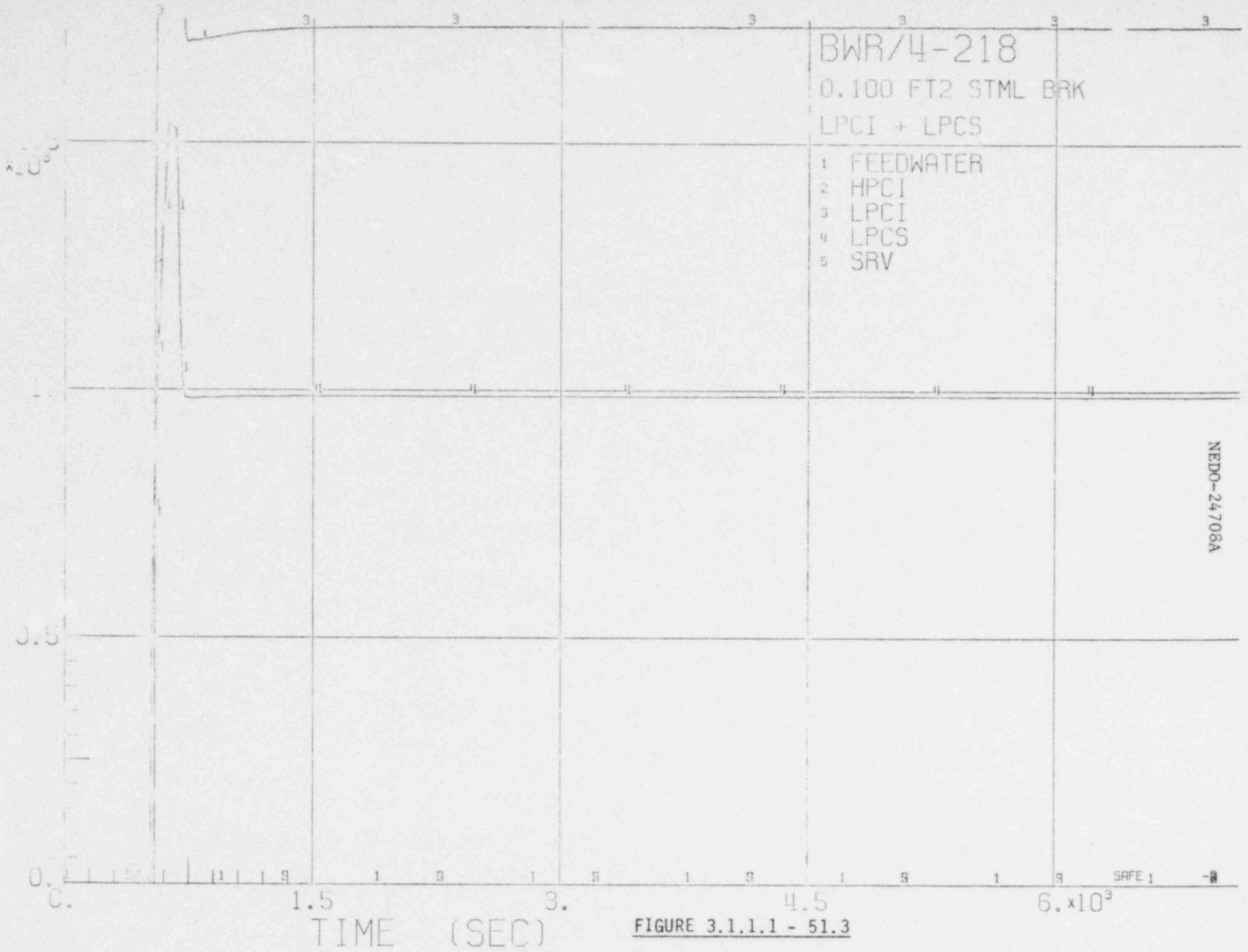

FIGURE 3.1.1.1 - 51.3

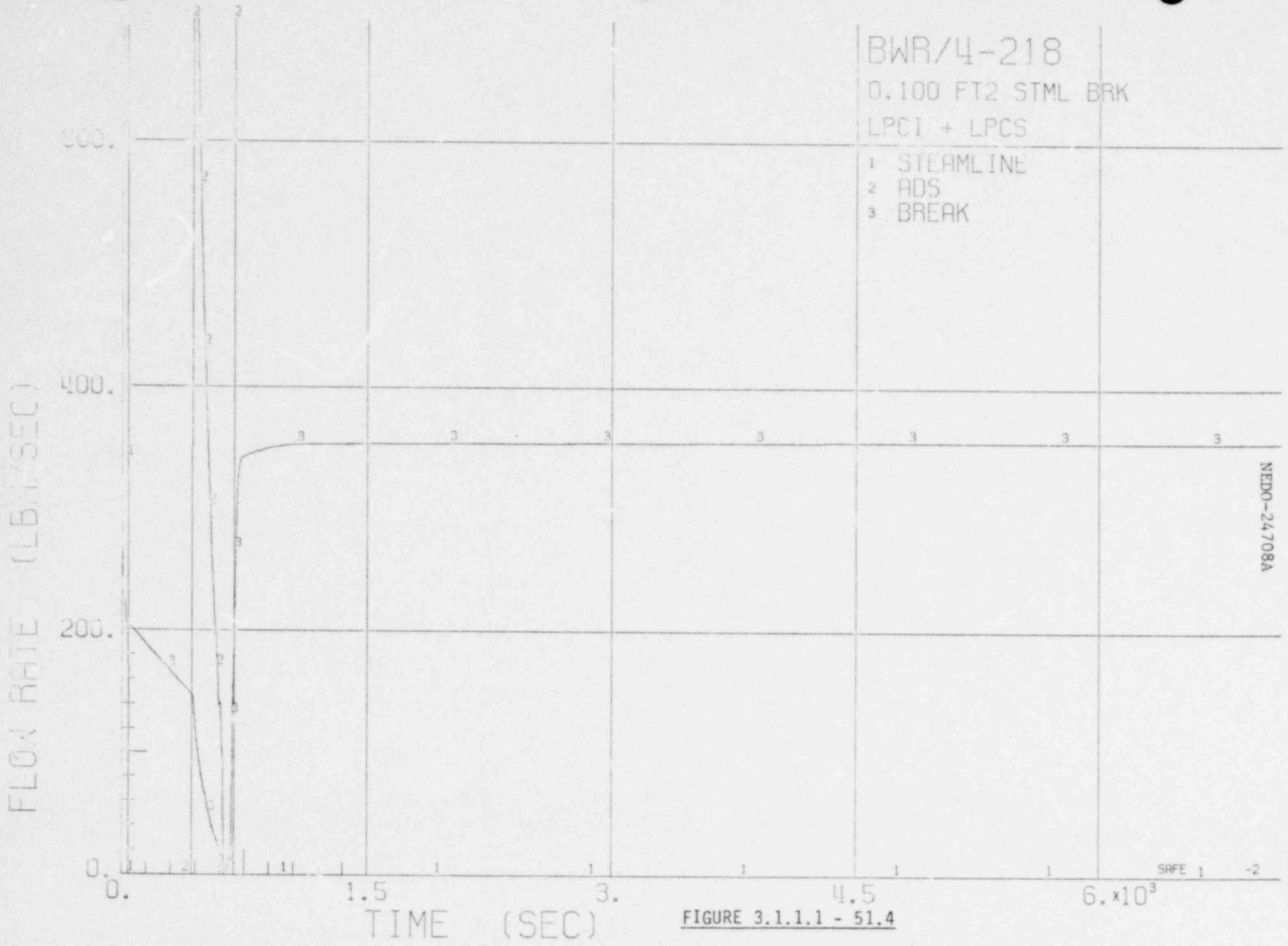

FIGURE 3.1.1.1 - 51.4

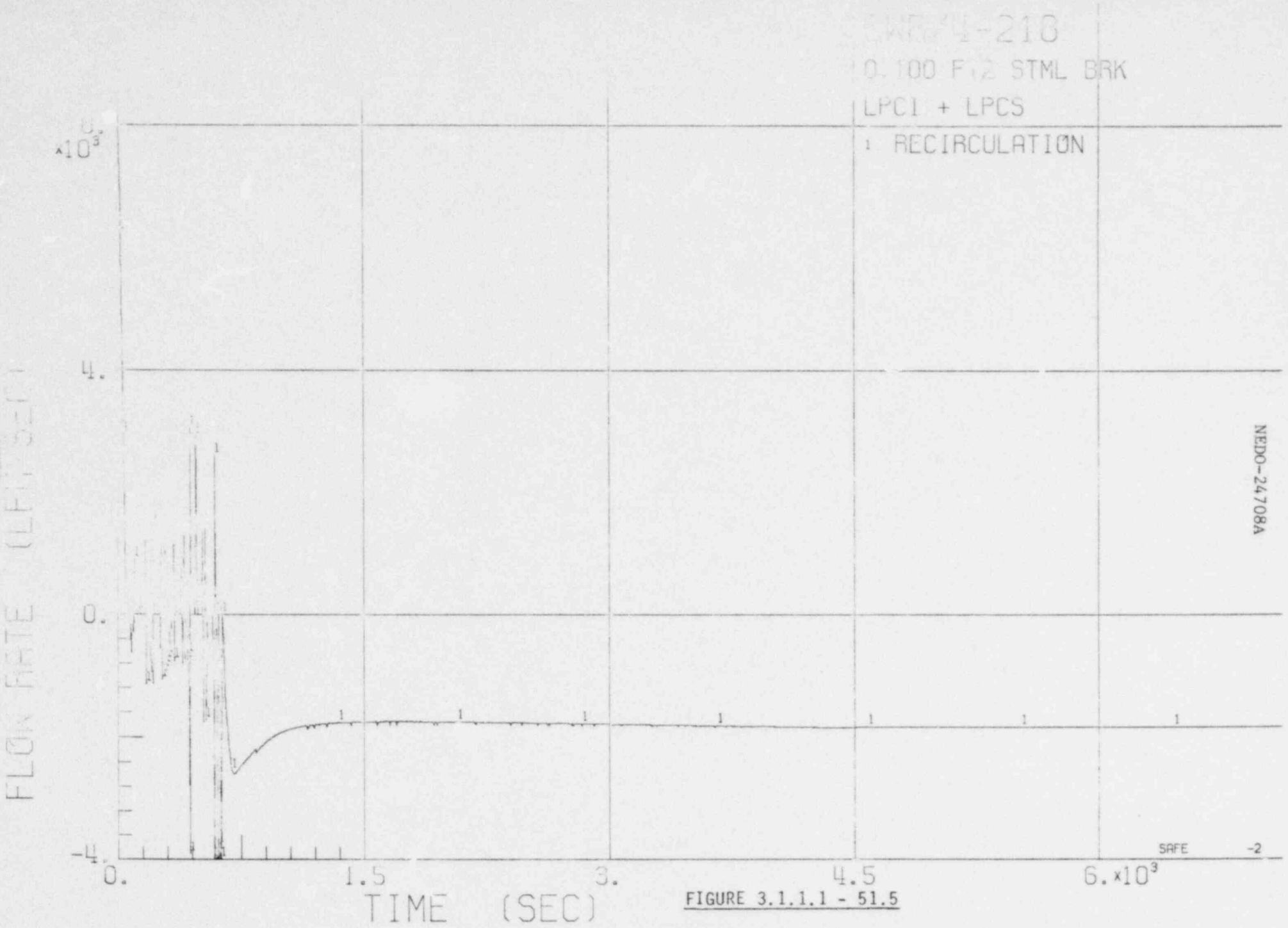

FIGURE 3.1.1.1 - 51.5

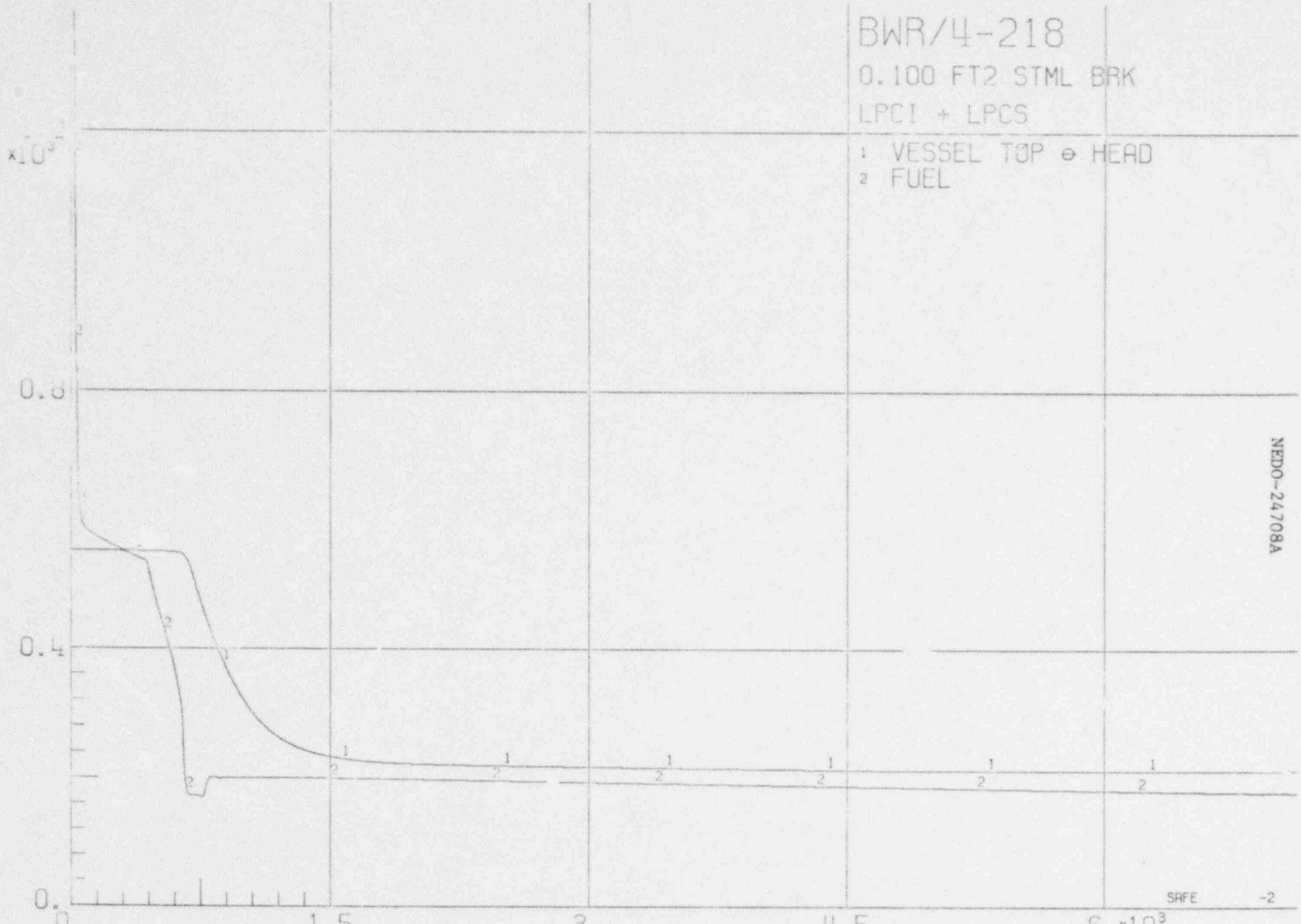

FIGURE 3.1.1.1 - 51.6

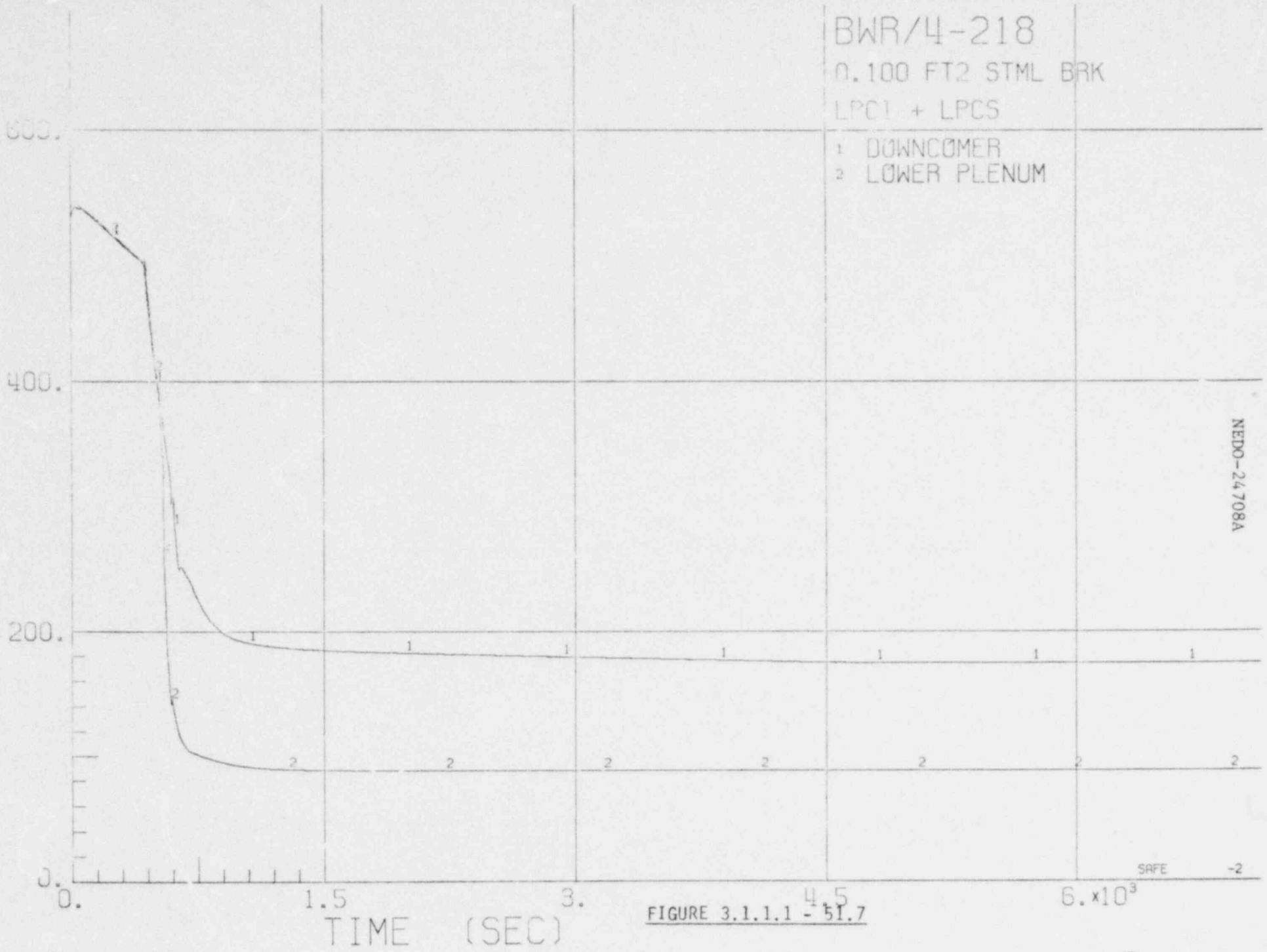

FIGURE 3.1.1.1 - 51.7

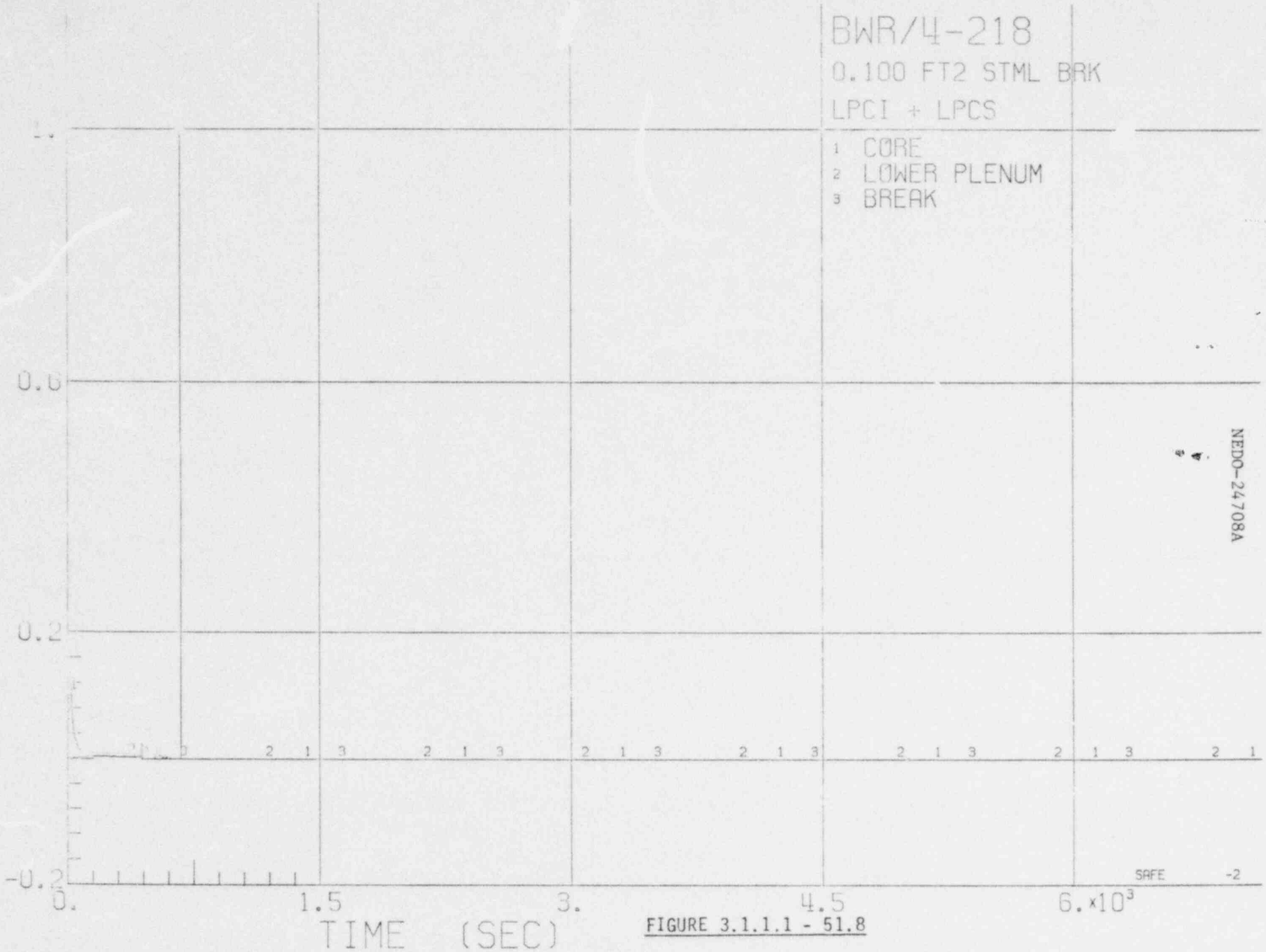

FIGURE 3.1.1.1 - 51.8

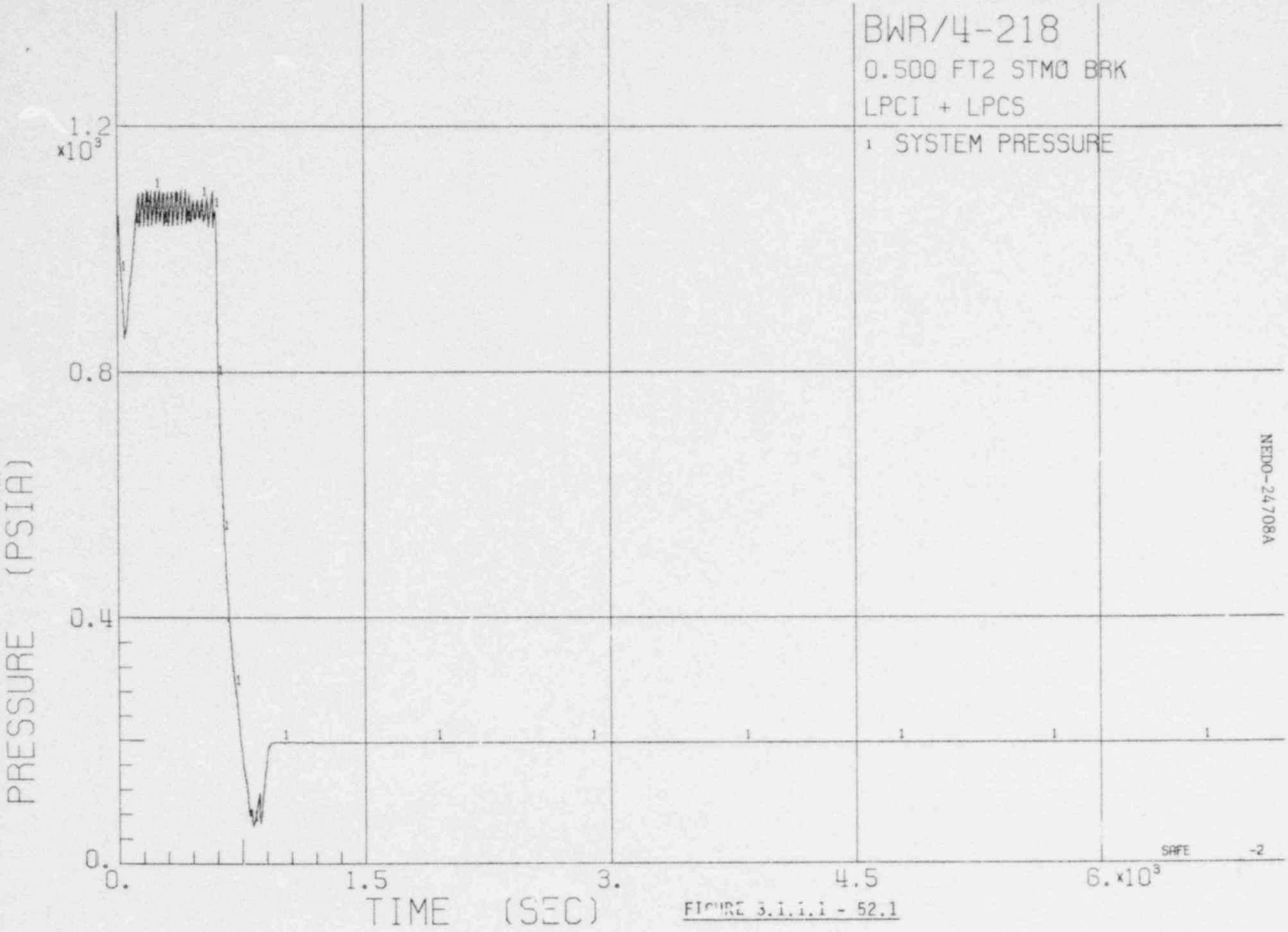

FIGURE 3.1.1.1 - 52.1

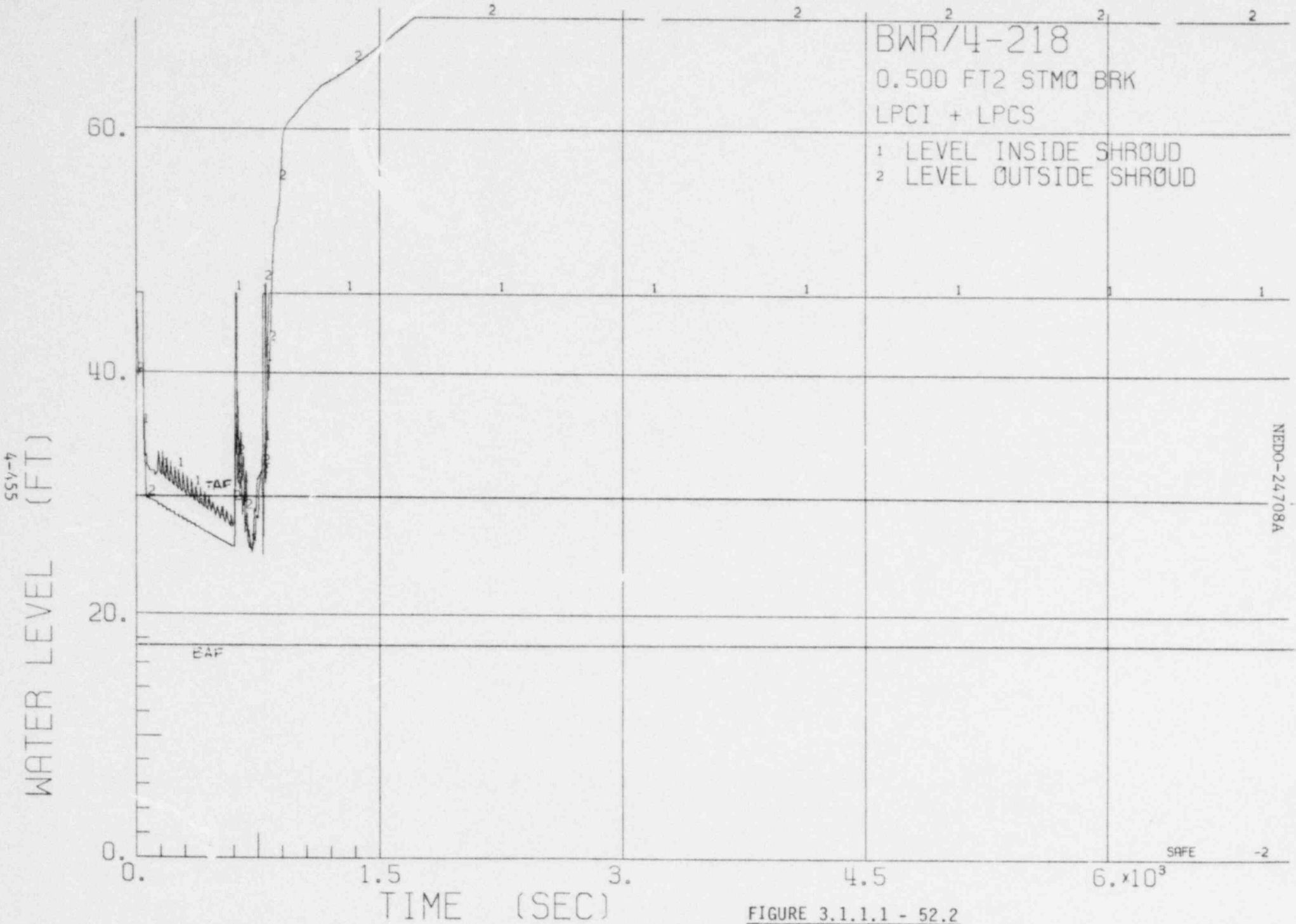

FIGURE 3.1.1.1 - 52.2

FIGURE 3 1 1.1 - 52.3

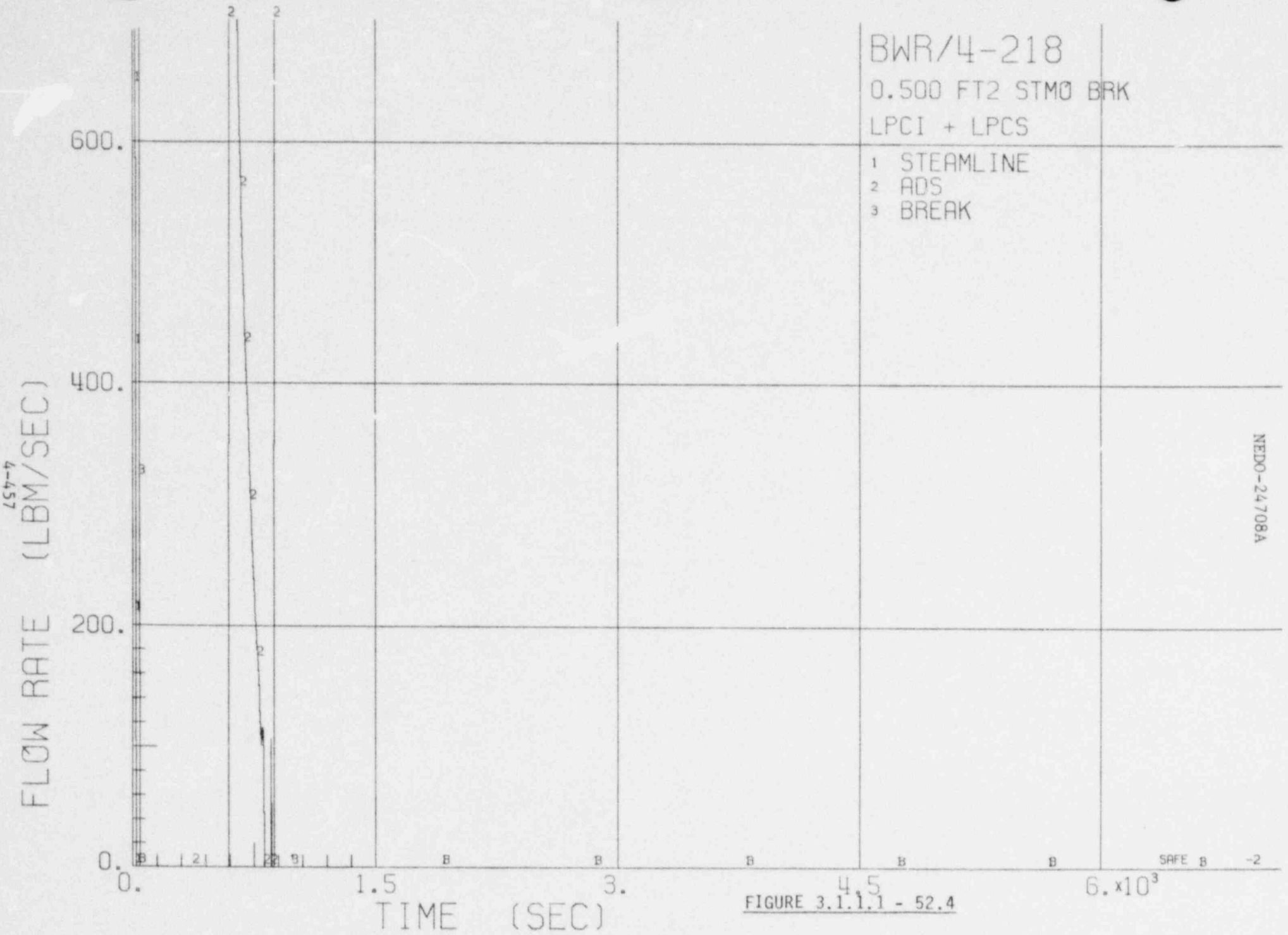

FIGURE 3.1.1.1 - 52.4

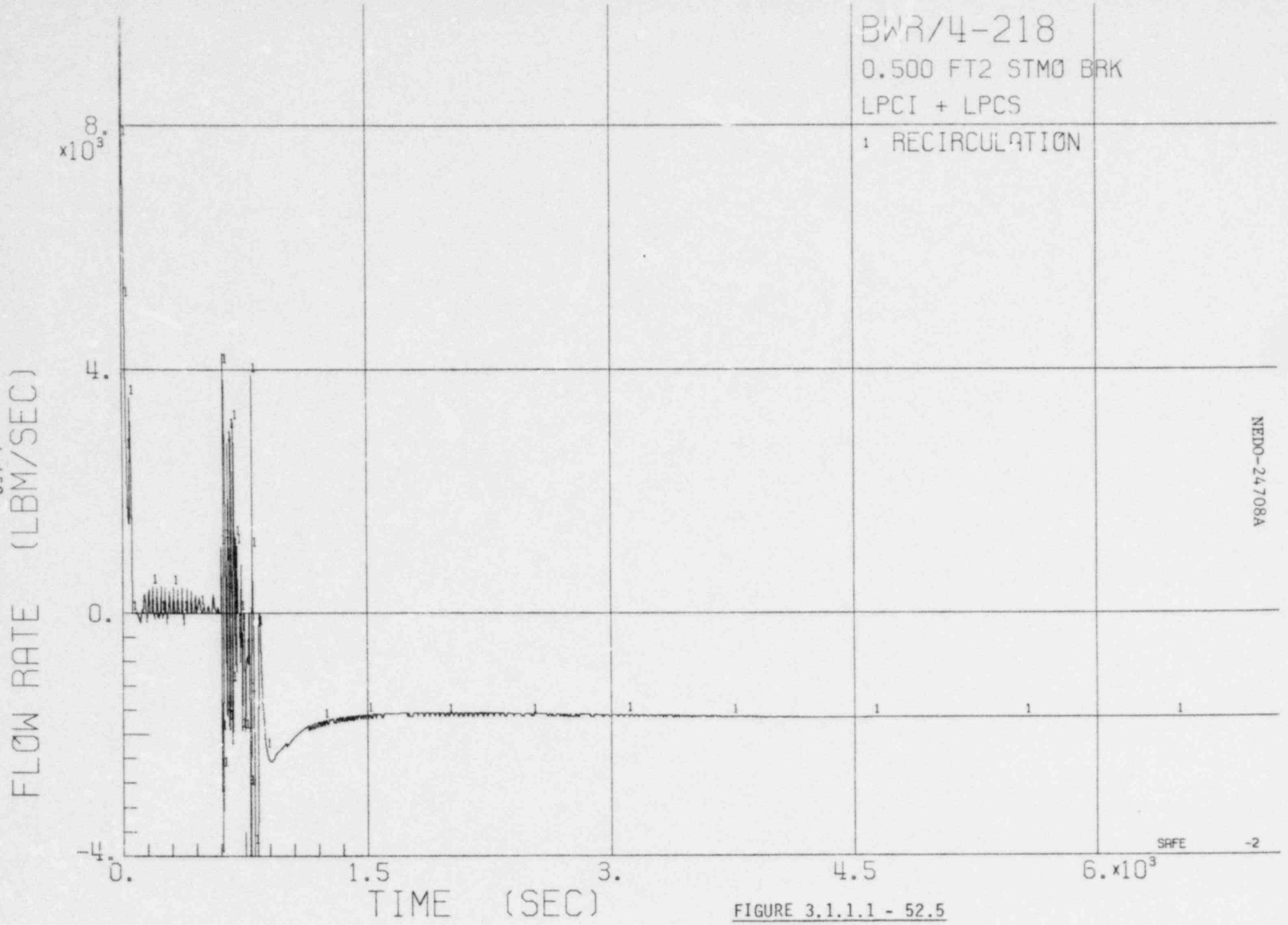

FIGURE 3.1.1.1 - 52.5

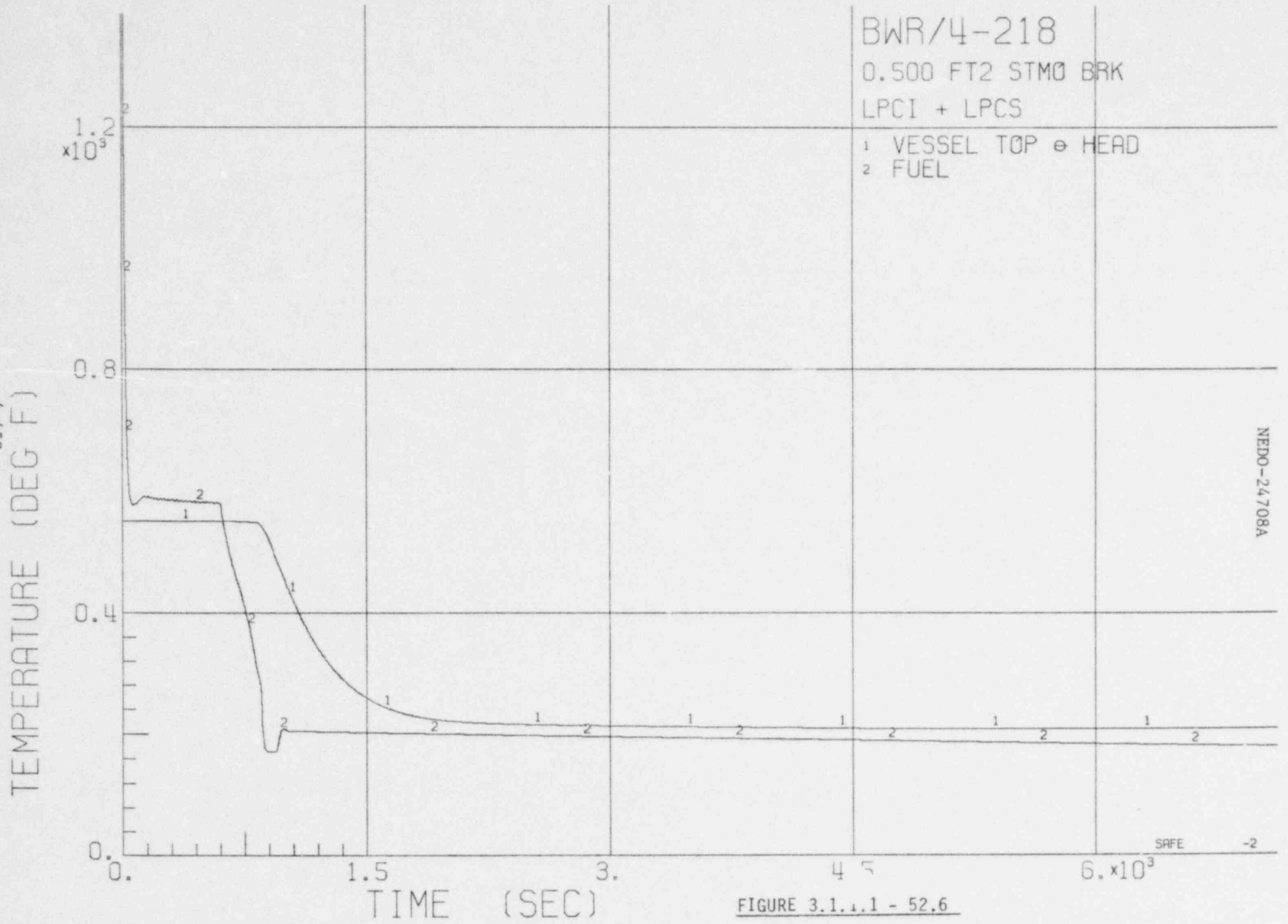

FIGURE 3.1.1.1 - 52.6

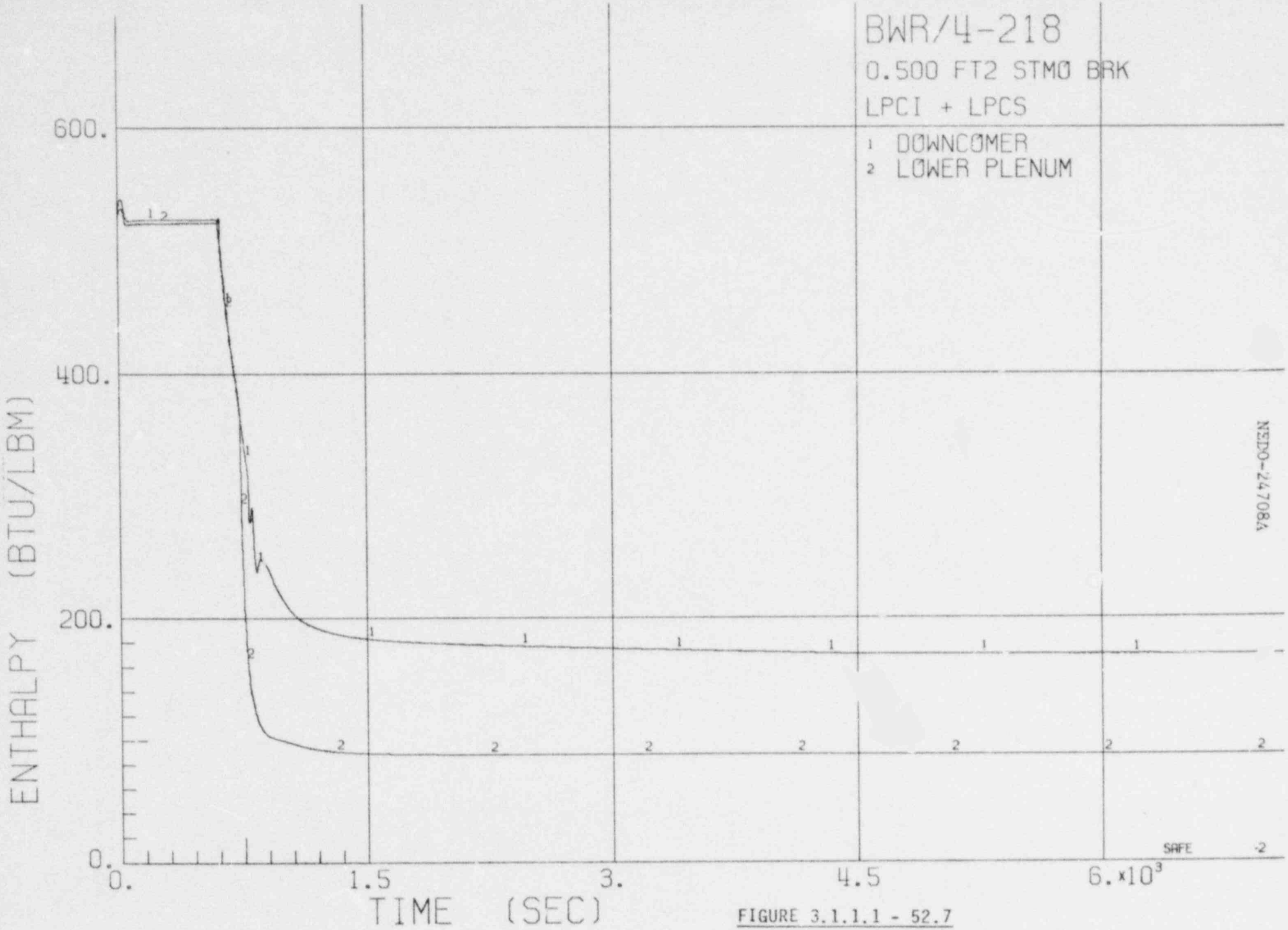

FIGURE 3.1.1.1 - 52.7

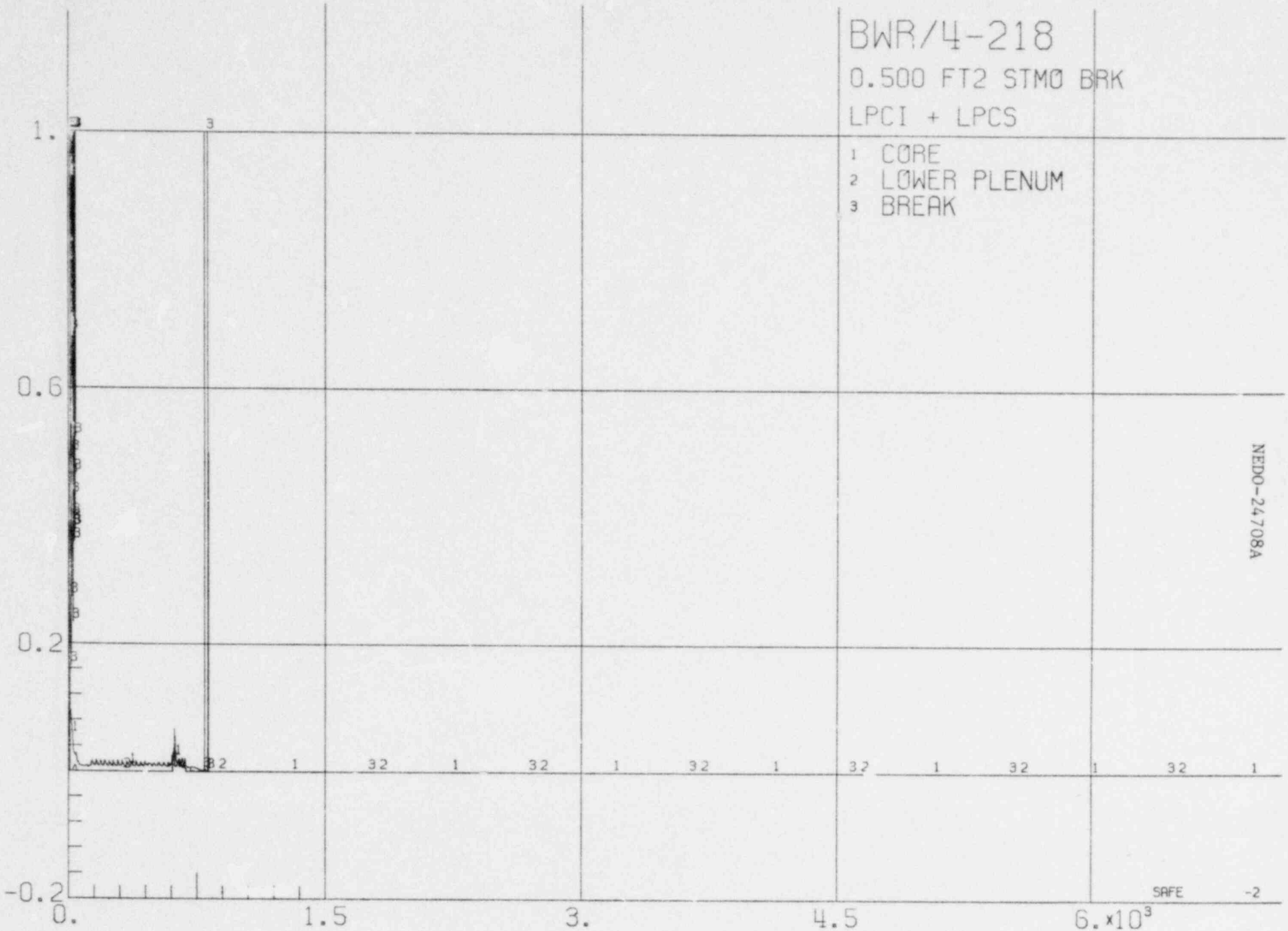

FIGURE 3.1.1.1 - 52.8

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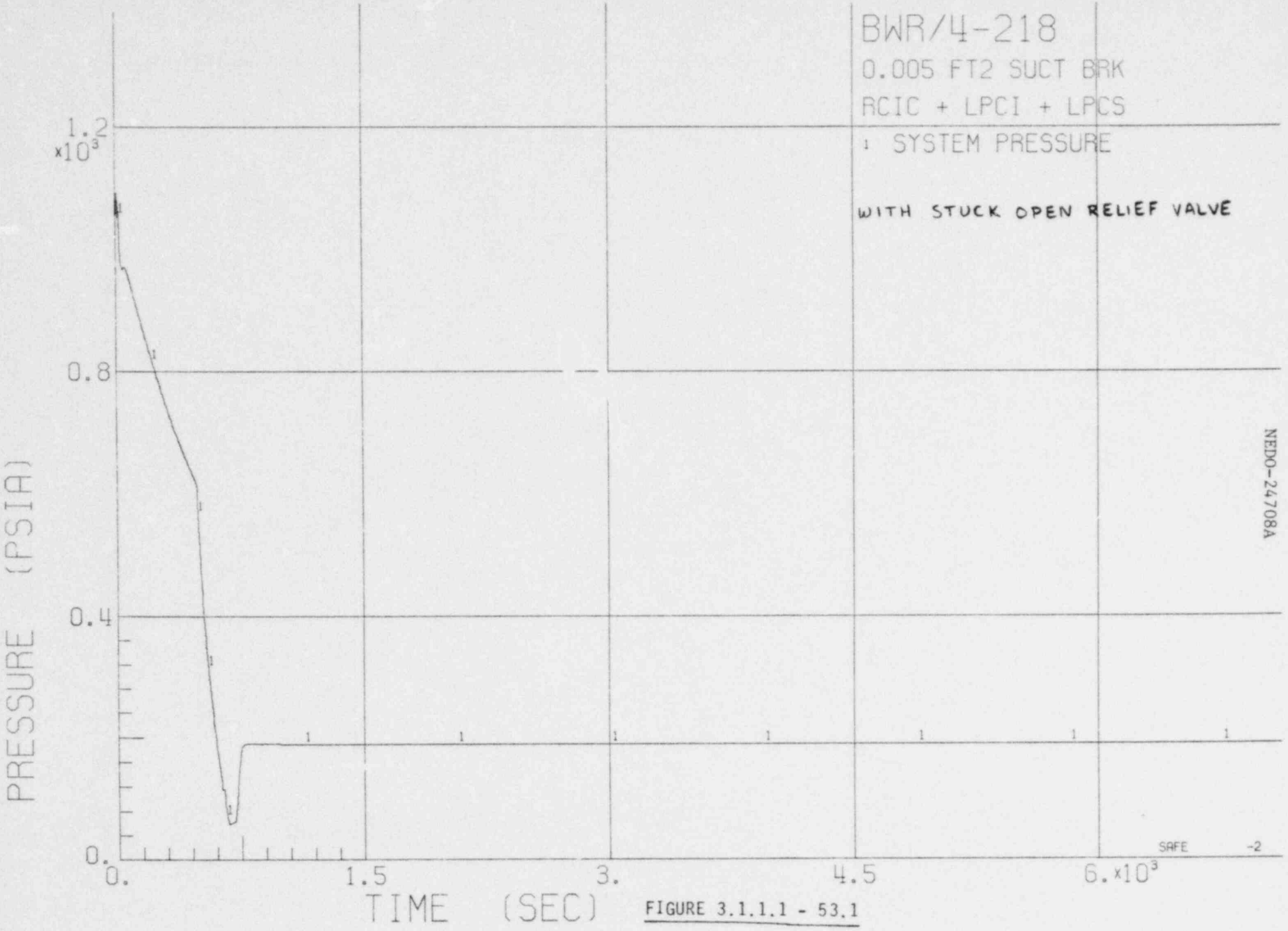

FIGURE 3.1.1.1 - 53.1

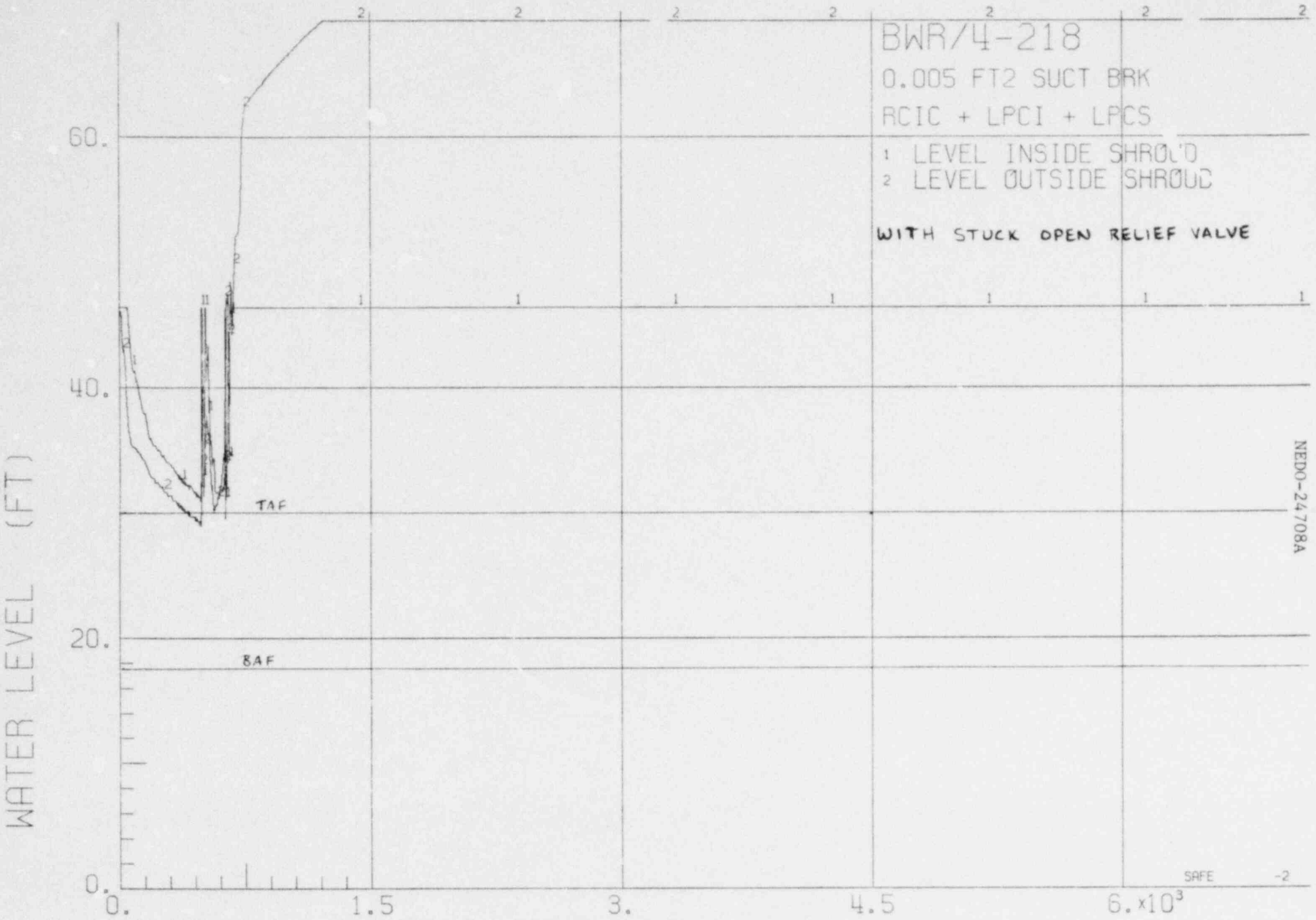

FIGURE 3.1.1.1 - 53.2

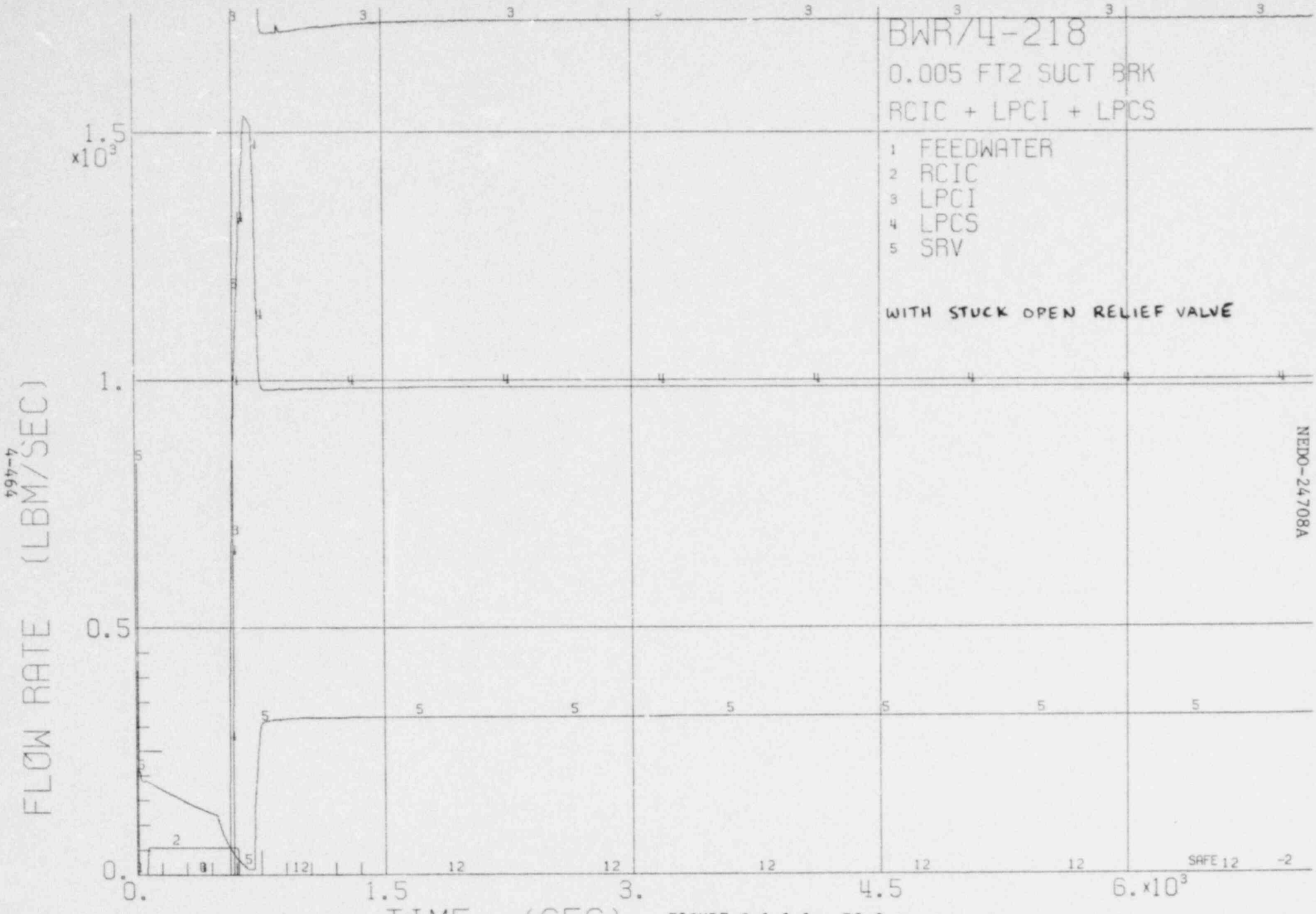

FIGURE 3.1.1.1 - 53.3

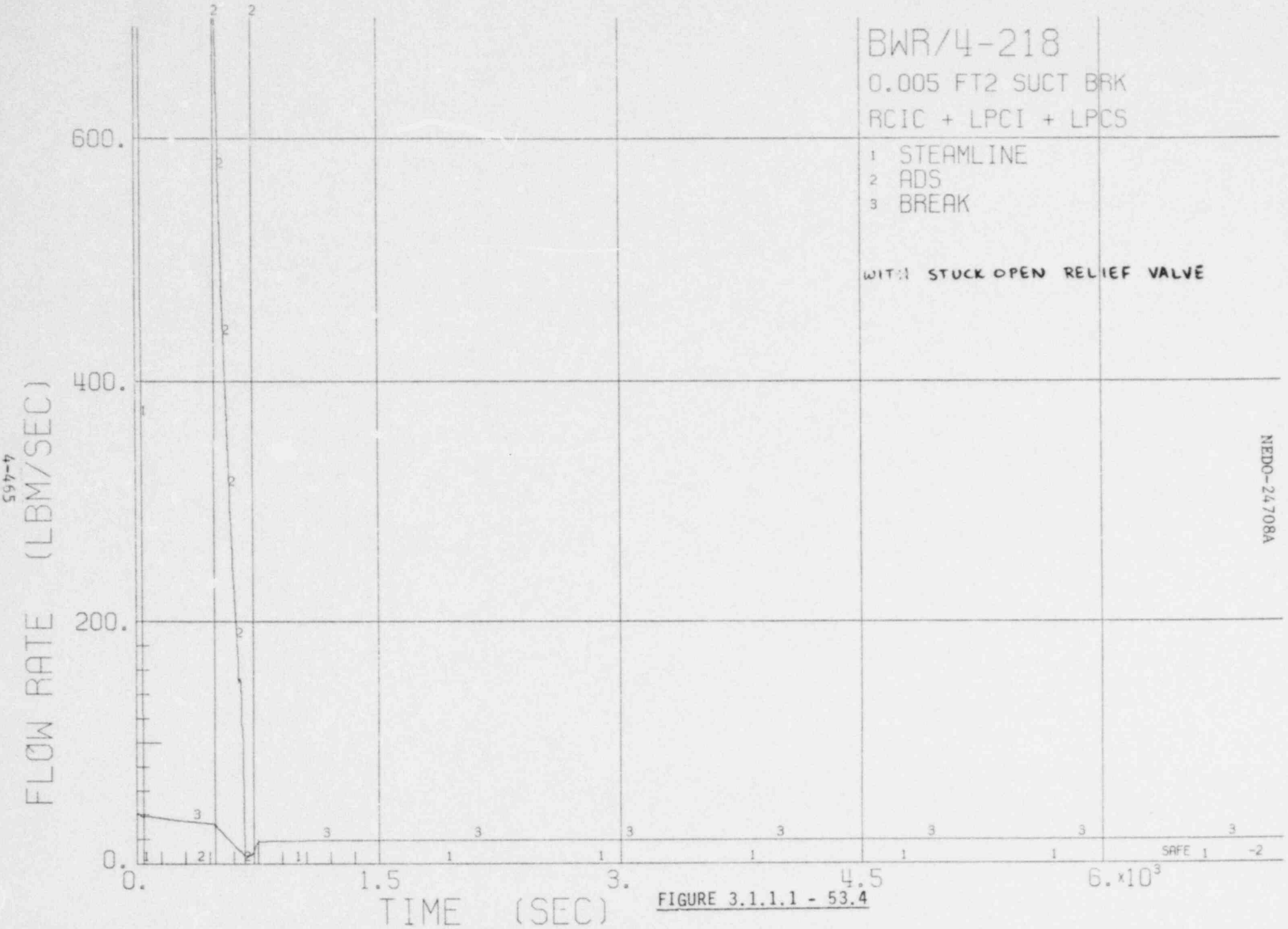

FIGURE 3.1.1.1 - 53.4

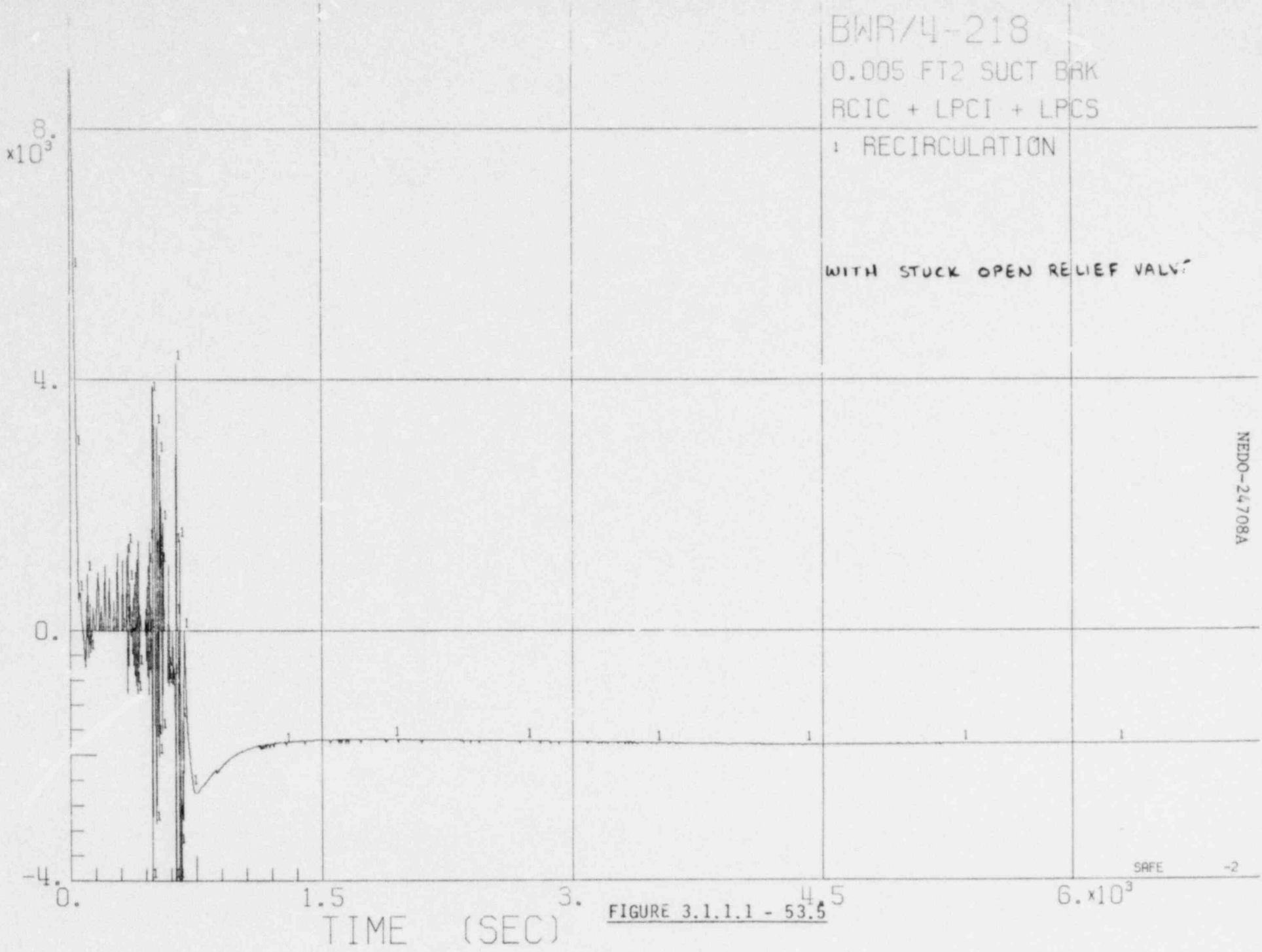

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FIGURE 3.1.1.1 - 53.5

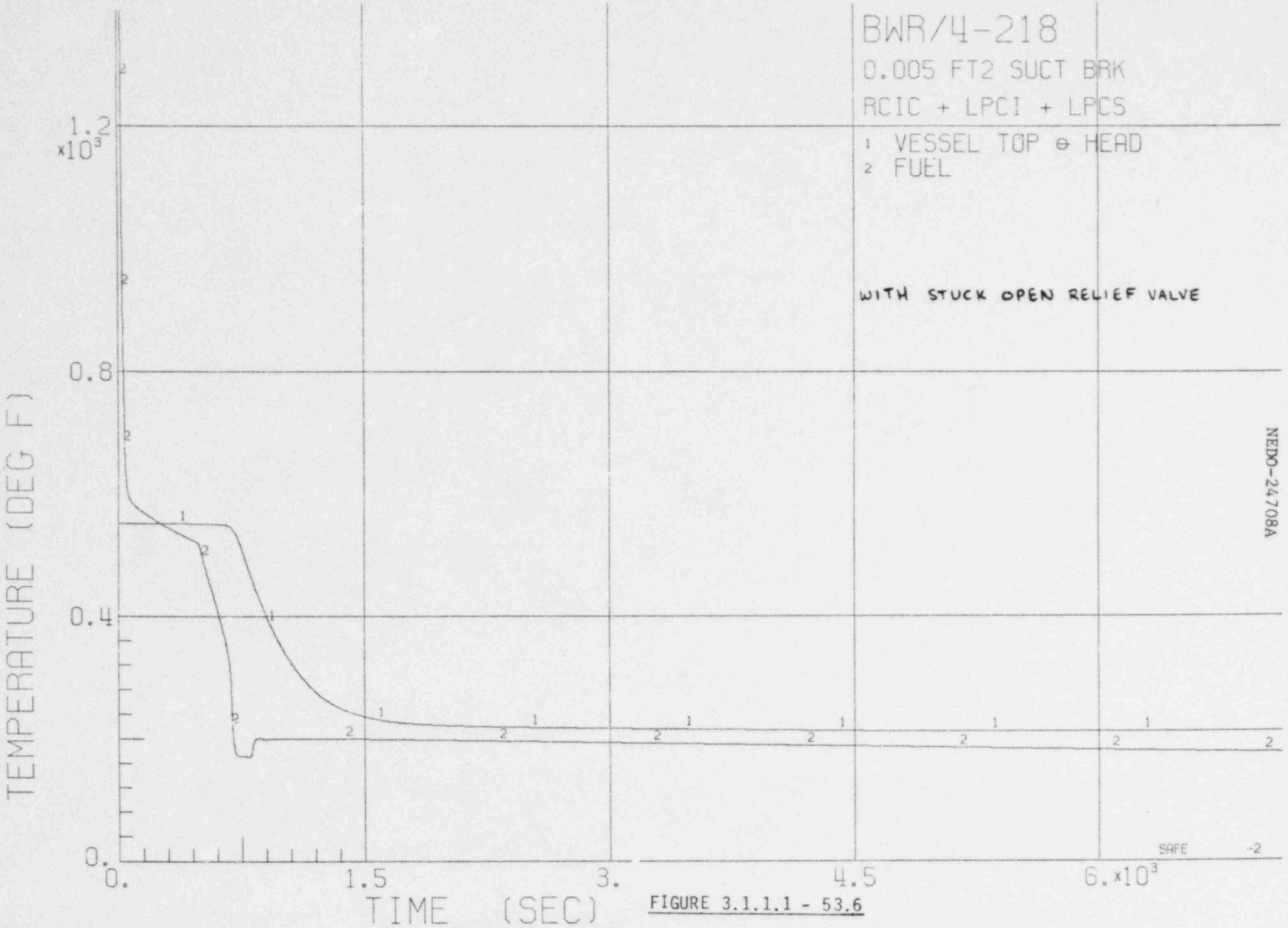

FIGURE 3.1.1.1 - 53.6

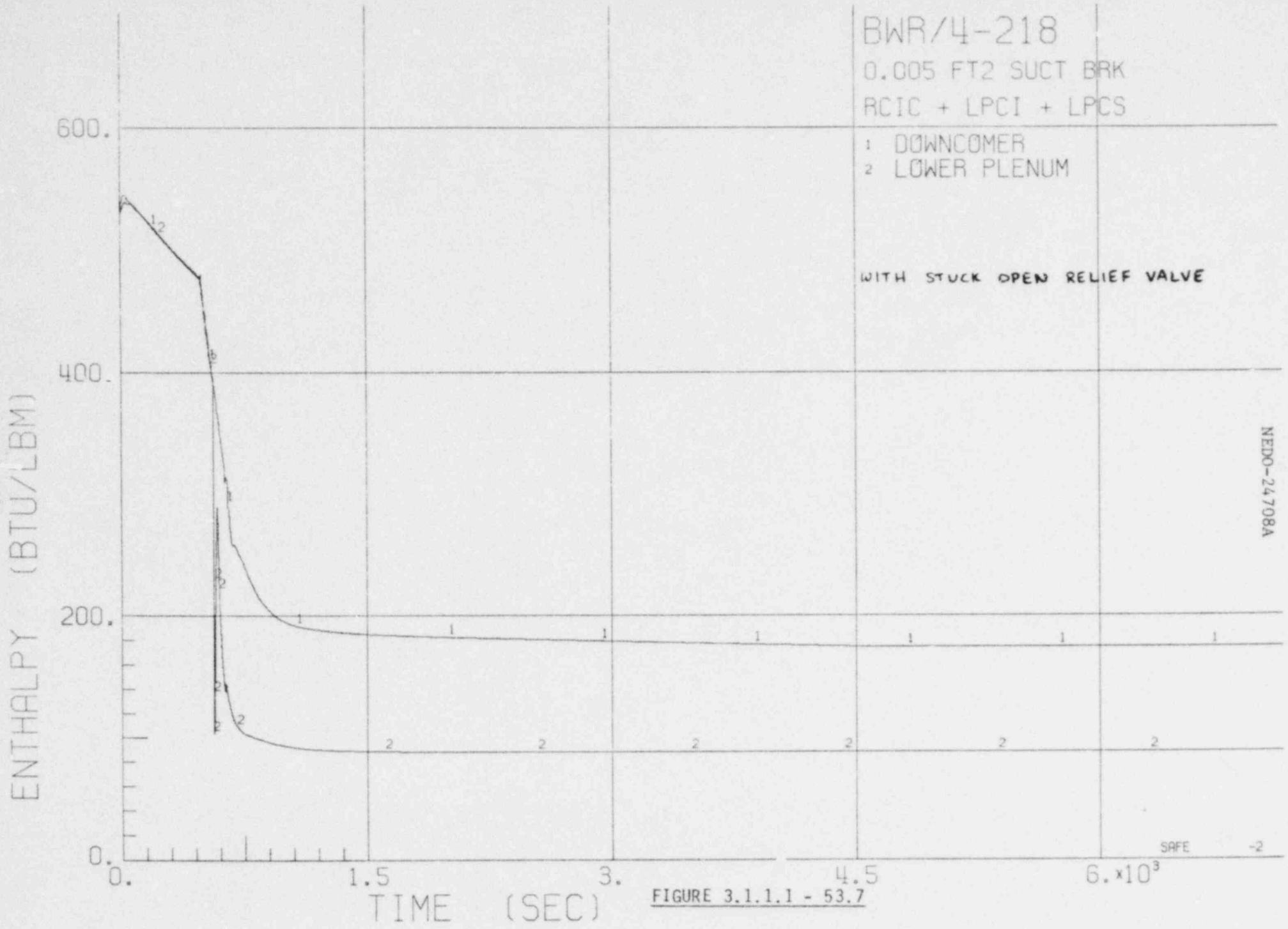

FIGURE 3.1.1.1 - 53.7

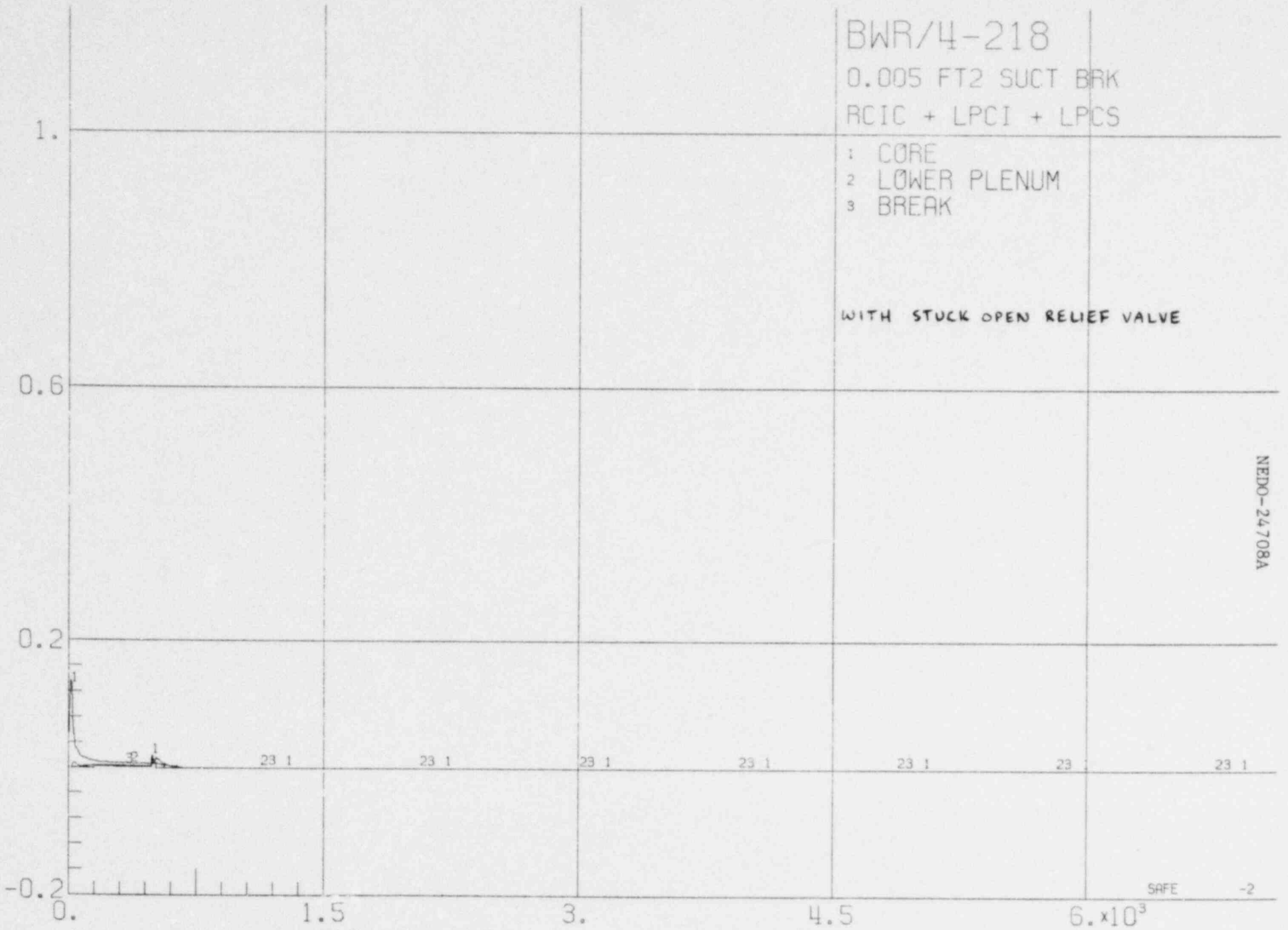

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FIGURE 3.1.1.1 - 53.8

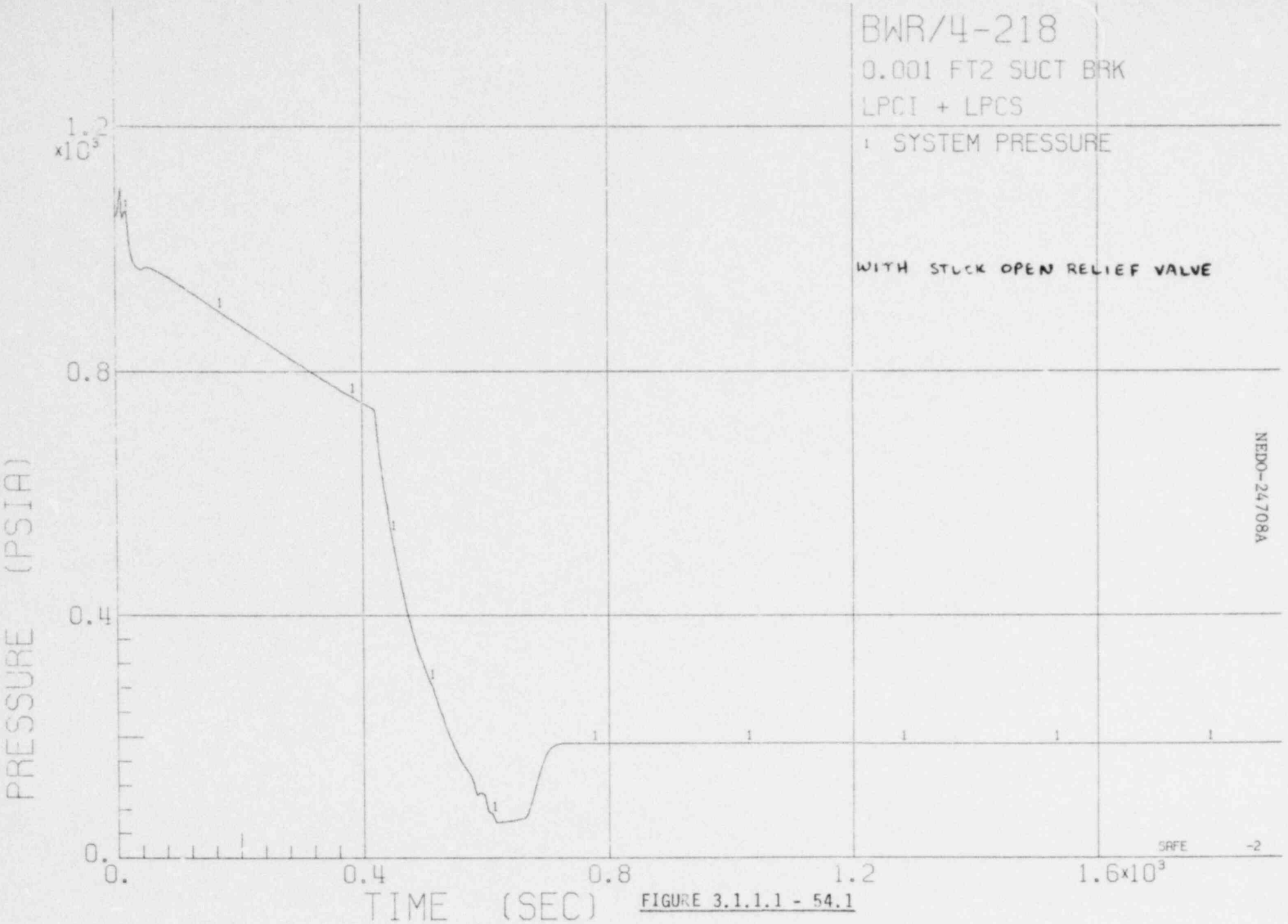

FIGURE 3.1.1.1 - 54.1

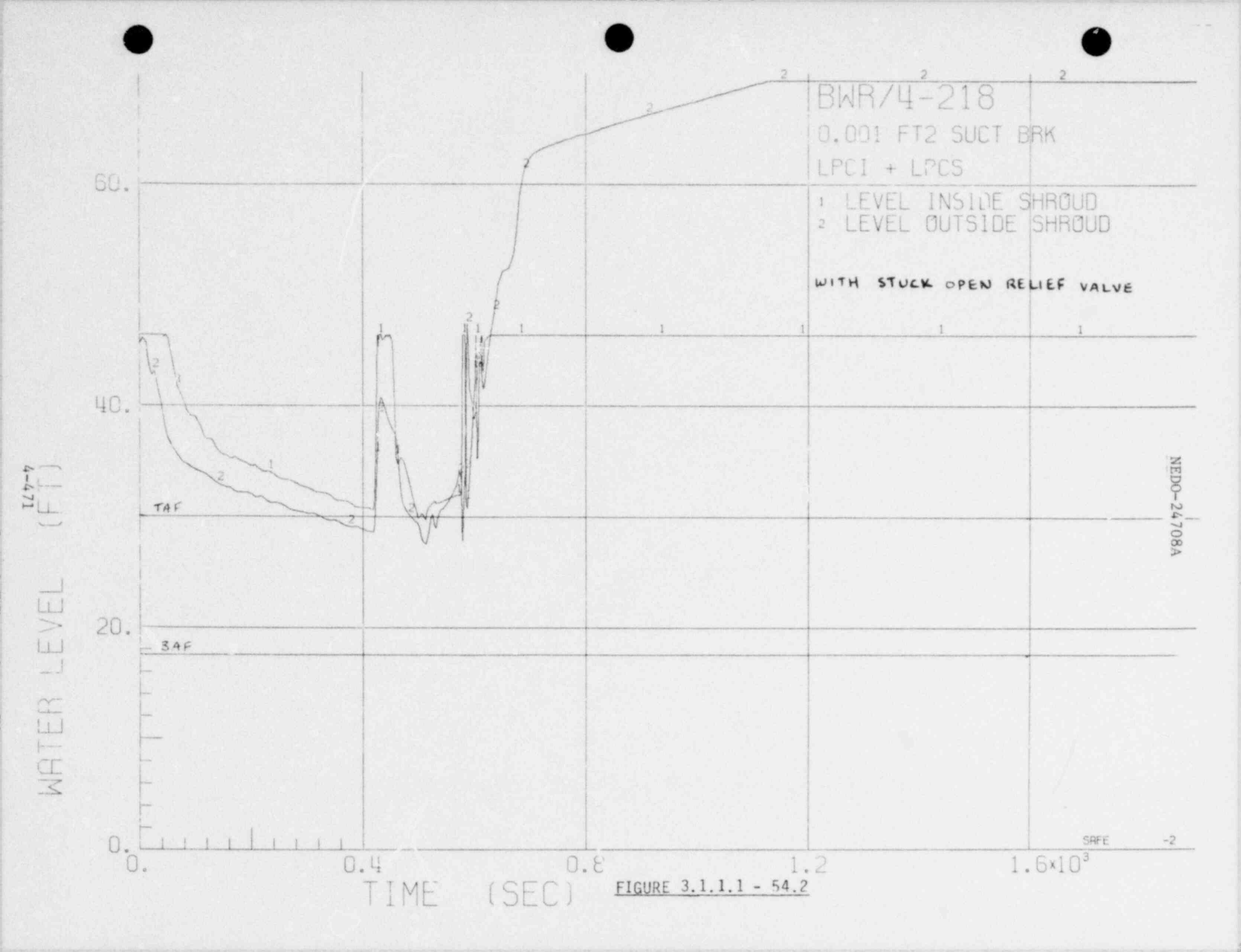

FIGURE 3.1.1.1 - 54.2

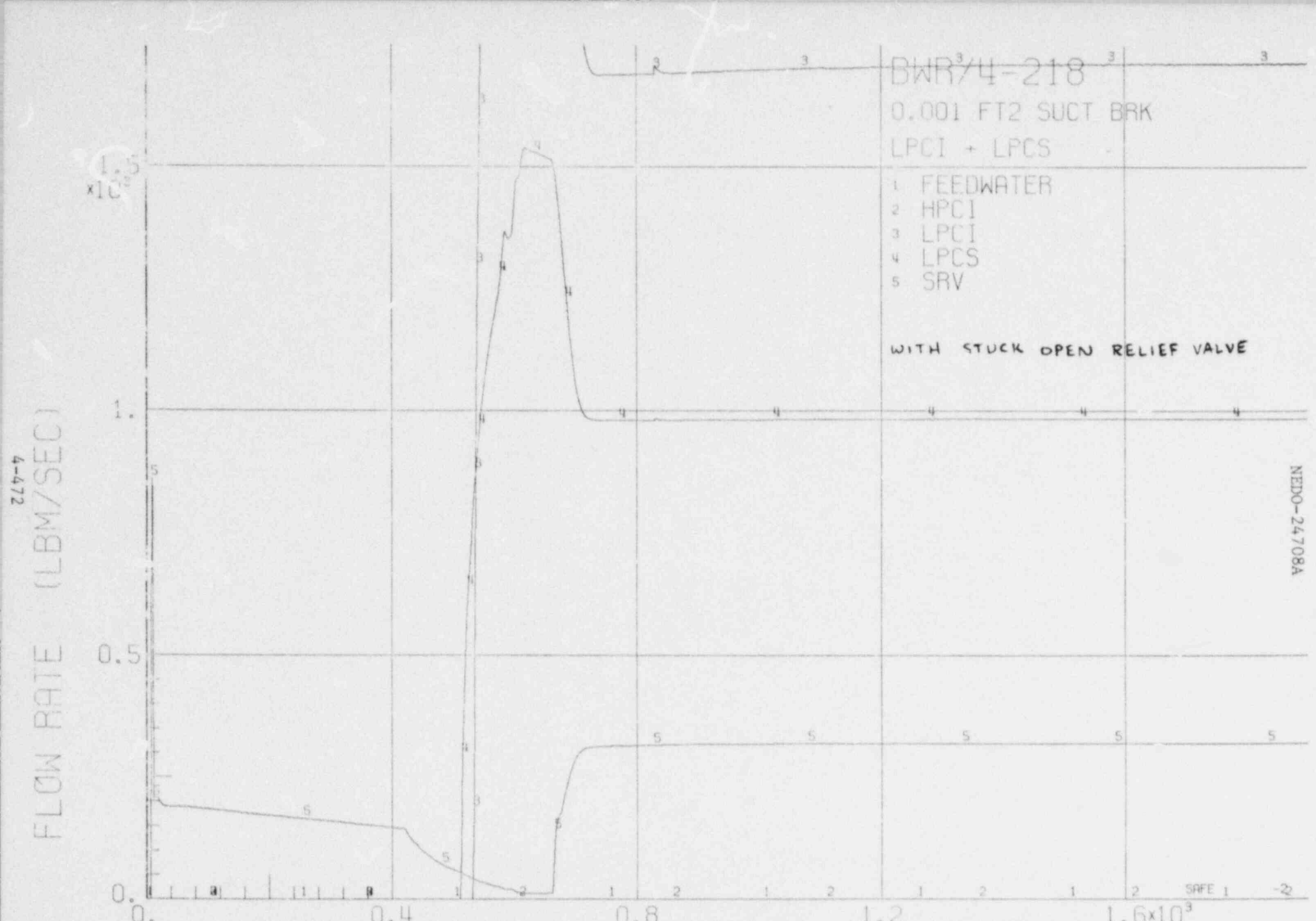

FIGURE 3.1.1.1 - 54.3

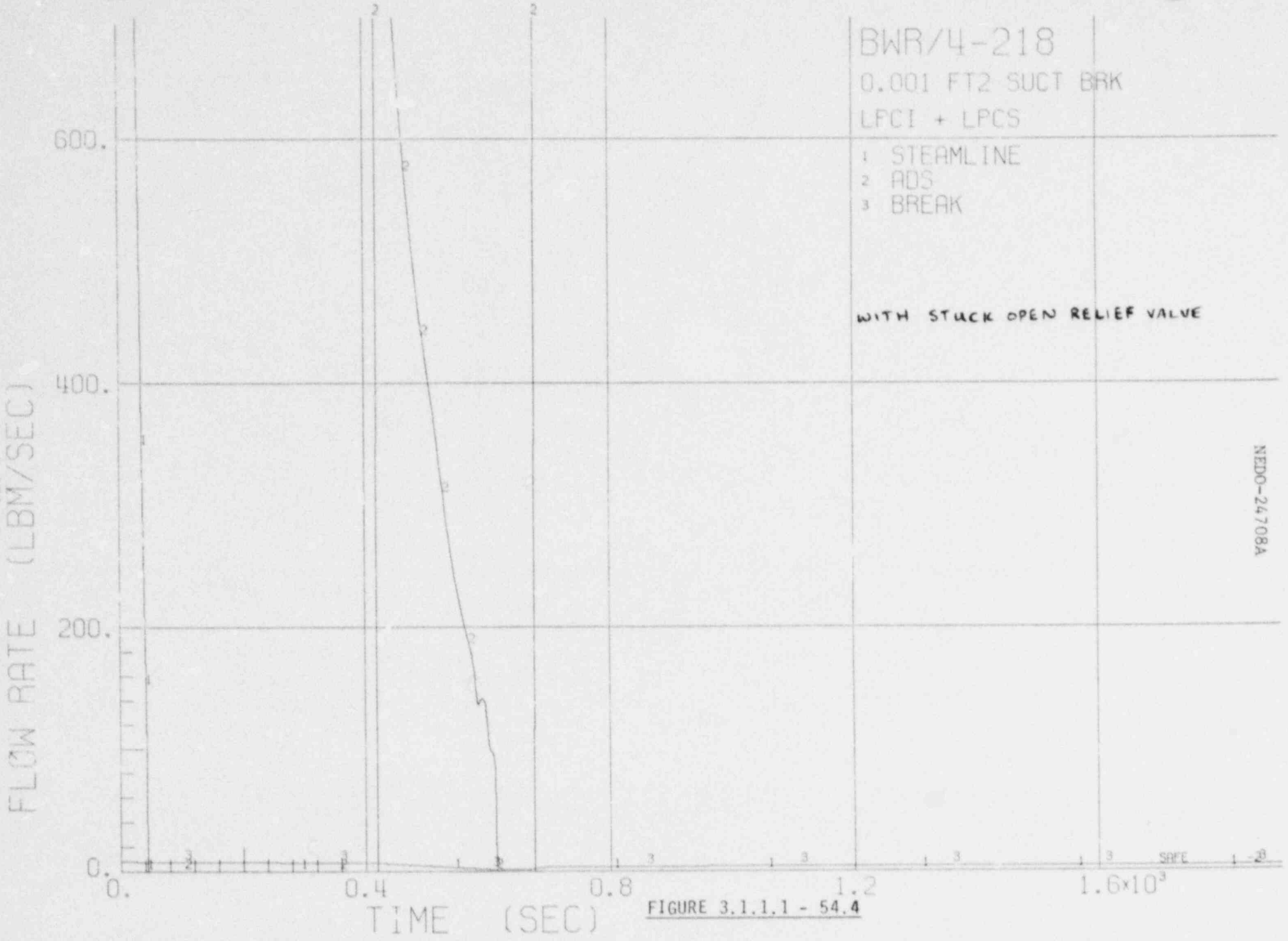

FIGURE 3.1.1.1 - 54.4

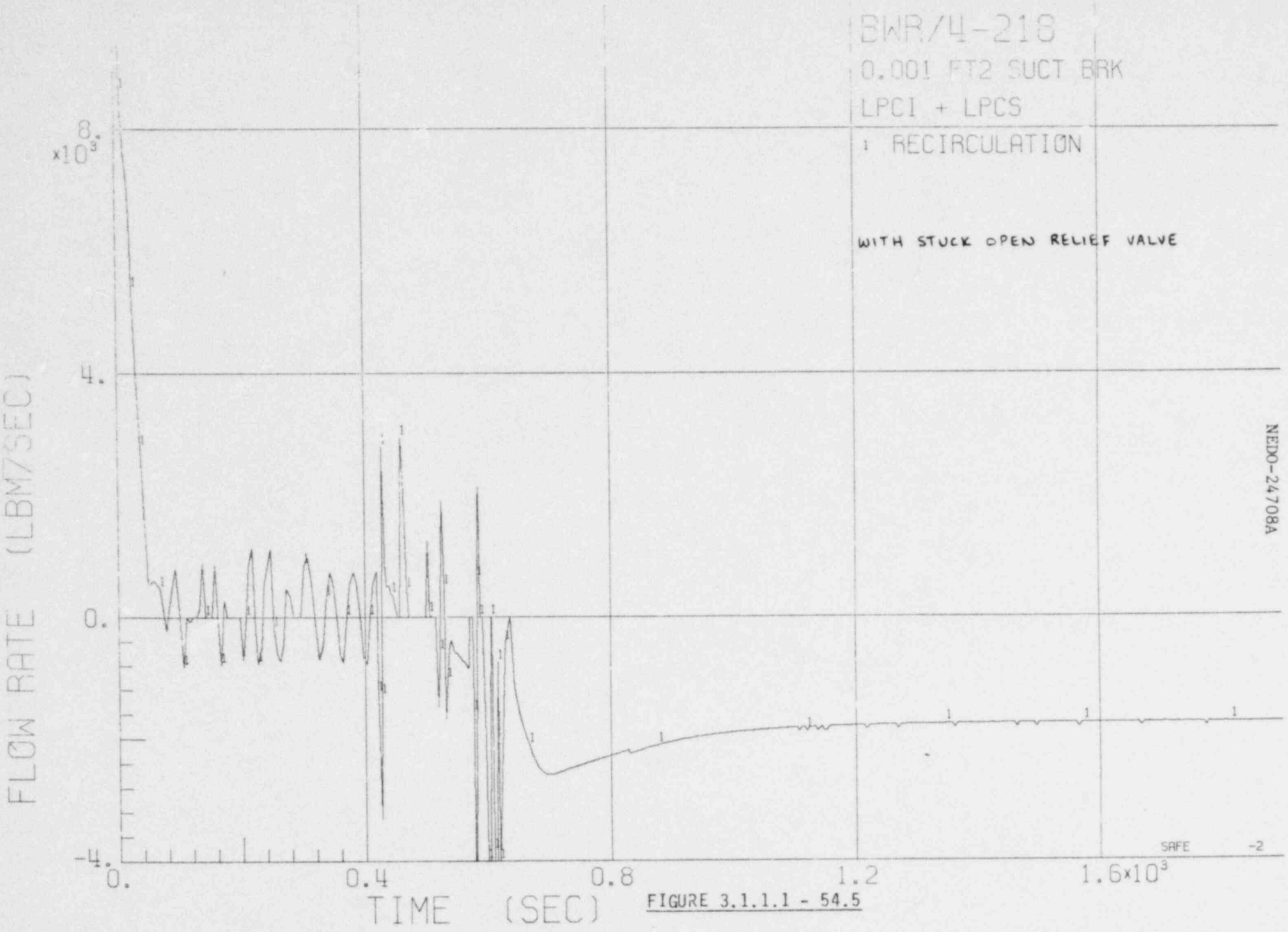

FIGURE 3.1.1.1 - 54.5

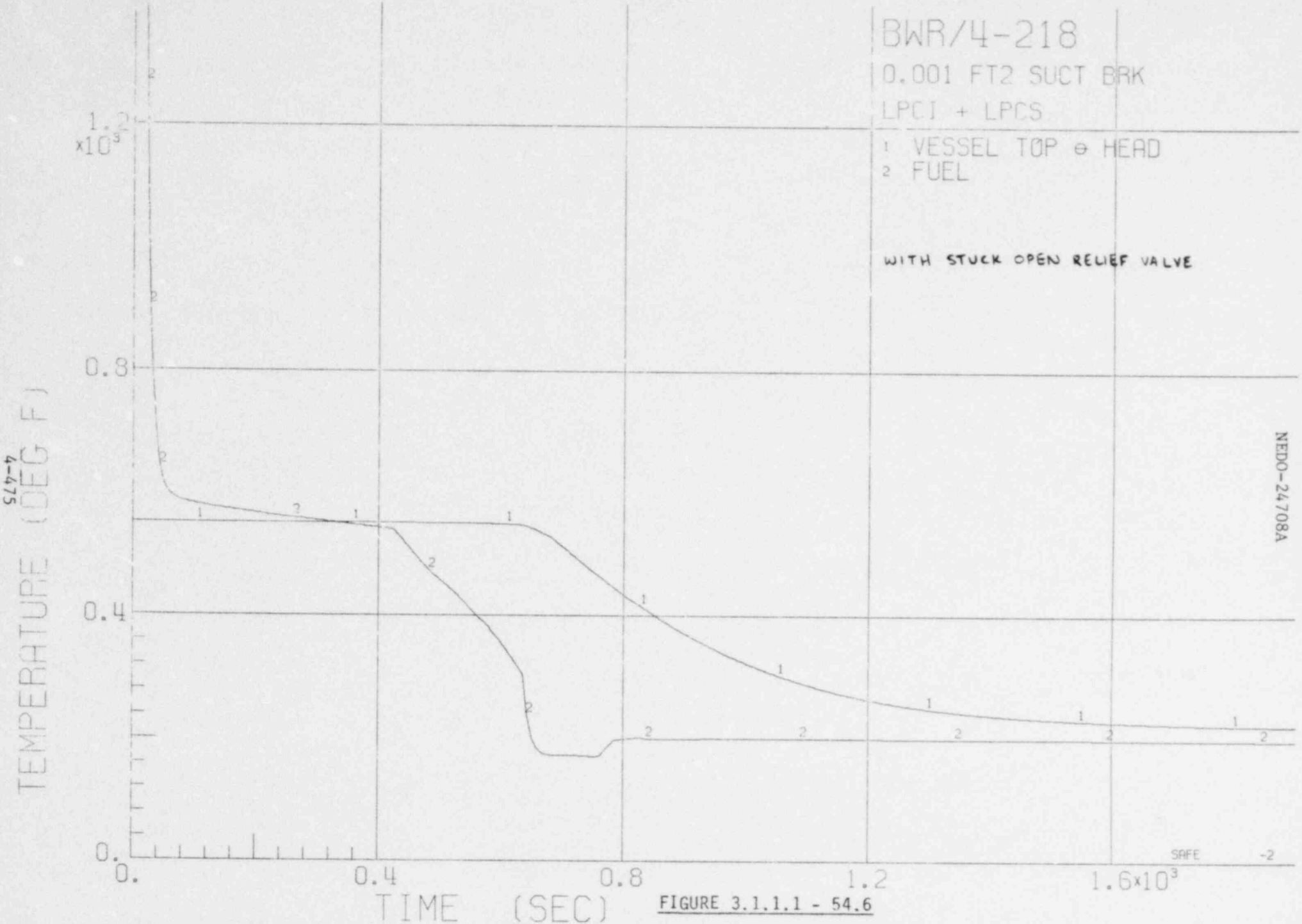

FIGURE 3.1.1.1 - 54.6

FIGURE 3.1.1.1 - 54.7

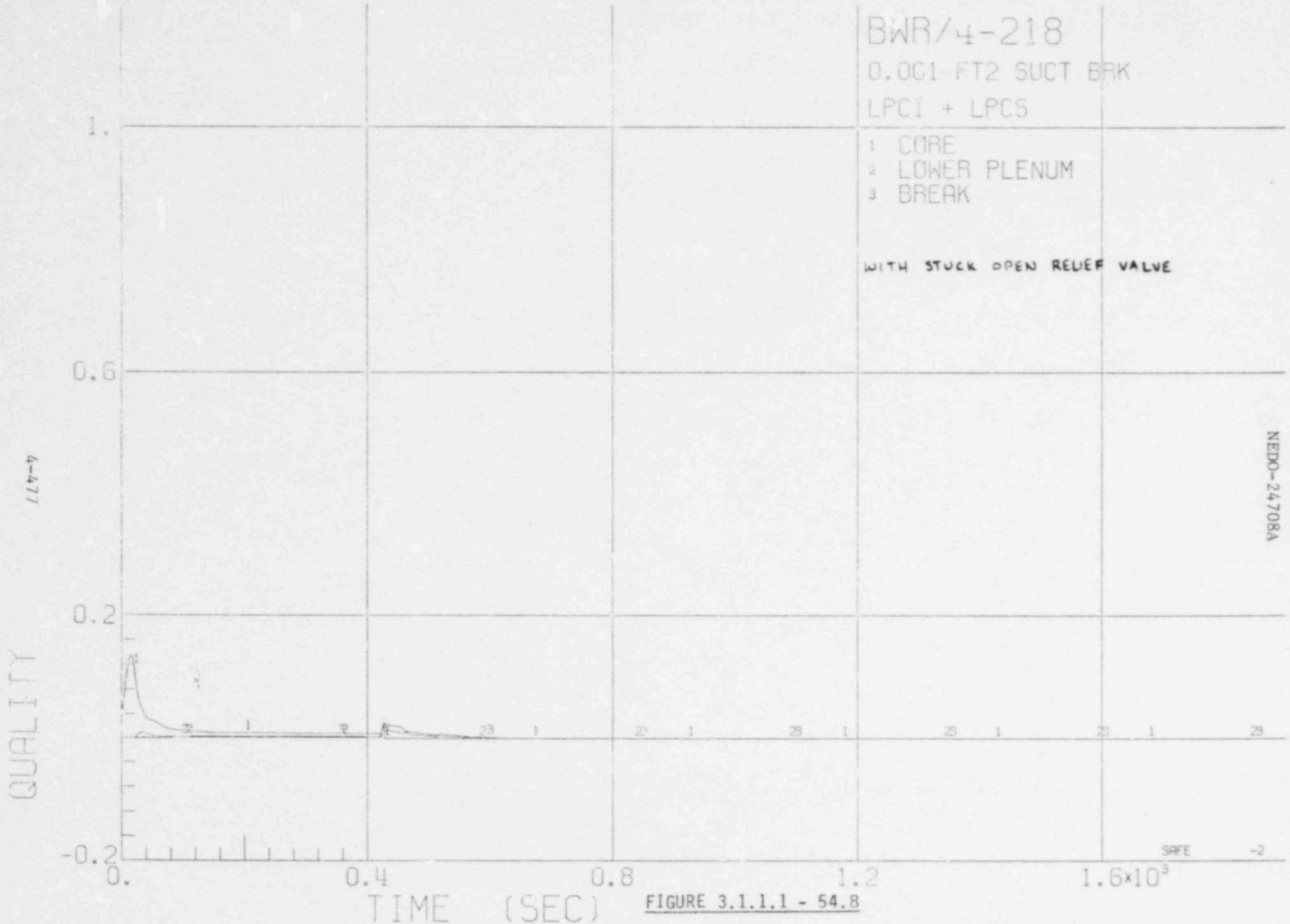

FIGURE 3.1.1.1 - 54.8

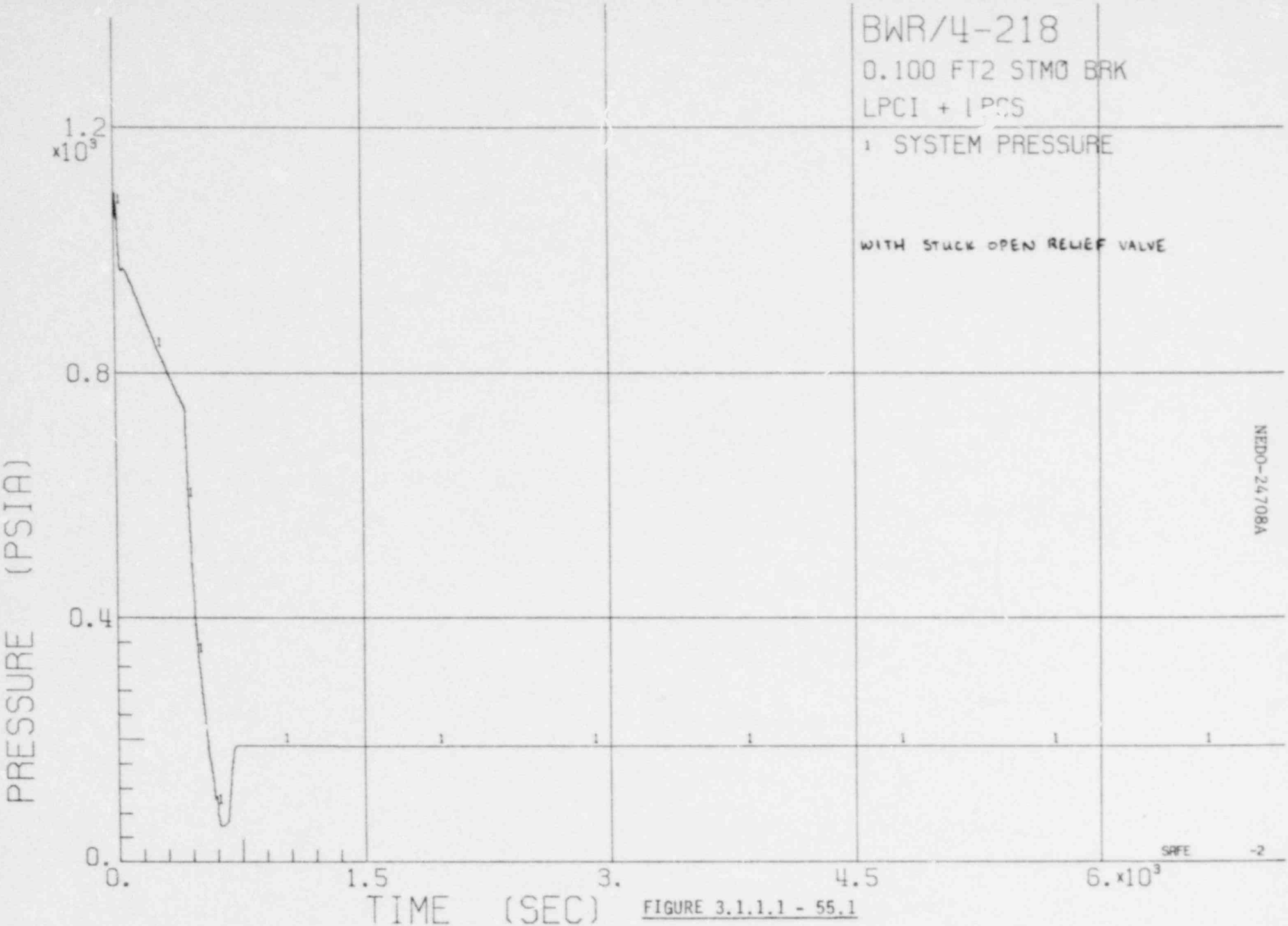

FIGURE 3.1.1.1 - 55.1

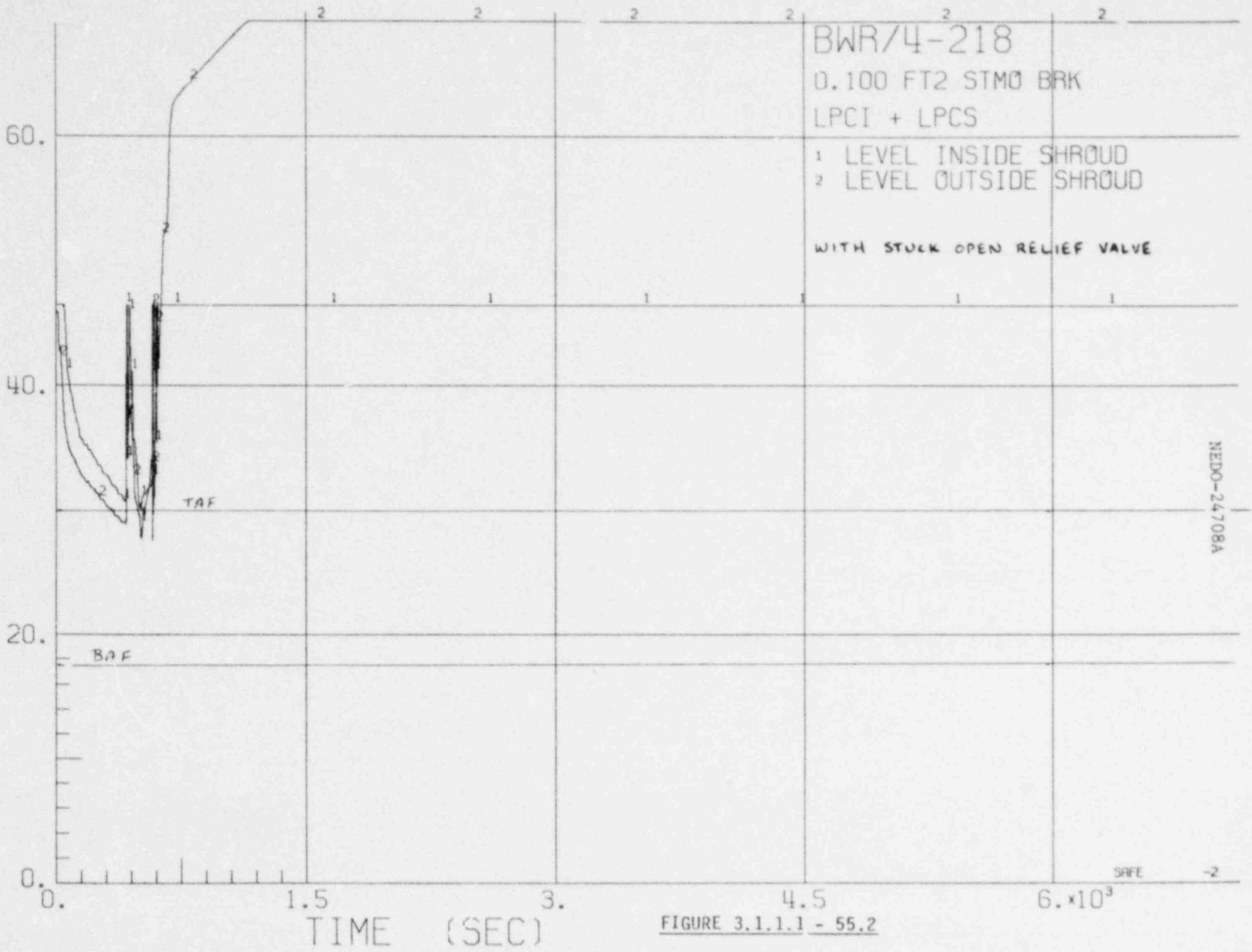

FIGURE 3.1.1.1 - 55.2

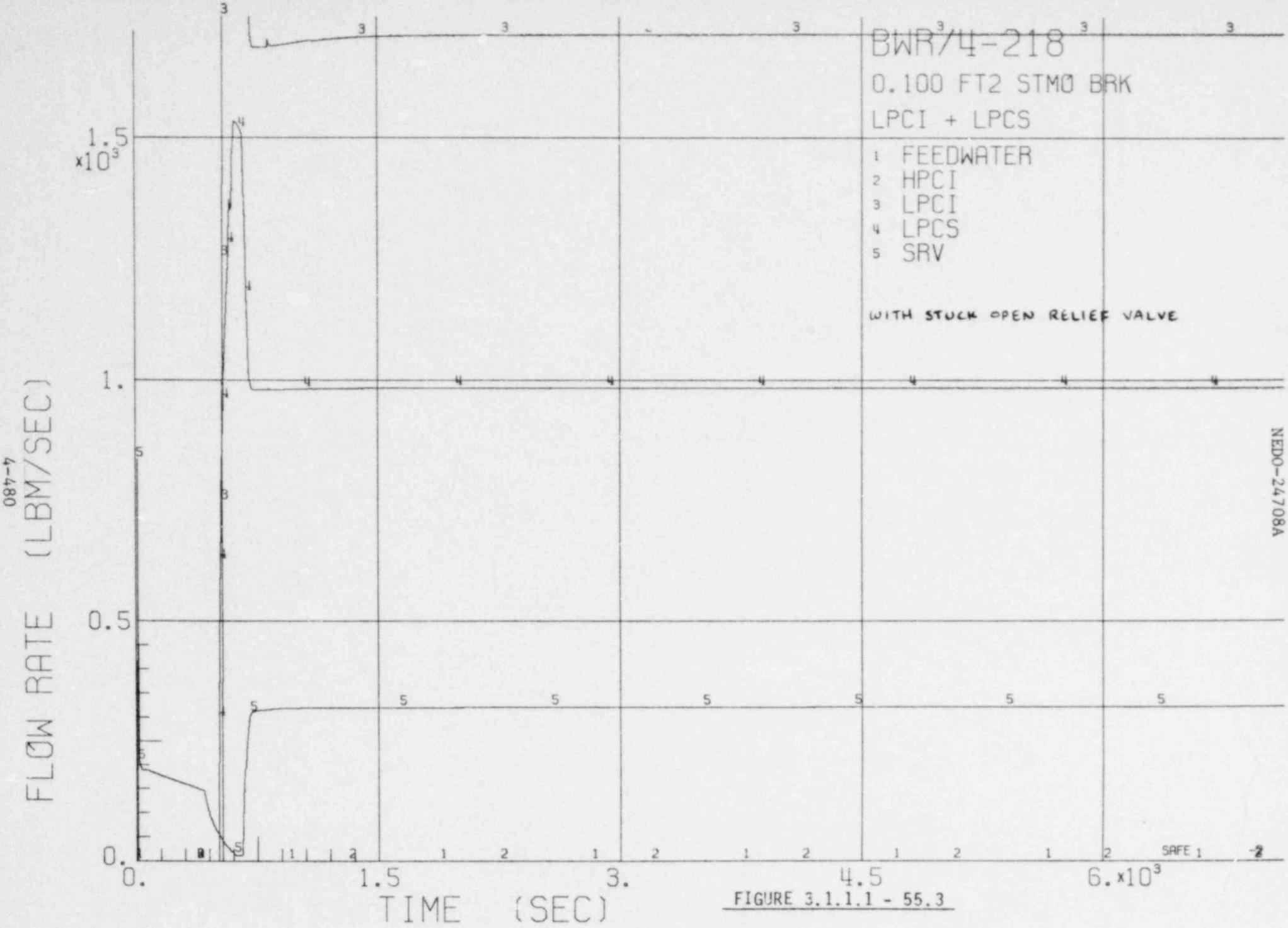

FIGURE 3.1.1.1 - 55.3

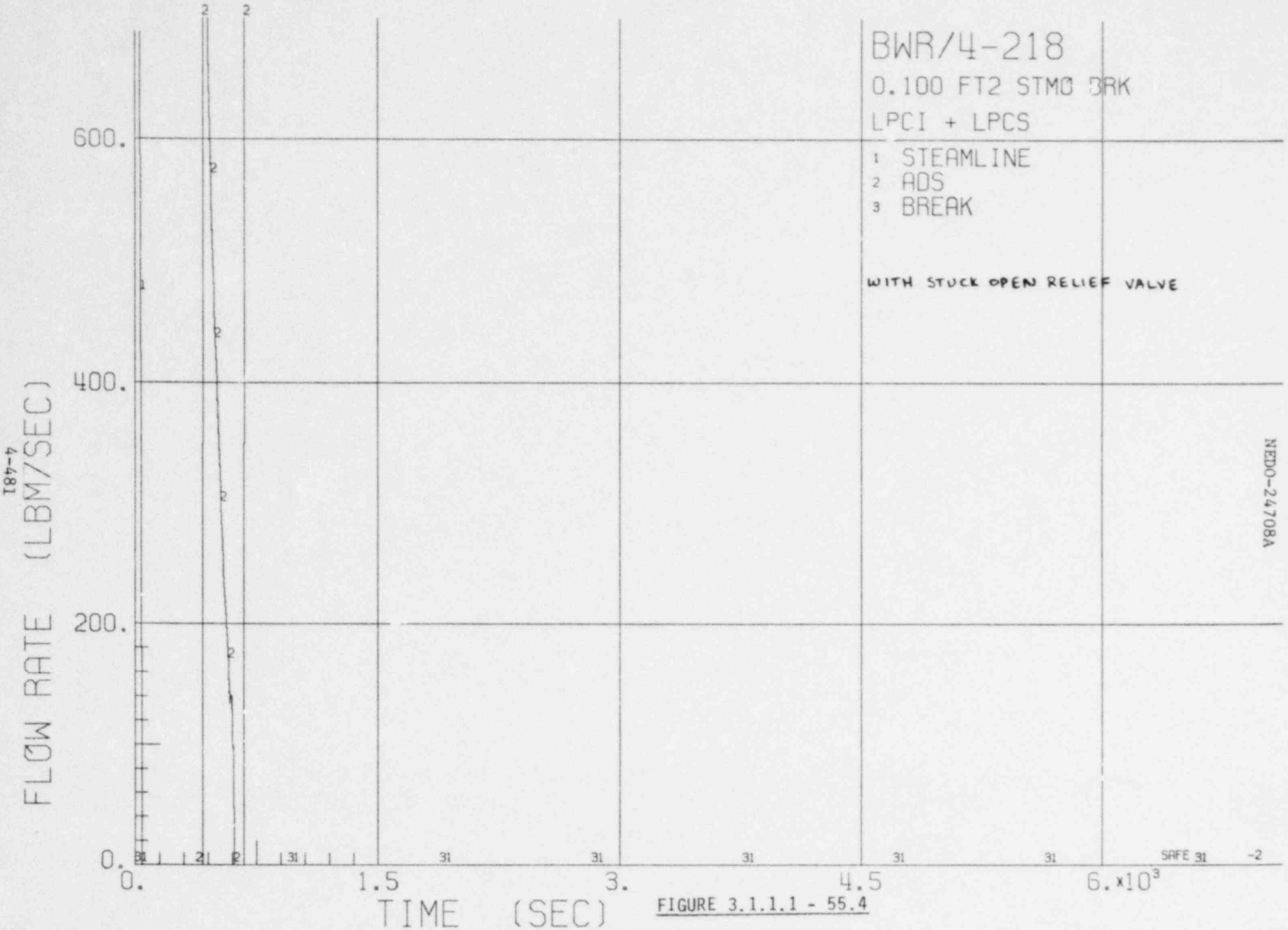

FIGURE 3.1.1.1 - 55.4

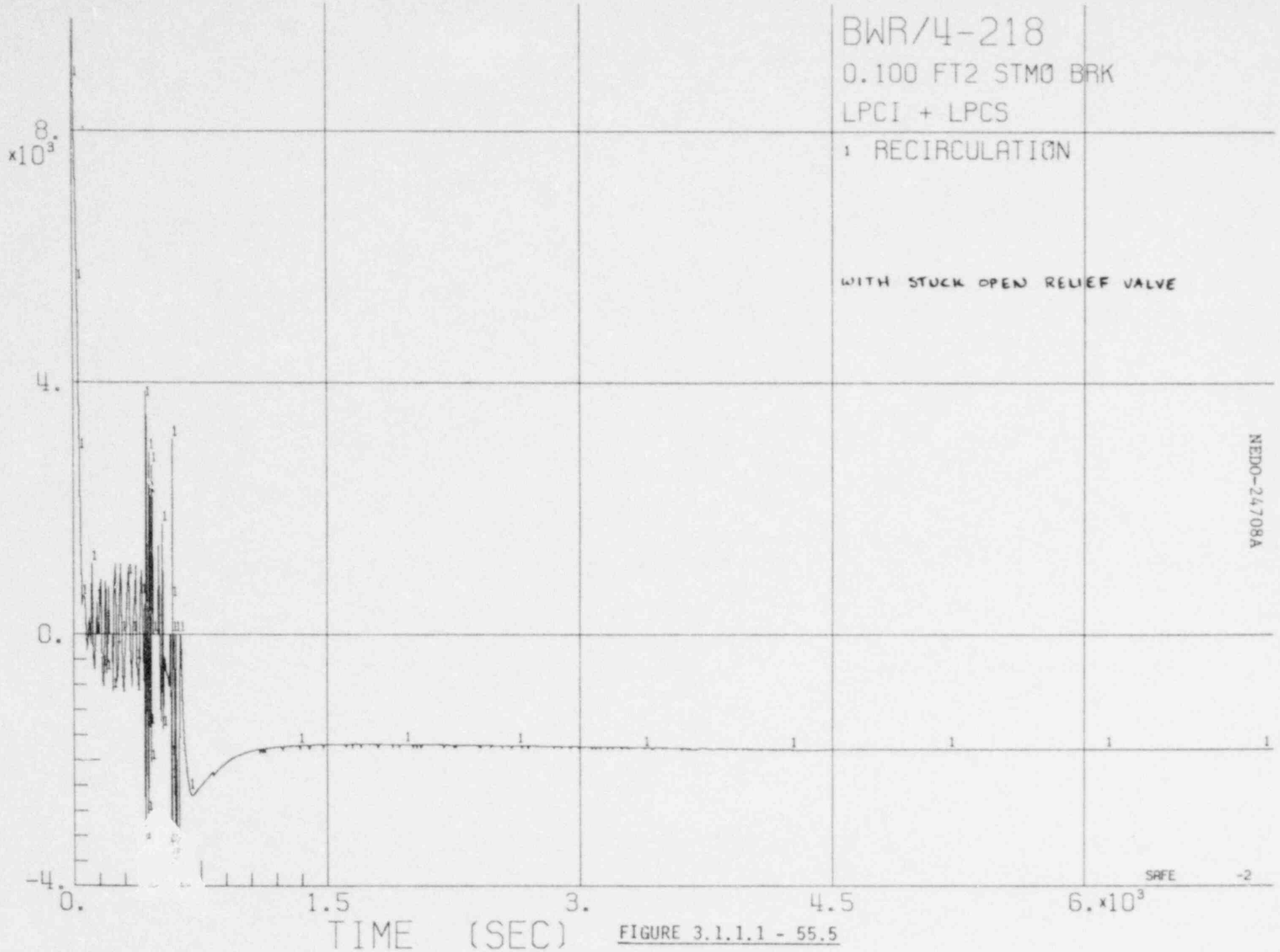

FIGURE 3.1.1.1 - 55.5

FIGURE 3.1.1.1 - 55.6

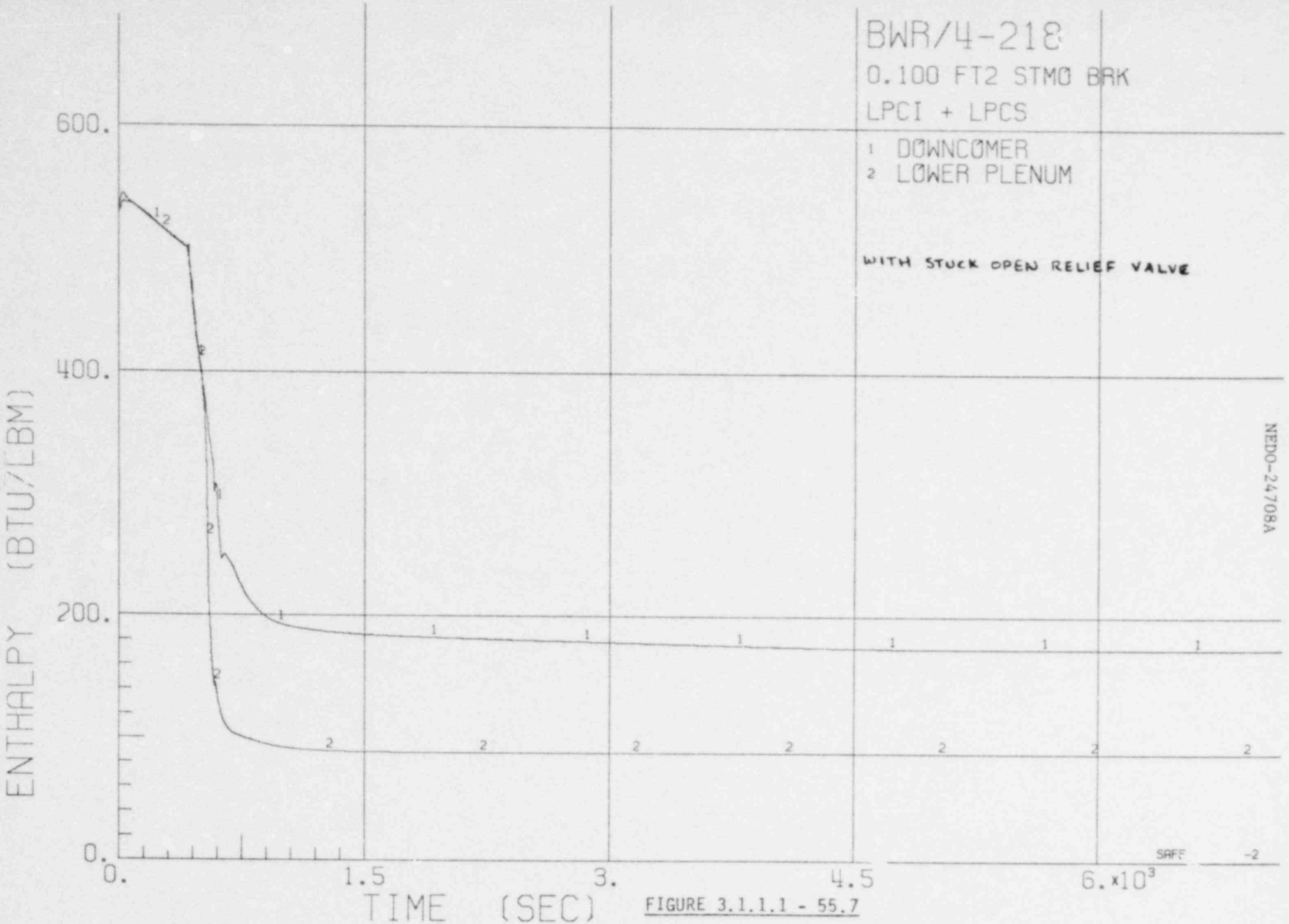

FIGURE 3.1.1.1 - 55.7

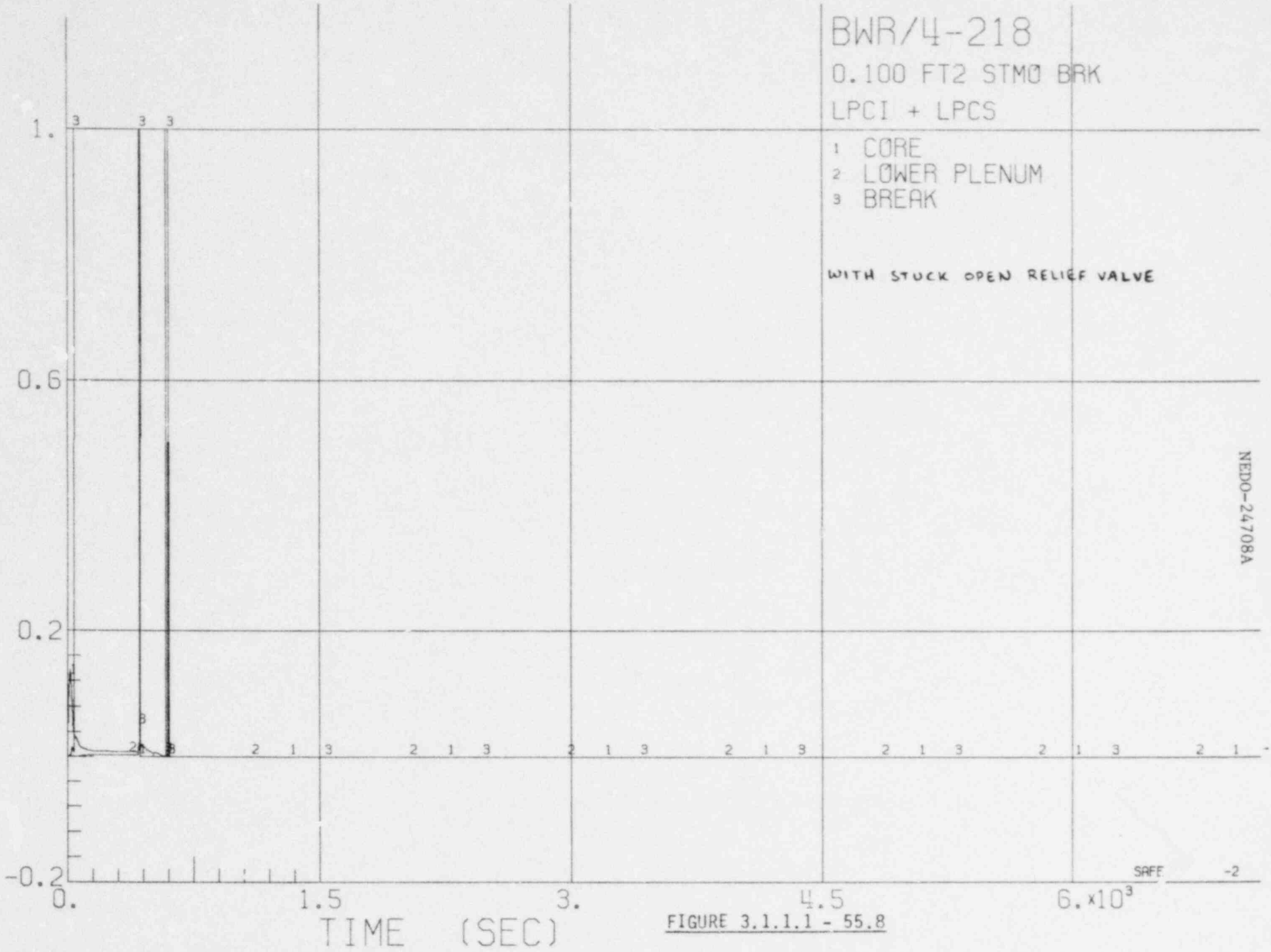

FIGURE 3.1.1.1 - 55.8

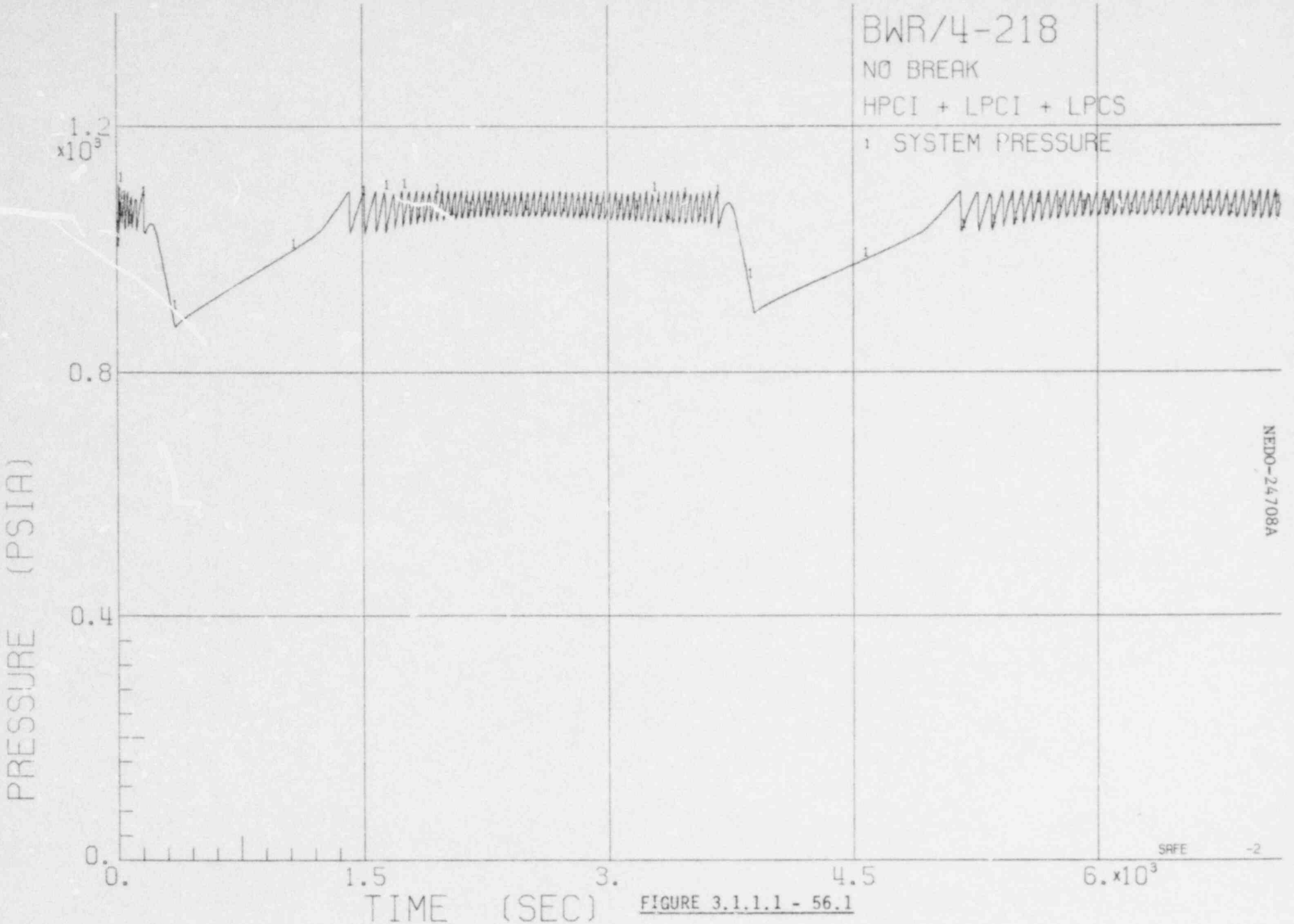

FIGURE 3.1.1.1 - 56.1

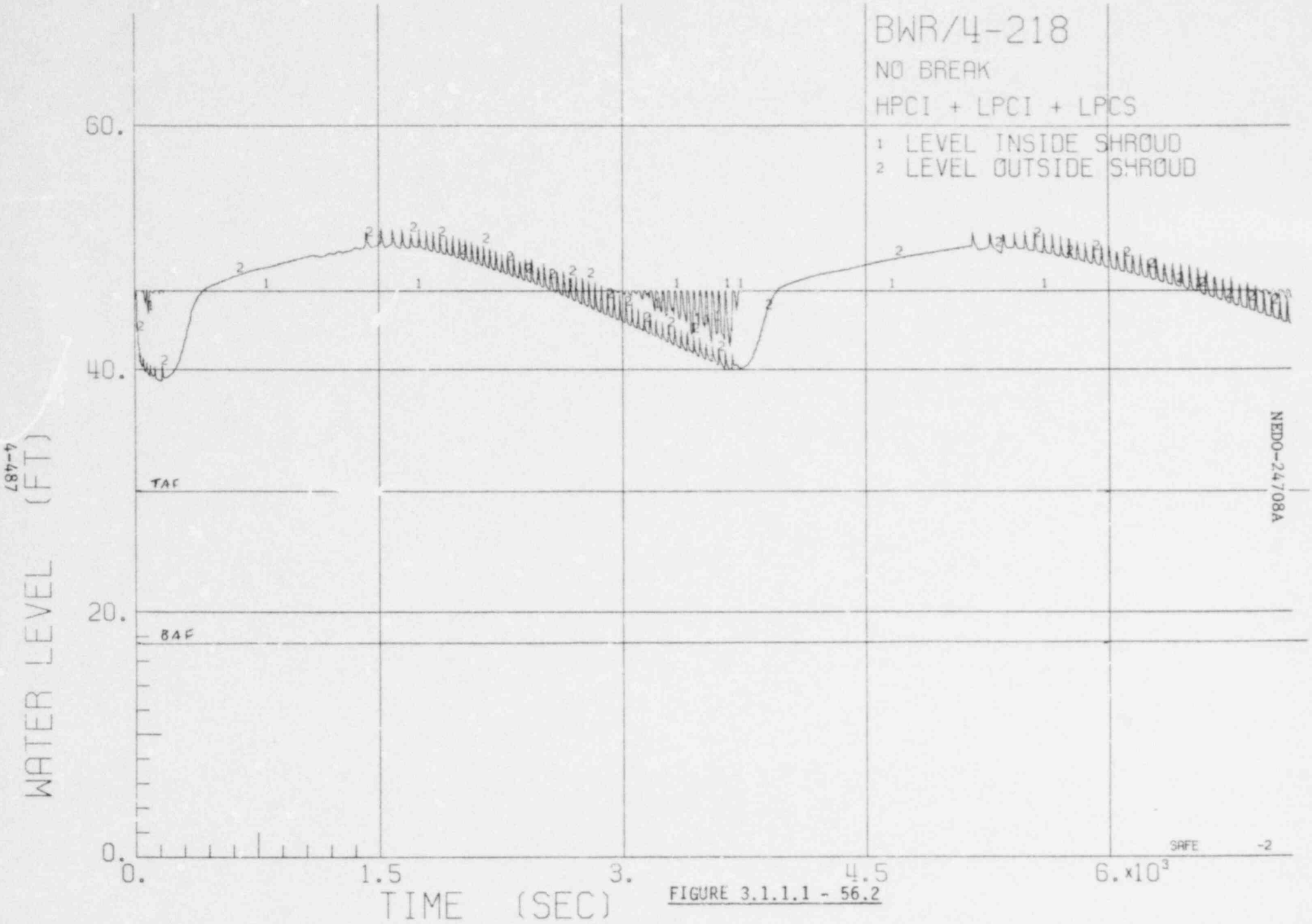

FIGURE 3.1.1.1 - 56.2

FIGURE 3.1.1.1 - 56.3

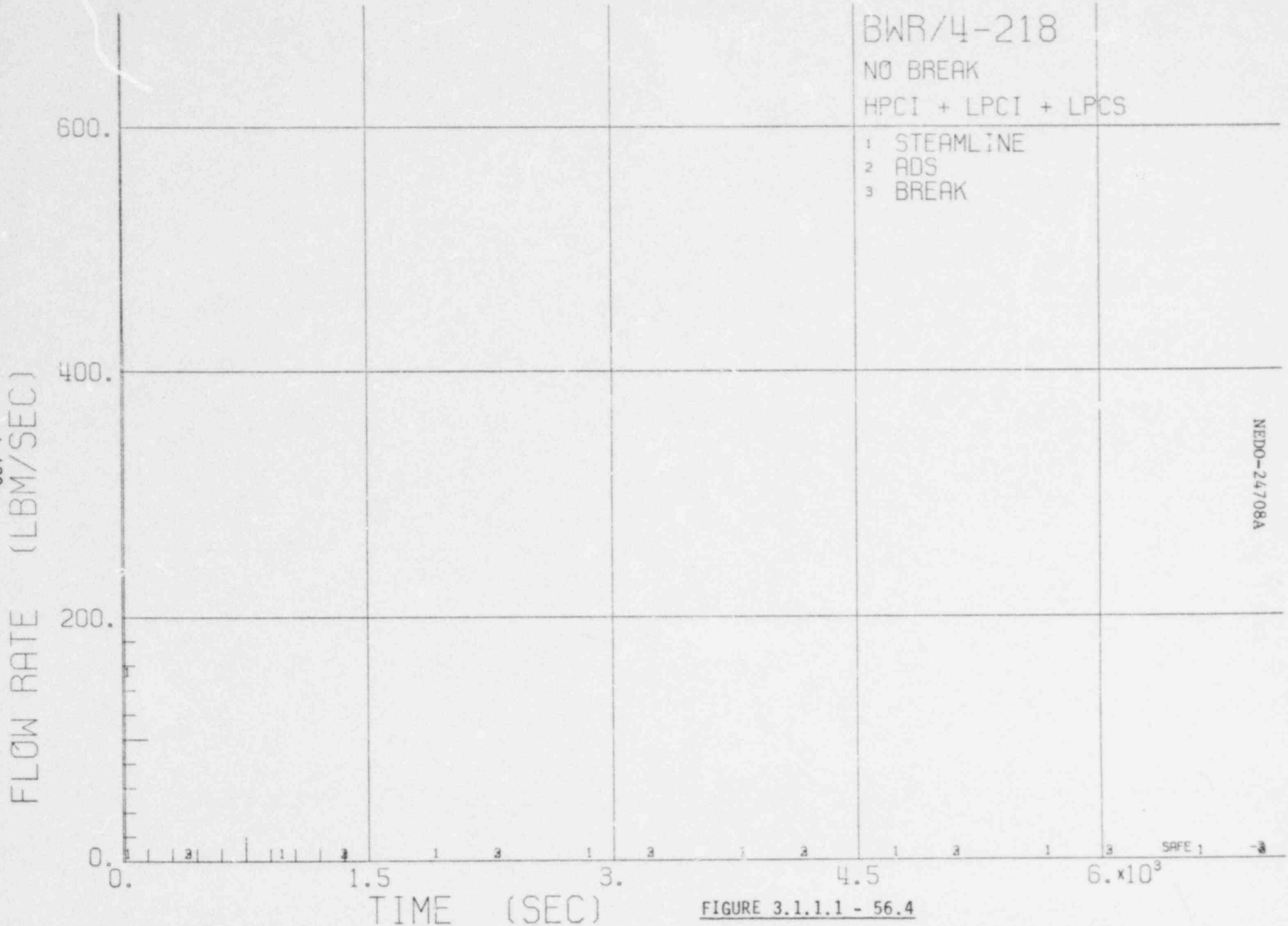

FIGURE 3.1.1.1 - 56.4

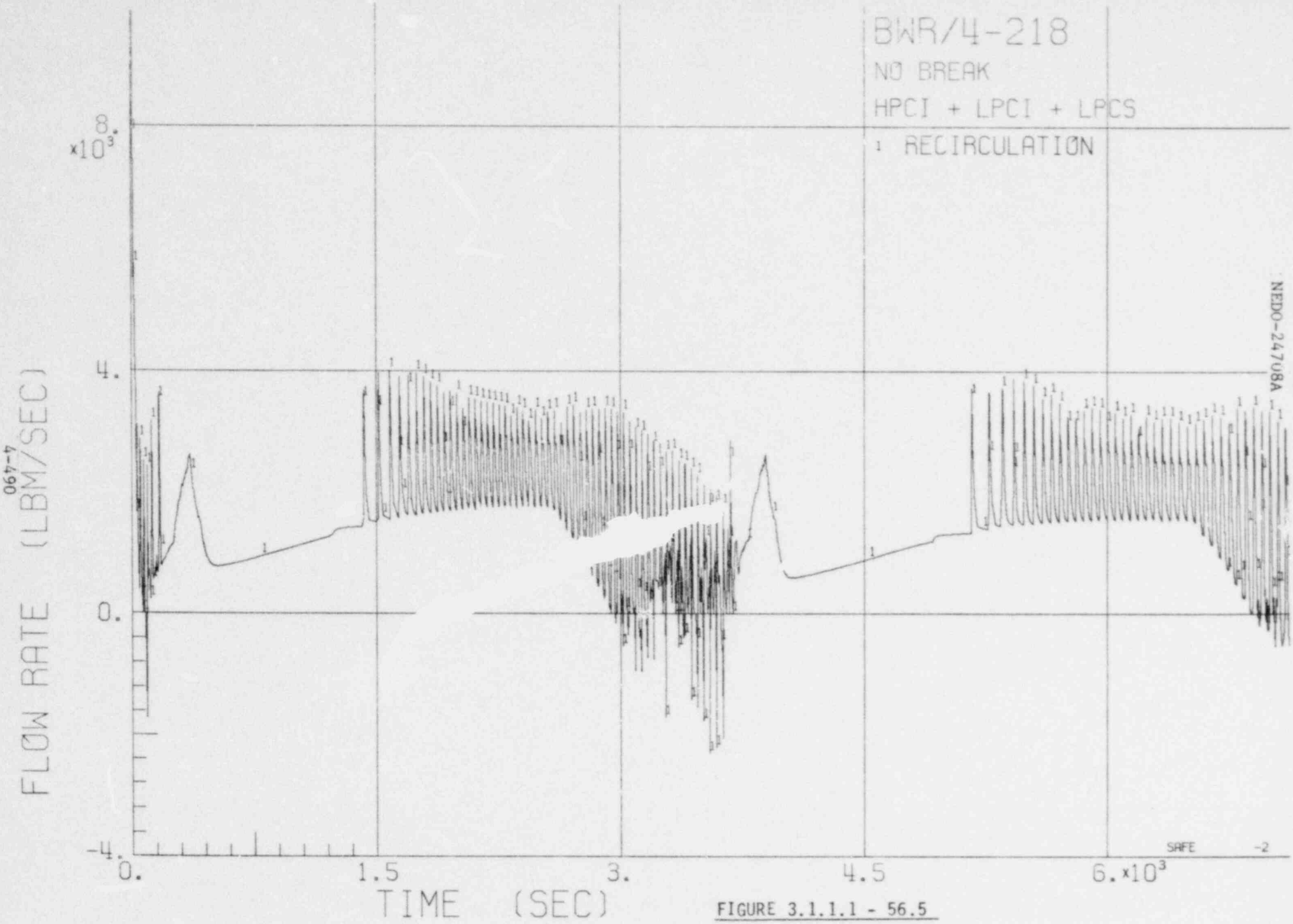

FIGURE 3.1.1.1 - 56.5

FIGURE 3.1.1.1 - 56.6

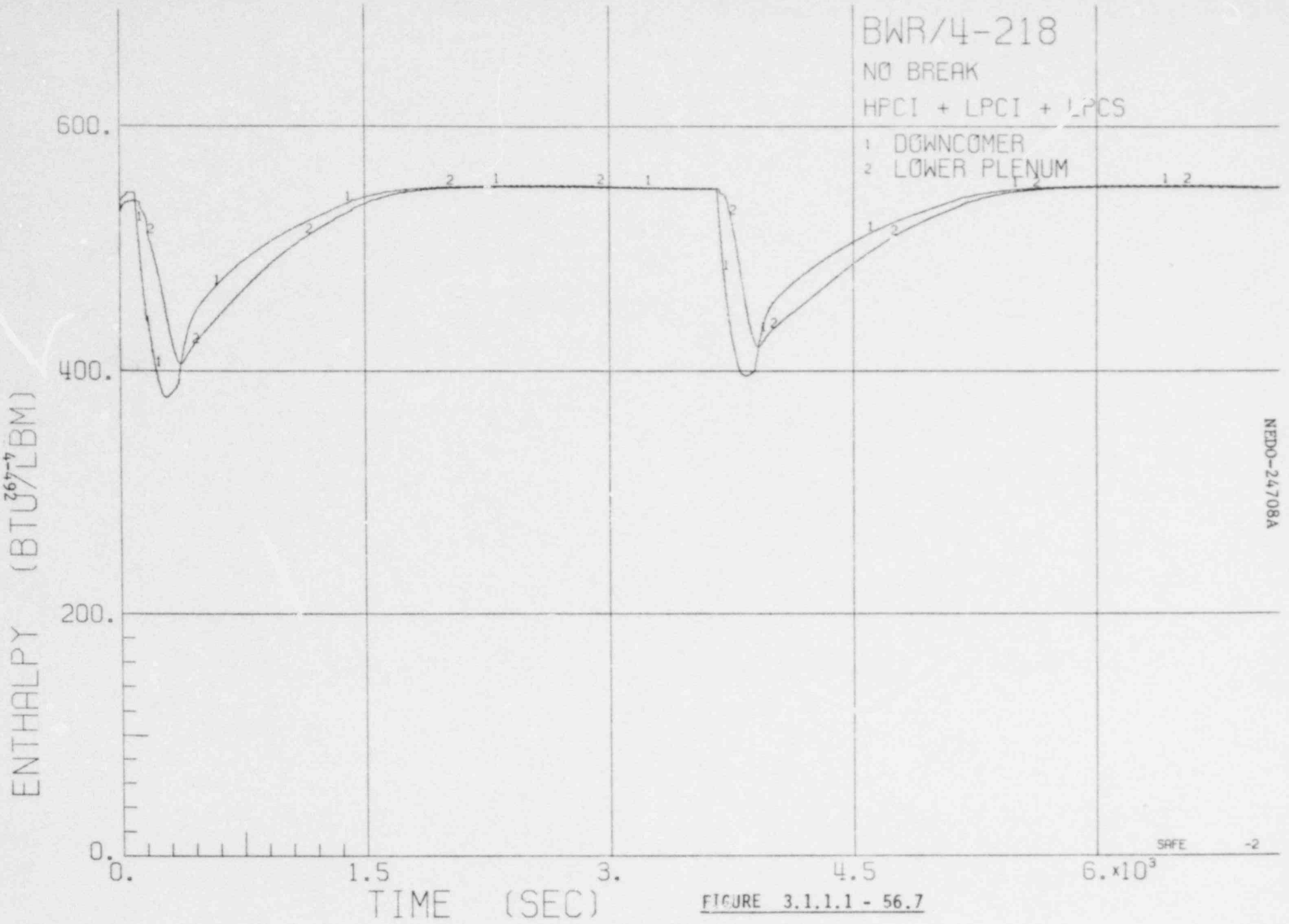

FIGURE 3.1.1.1 - 56.7

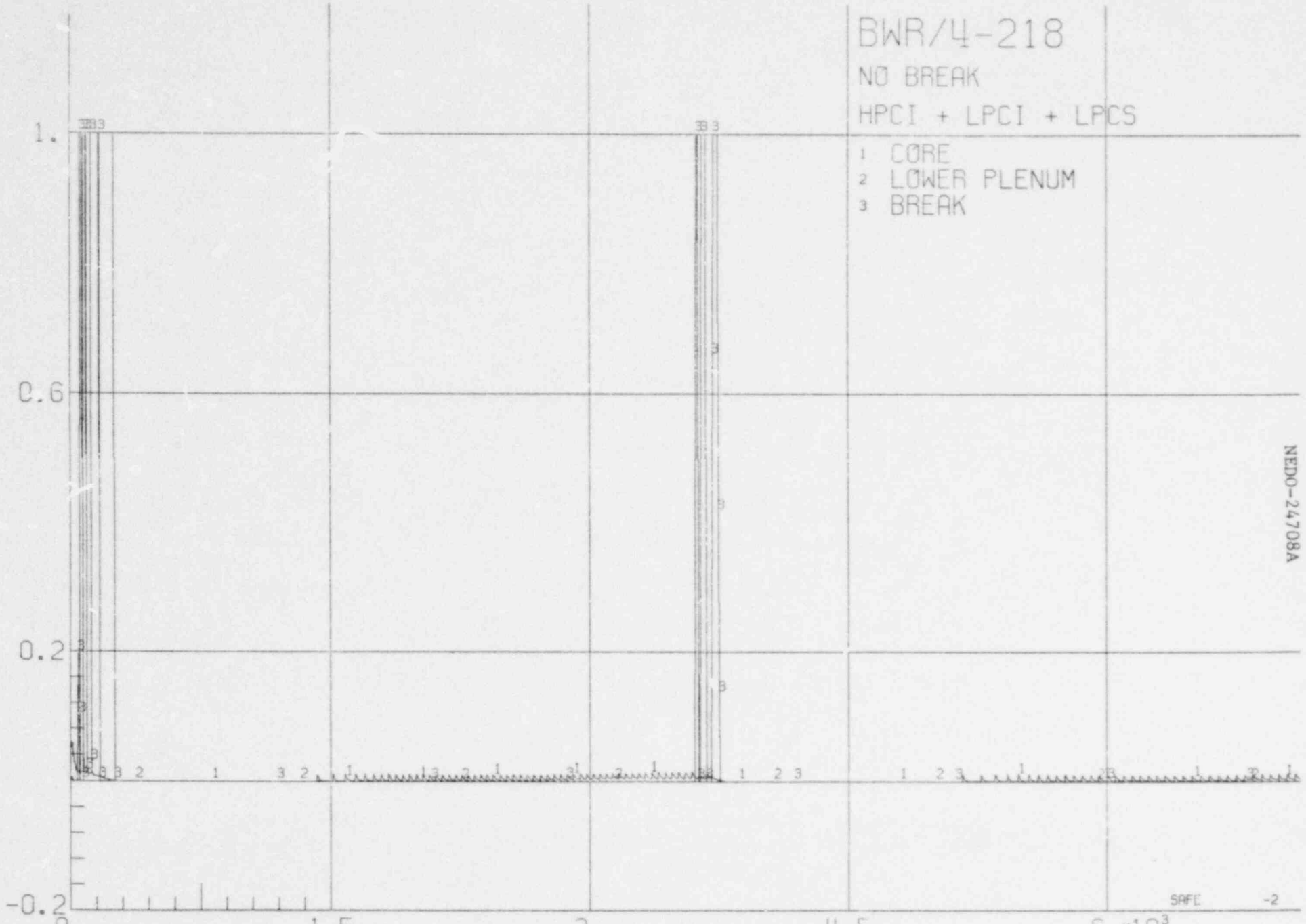

FIGURE 3.1.1.1 - 56.8

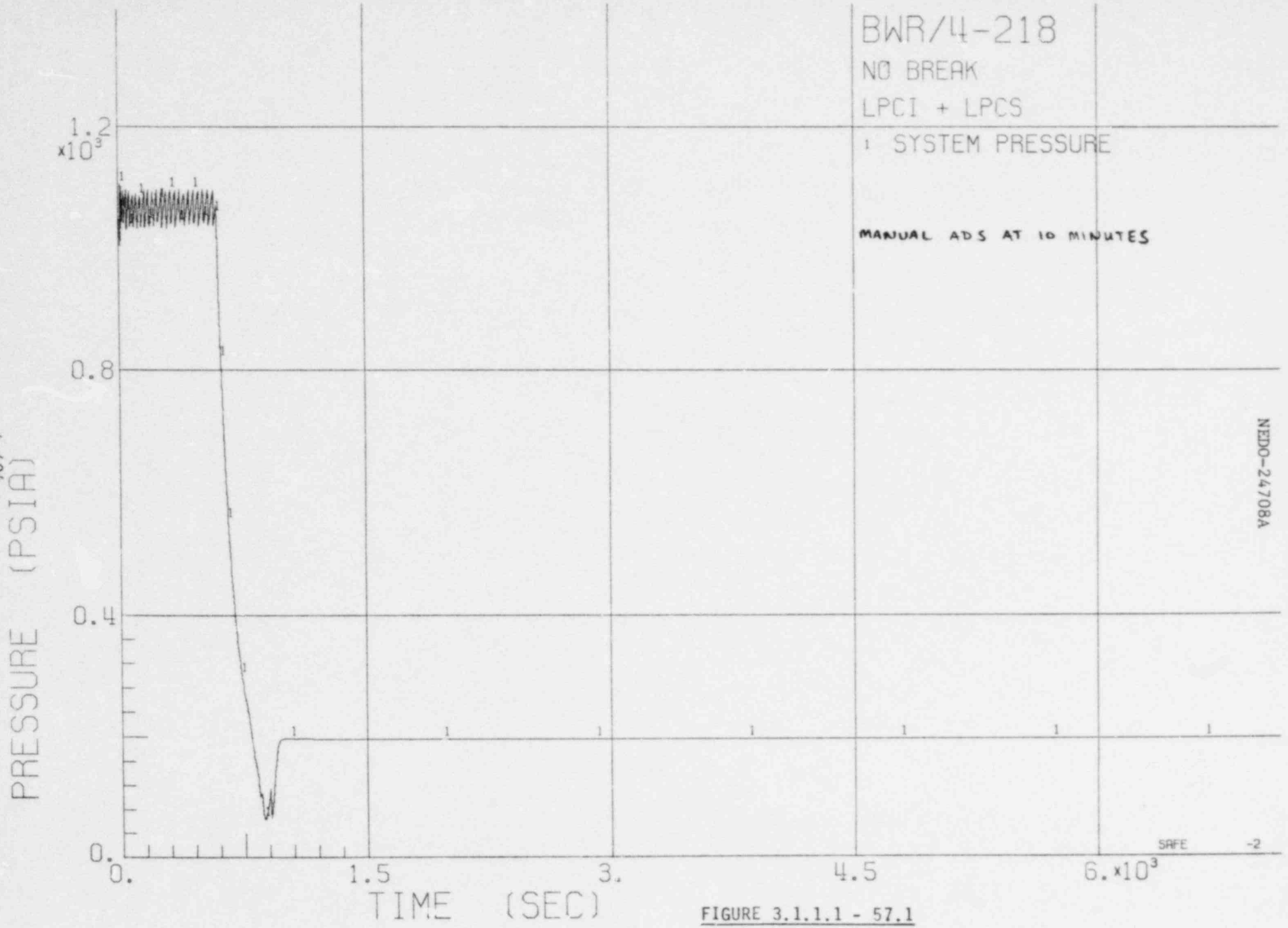

FIGURE 3.1.1.1 - 57.1

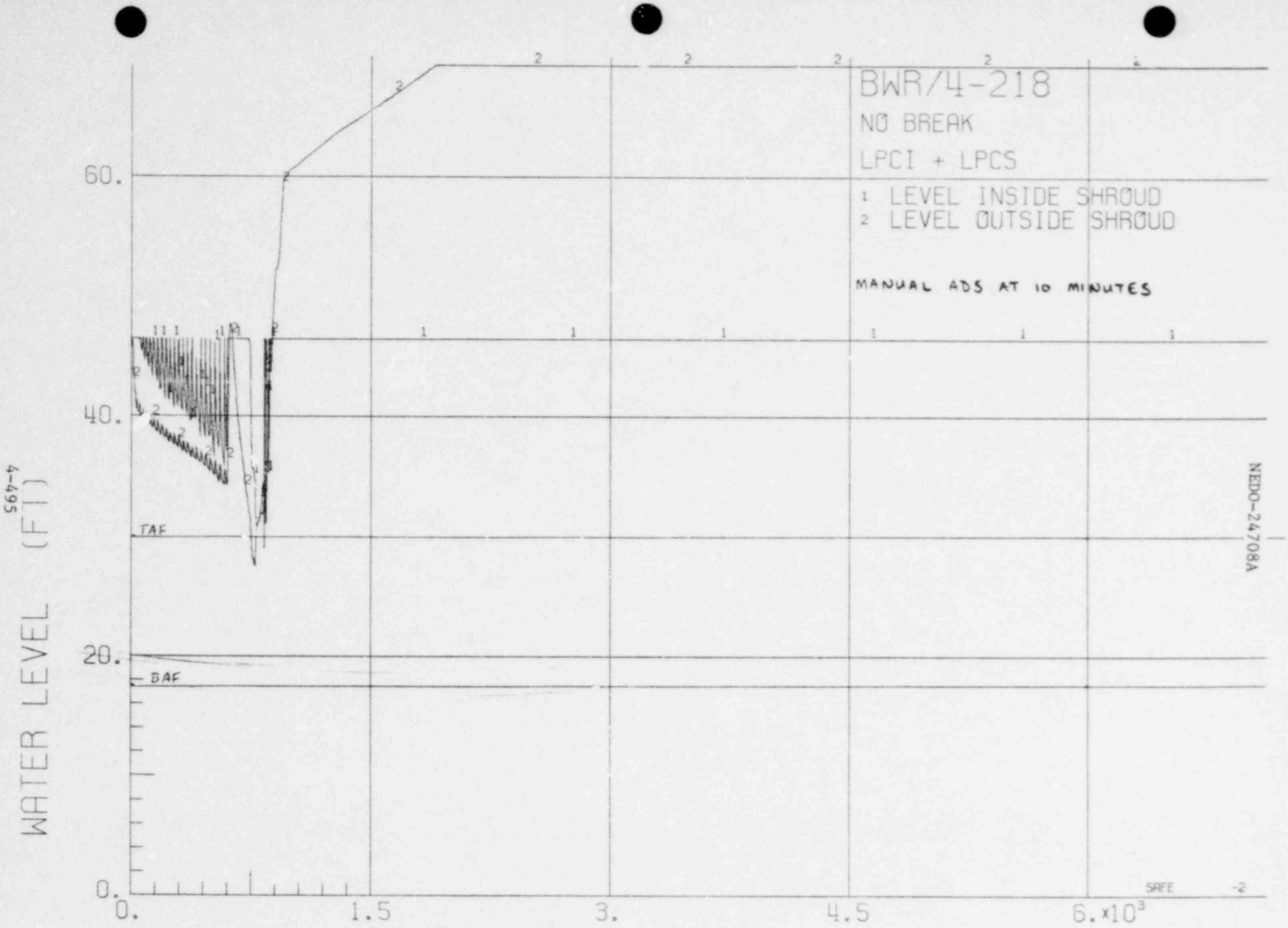

FIGURE 3.1.1.1 - 57.2

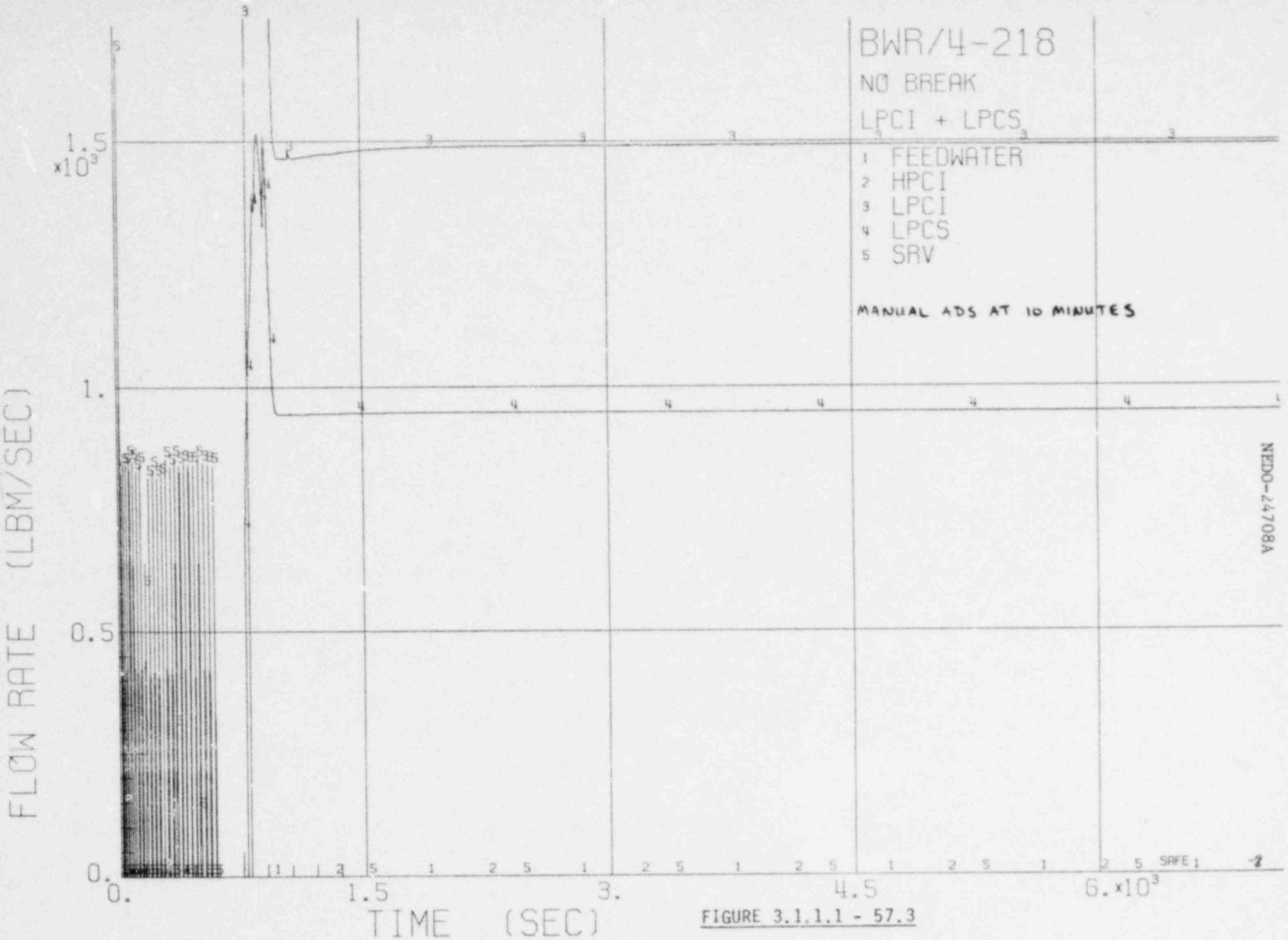

FIGURE 3.1.1.1 - 57.3

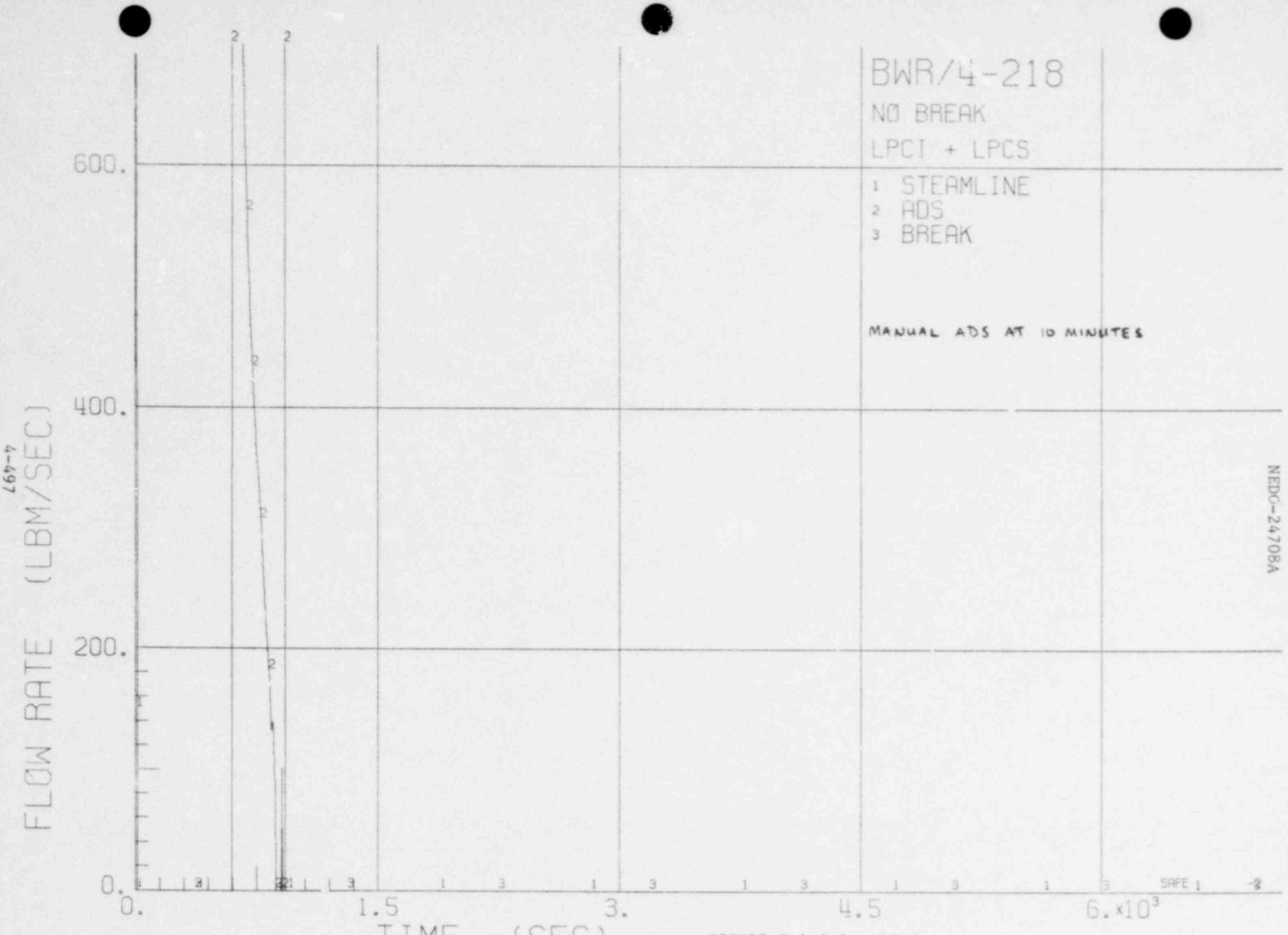

FIGURE 3.1.1.1 - 57.4

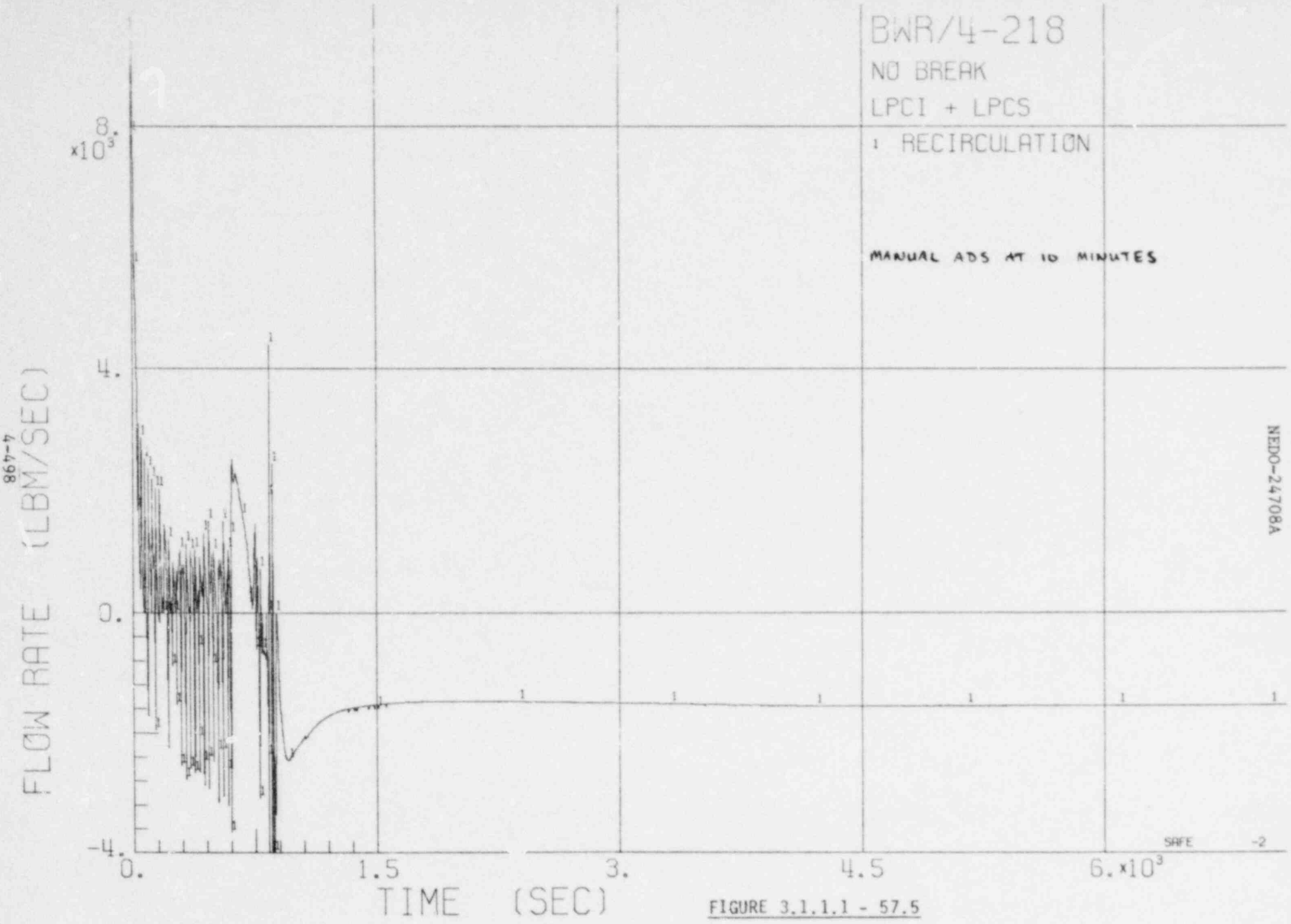

FIGURE 3.1.1.1 - 57.5

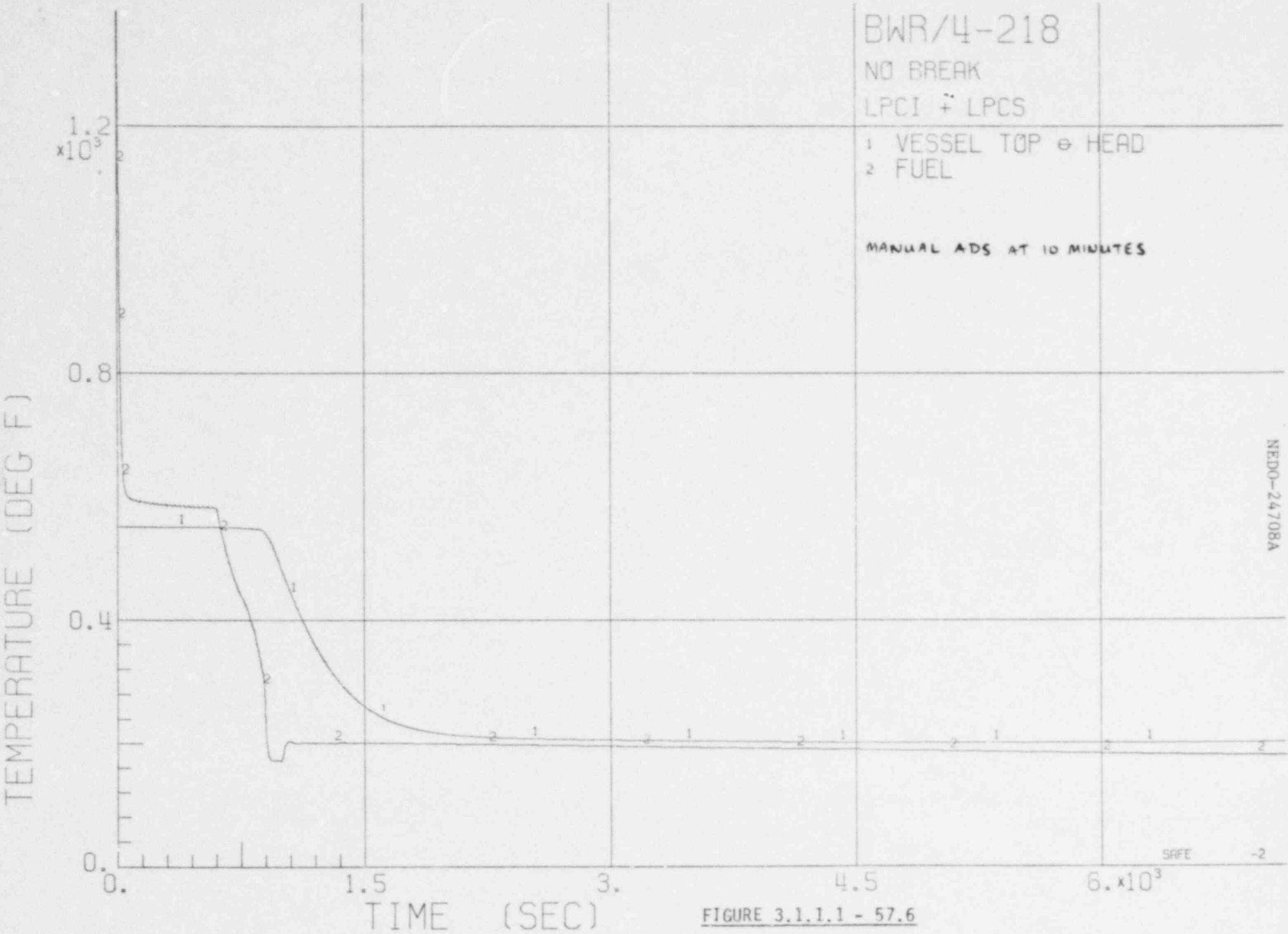

FIGURE 3.1.1.1 - 57.6

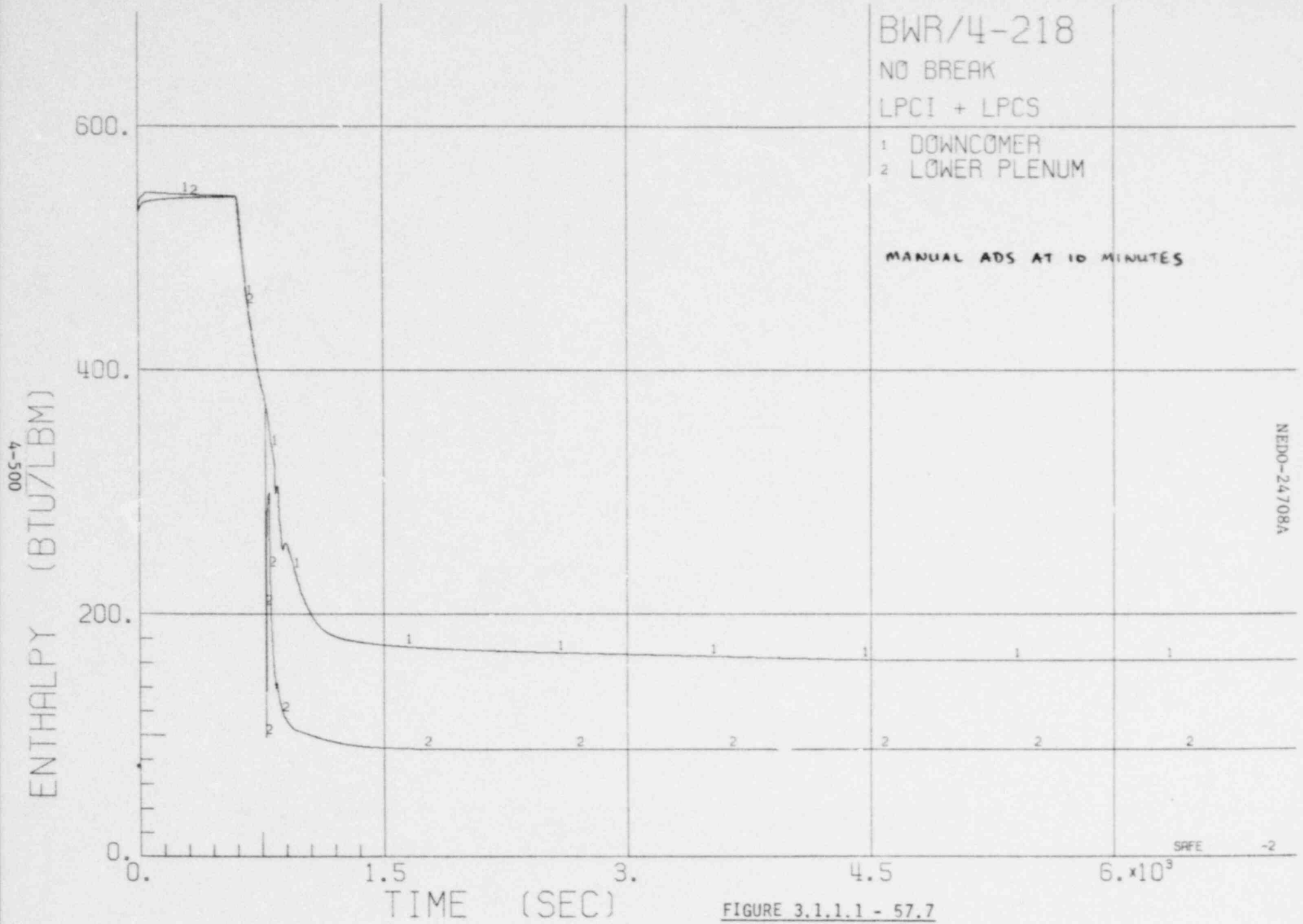

FIGURE 3.1.1.1 - 57.7

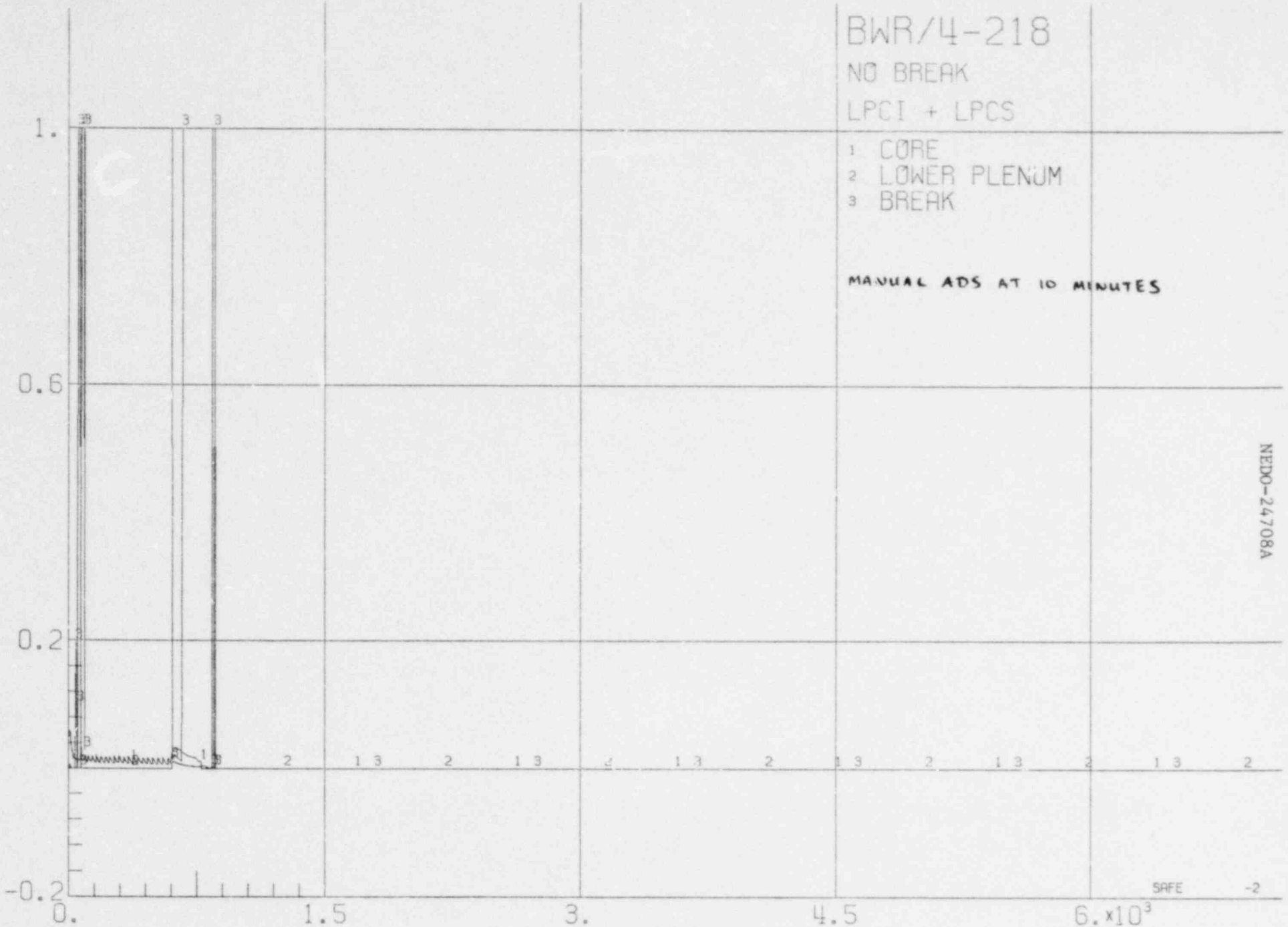

FIGURE 3.1.1.1 - 57.8

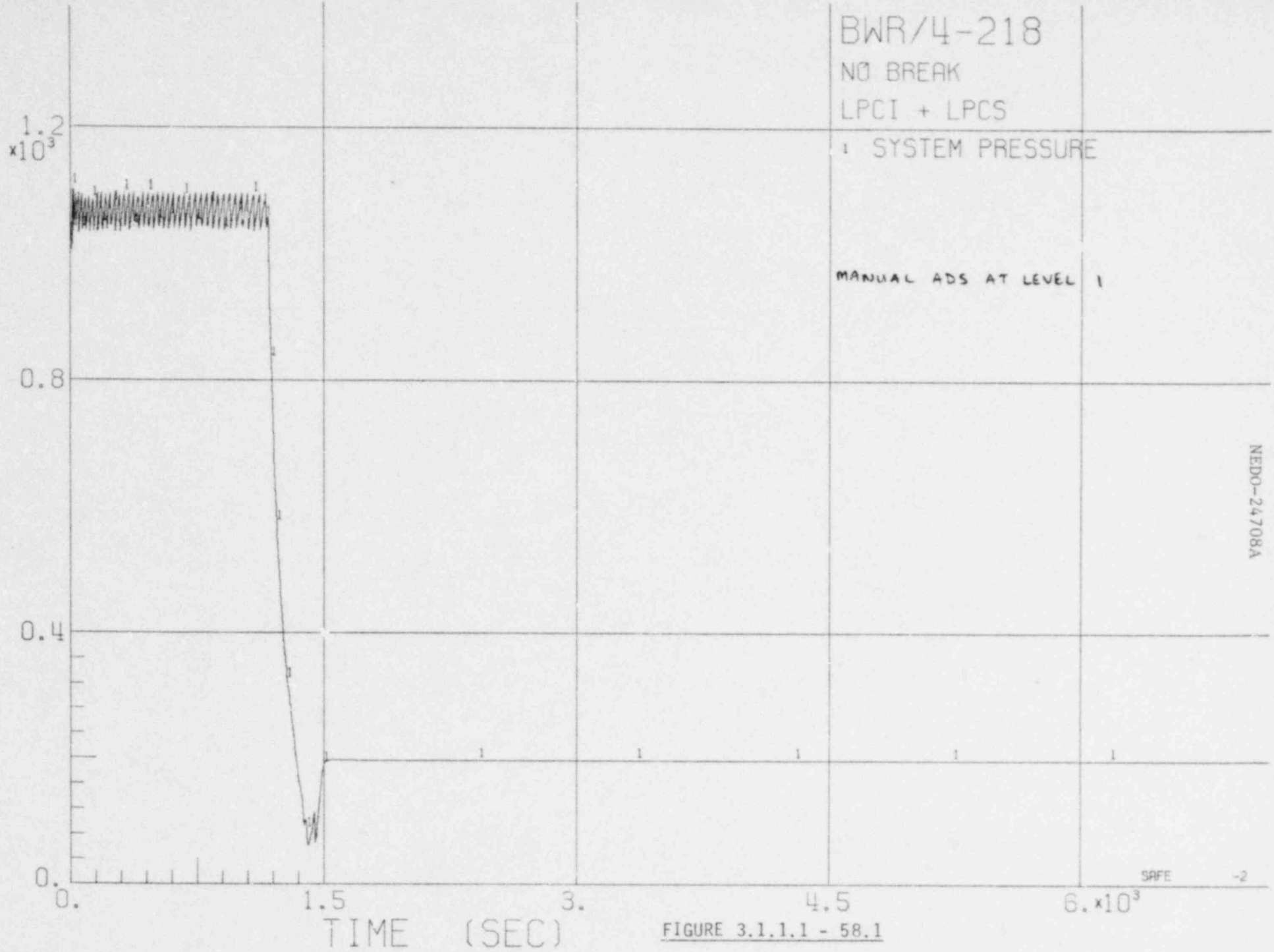

FIGURE 3.1.1.1 - 58.1

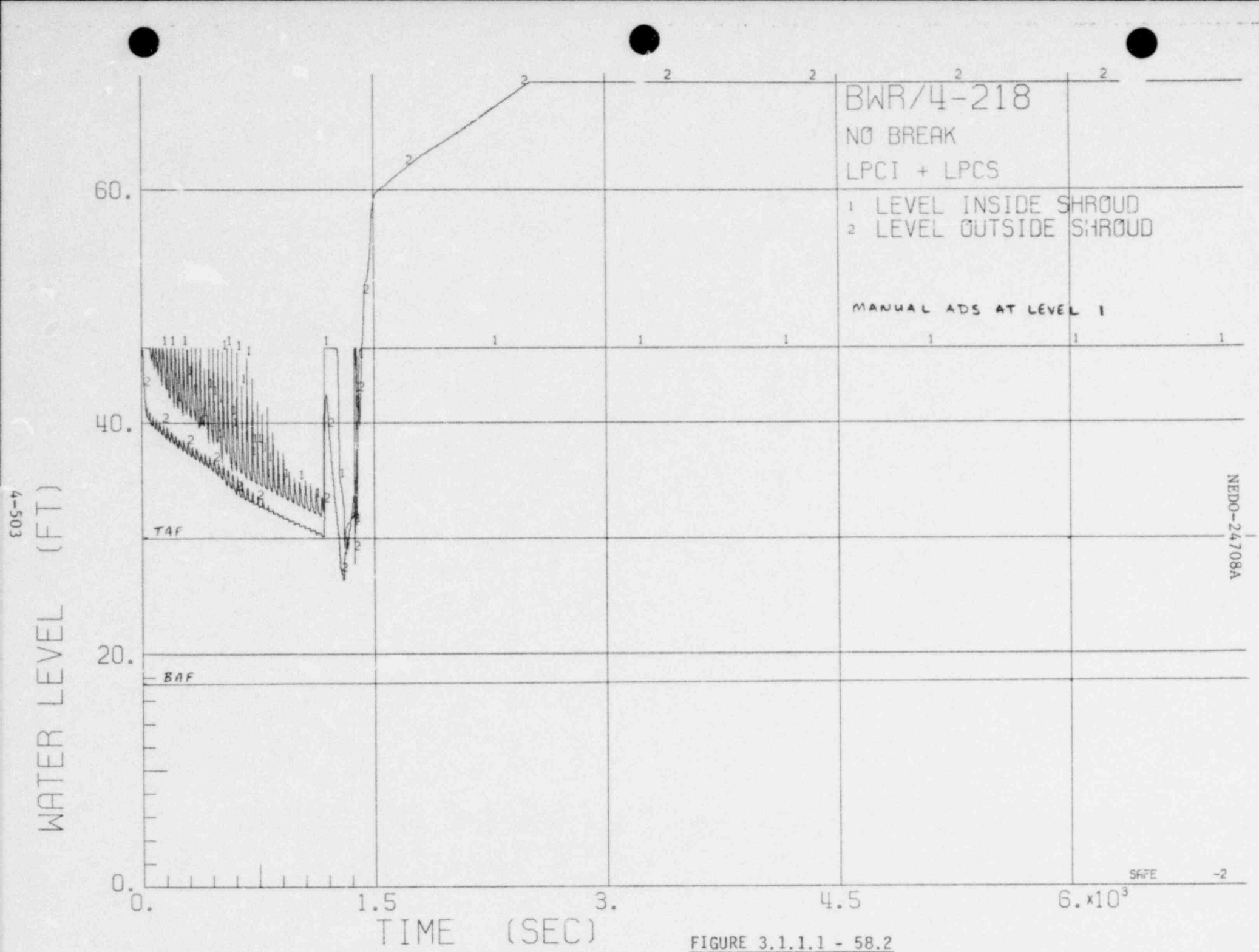

FIGURE 3.1.1.1 - 58.2

FIGURE 3.1.1.1 - 58.3

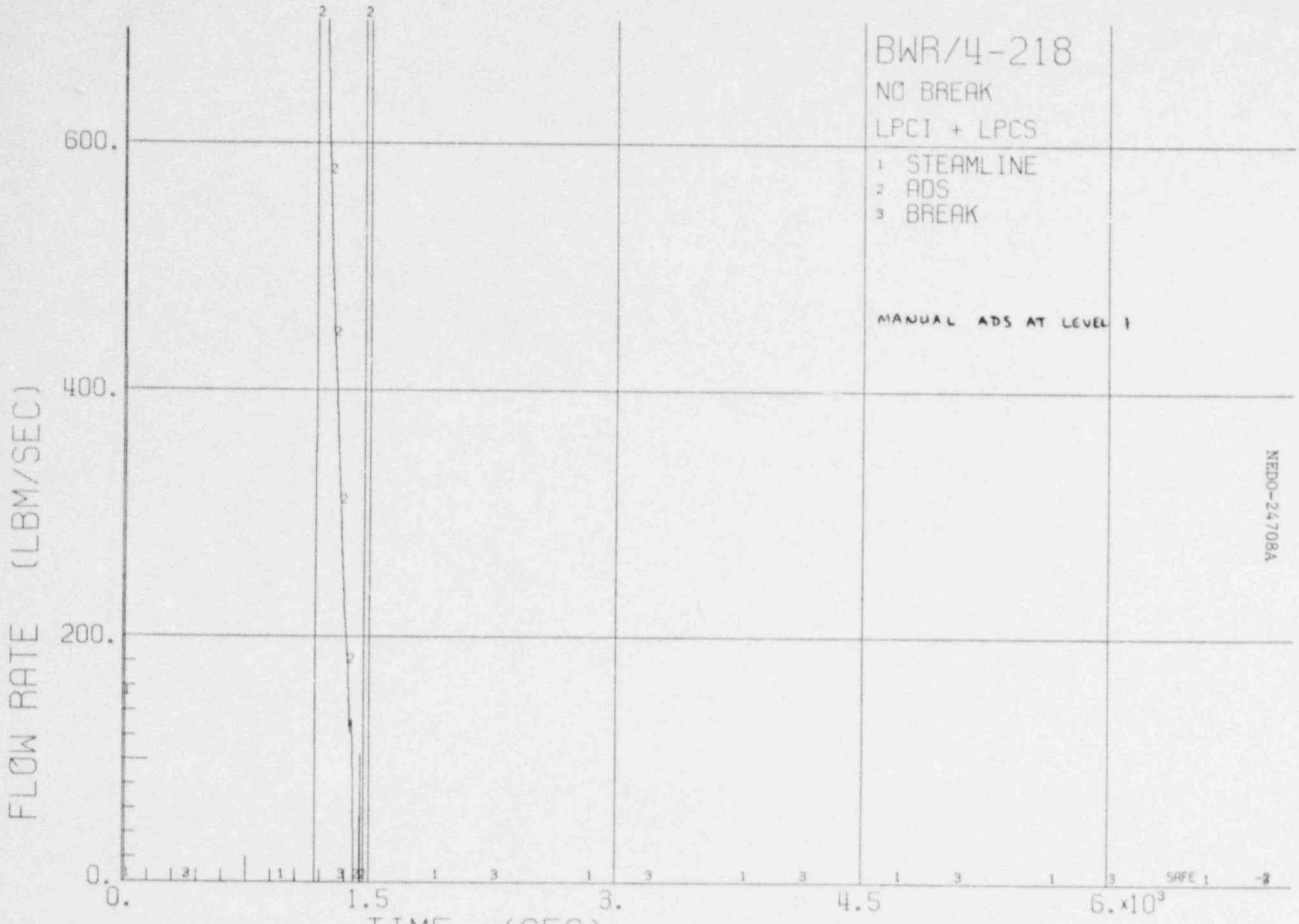

FIGURE 3.1.1.1 - 58.4

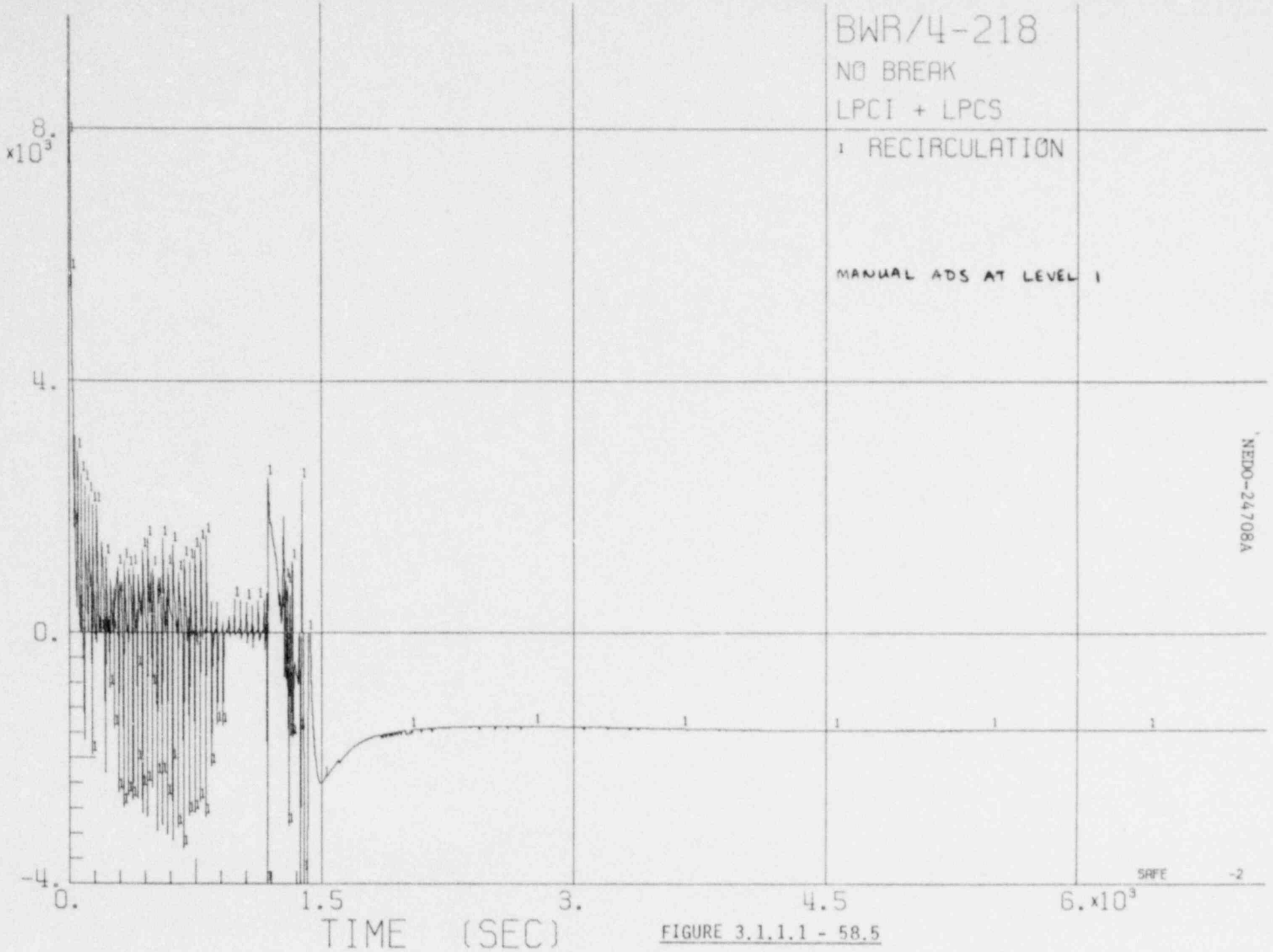

FIGURE 3.1.1.1 - 58.5

FIGURE 3.1.1.1 - 58.6

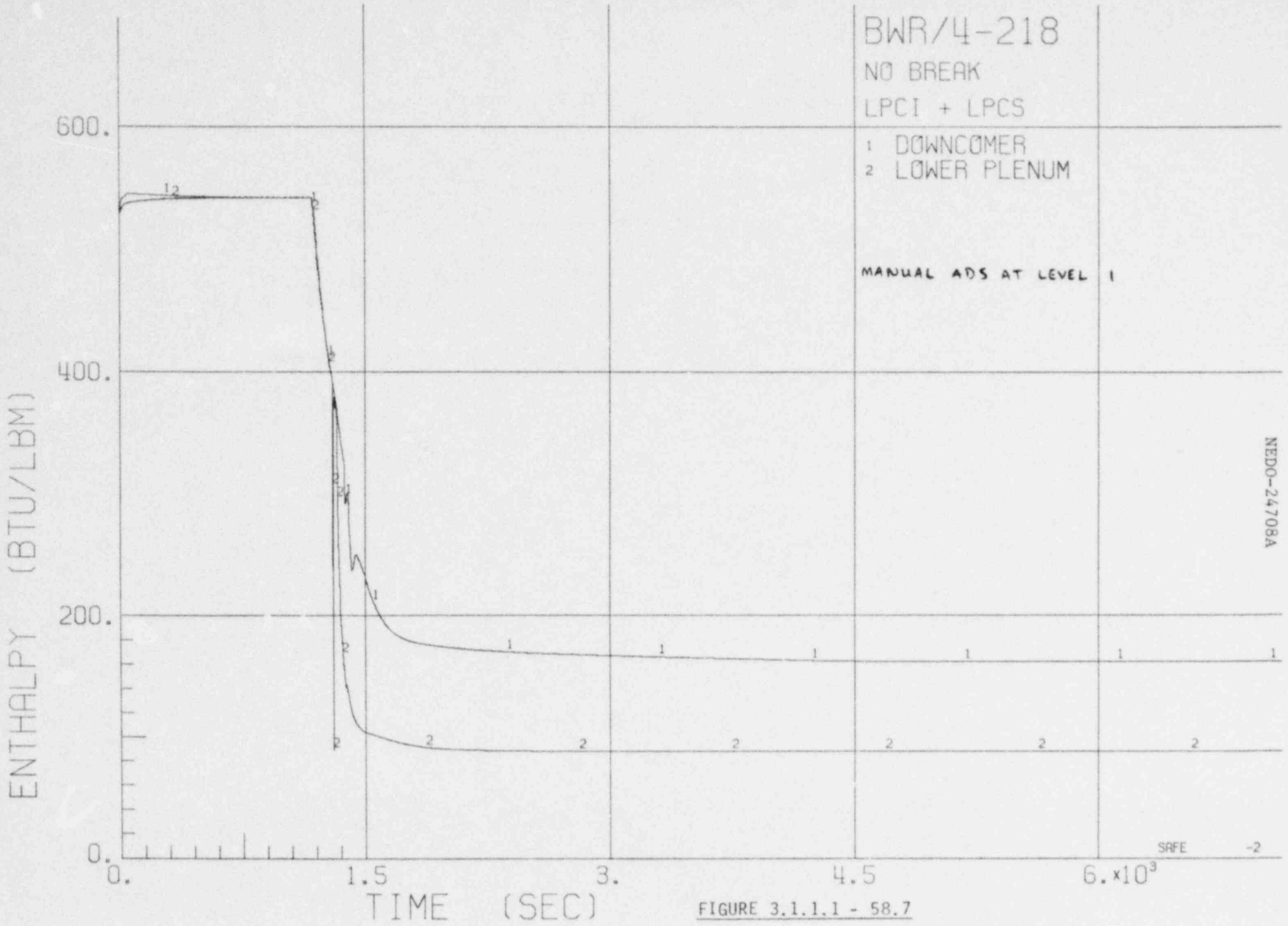

FIGURE 3.1.1.1 - 58.7

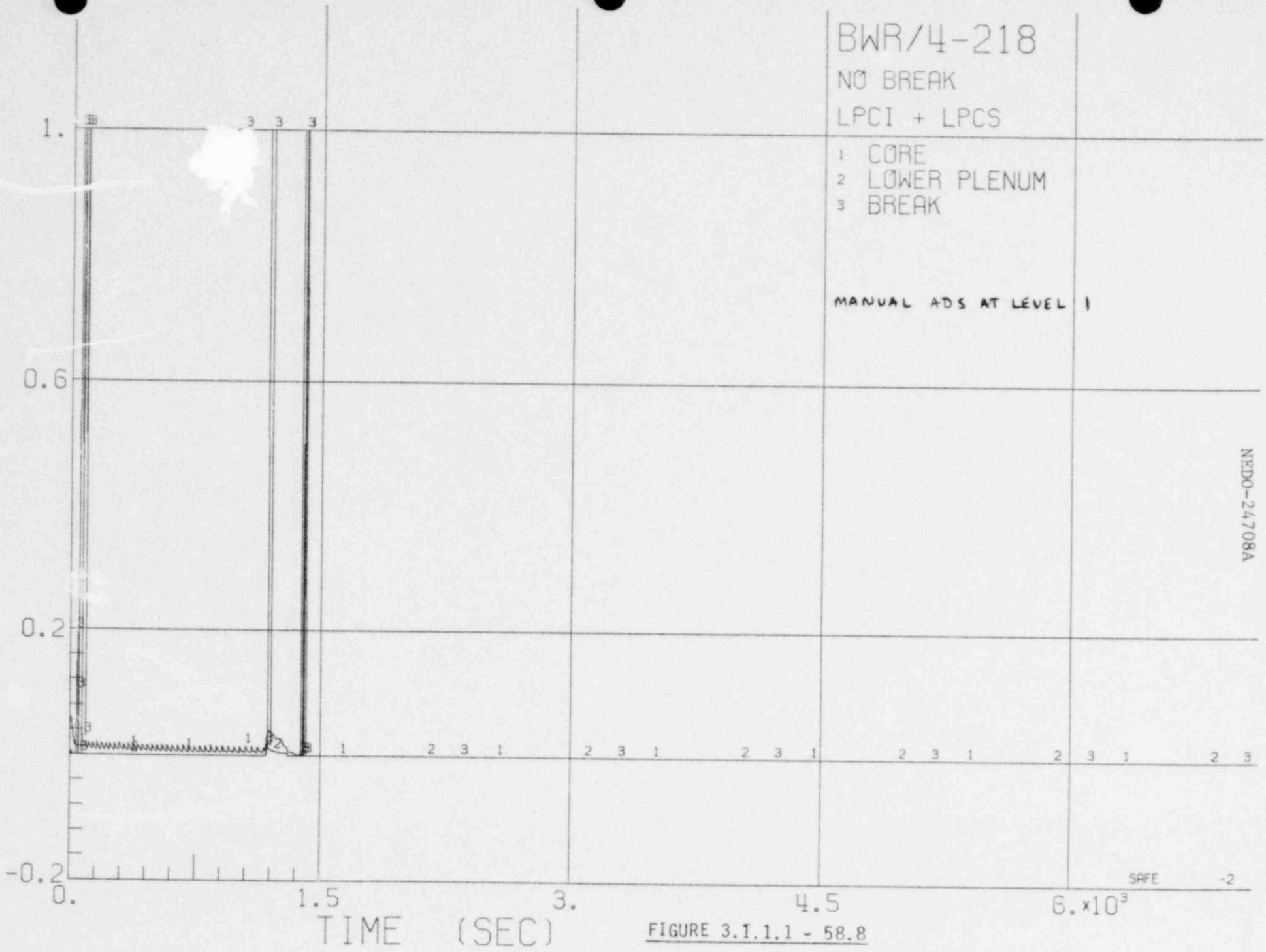

FIGURE 3.1.1.1 - 58.8

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Figure 3.1.1.1-59.2 WATER LEVEL VS TIME FOR A 0.005 FT^2 SUCTION BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

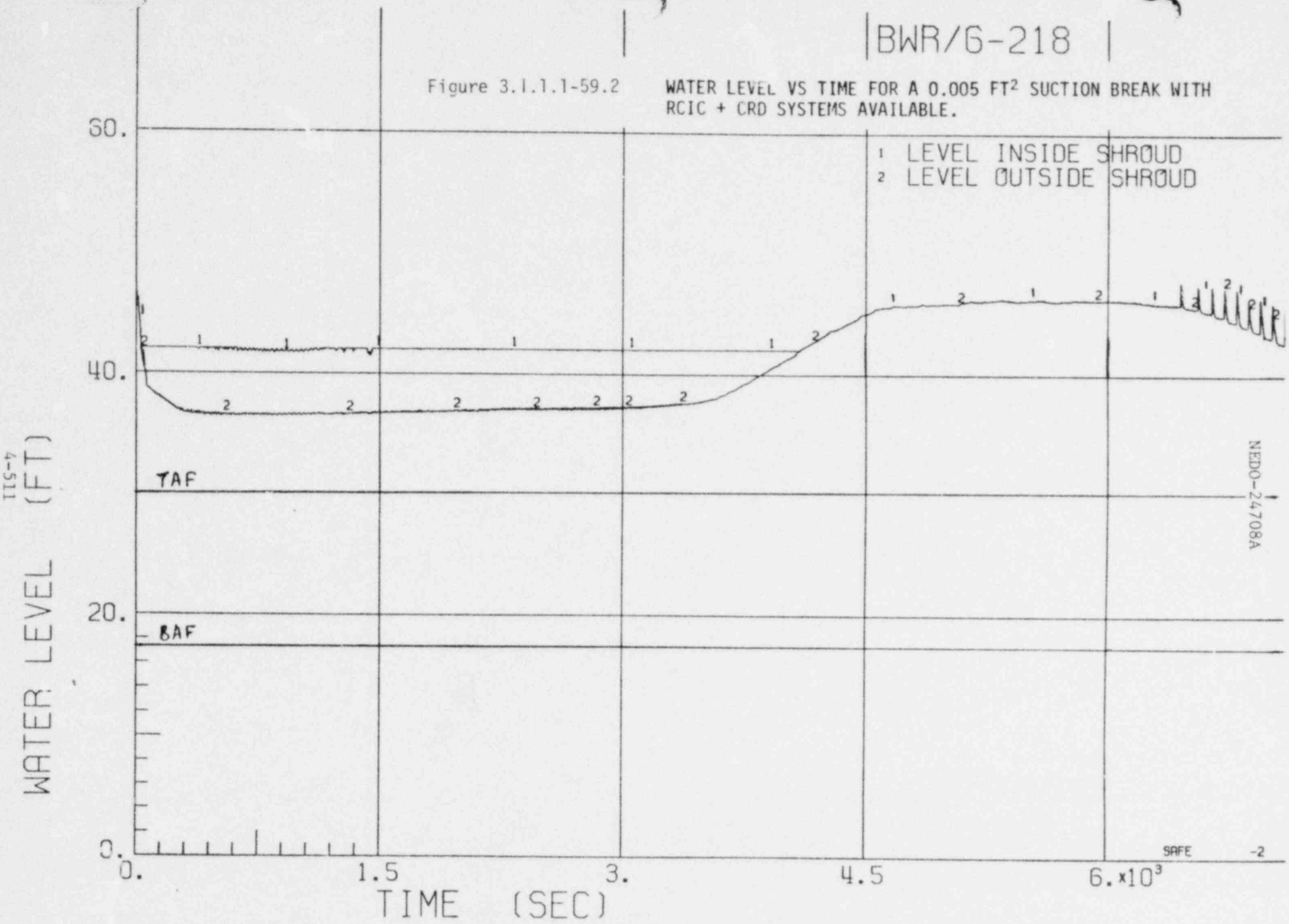

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Figure 3.1.1.1-59.3 SYSTEM FLOW RATES VS TIME FOR A 0.005 FT^2 SUCTION BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

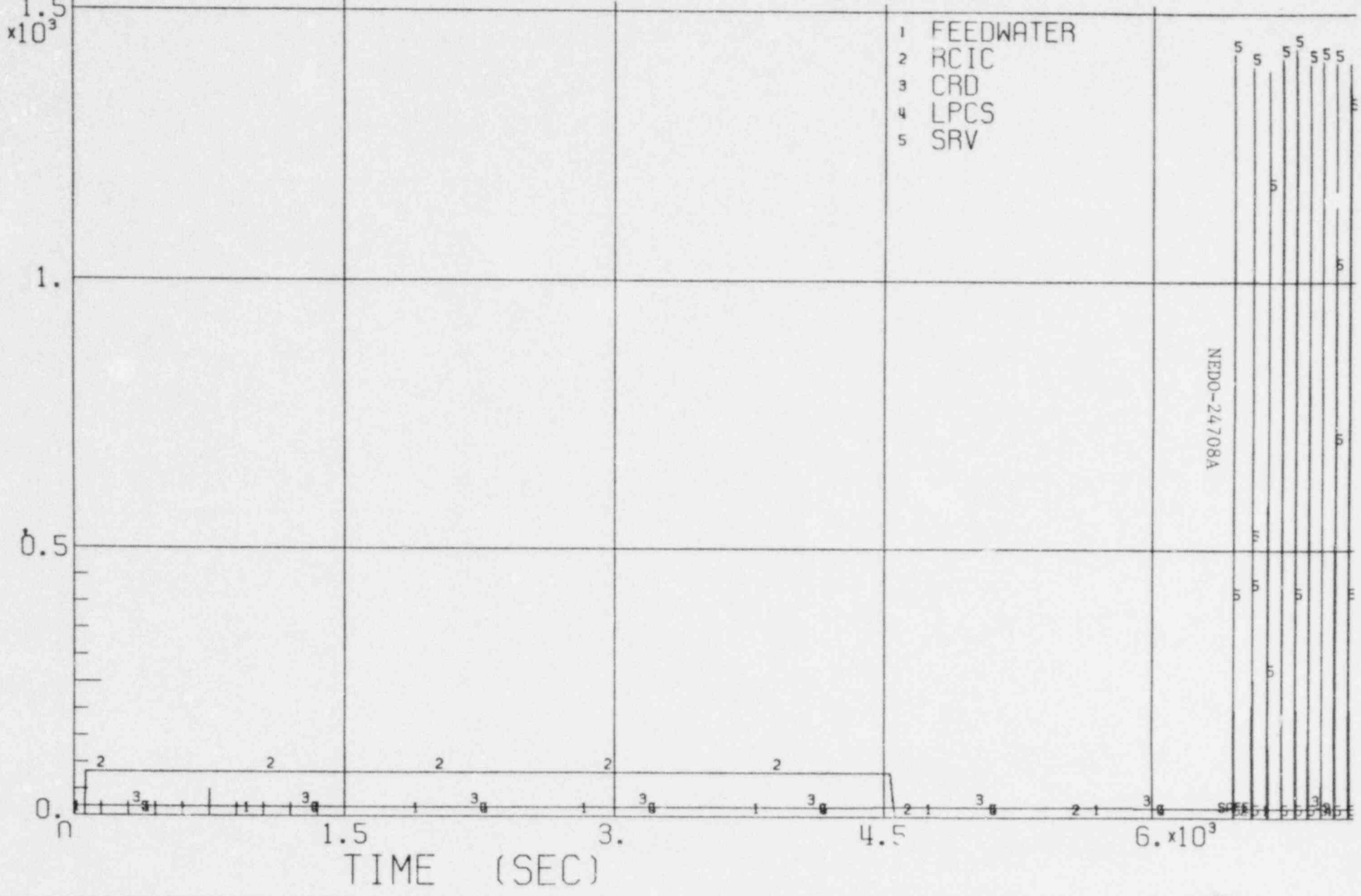

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Figure 3.1.1.1-59.4 FLOW RATES VS TIME FOR A 0.005 FT^2 SUCTION BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

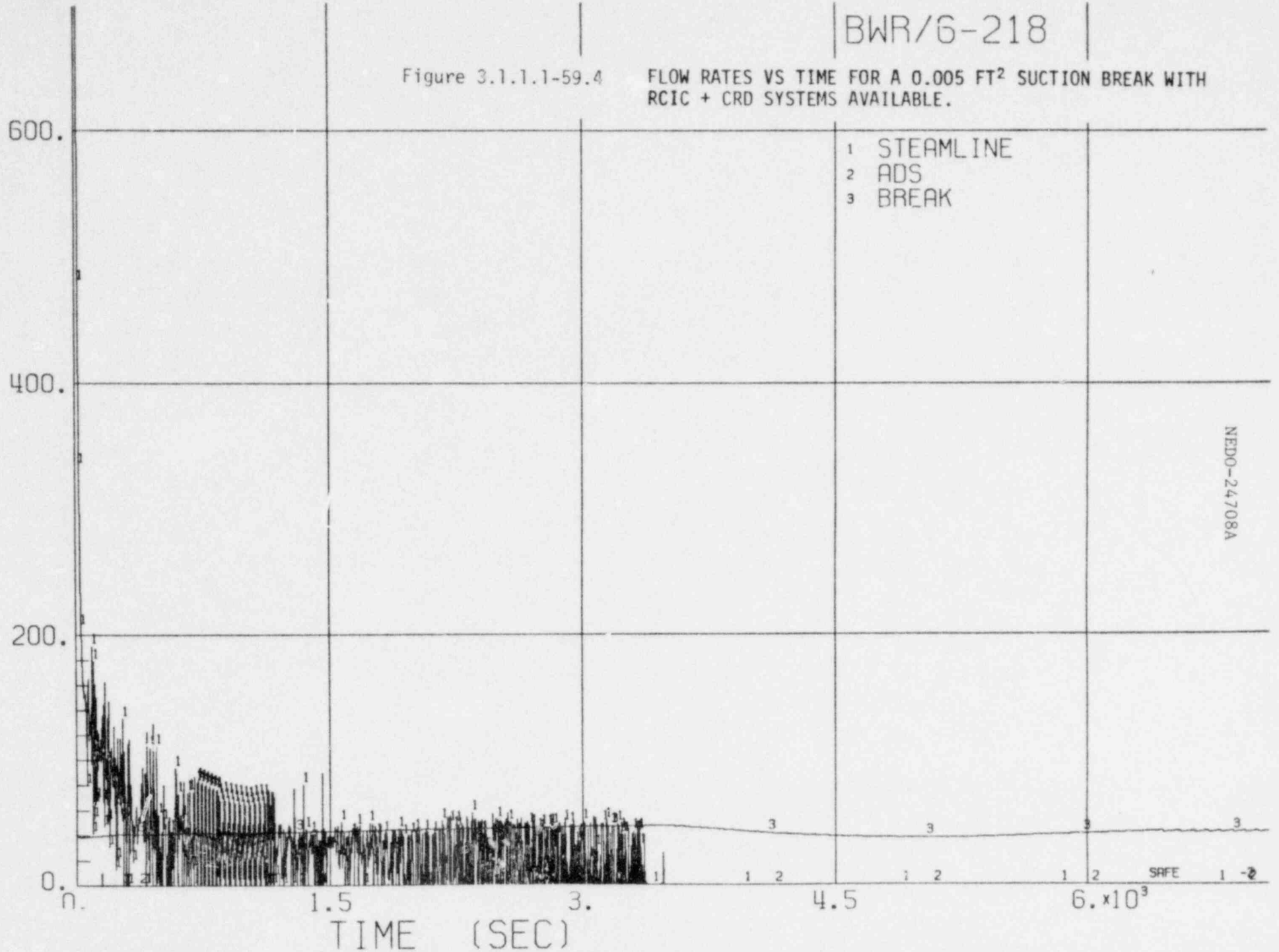

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Figure 3.1.1.1-55.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.005 FT² SUCTION BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

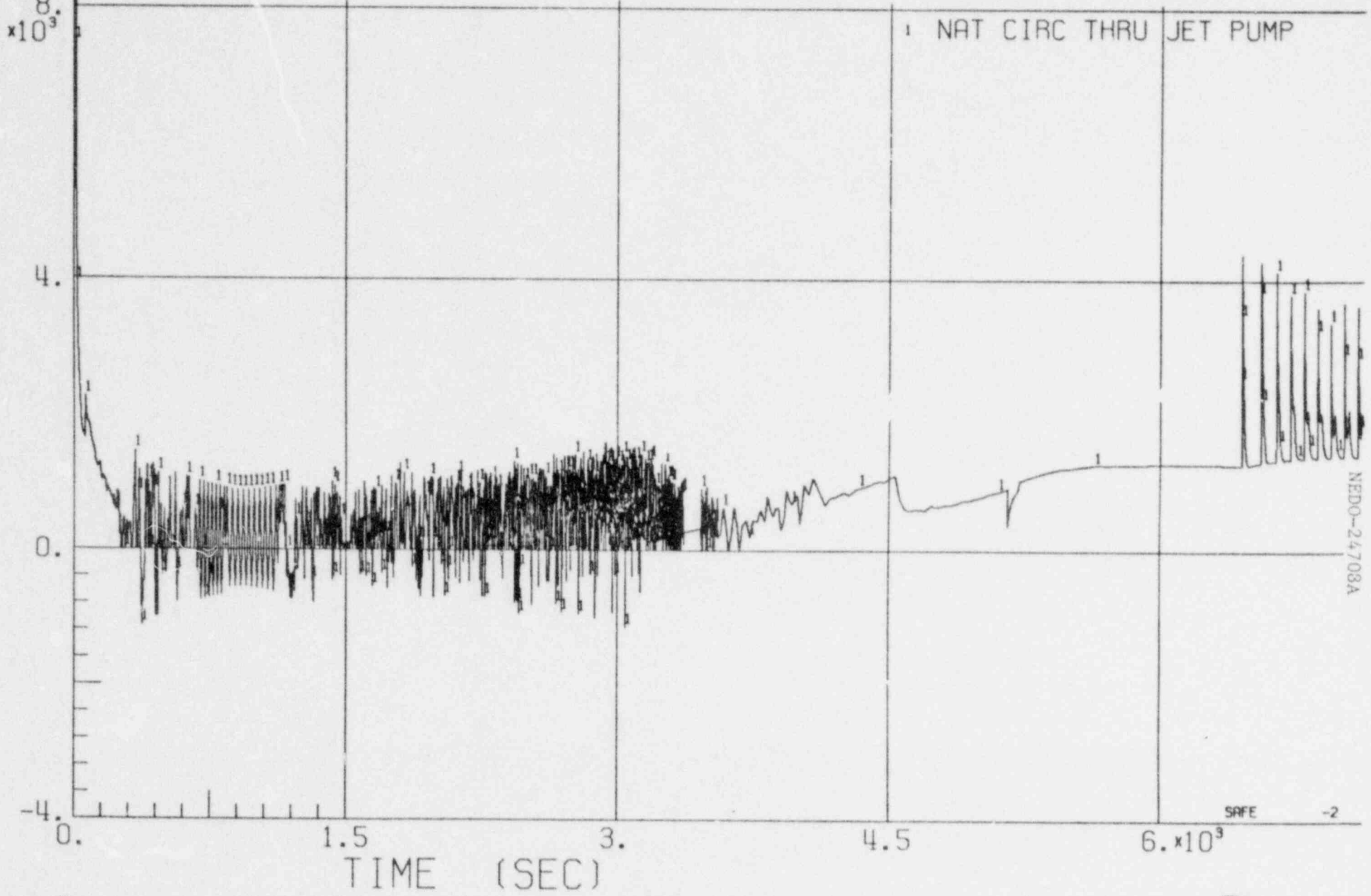

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Figure 3.1.1.1-33.6 TEMPERATURE VS TIME FOR A 0.005 FT^2 SUCTION BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

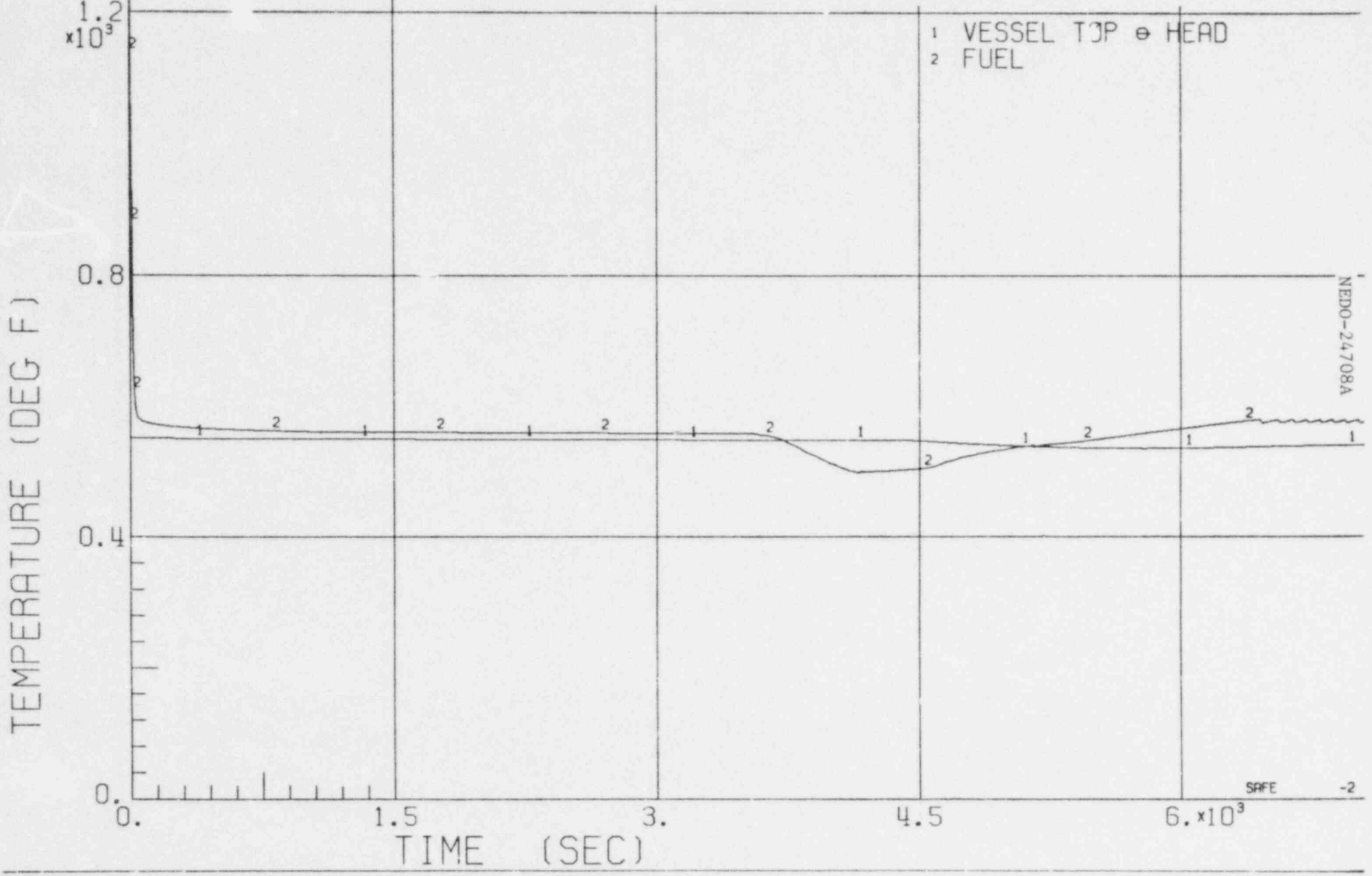

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Figure 3.1.1.1-59.7 ENTHALPY VS TIME FOR A 0.005 FT^2 SUCTION BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

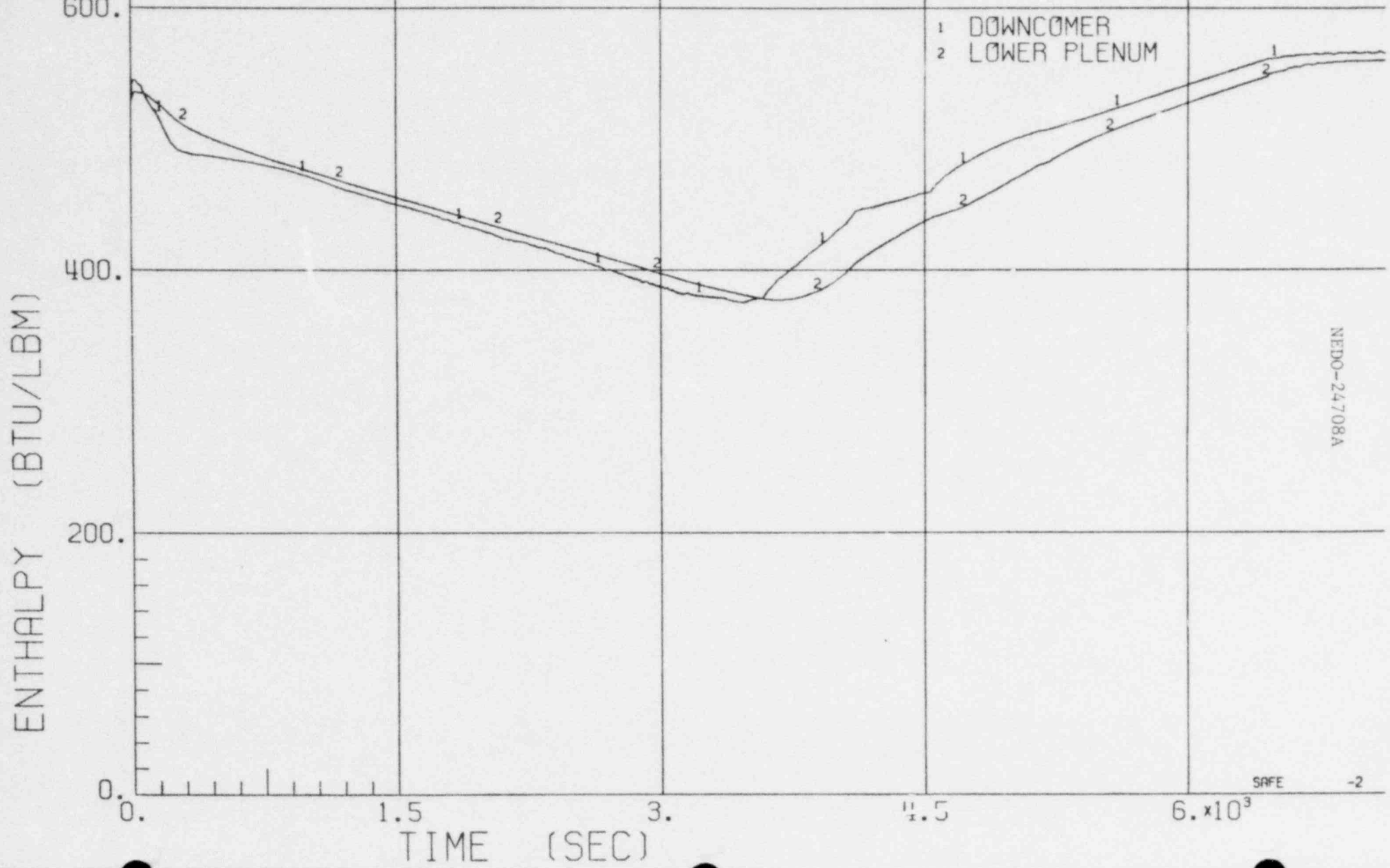

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Figure 3.1.1.1-59.8 QUALITY VS TIME FOR A 0.005 FT^2 SUCTION BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

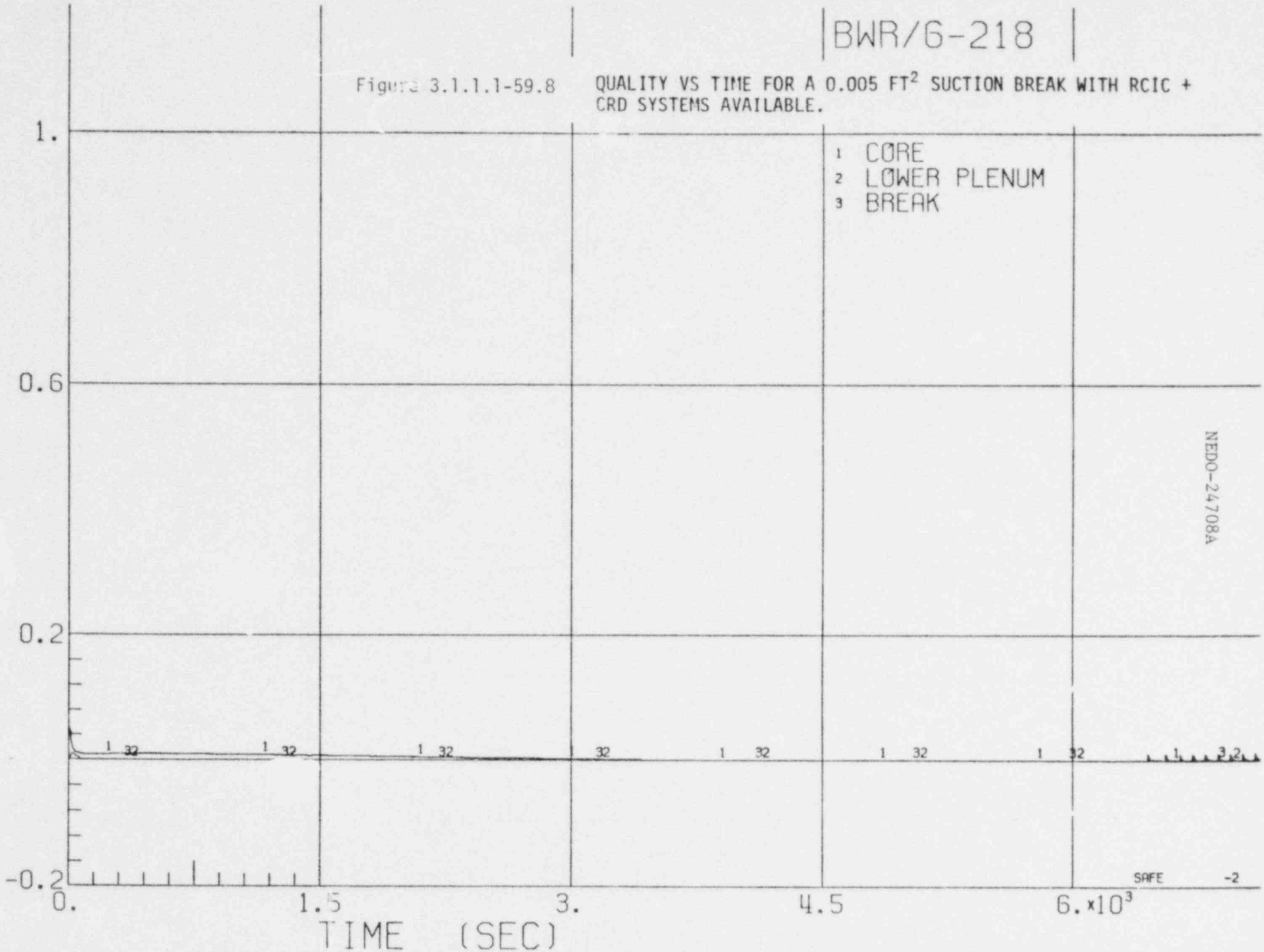

FIGURE 3.1.1.1-60.1 VESSEL PRESSURE VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

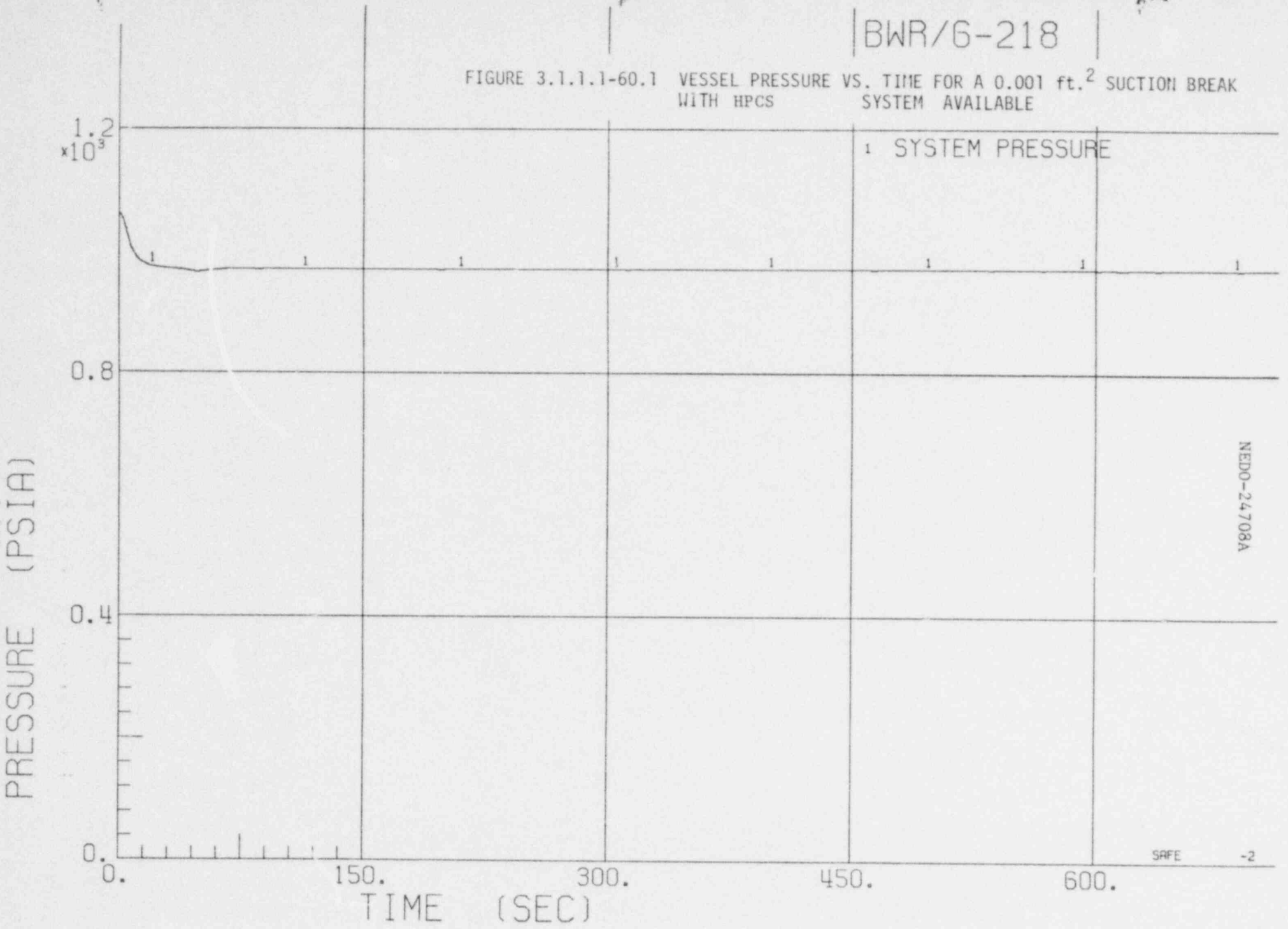

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FIGURE 3.1.1.1-60.2 WATER LEVEL VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

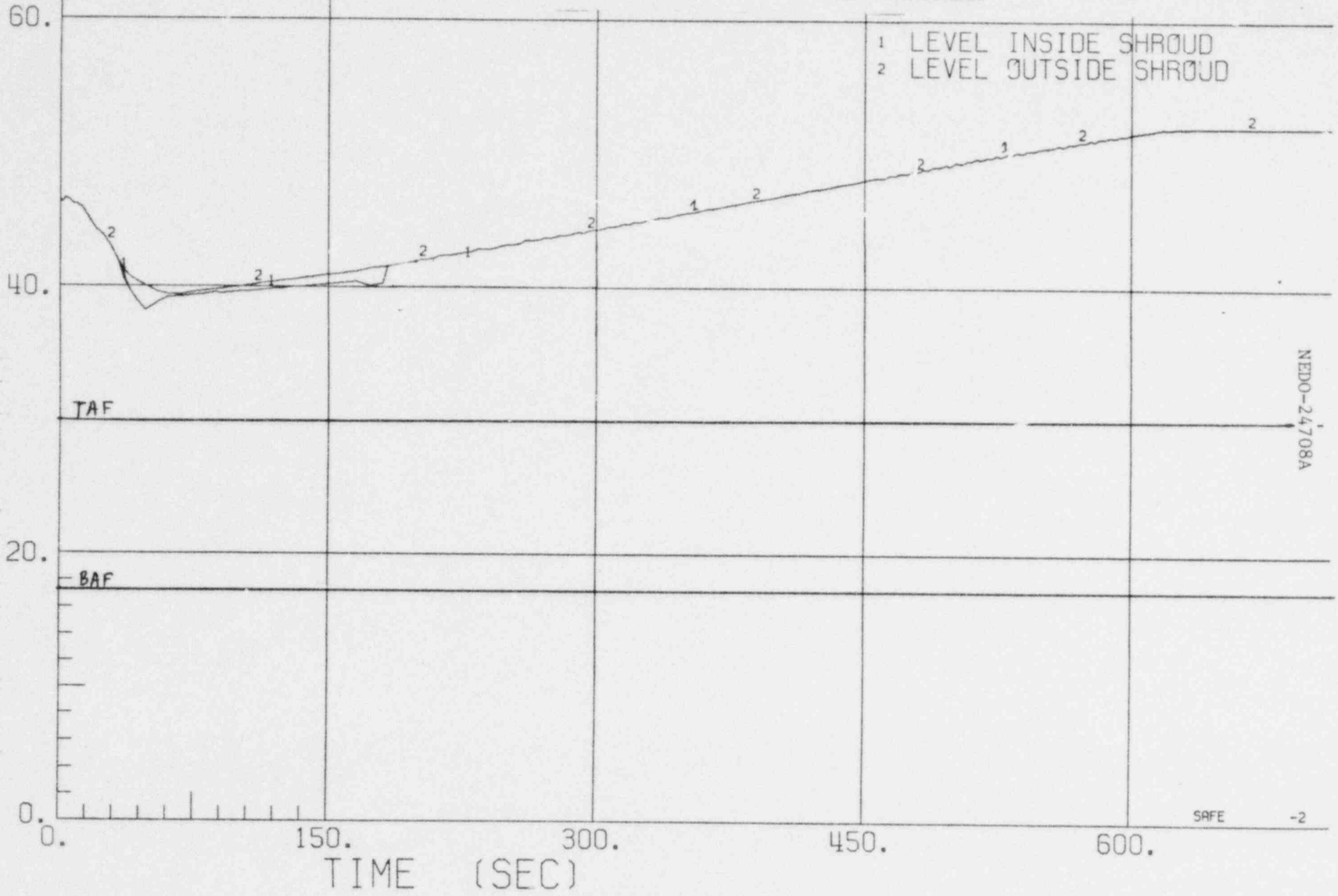

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FIGURE 3.1.1.1-60.3 SYSTEM FLOW RATES VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

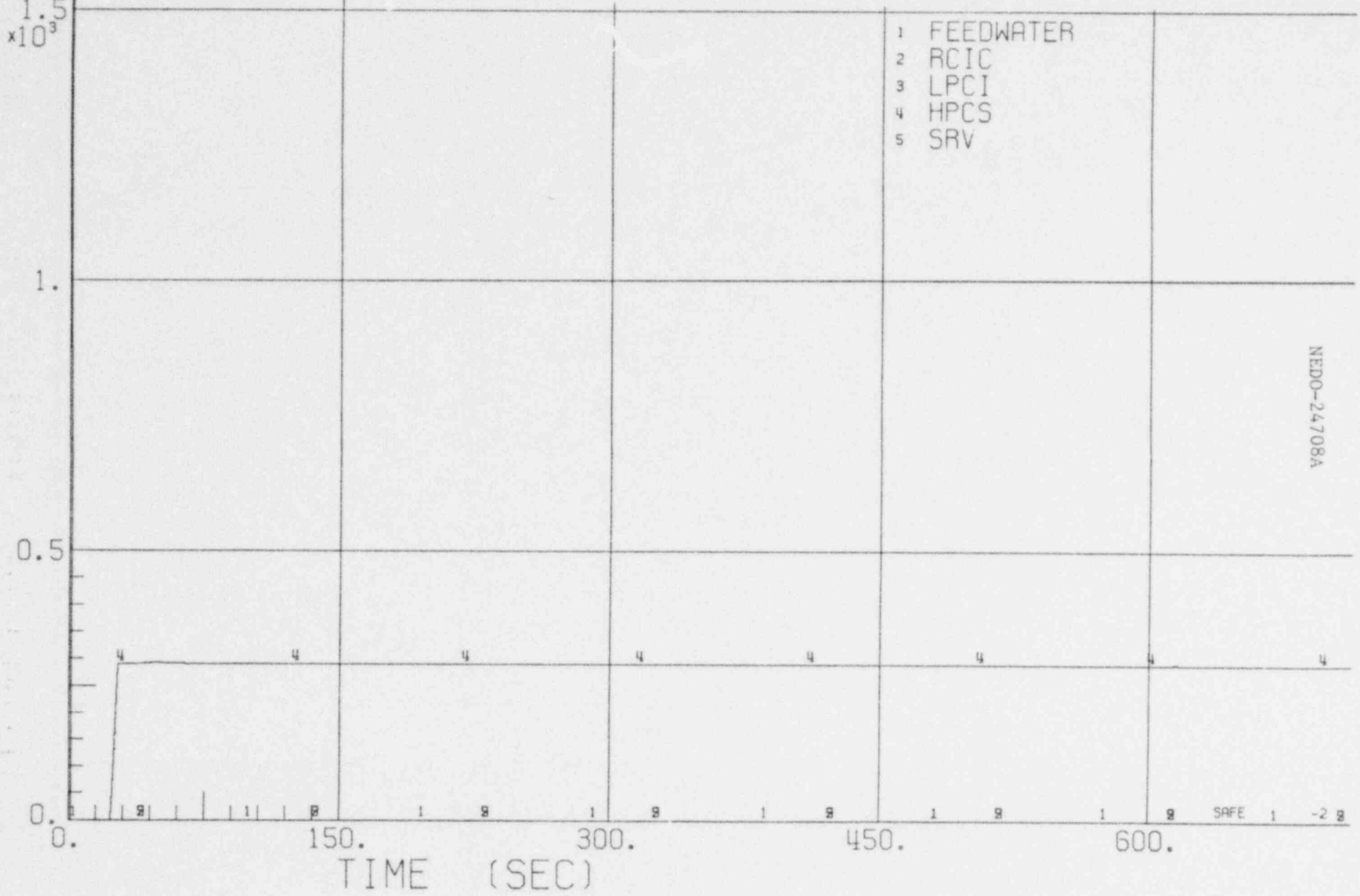

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FIGURE 3.1.3.1-60.4 FLOW RATES VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

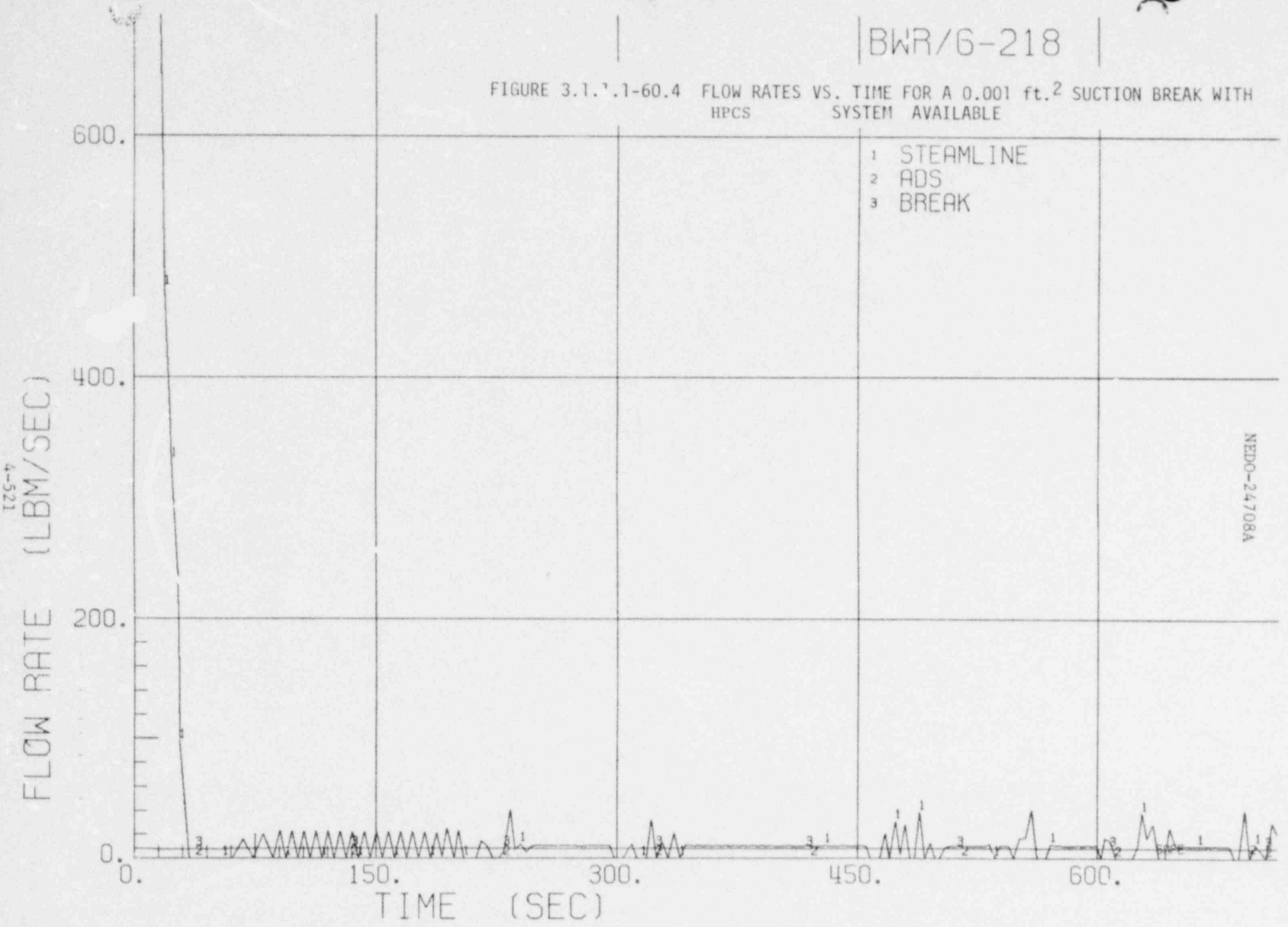

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FIGURE 3.1.1.1-60.5 NATURAL CIRCULATION FLOW RATE VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

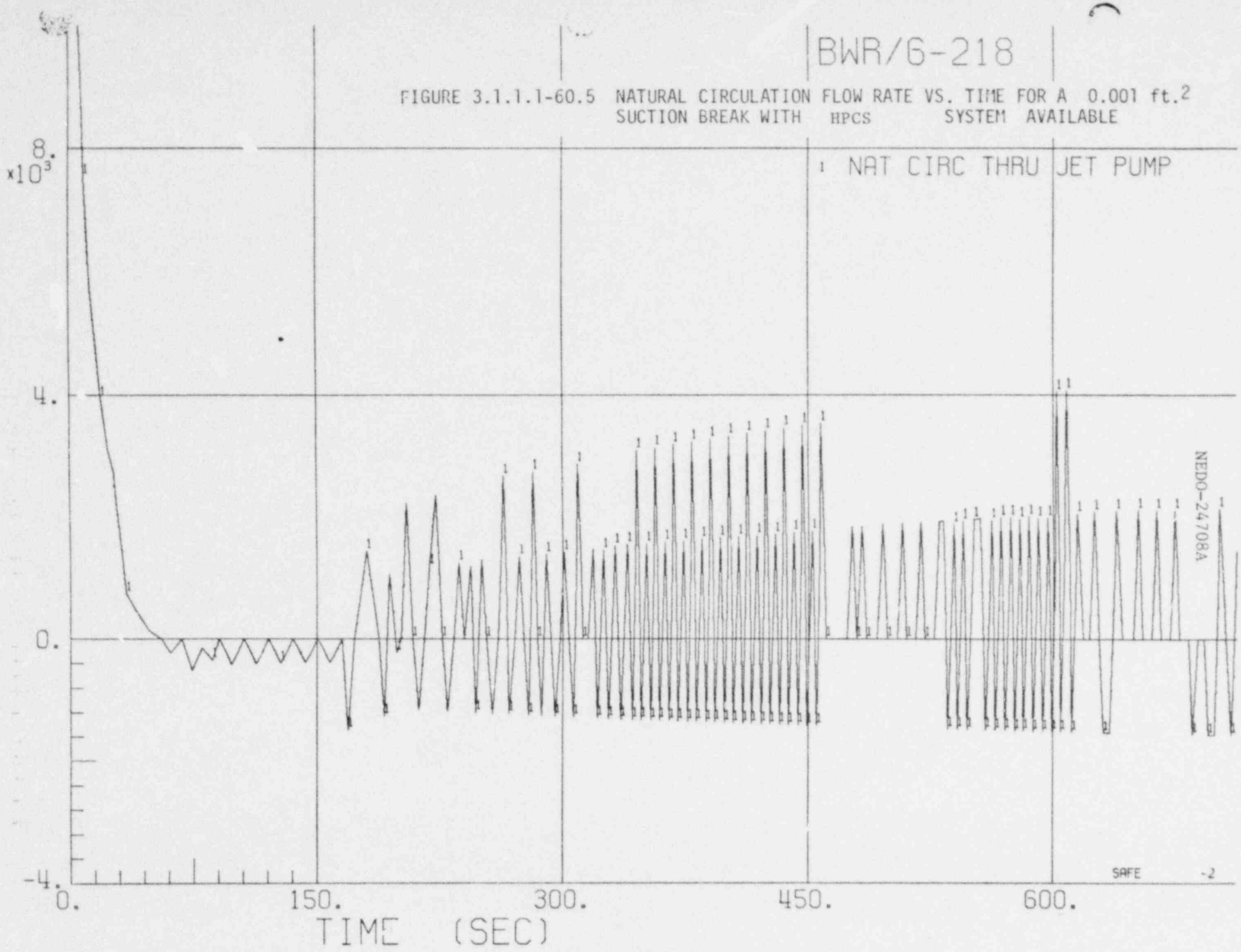

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FIGURE 3.1.1.1-60.6 TEMPERATURE VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

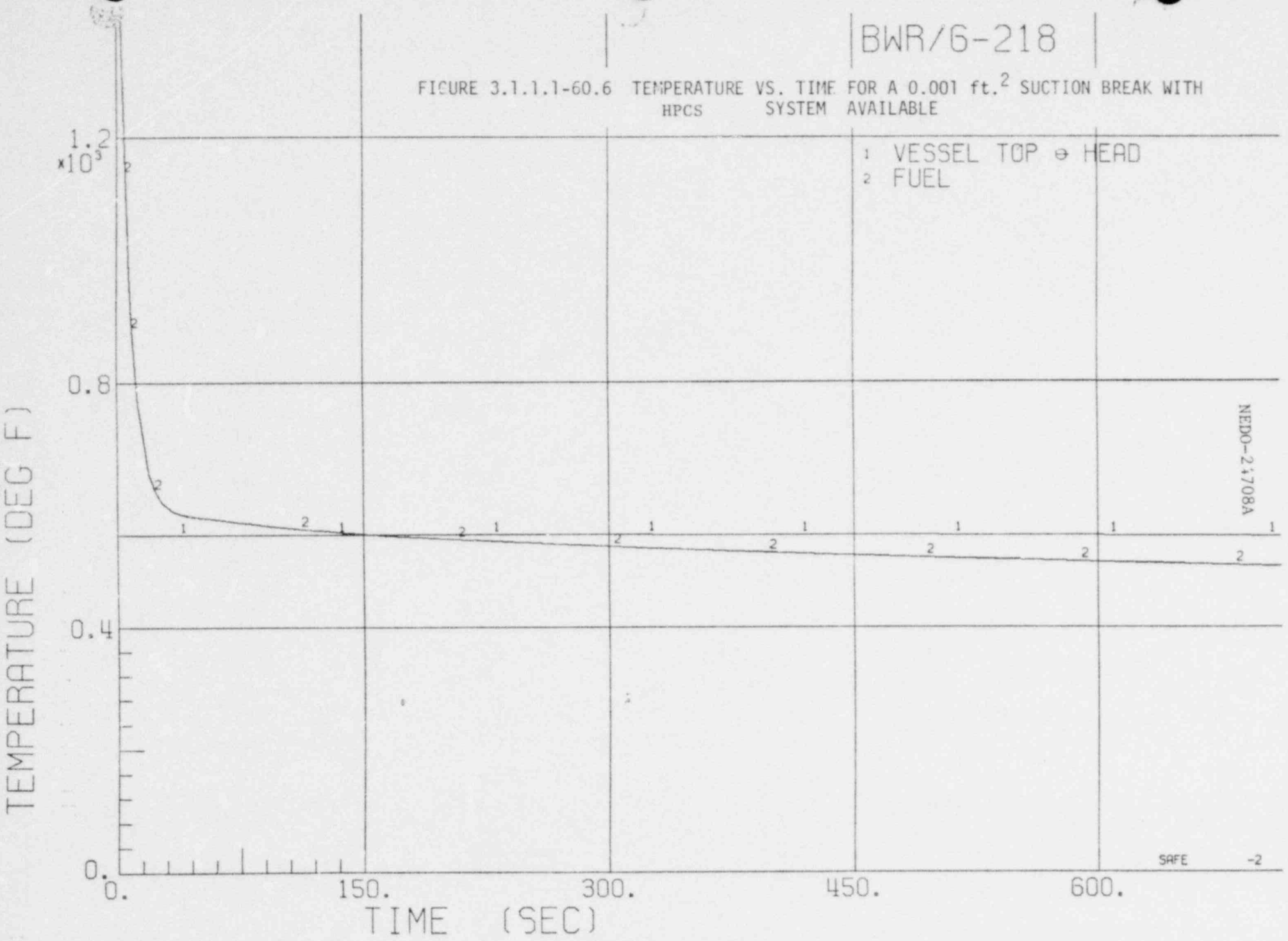

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FIGURE 3.1.1.1-60.7 ENTHALPY VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

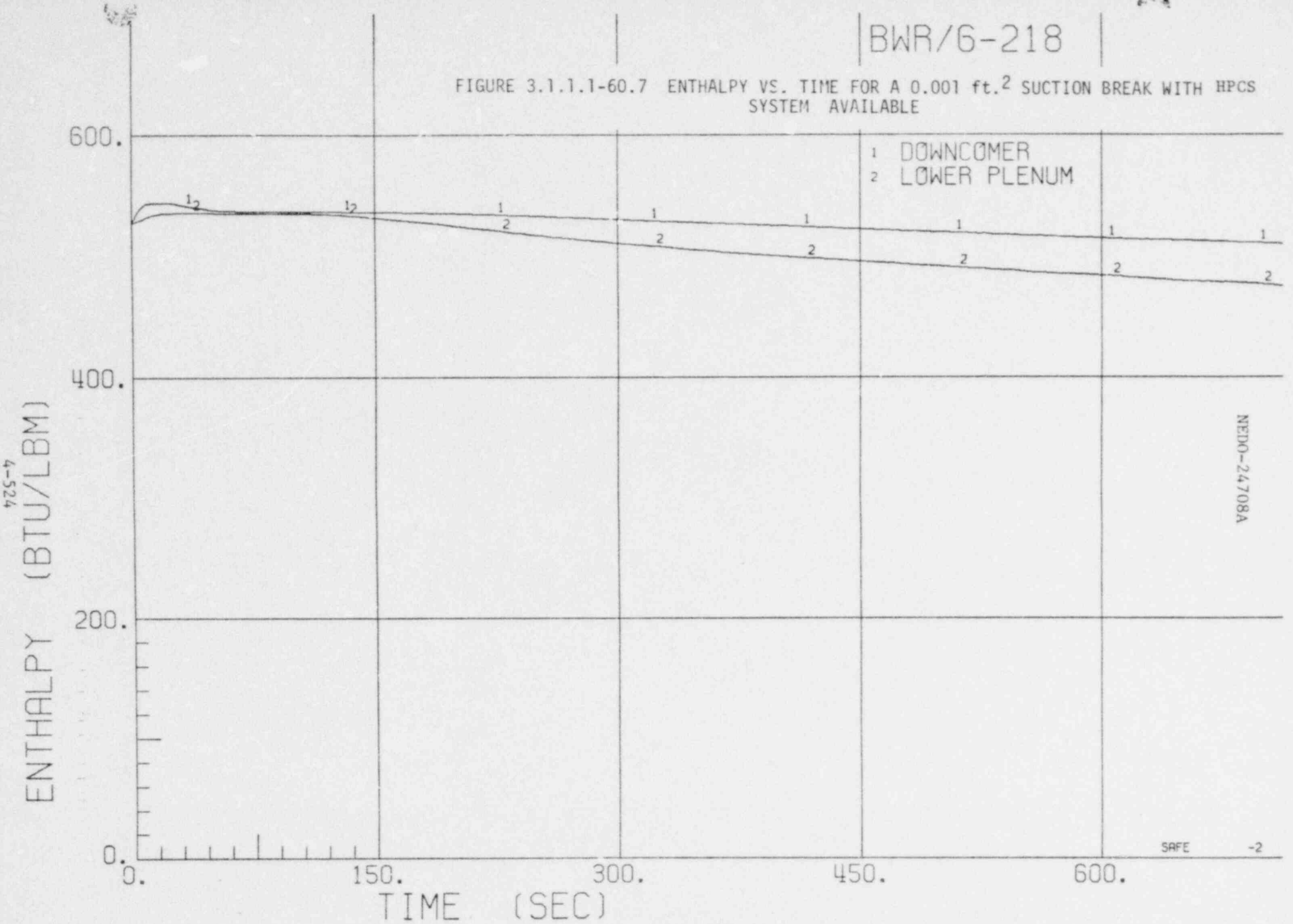

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FIGURE 3.1.1.1-60.8 QUALITY VS. TIME FOR A 0.001 ft.^{2} SUCTION BREAK WITH HPCS SYSTEM AVAILABLE

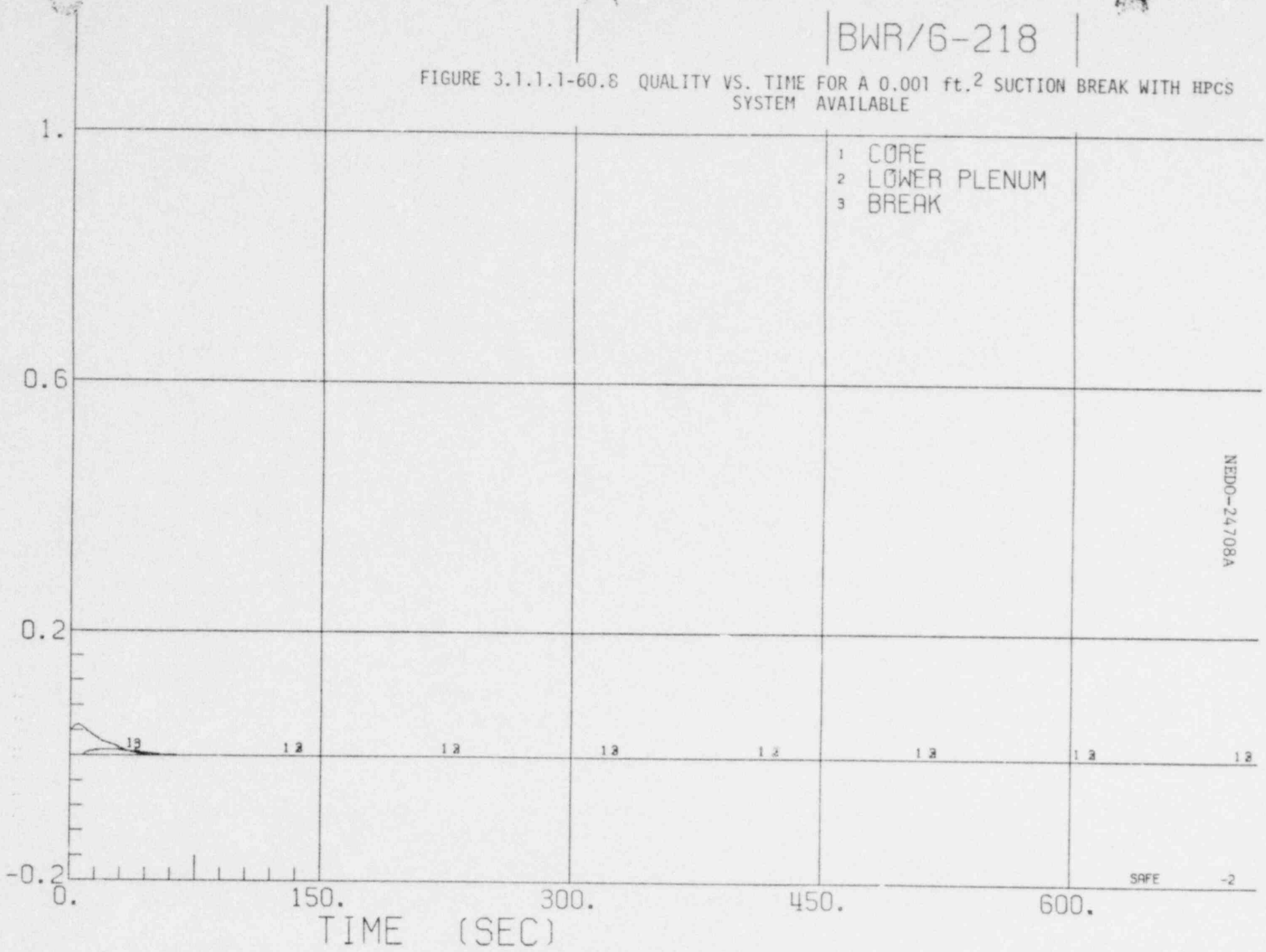

Figure 3.1.1.1-61.1 VESSEL PRESSURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

Figure 3.1.1.1-61.2 WATER LEVEL VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

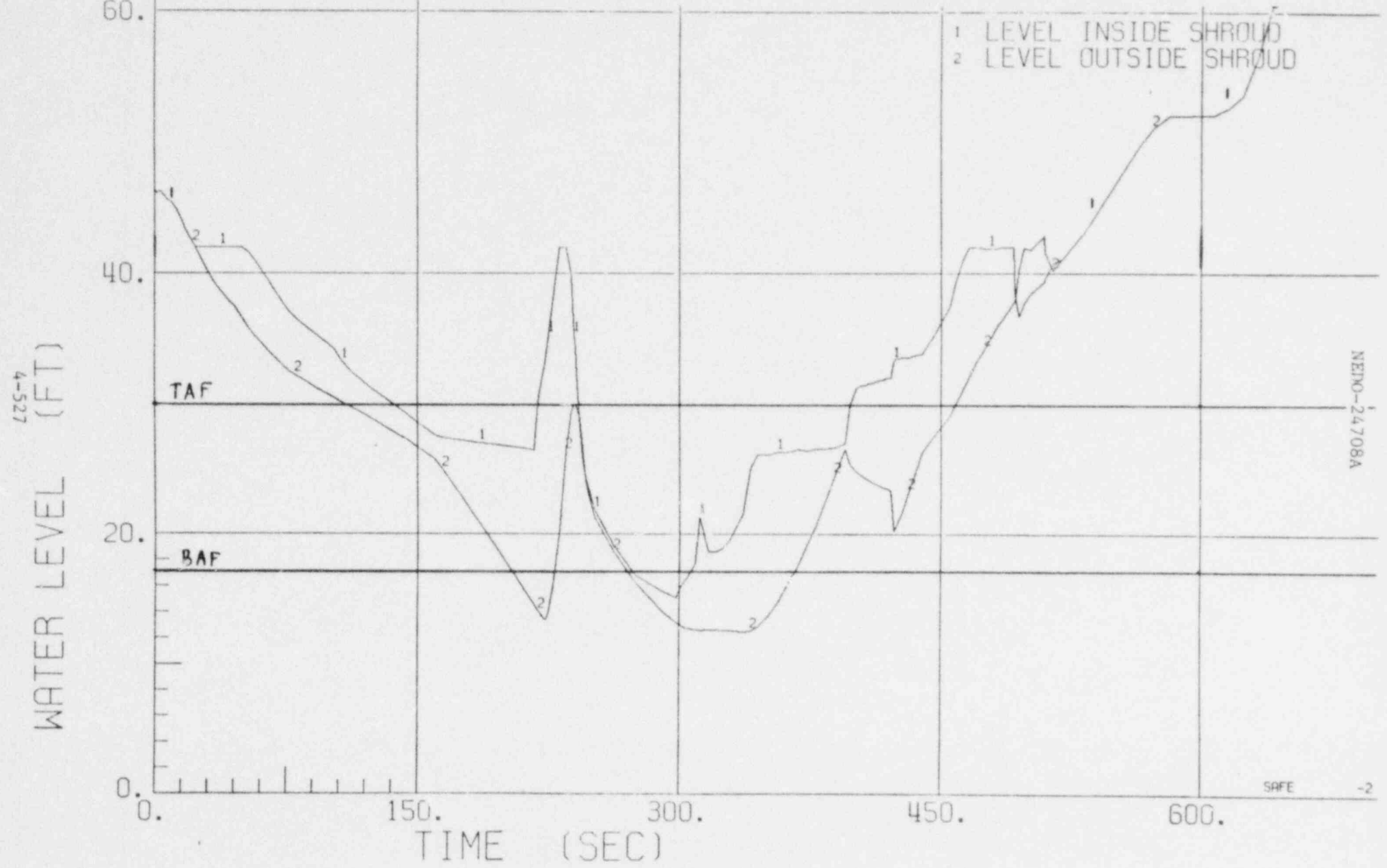

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Figure 3.1.1.1-61.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

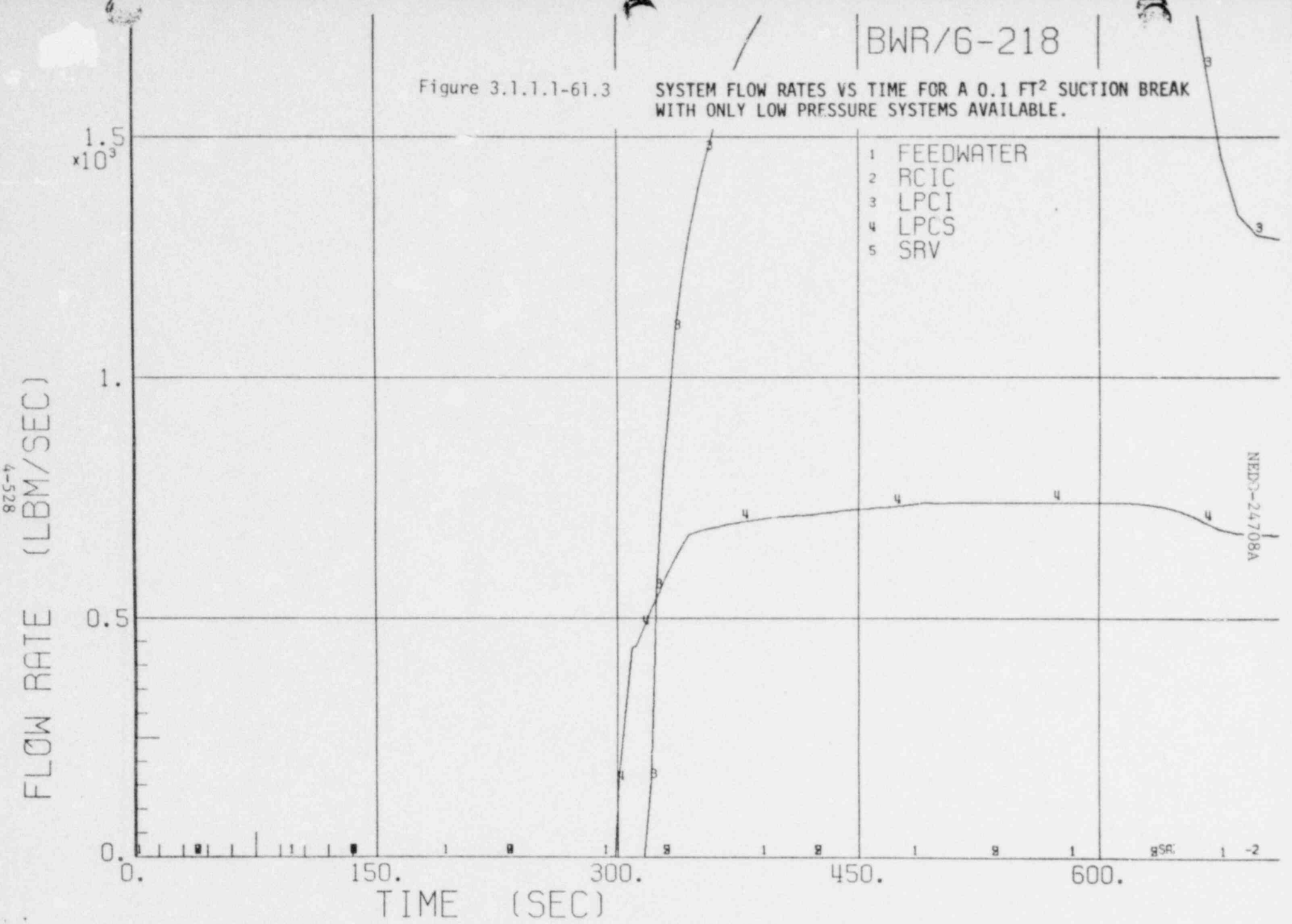

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Figure 3.1.1.1-61.4 FLOW RATES VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

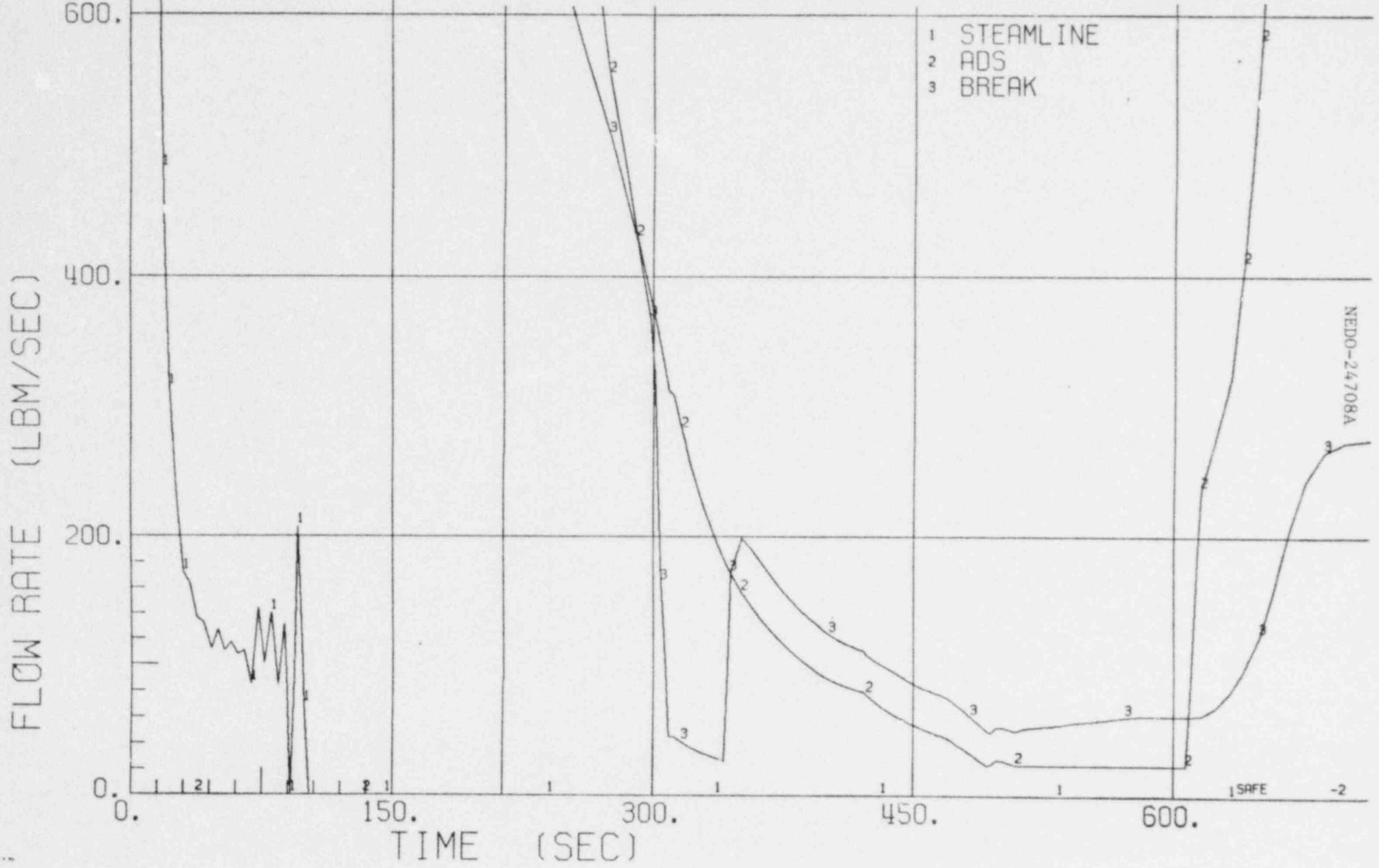

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Figure 3.1.1.1-61.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

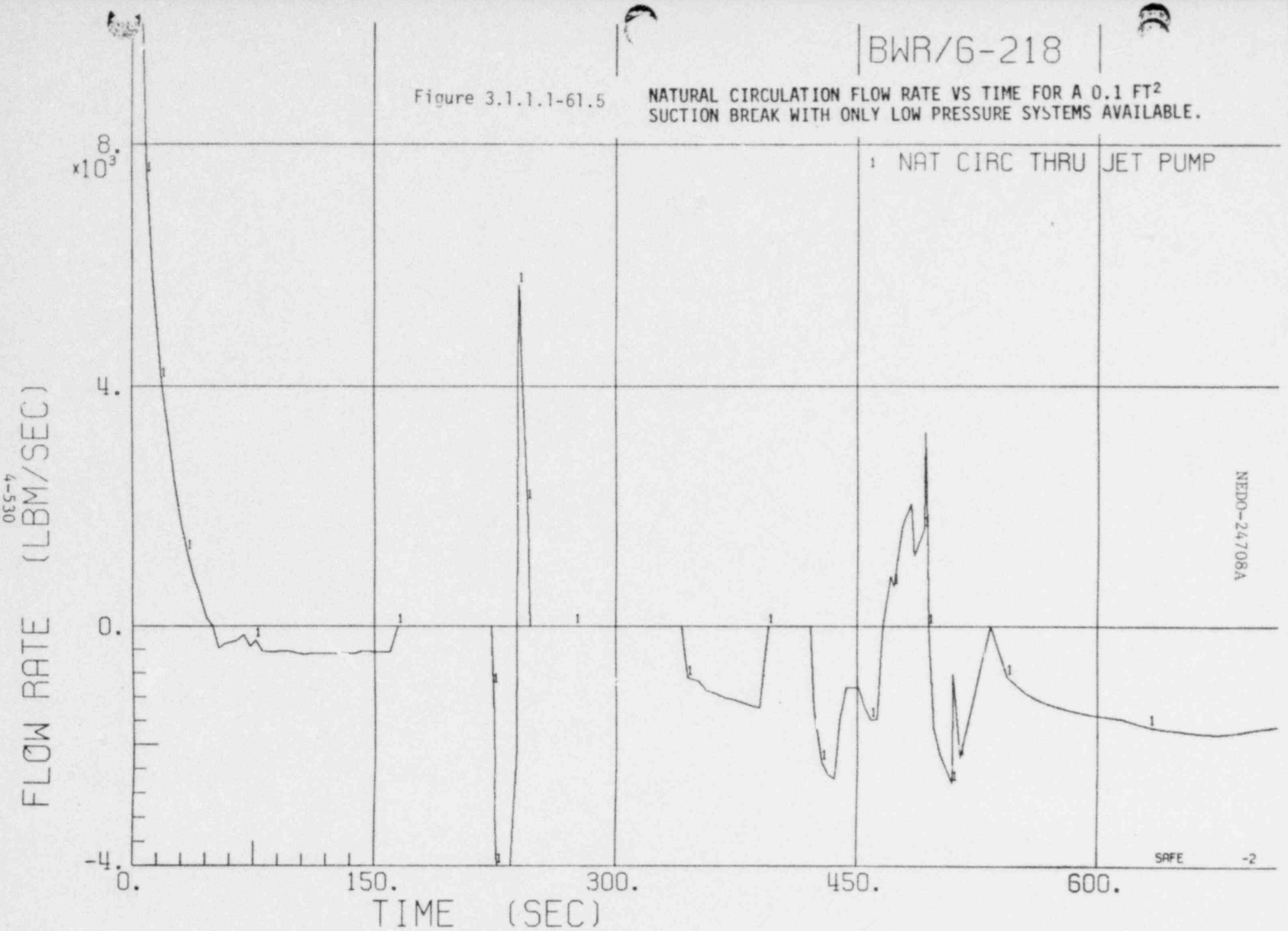

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Figure 3.1.1.1-61.6 TEMPERATURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

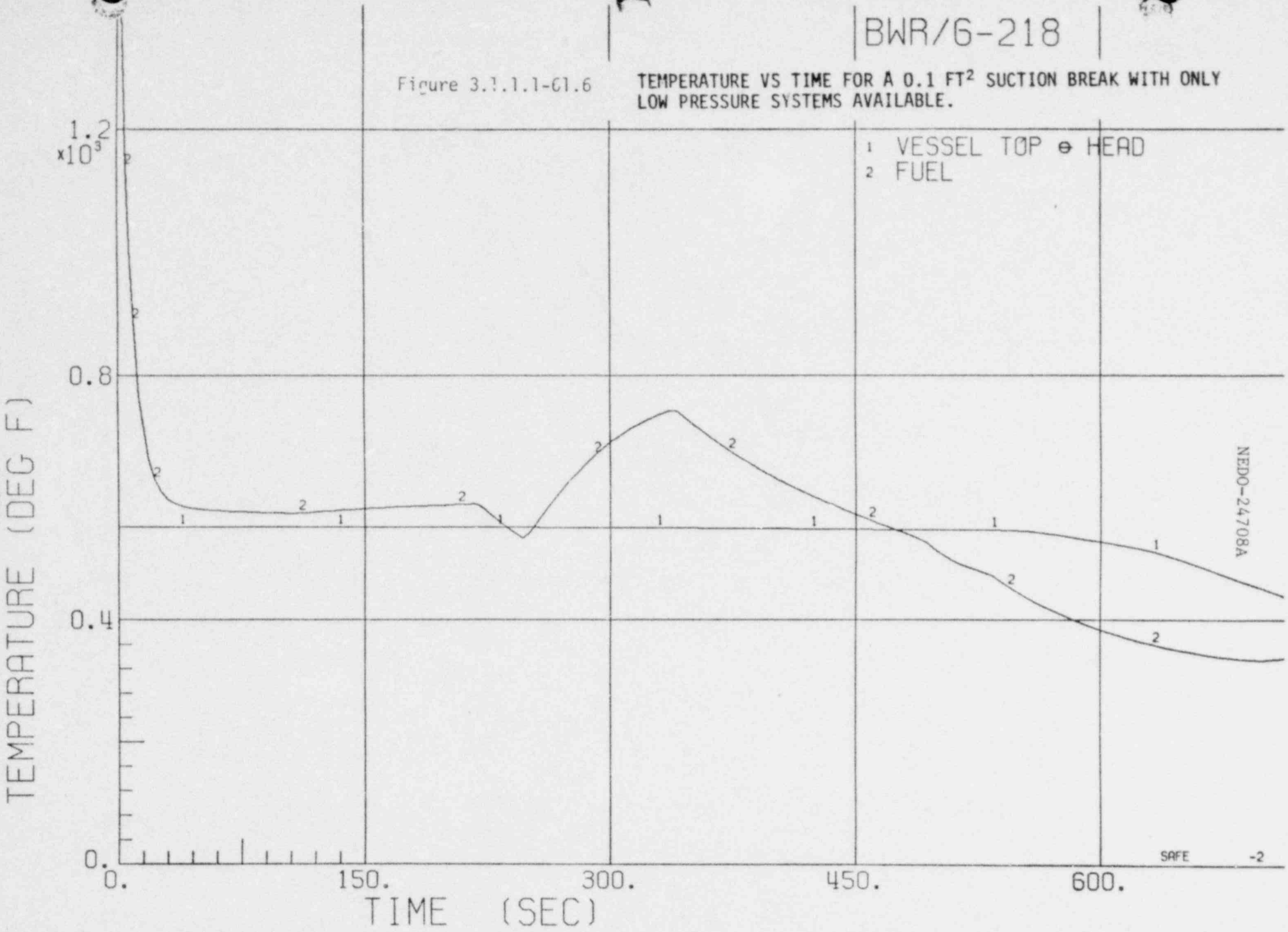

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Figure 3.1.1.1-61.7 ENTHALPY VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

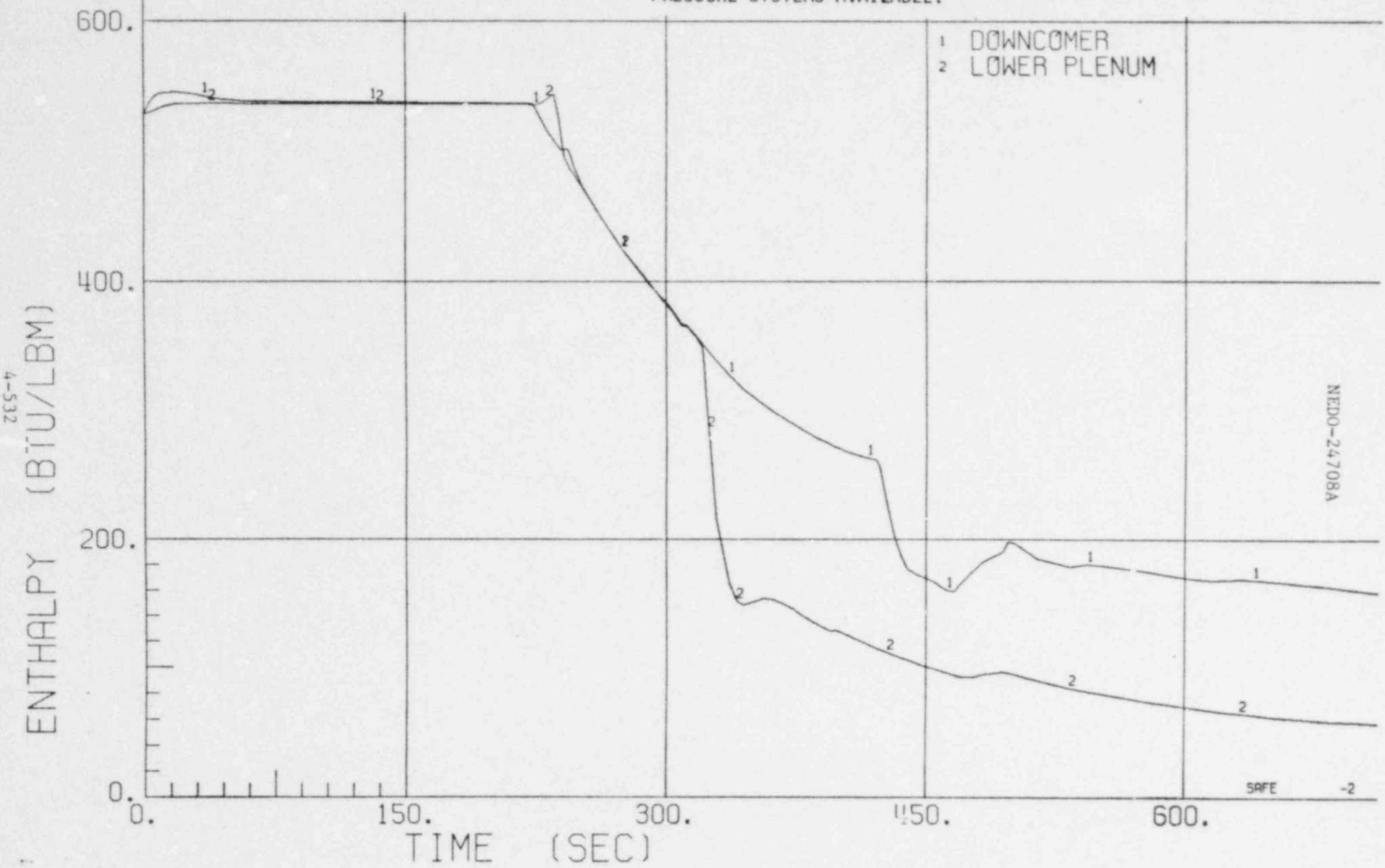

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Figure 3.1.1.1-61.8 QUALITY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONLY LOW PRESSURE SYSTEMS AVAILABLE.

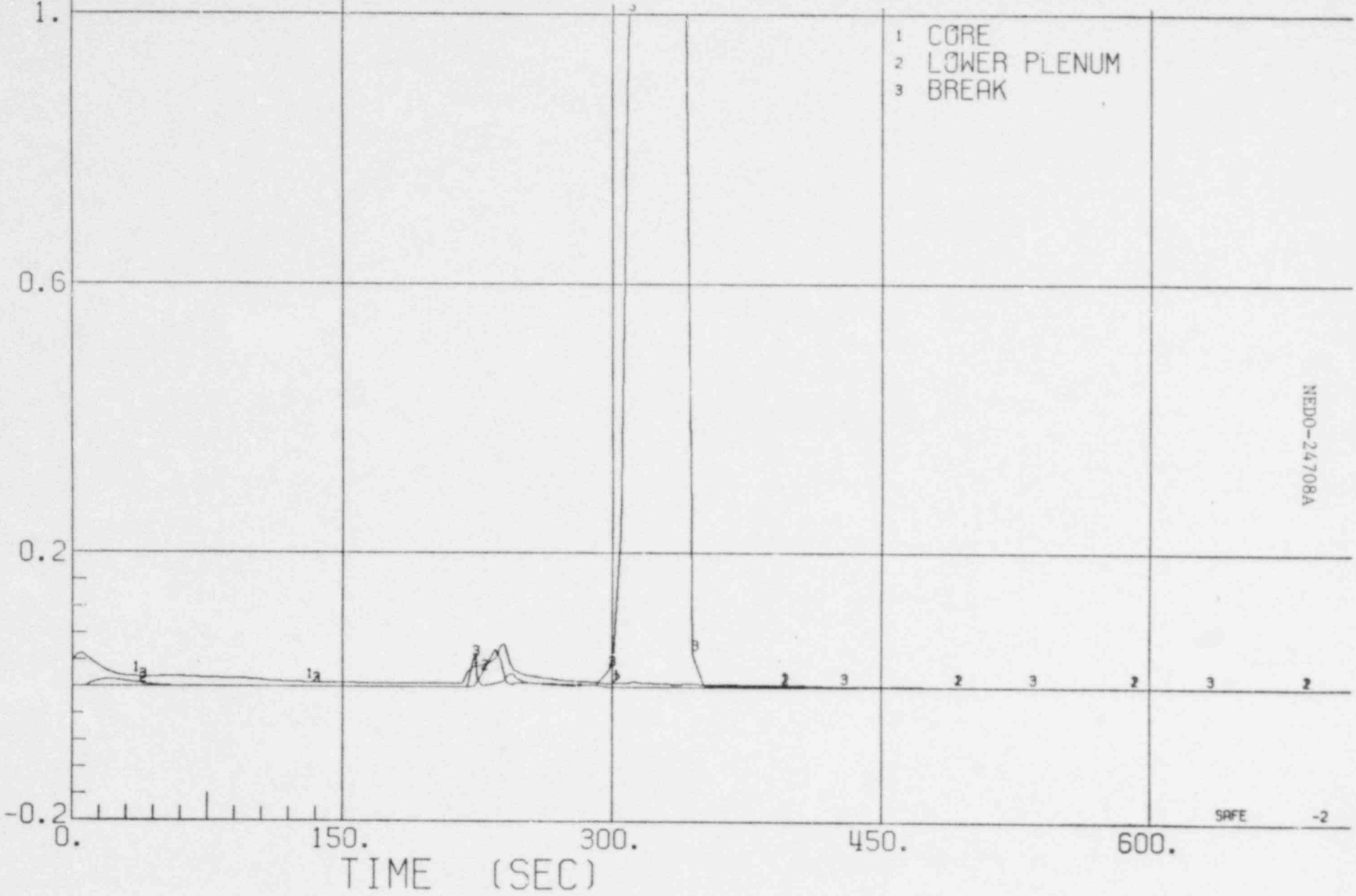

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Figure 3.1.1.1-62.1 VESSEL PRESSURE VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND RCIC + CRD SYSTEMS AVAILABLE.

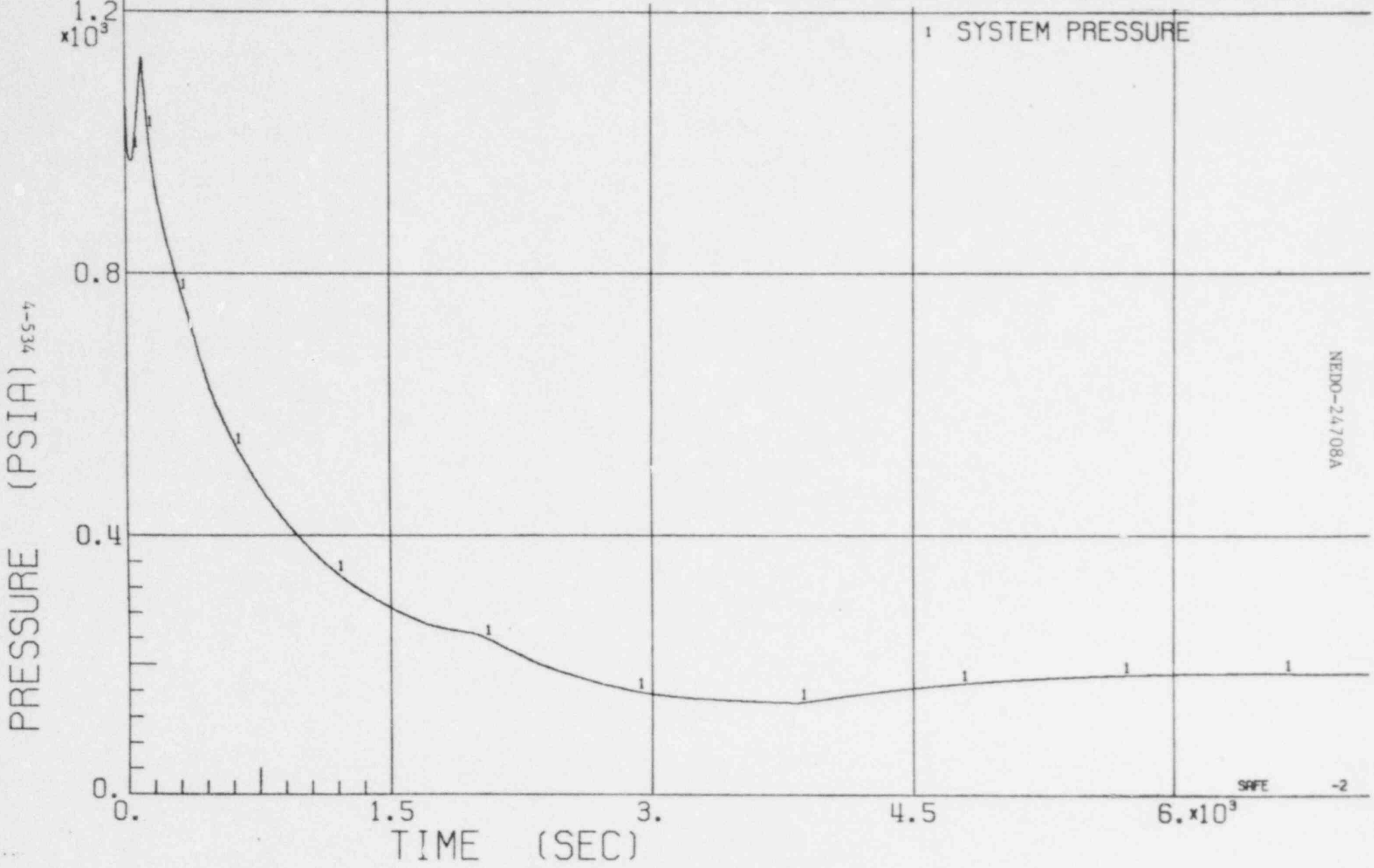

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Figure 3.1.1.1-62.2 WATER LEVEL VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND HCIC + CRD SYSTEMS AVAILABLE.

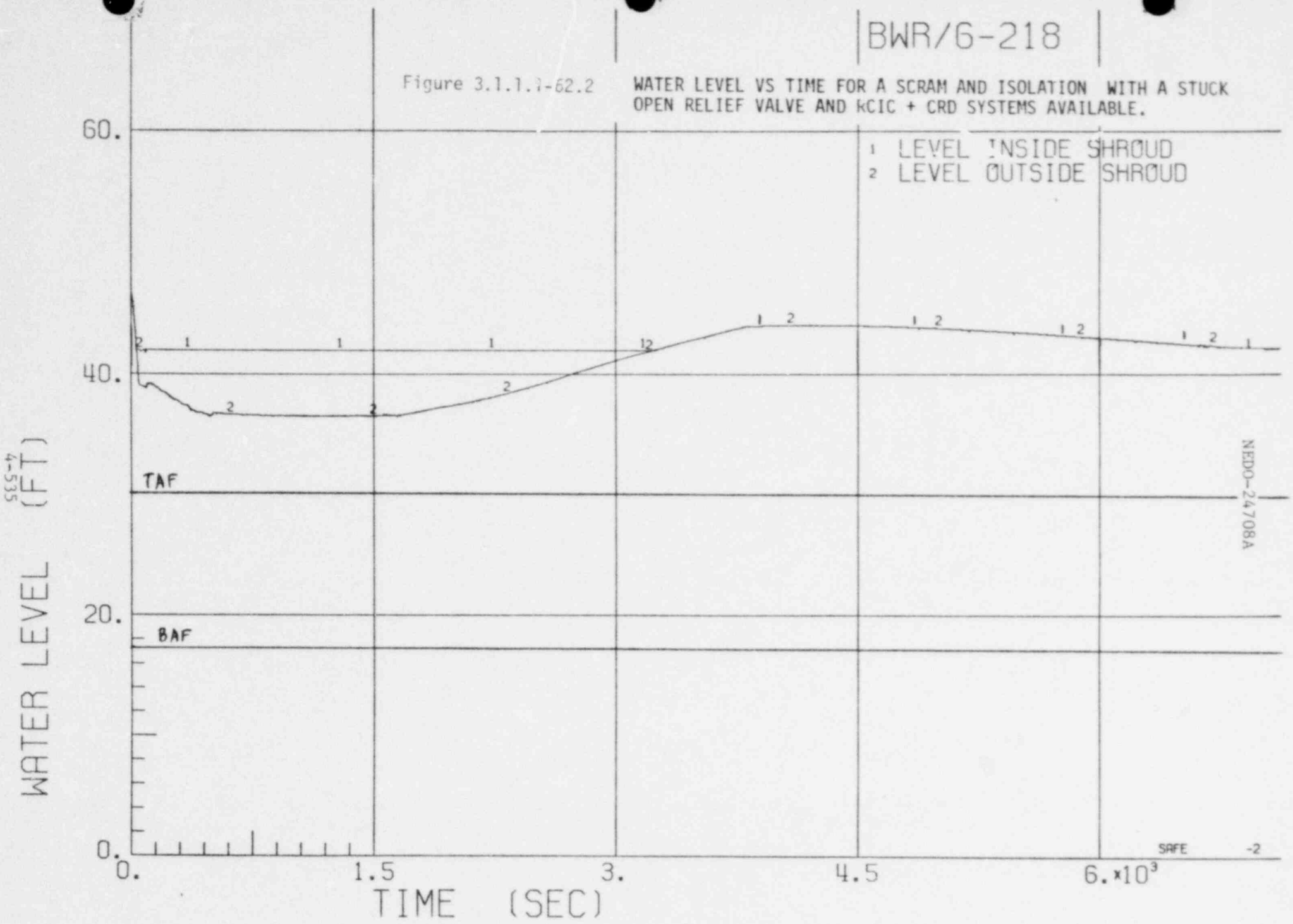

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Figure 3.1.1.1-62.3 SYSTEM FLOW RATES VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND RCIC + CRD SYSTEMS AVAILABLE.

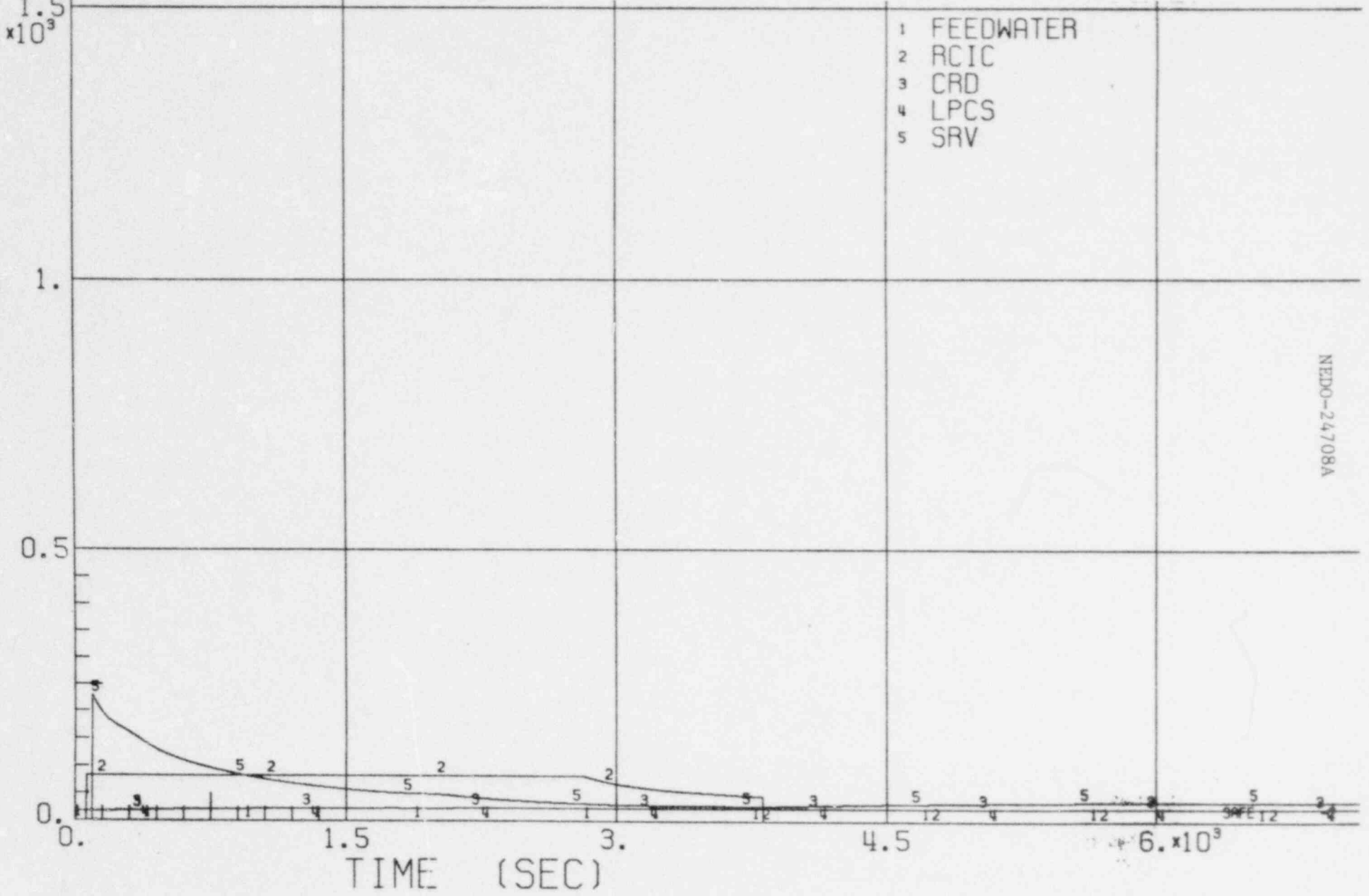

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Figure 3.1.1.1-62.4 FLOW RATES VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND RCIC + CRD SYSTEMS AVAILABLE.

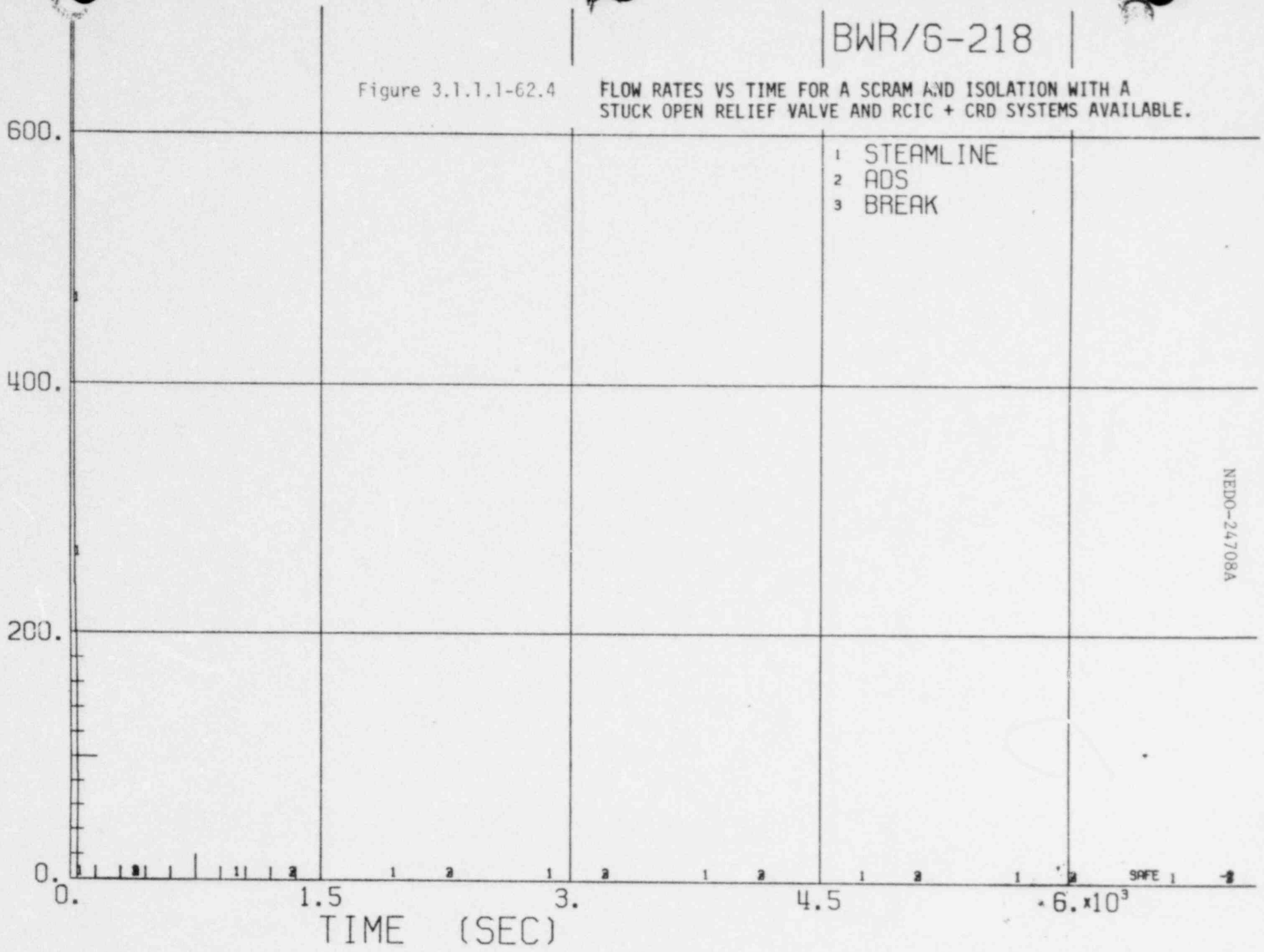

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Figure 3.1.1.1-62.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND RCIC + CRD SYSTEMS AVAILABLE.

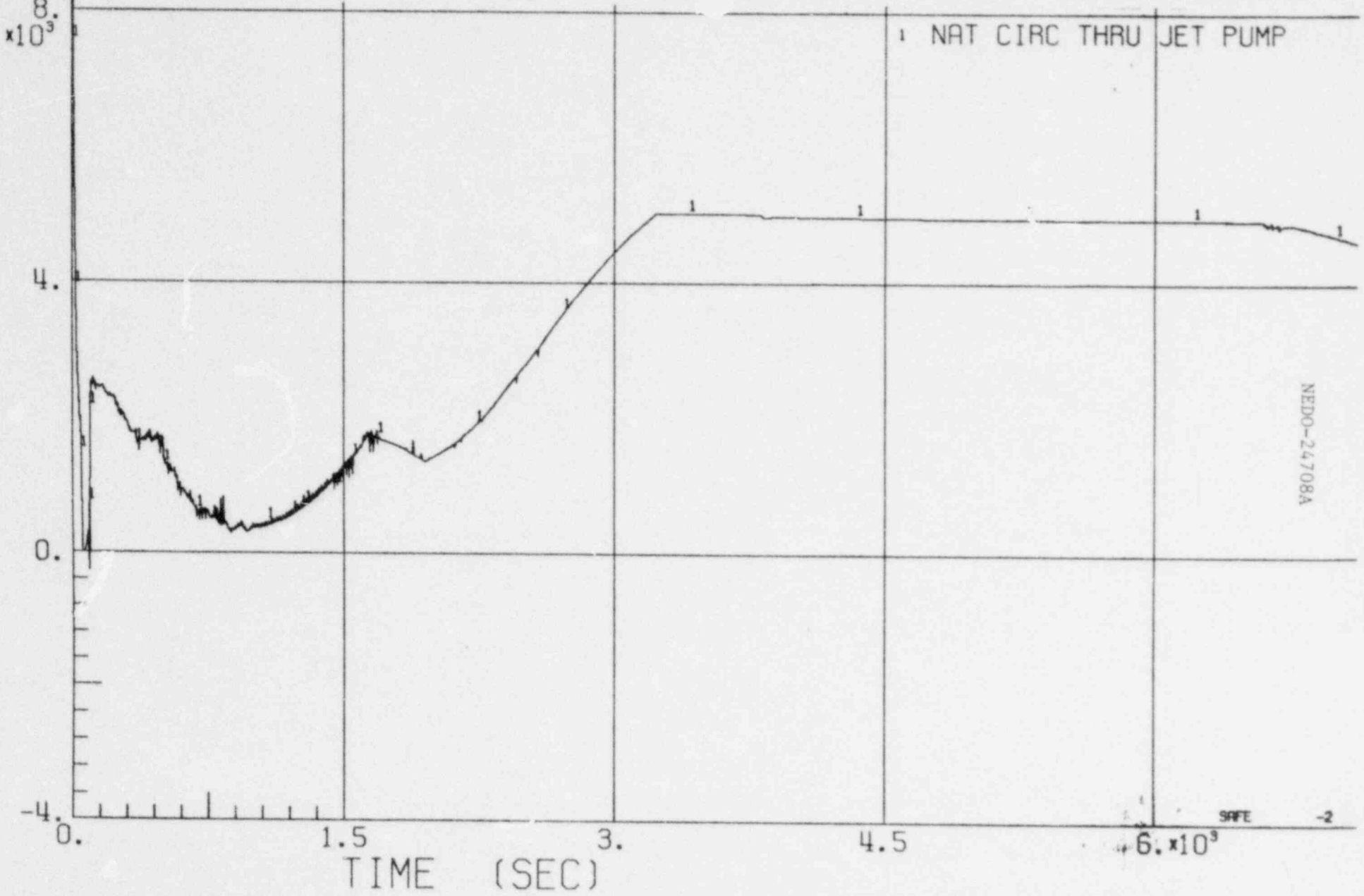

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Figure 3.1.1.1-62.6 TEMPERATURE VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND RCIC + CRD SYSTEMS AVAILABLE.

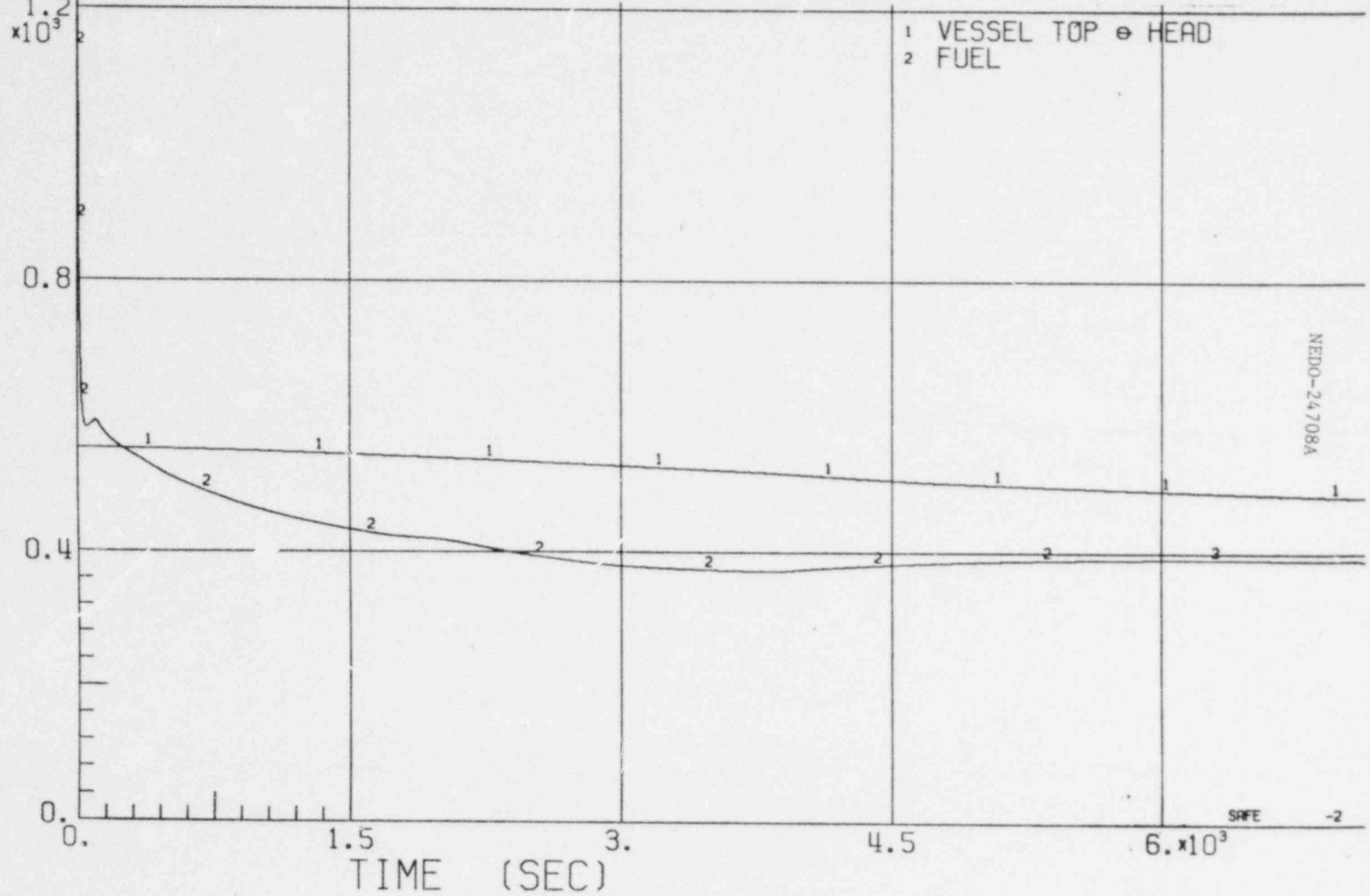

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Figure 3.1.1.1-62.7 ENTHALPY VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND RCIC + CRD SYSTEMS AVAILABLE.

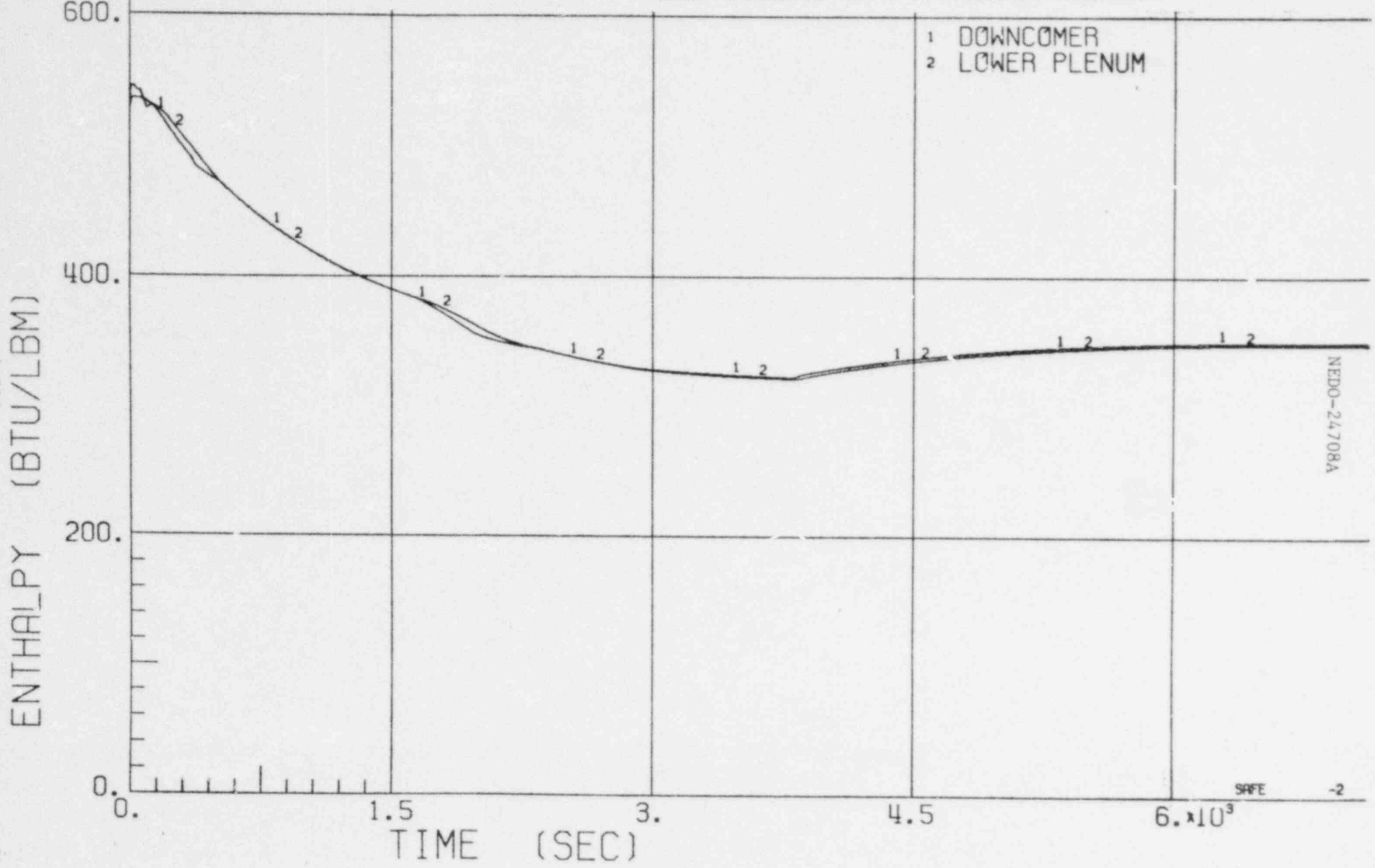

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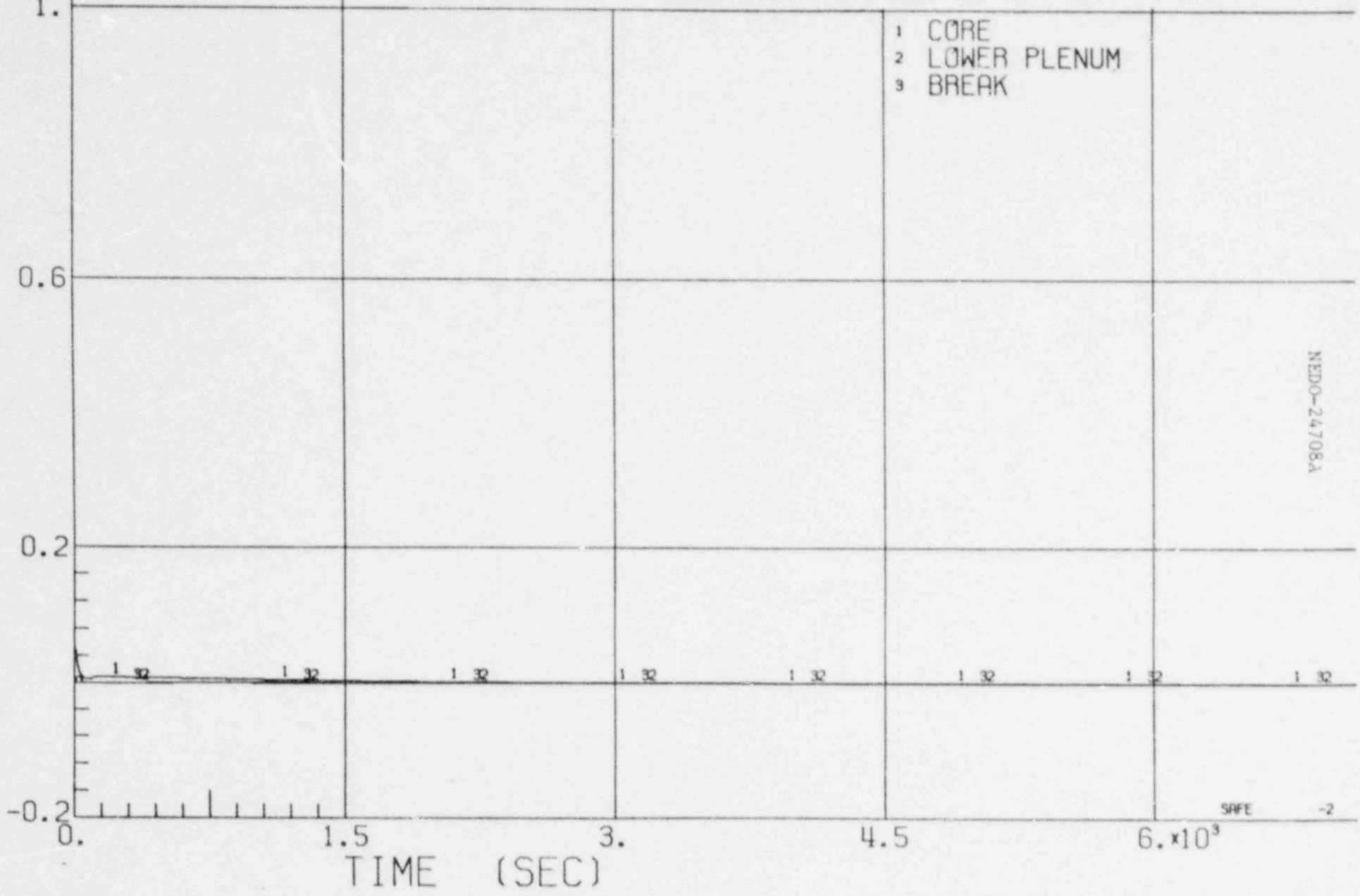
Figure 3.1.1.1-62.8 QUALITY VS TIME FOR A SCRAM AND ISOLATION WITH A STUCK OPEN RELIEF VALVE AND RCIC + CRD SYSTEMS AVAILABLE.



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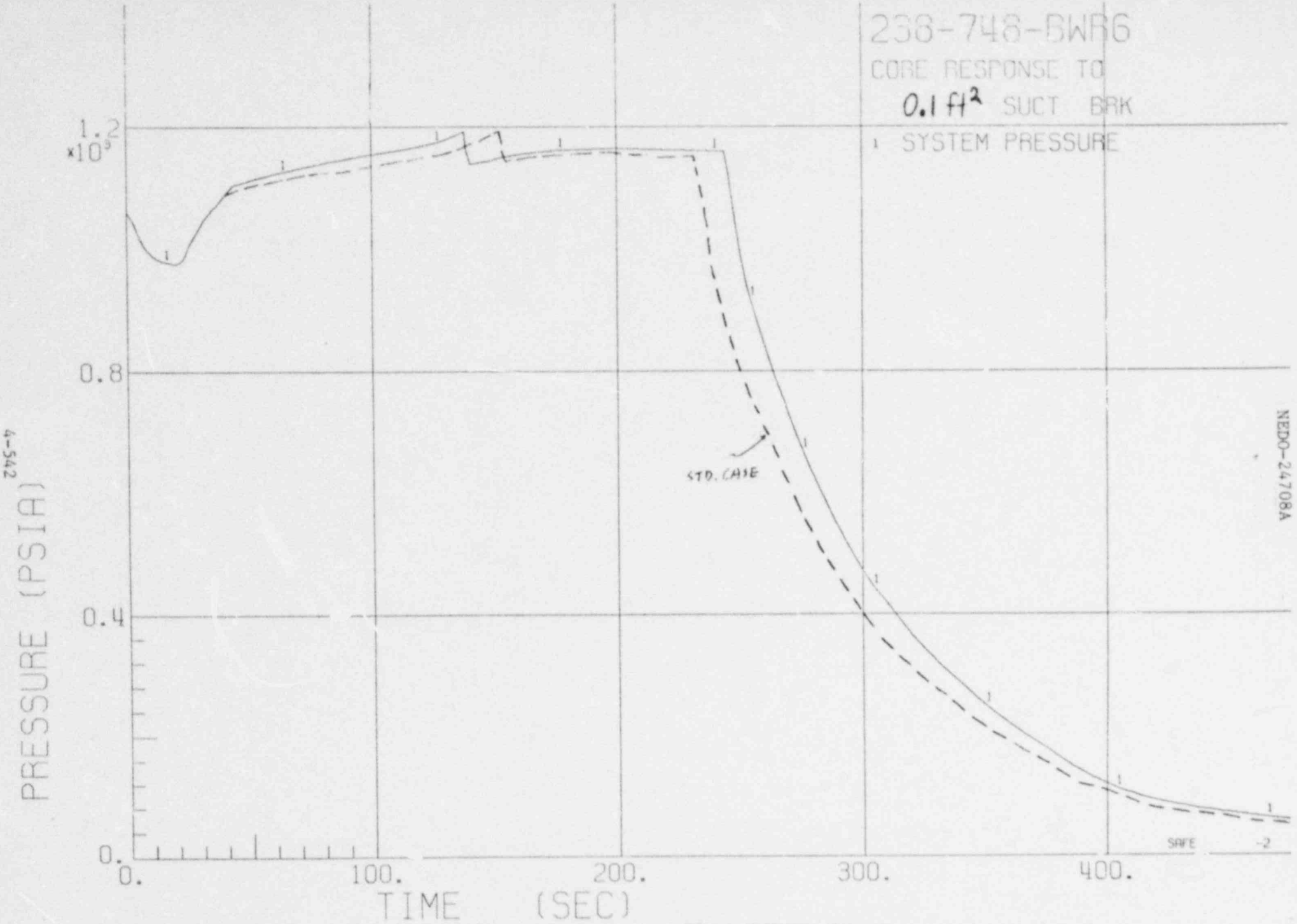

Figure 3.1.1.3-1. Reactor Pressure

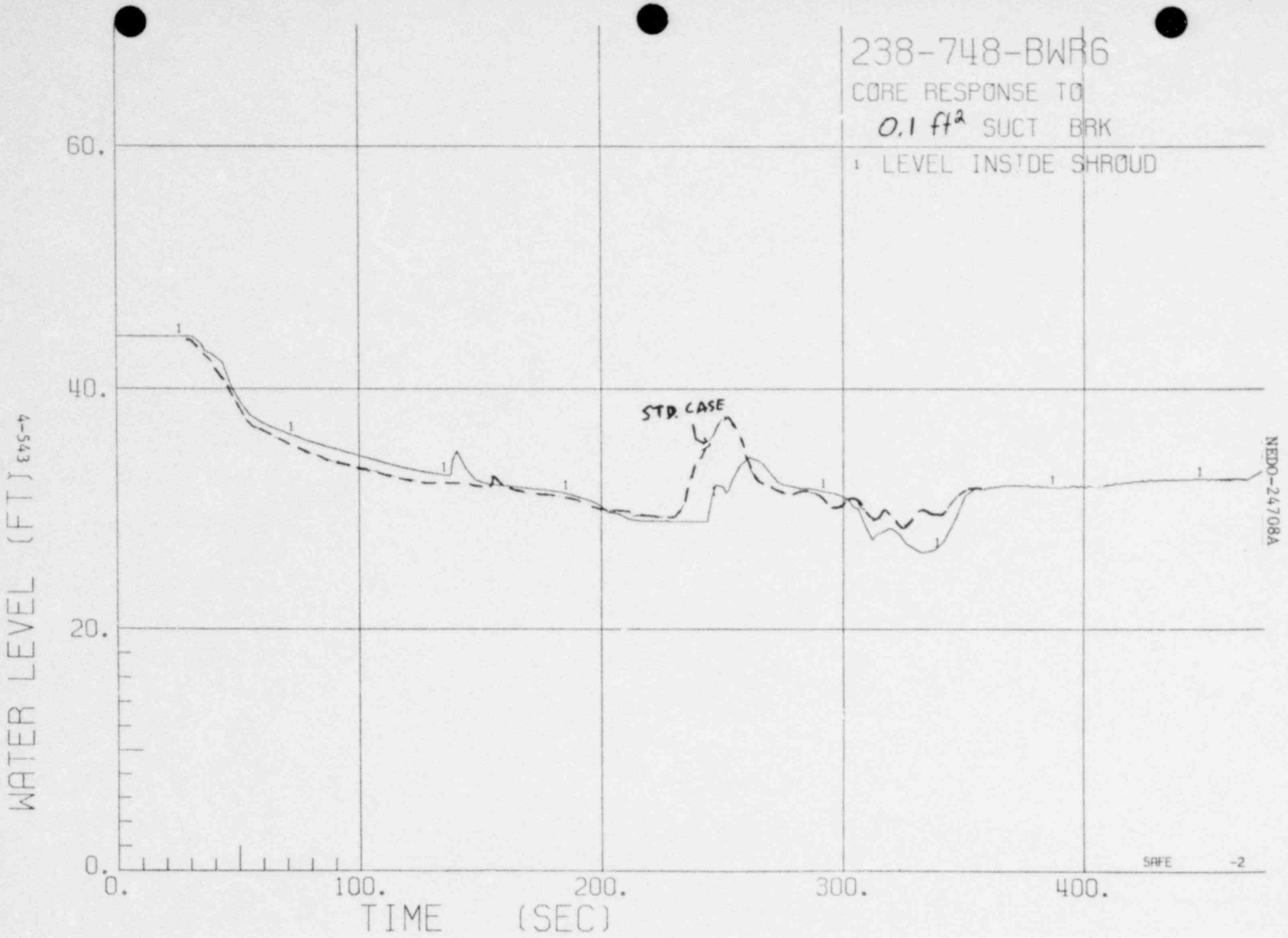

Figure 3.1.1.3-2. Water Level Inside the Shroud

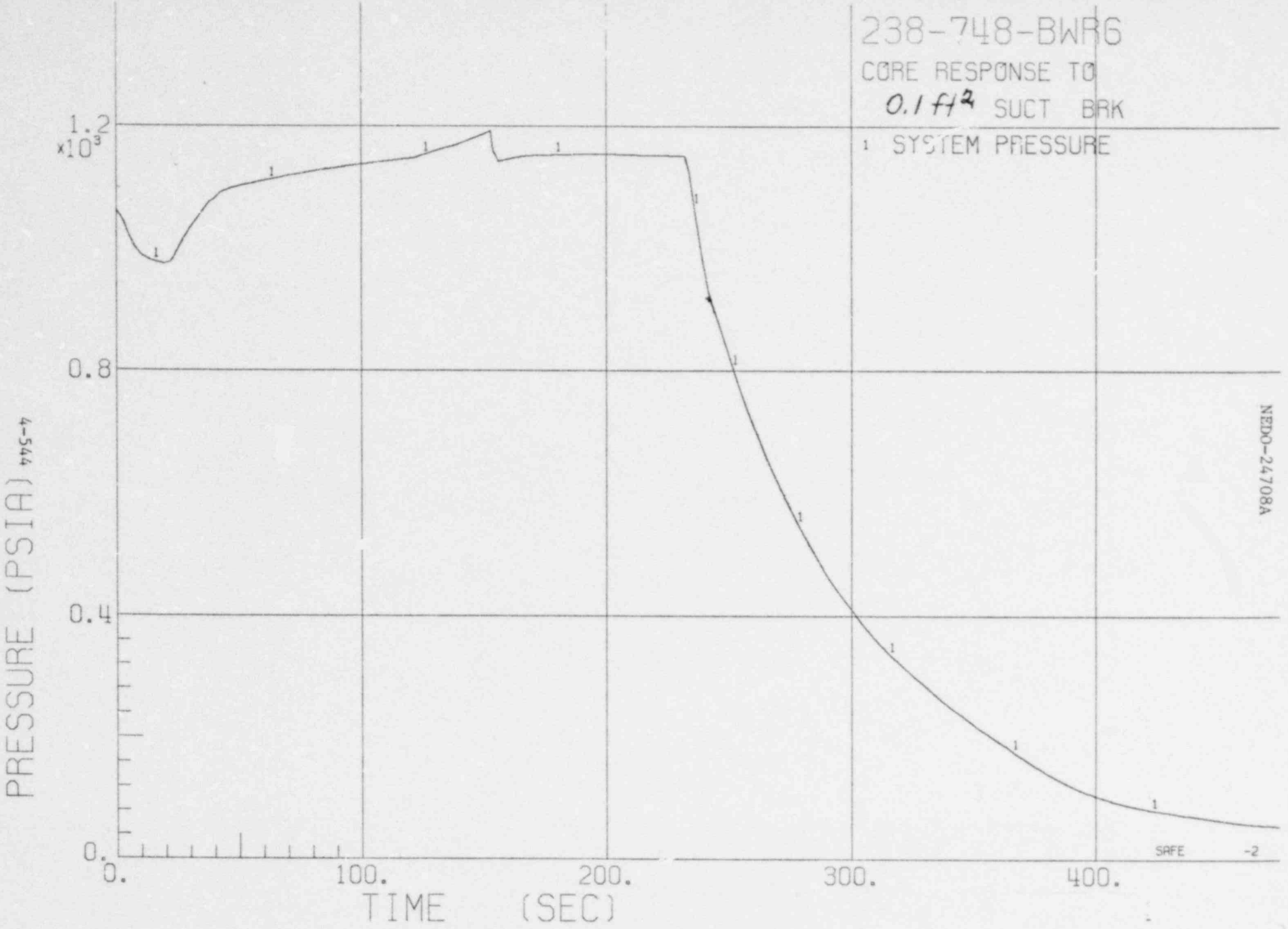

Figure 3.1.1.3-3. Reactor Pressure

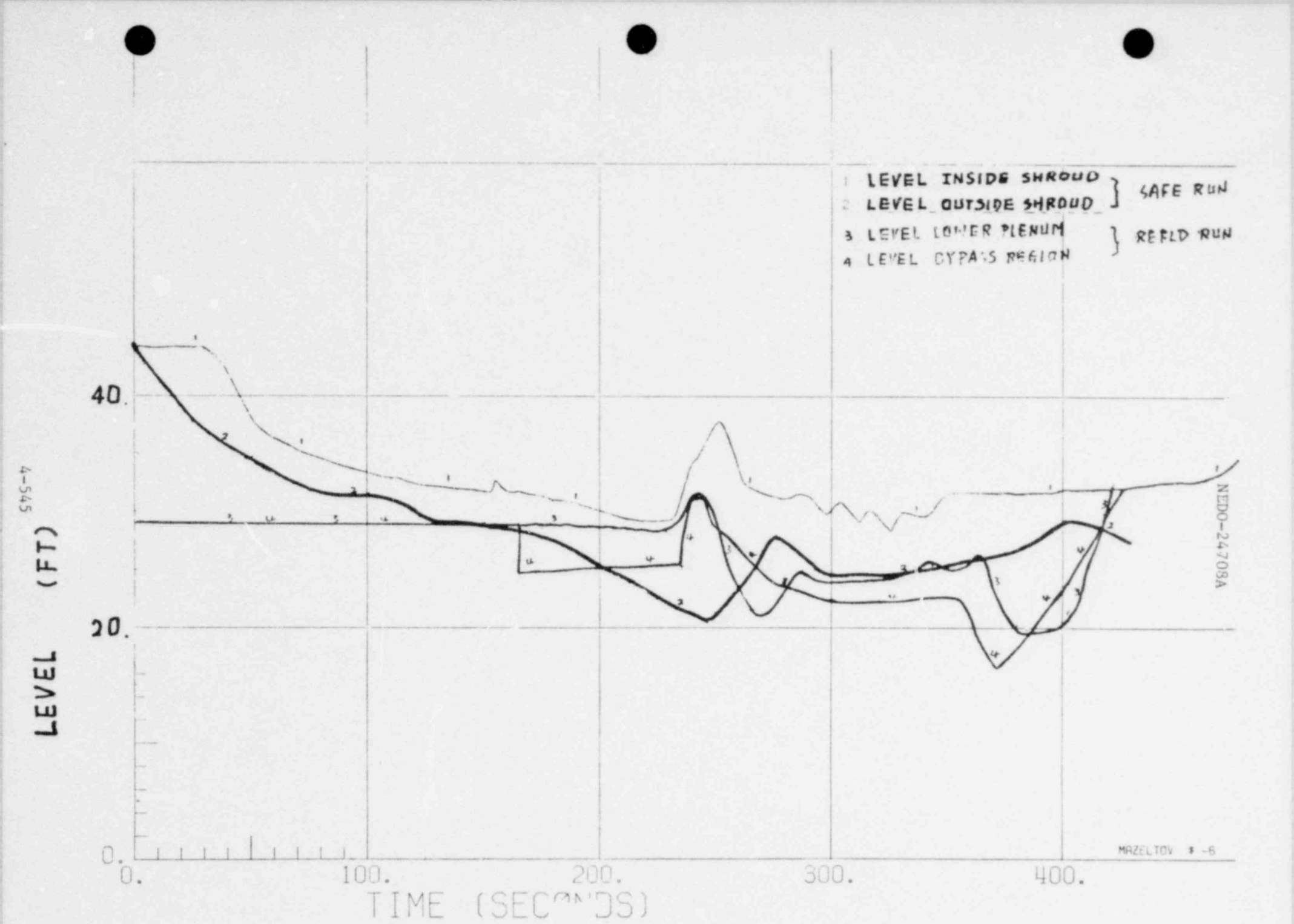

Figure 3.1.1.3-4. Water Level

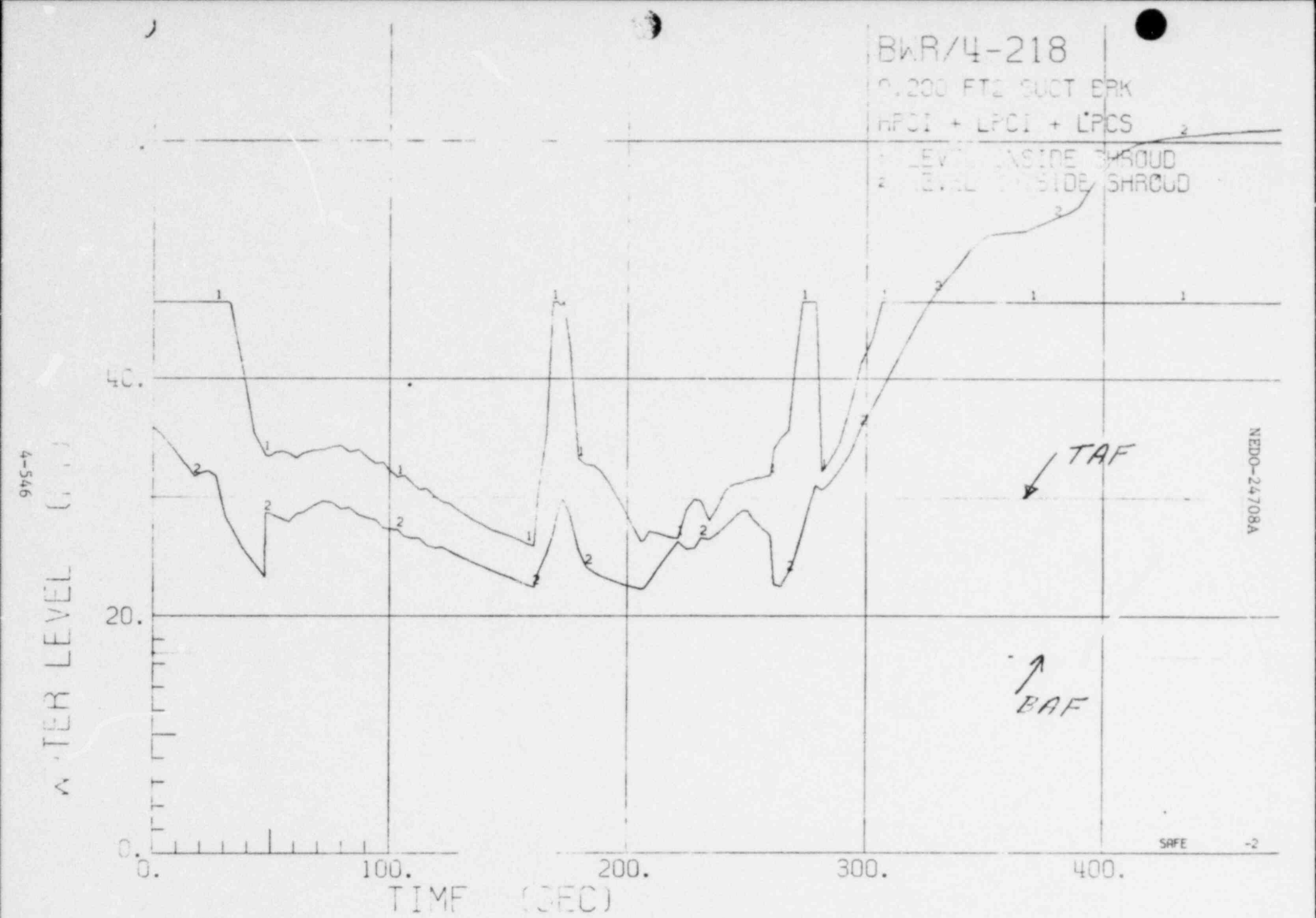

Figure 3.1.1.3-5. SAFE Water Levels

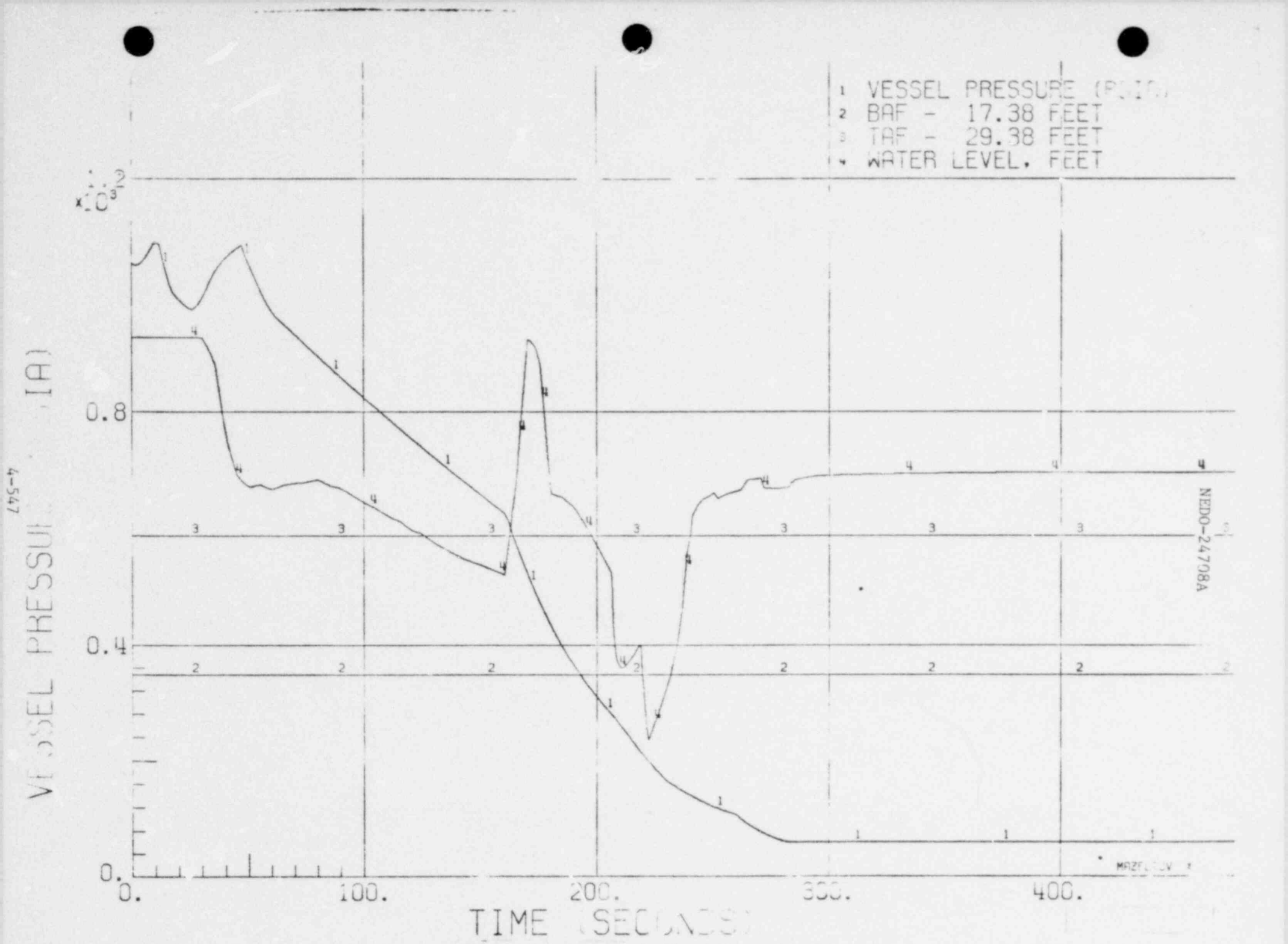

Figure 3.1.1.3-6. Reflood Water Levels

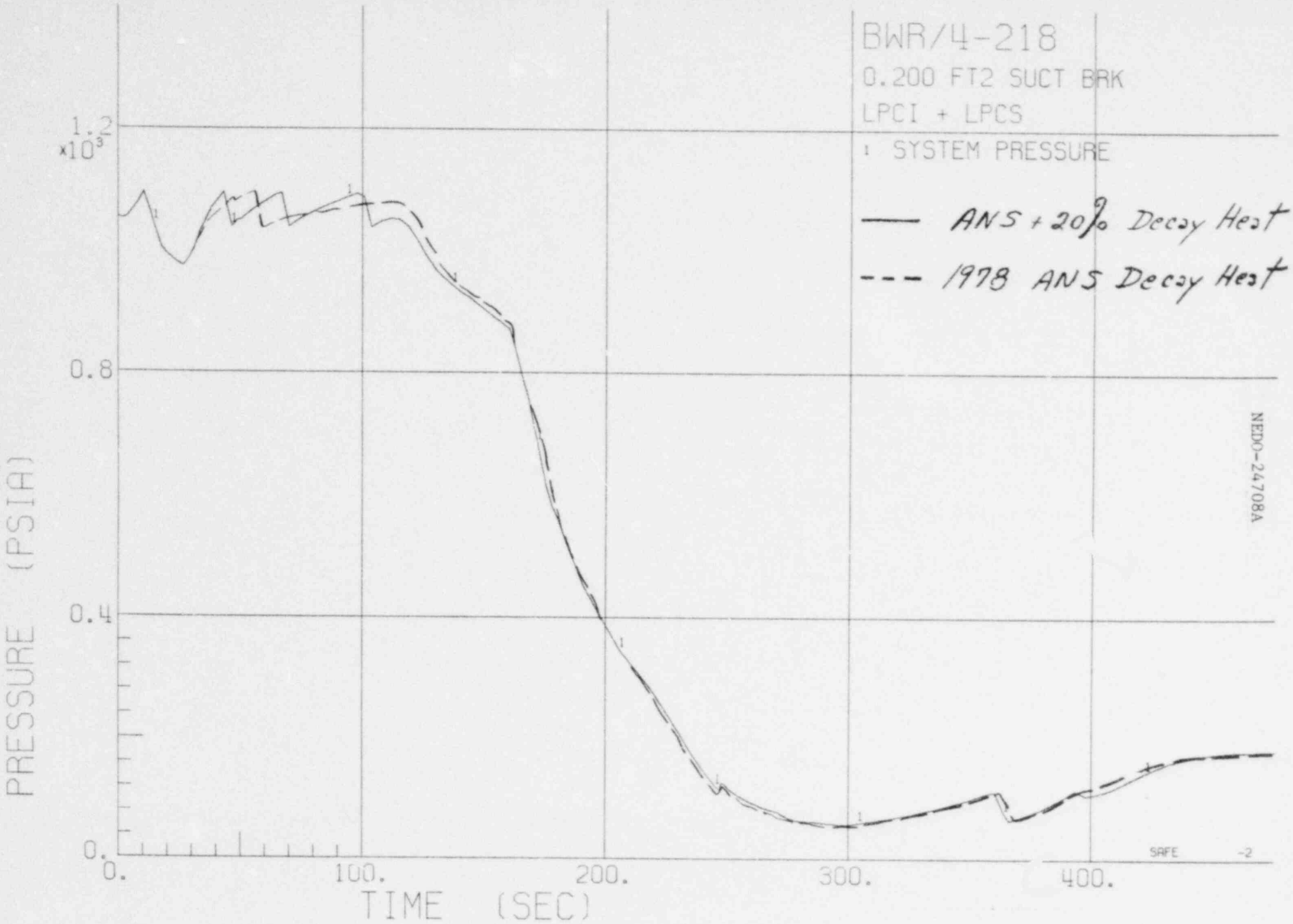

Figure 3.1.1.3-2 Reactor Pressure

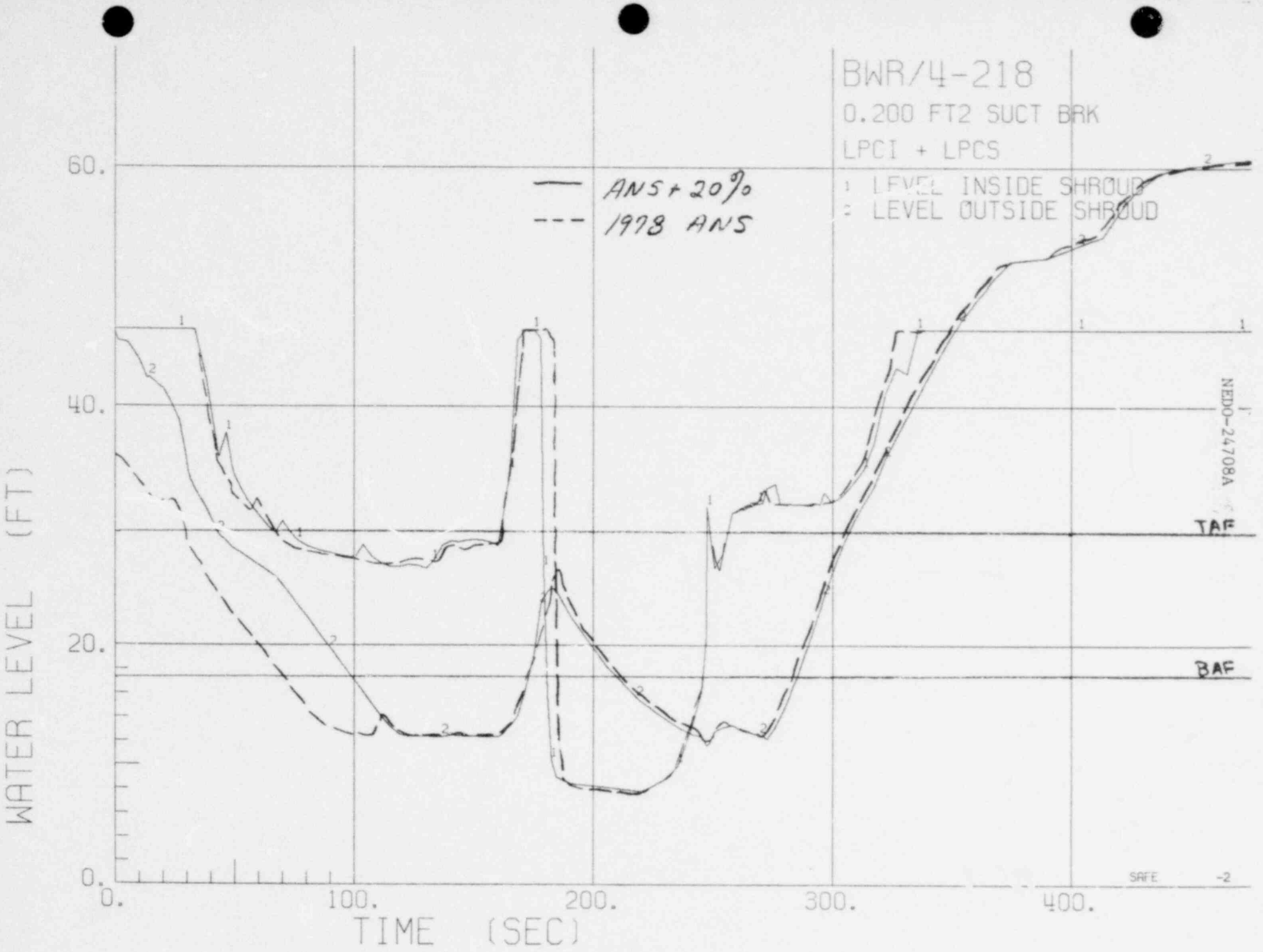

Figure 3.1.1.3-8. Water Level

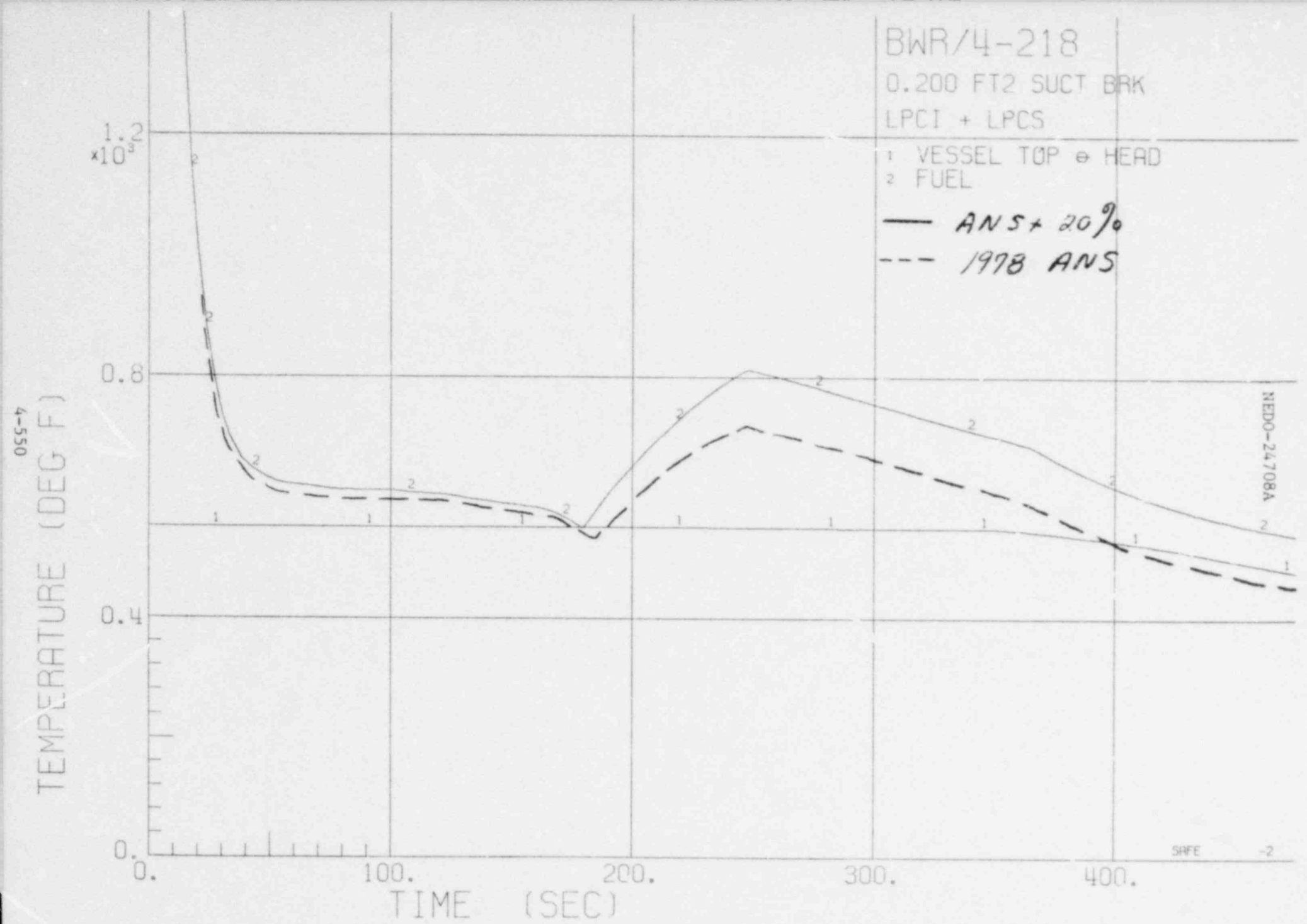

Figure 3.1.1.3-9. Cladding Temperature

Figure 3.1.1.3-10. Reactor Pressure

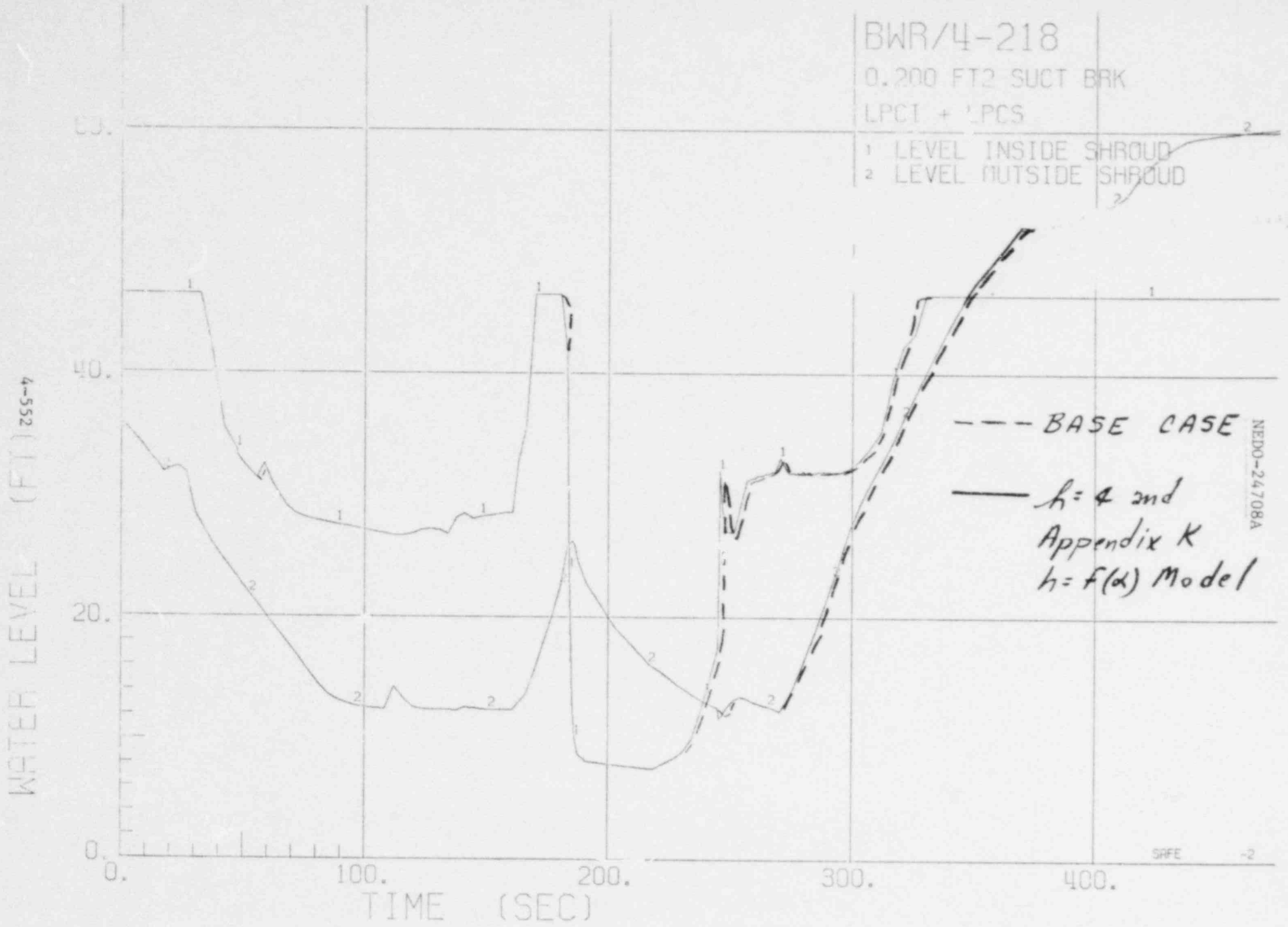

Figure 3.1.1 3-11. Water Level

Figure 3.1.1.3-12. Cladding Temperature

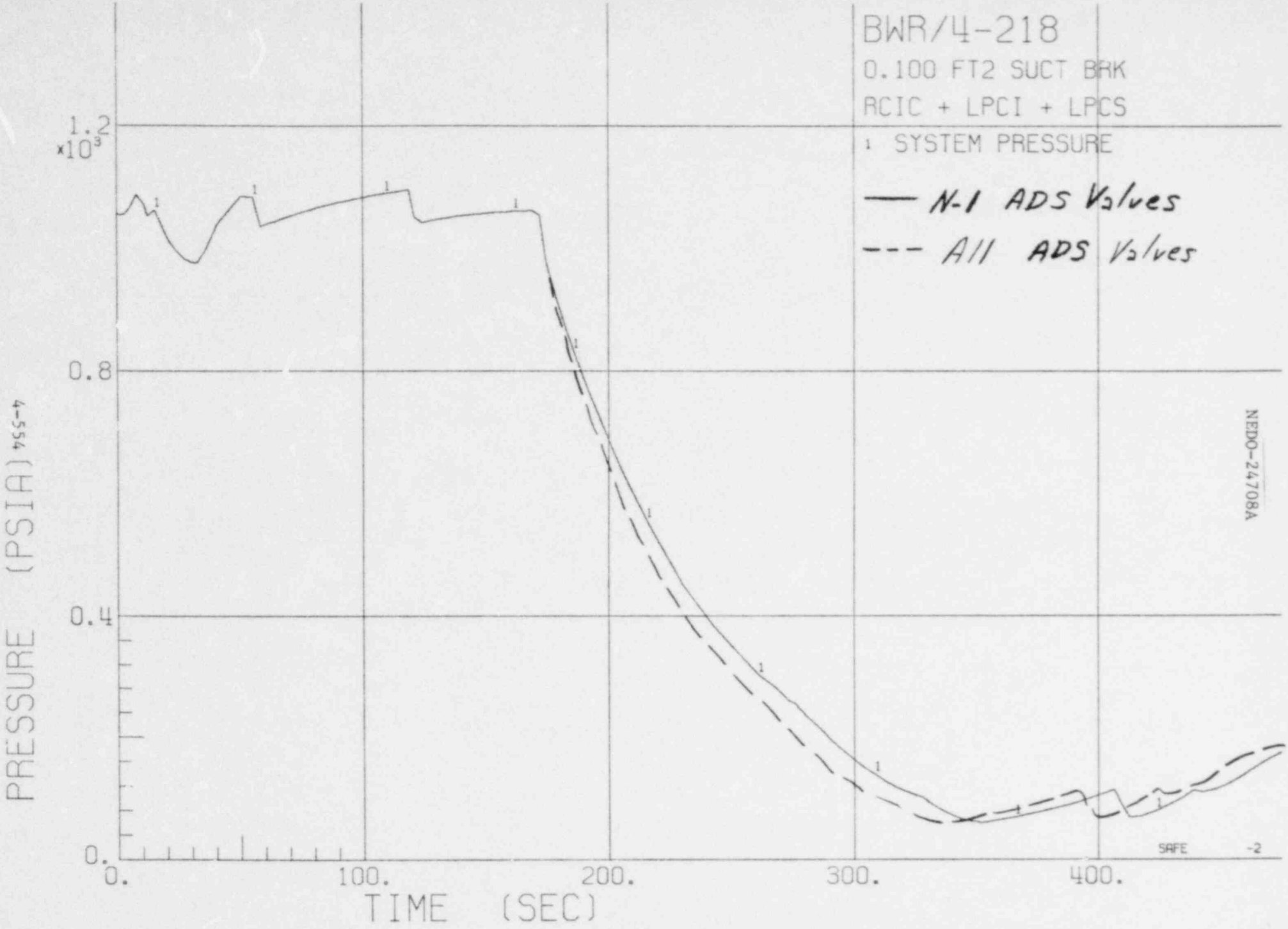

Figure 3.1.1.3-13. Reactor Pressure

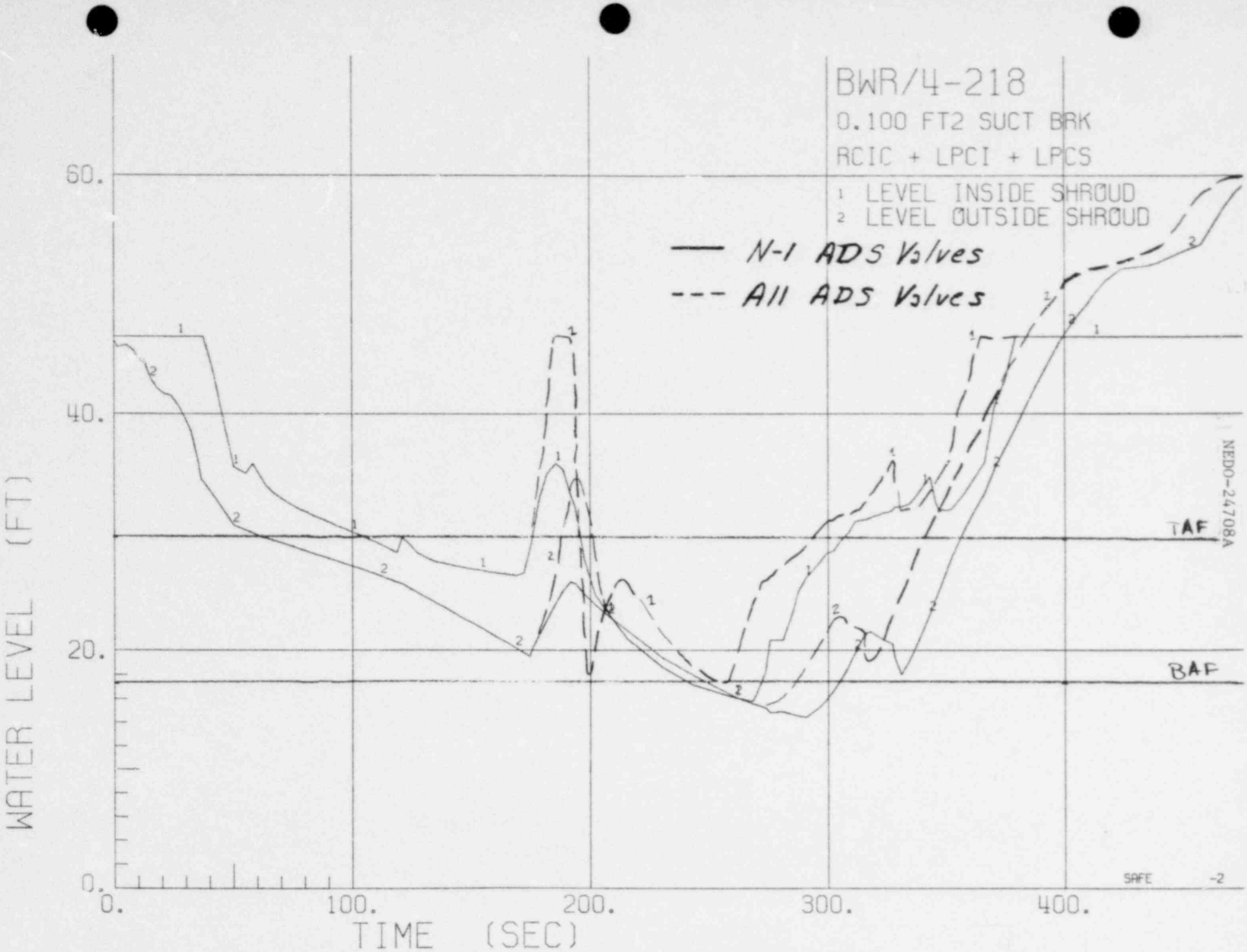

Figure 3.1.1.3-14. Water Level

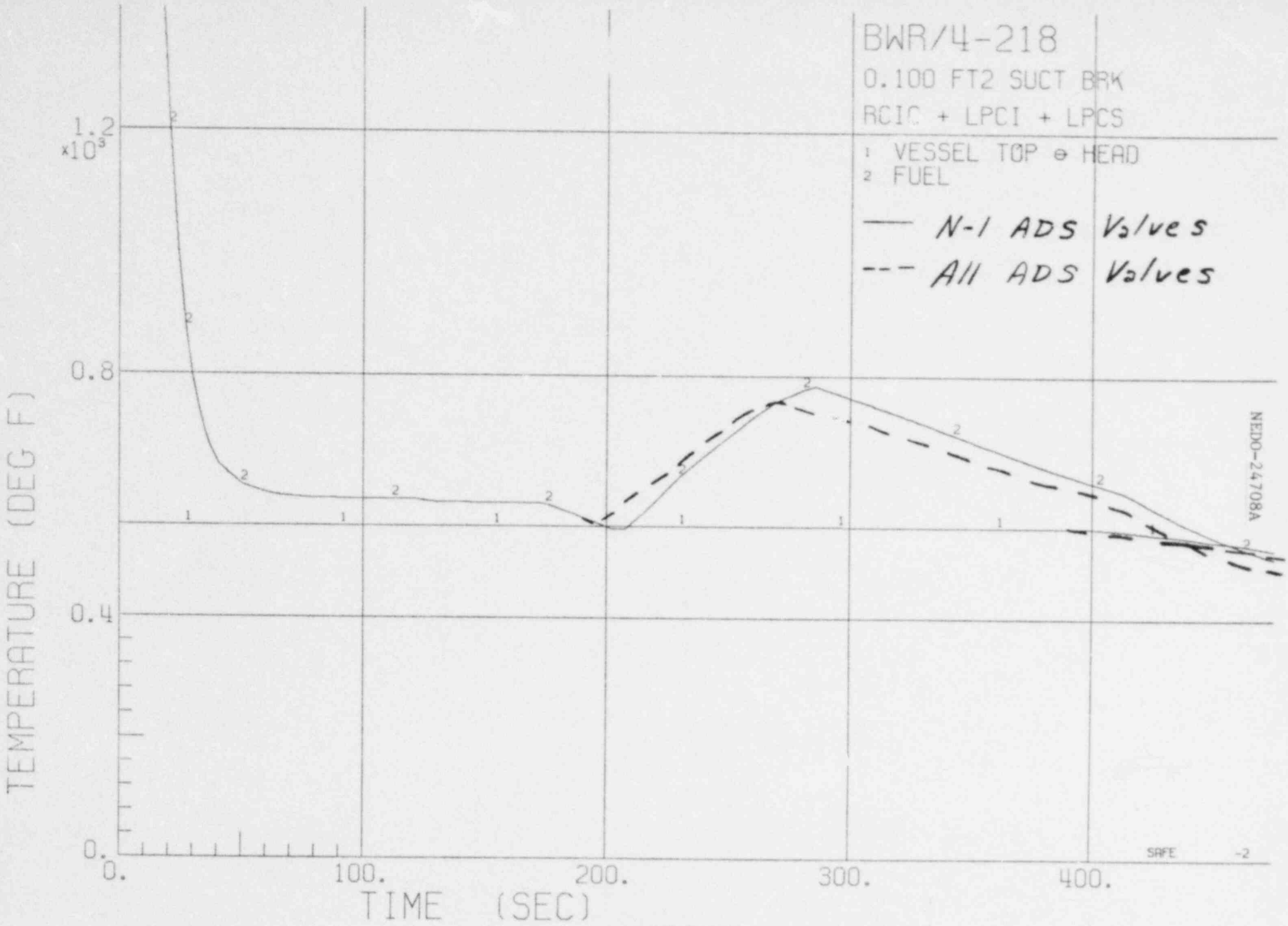

Figure 3.1.1.3-15. Cladding Temperature

Figure 3.1.1.3-16. Reactor Pressure

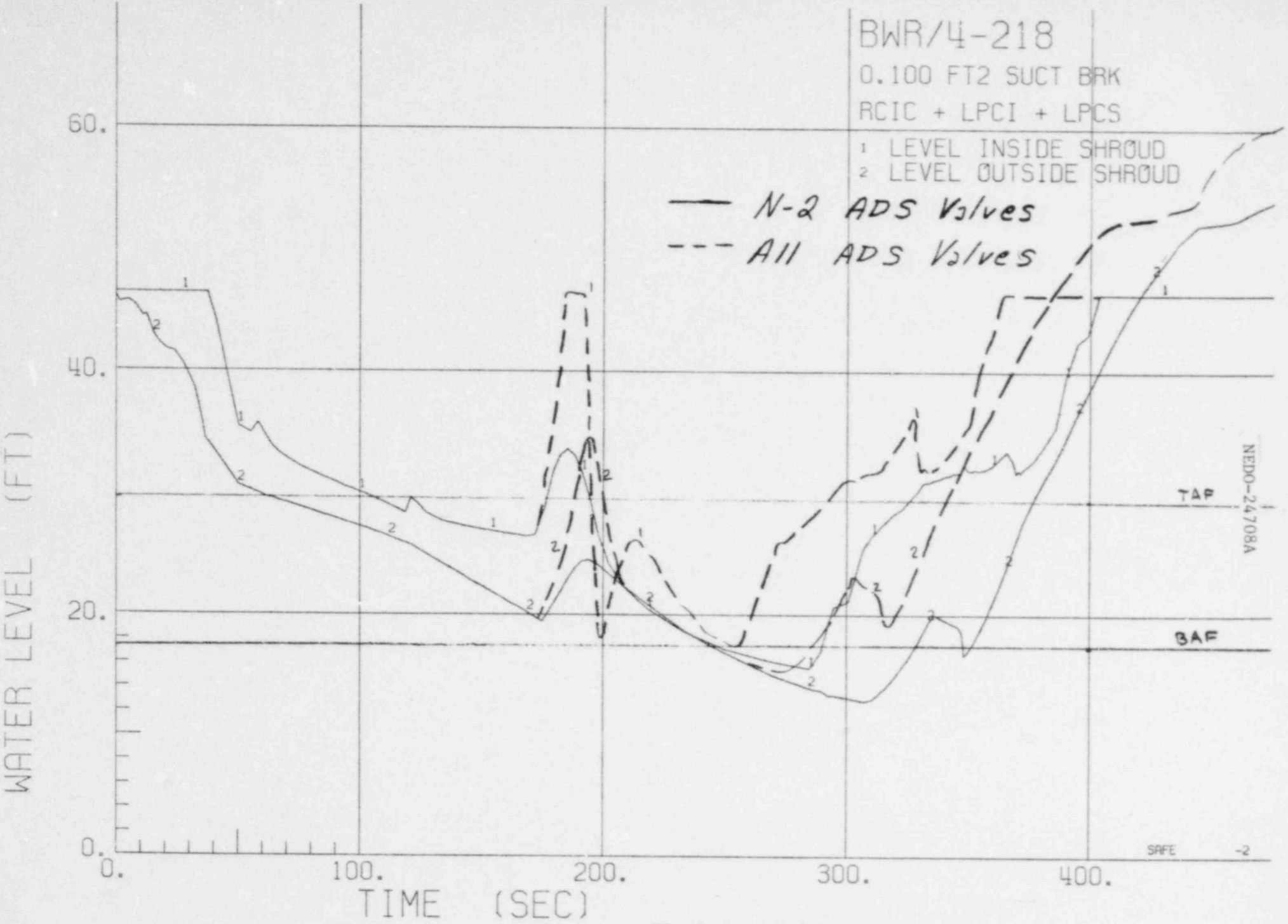

Figure 3.1.1.3-17. Water Level

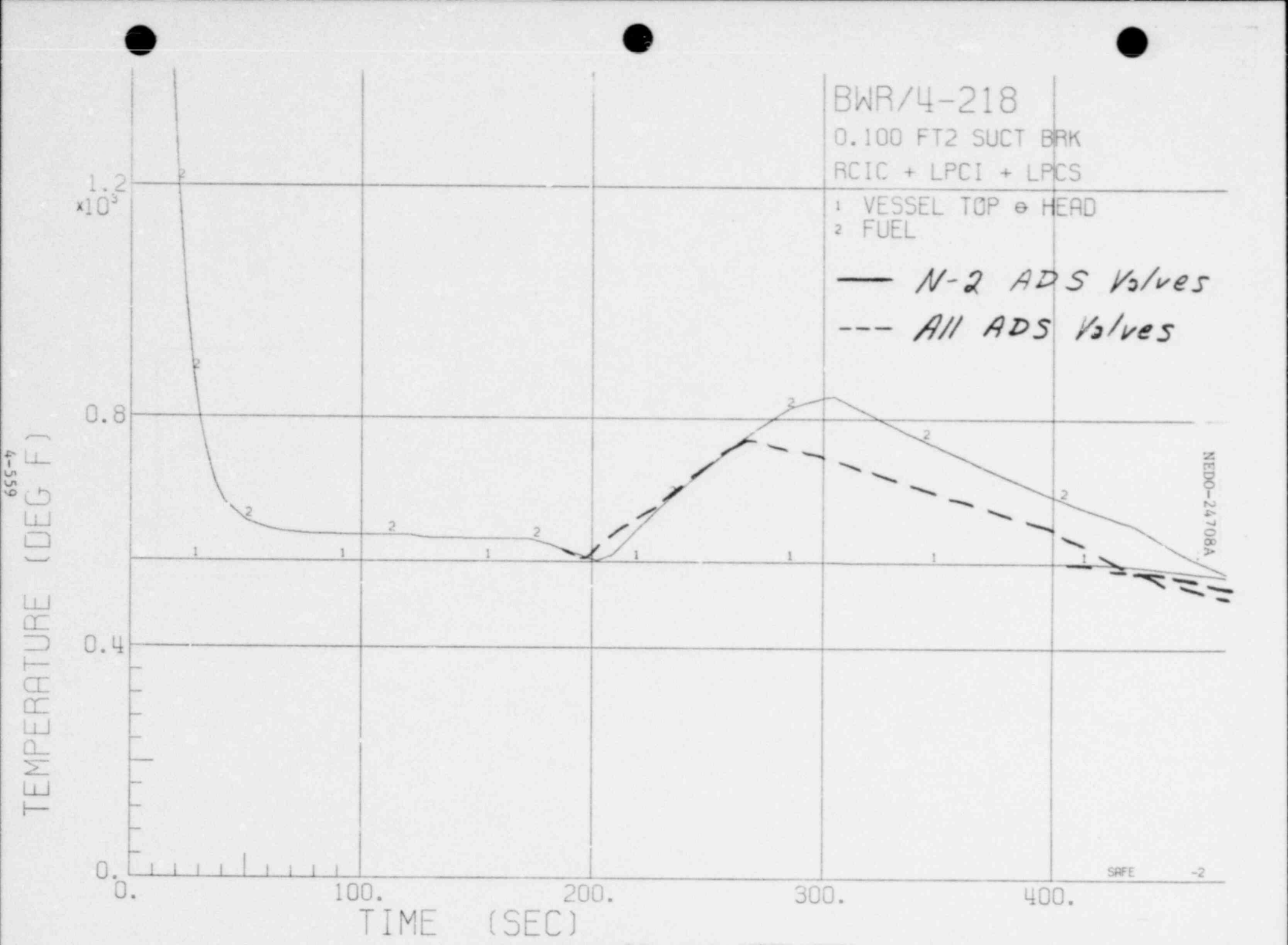

Figure 3.1.1.3-18. Cladding Temperature

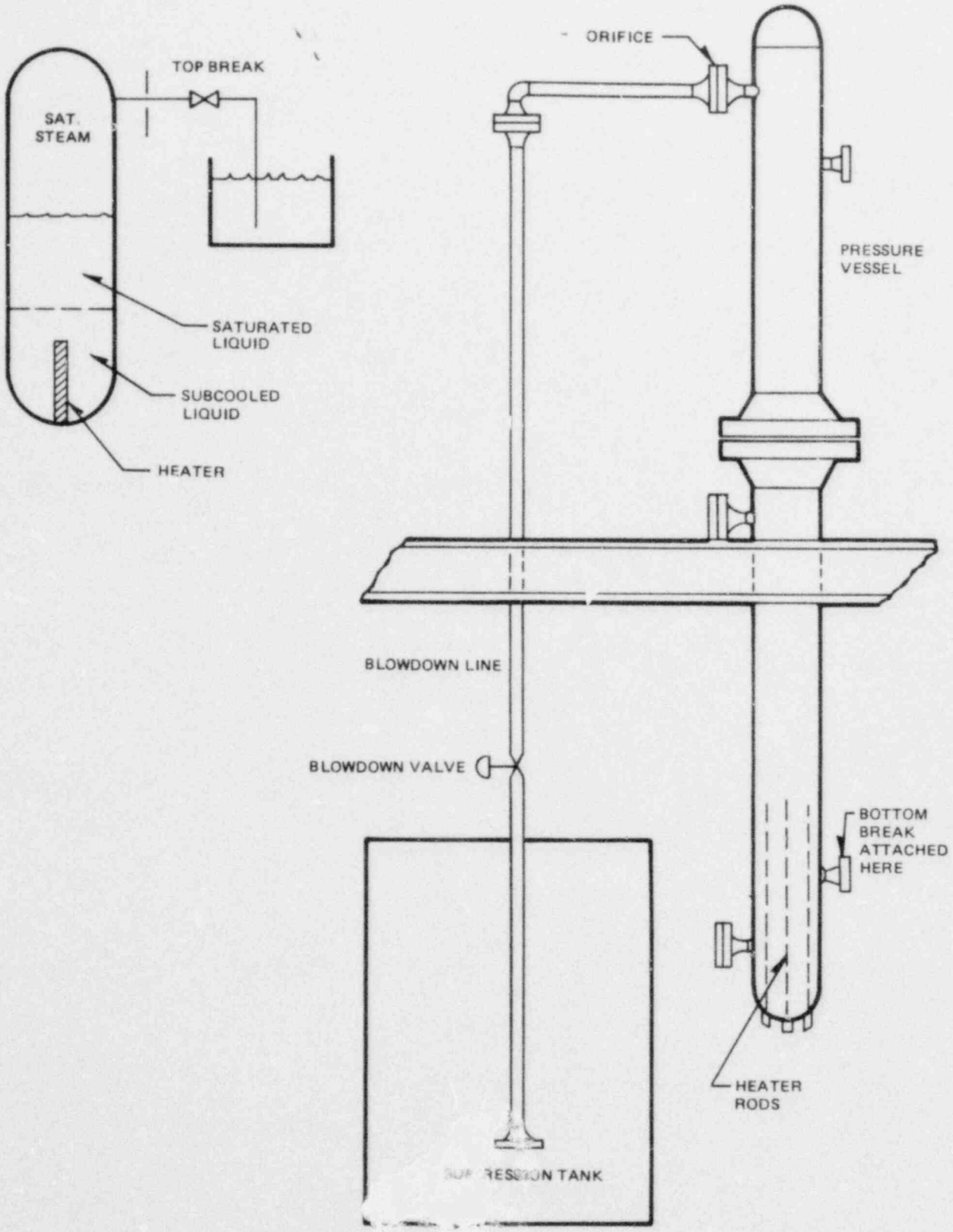

Figure 3.1.1.4-1. G.E. Blowdown Test Facility

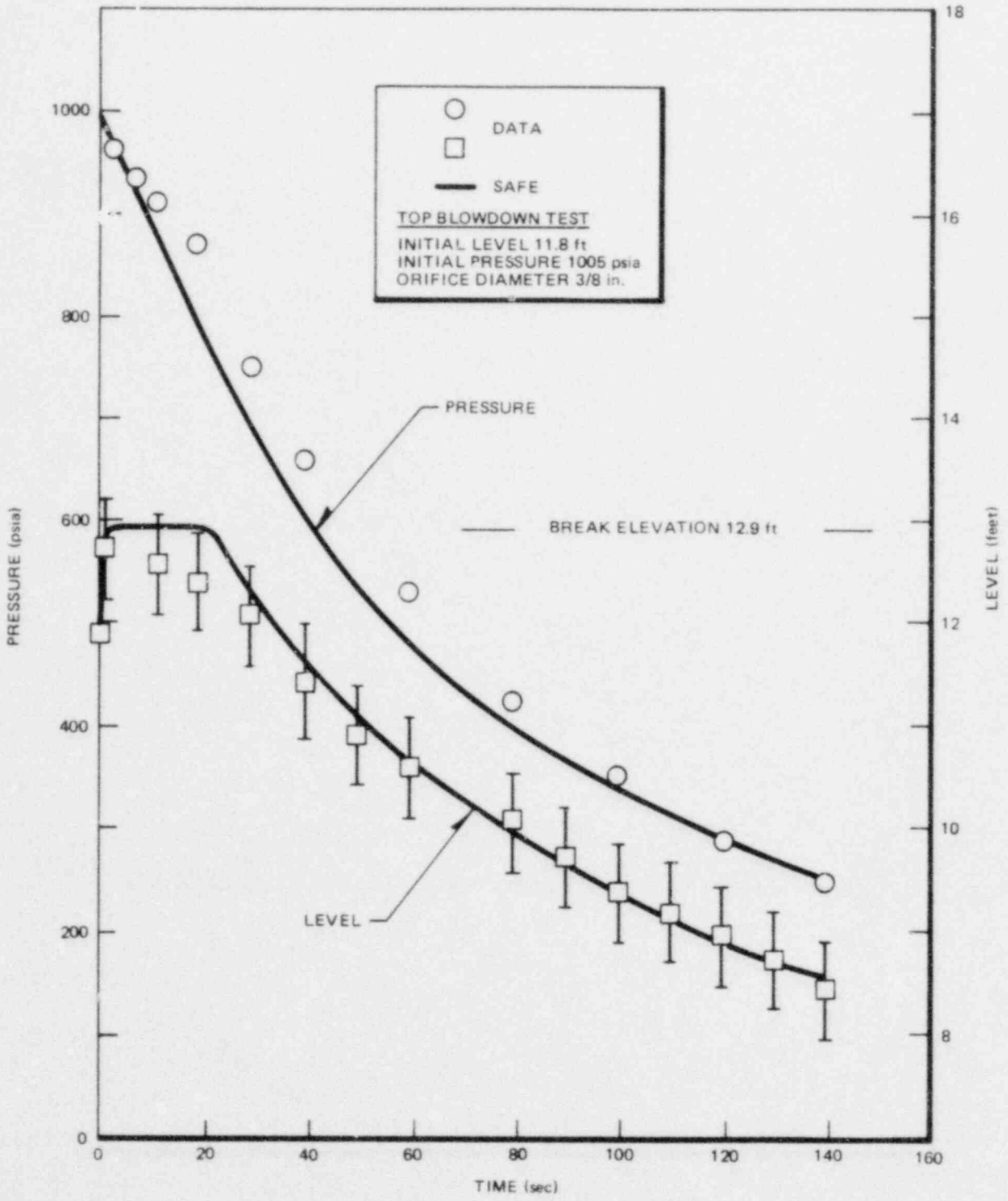

Figure 3.1.1.4-2. Top Break Blowdown Test

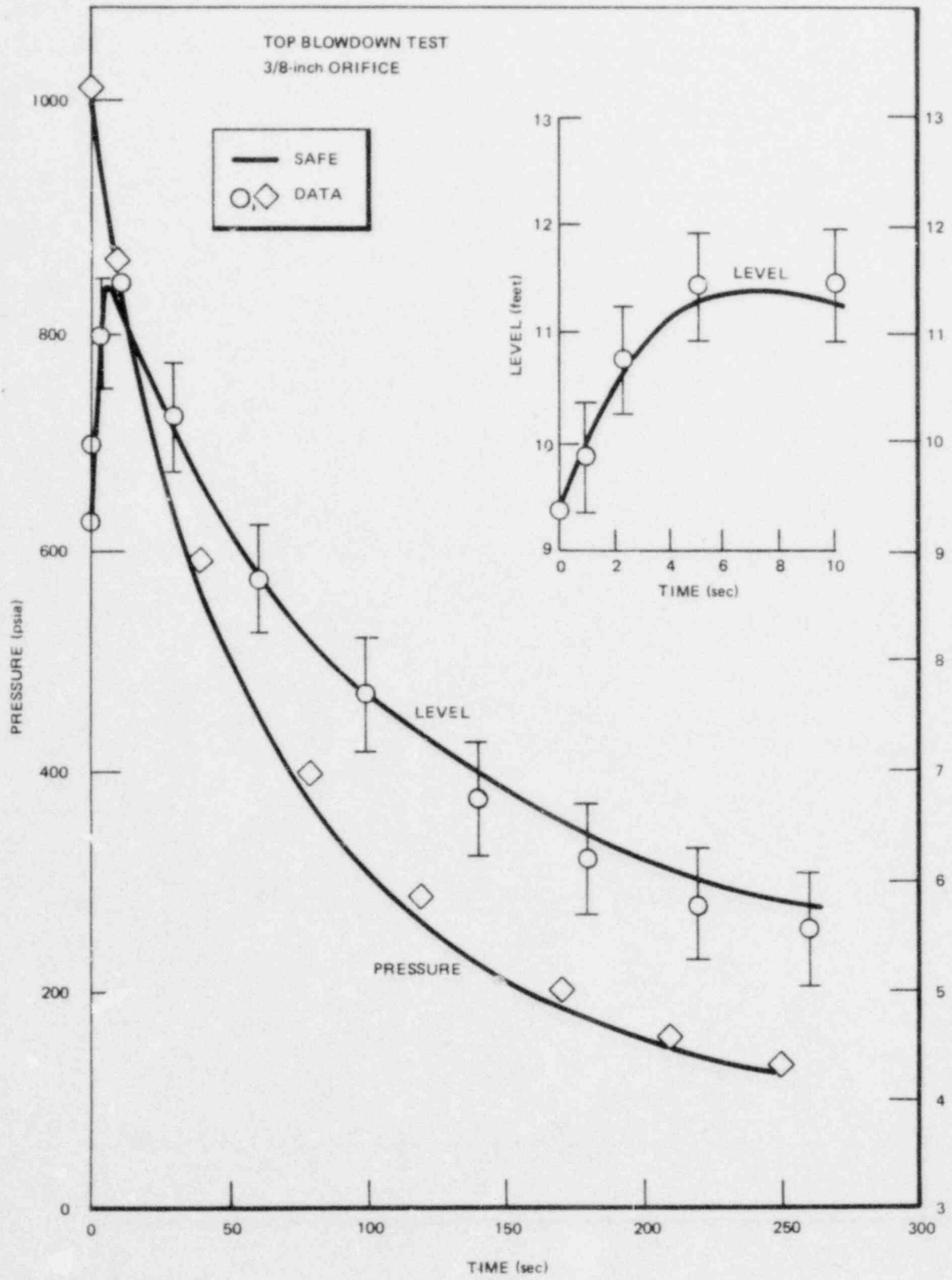

Figure 3.1.1.4-3. Top Break Blowdown Test With Heat Addition

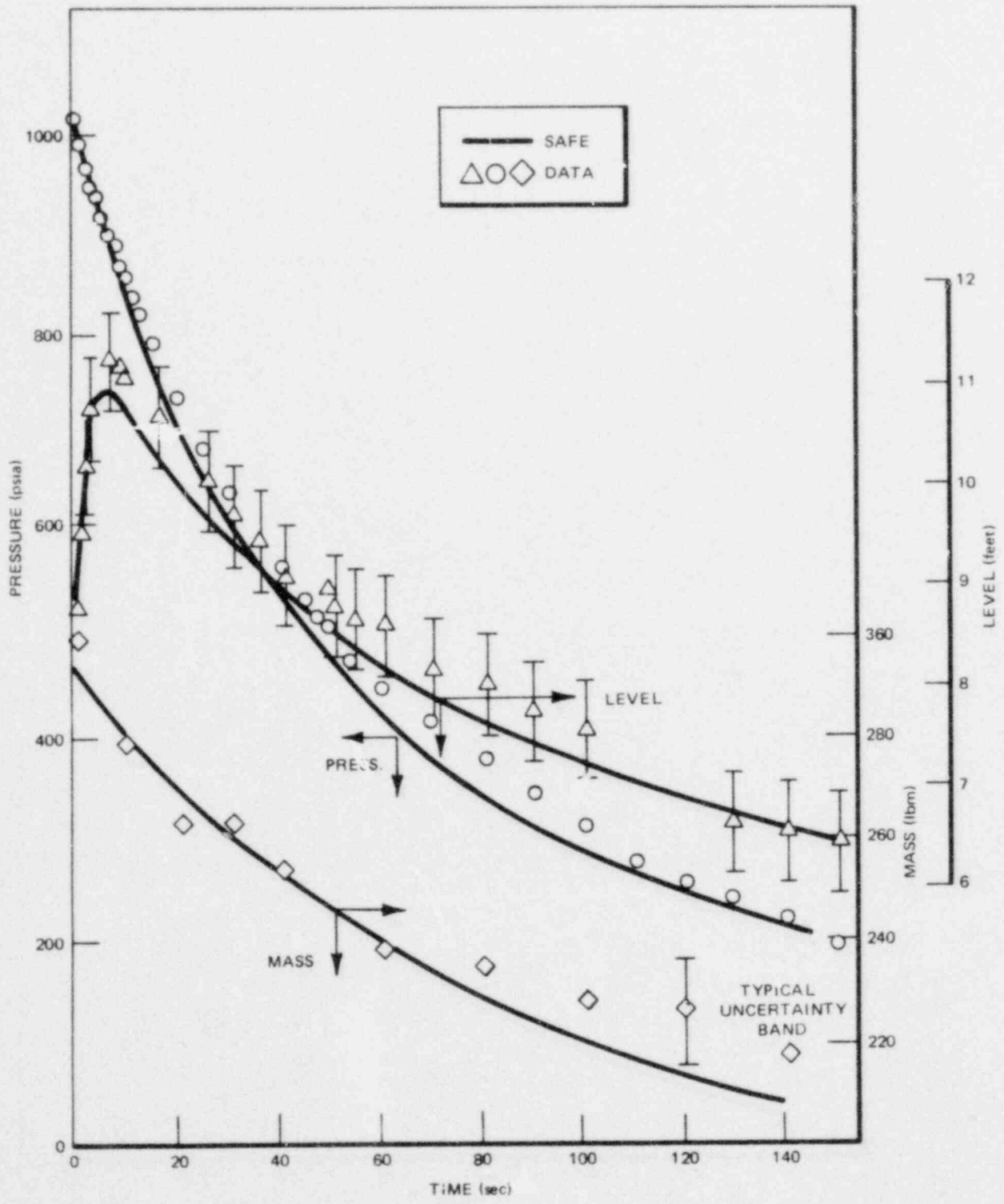

Figure 3.1.1.4-4. Top Break Blowdown Test

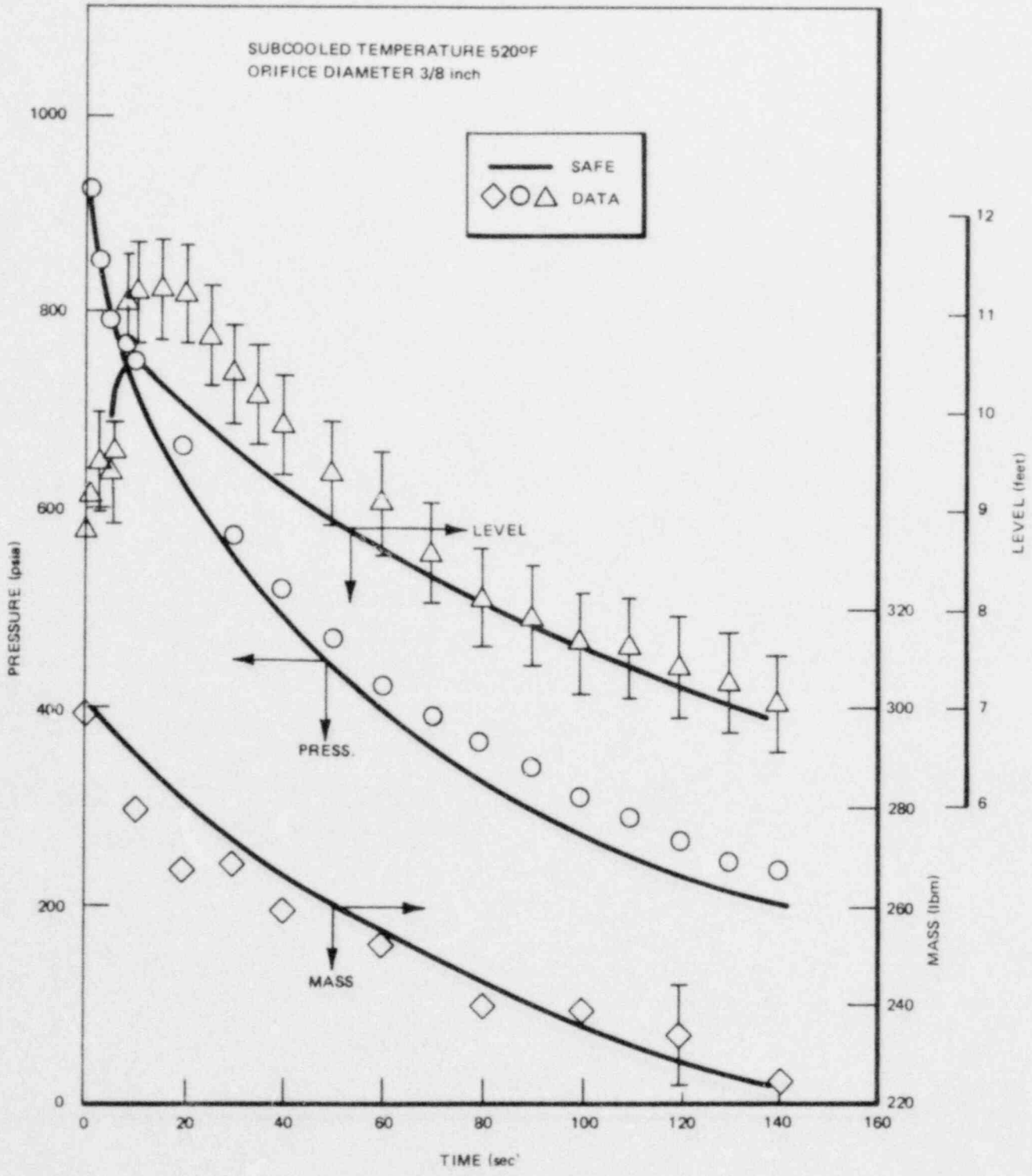

Figure 3.1.1.4-5. Top Break Blowdown Test With Initial Subcooling

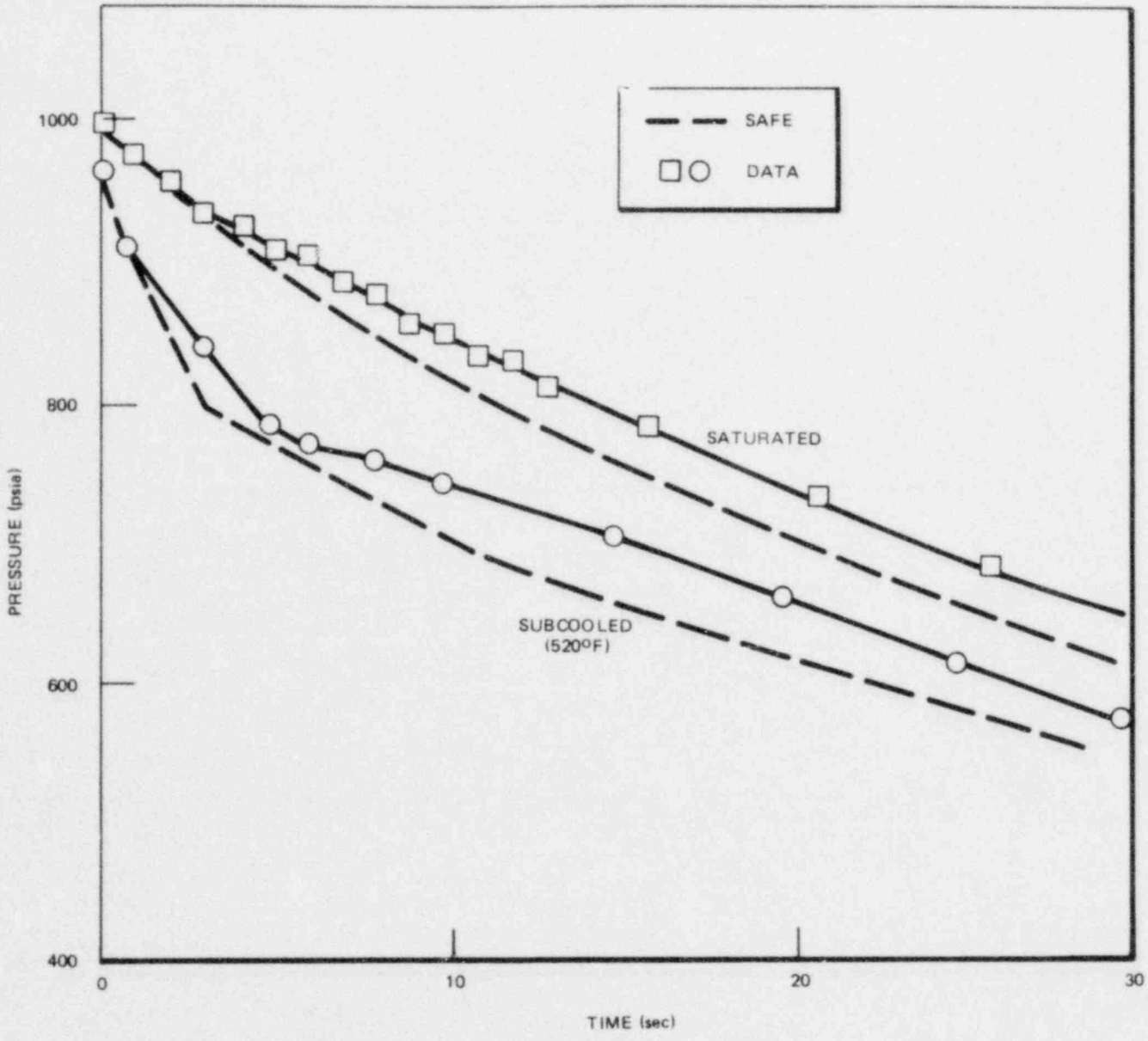

Figure 3.1.1.4-6A. Small Top Break Blowdown Test With And Without Initial Fluid Subcooling

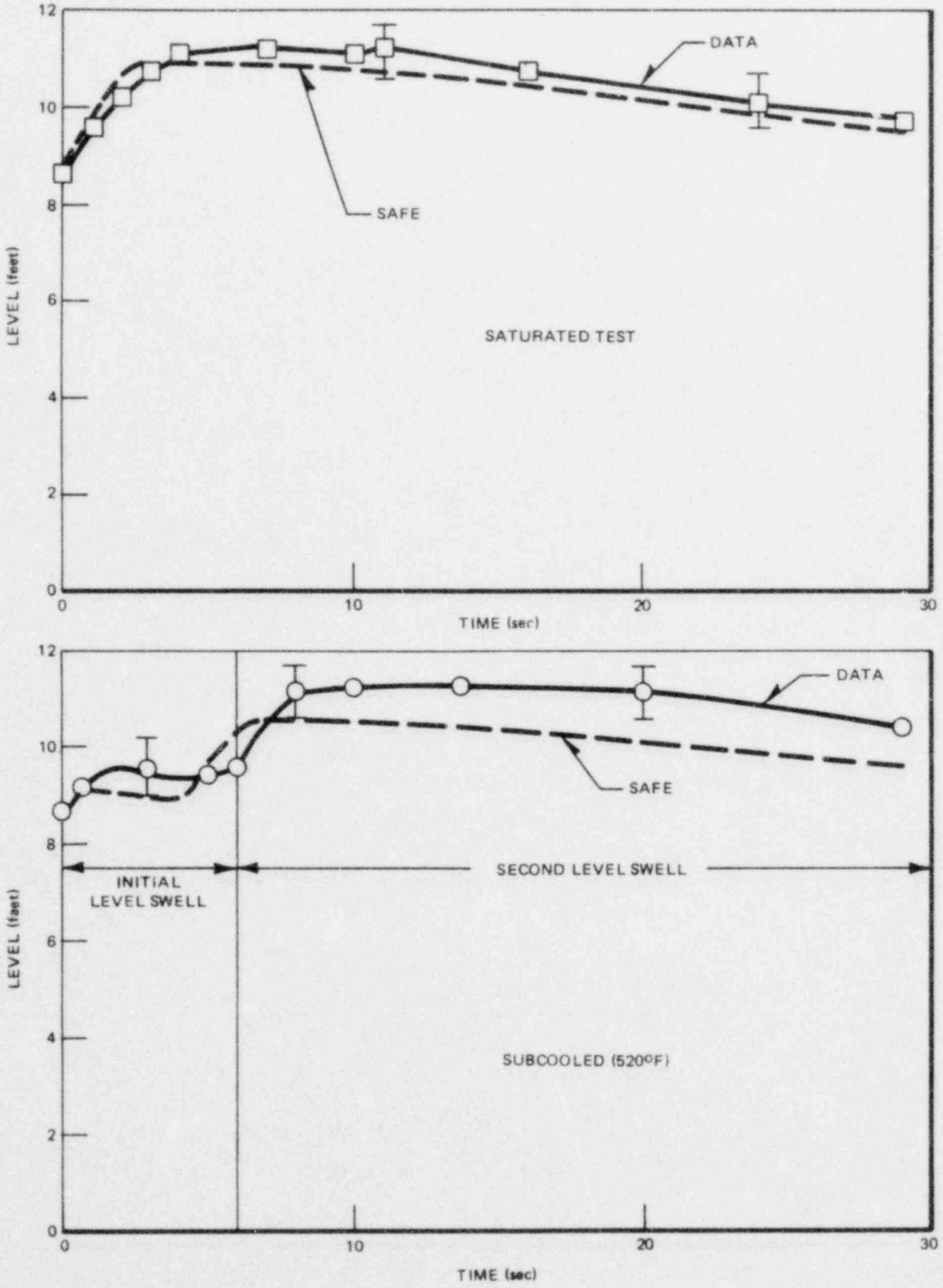

Figure 3.1.1.4-6B. Small Top Break Blowdown Test With And Without Initial Fluid Subcooled

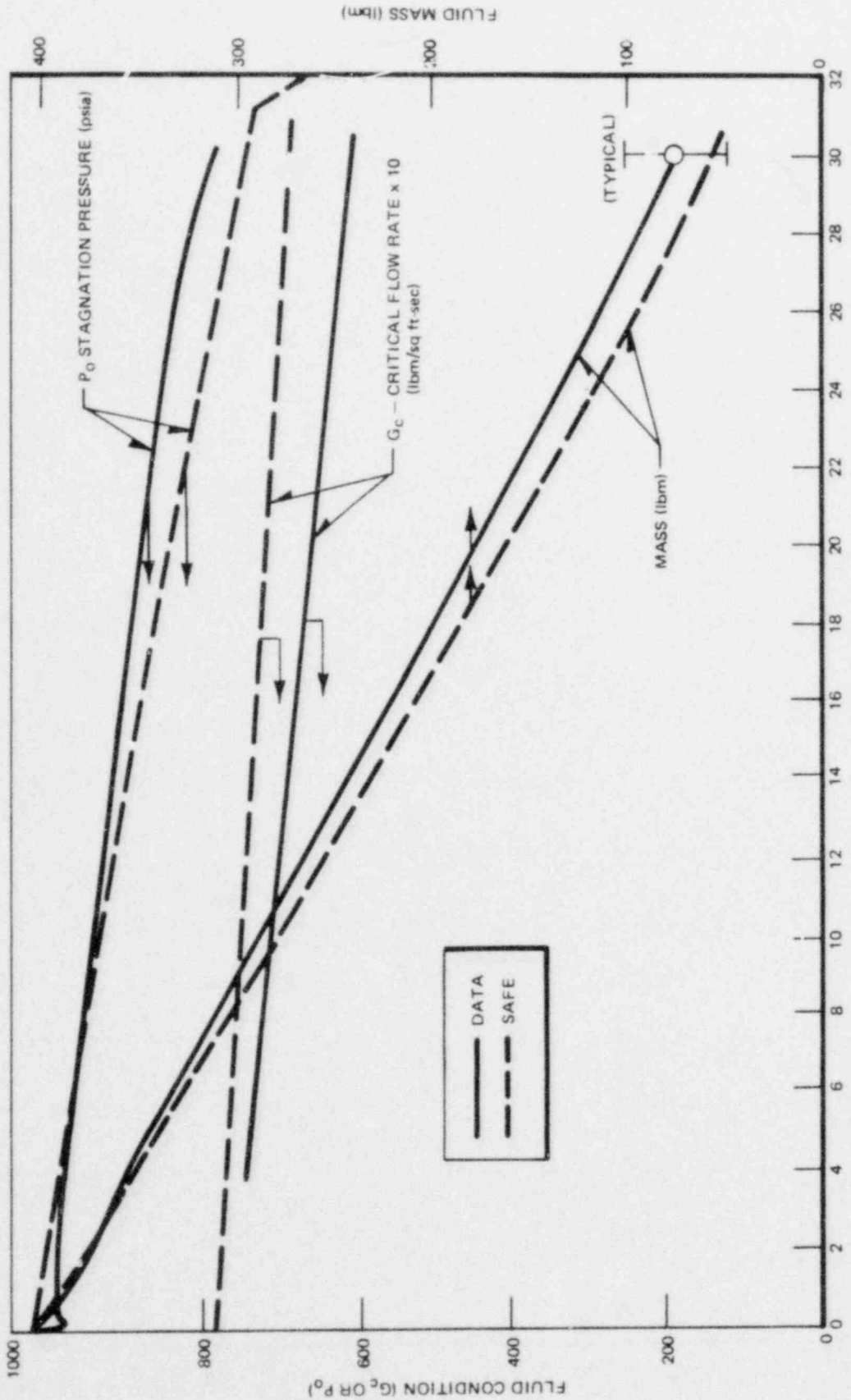

Figure 3.1.1.4-7. Bottom Break Blowdown Test

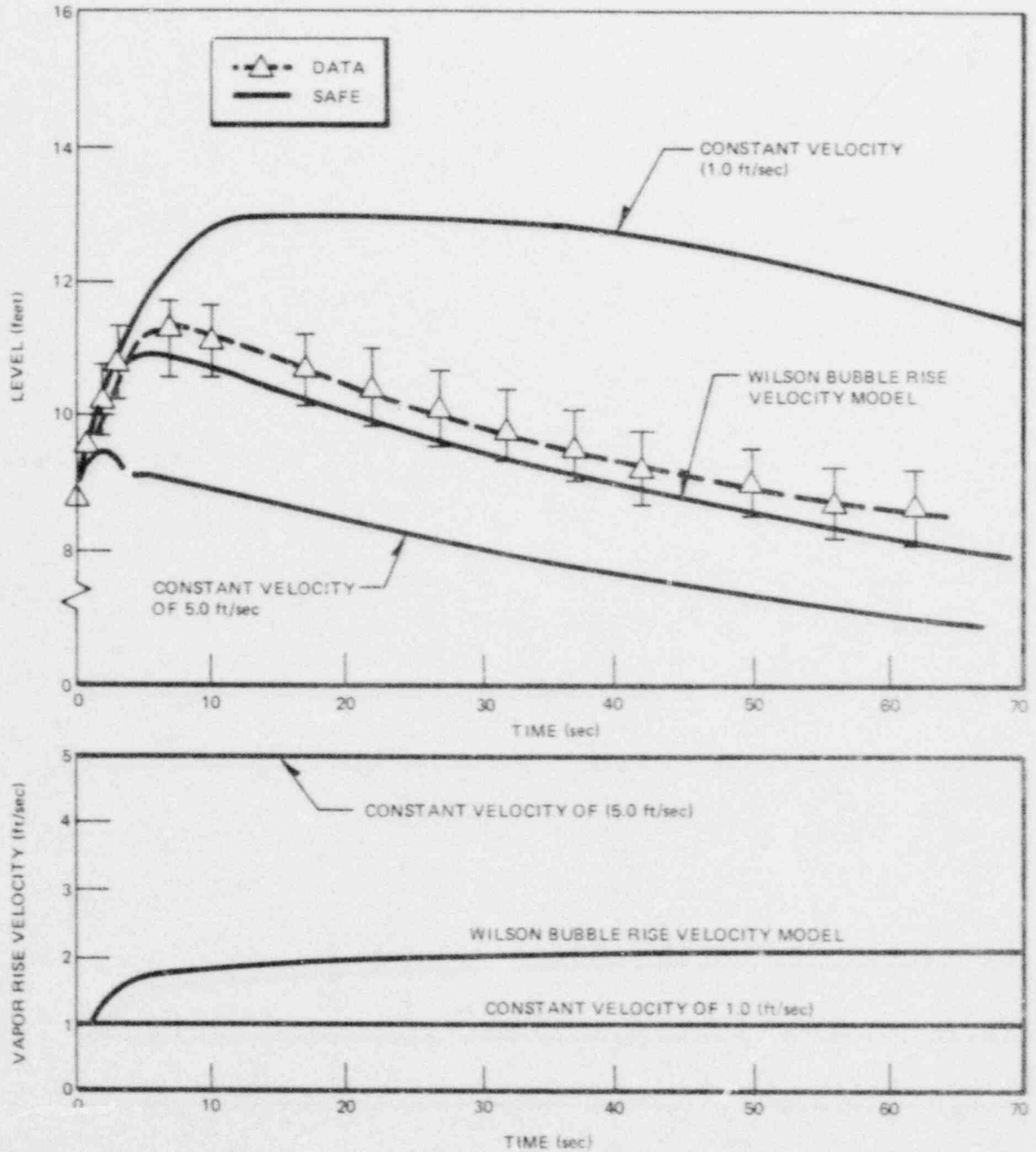

Figure 3.1.1.4-8. Effect of Vapor Rise Velocity on Level Swell Prediction

Table 3.1.1.5-1

MODIFICATIONS TO APPENDIX K MODELS
USED IN ANALYSES

	Appendix K	Guideline Analyses
1.	Use SAFE/REFLOOD models	Use SAFE model only
2.	Use 1973 ANS+20% decay heat	Use 1978 ANS decay heat
3.	Use a core spray heat transfer coefficient of 4 BTU/Hr-Ft^2-^oF.	Use a core spray heat transfer coefficient of 12 Btu/Hr-ft^2-^oF.
4.	Feedwater ramped to zero in one second.	Feedwater controller is modelled.
5.	One automatic depressurization valve is assumed unavailable.	All automatic depressurization valves are assumed available.
6.	Safety relief valves modelled at one set point.	Safety relief valves modelled in three groups.
7.	Calculations start at scram water level.	Calculations start at normal water level.
8.	Scram assumed on low water level.	Scram assumed on high drywell pressure.
9.	Offsite power is assumed unavailable.	Offsite power is assumed available.
10.	Emergency core cooling water assumed at 120^oF.	Emergency core cooling water assumed at 70^oF.
11.	Control rod drive flow assumed unavailable.	Control rod drive flow assumed available.
12.	Reactor core isolation cooling assumed unavailable.	Reactor core isolation cooling assumed available.

Figure 3.1.1.5-1.1 VESSEL PRESSURE VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

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Figure 3.1.1.5-1.2 WATER LEVEL VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

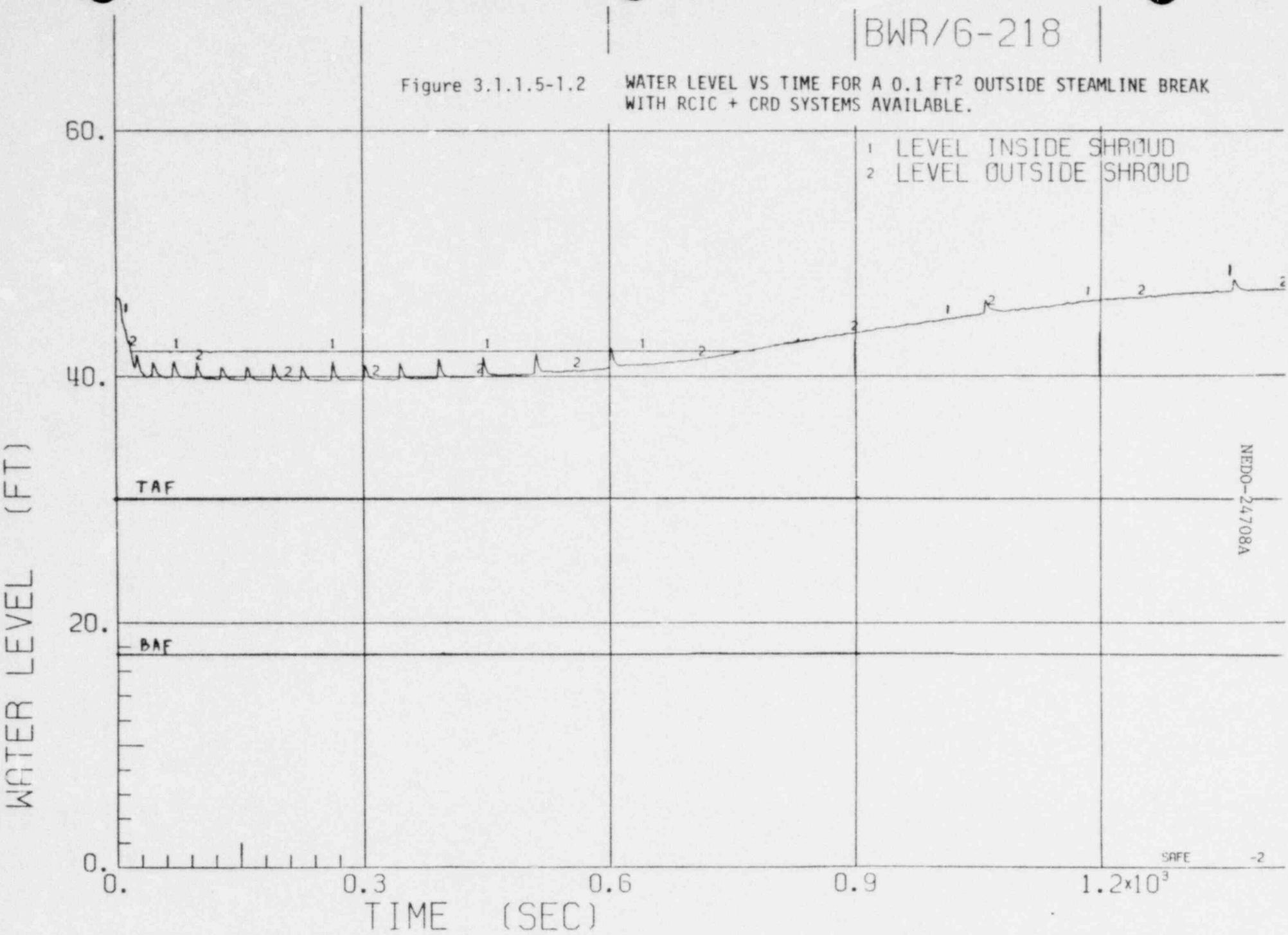

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Figure 3.1.1.5-1.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

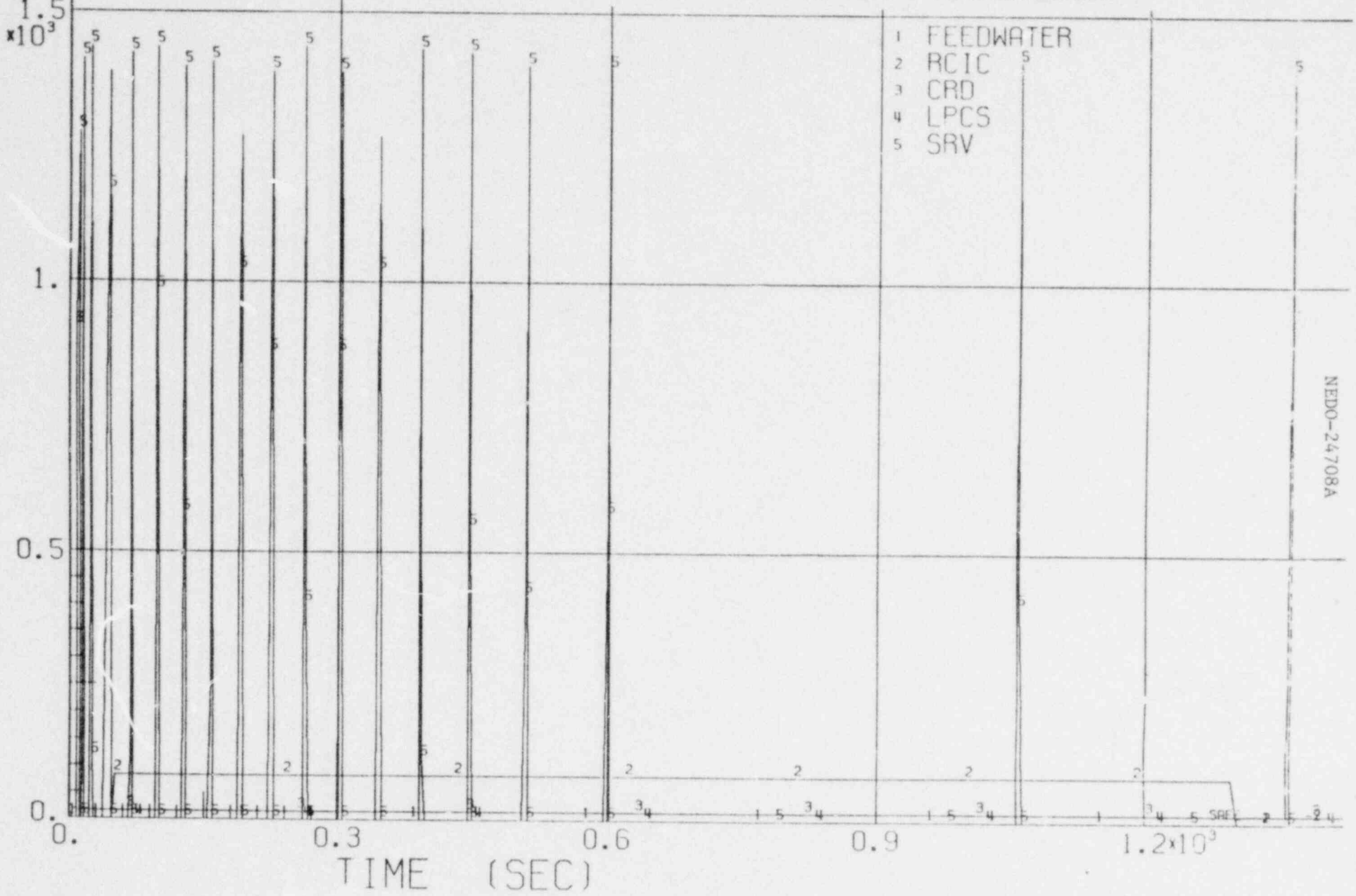

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Figure 3.1.1.5-1.4 FLOW RATES VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

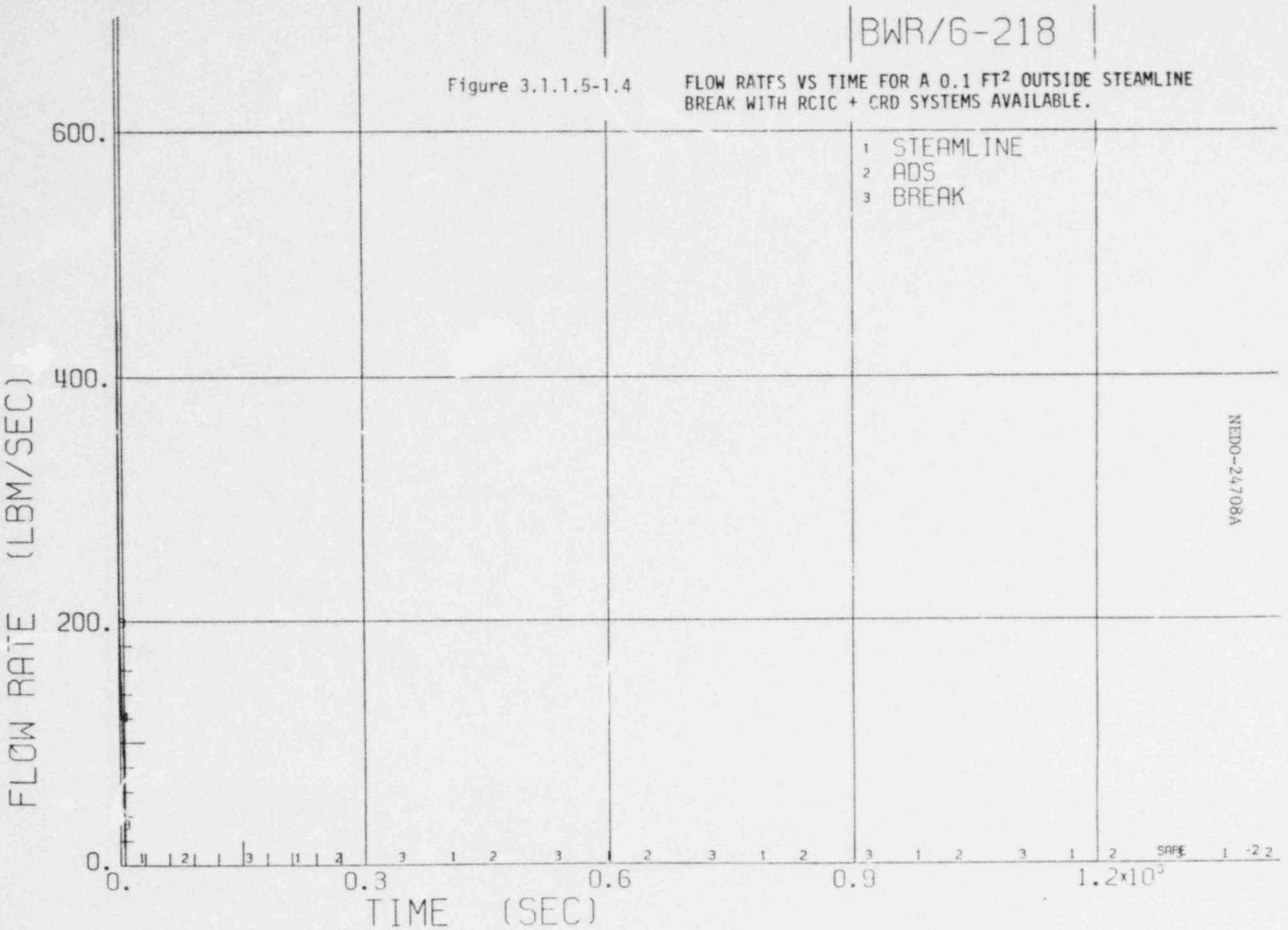

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Figure 3.1.1.5-1.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

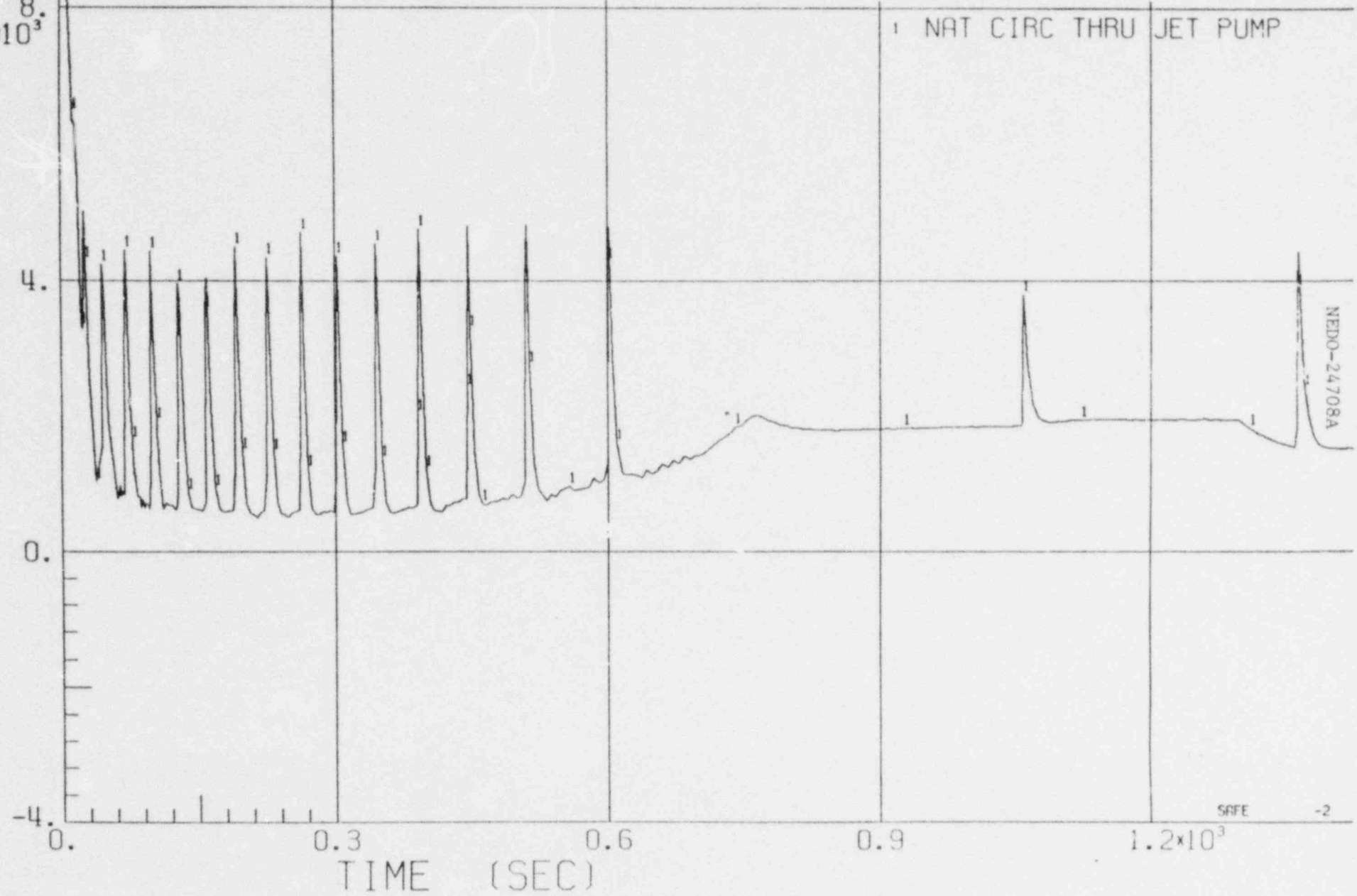

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Figure 3.1.1.5-1.6 TEMPERATURE VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

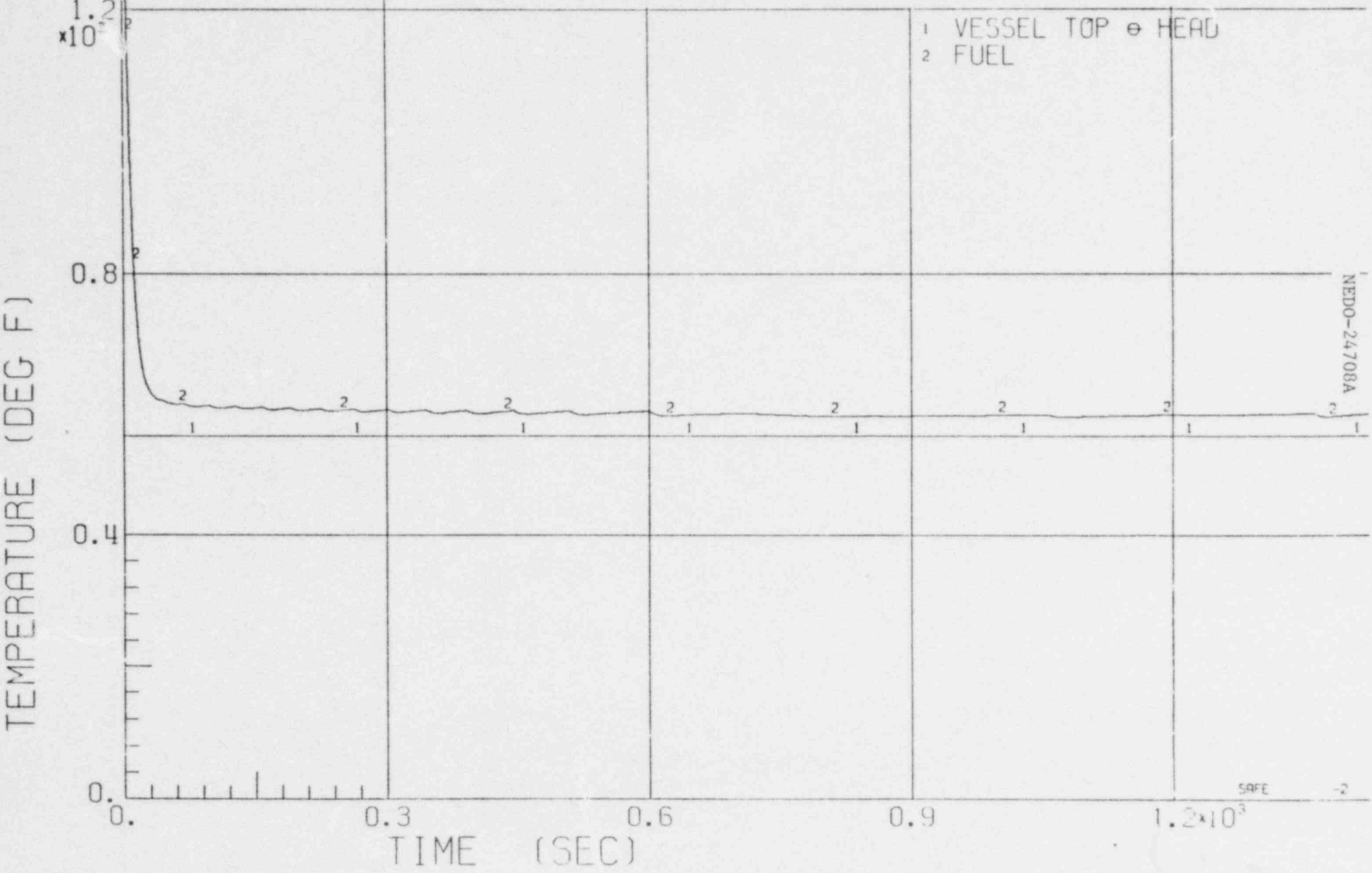

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Figure 3.1.1.5-1.7 ENTHALPY VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

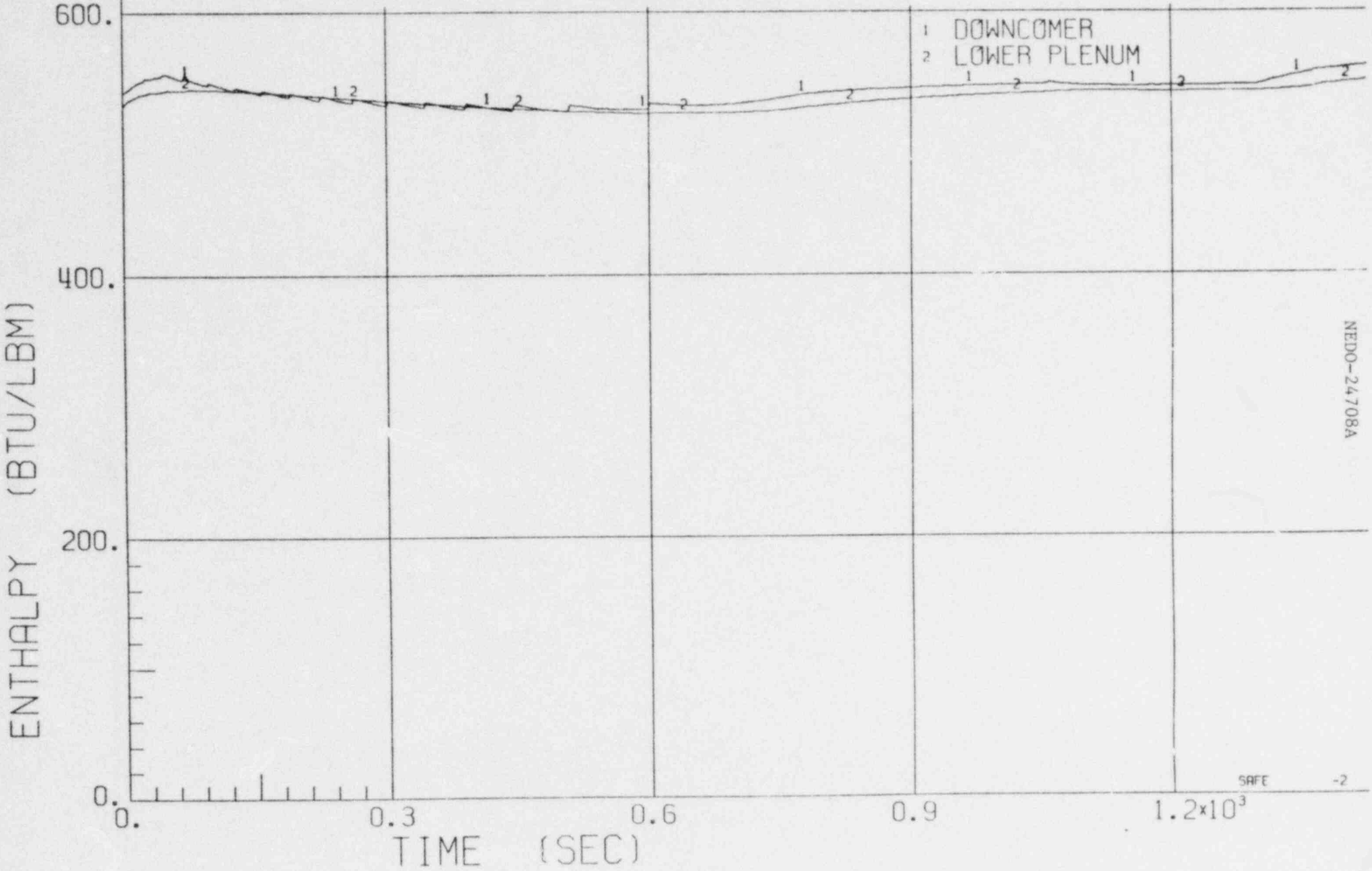

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Figure 3.1.1.5-1.8 QUALITY VS TIME FOR A 0.1 FT^2 OUTSIDE STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

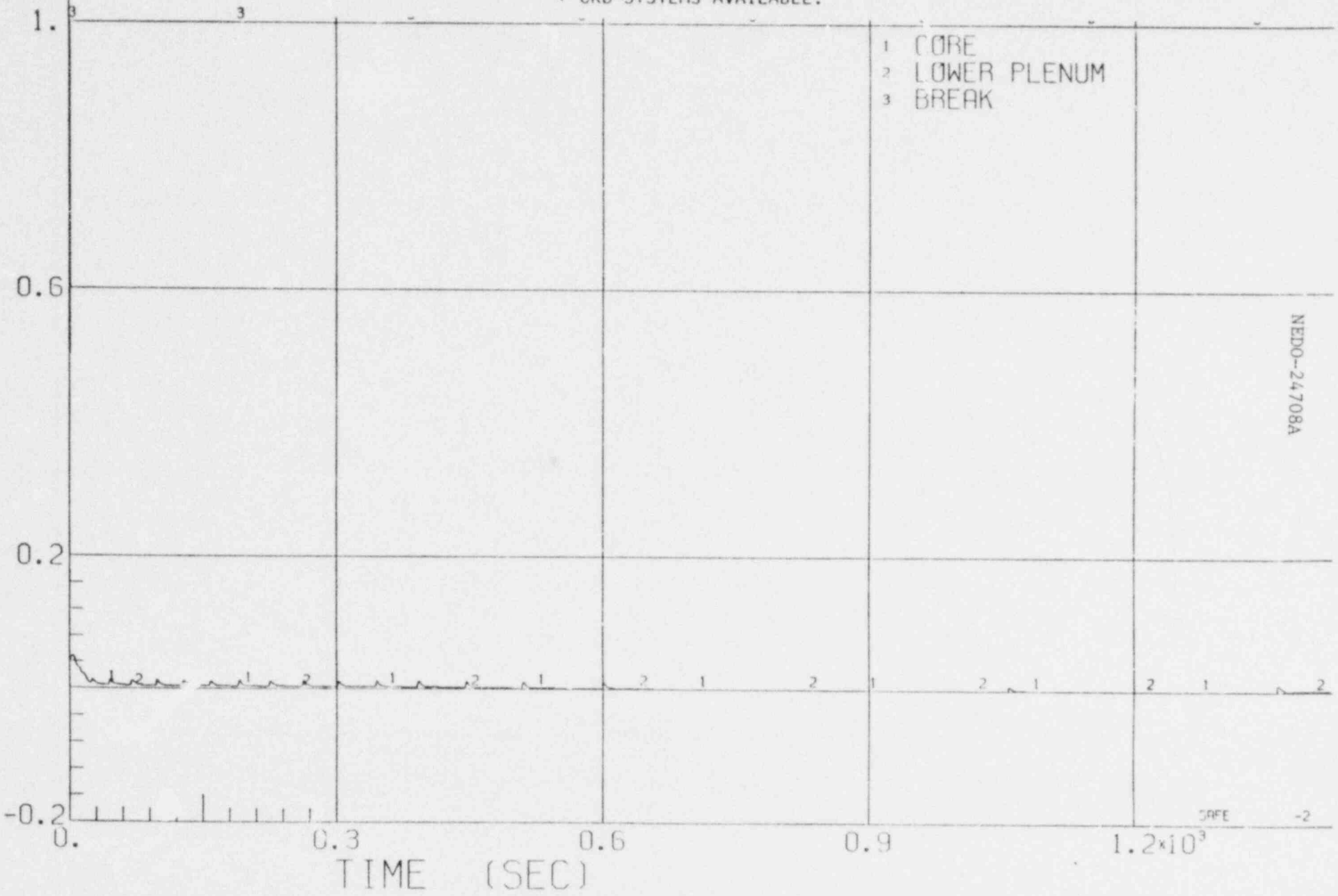

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Figure 3.1.1.5-2.1 System pressure vs time for a 0.001 ft^2 suction break with HPCS only available.

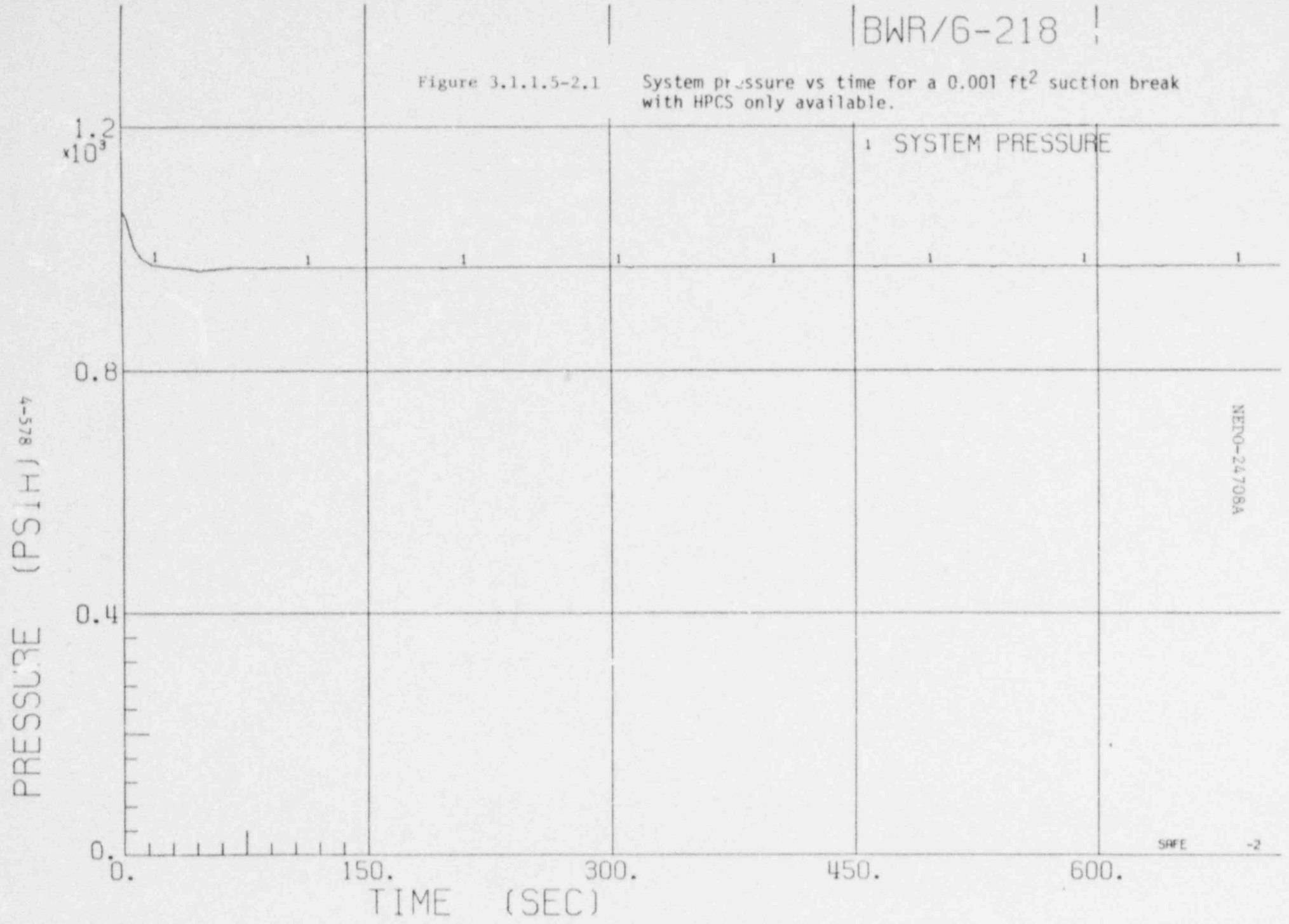

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Figure 3.1.1.5-2.2 Water level vs time for a 0.001 ft^2 suction break with HPCS only available.

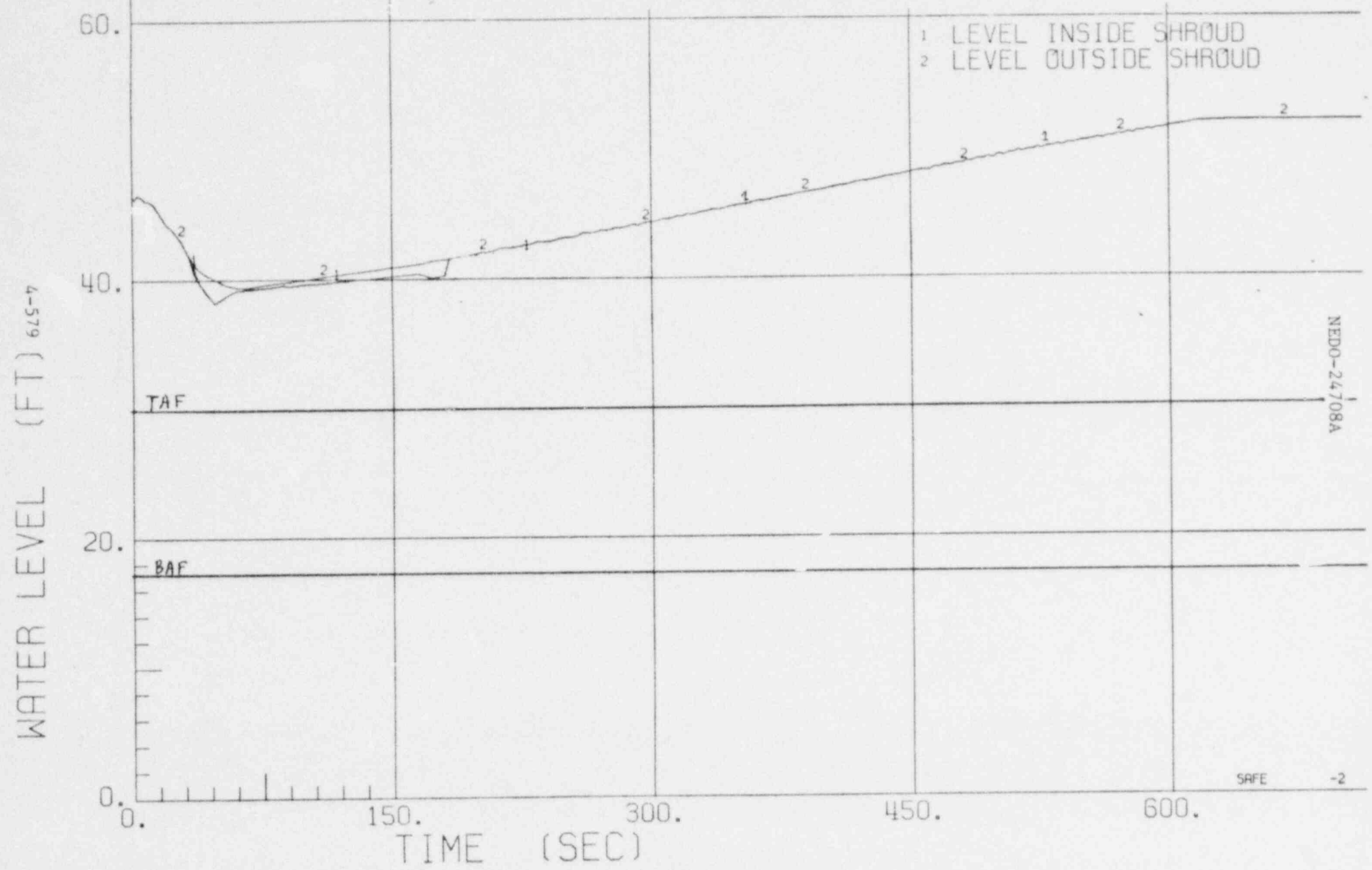

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Figure 3.1.1.5-2.3 System flow rates vs time for a 0.001 ft^2 suction break with HPCS only available.

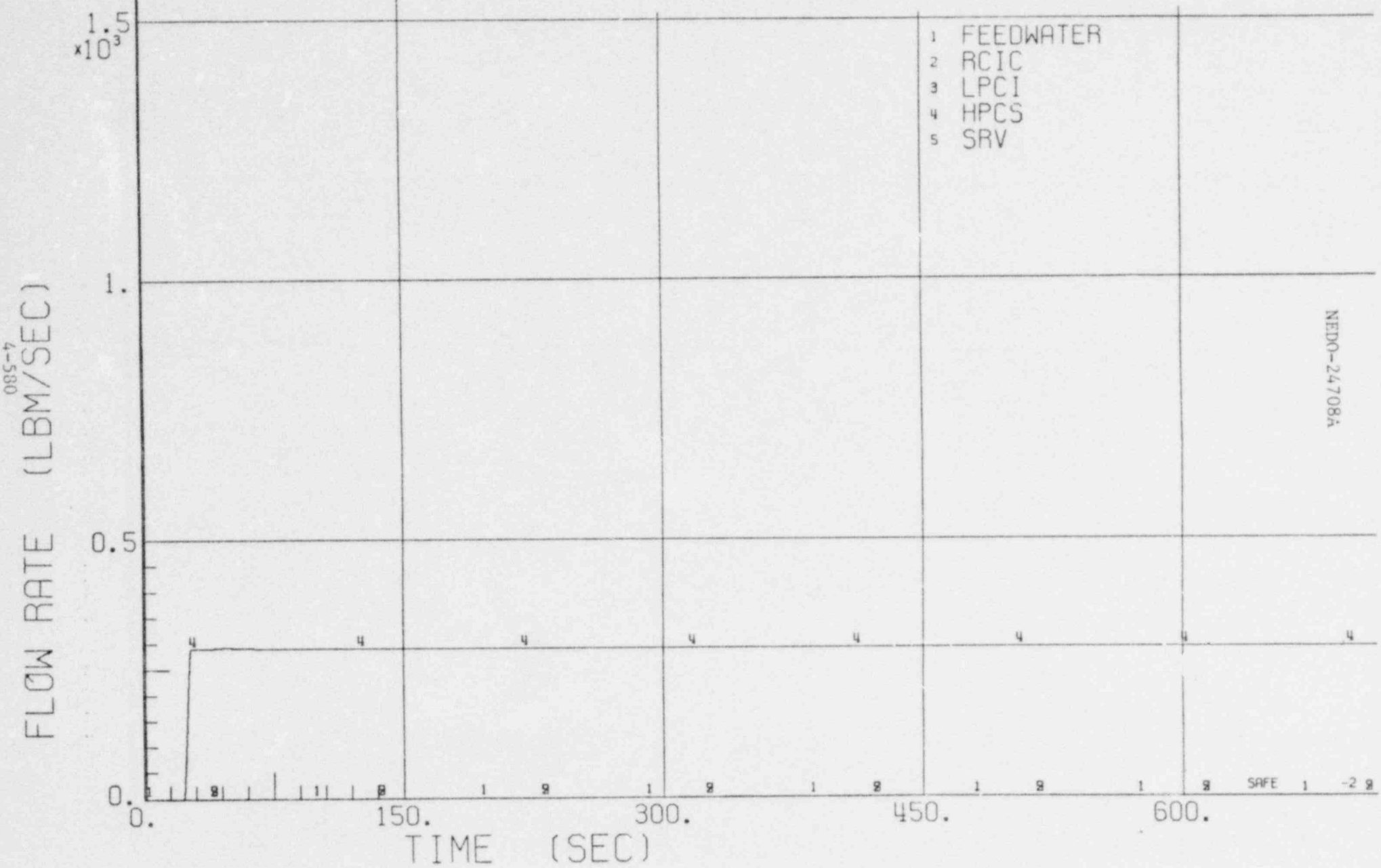

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Figure 3.1.1.5-2.4 Flow rates vs time for a 0.001 ft^2 suction break with HPCS only available.

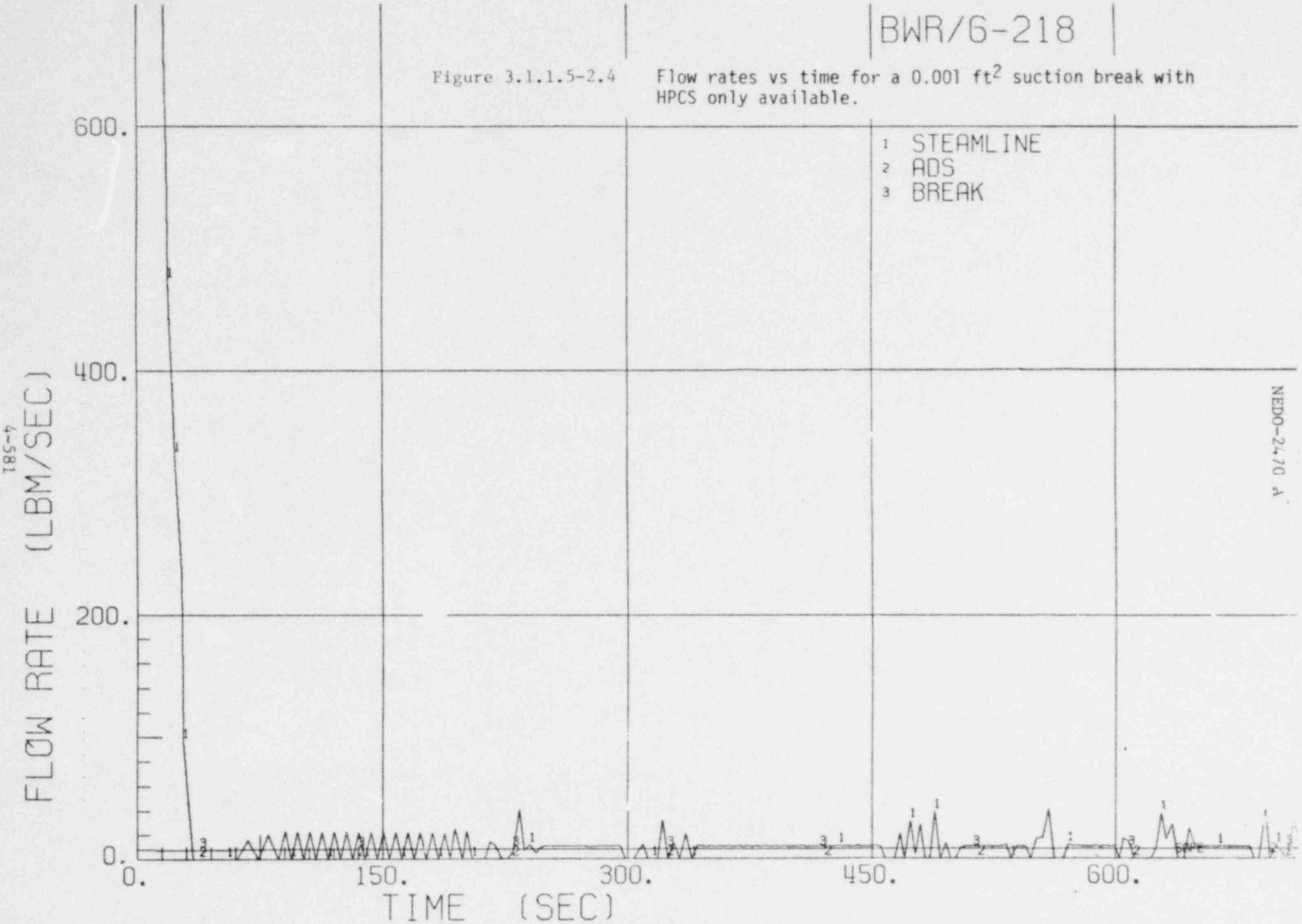

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Figure 3.1.1.5-2.5 Natural circulation flow rate vs time for a 0.001 ft^2 suction break with HPCS only available.

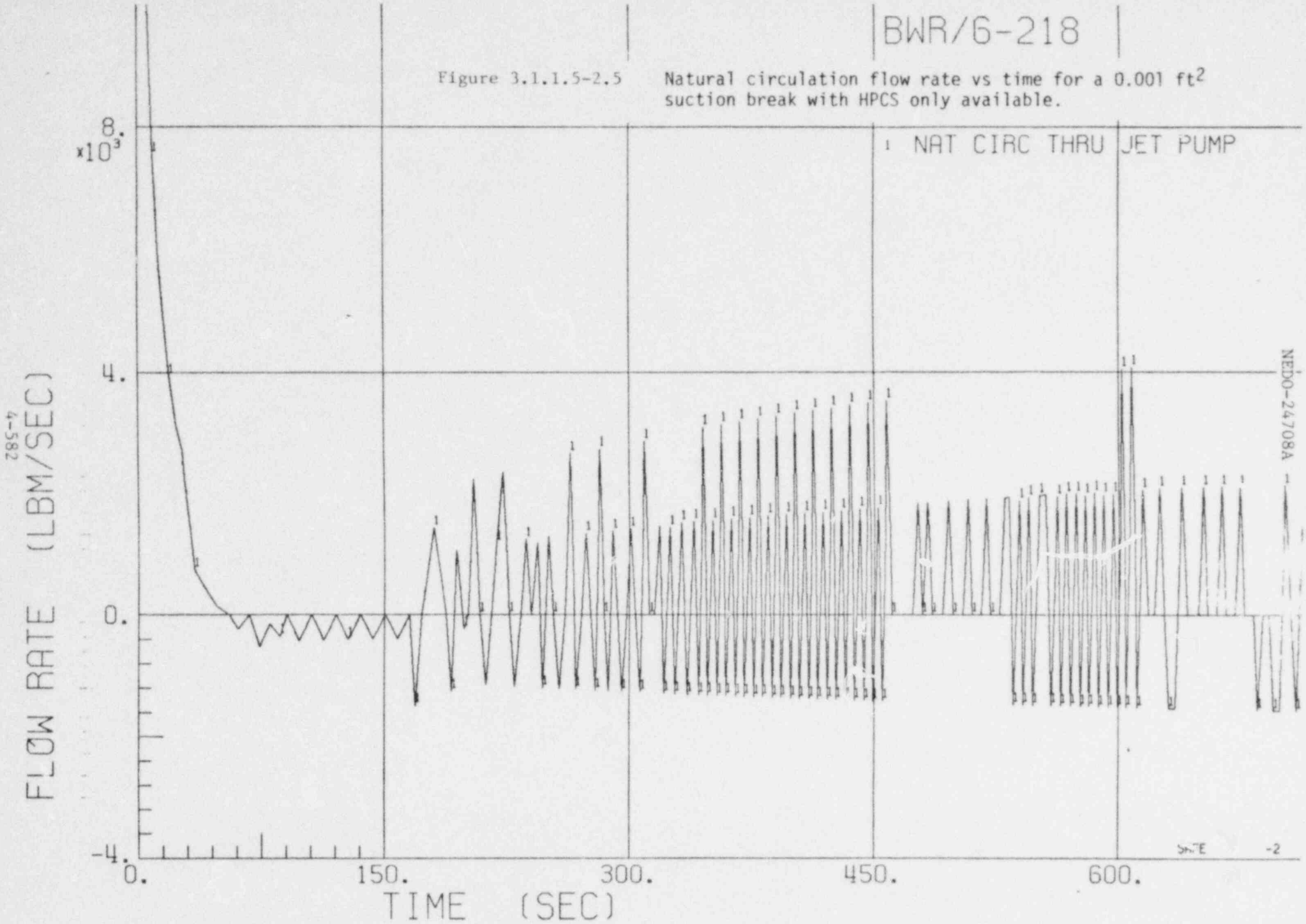

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Figure 3.1.1.5-2.6 Temperature vs time for a 0.001 ft^2 suction break with HPCS only available.

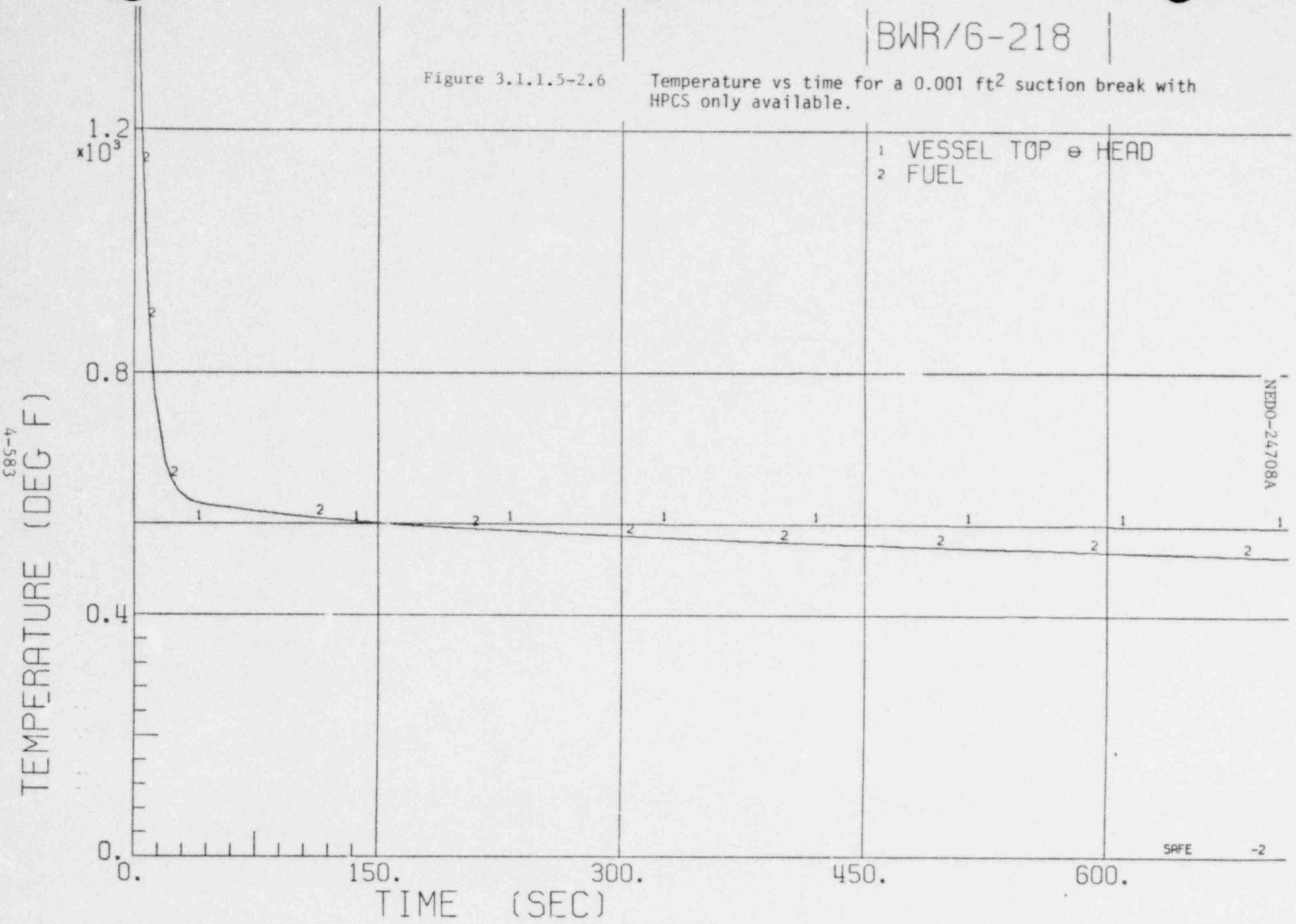
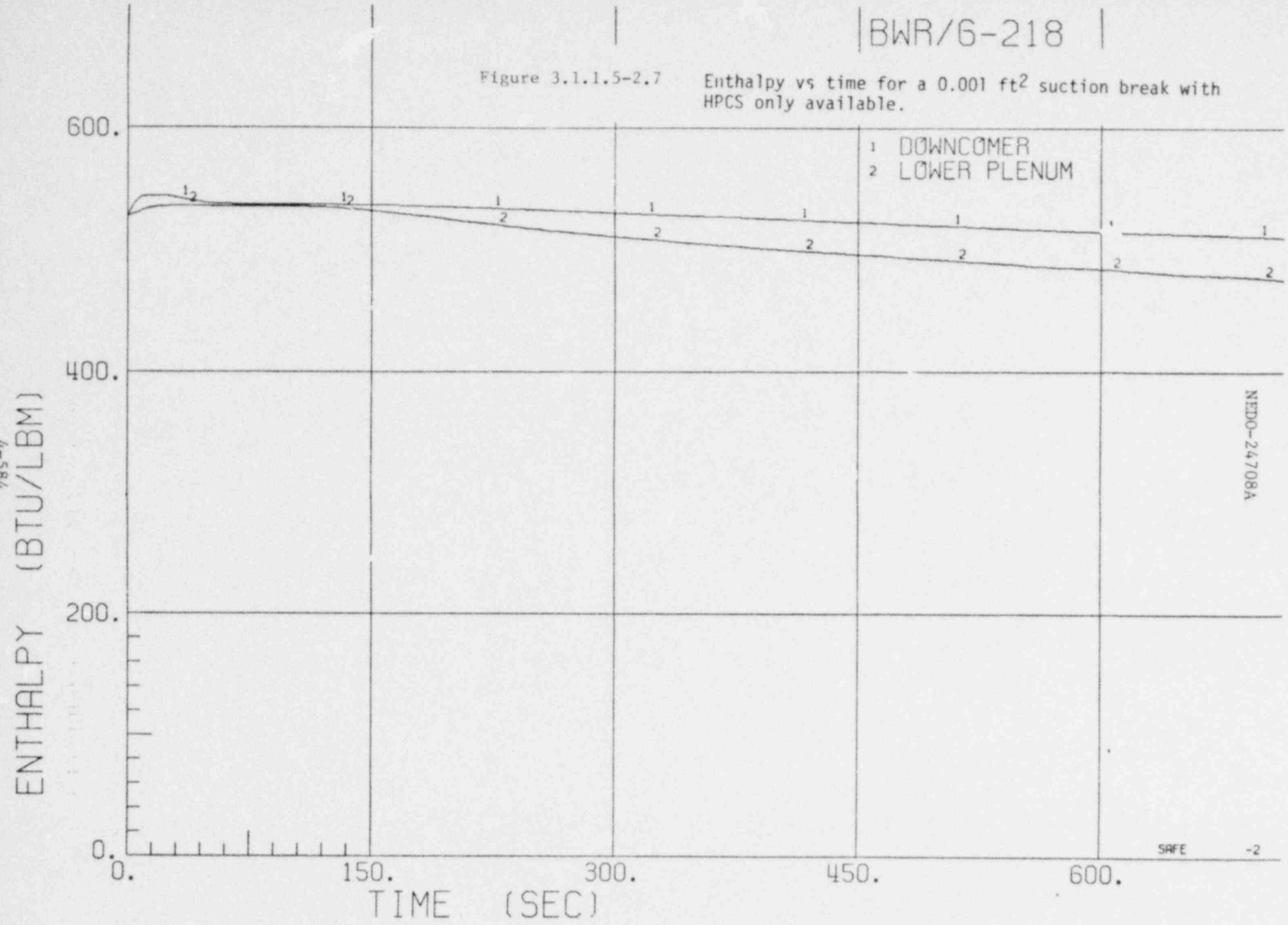


Figure 3.1.1.5-2.7 Enthalpy vs time for a 0.001 ft^2 suction break with HPCS only available.



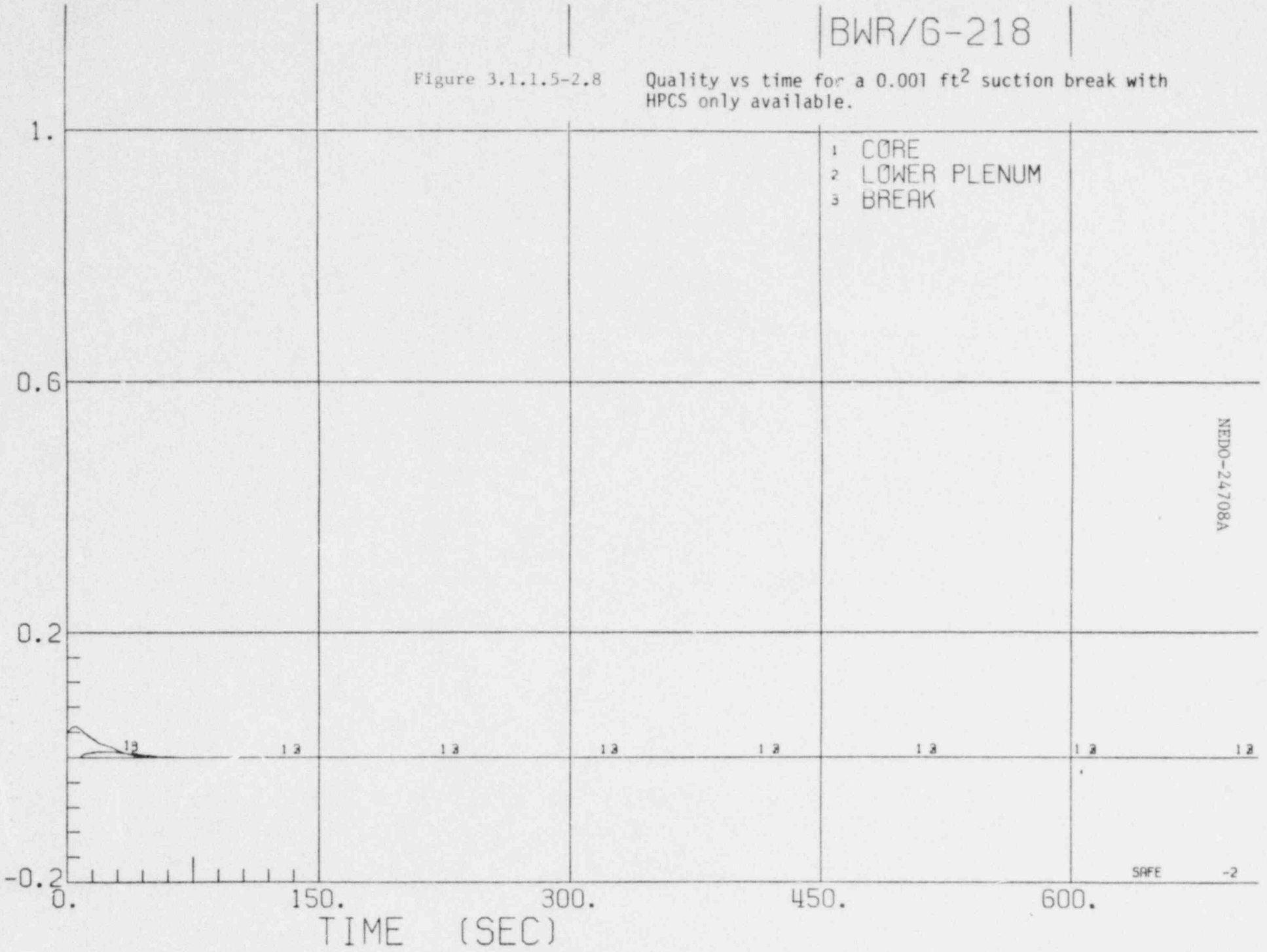


Figure 3.1.1.5-2.8 Quality vs time for a 0.001 ft^2 suction break with HPCS only available.

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Figure 3.1.1.5-3.1 VESSEL PRESSURE VS TIME FOR A 0.05 FT^2 STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

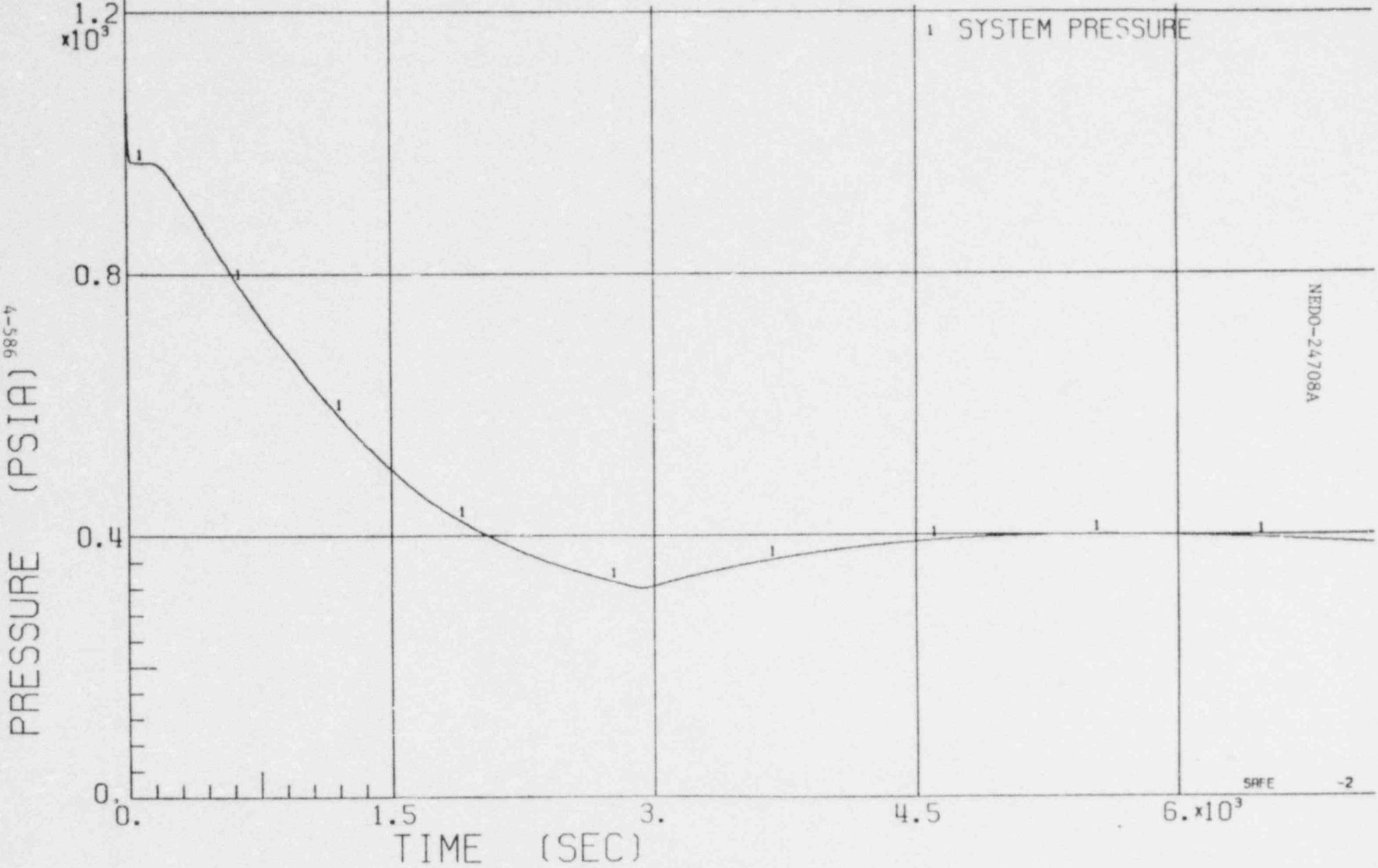

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Figure 3.1.1.5-3.2 WATER LEVEL VS TIME FOR A 0.05 FT^2 STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

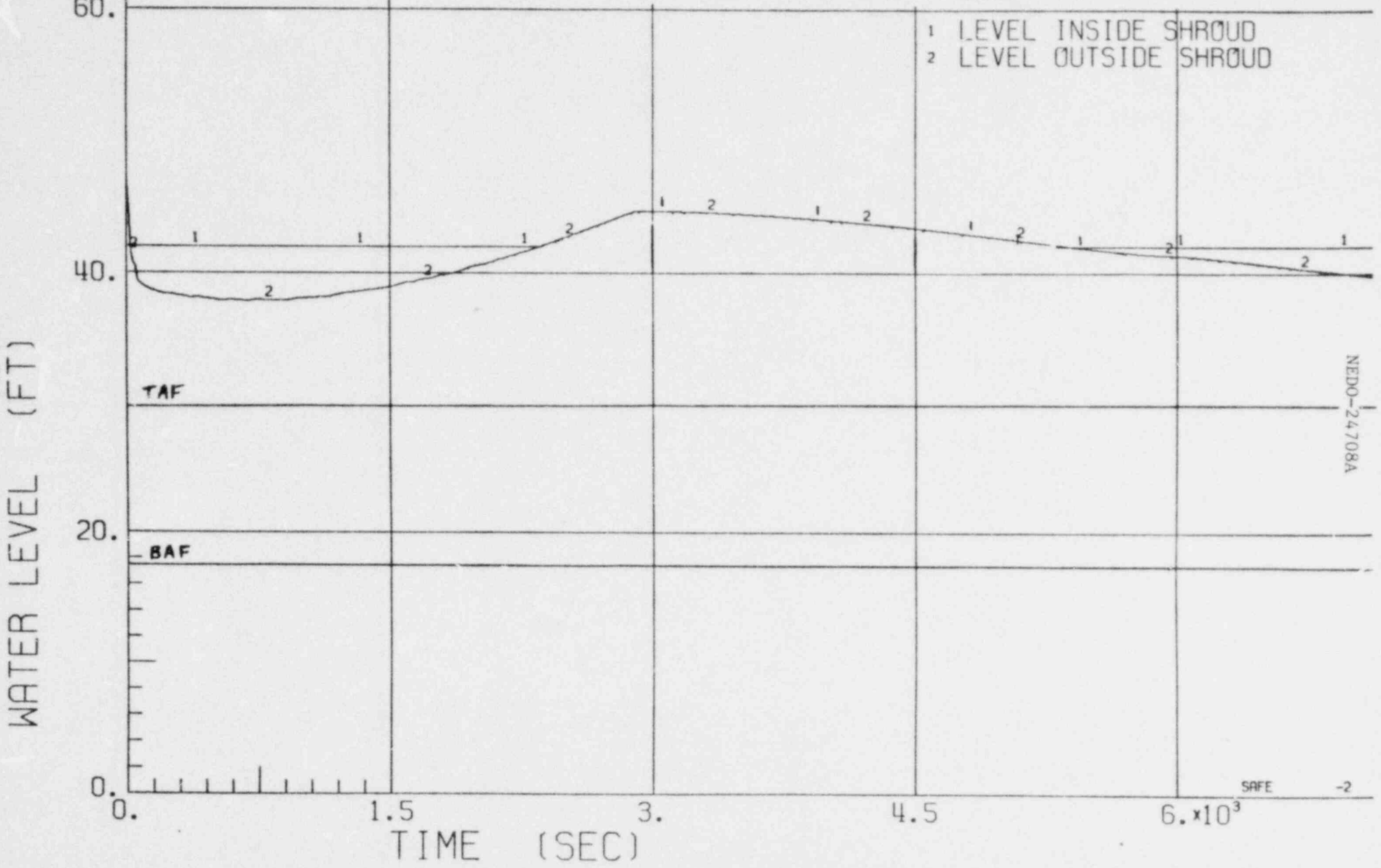

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Figure 3.1.1.5-3.3 SYSTEM FLOW RATES VS TIME FOR A 0.05 FT^2 STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

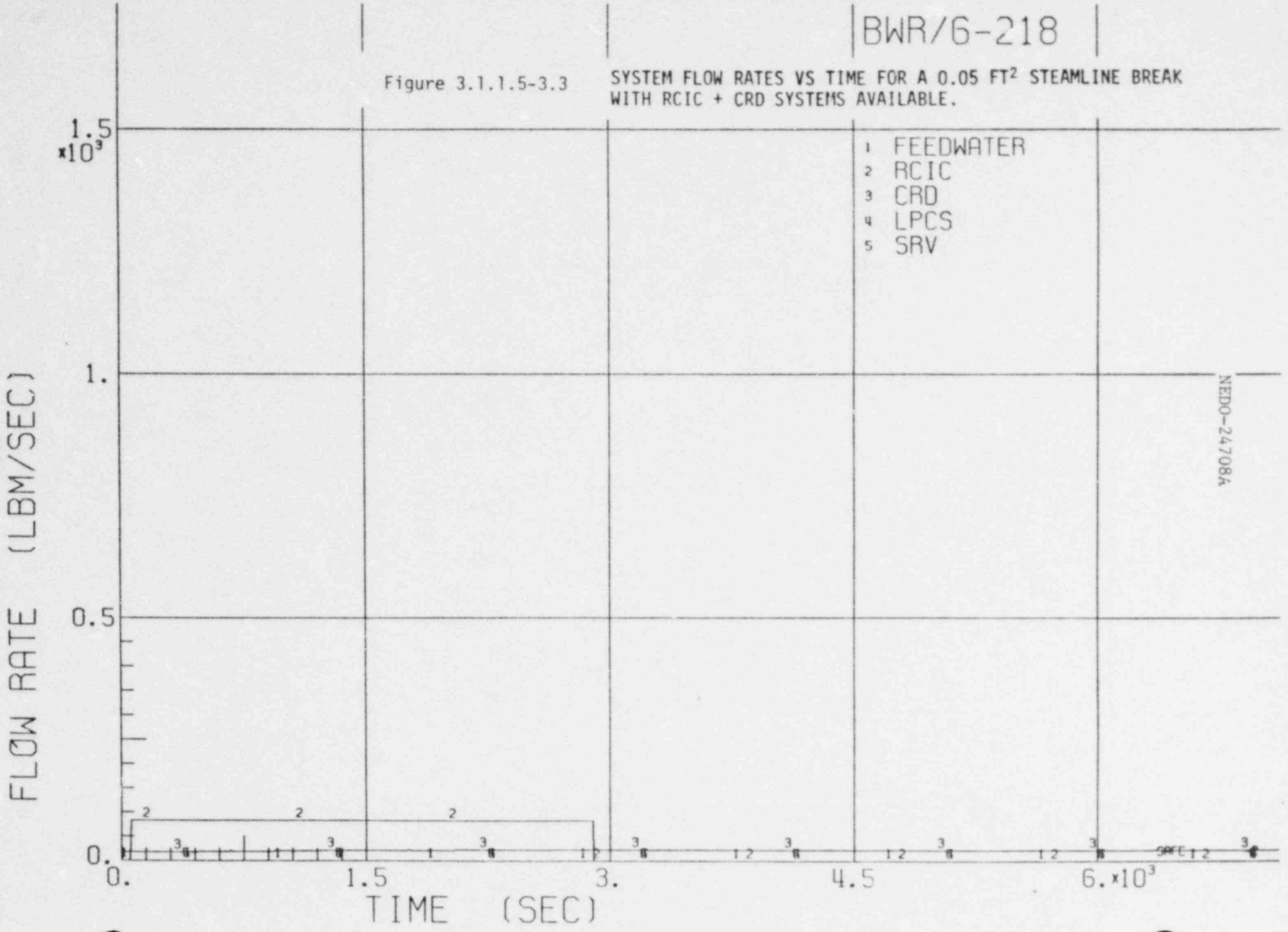

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Figure 3.1.1.5-3.4 FLOW RATES VS TIME FOR A 0.05 FT^2 STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

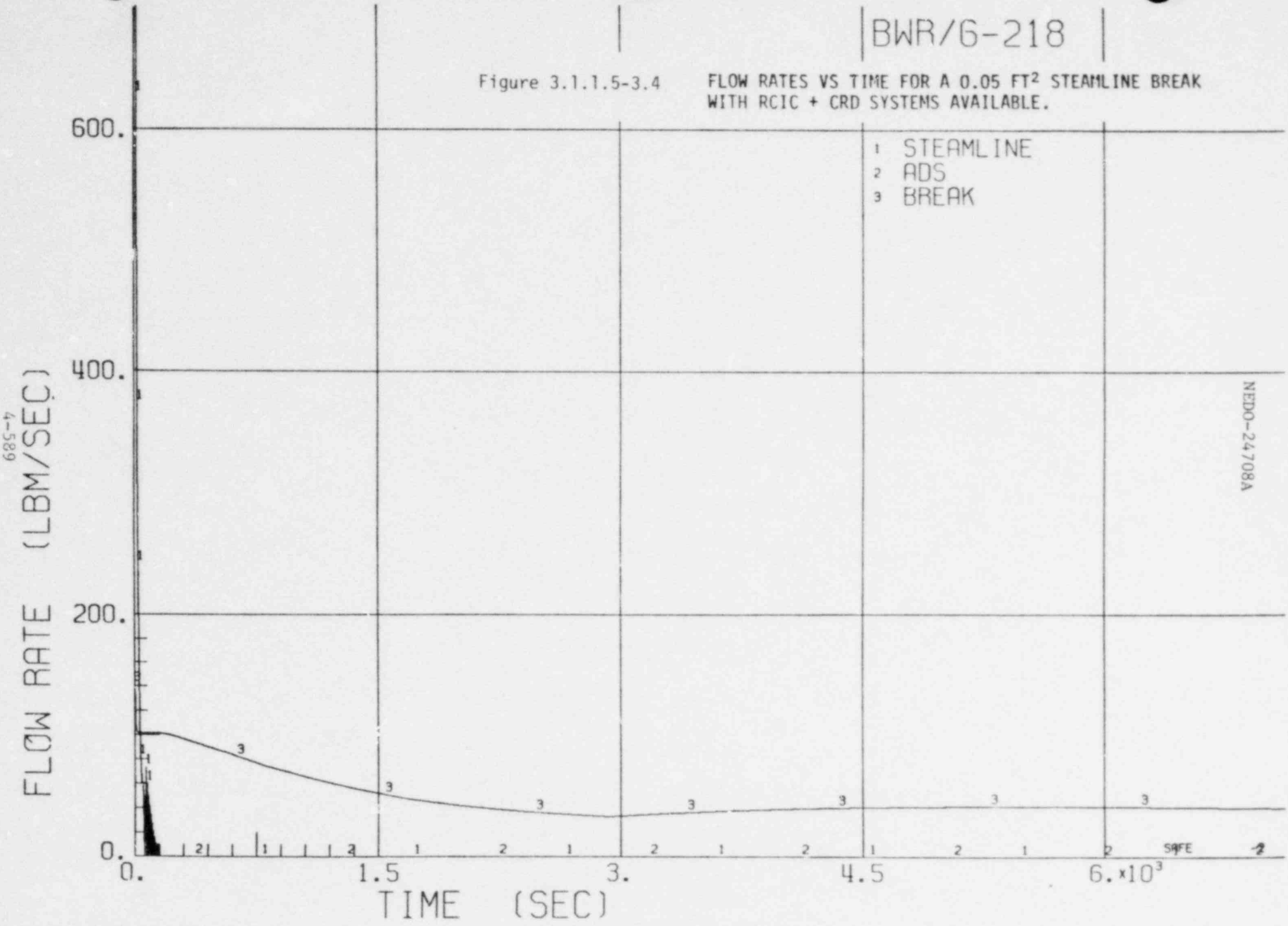

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Figure 3.1.1.5-3.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.05 FT² STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

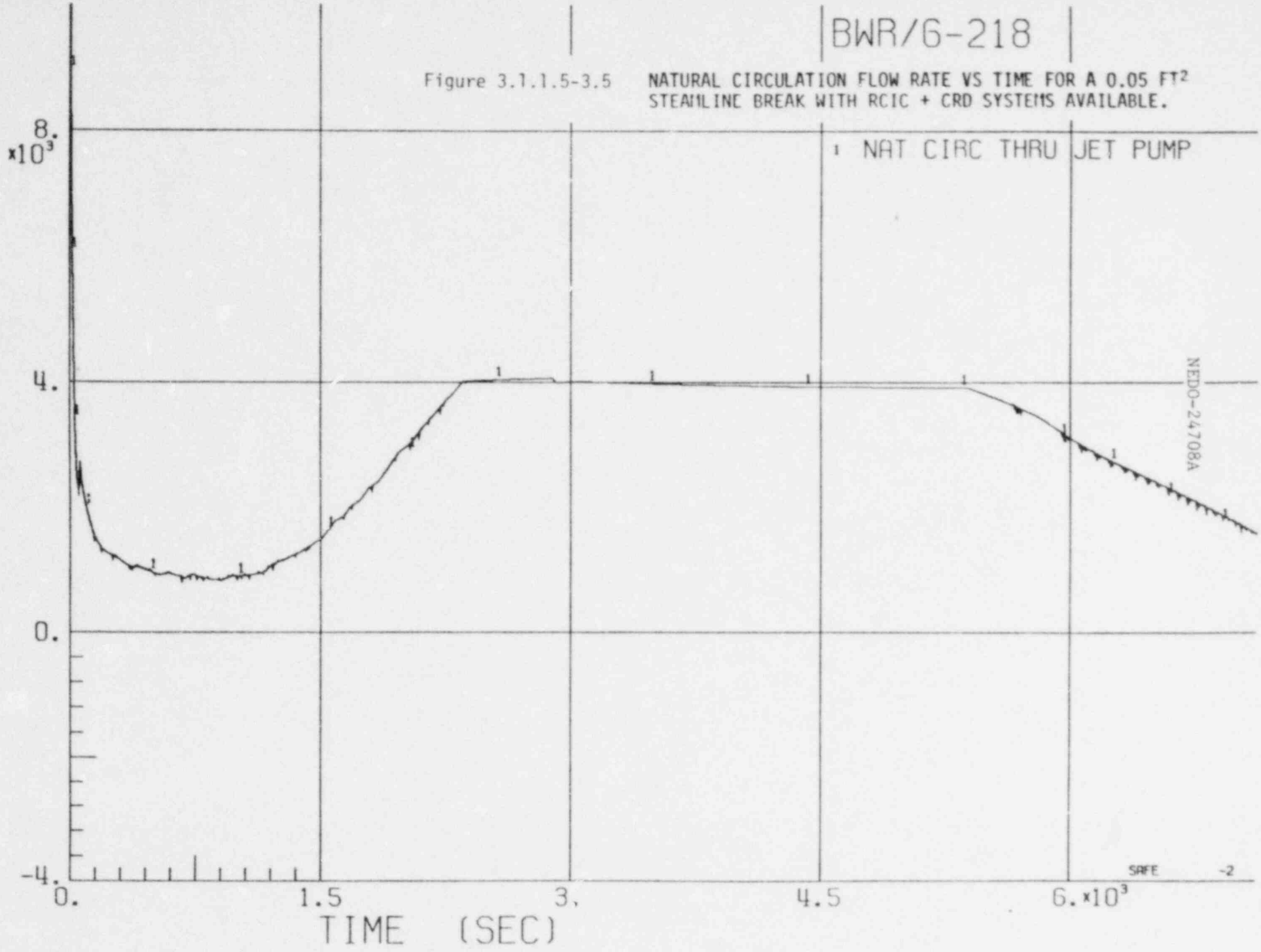

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Figure 3.1.1.5-3.6 TEMPERATURE VS TIME FOR A 0.05 FT^2 STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

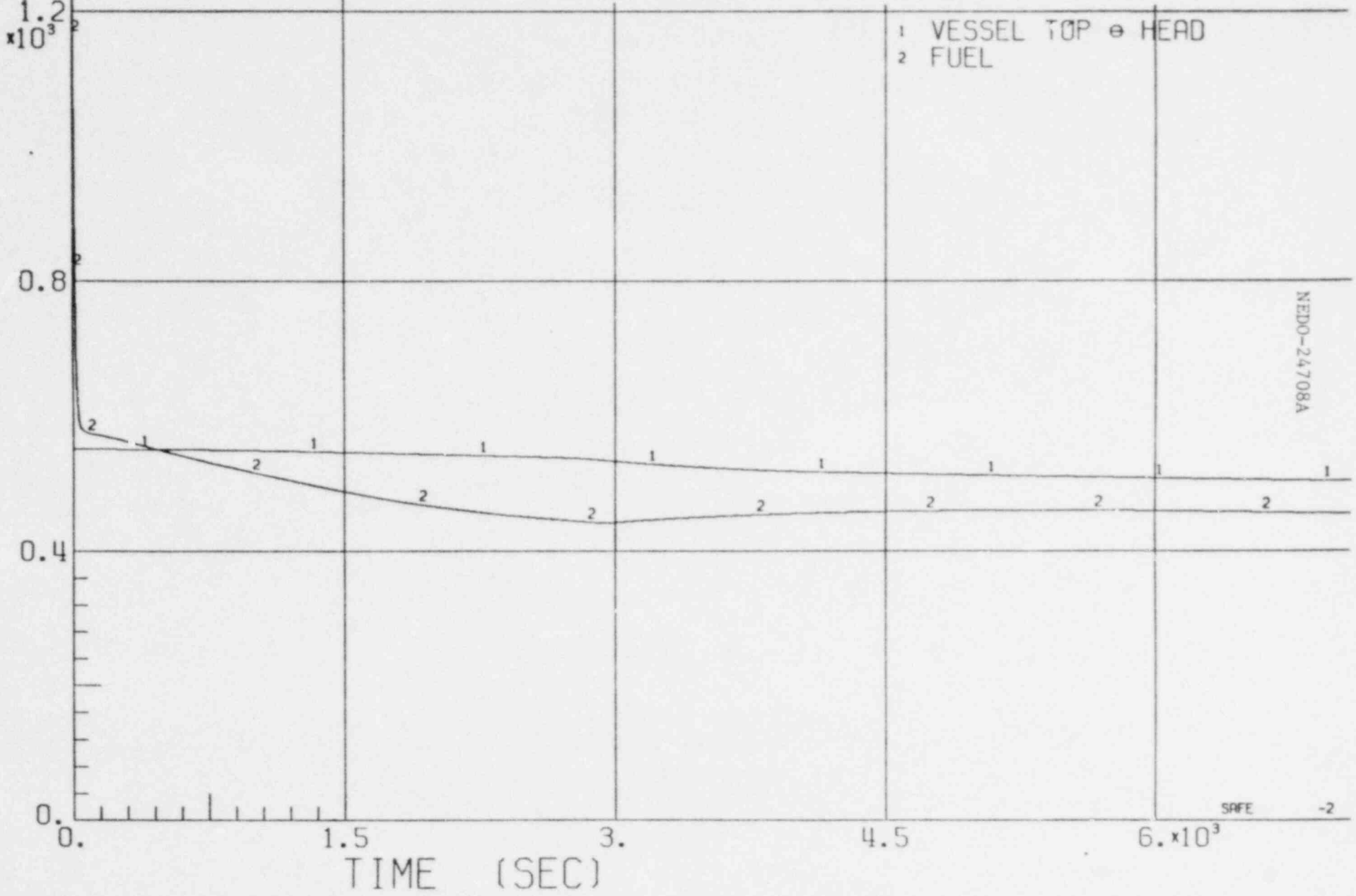

Figure 3.1.1.5-3.7 ENTHALPY VS TIME FOR A 0.05 FT^2 STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

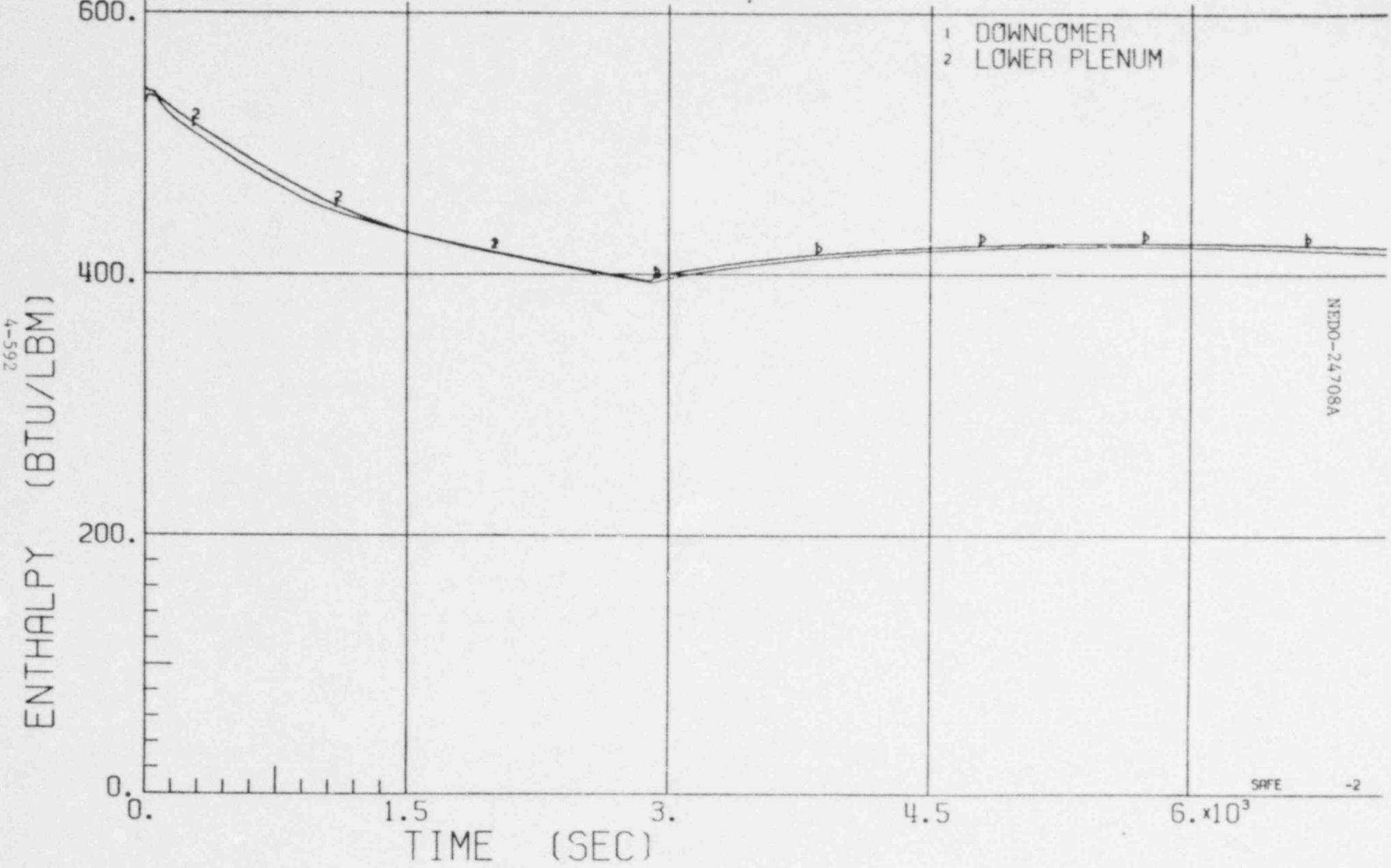

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Figure 3.1.1.5-3.3 QUALITY VS TIME FOR A 0.05 FT^2 STEAMLINE BREAK WITH RCIC + CRD SYSTEMS AVAILABLE.

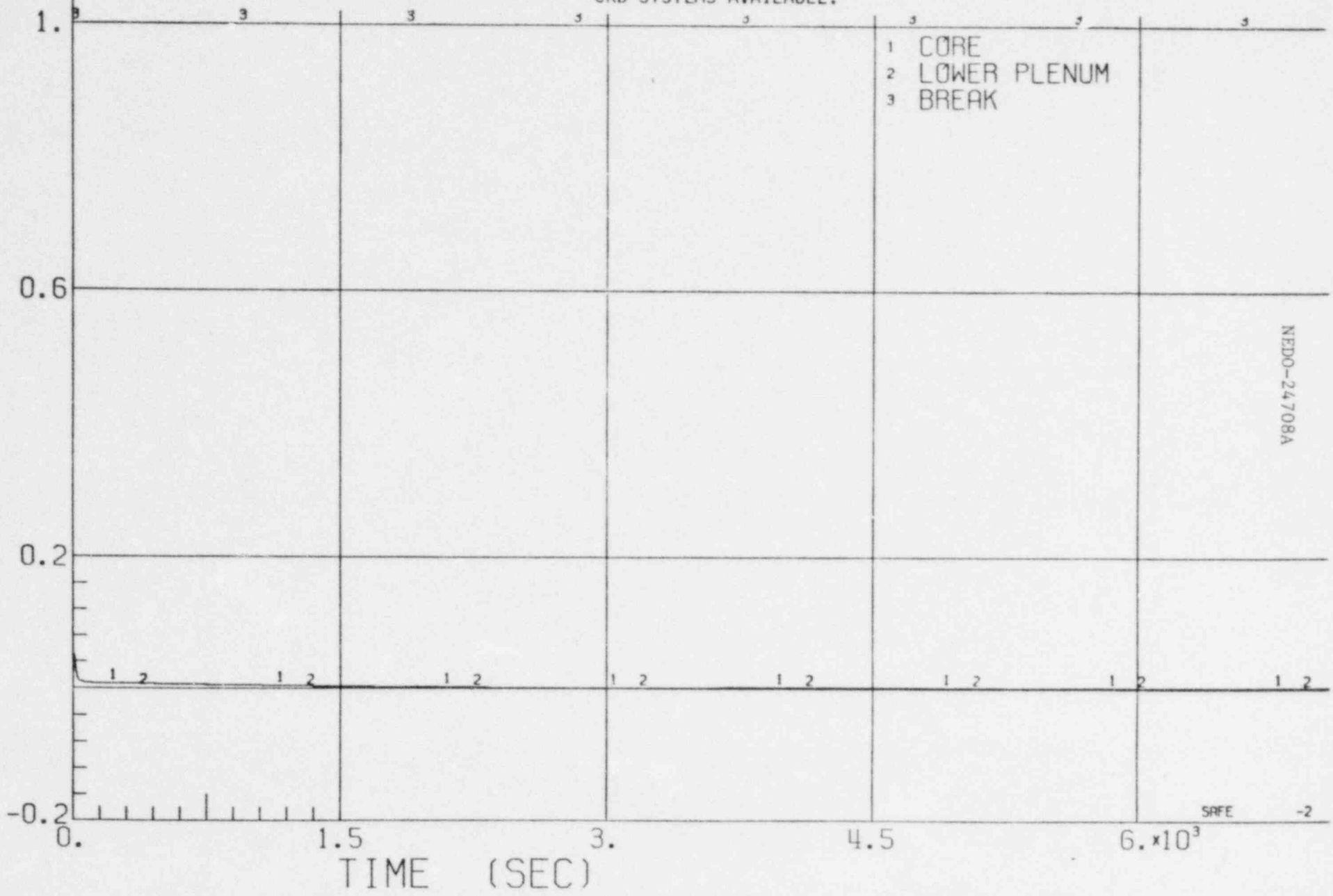

Figure 3.1.1.5-4.1 System pressure vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.

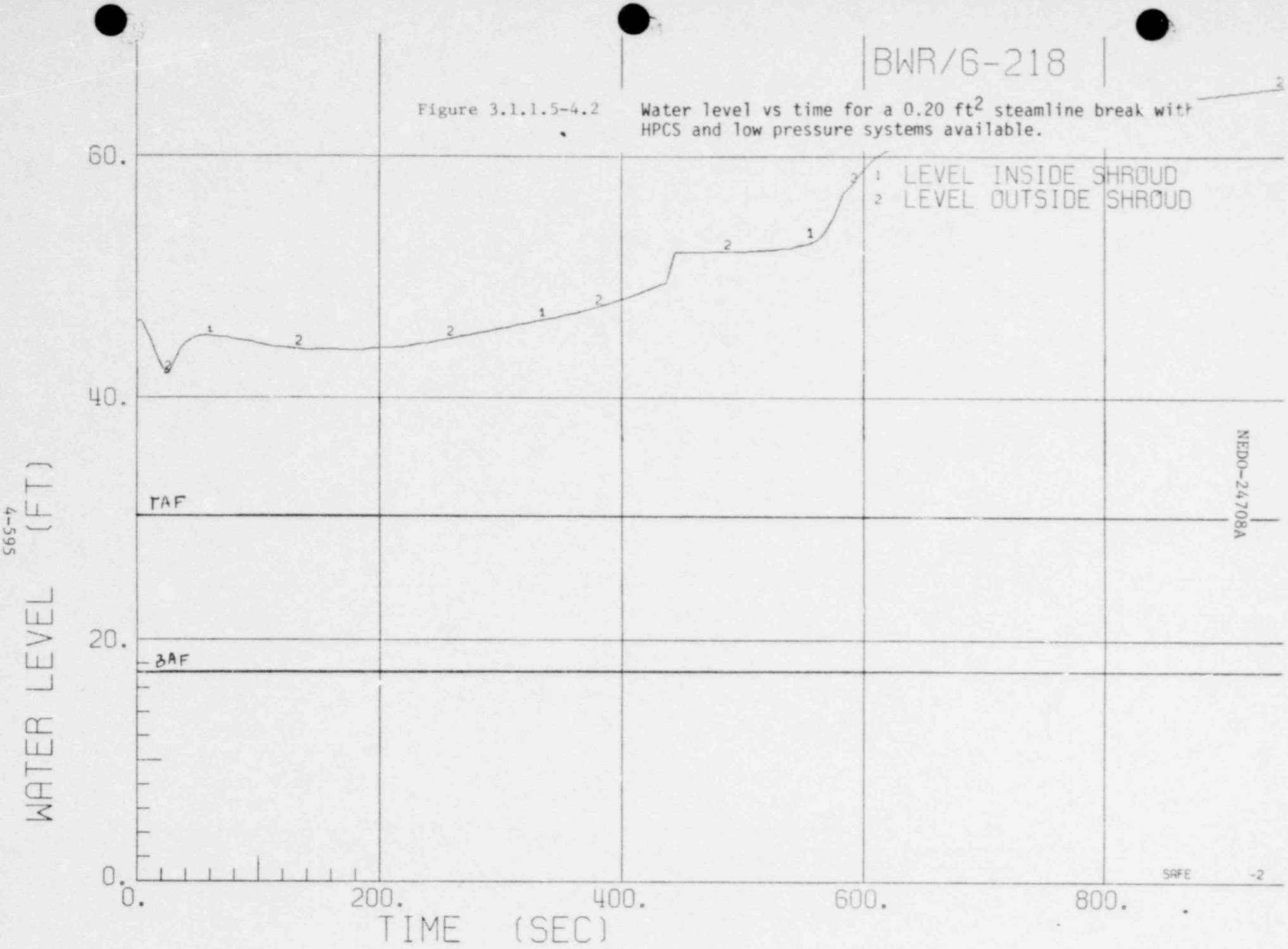

Figure 3.1.1.5-4.2 Water level vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.

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Figure 3.1.1.5-4.3 System flow rates vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.

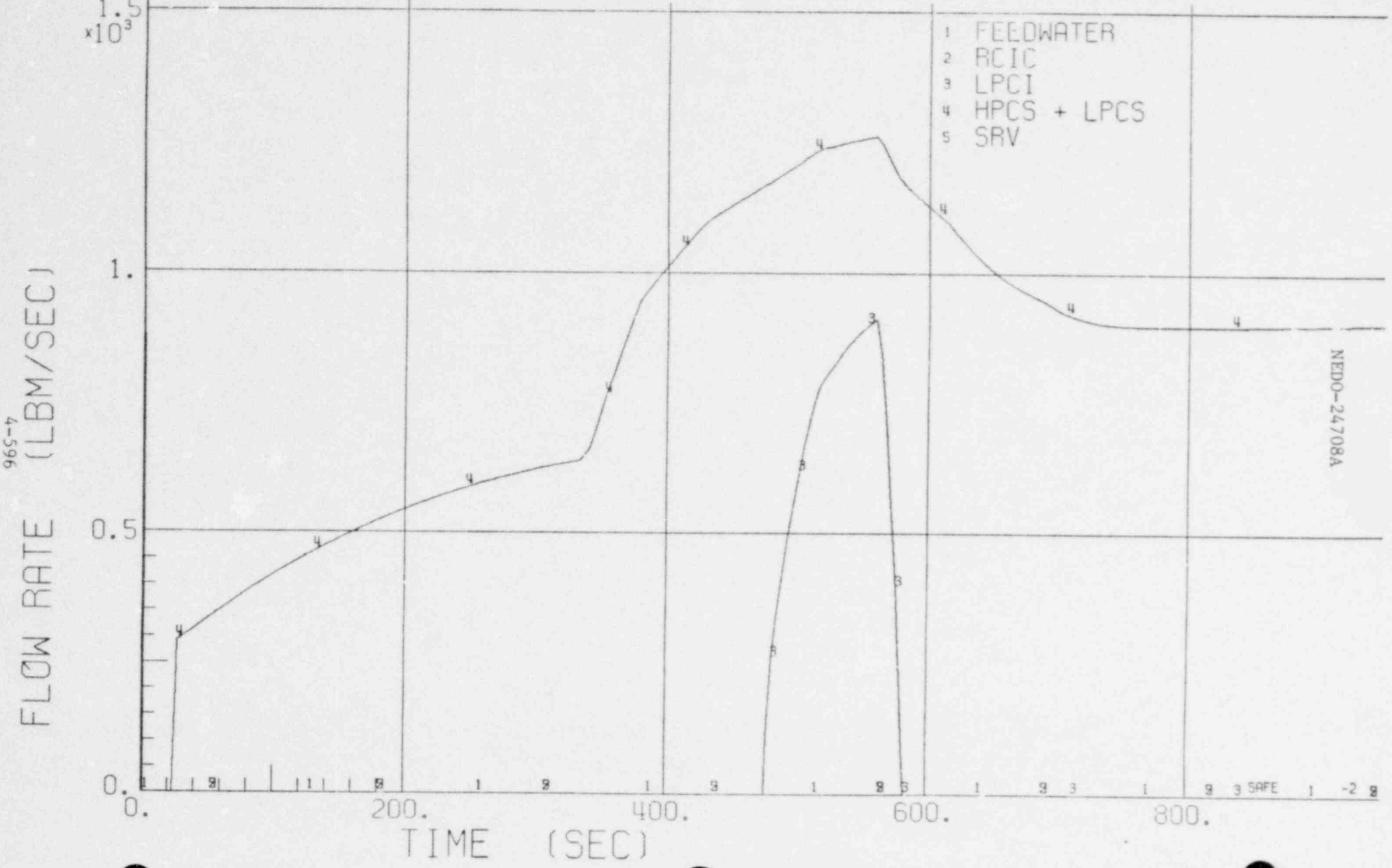

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Figure 3.1.1.5-4.4 Flow rates vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.

Figure 3.1.1.5-4.5 Natural circulation flow rate vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.

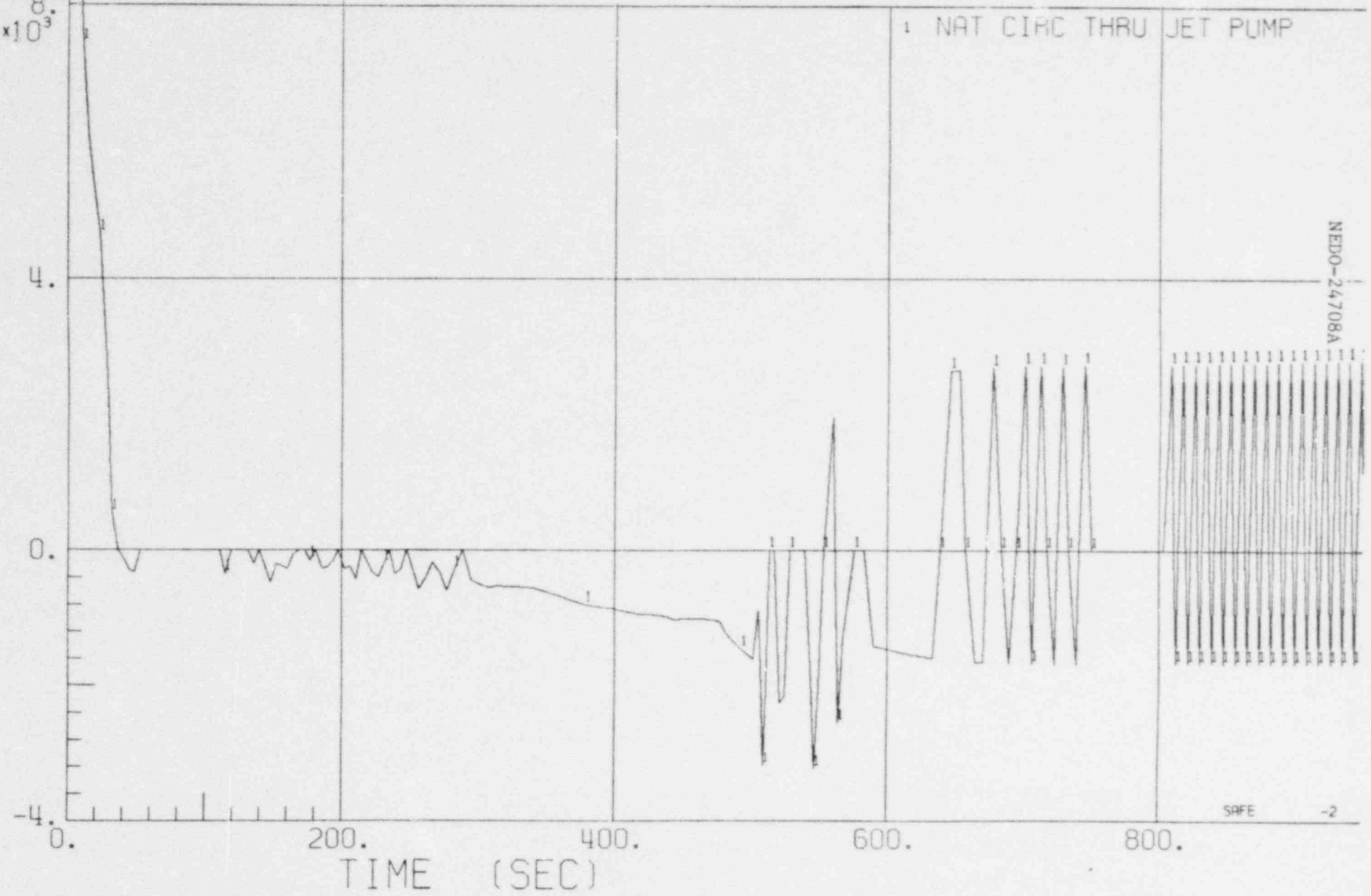

Figure 3.1.1.5-4.6 Temperature vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.

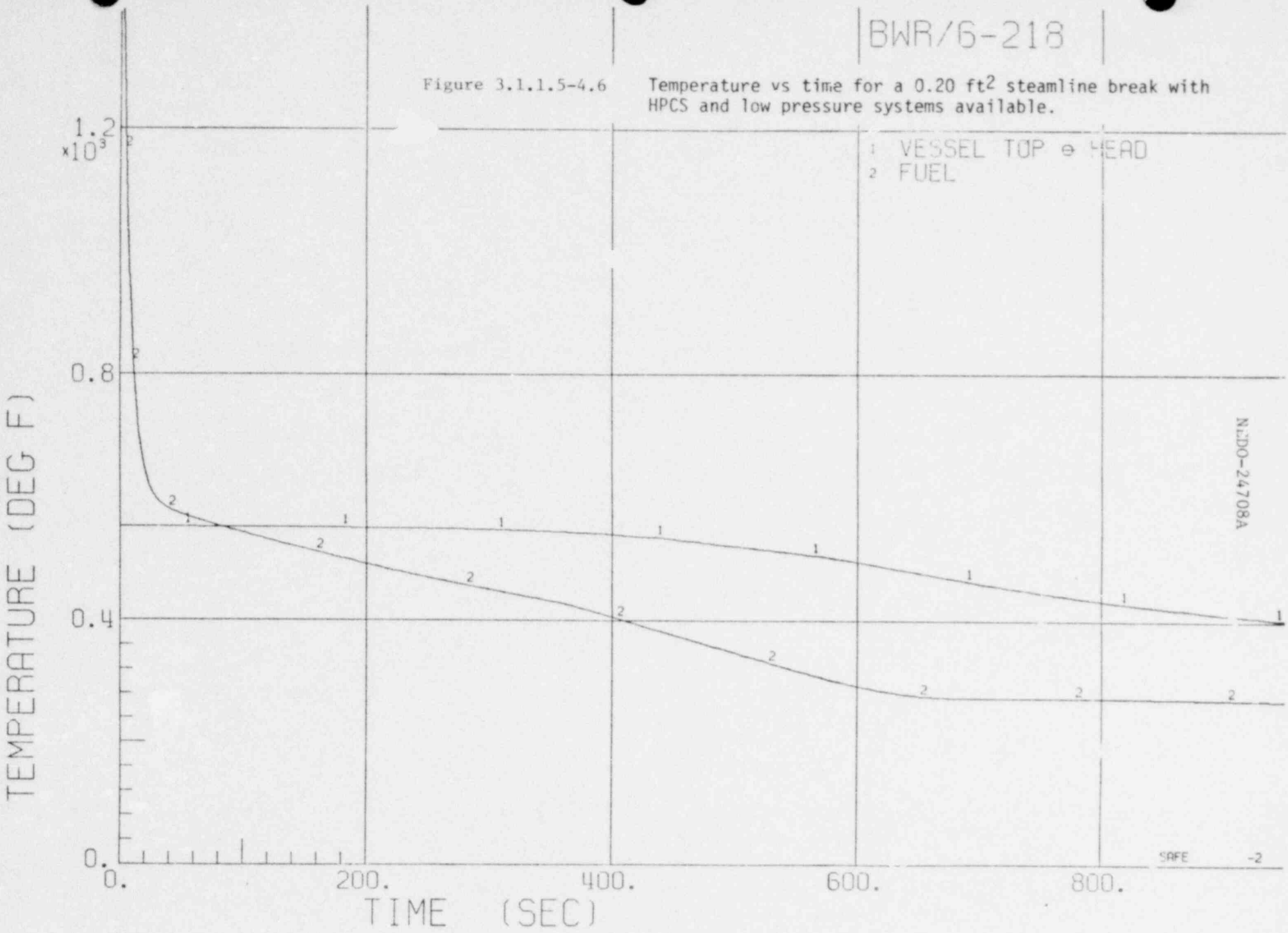

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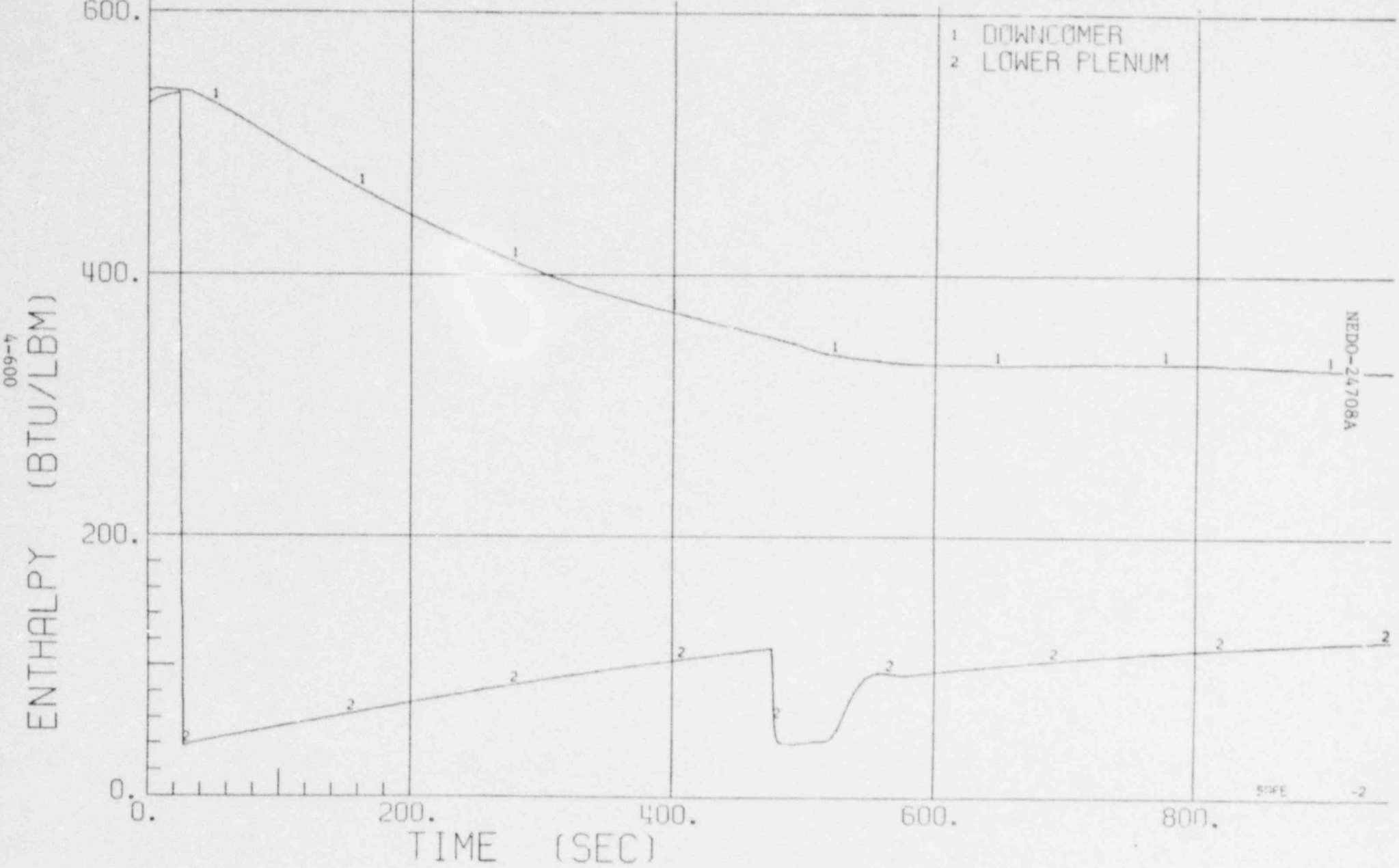
Figure 3.1.'.5-4.7 Enthalpy vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.



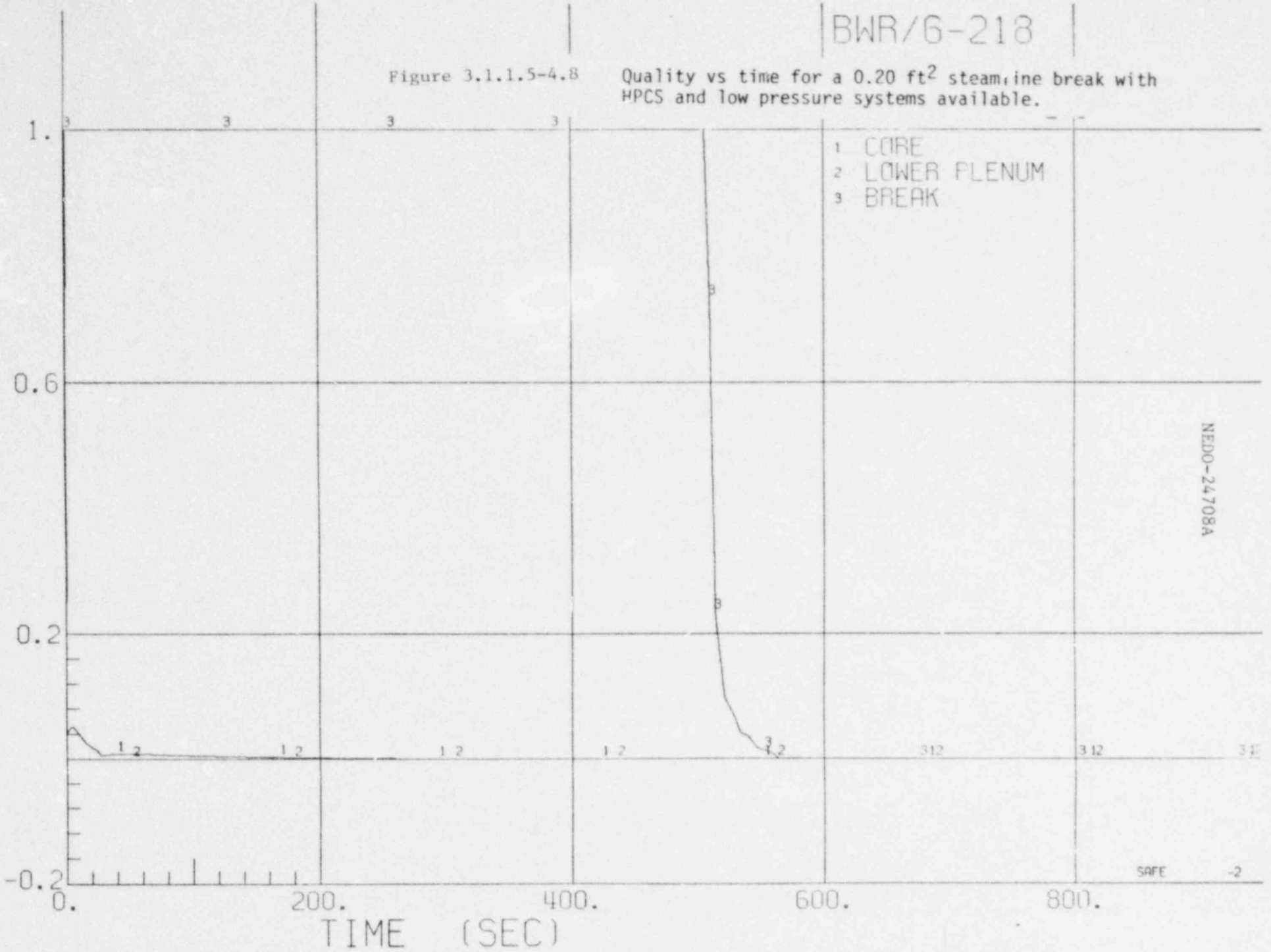


Figure 3.1.1.5-4.8 Quality vs time for a 0.20 ft^2 steamline break with HPCS and low pressure systems available.

Figure 3.1.1.5-5.1 VESSEL PRESSURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

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Figure 3.1.1.5-5.2 WATER LEVEL VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

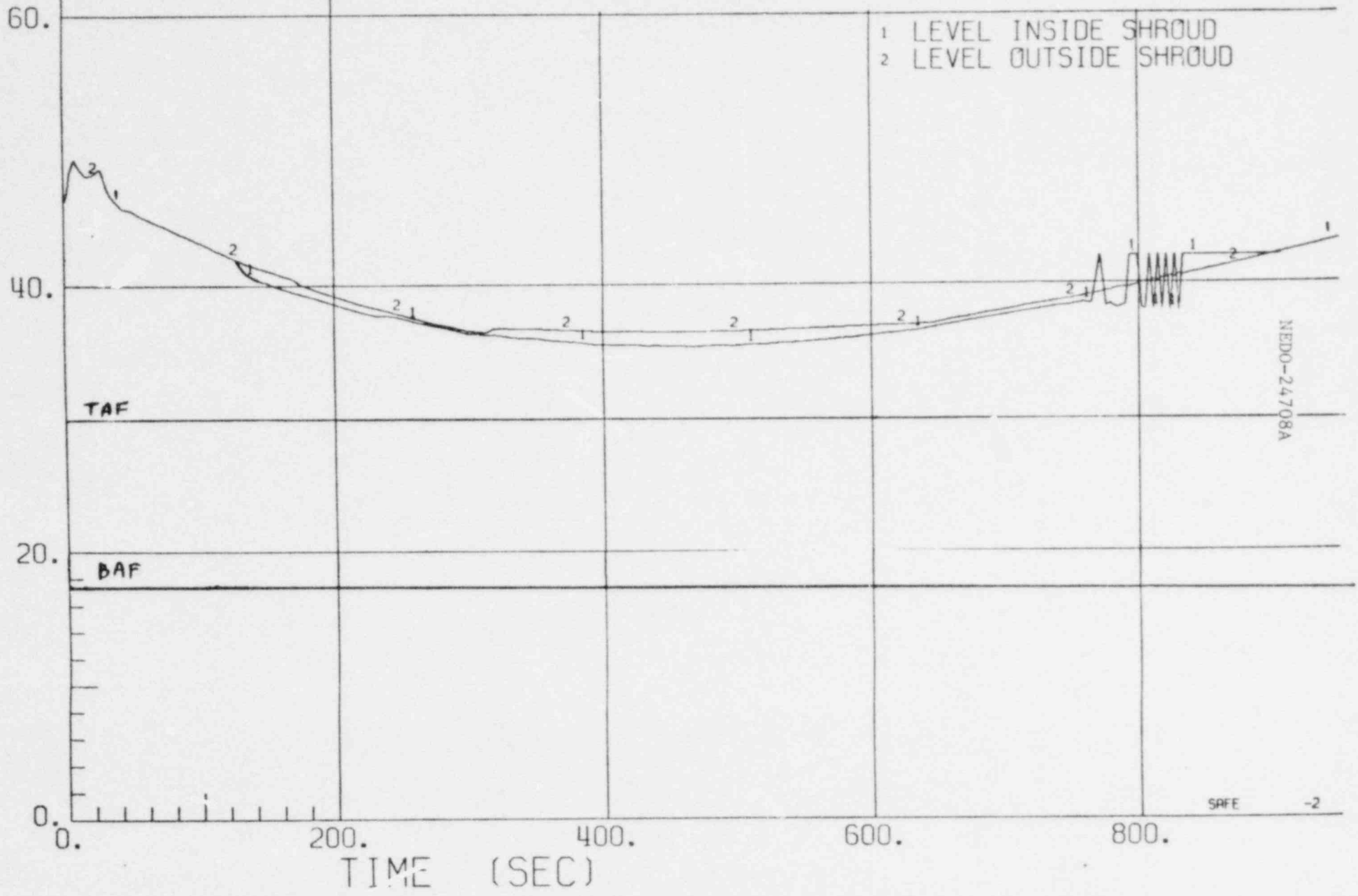

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Figure 3.1.1.5-5.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

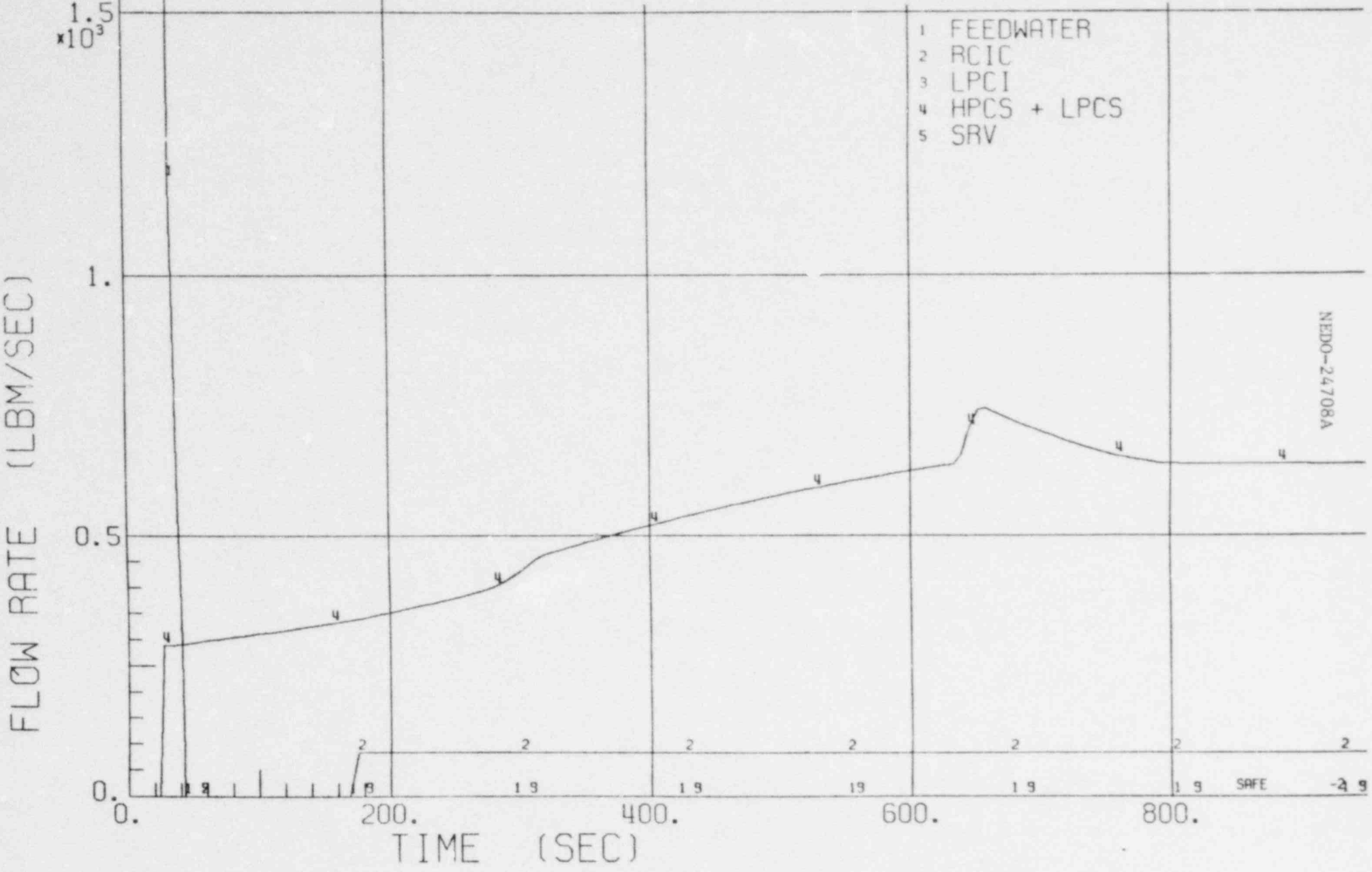

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Figure 3.1.1.5-5.4 FLOW RATES VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

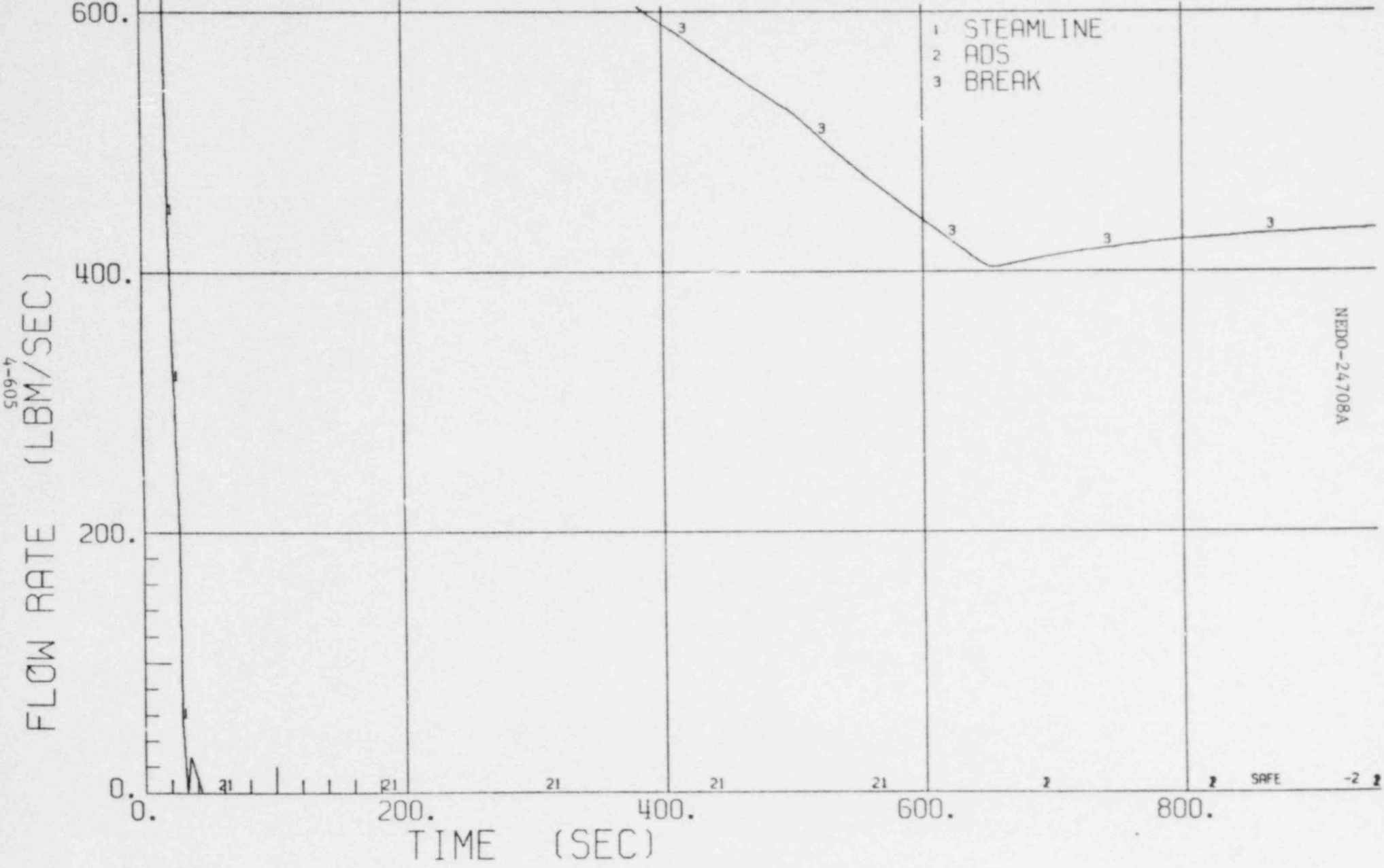

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Figure 3.1.1.5-5.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

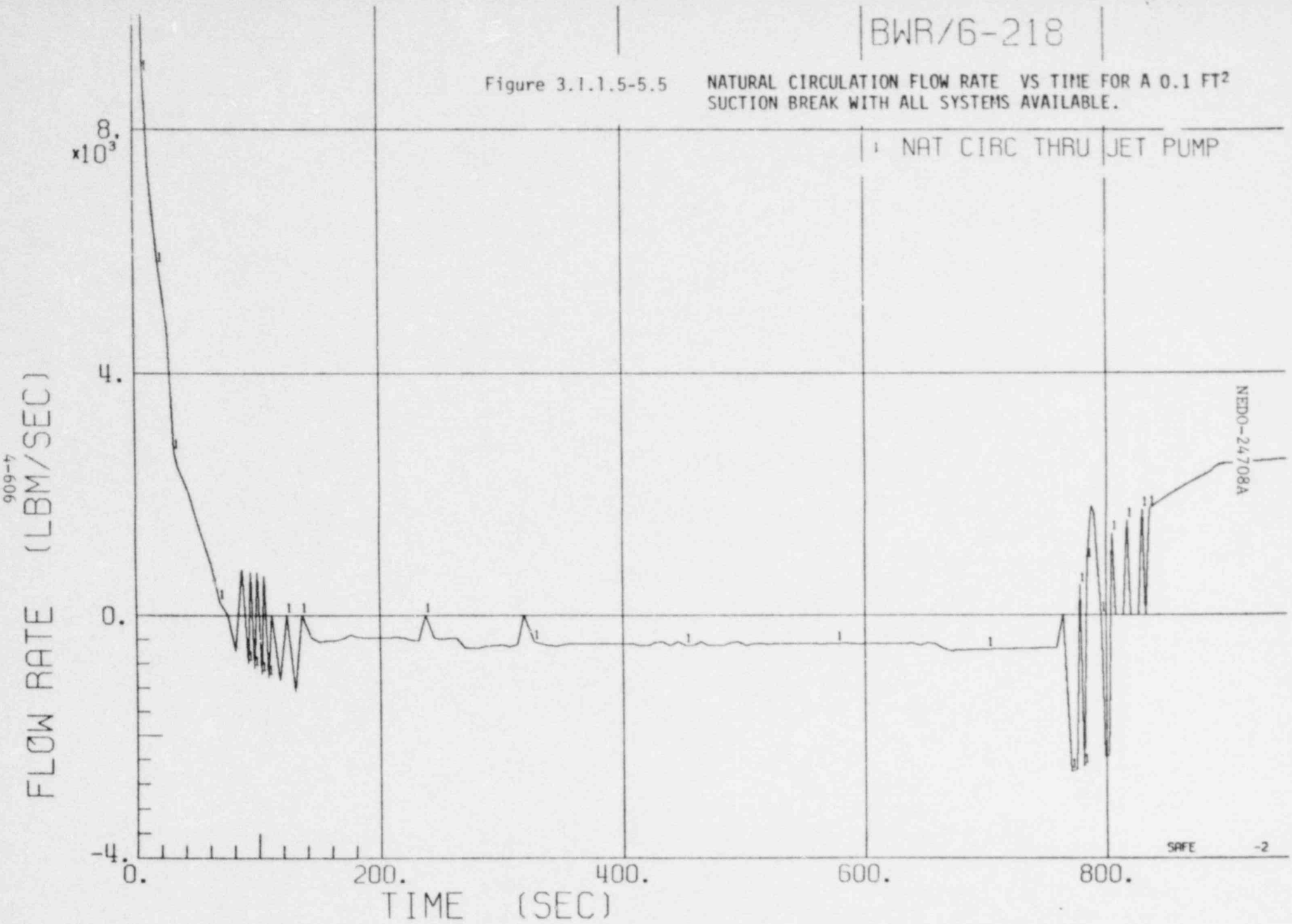

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Figure 3.1.1.5-5.6 TEMPERATURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

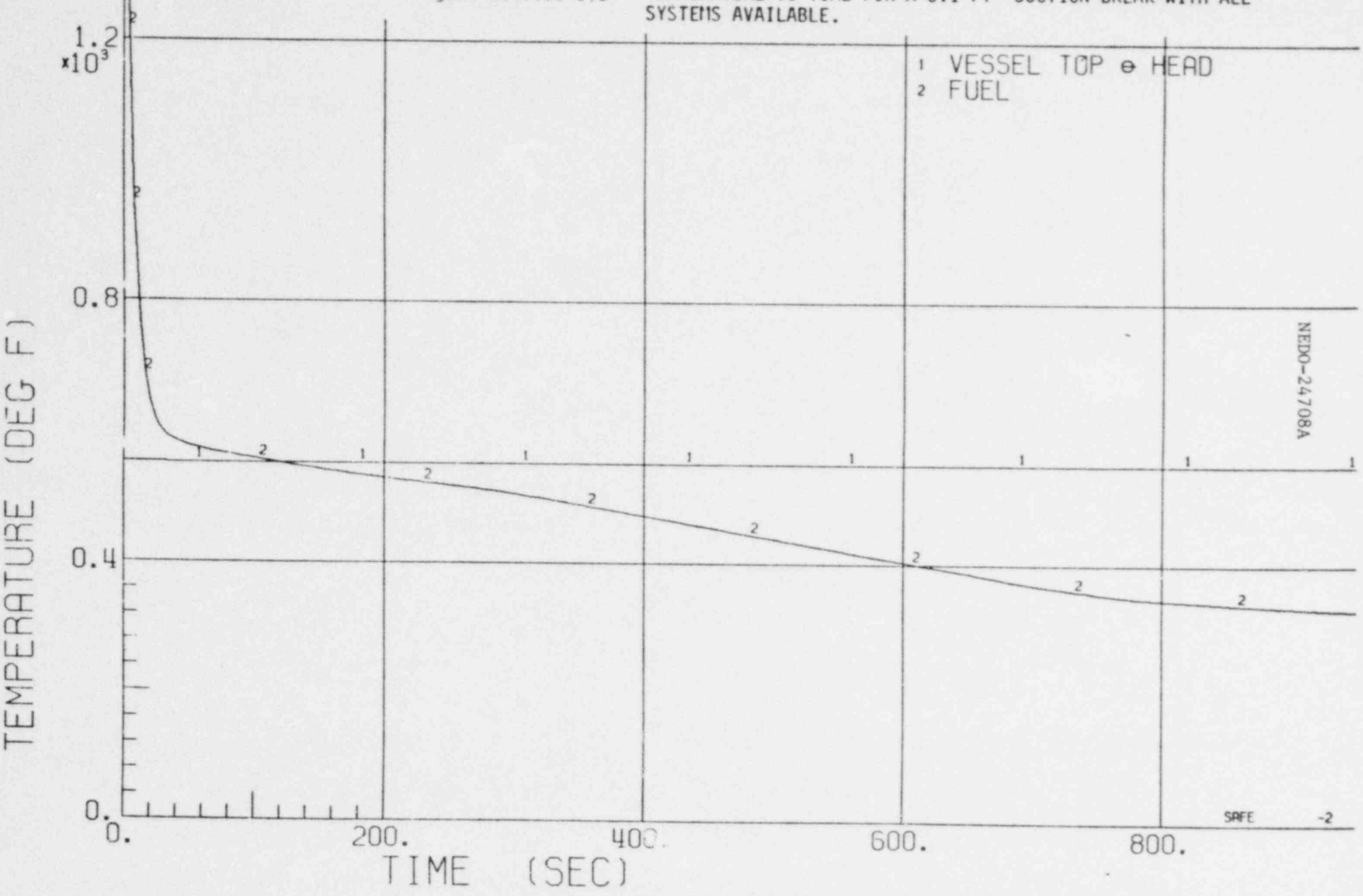

Figure 3.1.1.5-5.7 ENTHALPY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

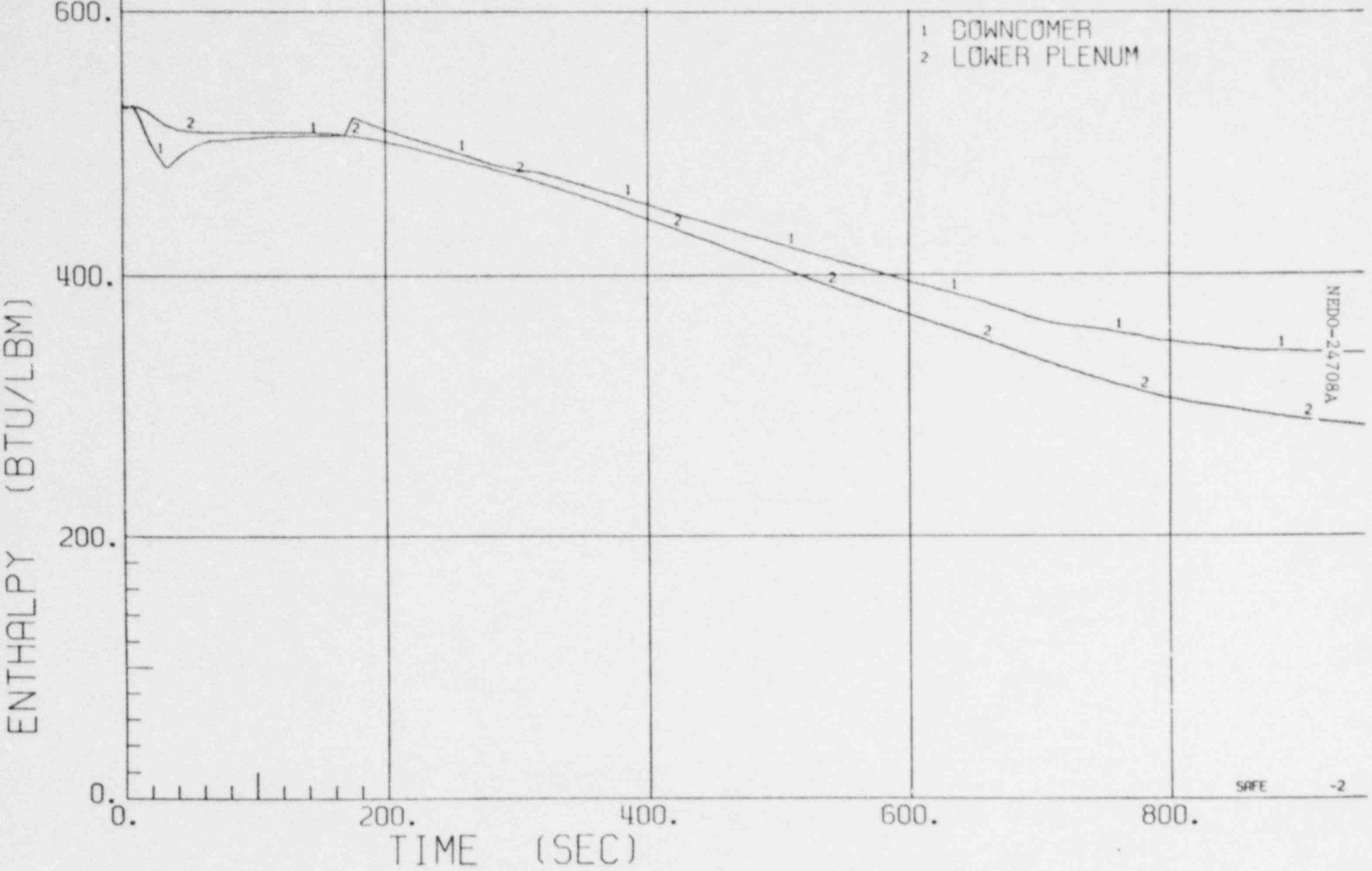

Figure 3.1.1.5-5.8 QUALITY VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ALL SYSTEMS AVAILABLE.

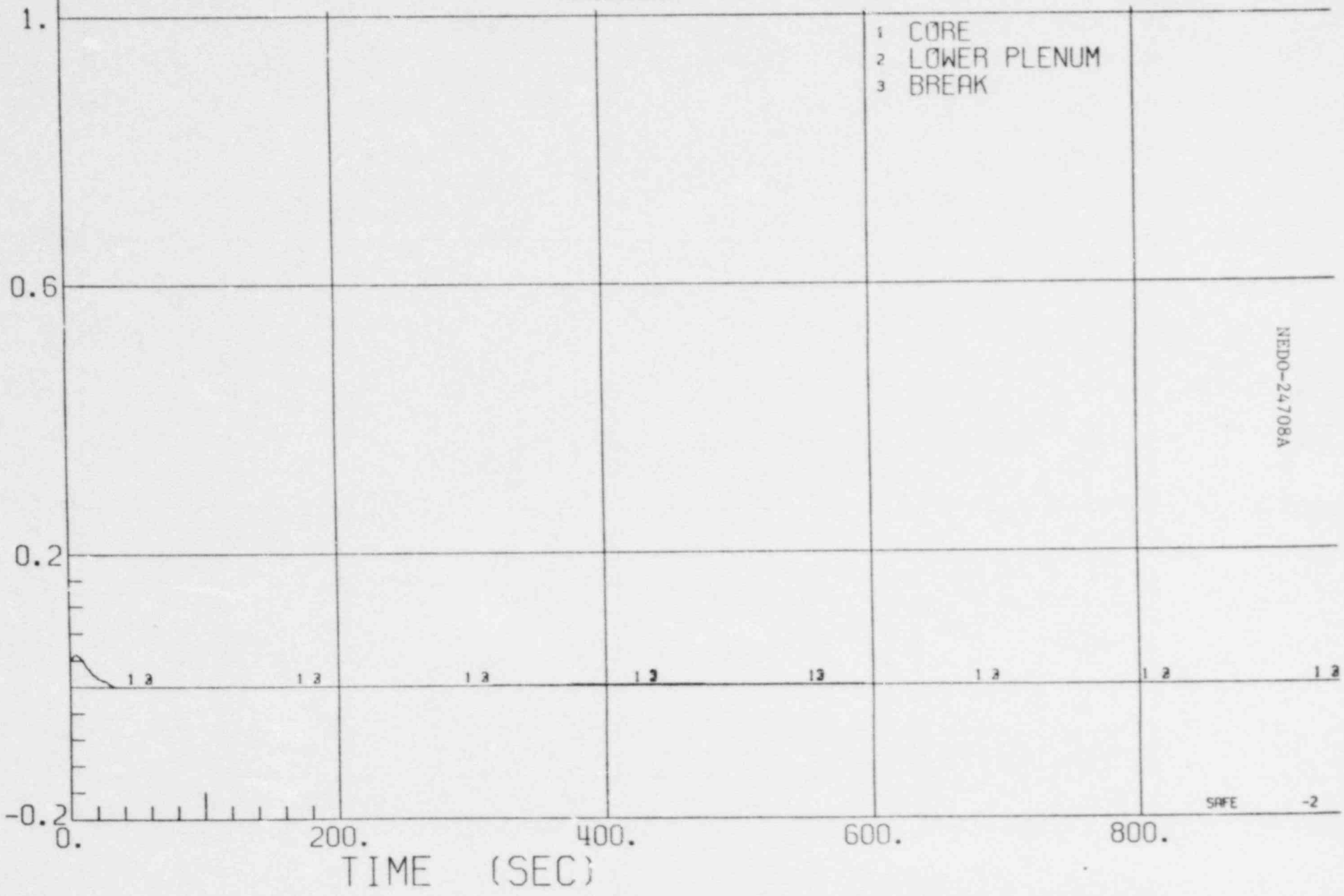

Figure 3.1.1.5-6.1 VESSEL PRESSURE VS. TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

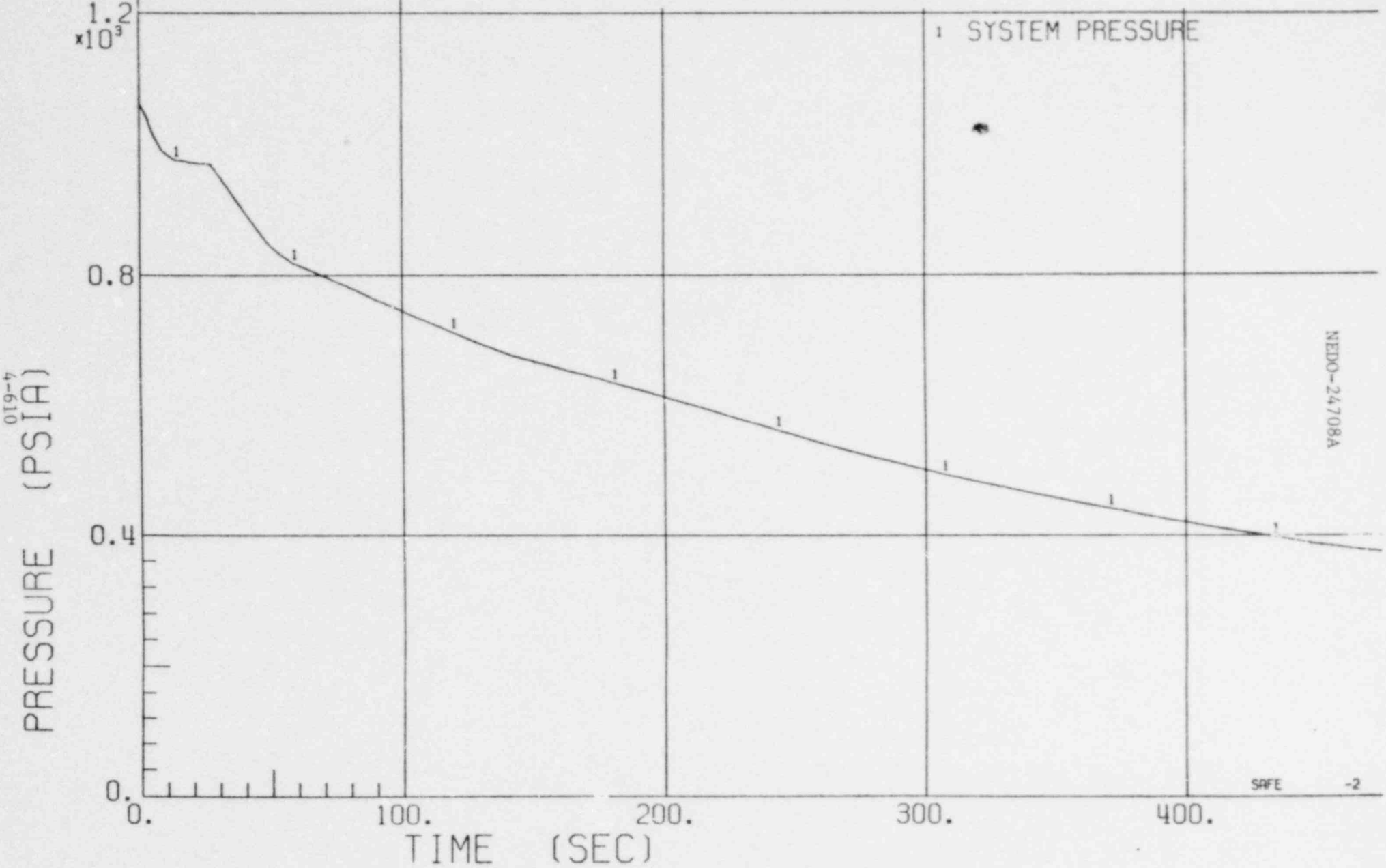

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Figure 3.1.1.5-6.2 WATER LEVEL VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

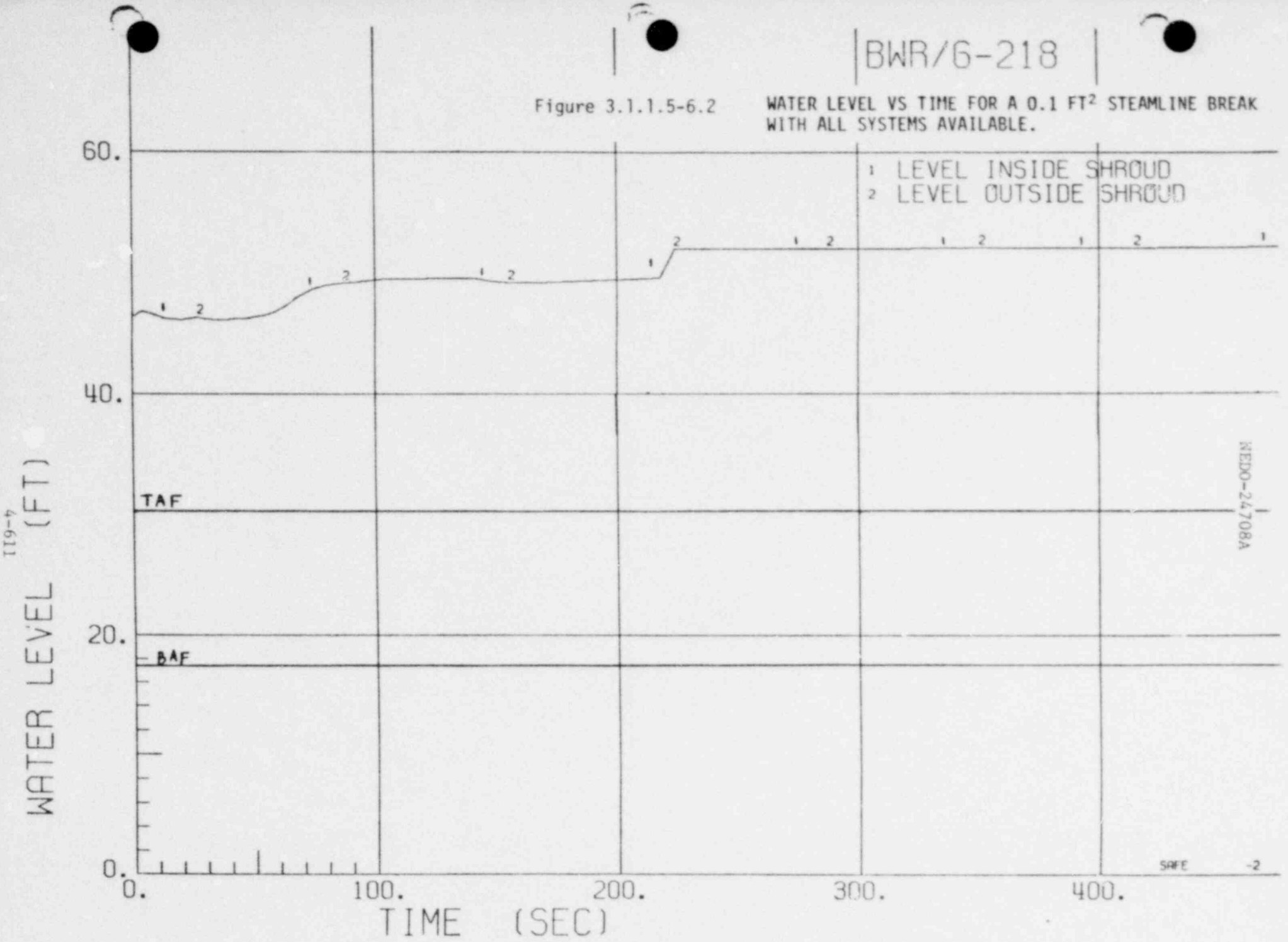

Figure 3.1.1.5-6.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

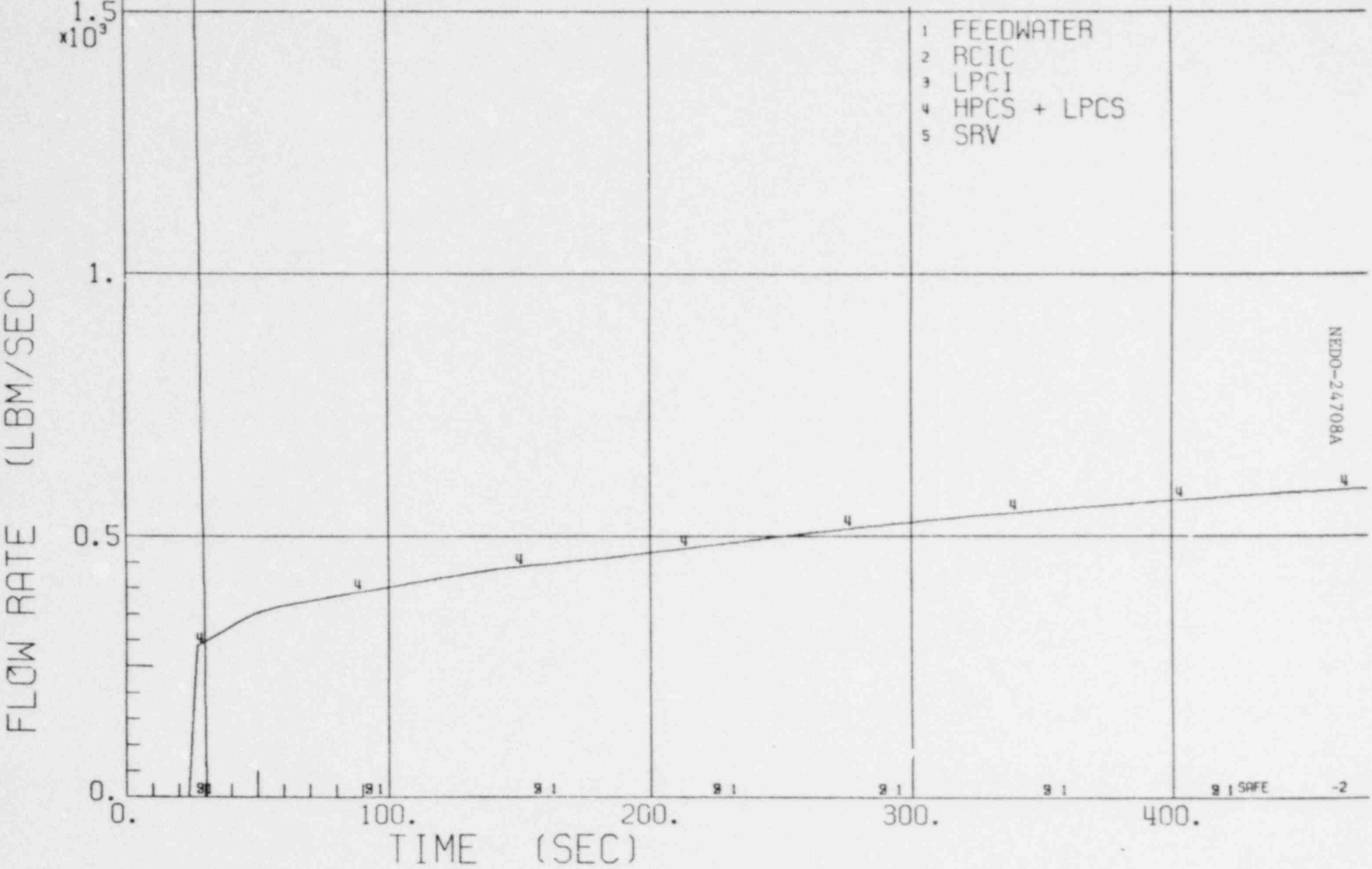

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Figure 3.1.1.5-6.4 FLOW RATE VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

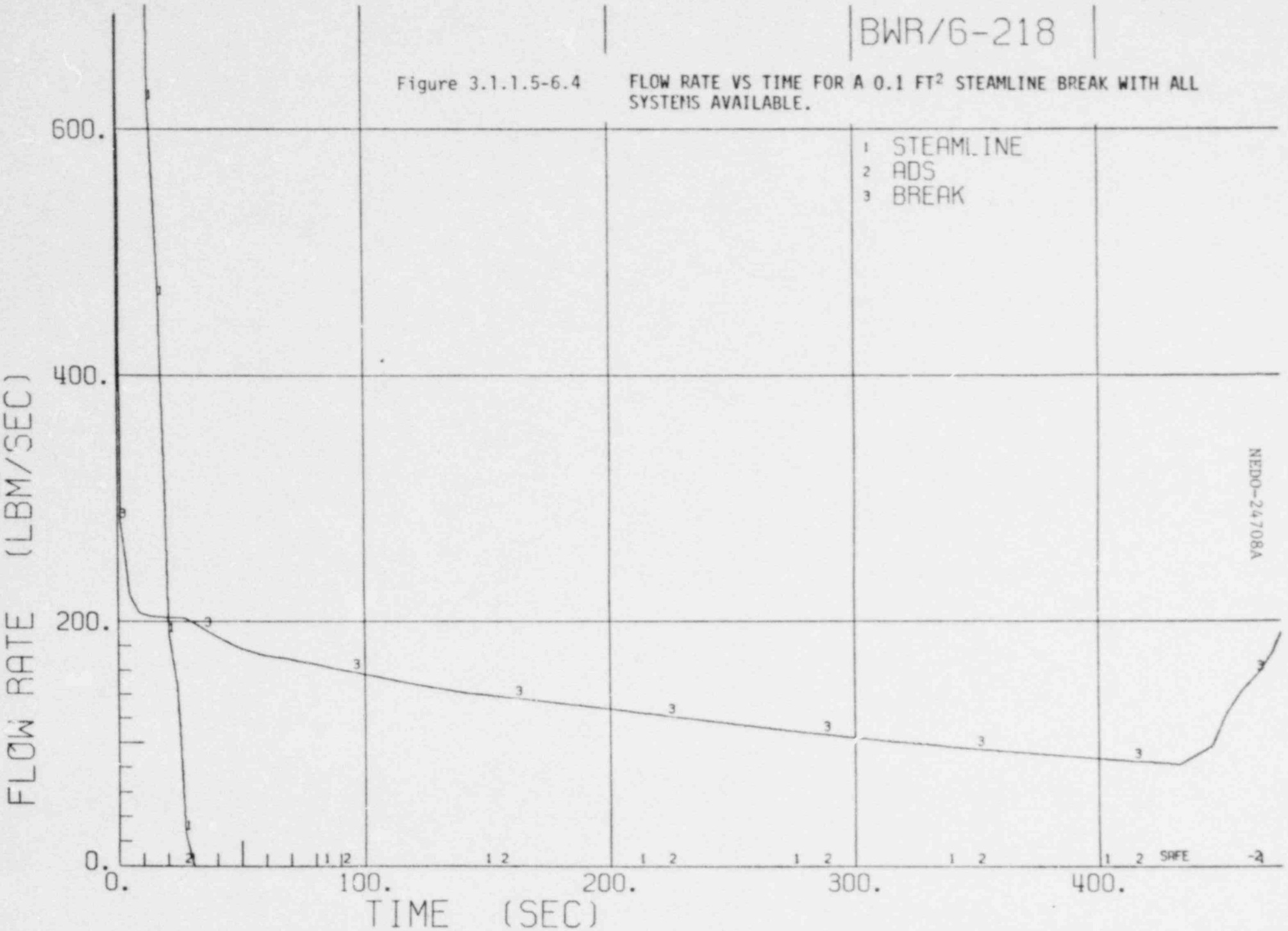

Figure 3.1.1.5-6.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

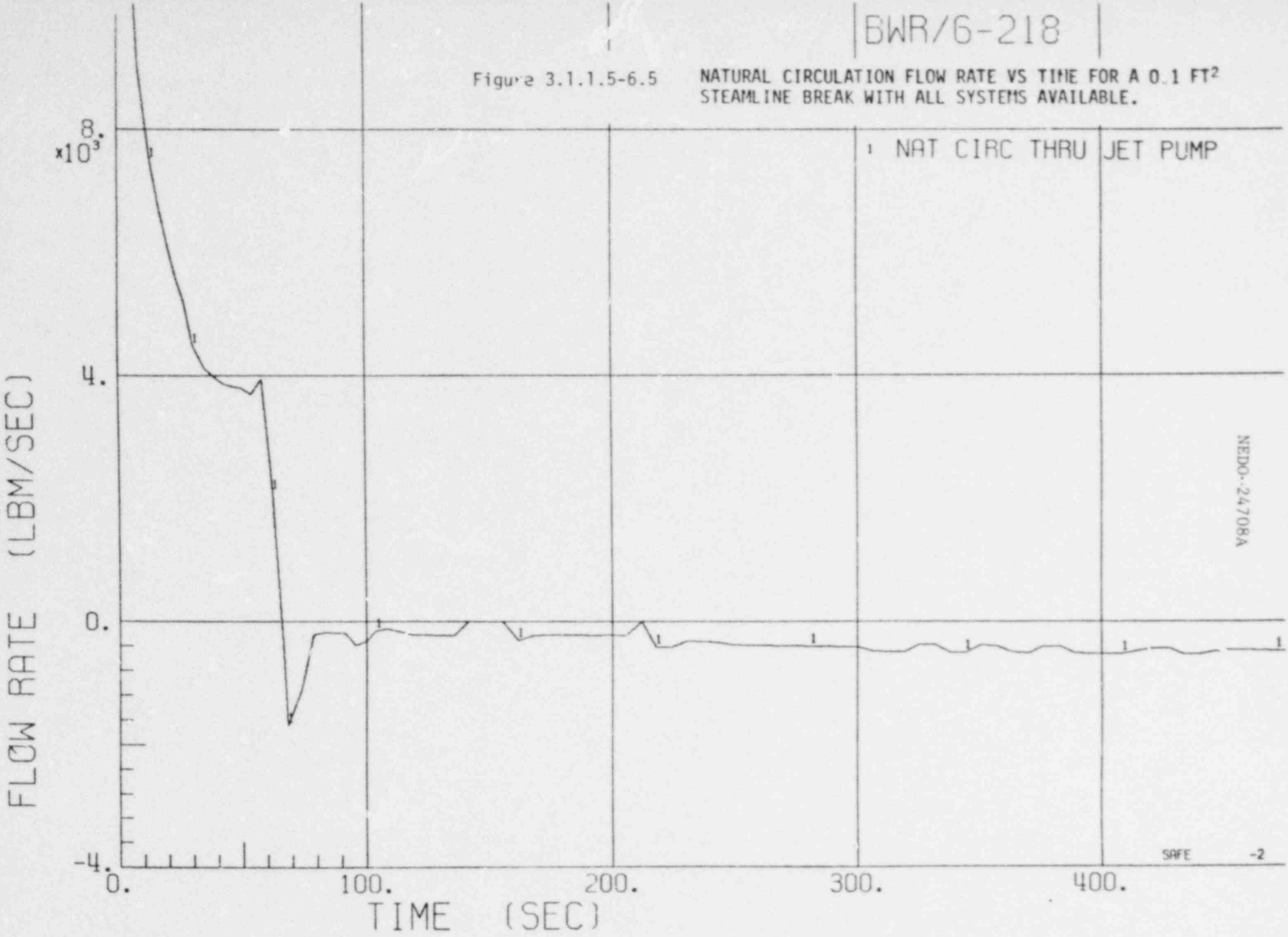

Figure 3.1.1.5-6.6 TEMPERATURE VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

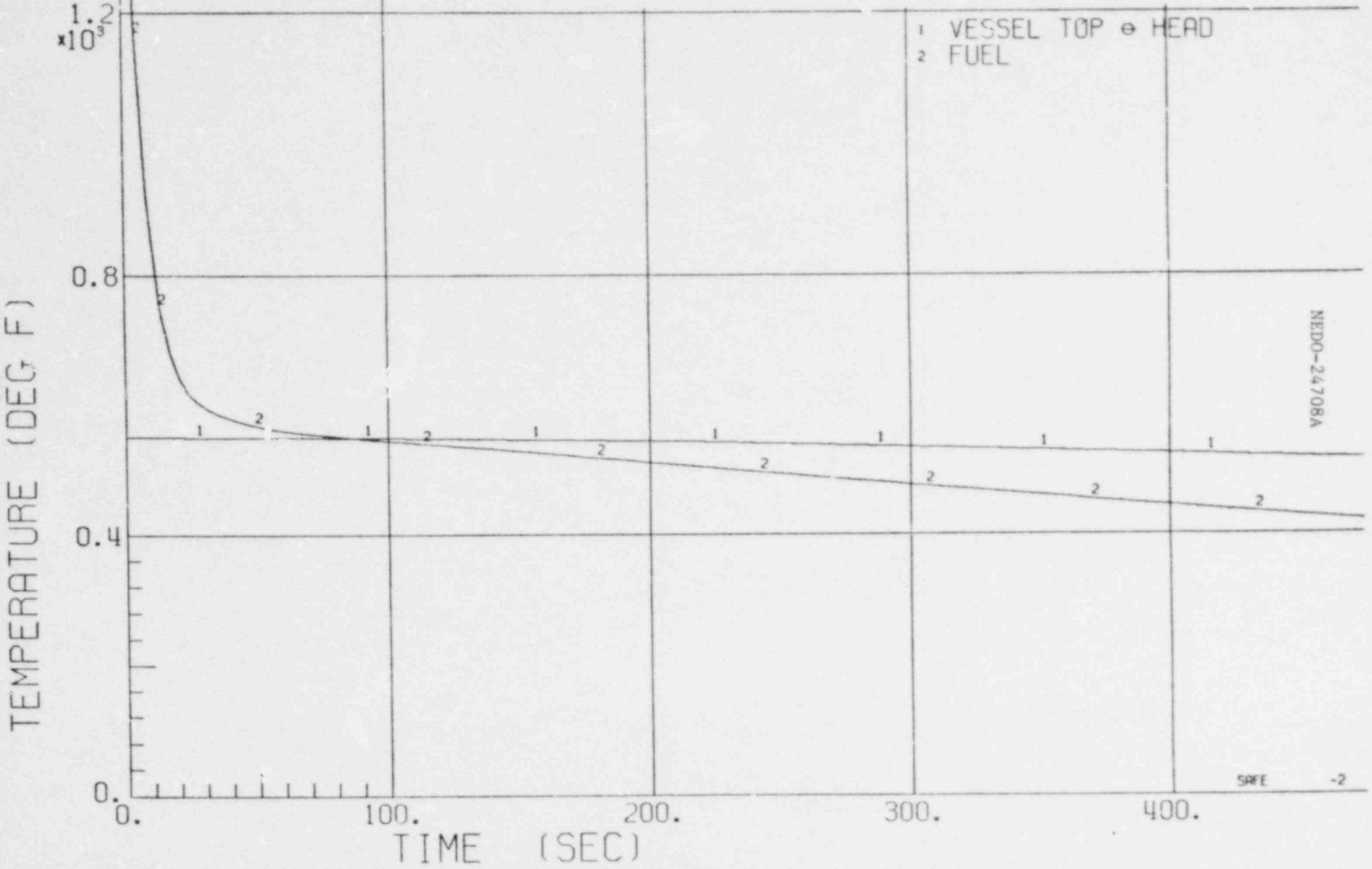

Figure 3.1.1.5-6.7 ENTHALPY VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

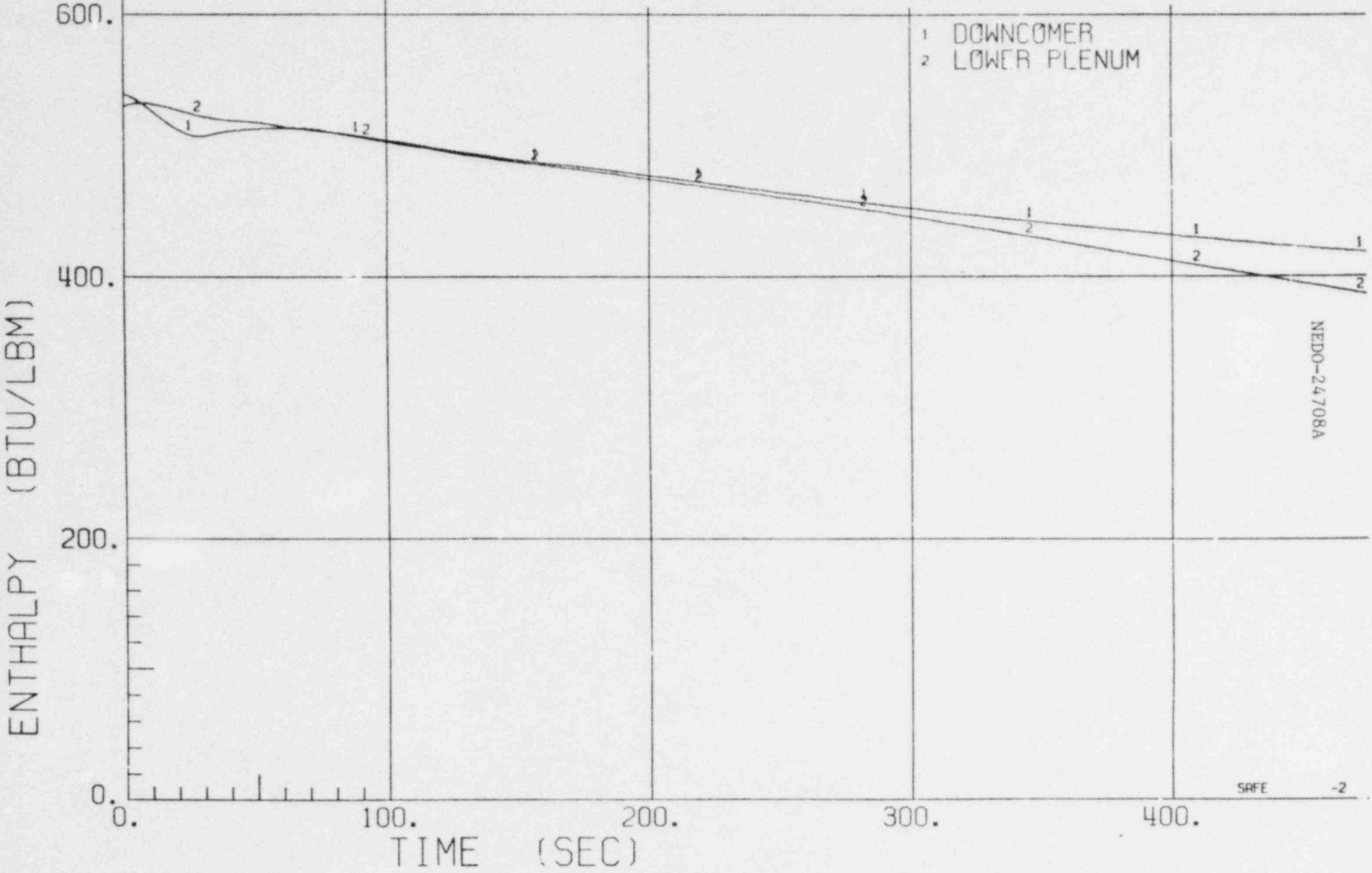

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Figure 3.1.1.5-6-8 QUALITY VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ALL SYSTEMS AVAILABLE.

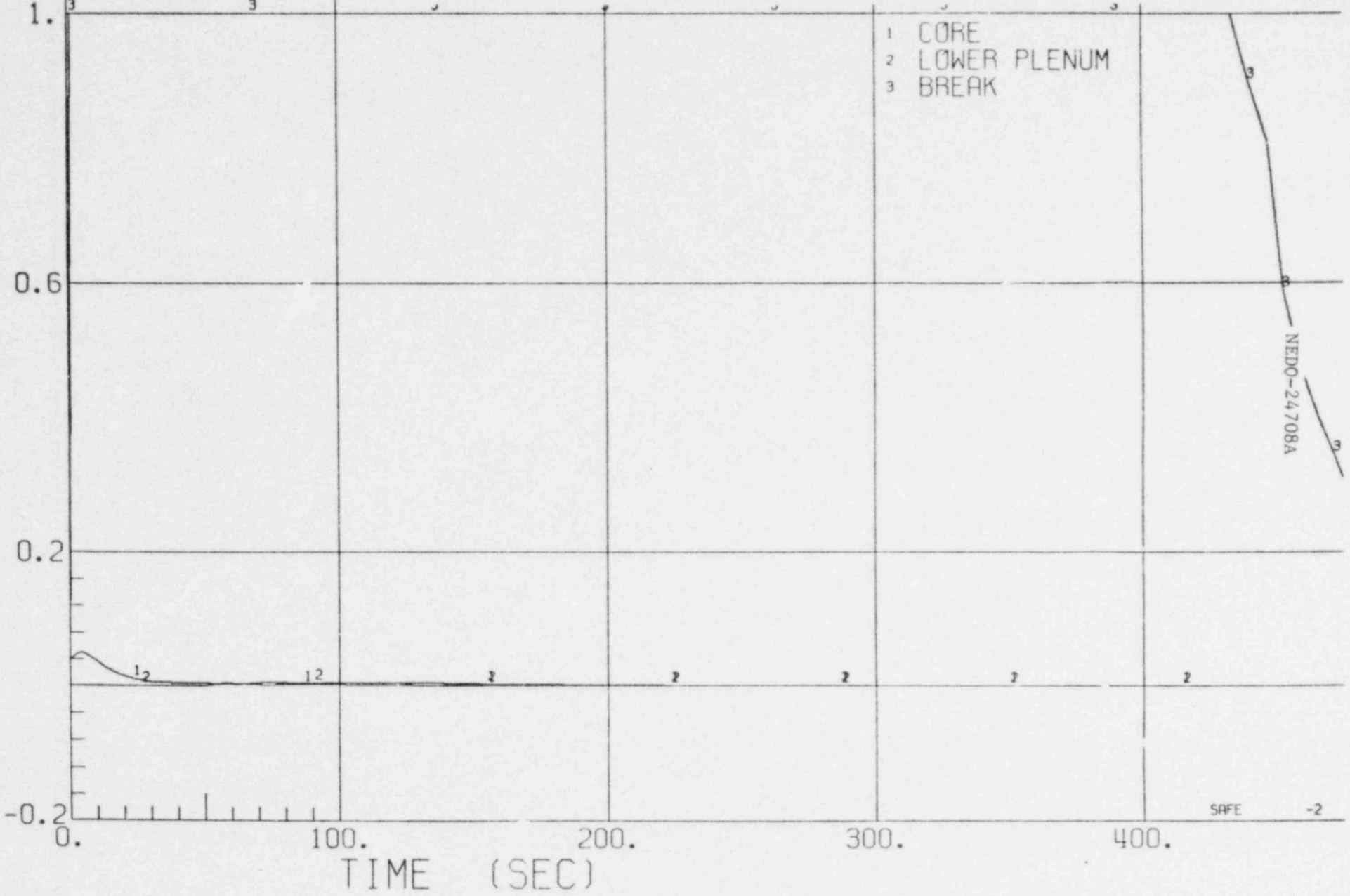

Figure 3.1.1.5-7.1 VESSEL PRESSURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

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Figure 3.1.1.5-7.2 WATER LEVEL VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

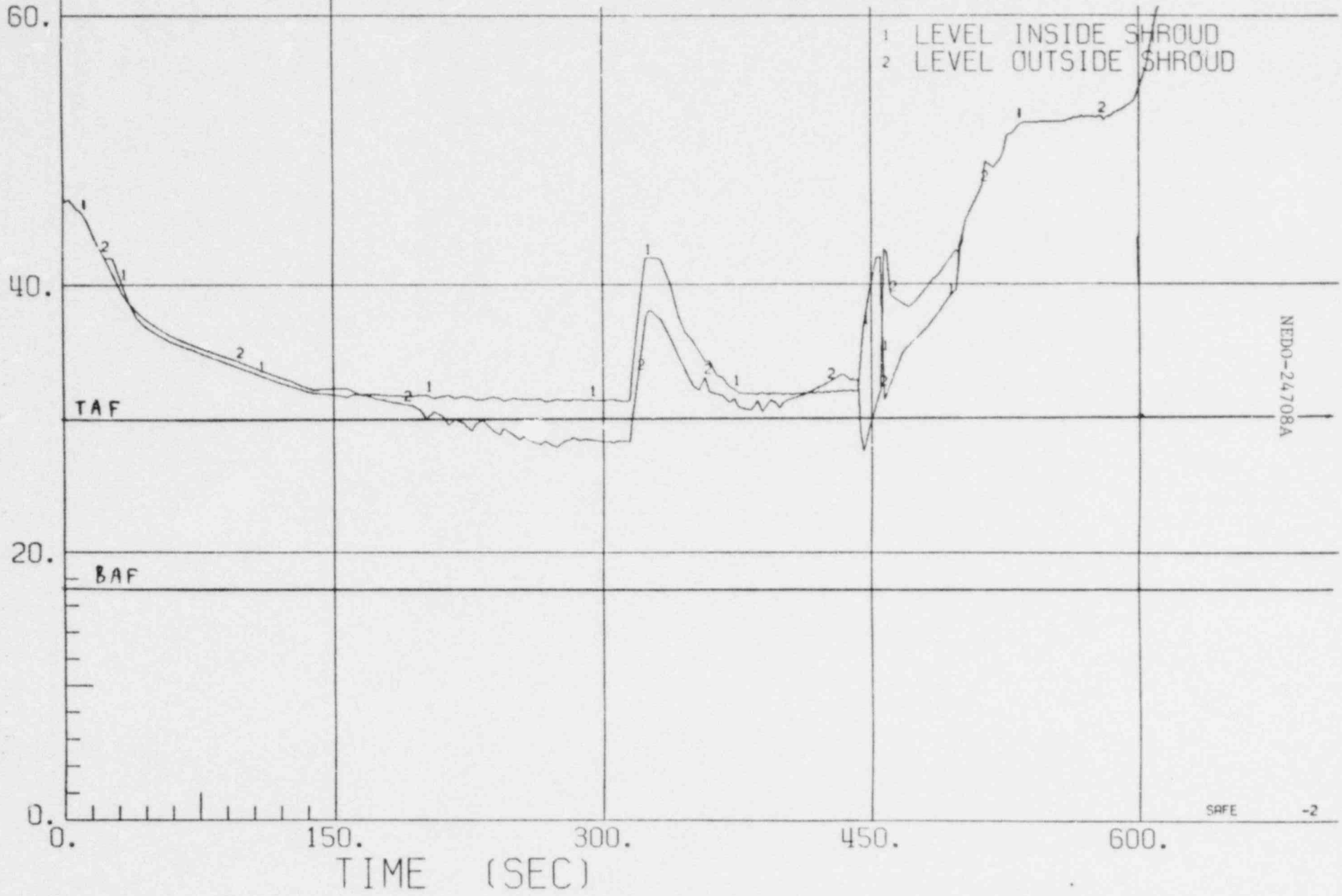

Figure 3.1.1.5-7.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

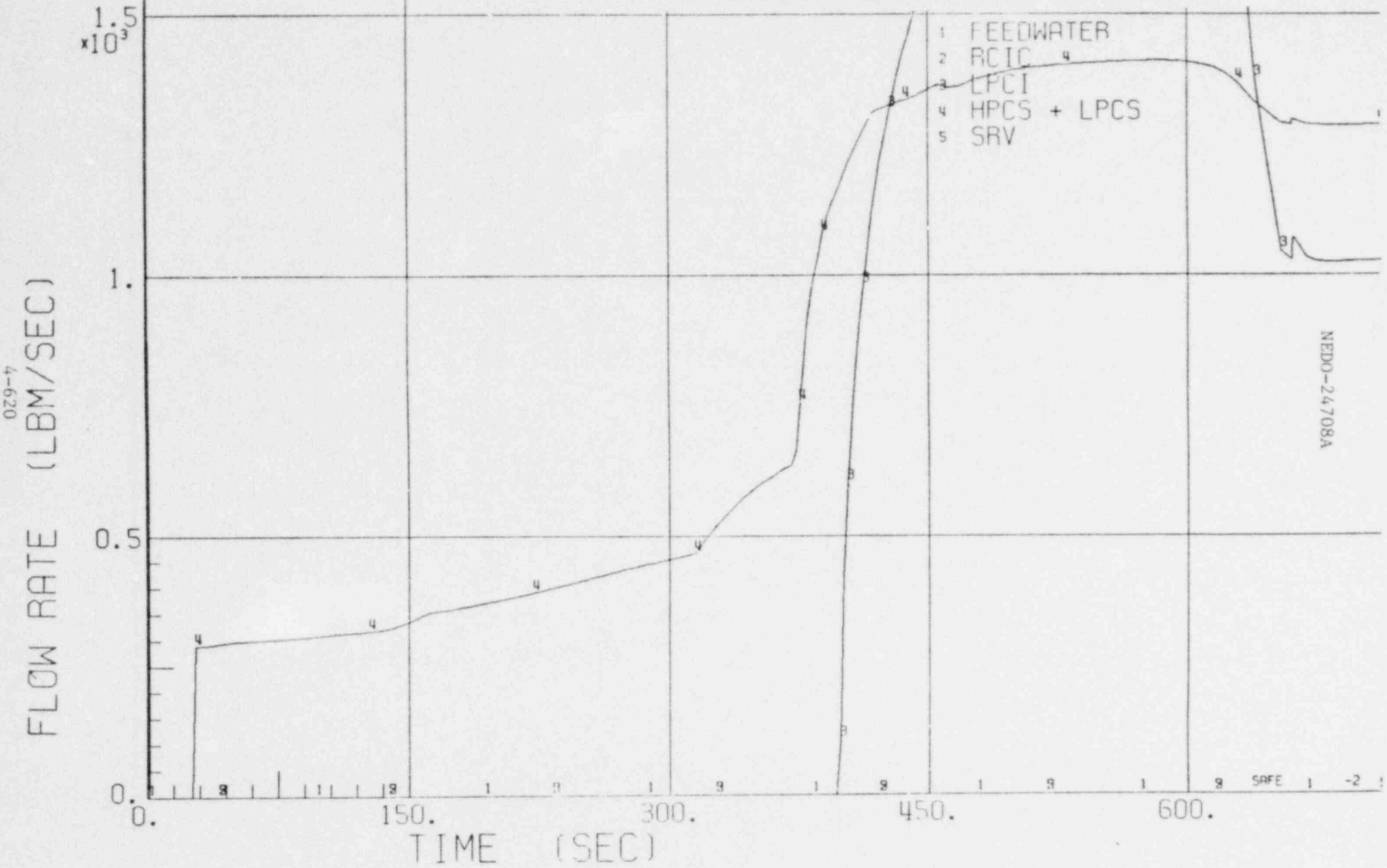

Figure 3.1.1.5-7.4 FLOW RATES VS TIME FOR A 0.1 FT² SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

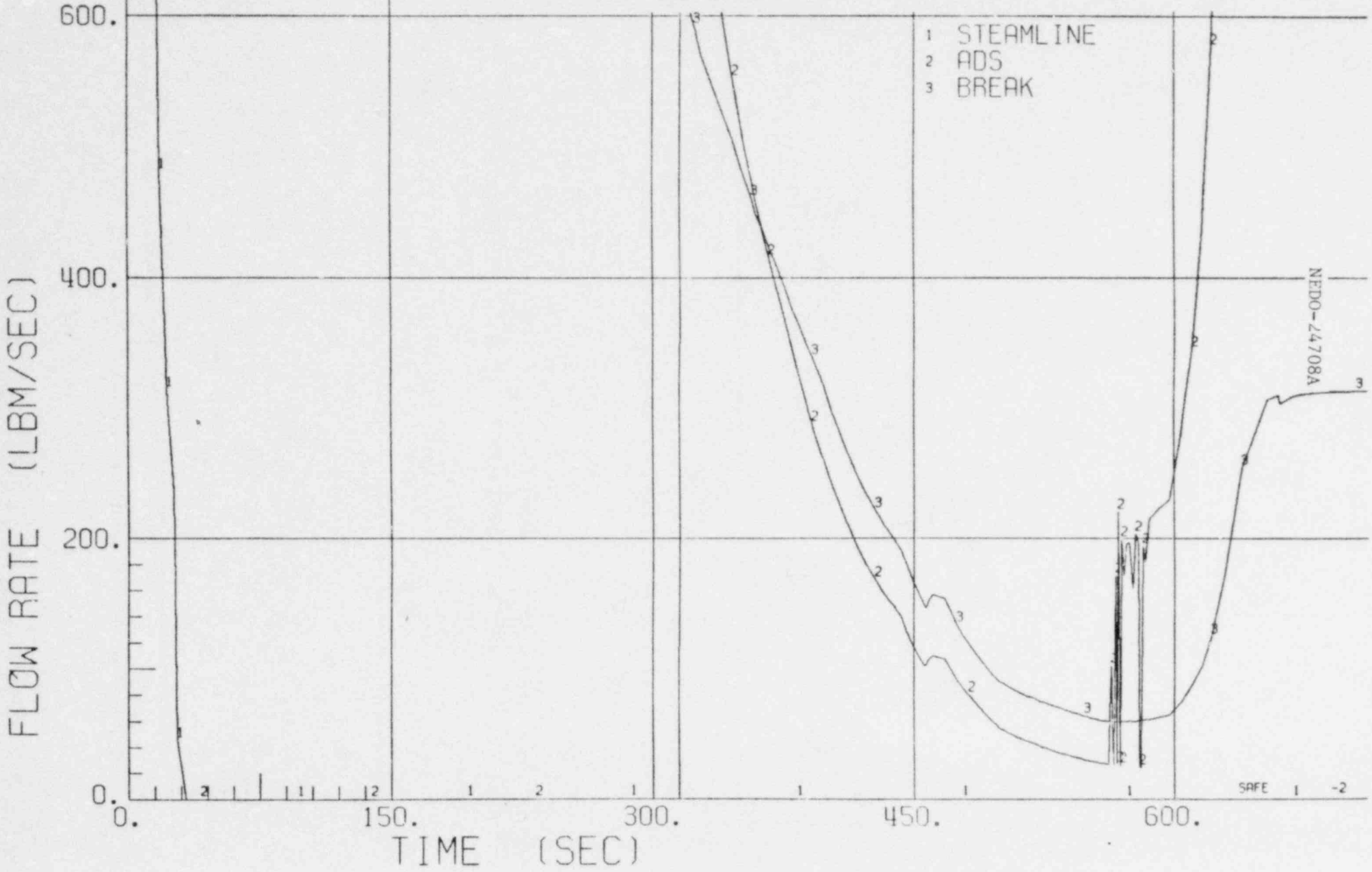

Figure 3.1.1.5-7.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

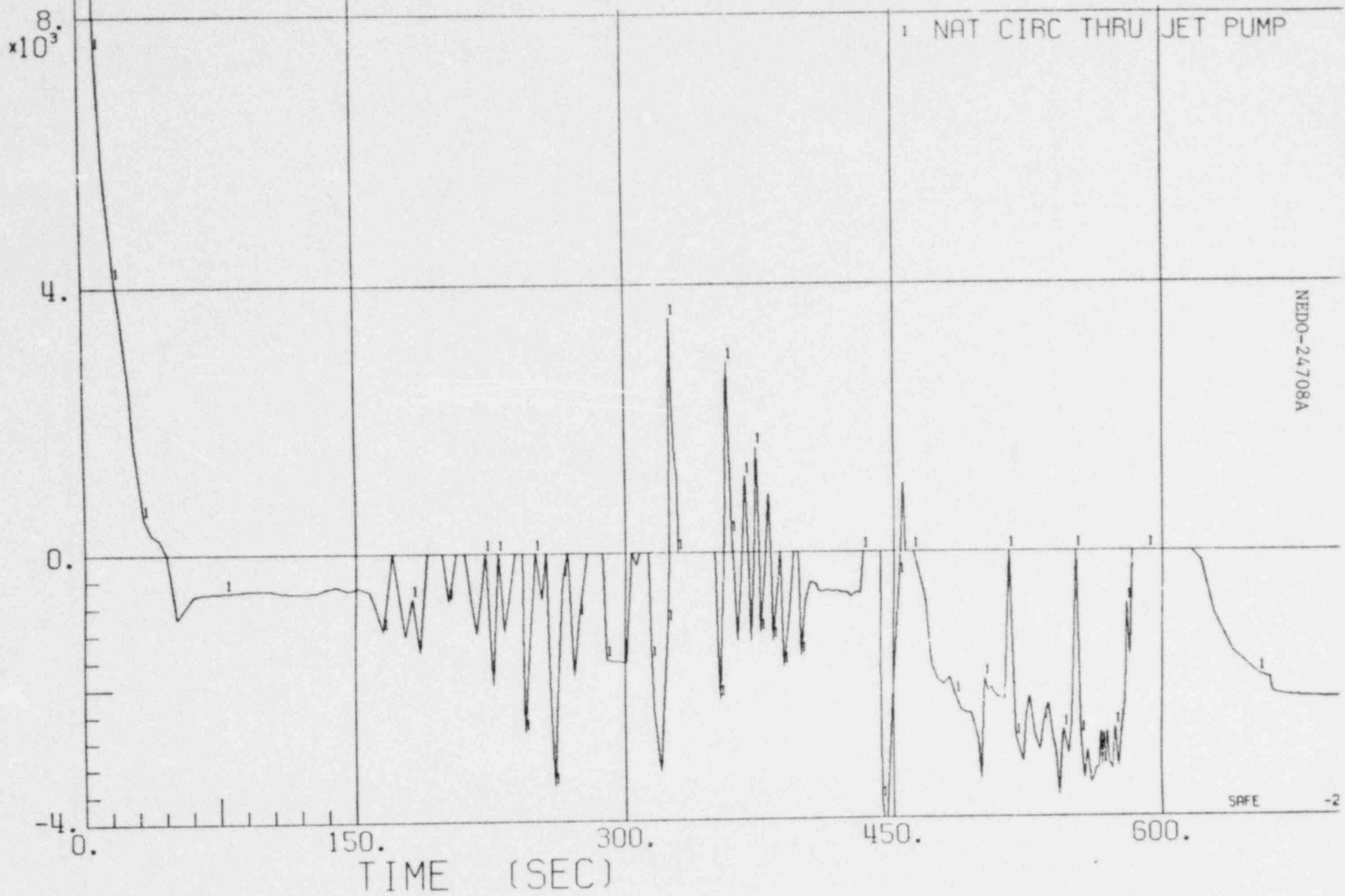

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Figure 3.1.1.5-7.6 TEMPERATURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

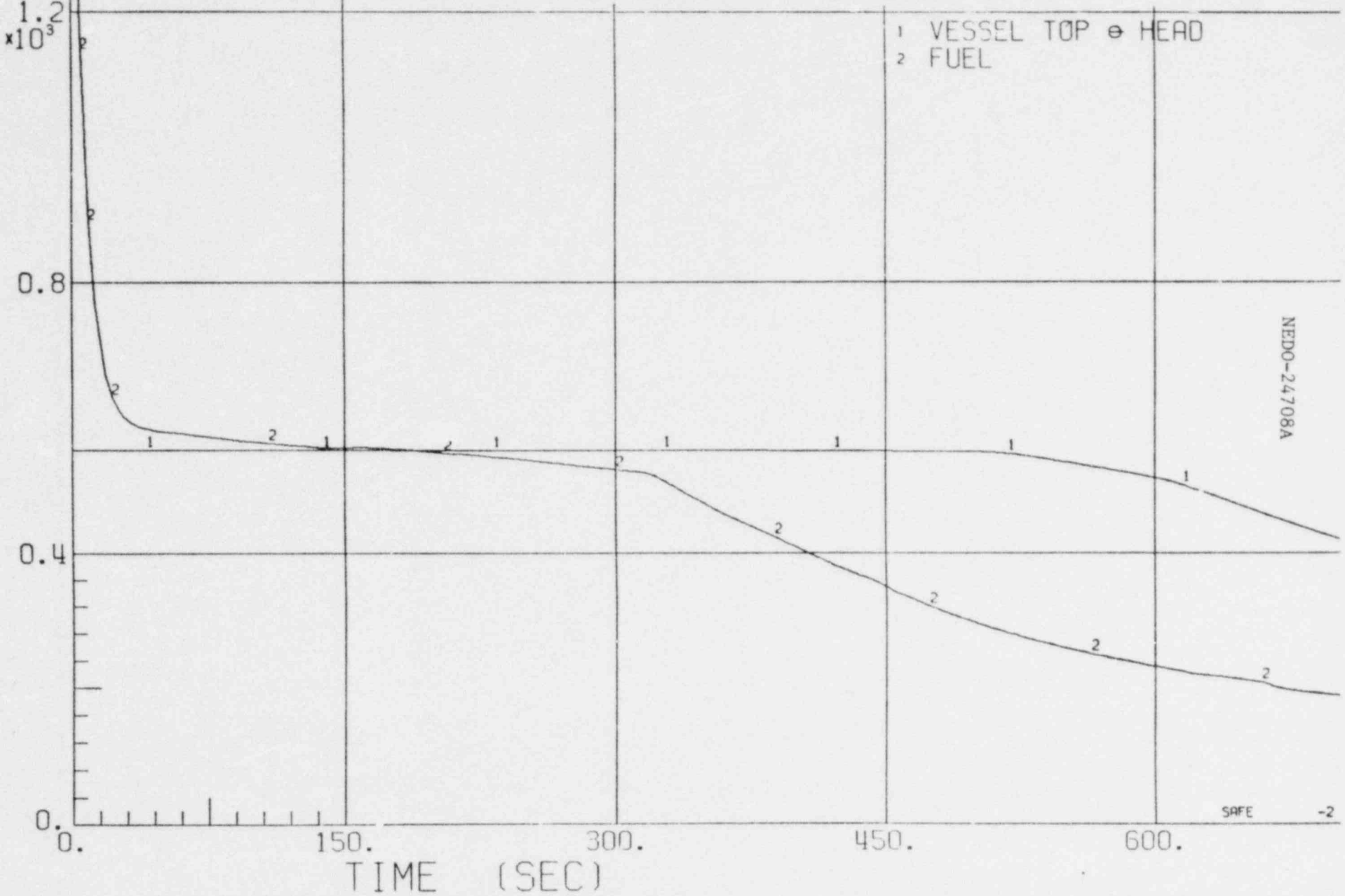

Figure 3.1.1.5-7.7 ENTHALPY VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

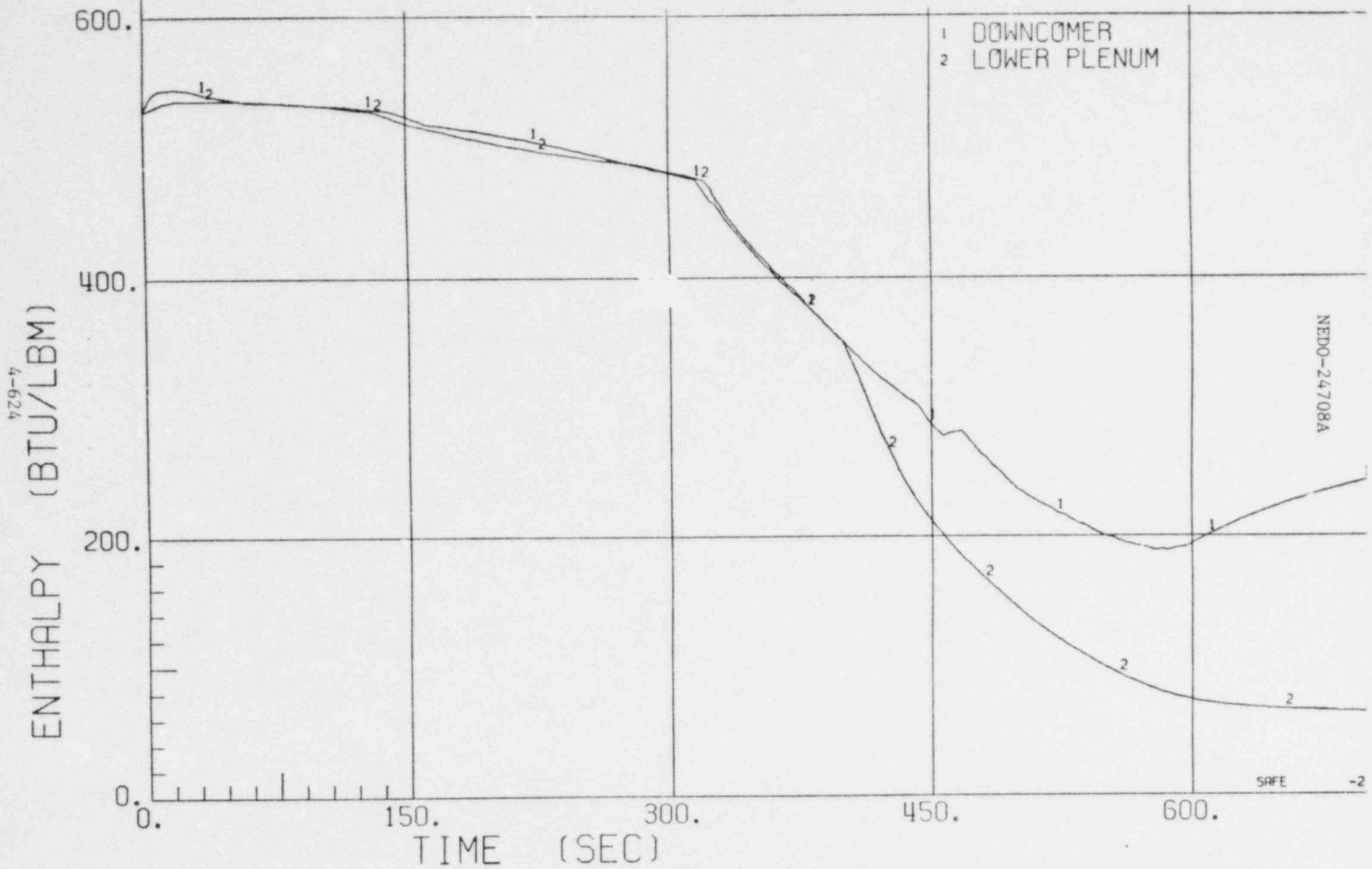

Figure 3.1.1.5-7-8 QUALITY VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH HPCS + LOW PRESSURE SYSTEMS AVAILABLE.

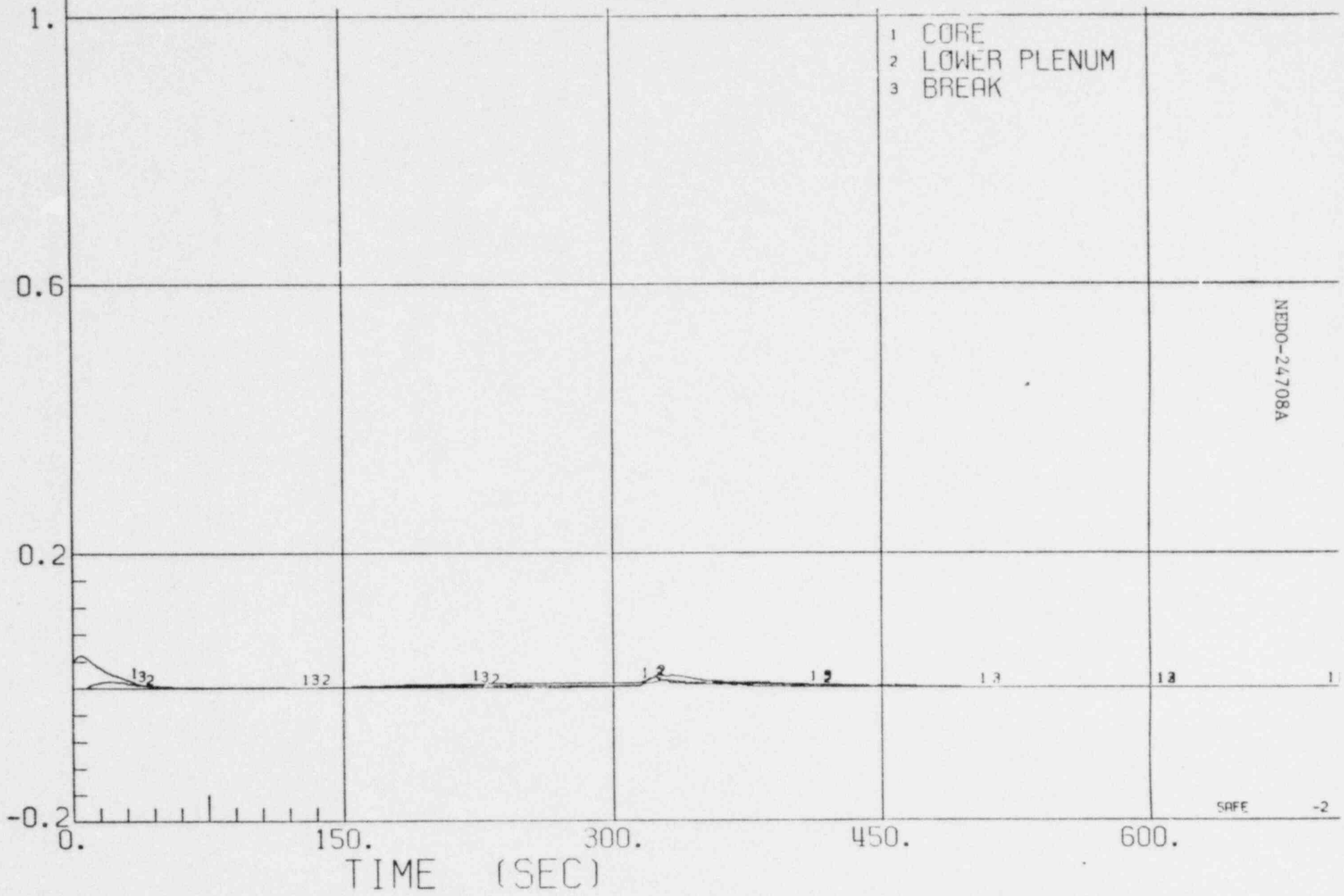

Figure 3.1.1.5-8.1 System pressure vs time for a 0.20 ft^2 steamline break with HPCS only available.

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Figure 3.1.1.5-8.2 Water level vs time for a 0.20 ft^2 steamline break with HPCS only available.

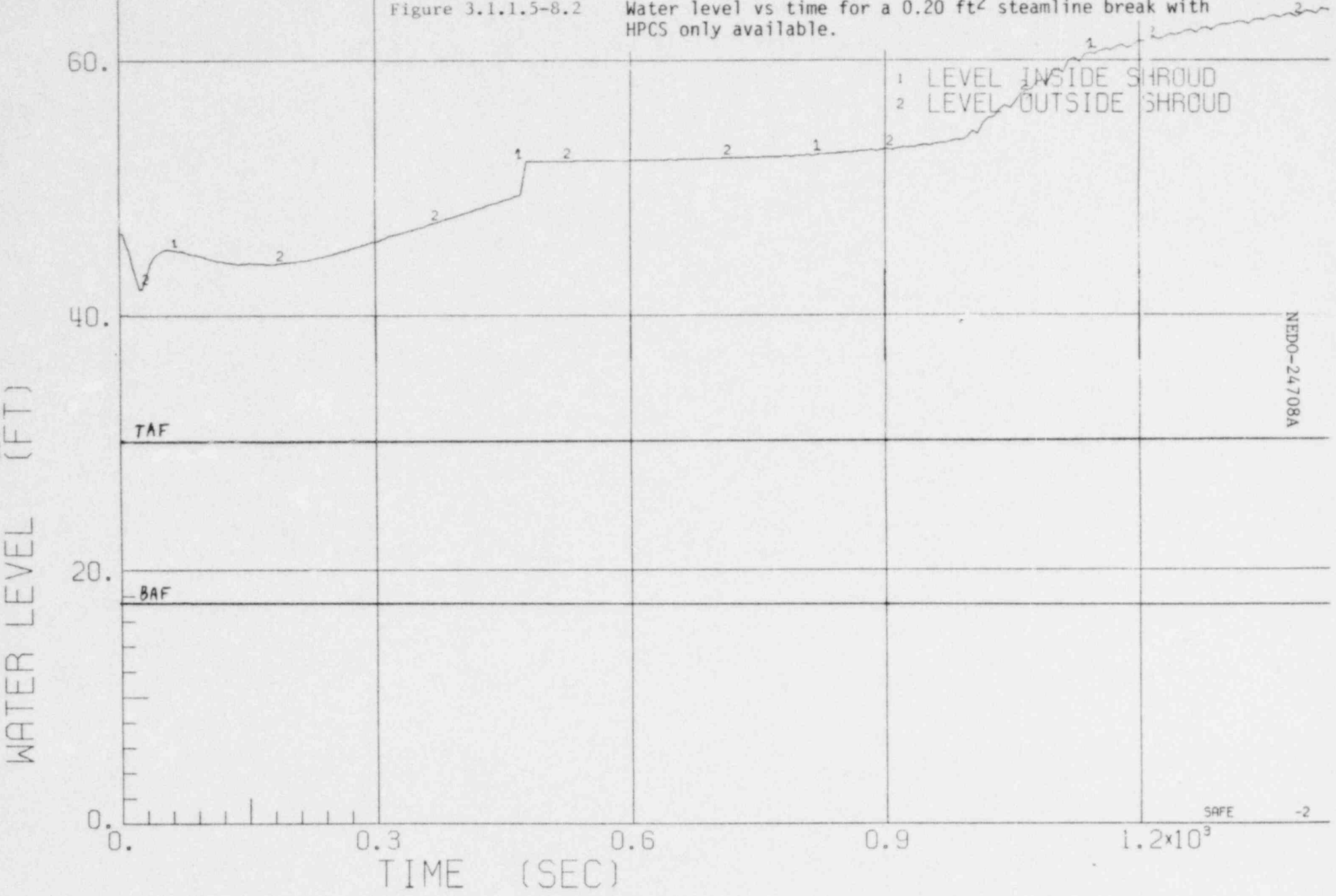

Figure 3.1.1.5-8.3 System flow rates vs time for a 0.20 ft^2 steamline break with HPCS only available.

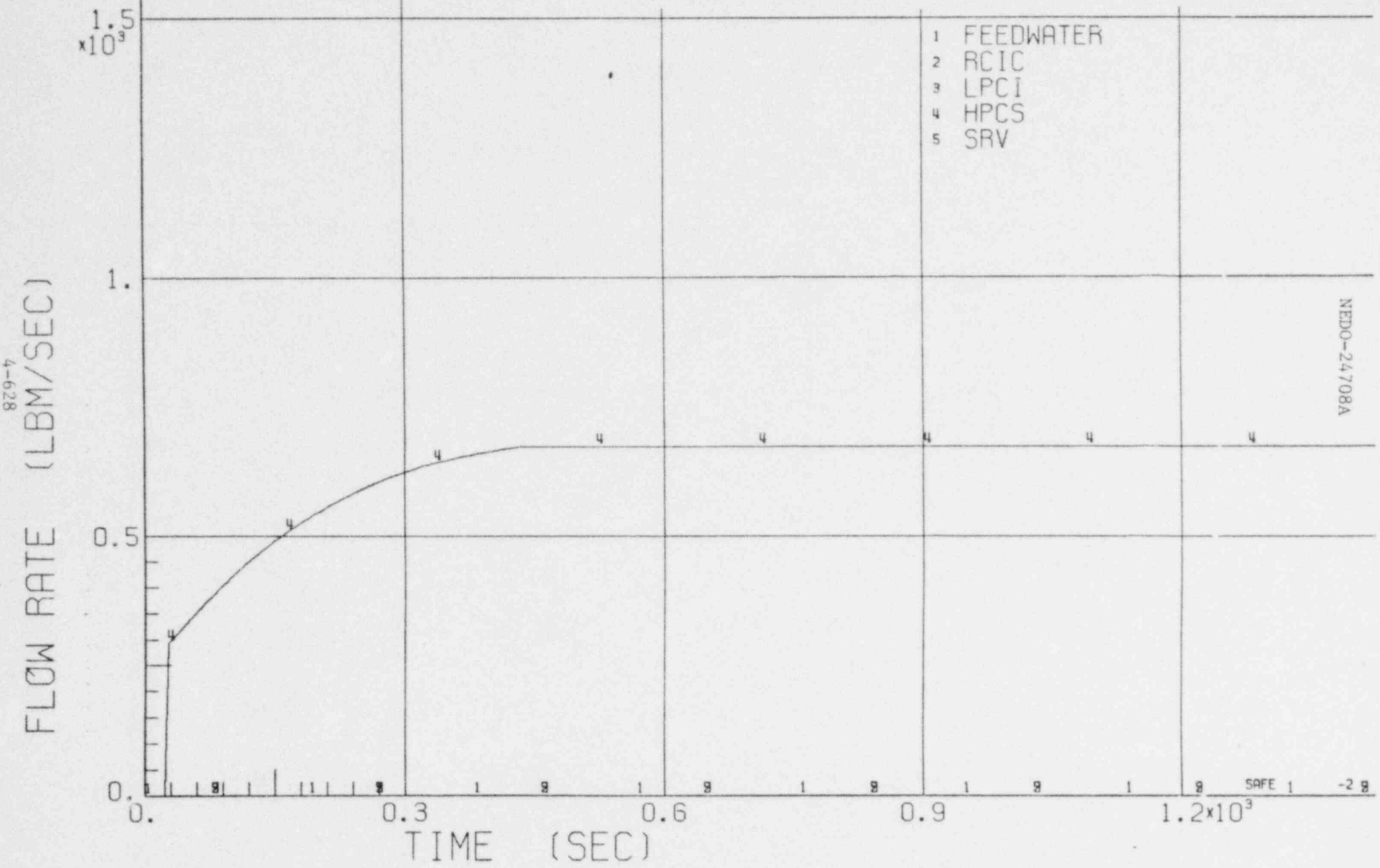

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Figure 3.1.1.5-8.4 Flow rates vs time for a 0.20 ft^2 steamline break with HPCS only available.

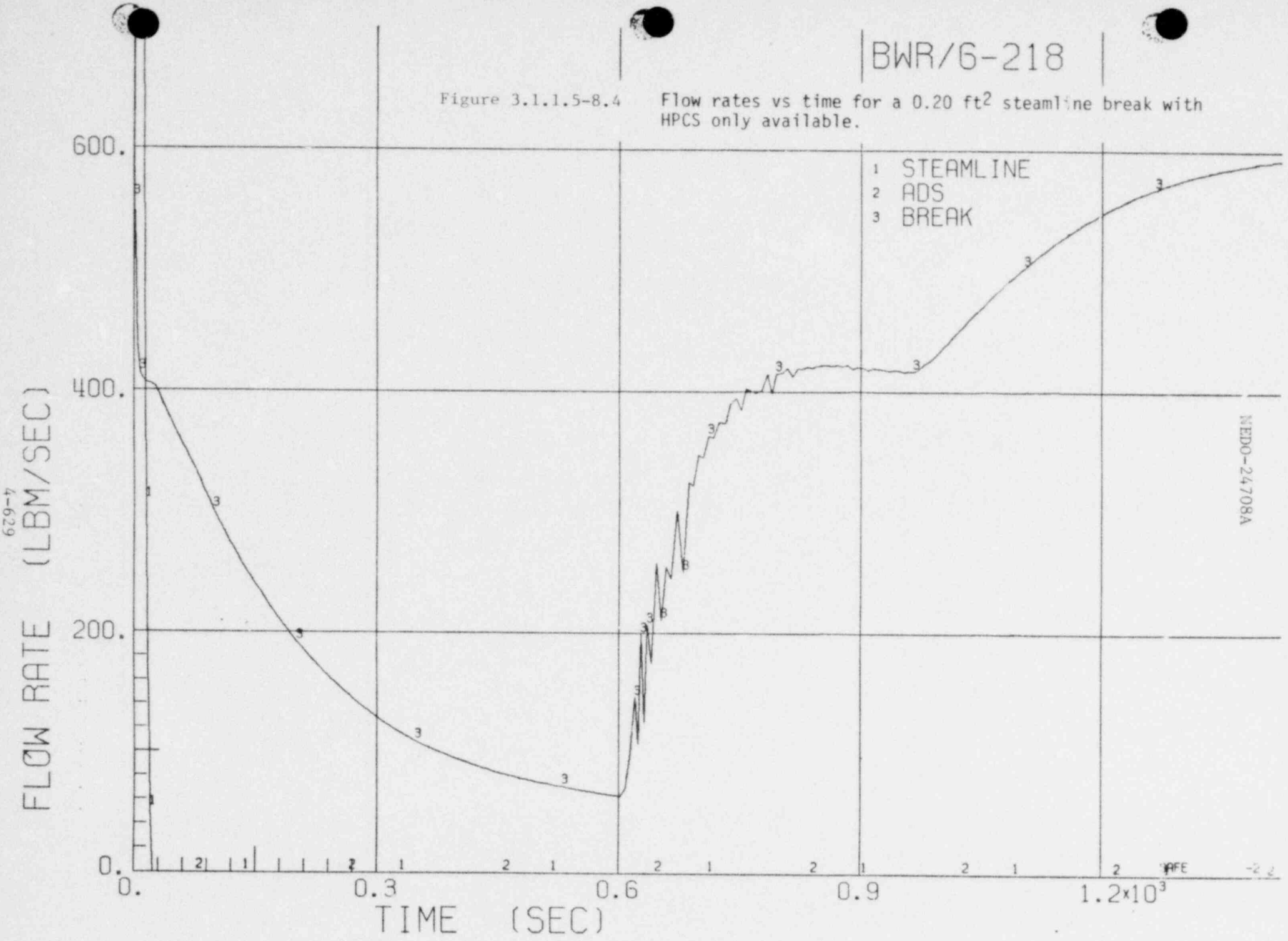

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Figure 3.1.1.5-8.5 Natural circulation flow rate vs time for a 0.20 ft^2 steamline break with HPCS only available.

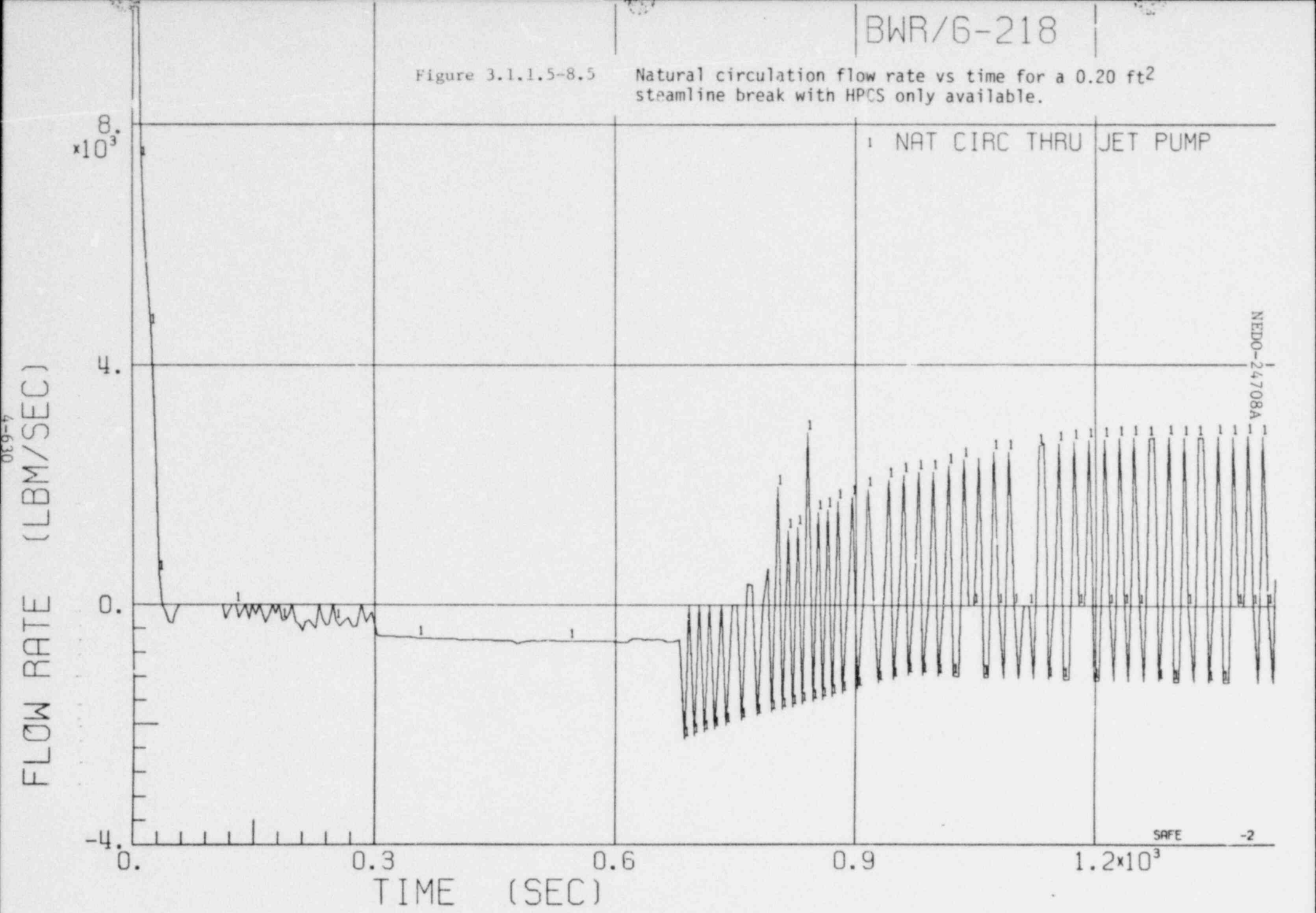

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Figure 3.1.1.5-8.6 Temperature vs time for a 0.20 ft^2 steamline break with HPCS only available.

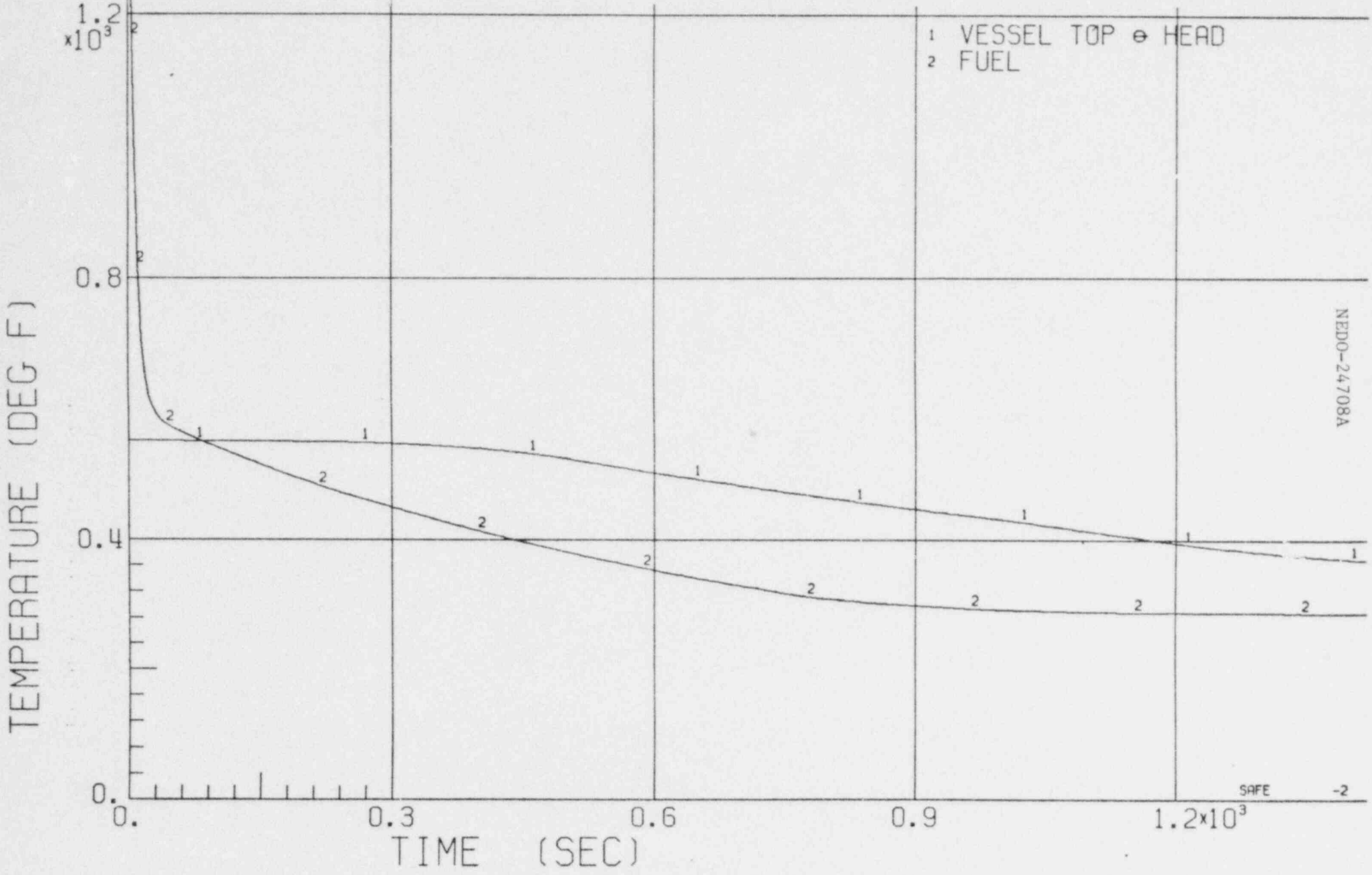

Figure 3.1.1.5-8.7 Enthalpy vs time for a 0.20 ft^2 steamline break with HPCS only available.

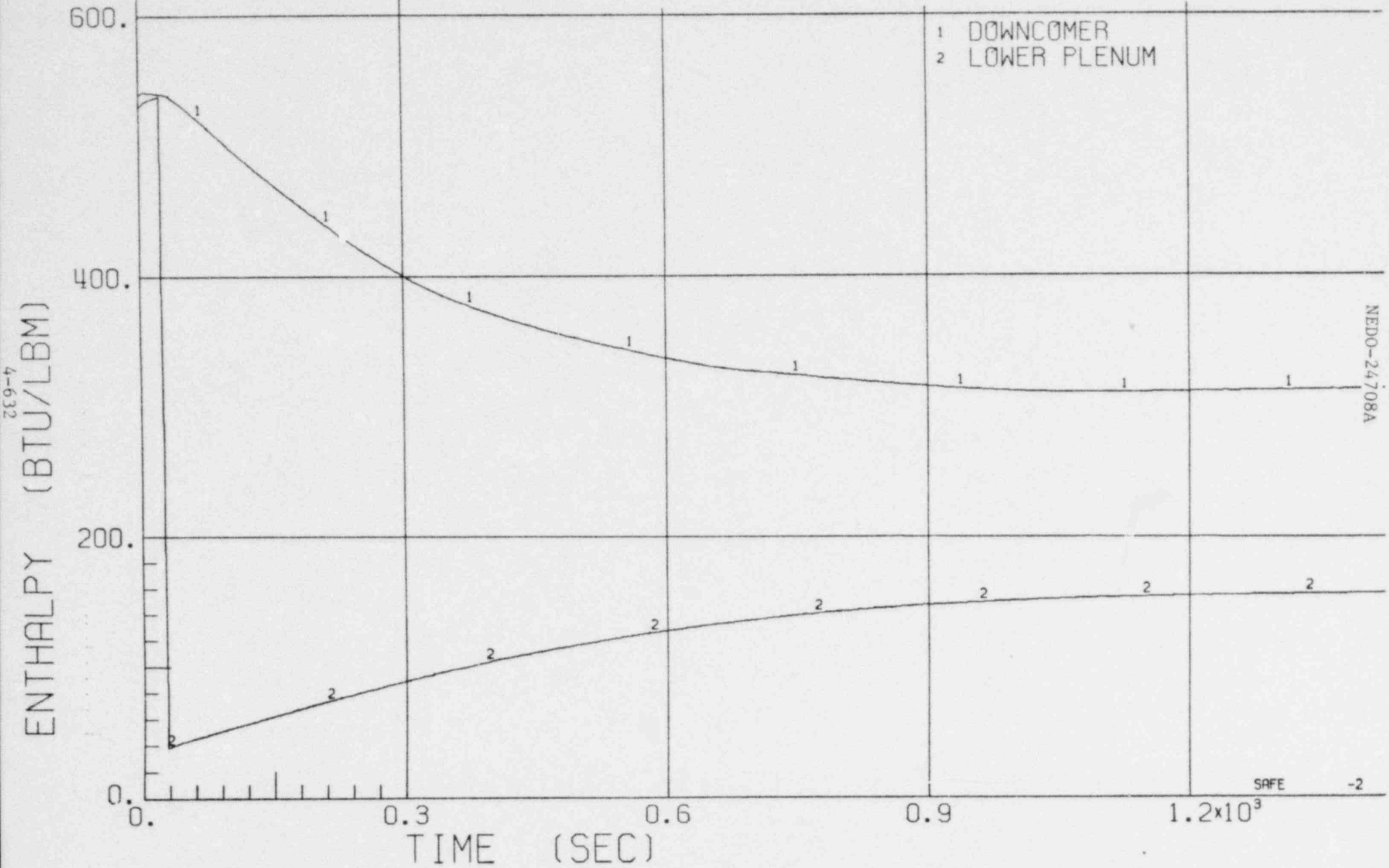

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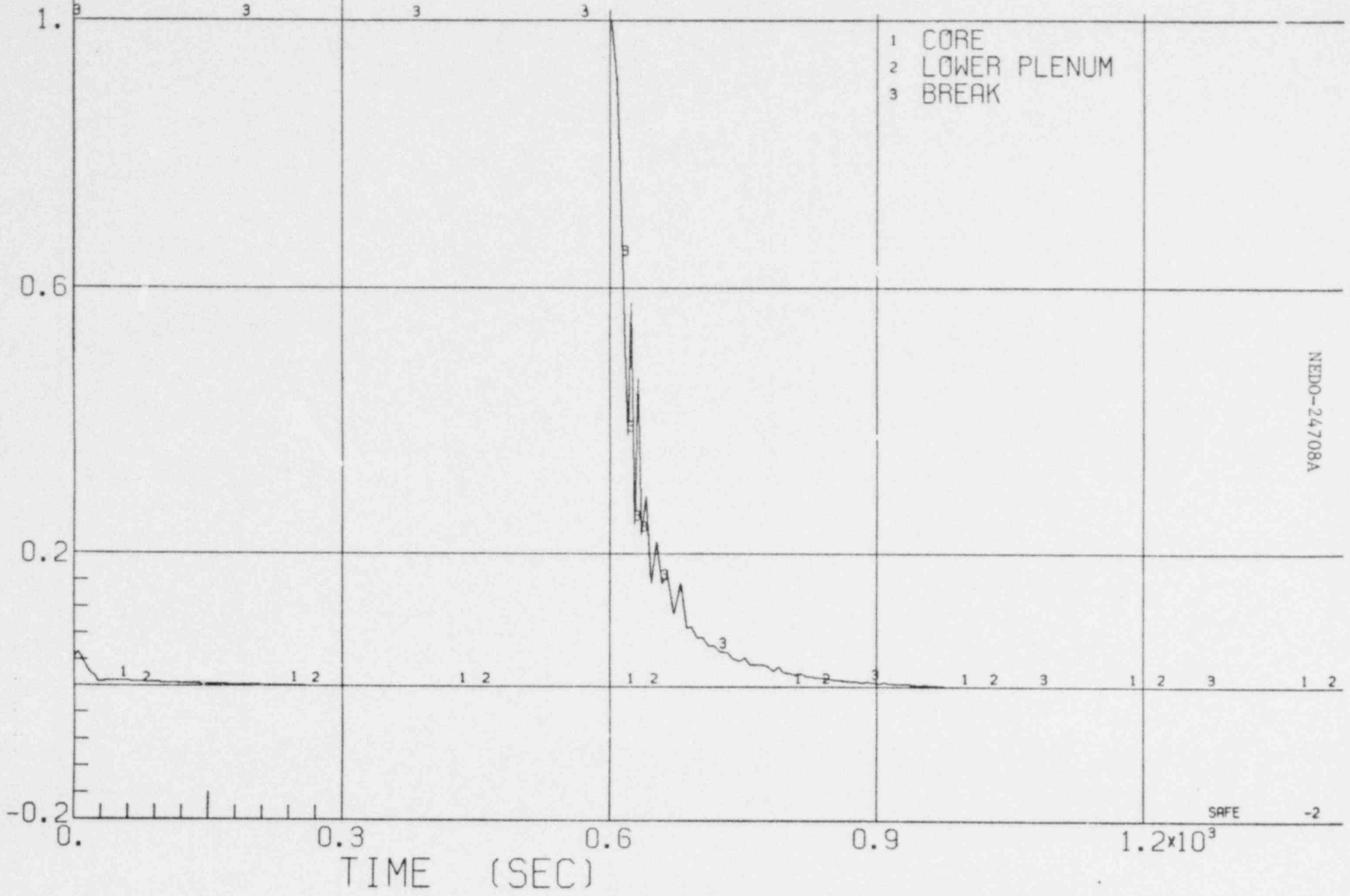
Figure 3.1.1.5-8.8 Quality vs time for a 0.20 ft^2 steamline break with HPCS only available.



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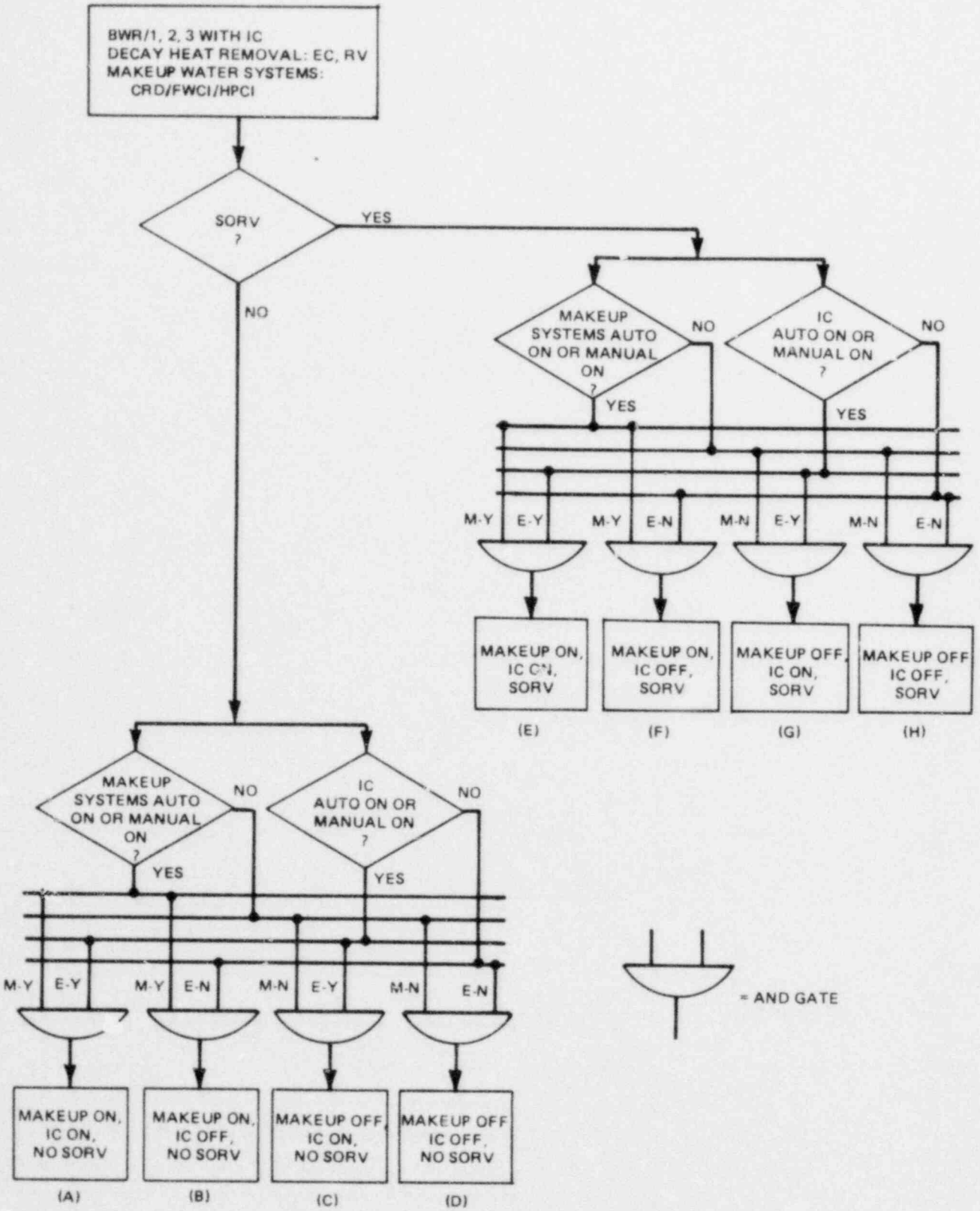

Figure 3.2.1.1.3.1. System Configurations for BWR/1,2,3 with IC

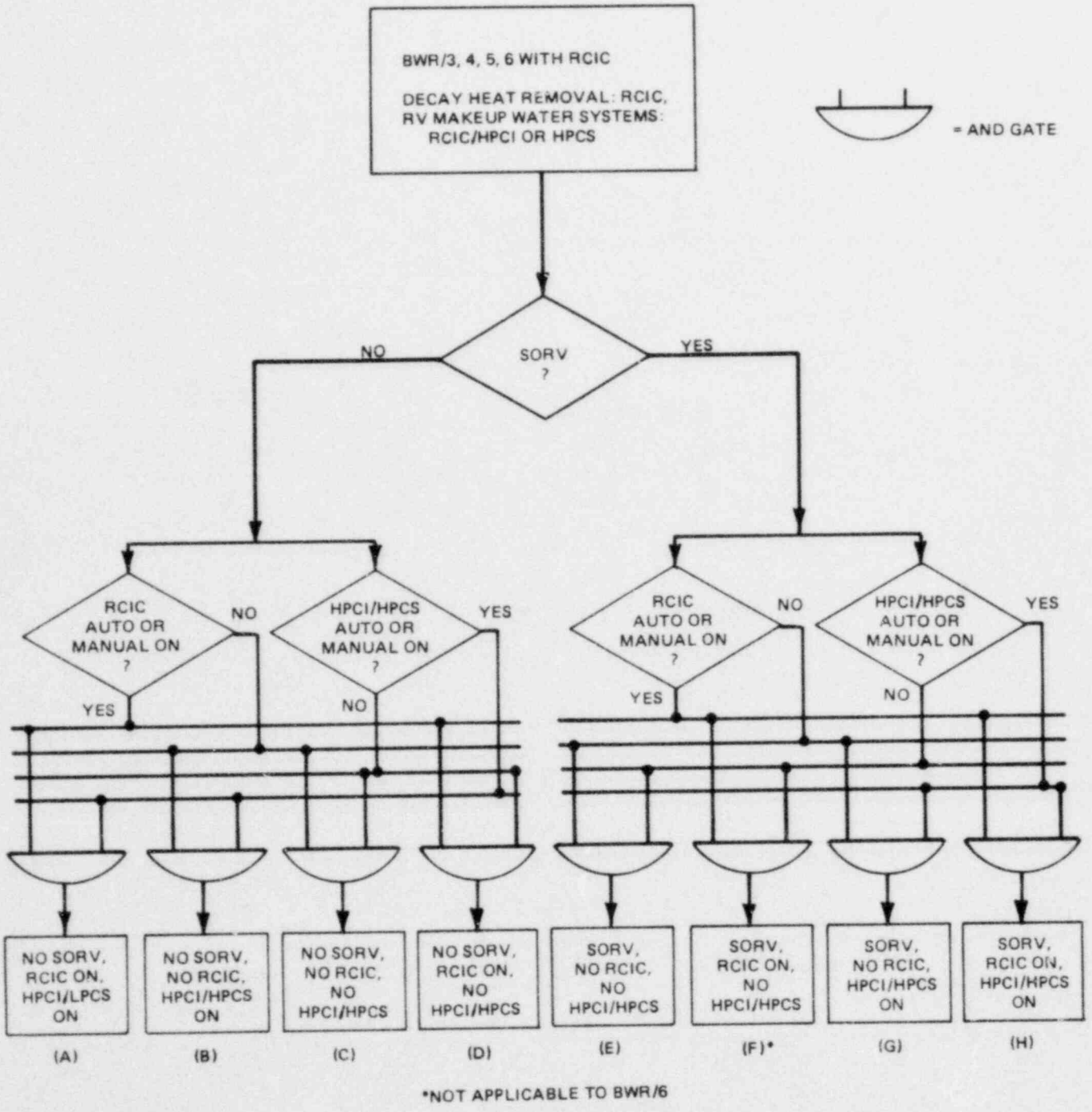

Figure 3.2.1.1.3.2. System Configurations for BWR/3,4,5,6 With RCIC

Table 3.2.1.1.5-1

BWR/2 LOF

SEQUENCE OF EVENTS

Time (Sec)	Event
	INITIAL VESSEL LEVEL = 43 FT., TAF = 29.44 ft.
0	Trip of all feedwater pumps initiated.
5	Feedwater flow decays to zero.
14	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
35	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves including the main steam line isolation valves are initiated to close. The isolation condensers are initiated. The LPCS system is also initiated (partial logic). FWCI (if applicable) is also initiated.
40	MSIV's are fully closed.
40	Reactor pressure starts to rise due to MSIV closure.
50	Flow from both isolation condensers enter the vessel. Reactor pressure starts to decrease.
100	Reactor water level reaches a plateau and the reactor pressure continues to decrease at a slower rate. The reactor reaches a safe and stable condition.

Table 3.2.1.1.5-2

BWR/3 LOF

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 42.7 ft., TAF = 30.03 ft.
0	Trip of all feedwater pumps initiated.
5	Feedwater flow decays to zero.
14	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
38	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves including the main steam line isolation valves are initiated to close. The FWCI or HPCI system is initiated. The LPCI/LPCS (partial logic) and ADS (partial logic) systems are also initiated.
43	MSIV's are fully closed, reactor pressure starts to rise due to MSIV closure.
90	Reactor pressure reaches the setpoint of the isolation condenser. The isolation condenser is initiated. Shortly afterwards, reactor pressure reaches the setpoint of the lowest safety/relief valve group. The lowest-set safety/relief valves start to open. Reactor pressure cycles between the opening and reclosing setpoint.
128	The isolation condenser flow and RWCI flow enter the vessel. Levels increase.
180	Decay heat falls below the capacity of IC. Relief valves stop cycling. Pressure slowly decreases due to the operation of IC. Reactor reaches a safe and stable condition.

Table 3.2.1.1.5-3

BWR/4: LOF

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 46.75 ft., TAF = 30.03 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
15	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. All primary system isolation valves except the main steam line isolation valves (e.g., RHR shutdown isolation valves, RWCU isolation valves, and containment) are initiated to close. Automatic depressurization permissive.
34.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI systems are initiated.
39.0	MSIV's fully closed.
64.0	HPCI and RCIC flow starts to enter the vessel, in shroud level bottoms out 12.6 ft above TAF and starts to rise.
93	Group 1 safety/relief valves start to open.
97	Group 1 safety/relief valves completely closed.
120	Group 1 safety/relief valves start to open again. Valves continue to cycle on and off on setpoints.
230	Group 1 safety/relief valves cease cycling due to HPCI and RCIC steam extraction.
380	Water level approaches normal water level. The operator takes manual control of HPCI and RCIC to maintain normal water level. Reactor reaches a safet and stable condition.

Table 3.2.1.1.5-4

SEQUENCE OF EVENTS

BWR/5: LOF

Time (Sec)	Event
	Initial vessel level = 46 ft., TAF - 29.55 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
10.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
28.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI system are initiated.
33.0	MSIV's are fully closed.
55.0	HPCS flow starts to enter the vessel.
58.0	RCIC flow starts to enter the vessel. Due to the steam quenching effect of HPCS and RCIC reactor depressurizes.
70.0	Water level bottoms out 7.5 ft above TAF and starts to rise.
380.0	Water level approaches normal water level. The operator takes manual control of HPCS and RCIC to maintain normal water level. Reactor pressure starts to increase.
1080.0	Group 1 safety/relief valves begin to cycle between the opening and reclosing setpoint. Reactor is in a safe and stable condition.

Table 3.2.1.1.5-4A

BWR/6: LOF

SEQUENCE OF EVENTS

Approximate Time (Sec)	Event
0.0	Trip of all feedwater pumps initiated.
1.0 (est)	Reactor power expected to start to drop due to decreased subcooling (not simulated).
2.5	Narrow range (NR) sensed water level reaches low alarm (Level 4).
3.5	Feedwater flow drops below 20%. Recirculation flow would be reduced (not simulated).
5.0	Feedwater flow decays to zero.
9.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. RHR shutdown isolation valves are closed. Automatic depressurization permissive. Recirculation pumps tripped to LFMG set (not simulated).
10	Turbine control valves start to close to regulate pressure.
15 (Est)	Neutron flux below 1%.
20	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All remaining primary system isolation valves are closed except main steam line isolation valves. RCIC and HPCS systems are initiated.
47	HPCS flow starts to enter the vessel. Turbine control valves close completely and vessel pressure continues to drop.
50	RCIC flow starts to enter the vessel.
75	Water level bottoms out 6.5 feet above TAF and starts to rise.
130	Vessel pressure decreased to 850 psig. With the reactor in RUN mode, the main steamline isolation valves will close.
360	Water level approaches normal water level. The operator takes manual control of RCIC to maintain normal water level (not simulated).
1200	Group 1 safety/relief valve begins to cycle.
1800	Operator deisolates to use the main condenser as a heat sink (not simulated). The transient terminates.

Table 3.2.1.1.5-5

BWR/2: LOF + 1 IC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial Vessel Level = 43 ft., TAF = 29.44
0	Trip of all feedwater pumps initiated.
5	Feedwater flow decays to zero.
14	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
35	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves including the main steam line isolation valves are initiated to close. The isolation condensers are initiated. The LPCS system is also initiated (partial logic). FWCI (if applicable) is also initiated.
40	MSIV's are fully closed.
40	Reactor pressure starts to rise due to MSIV closure.
50	Flow from one isolation condenser enters the vessel. Reactor pressure continues to rise and reactor water level continues to decrease.
120	Reactor pressure reaches the setpoint of the lowest relief valve group. Reactor pressure cycles between the opening and reclosing setpoint. Reactor level decreases slowly.
300	Decay heat falls below the capacity of one IC, reactor pressure decreases slowly. Relief valves no longer open. Reactor reaches a safe and stable condition.

Table 3.2.1.1.5-6

BWR/3: LOF + SORV + FWCI + IC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 42.7 ft., TAF = 30.03 ft.
0	Trip of all feedwater pumps initiated.
5	Feedwater flow decays to zero.
14	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
38	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves icluding the main steam line isolation valves are initiated to close. The FWCI or HPCI system is initiated. The LPCI/LPCS (partial logic) and ADS (partial logic) systems are also initiated.
43	MSIV's are fully closed, reactor pressure starts to rise due to MSIV closure.
90	Reactor pressure reaches the setpoint of the isolation condenser. The emergency condenser is initiated. Shortly afterwards, reactor pressure reaches the set point of the lowest safety/relief valve group. The lowest-set safety/relief valves starts to open. Reactor pressure peaks and then starts to decrease.
95	Reactor pressure drops below the reclosure set point of the lowest-set safety/relief valves. All valves, are closed with the exception of one, which is stuck open. As a result, reactor pressure continues to decrease. Reactor water level also slowly decreases.
128	The isolation condenser and FWCI start to enter the vessel. Level increases. Reactor depressurizes.
280	Vessel level is recovered to normal range. Operator manually trips FWCI and IC. Reactor reaches a safety and stable condition.

Table 3.2.1.1.5-7

BWR/4: LOF + SORV, HPCI/RCIC ON

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level - 46,75 ft., TAF - 30.03 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
15.	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. Most are initiated to close. Automatic depressurization permissive.
34.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI systems are initiated.
39.0	MSIV's and all other isolation valves fully closed.
64.0	HPCI and RCIC flow start to enter the vessel. In-shroud level bottoms out 12.6 ft. above TAF and begins to rise.
93.0	Group 1 safety/relief valves start to open.
97.0	All Group 1 safety relief valves except one close on setpoint. Operator should try to manually close the valve. The reactor will continue to depressurize through the stuck open S/R valve.
380.0	Water level approaches normal water level. The operator takes manual contro of HPCI and RCIC to maintain normal water level.
1800.	Operator initiates steam condensing mode if available. Operator can also choose to de-isolate and use the main condenser as a sink. When the reactor pressure reaches 150 psia the operator can switch RHR to shutdown cooling mode. (Not simulated).

Table 3.2.1.1.5-8

BWR/5: LOF + SORV, WITH HPCS/RCIC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 46 ft., TAF = 29.55 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
10.0	NR sensed water level reaches low level scram (Level). Reactor scram is initiated.
28.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI system are initiated.
33.0	MSIV's are fully closed.
55.0	HPCS flow starts to enter the vessel.
58.0	RCIC flow starts to enter the vessel, due to the steam quenching effect of HPCS and RCIC reactor depressurizes.
70.0	Water level bottoms out 7.5 ft above TAF and begins to rise.
380.0	Water level approaches normal water level. The operator takes manual control of HPCS and RCIC to maintain normal water level. Reactor pressure starts to increase.
1080.0	Group 1 safety/relief valves start to open.
1085.0	Group 1 safety/relief valves except one close on closing setpoint. The reactor will continue to depressurize through the stuck open valve. The operator should try to manually close the valve.
1800.0	Operator selects steam condensing mode. The operator can also choose to deisolate and use the main condensor as a heat sink. When the reactor reaches 150 psia the operator can place the RHR in the shutdown cooling mode. (Not simulated)

Table 3.2.1.1.5-8A

BWR/6: LOF + SORV

SEQUENCE OF EVENTS

Approximate Time (Sec)	Event
0.0	Trip of all feedwater pumps initiated.
1.0 (est)	Reactor power expected to start to drop due to decreased subcooling (not simulated).
2.5	Narrow range (NR) sensed water level reaches low alarm (Level 4).
3.5	Feedwater flow drops below 20%. Recirculation flow would be reduced (not simulated).
5.0	Feedwater flow decays to zero.
9.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. RHR shutdown isolation valves are closed. Automatic depressurization permissive. Recirculation pumps tripped to LFMG set (not simulated).
10	Turbine control valves start to close to regulate pressure.
15 (est)	Neutron flux below 1%.
20	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All remaining primary system isolation valves are closed except main steam isolation valves. RCIC and HPCS systems are initiated.
47	HPCS flow starts to enter the vessel. Turbine control valves close completely and vessel pressure continues to drop.
50	RCIC flow starts to enter the vessel.
75	Water level bottoms out 6.5 feet above TAF and starts to rise.
130	Vessel pressure decreases to 850 psig. With the reactor in RUN mode, the main steamline isolation valves will close.
360	Water level approaches normal water level. The operator takes manual control of HPCS and RCIC to maintain normal water level (not simulated).
1200	Group 1 safety/relief valve begins to cycle.
1220	A safety/relief valve from Group 1 is assumed to fail to close on closing setpoint. The reactor will continue to depressurize through the stuck open valve. The operator should try to manually close the valve.
1880	Operator deisolates to use the main condenser as a heat sink (not simulated). If no operator action is taken at this time the vessel will continue to depressurize through the stuck open safety/relief valve at a rate such that it reaches a pressure of about 300 psig at one hour.
24-48 hrs (est)	cold shutdown achieved

Table 3.2.1.1.5-9

BWR/4: LOF + SORV, RCIC ONLY

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 46.75 ft., TAF = 30.03 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
15	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. Most primary system isolation valves are initiated to close. Automatic depressurization permissive.
34.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI systems are initiated.
39.0	MSIV's and all other isolation valves fully closed.
64.0	RCIC flow enters the vessel.
88.0	Group 1 safety relief valves begin to open.
92.0	All group 1 safety relief valves except one close on closing setpoint. The reactor continues to depressurize through the stuck open relief valve. Reactor level decreases slowly.
1800.0	RCIC flow equals SORV flow. In-shroud level reaches a plateau (4.3 ft. above TAF). Reactor pressure is approximately 340 psia and decreasing slowly.
1900.0	Operator opens a relief valve to speed up the depressurization.
2480.0	LPCS flow enters the reactor. In-shroud level bottoms out (2.4 ft. above TAF), reactor is quickly reflooded.

Table 3.2.1.1.5-10

BWR/5: LOF + SORV, RCIC ONLY

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 46 ft., TAF = 29.55 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
10.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is intiated.
28.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI system are initiated.
33.0	MSIV's are fully closed.
55.0	No HPCS flow enters the vessel.
58.0	RCIC flow enters the vessel.
70.0	Group 1 safety/relief valves begin to open.
75.0	All Group 1 safety/relief valves except one close on closing setpoint. The reactor continues to depressurize through the open valve. Reactor level decreases slowly.
∿1800.0	RCIC flow equals SOR" flow. In-shroud levels reaches a plateau (∿2.0 ft above TAF). Reactor pressure is approximately 280 psia. The operator can open a SRV to depressurize the reactor to enable the injection of low pressure ECCS systems (not simulated).
1900-3200	Reactor pressure slowly decreases, water level slowly increases. (The injection of low pressure ECCS is not simulated.)

Table 3.2.1.1.5-10A

BWR/6: LOF + RCIC ONLY

SEQUENCE OF EVENTS

Approximate Time (Sec)	Event
0.0	Trip of all feedwater pumps initiated.
1.0 (est)	Reactor power expected to start to drop due to decreased subcooling (not simulated).
2.5	Narrow range (NR) sensed water level reaches low alarm (Level 4).
3.5	Feedwater flow drops below 20%. Recirculation flow would be reduced (not simulated).
5.0	Feedwater flow decays to zero.
9.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. RHR shutdown isolation valves are closed. Automatic depressurization permissive. Recirculation pumps tripped to LFMG set (not simulated).
10	Turbine control valves start to close to regulate pressure.
15 (est)	Neutron flux below 1%.
20	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All remaining primary system isolation valves are closed except main steam line isolation valves. RCIC and HPCS systems are initiated.
47	HPCS flow is assumed to fail to enter the vessel.
50	RCIC flow starts to enter the vessel.
235	Water level bottoms out 10.8 feet above TAF and starts to rise.
2430	Water level approaches normal water level. The operator takes manual control of HPCS and RCIC to maintain normal water level (not simulated). The transient terminates.

Table 3.2.1.1.5-10B

BWR/6: LOF + SORV + MANUAL HPCS AND RCIC

SEQUENCE OF EVENTS

Approximate Time (Sec)	Event
0.0	Trip of all feedwater pumps initiated.
1.0 (est)	Reactor power expected to start to drop due to decreased subcooling (not simulated).
2.5	Narrow range (NR) sensed water level reaches low alarm (Level 4).
3.5	Feedwater flow drops below 20%. Recirculation flow would be reduced (not simulated).
5.0	Feedwater flow decays to zero.
9.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. RHR shutdown isolation valves are closed. Automatic depressurization permissive. Recirculation pumps tripped to LFMG set (not simulated).
10	Turbine control valves start to close to regulate pressure.
15 (est)	Neutron flux below 1%.
20	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All remaining primary system isolation valves are closed except main steam isolation valves. RCIC and HPCS systems are initiated.
50	HPCS and RCIC flows fail to enter the vessel. (HPCS flow is actually expected about 20 seconds earlier providing advanced warning of the assumed failure.) The operator manually attempts to initiate HPCS and RCIC systems. Priority should be given to starting HPCS. Manual initiation of RCIC alone may not preclude core uncovery for this event whereas manual initiation of HPCS would if initiated early enough.
425	Wide range sensed level reaches low water level (Level 1). The main steamline isolation valves close. Attempts to initiate HPCS and RCIC manually have been successful and it is assumed that their flows enter the vessel at this time.

Table 3.2.1.1.5-10B (Continued)

Approximate Time (Sec)	Event
435	The water level reaches a minimum 2.5 feet above the top of the active fuel.
750	Water level approaches normal water level. The operator takes manual control of HPCS and RCIC to maintain normal water level (not simulated).
1700	Group 1 safety relief valve begins to cycle.
1715	A safety relief valve from Group 1 is assumed to fail to close on closing setpoint. The reactor will continue to depressurize through the stuck open relief valve. The operator should try to manually close the valve.
1800	Operator deisolates to use main condenser as a heat sink (not simulated). If no operator action is taken the vessel will continue to depressurize at a rate determined by the stuck open relief valve.

Table 3.2.1.1.5-11

BWR/2: LOF, NO SORV, NO FWCI/IC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial Vessel Level = 43 ft., TAF = 29.44 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
14.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
35.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves including the main steam line isolation valves are initiated to close. The isolation - condensers are initiated. The LPCS system is also initiated (partial logic). FWCI (if applicable) is also initiated.
40.0	MSIV's are fully closed.
40.0	Reactor pressure starts to rise due to MSIV closure. No flow from the isolation condenser enters the vessel. Reactor pressure continues to rise and reactor water level continues to decrease.
84.0	Reactor pressure reaches the setpoint of the lowest relief valve group. Reactor pressure cycles between the opening and reclosing setpoint. Reactor level decreases.
165.0	Reactor water level decreases to about 5 ft. above TAF, the operator manually actuates ADS in order to depressurize the reactor in time to allow LPCS operation.
540.0	Reactor pressure decreases to 265 psig and LPCS flow enters the reactor. Reactor is quickly reflooded.

Table 3.2.1.1.5-12

BWR/3: LOF, NO SORV, NO FWCI/IC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 42.7 ft., TAF = 30.03 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
14.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
38.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves including the main steam line isolation valves are initiated to close. The FWCI or HPCI system fails to be initiated. The LPCI/LPCS (partial logic) and ADS (partial logic) systems are also initiated.
43.0	MSIV's are fully closed, reactor pressure starts to rise due to MSIV closure.
60.0	Reactor level decreases to 5 ft. above TAF. The operator manually actuates ADS valves.
680.0	Reactor depressurizes to 275 psig, LPCS injects. Reactor is quickly reflooded.

Table 3.2.1.1.5-13

BWR/4: LOF, NO SORV, NO HPCI/RCIC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 46.75 ft., TAF = 30.03 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
15.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. Most primary system isolation valves are initiated to close. Automatic depressurization permissive.
34.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI systems are initiated.
39.0	MSIV's and all other isolation valves fully closed.
64.0	No HPCI and RCIC flow enter the vessel. Reactor pressure increases.
88.0	Group 1 safety relief valves.
100.0	Group 1 safety relief valves cycle between opening and reclosing setpoint. Level decreases.
233.0	Reactor water level decreases to about 5 ft above TAF. The operator manually initiates ADS.
444.0	Low pressure ECCS begin to inject water into the vessel as vessel pressure falls below shutoff head. The reactor is quickly reflooded.

Table 3.2.i.1.5-14

BWR/5: LOF + NO SORV, NO HPCS/RCIC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 46 ft., TAF = 29.55 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
10.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
28.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI fail to initiate.
33.0	MSIV's are fully closed.
65.0	Group 1 safety/relief valves begin to open. No HPCS or RCIC flow enters the vessel.
70.0	Group 1 safety/relief valves close, reactor pressure cycles between the opening and closing setpoint of Group 1 SRVs.
335.0	Reactor water level decreases to about five feet above TAF. The operator manually initiates ADS and low pressure ECCS.
500.0	Reactor vessel pressure falls below the shutoff head of the low pressure ECCS and they begin to inject flow into the vessel. Reactor is quickly reflooded.

Table 3.2.1.1.5-14A

BWR/6: LOW + NO HPCS/RCIC

SEQUENCE OF EVENTS

Approximate Time (Sec)	Event
0.0	Trip of all feedwater pumps initiated.
1.0 (est)	Reactor power expected to start to drop due to decreased subcooling (not simulated).
2.5	Narrow range (NR) sensed water level reaches low alarm (Level 4).
3.5	Feedwater flow drops below 20%. Recirculation flow would be reduced (not simulated).
5.0	Feedwater flow decays to zero.
9.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. RHR shutdown isolation valves are closed. Automatic depressurization permissive. Recirculation pumps tripped to LFMG set (not simulated).
10	Turbine control valves start to close to regulate pressure.
~ (est)	Neutron flux below 1%.
20	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All remaining primary system isolation valves are closed except main steam isolation valves. RCIC and HPCS systems are initiated.
50	HPCS and RCIC flows fail to enter the vessel. (HPCS flow is actually expected about 20 seconds earlier providing advanced warning of the assumed failure.) The operator manually attempts to initiate HPCS and RCIC systems. Priority should be given to starting HPCS. Manual initiation of RCIC alone may not preclude core uncovery for this event whereas manual initiation of HPCS would if initiated early enough.
425	Wide range sensed level reaches low water level (Level 1). The main steamline isolation valves close. Priority attempts to initiate HPCS (since sensing its failure to inject) have been concluded to be unsuccessful (however ongoing efforts to start RCIC or HPCS should continue as possible). Reactor water level as indicated to the operator has failed to recover due to a lack of high pressure makeup and has dropped to L1. Manual opening of the ADS valves is assumed to be initiated (after checking that low pressure systems are

Table 3.2.1.1.5-14A (Continued)

Approximate Time (Sec)	Event
	running). During depressurization a rapid level swell occurs (still below normal) followed by a rapid level decrease.
560	Reactor vessel pressure falls below the shutoff head of the low pressure ECCS and they begin to inject flow into the vessel.
565	Water level reaches its minimum near the top of active fuel.
760	Water level approaches normal water level. Reactor pressure is less than 150 psia. Operator switches to shutdown cooling mode and takes manual control of the low pressure ECCS to maintain normal water level (not simulated).
24-48 hrs (est)	Cold shutdown achieved.

Table 3.2.1.1.5-15

BWR/2: LOF + SORV, NO FWCI/IC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial Vessel Level = 43 ft., TAF = 29.44 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
14.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
35.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves including the main steam line isolation valves are initiated to close. The isolation condensers are initiated. The LPCS system is also initiated (partial logic). FWCI (if applicable) is also initiated.
40.0	MSIV's are fully closed.
40.0	Reactor pressure starts to rise due to MSIV closure. No flow from the isolation condenser enters the vessel. Reactor pressure continues to rise and reactor water level continues to decrease.
84.0	Reactor pressure reaches the setpoint of the lowest relief valve group. The lowest-set relief valves start to open. Reactor pressure peaks and starts to decrease.
90.0	Reactor pressure drops below the reclosure set point of the lowest relief valve group. All relief valves are closed with the exception of one, which is stuck open. As a consequence, reactor pressure continues to decrease and reactor water level also slowly decreases.
220.0	Reactor water level decreases to about 5 ft above TAF, the operator manually actuates ADS in order to depressurize the reactor in time to allow LPCS operation.
490.0	Reactor pressure decreases to 265 psig and LPCS flow enters the reactor. Reactor is quickly reflooded.

Table 3.2.1.1.5-16

BWR/3: LOF + SORV, NO FWCI/IC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 42.7 ft., TAF = 30.03 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
14.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
38.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. All primary system isolation valves including the main steam line isolation valves are initiated to close. The FWCI or HPCI system is initiated. The LPCI/LPCS (partial logic) and ADS (partial logic) systems are also initiated.
43.0	MSIV's are fully closed, reactor pressure starts to rise due to MSIV closure.
60.0	Reactor water level decreases to 5 ft above TAF. Operator waits 120 seconds to actuate ADS valves.
90.0	Reactor pressure reaches the set point of the emergency condenser. The emergency condenser is initiated. Shortly afterwards, reactor pressure reaches the set point of the lowest safety/relief valve group. The lowest-set safety/relief valves starts to open. Reactor pressure peaks and then starts to decrease.
95.0	Reactor pressure drops below the reclosure setpoint of the lowest-set safety/relief valves. All valves are closed with the exception of one which is stuck open. As a result, reactor pressure continues to decrease. Reactor water level also slowly decreases.
126.0	No flow from FWCI (if applicable) and IC enter the vessel.
180.0	The operator manually initiates ADS.
470.0	Reactor pressure decreases to 265 psig and LPCI/LPCS flow enters the reactor. Reactor is quickly reflooded.

Table 3.2.1.1.5-17

BWR/4: LOF + SORV + NO HPCI/RICI

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level - 46.75 ft., TAF - 30.03 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero
15	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated. Most are initiated to close. Automatic depressurization permissive.
34.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI systems are initiated.
39.0	MSIV's and all other isolation valves fully closed.
64.0	No HPCI and RCIC flow enter the vessel. Reactor pressure increases.
88.0	Group 1 safety relief valves start to open.
92.0	All group 1 safety relief valves except one close on closing setpoints. The reactor continues to depressurize through the stuck open valve.
270.0	Reactor water level decreases to about 5 ft. above TAF. The operator manually initiates ADS.
460.0	Low pressure ECCS begin to inject water into the vessel as vessel pressure falls below shutoff head. The reactor is quickly reflooded.

Table 3.2.1.1.5-18

BWR/5: LOF + SORV, NO HPCS/RCIC

SEQUENCE OF EVENTS

Time (Sec)	Event
	Initial vessel level = 46 ft., TAF = 29.55 ft.
0.0	Trip of all feedwater pumps initiated.
5.0	Feedwater flow decays to zero.
10.0	NR sensed water level reaches low level scram (Level 3). Reactor scram is initiated.
28.0	Wide range sensed water level reaches low low water level (Level 2). Recirculation pumps are tripped. The main steam isolation valves are closed. RCIC and HPCI fail to initiate.
33.0	MSIV's are fully closed.
65.0	Group 1 safety/relief valves begin to open. No HPCS or RCIC flow enter the vessel.
70.0	Group 1 safety/relief valves close except one valve which remains stuck open. The reactor depressurizes through the stuck open valve.
300.0	Reactor water level decreases to about five feet above TAF. The operator manually initiates ADS and low pressure ECCS.
425.0	Reactor vessel pressure falls below the shutoff head of the low pressure ECCS and they begin to inject flow into the vessel. Reactor is quickly reflooded.

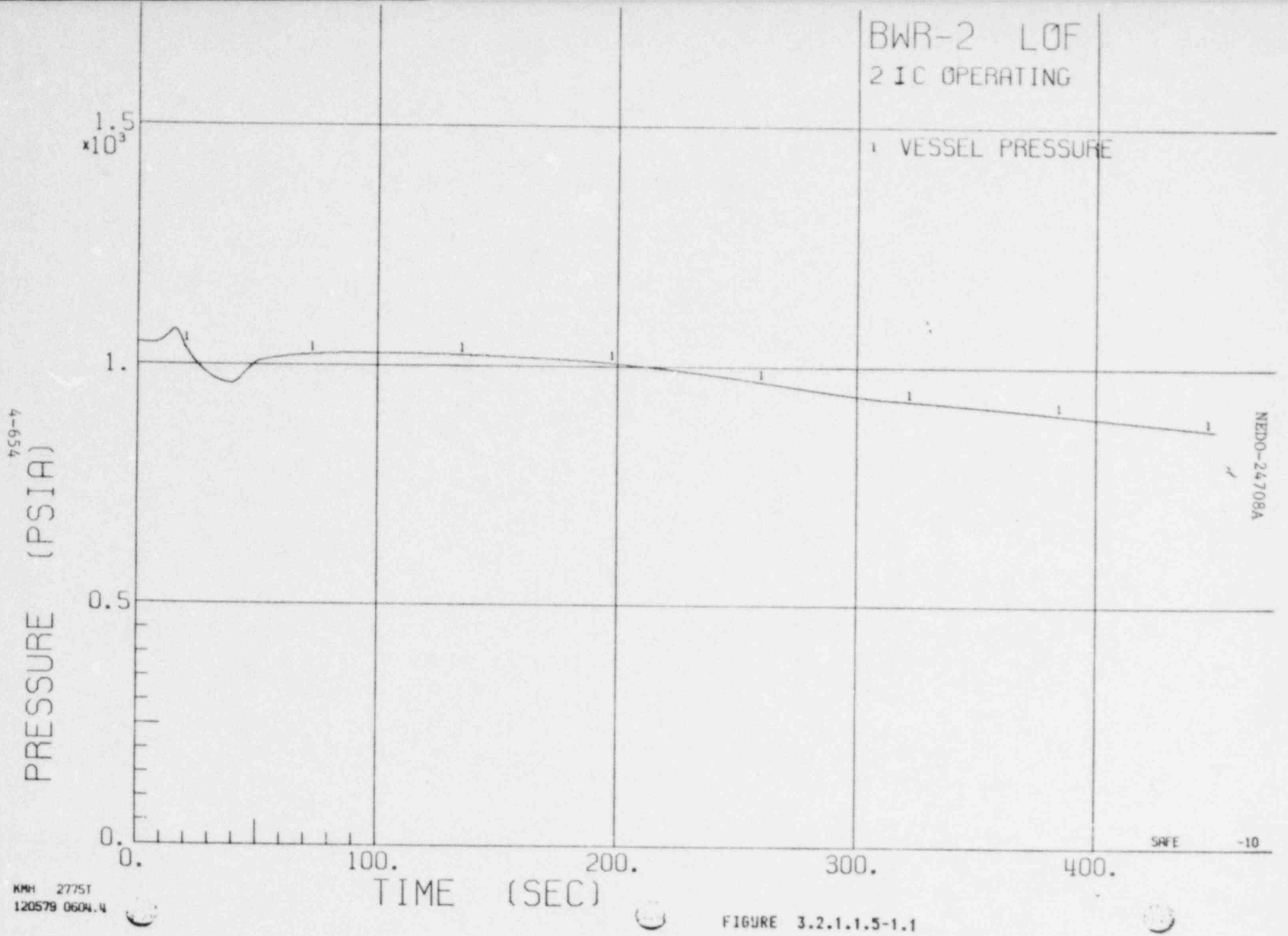

FIGURE 3.2.1.1.5-1.1

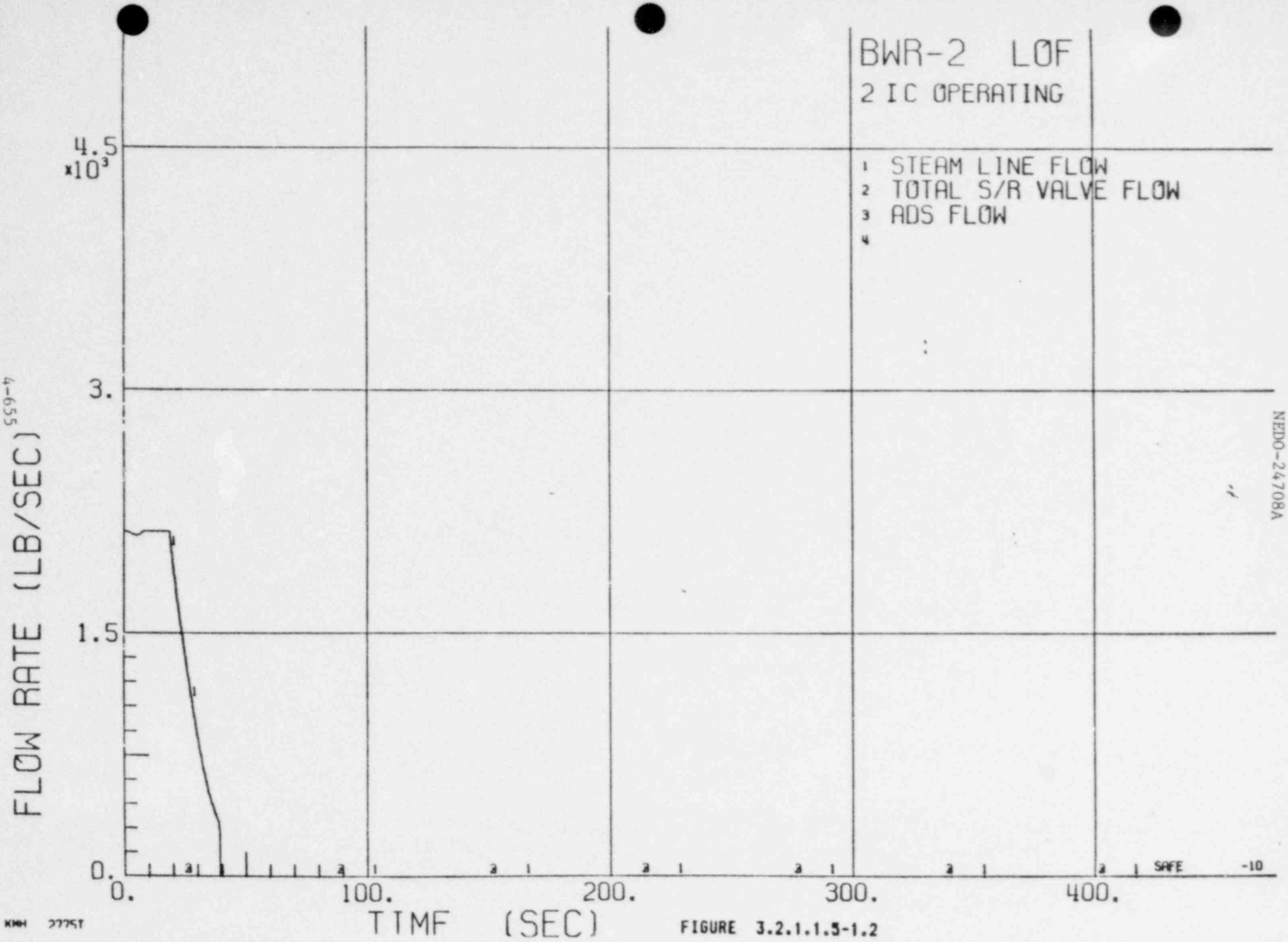

FIGURE 3.2.1.1.5-1.2

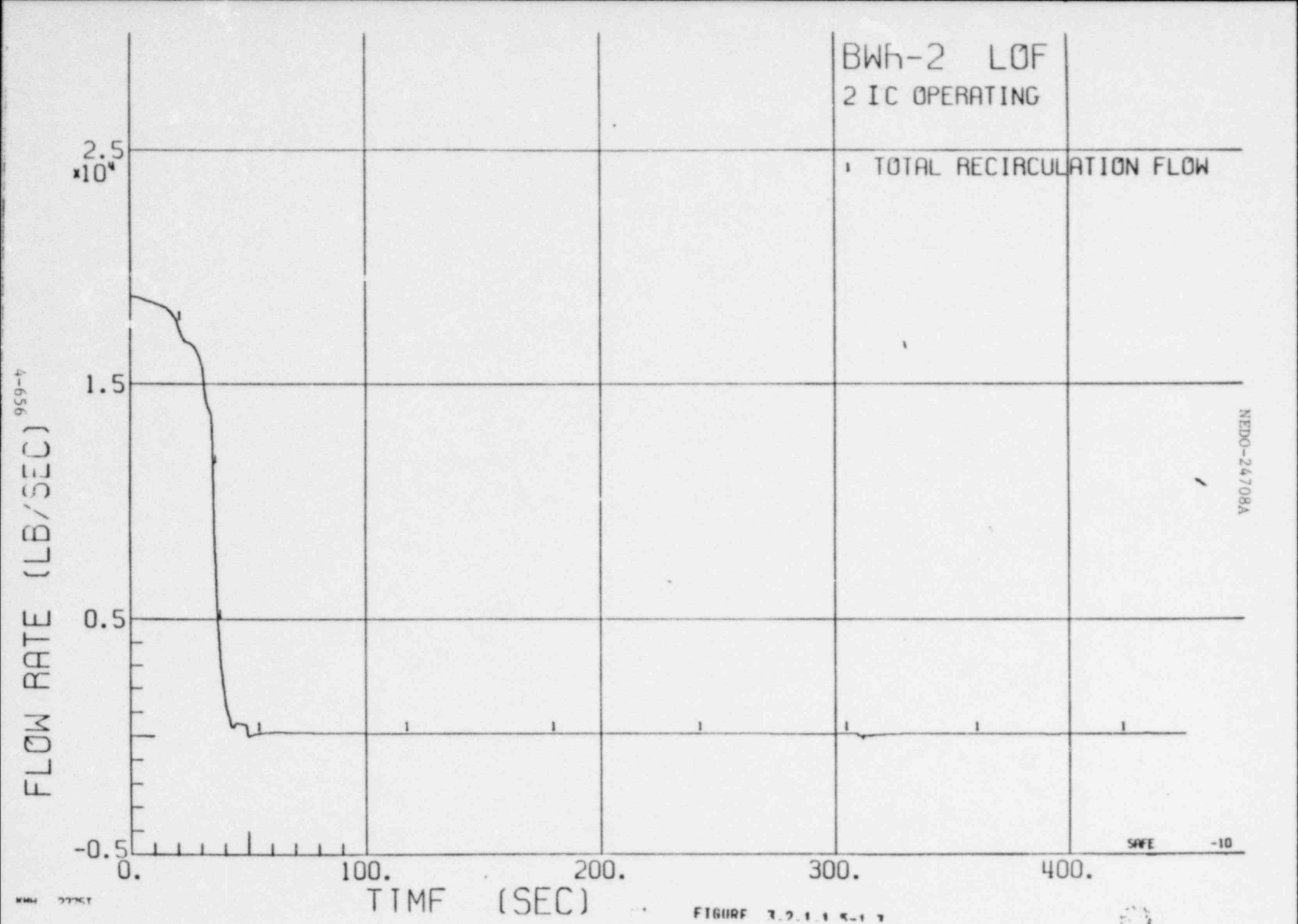

FIGURE 3.2.1.1 5-1 3

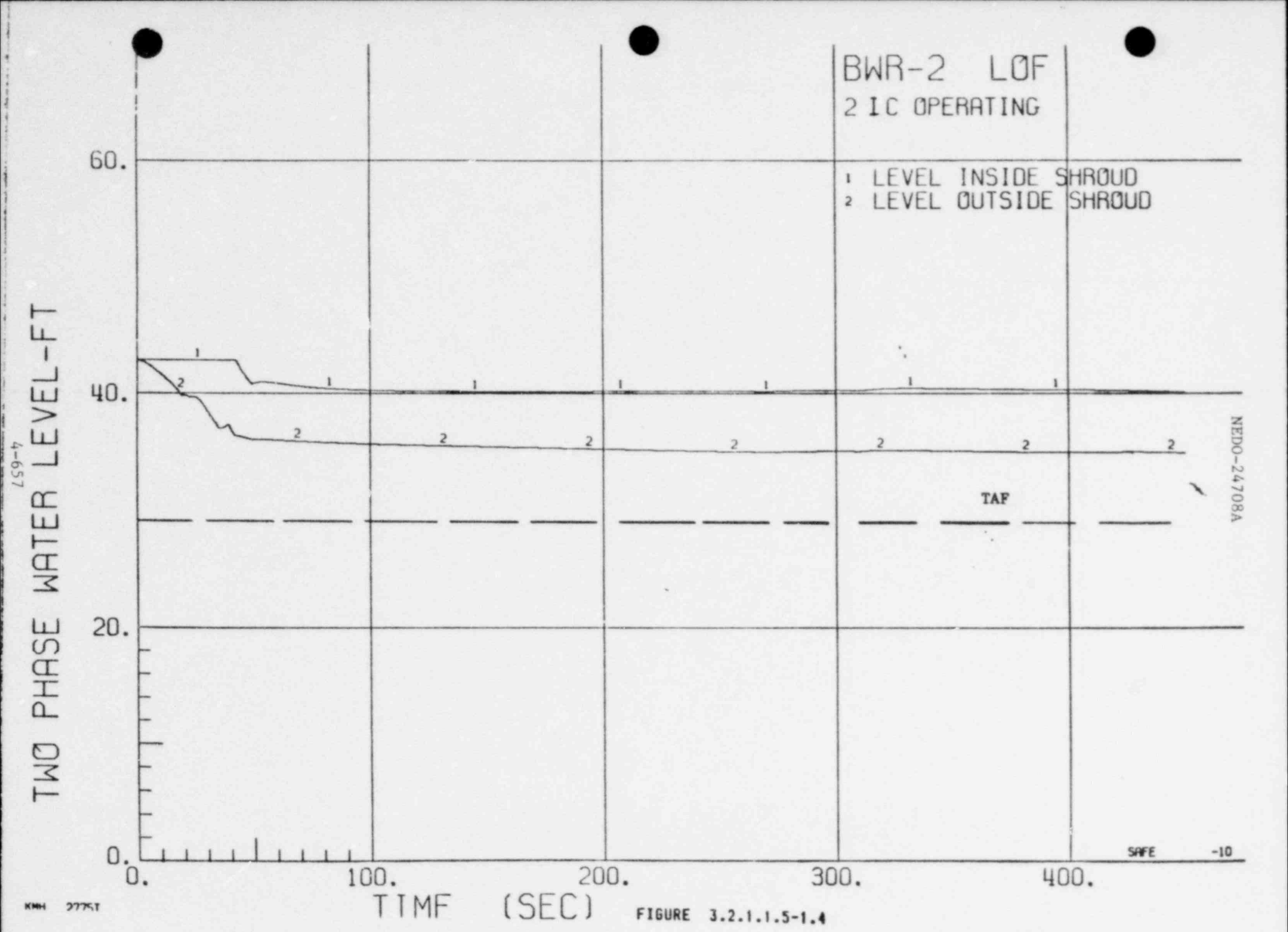

FIGURE 3.2.1.1.5-1.4

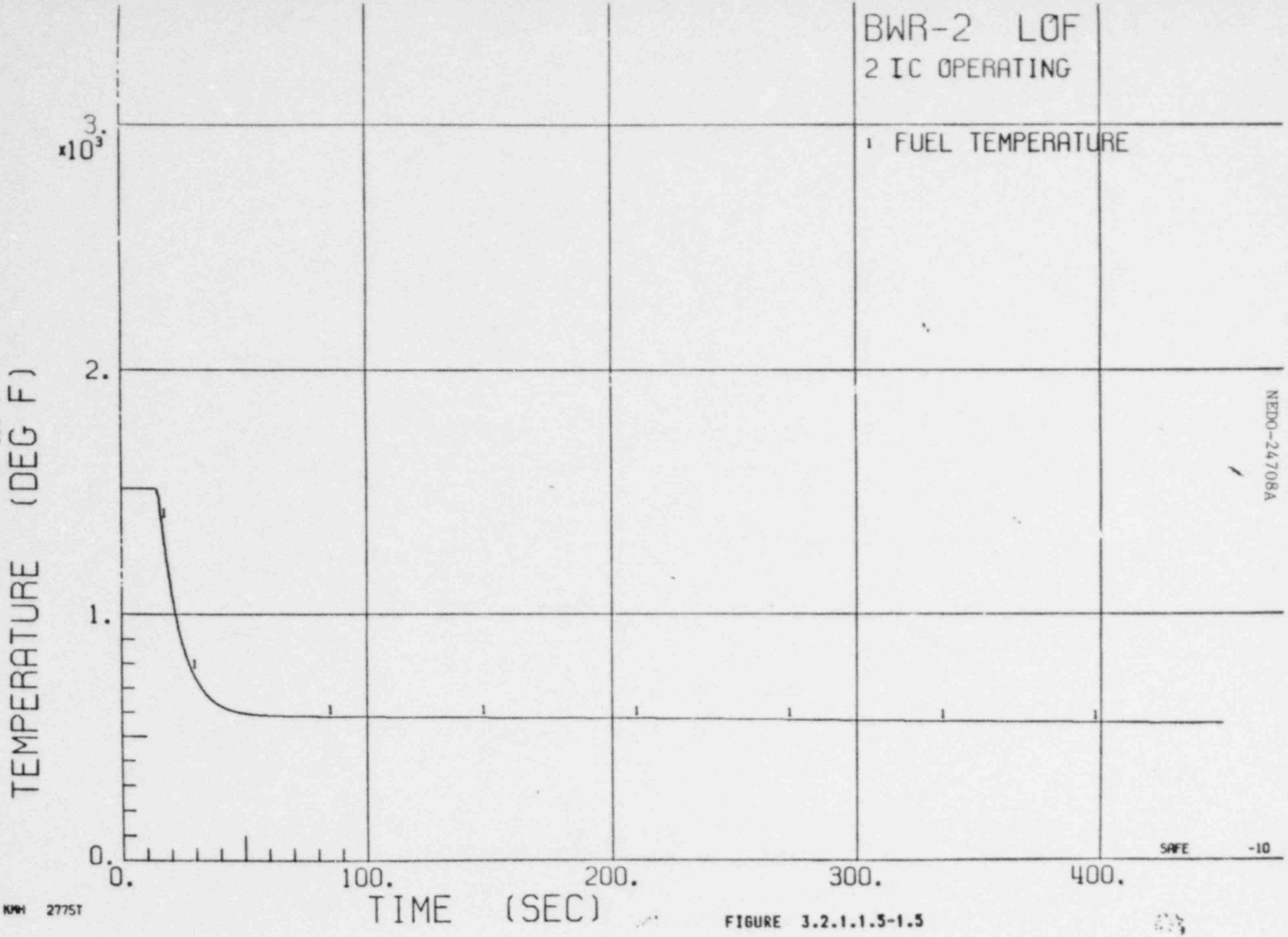

FIGURE 3.2.1.1.5-1.5

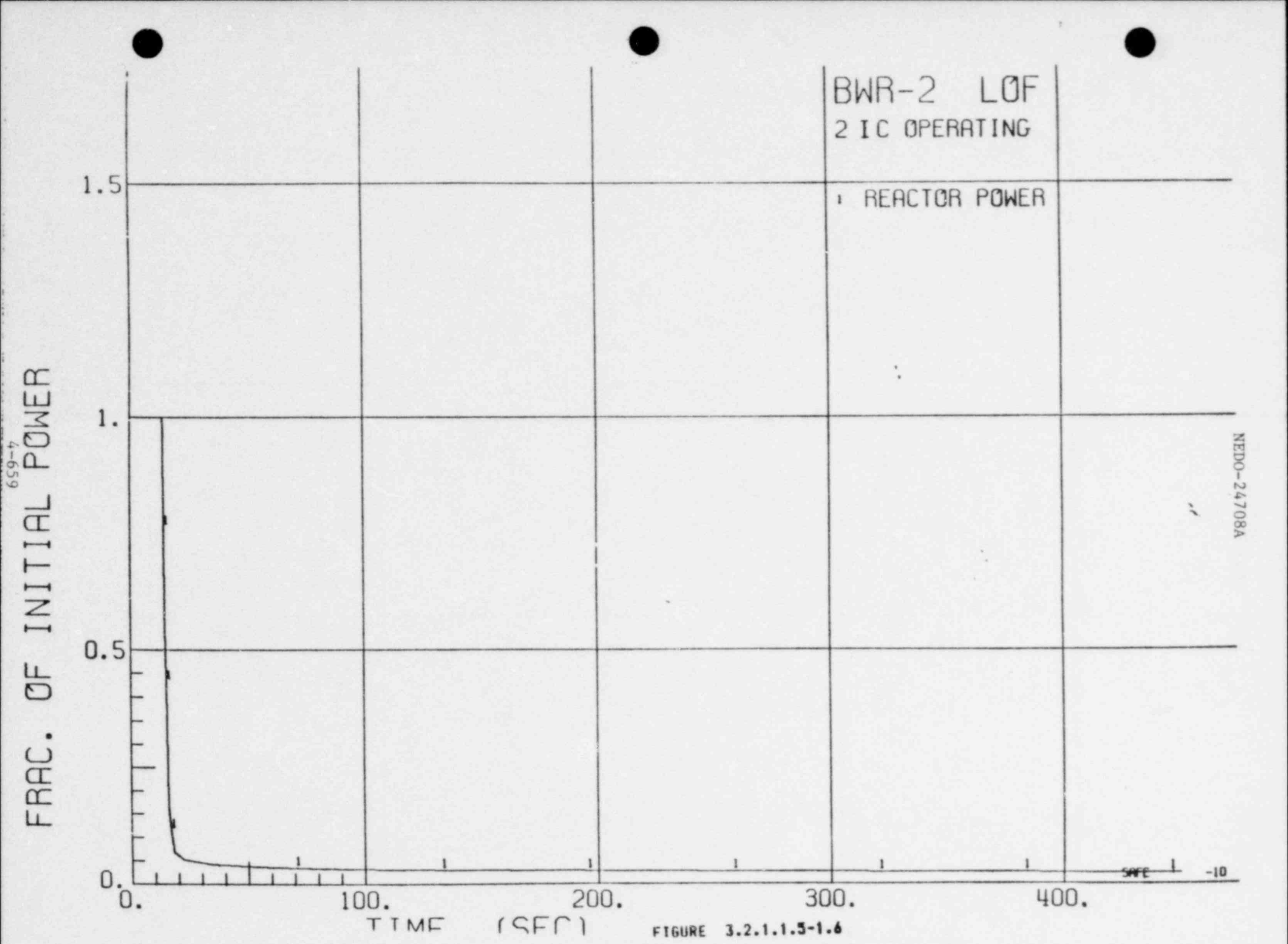

FIGURE 3.2.1.1.3-1.6

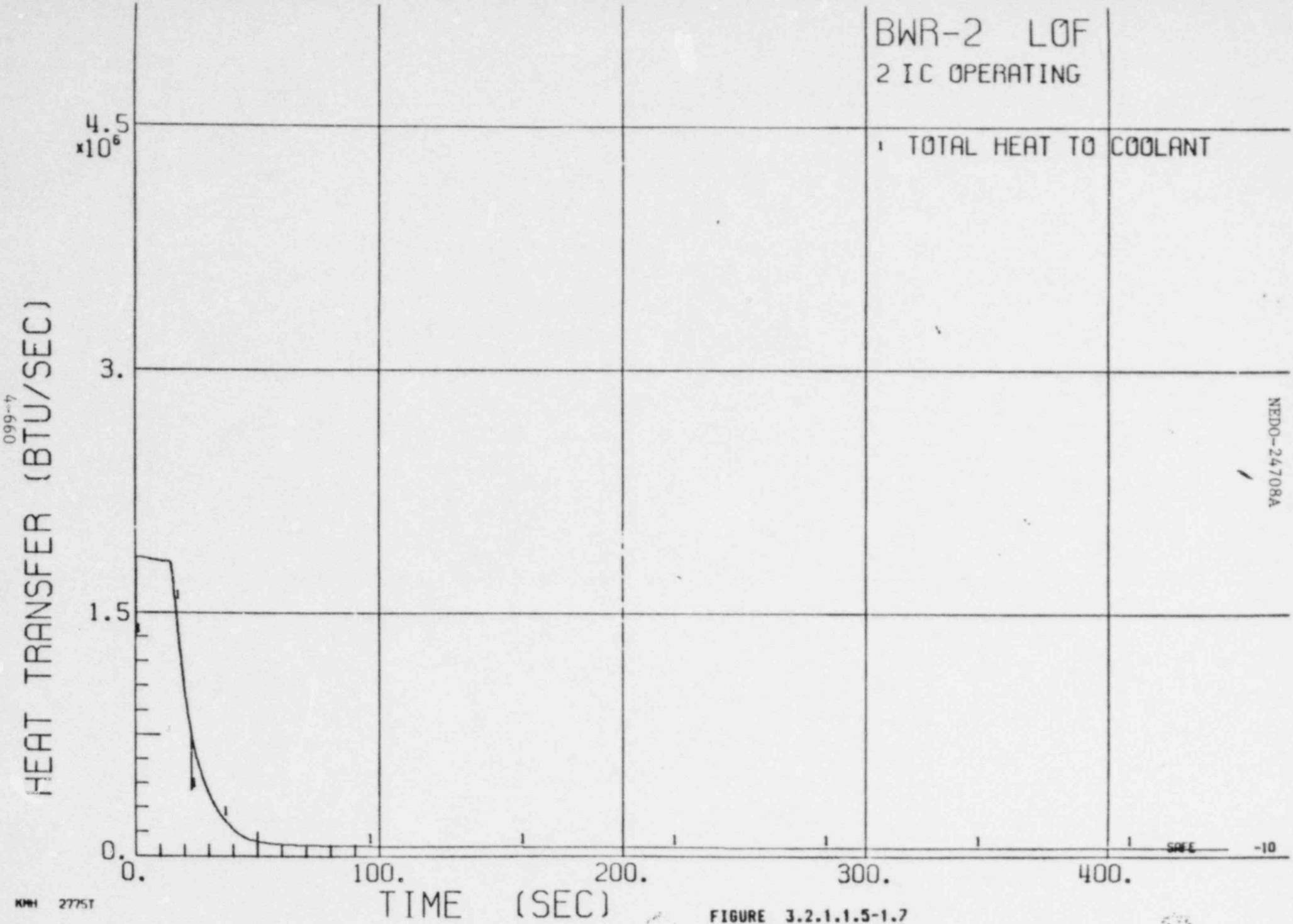

FIGURE 3.2.1.1.5-1.7

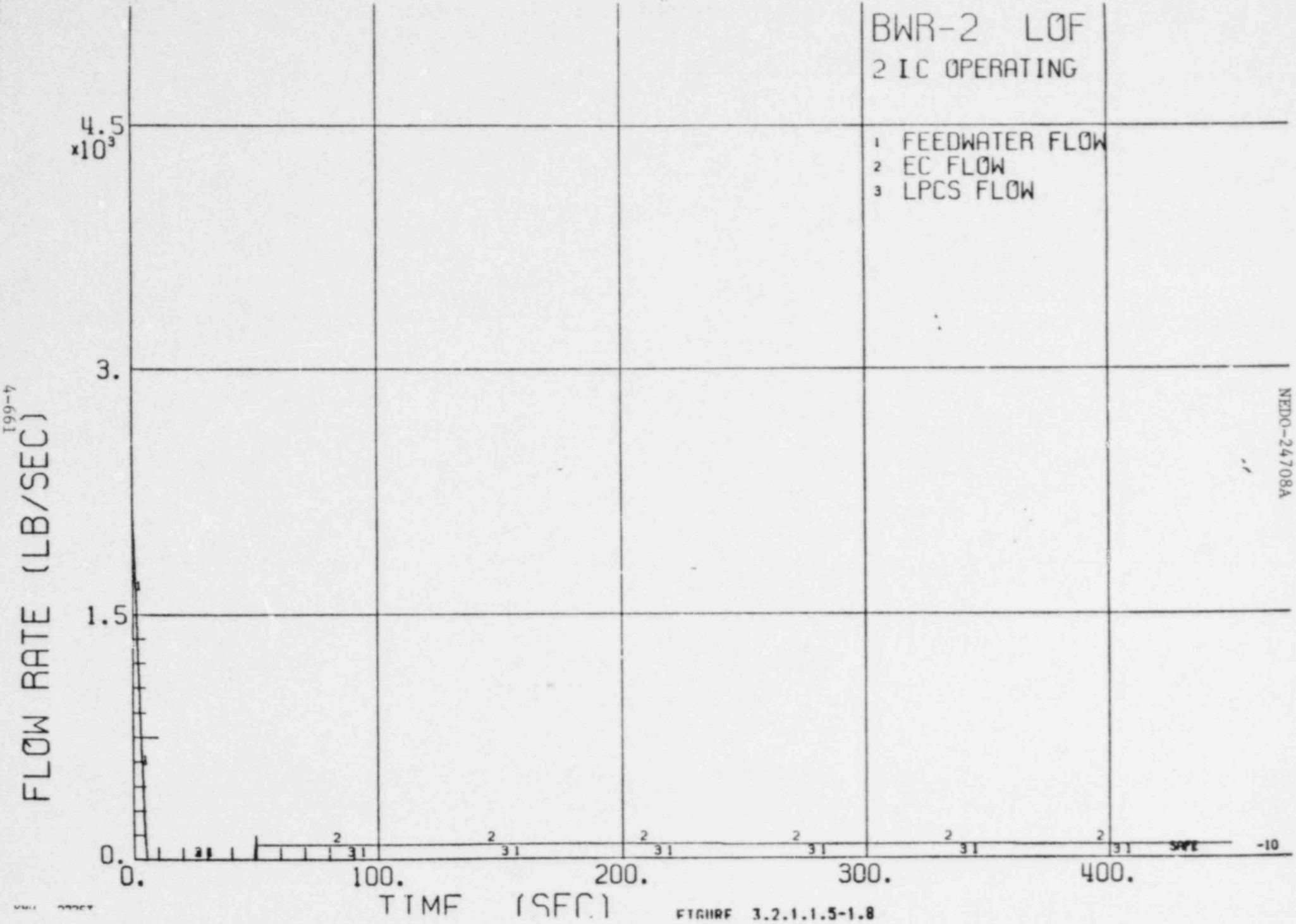

FIGURE 3.2.1.1.5-1.8

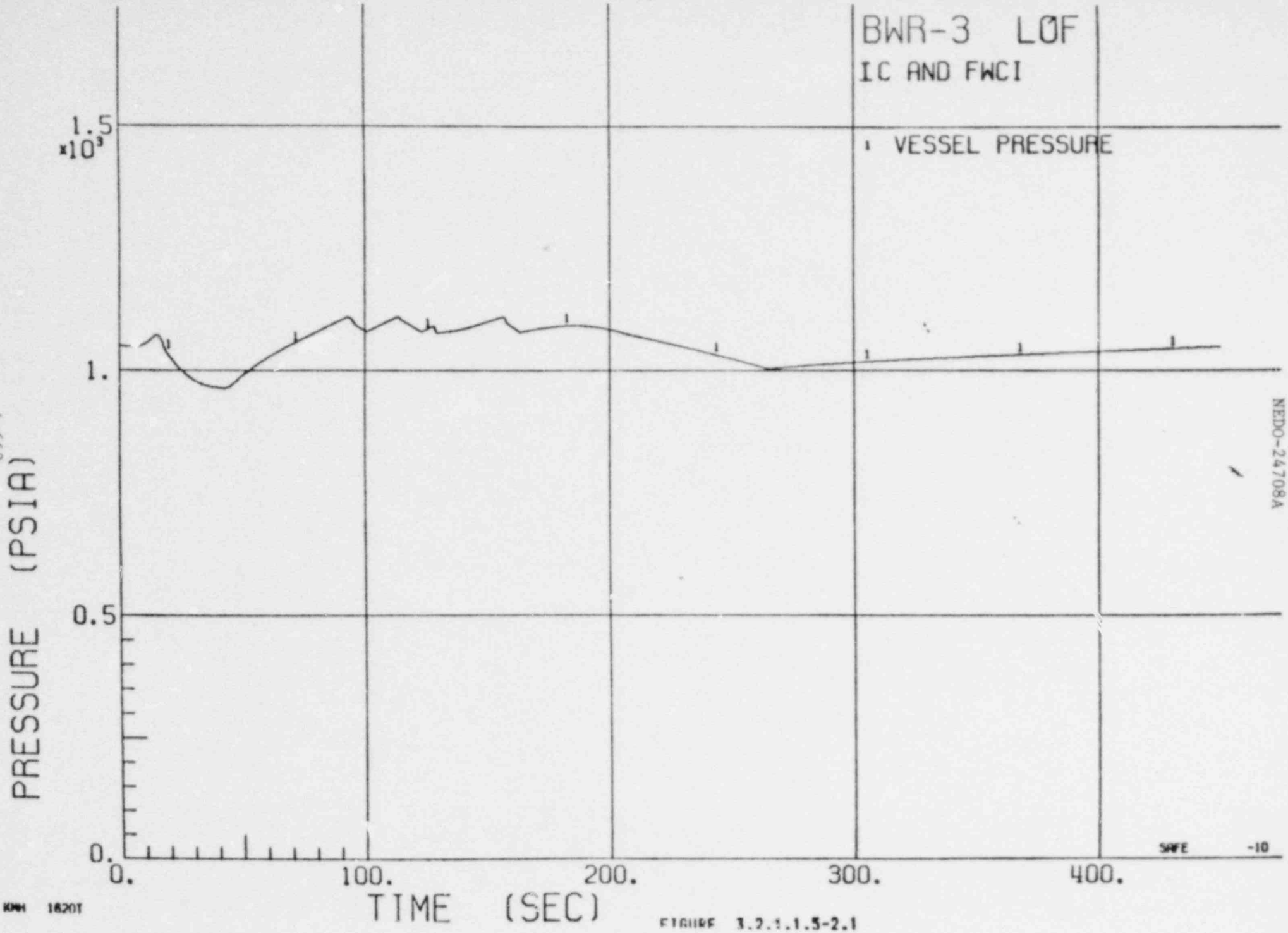

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FIGURE 3.2.1.1.3-2.1

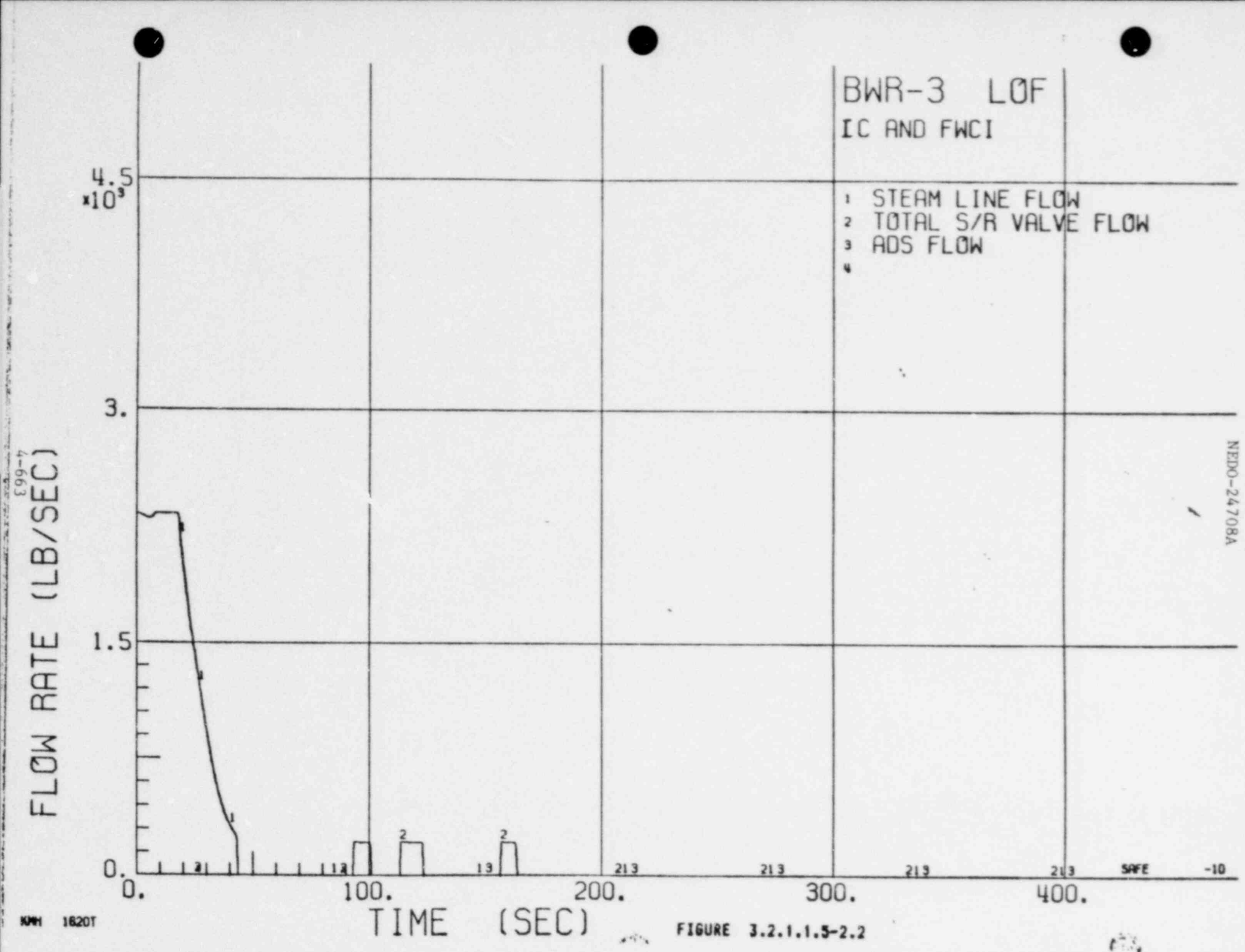


FIGURE 3.2.1.1.5-2.2

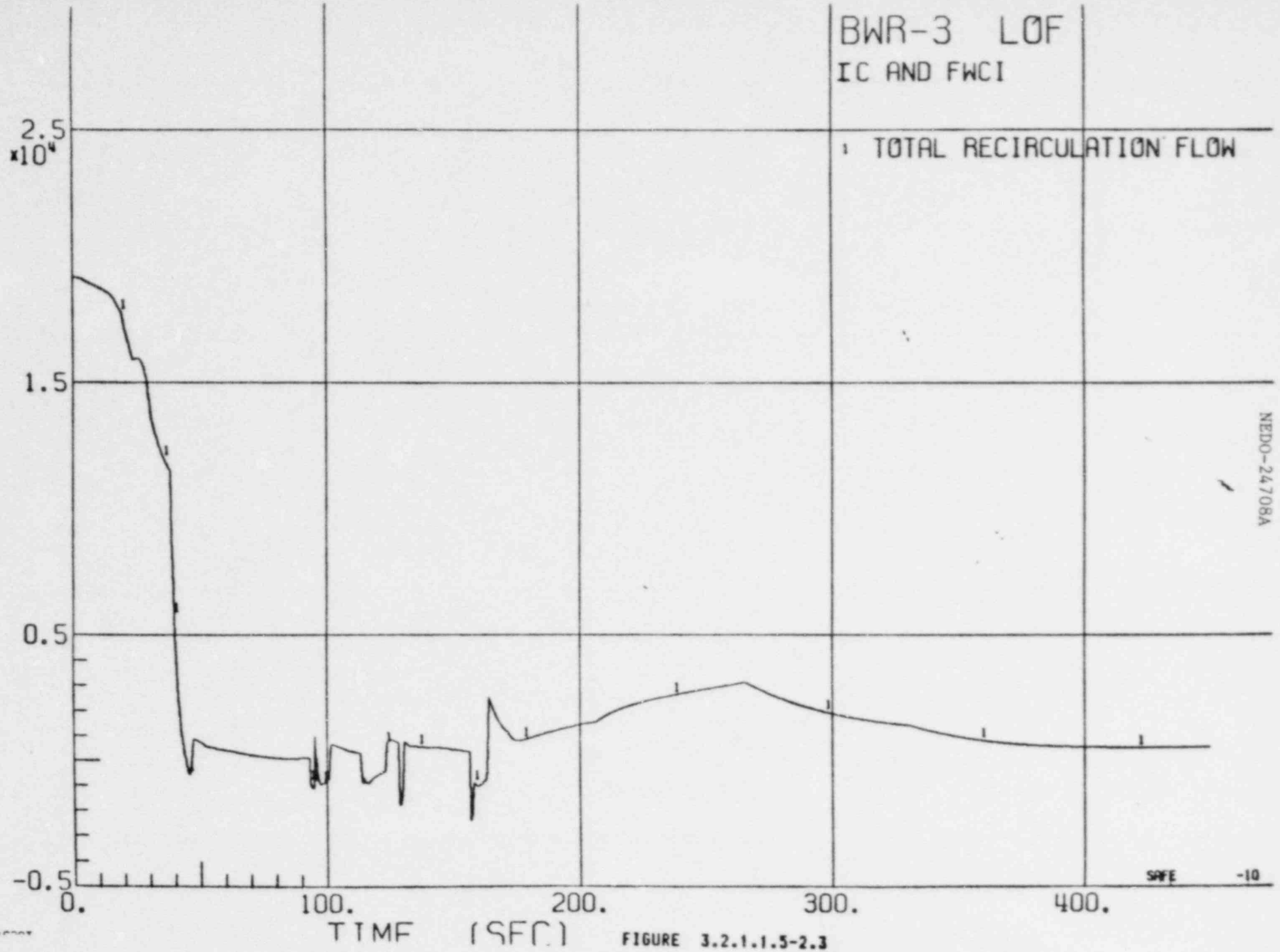


FIGURE 3.2.1.1.5-2.3

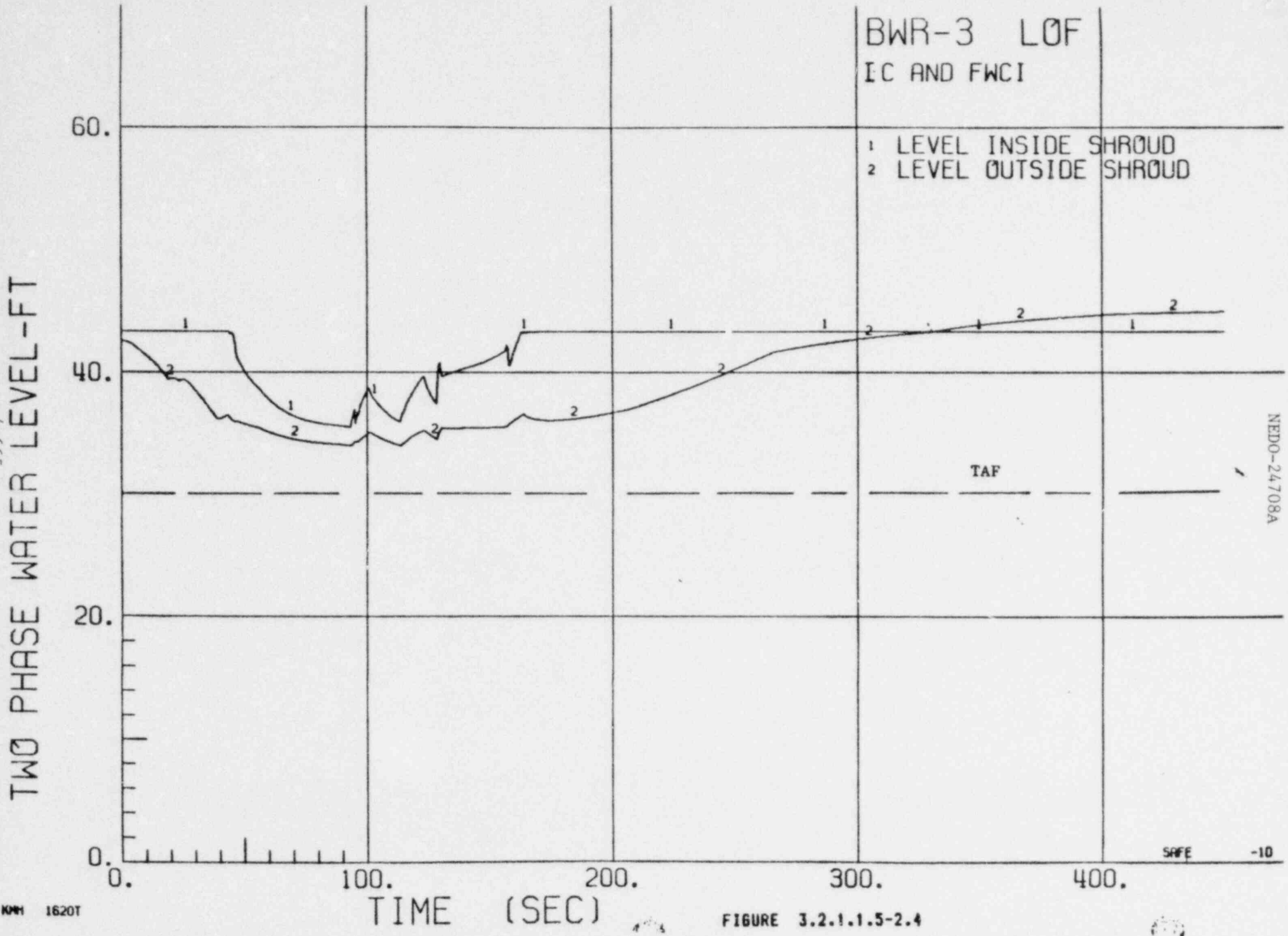


FIGURE 3.2.1.1.5-2.4

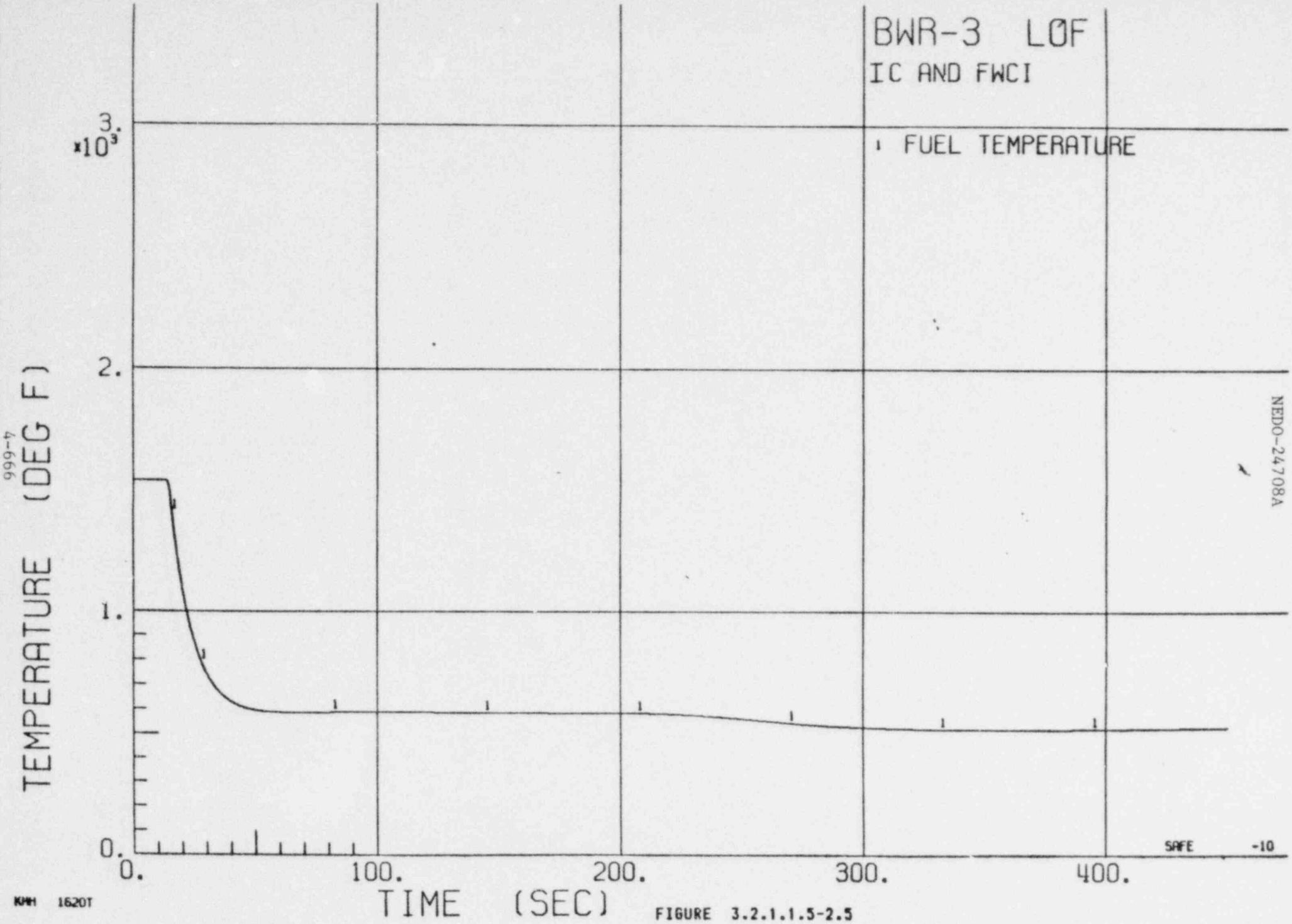


FIGURE 3.2.1.1.5-2.5

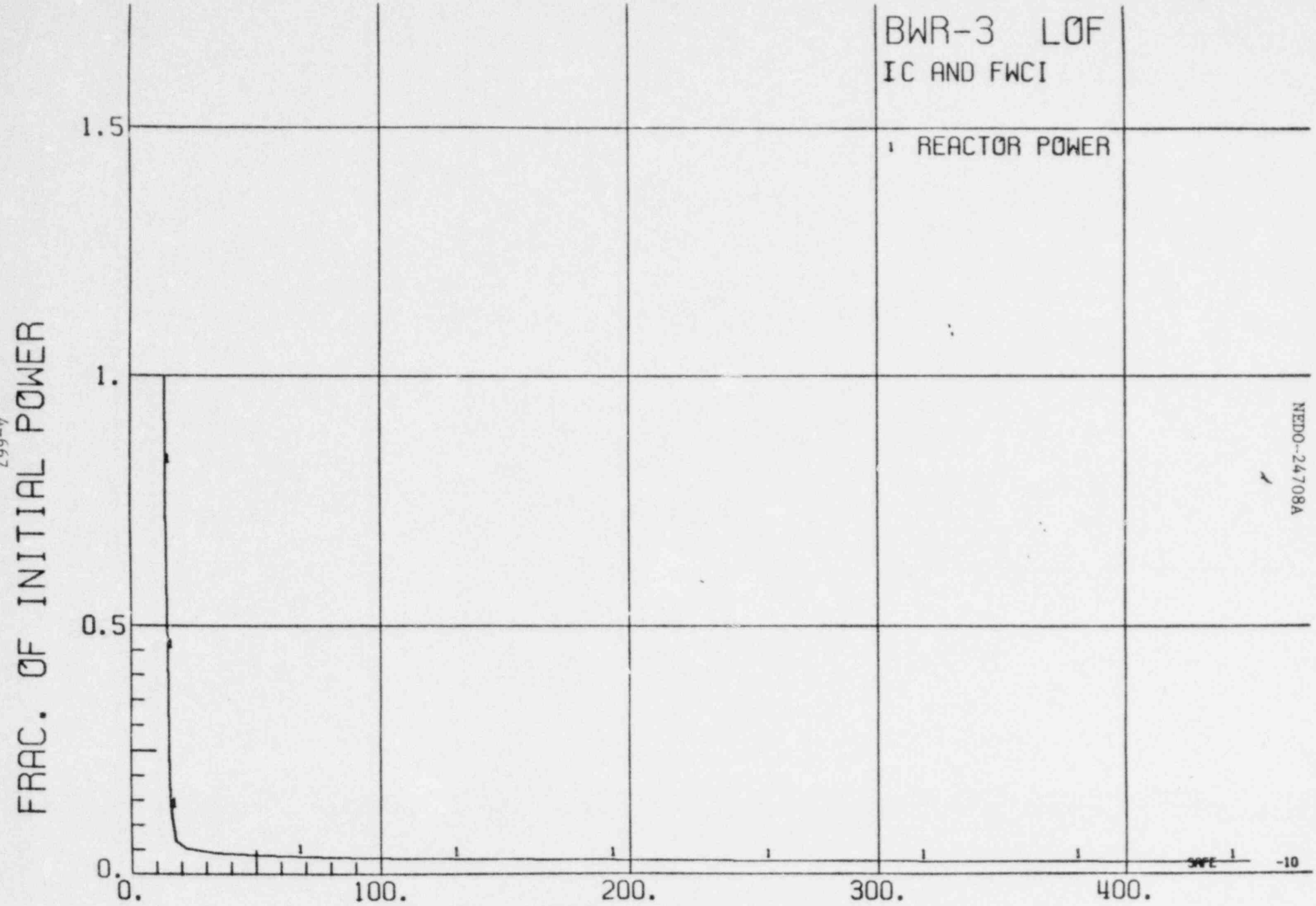


FIGURE 3.2.1.1.5-2.6

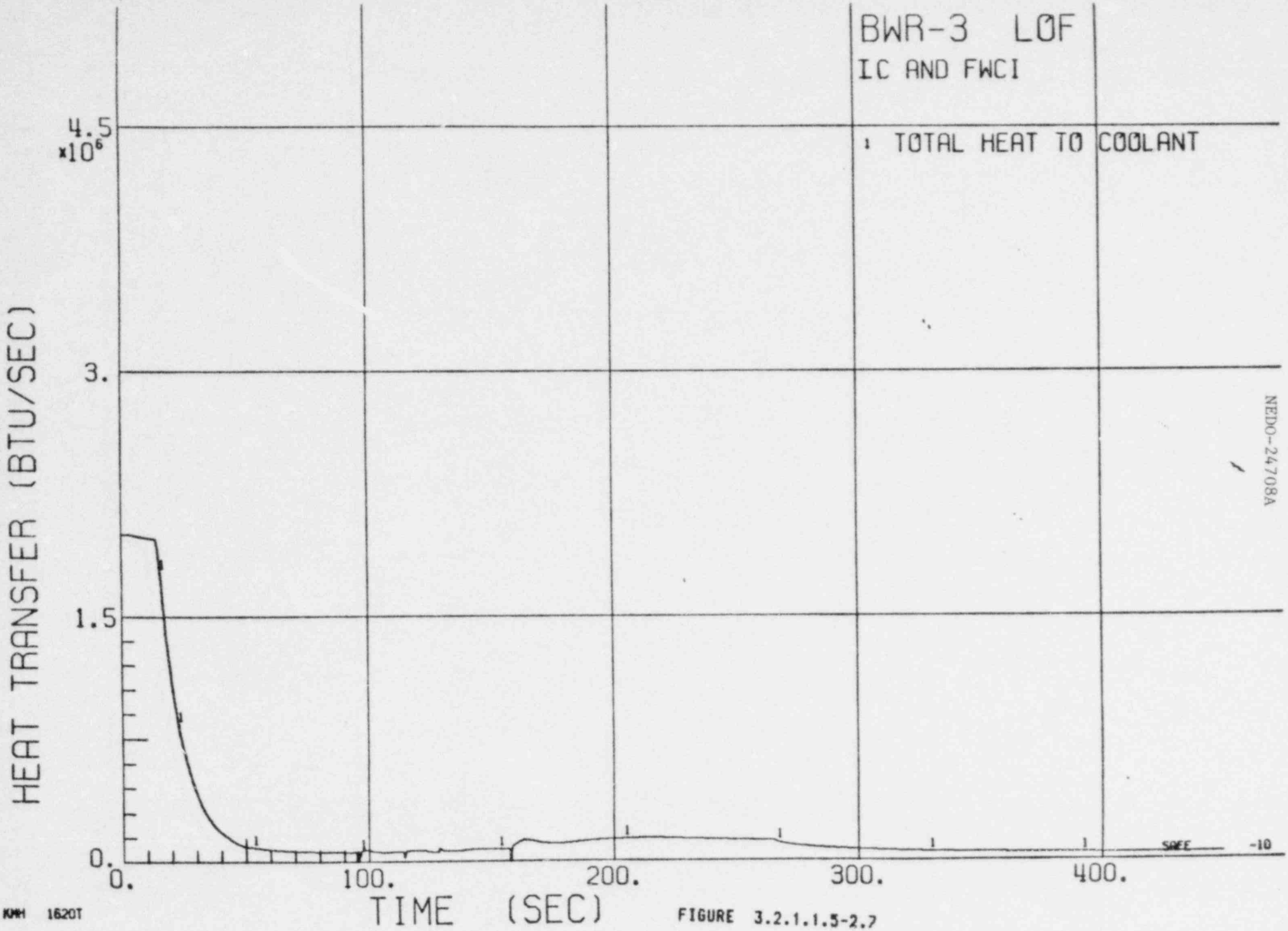


FIGURE 3.2.1.1.5-2.7

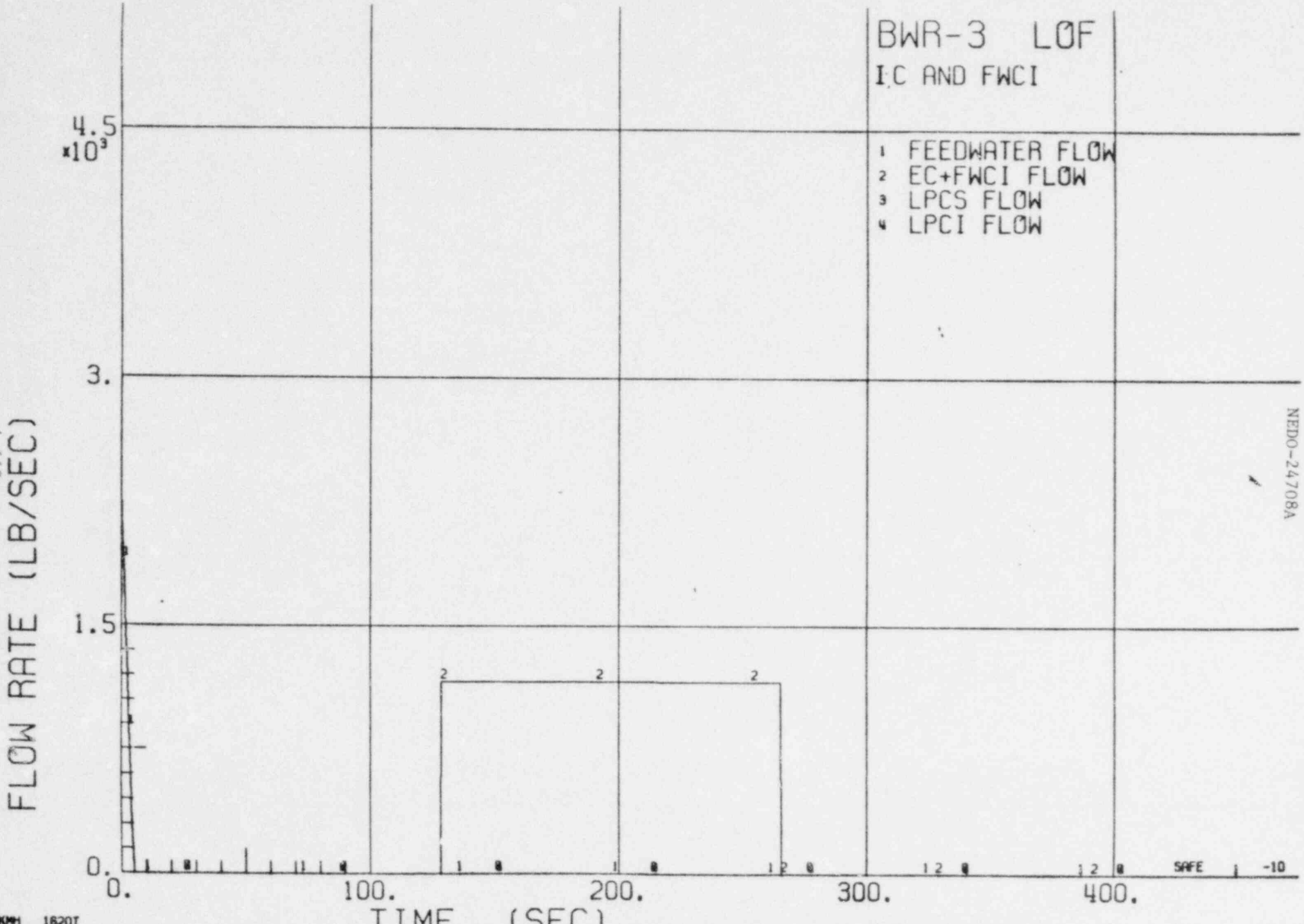


FIGURE 3.2.1.1.3-2.8

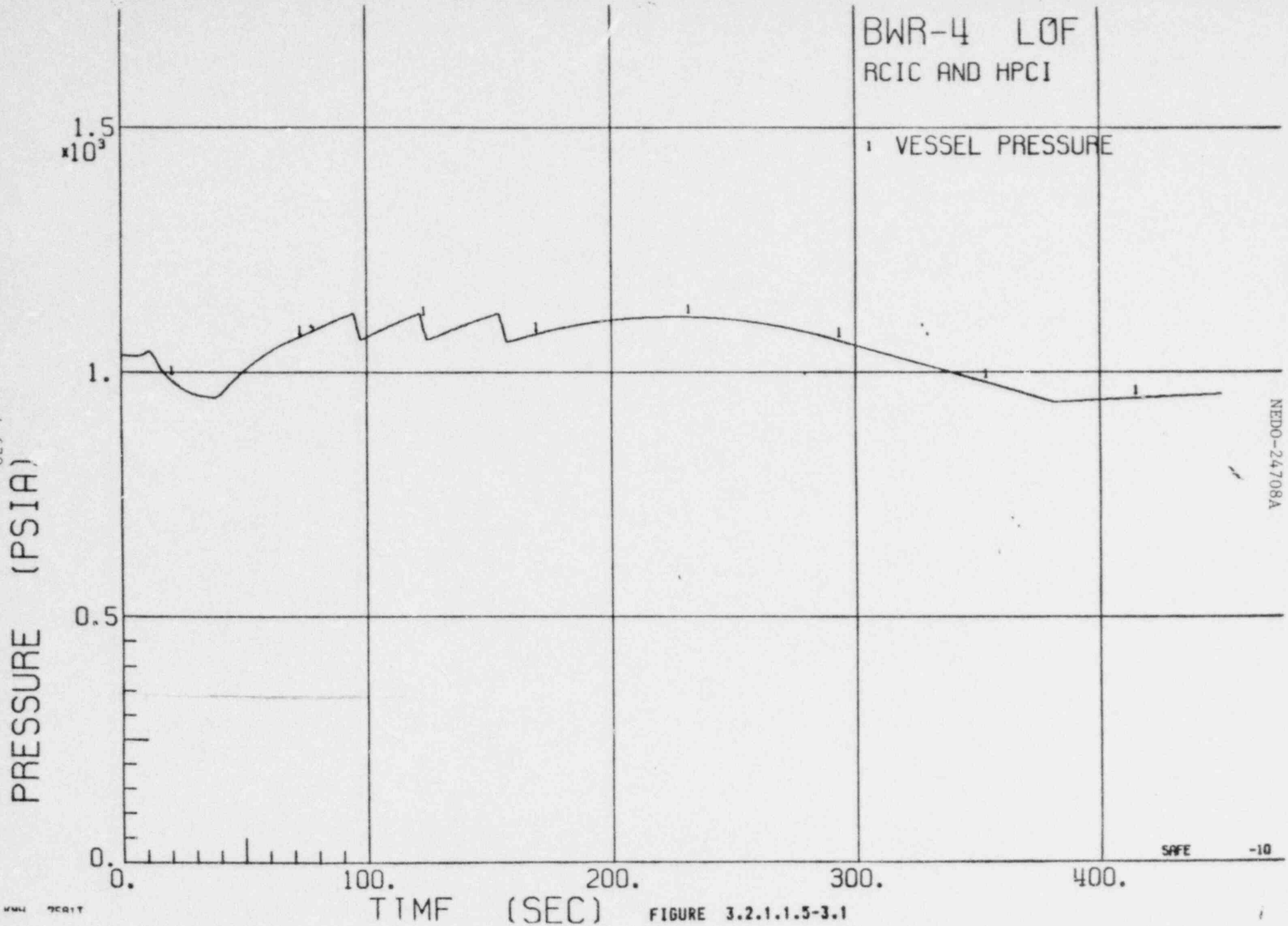
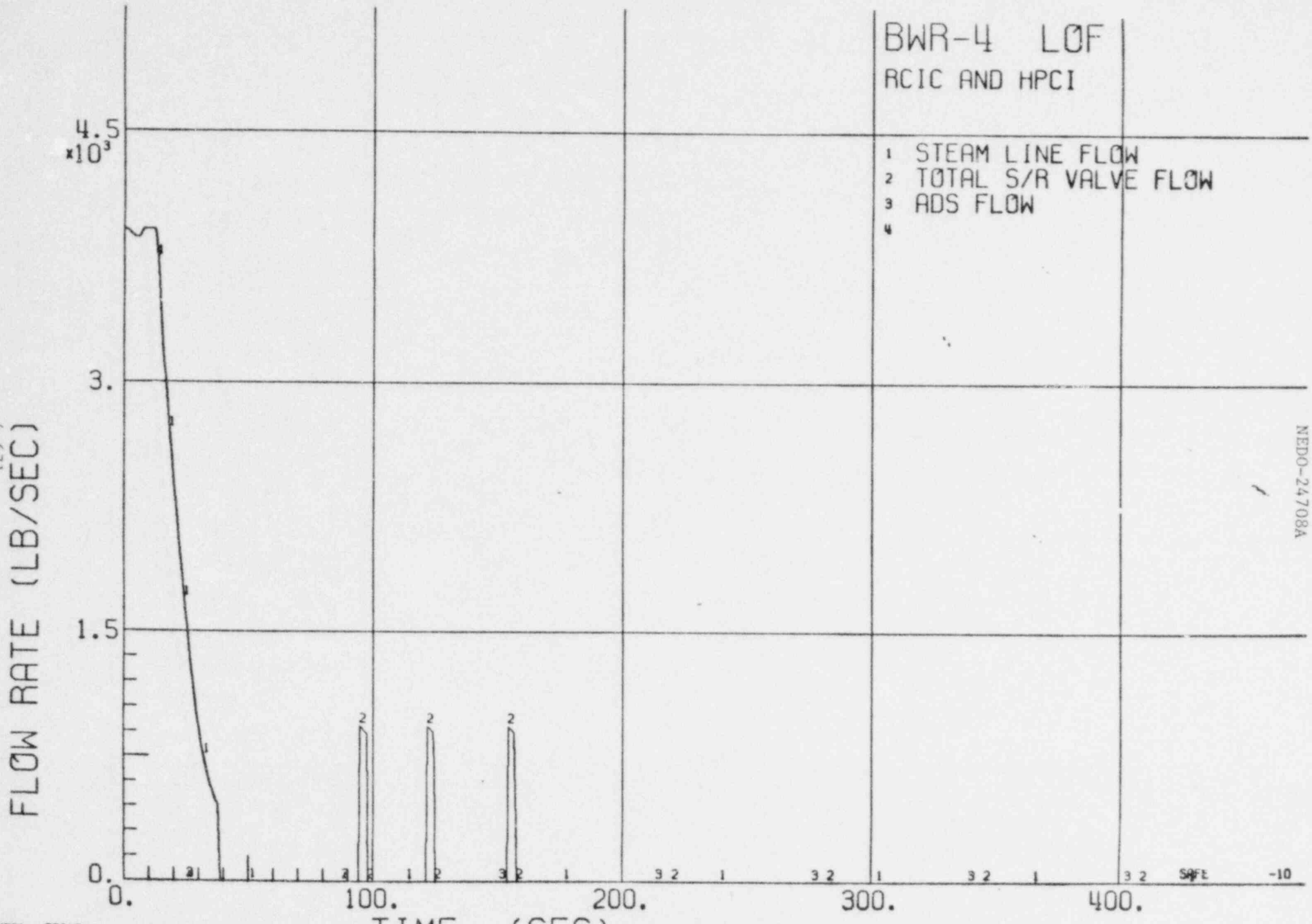


FIGURE 3.2.1.1.5-3.1



KMH 7581T

FIGURE 3.2.1.1.5-3.2

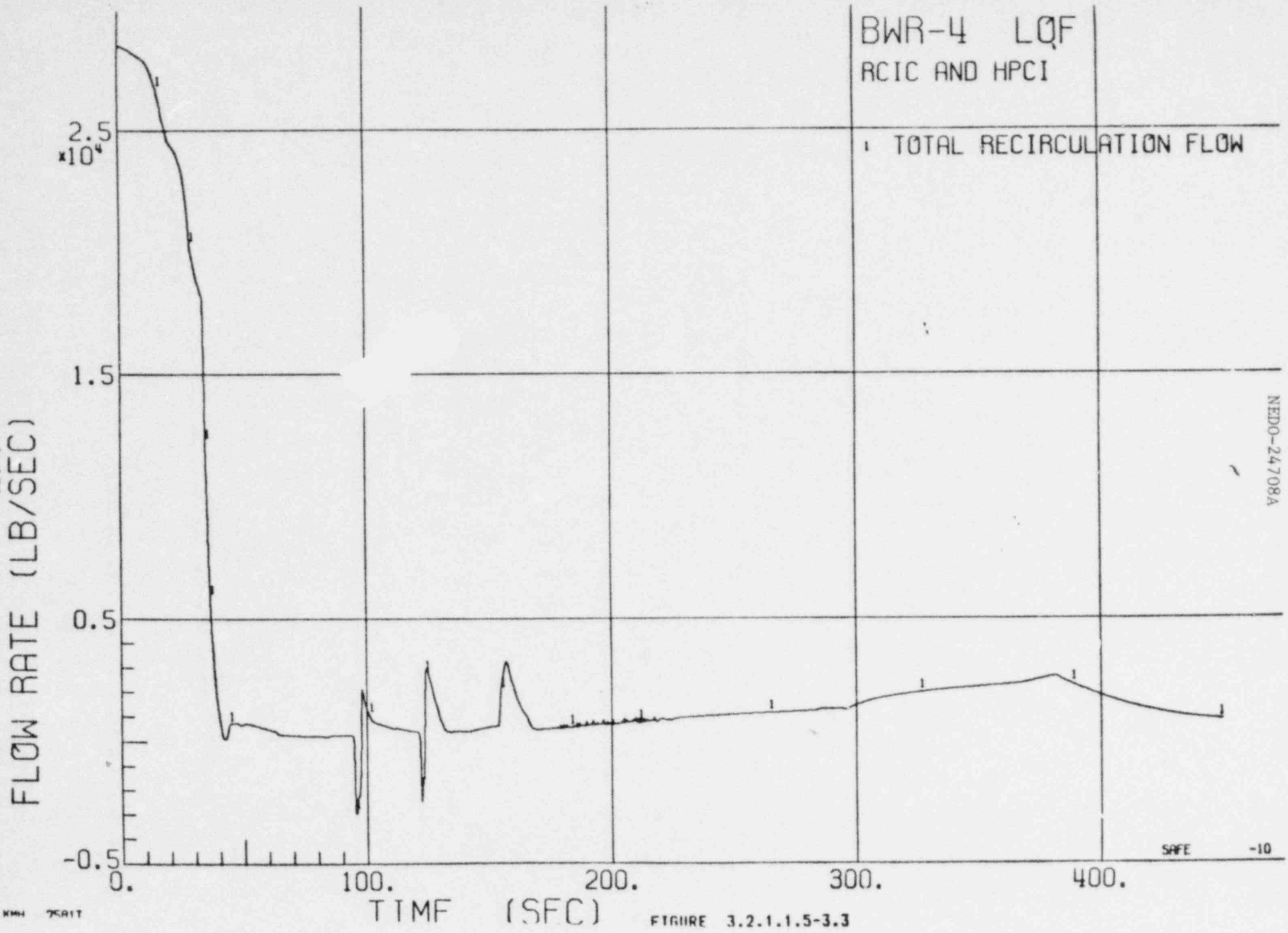


FIGURE 3.2.1.1.5-3.3

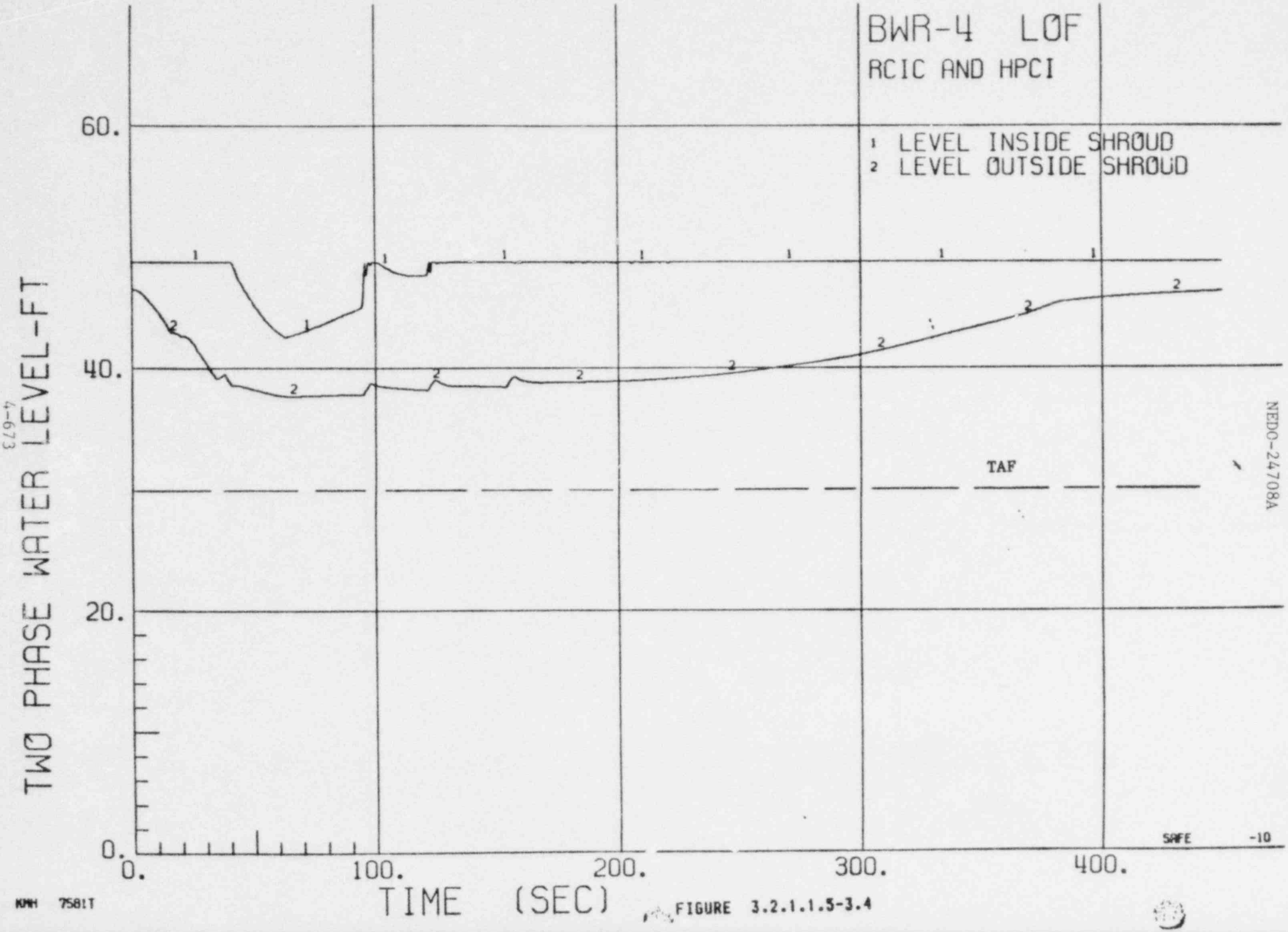


FIGURE 3.2.1.1.5-3.4

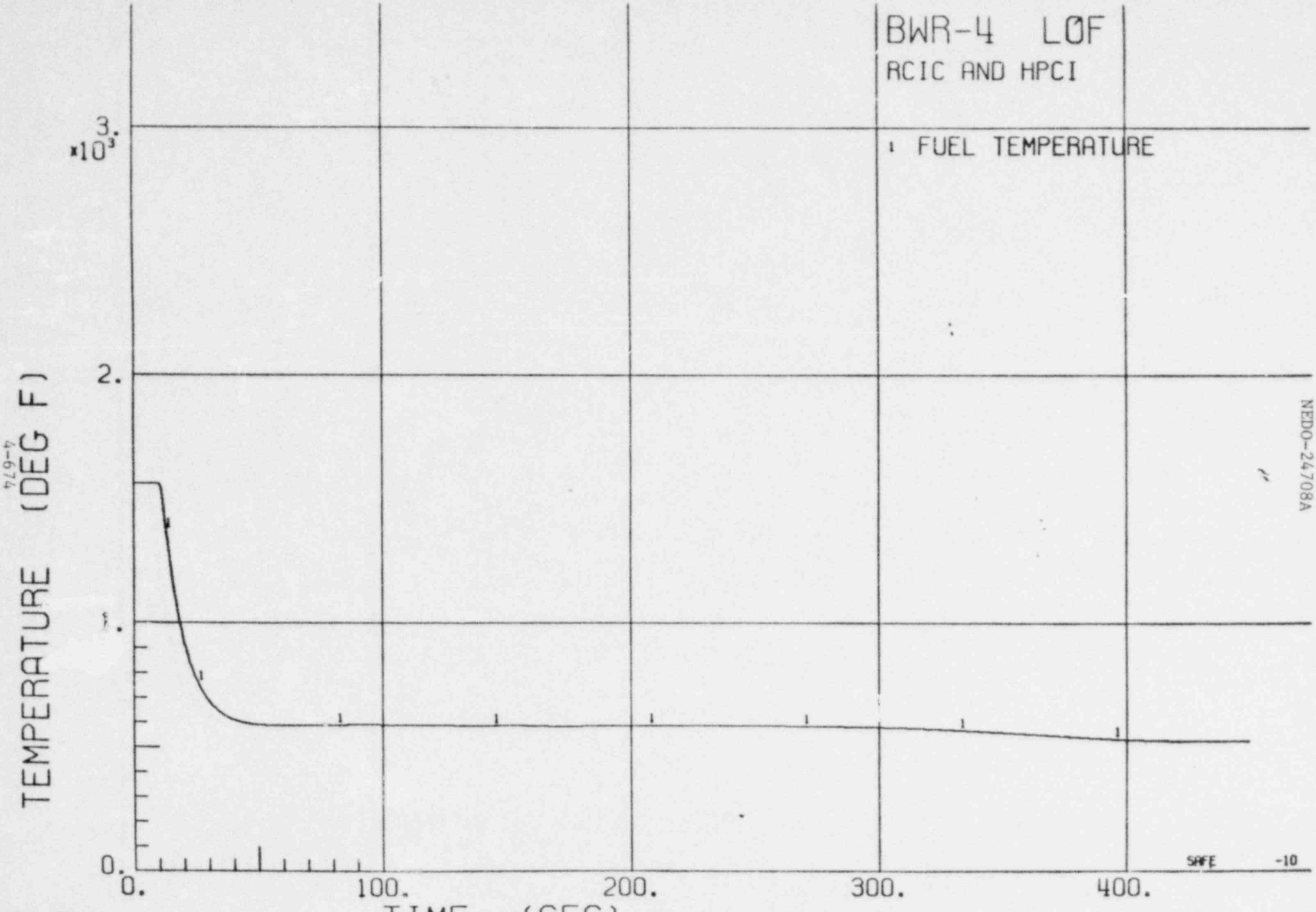


FIGURE 3.2.1.1.5-3.5

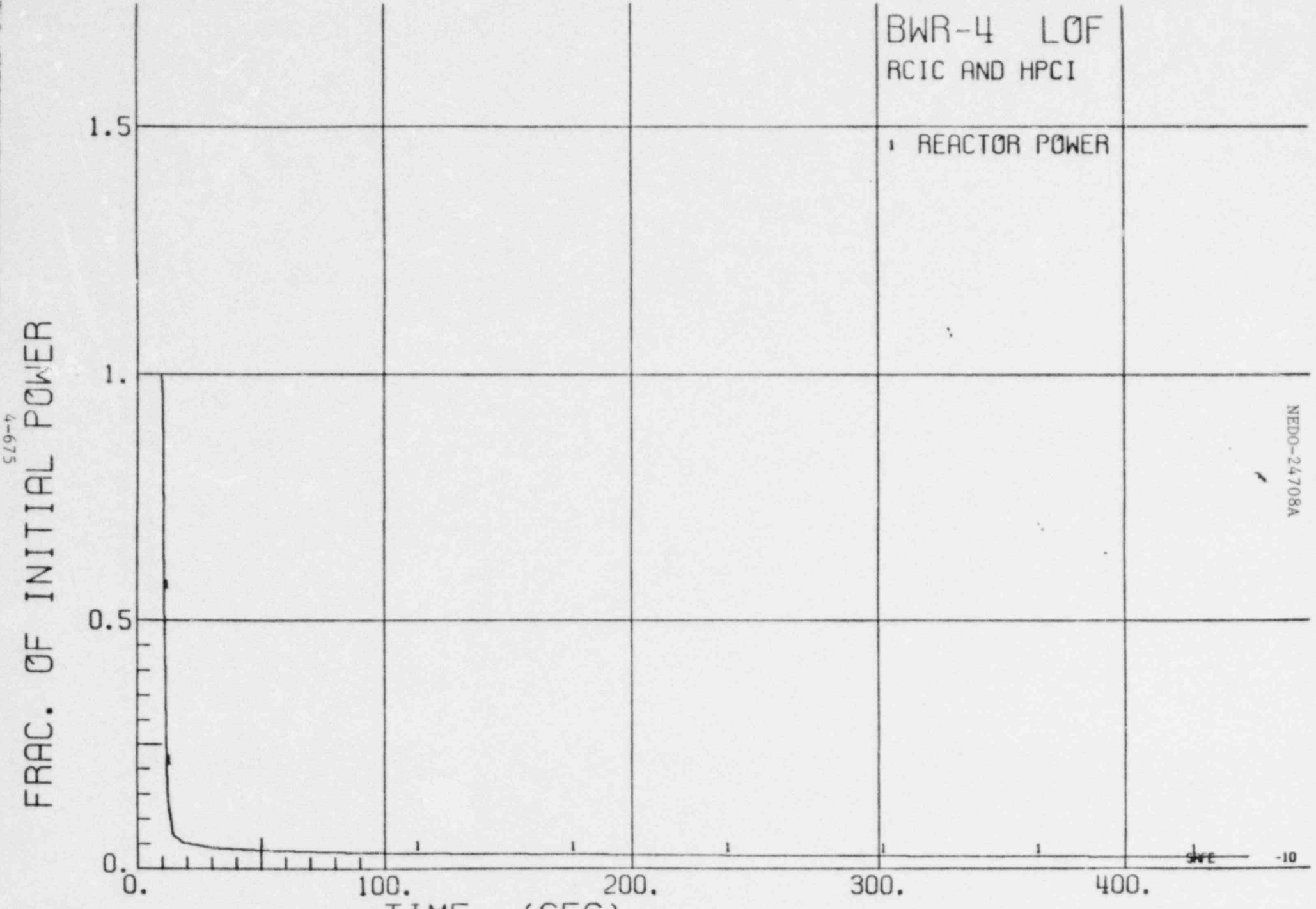


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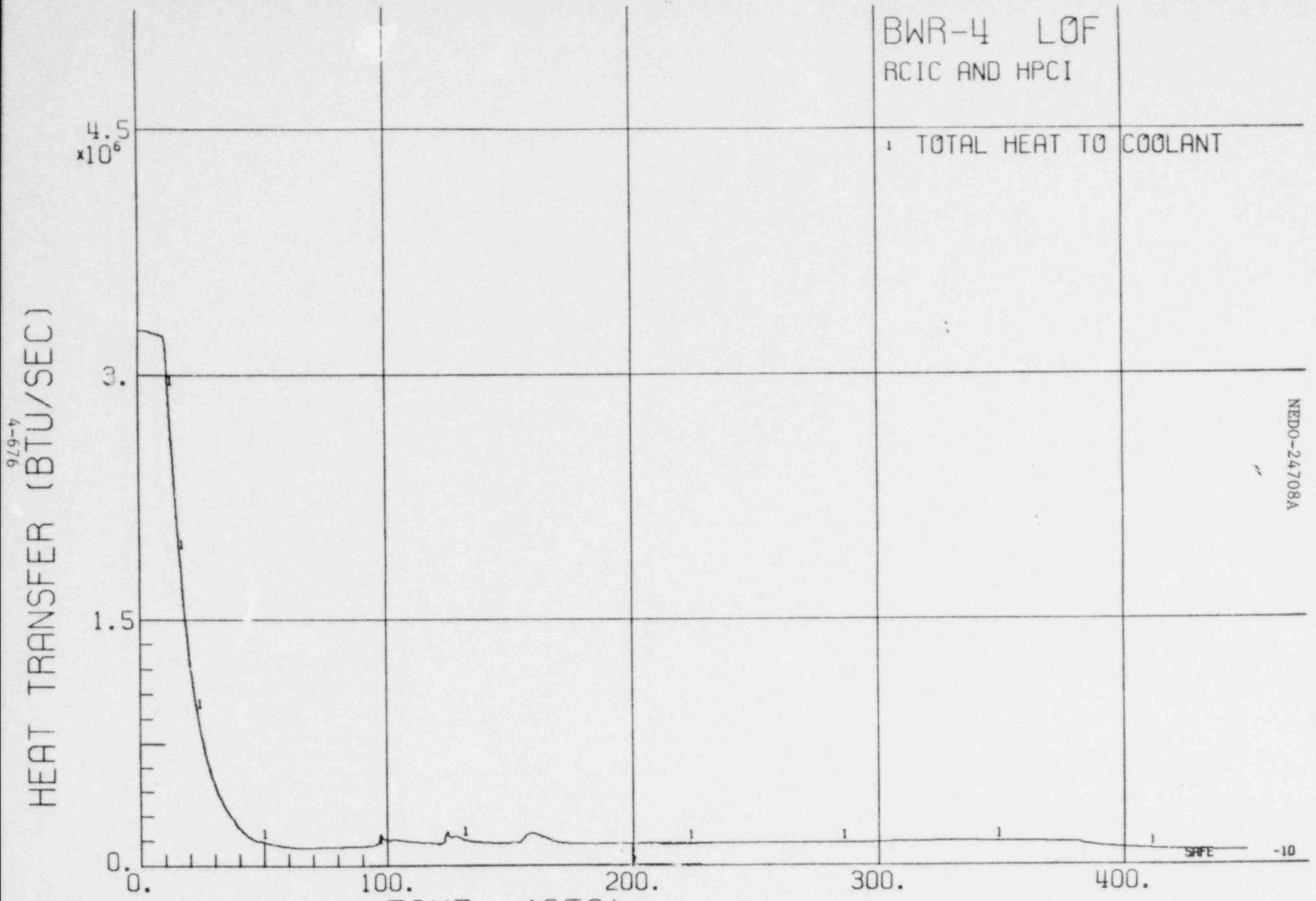
FIGURE 3.2.1.1.5-3.6



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KMH 7581T
120779 0355.6

FIGURE 3.2.1.1.5-3.7

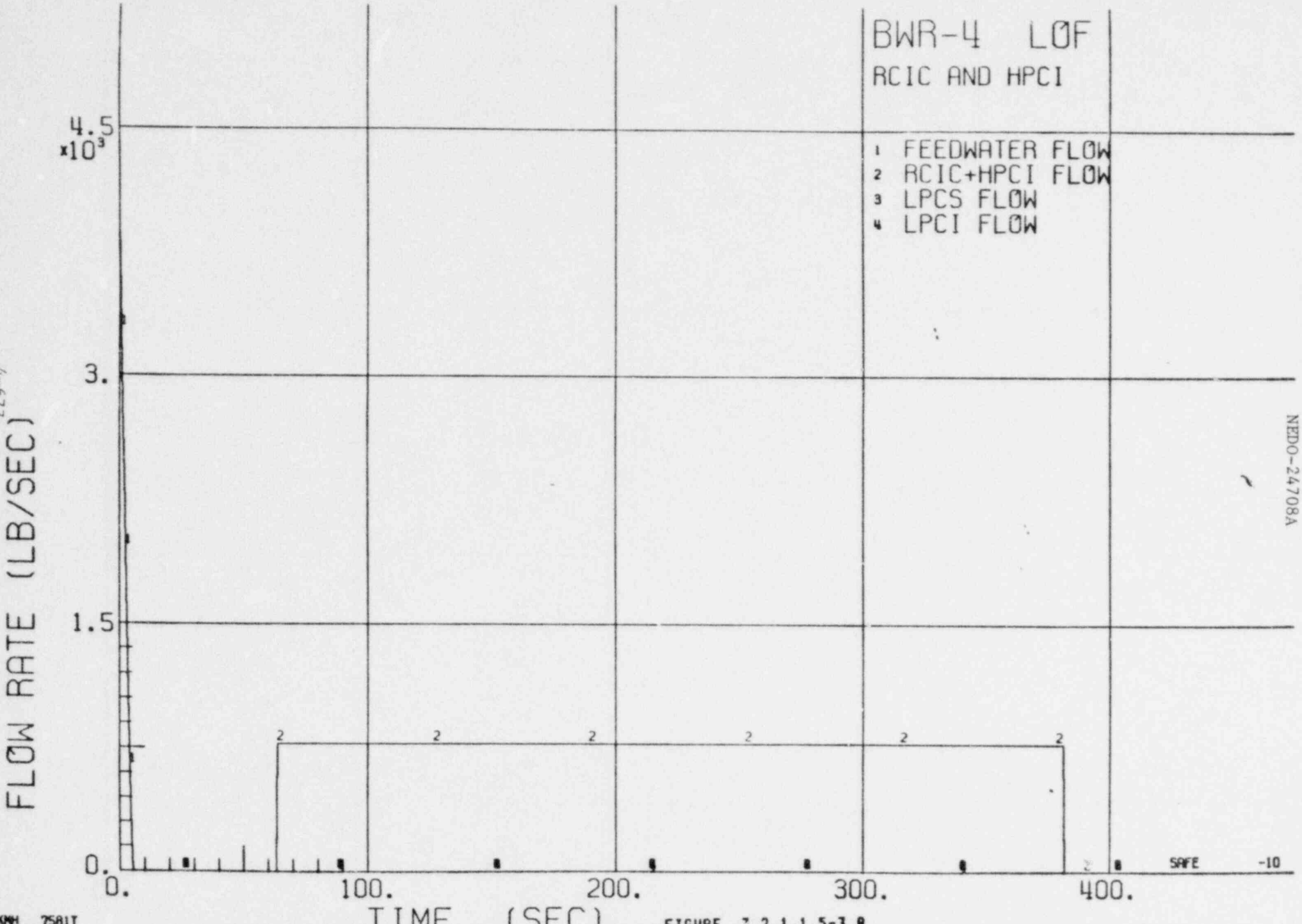

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FIGURE 3.2.1.1.5-3.8

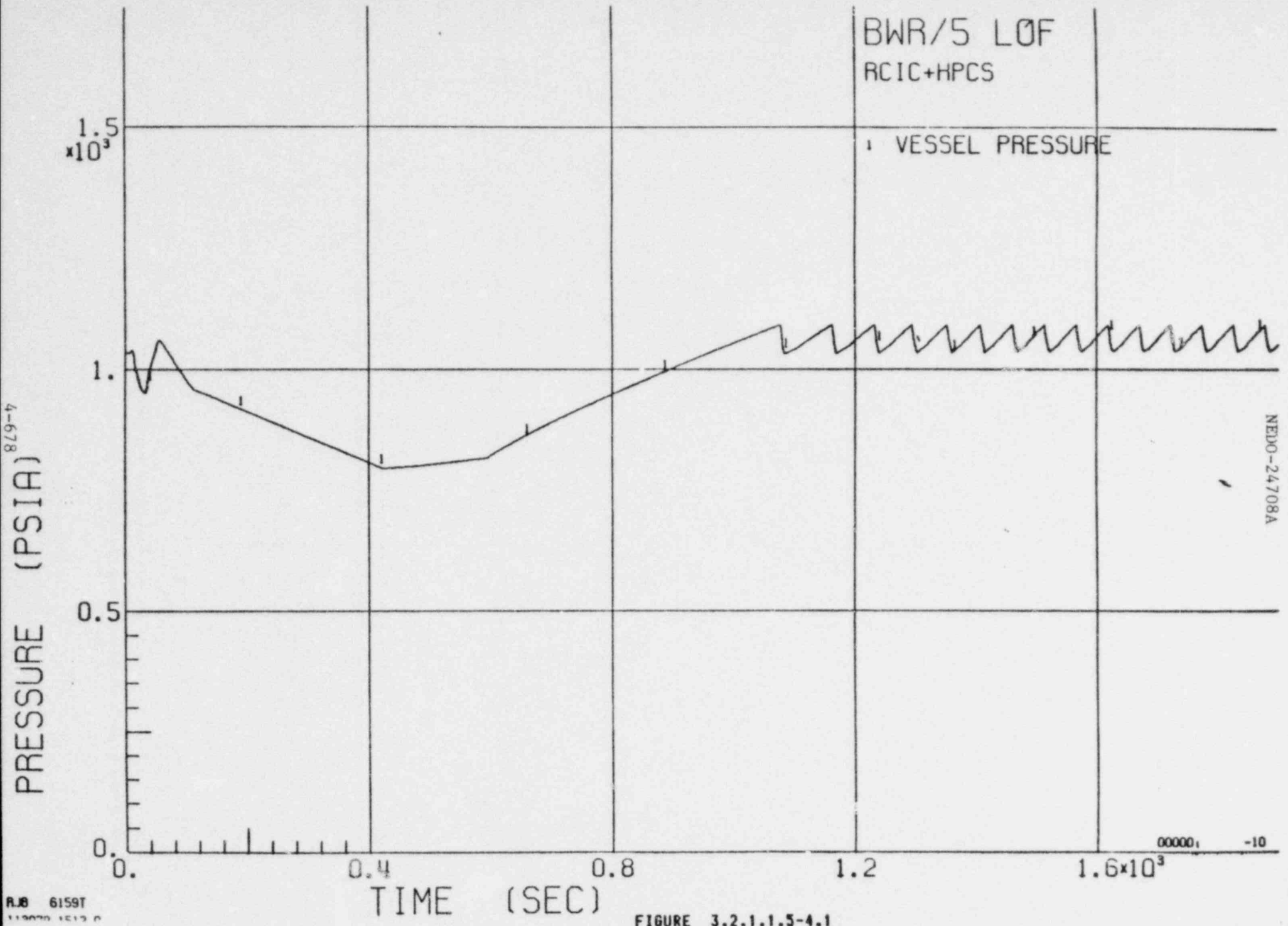


FIGURE 3.2.1.1.5-4.1

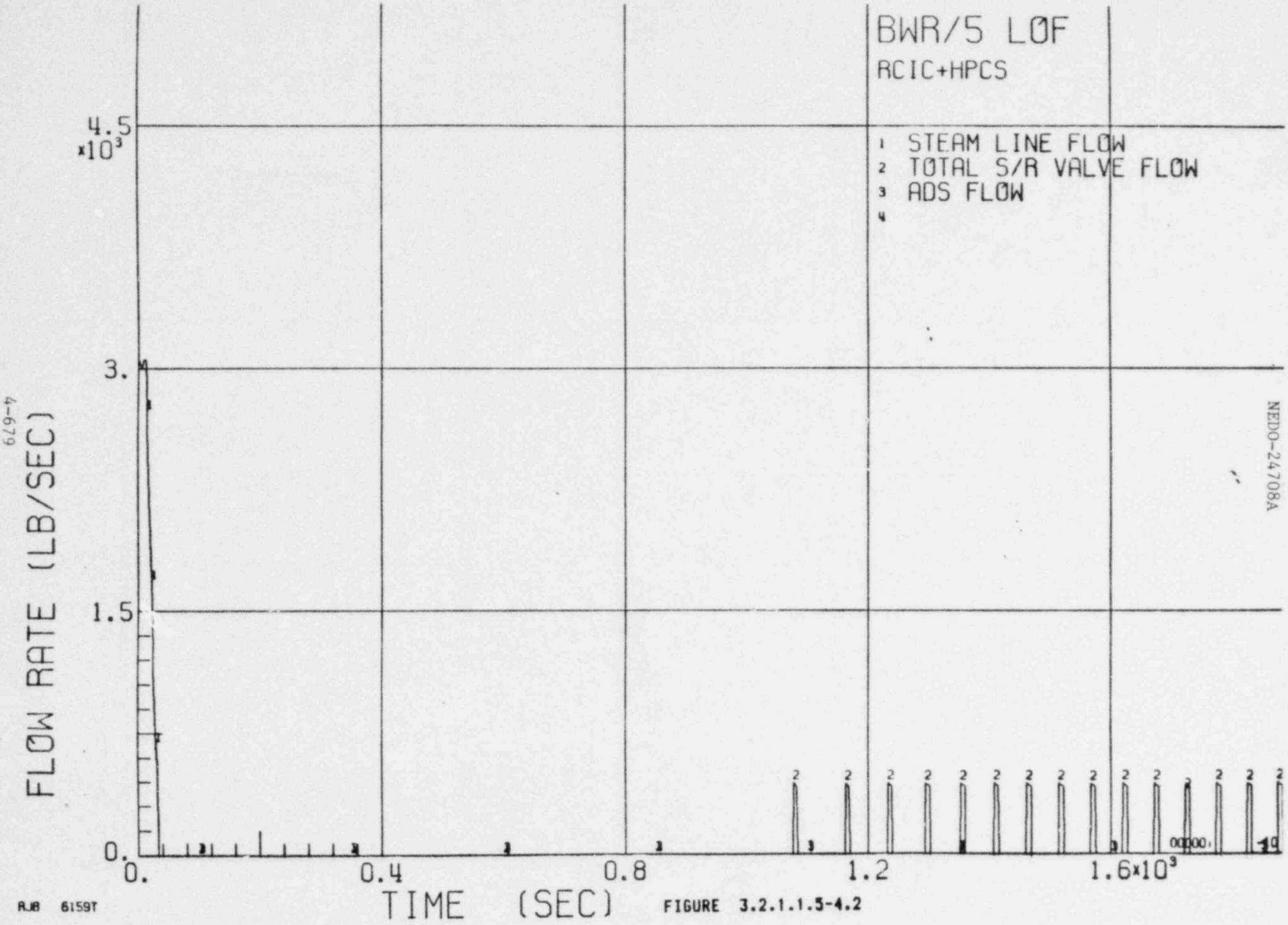


FIGURE 3.2.1.1.5-4.2

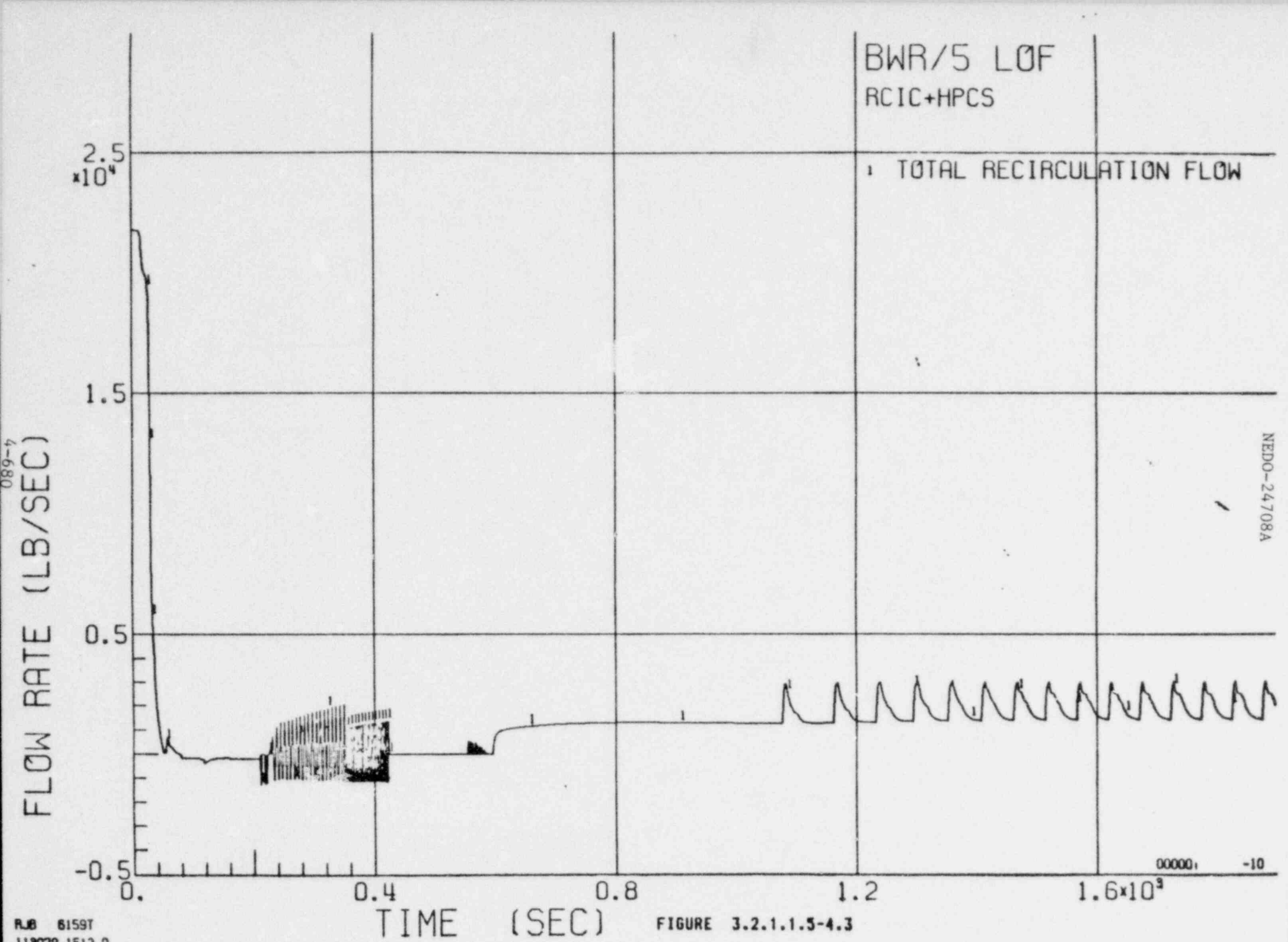
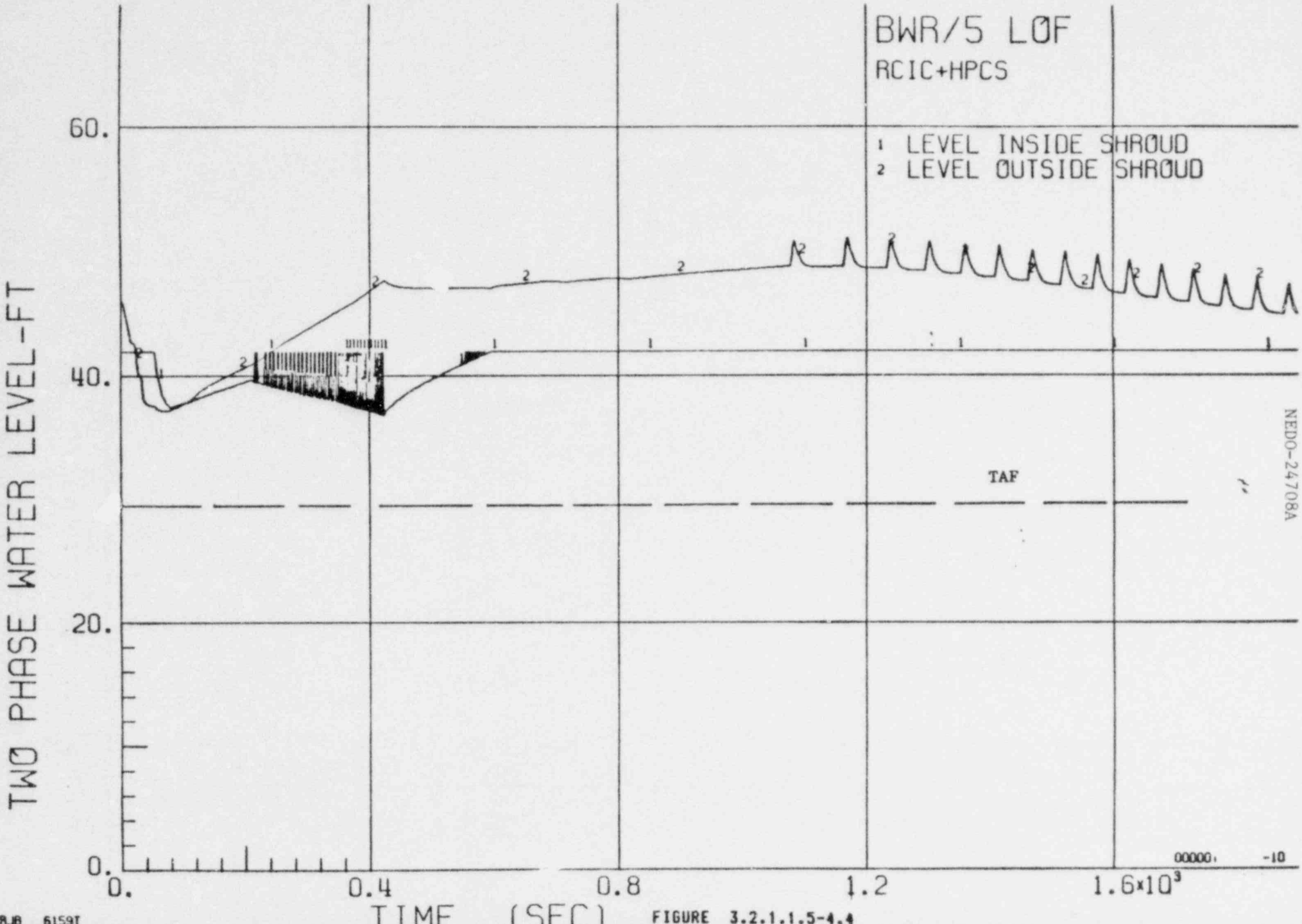


FIGURE 3.2.1.1.5-4.3



4-681

RJB 61597

FIGURE 3.2.1.1.5-4.4

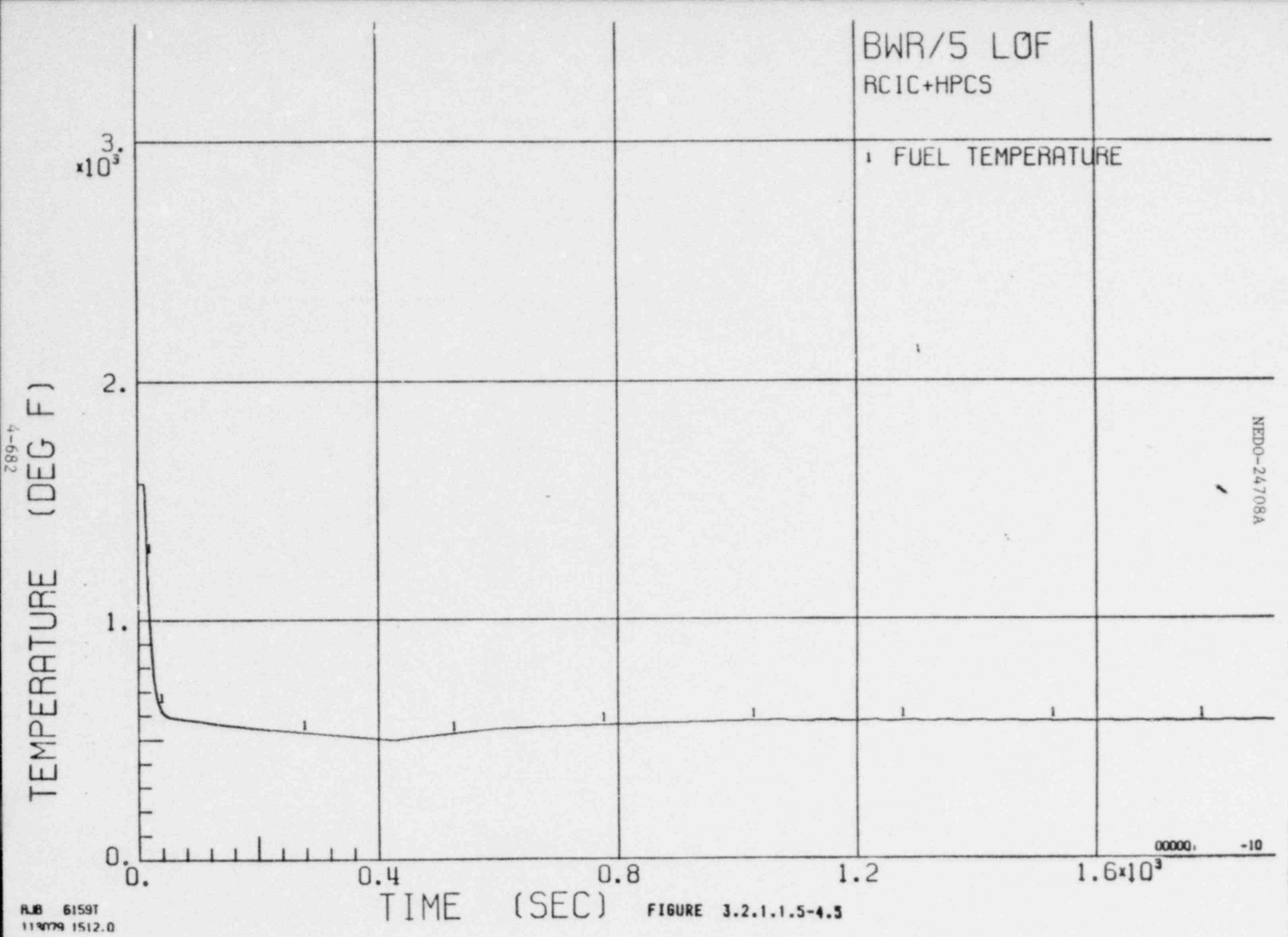
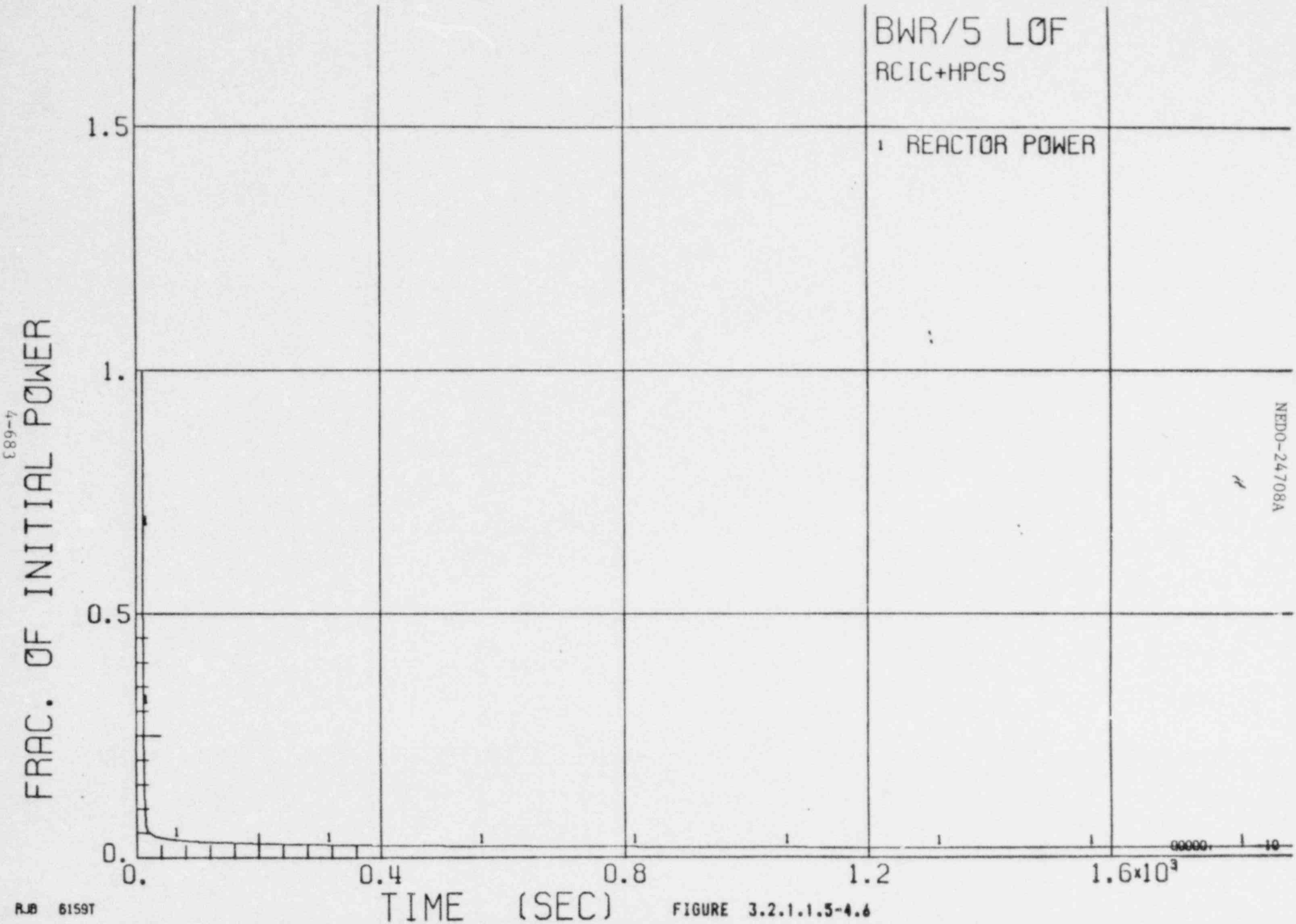
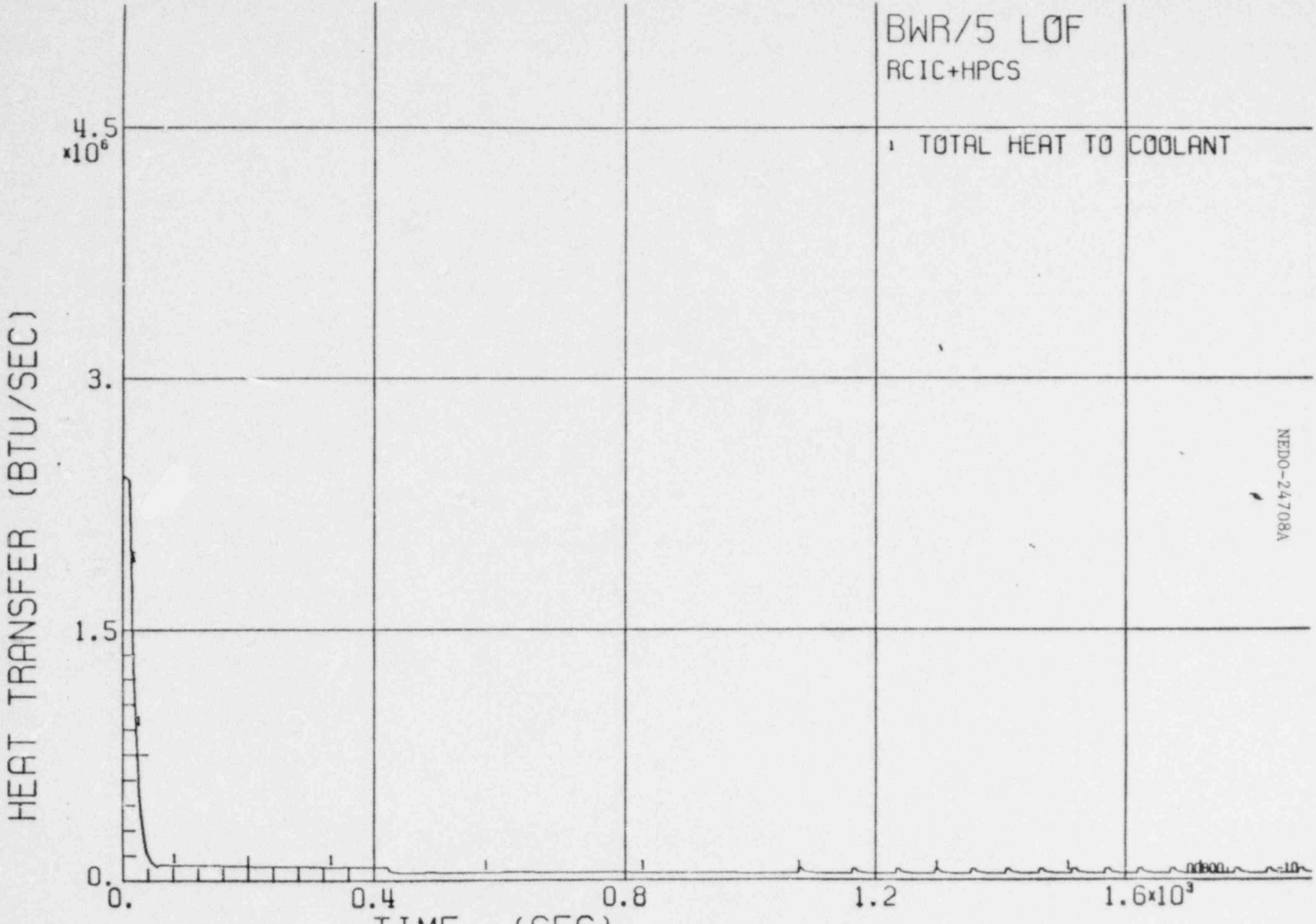


FIGURE 3.2.1.1.5-4.5



RJB 6159T

FIGURE 3.2.1.1.5-4.6



BJB 6159T
113079 1518.2

FIGURE 3.2.1.1.3-4.7

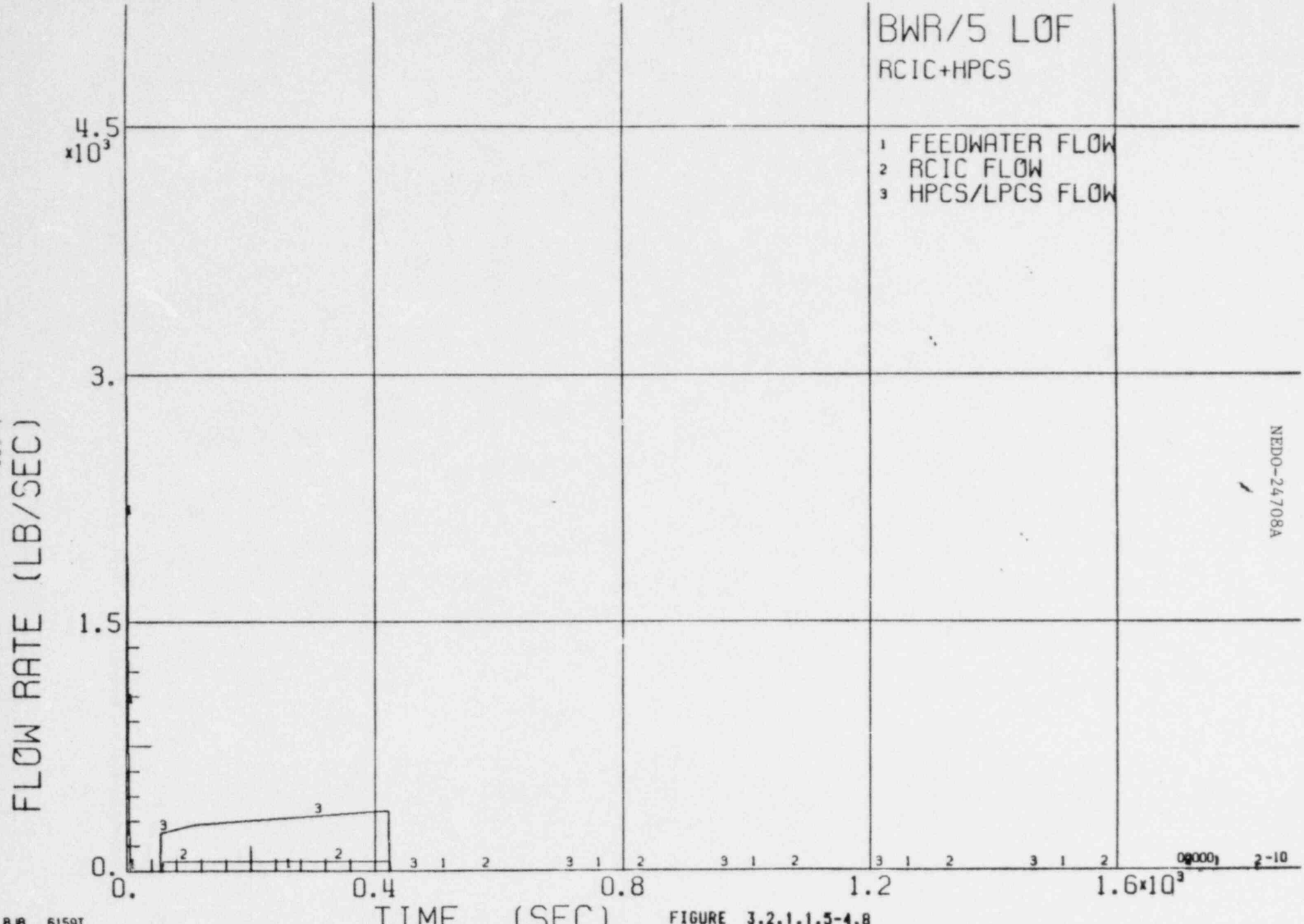


FIGURE 3.2.1.1.5-4.8

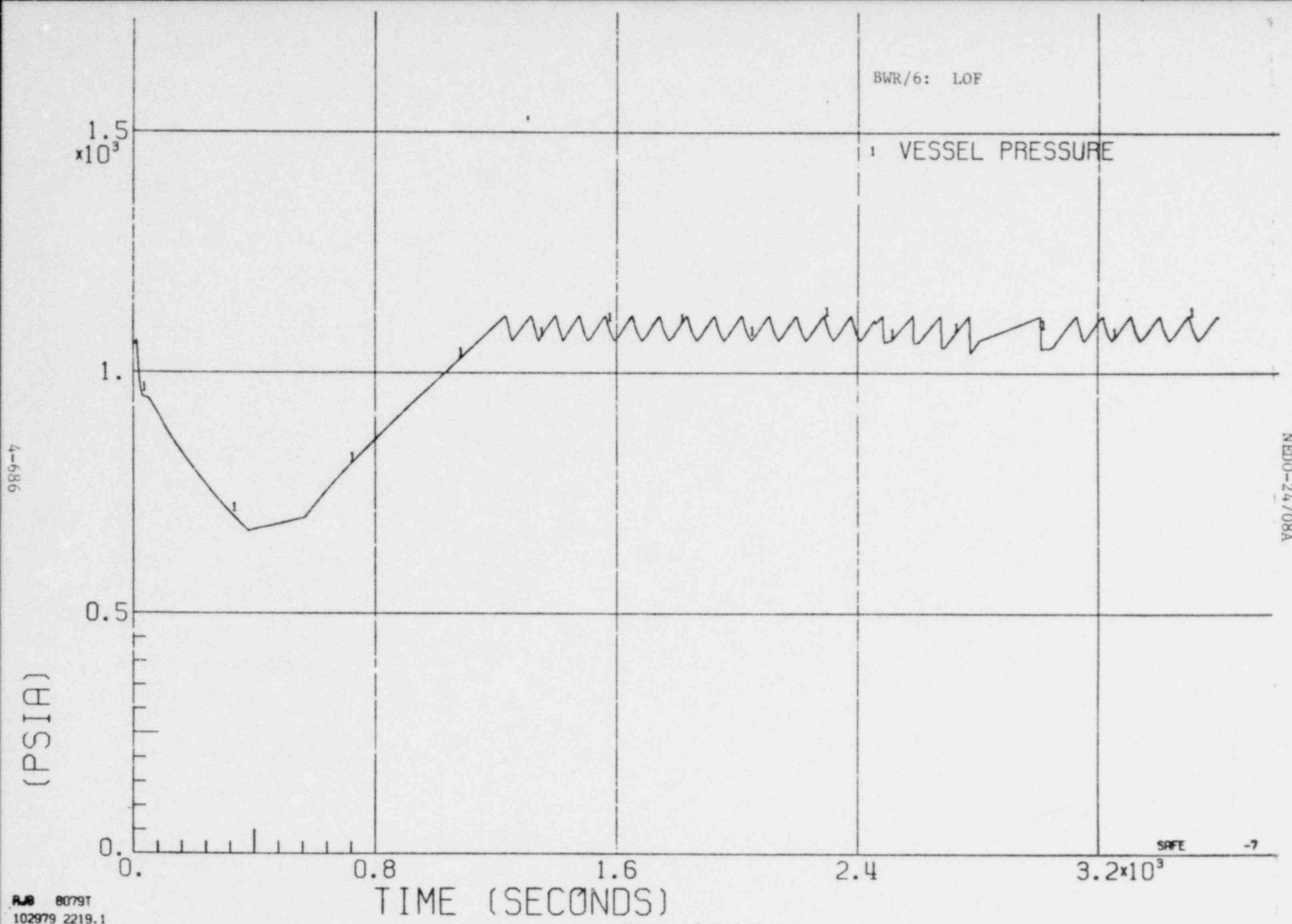


Figure 3.2.1.1.5-4A.1

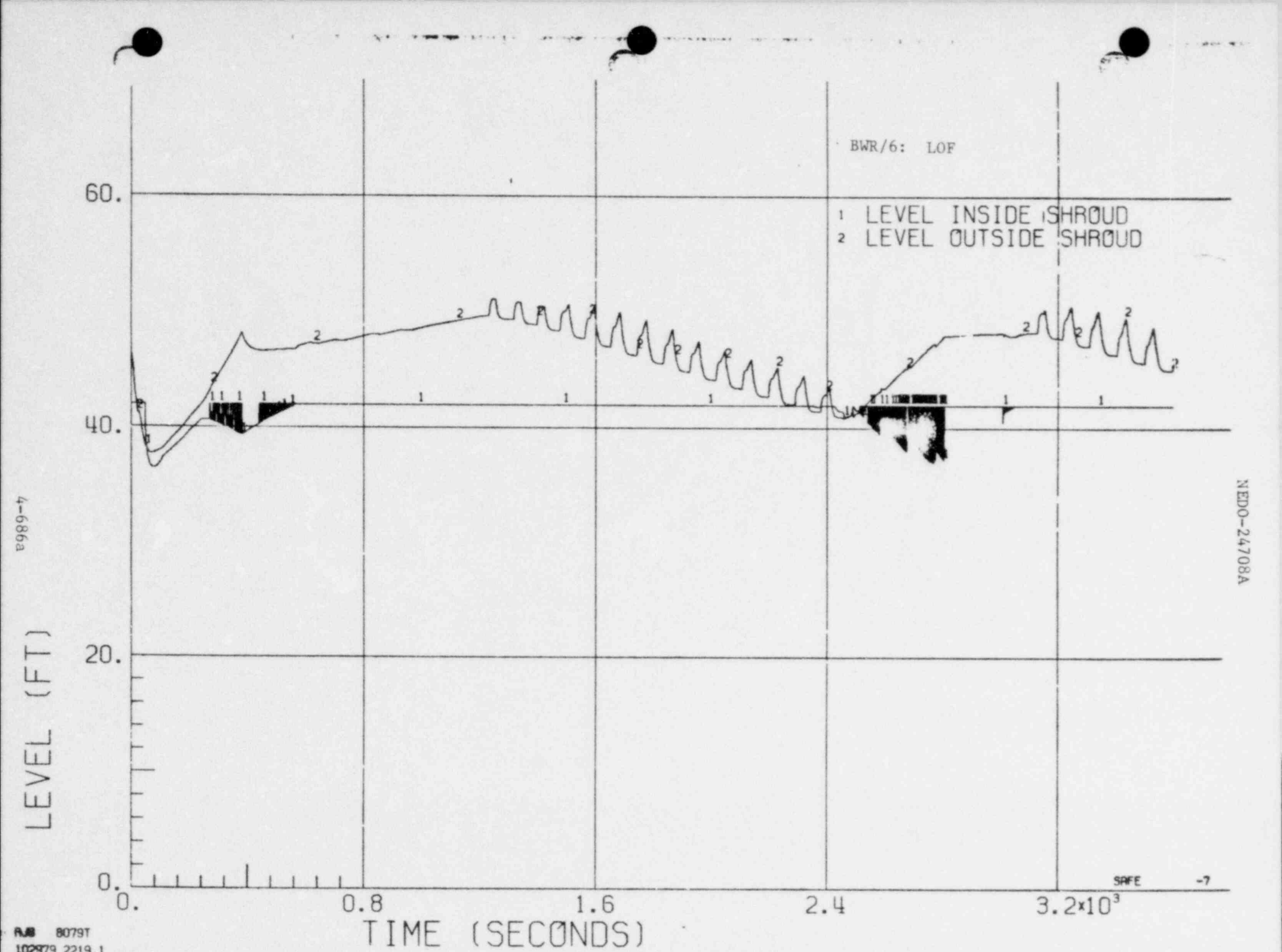


Figure 3.2.1.1.5-4A.2

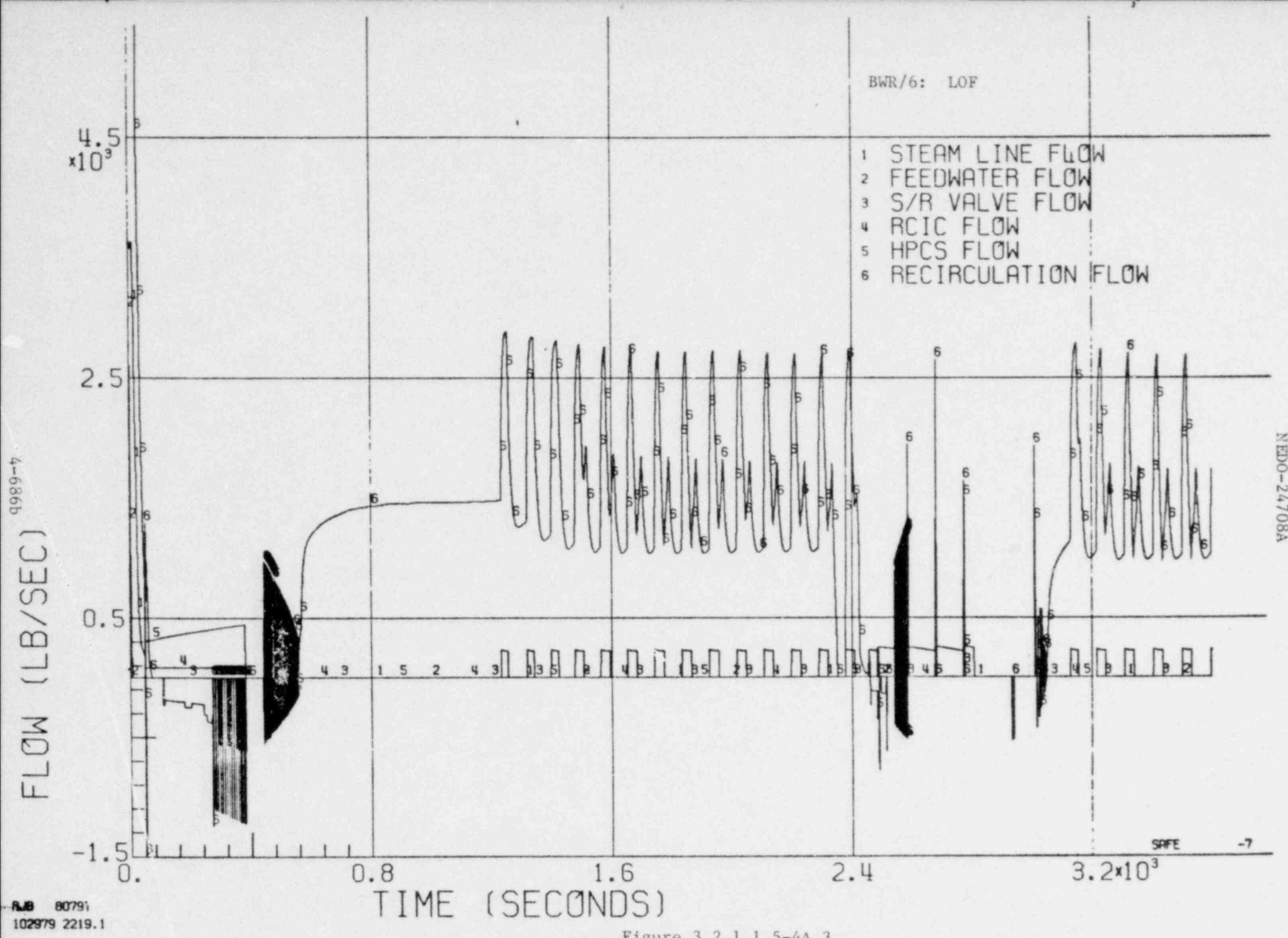


Figure 3.2.1.1.5-4A.3

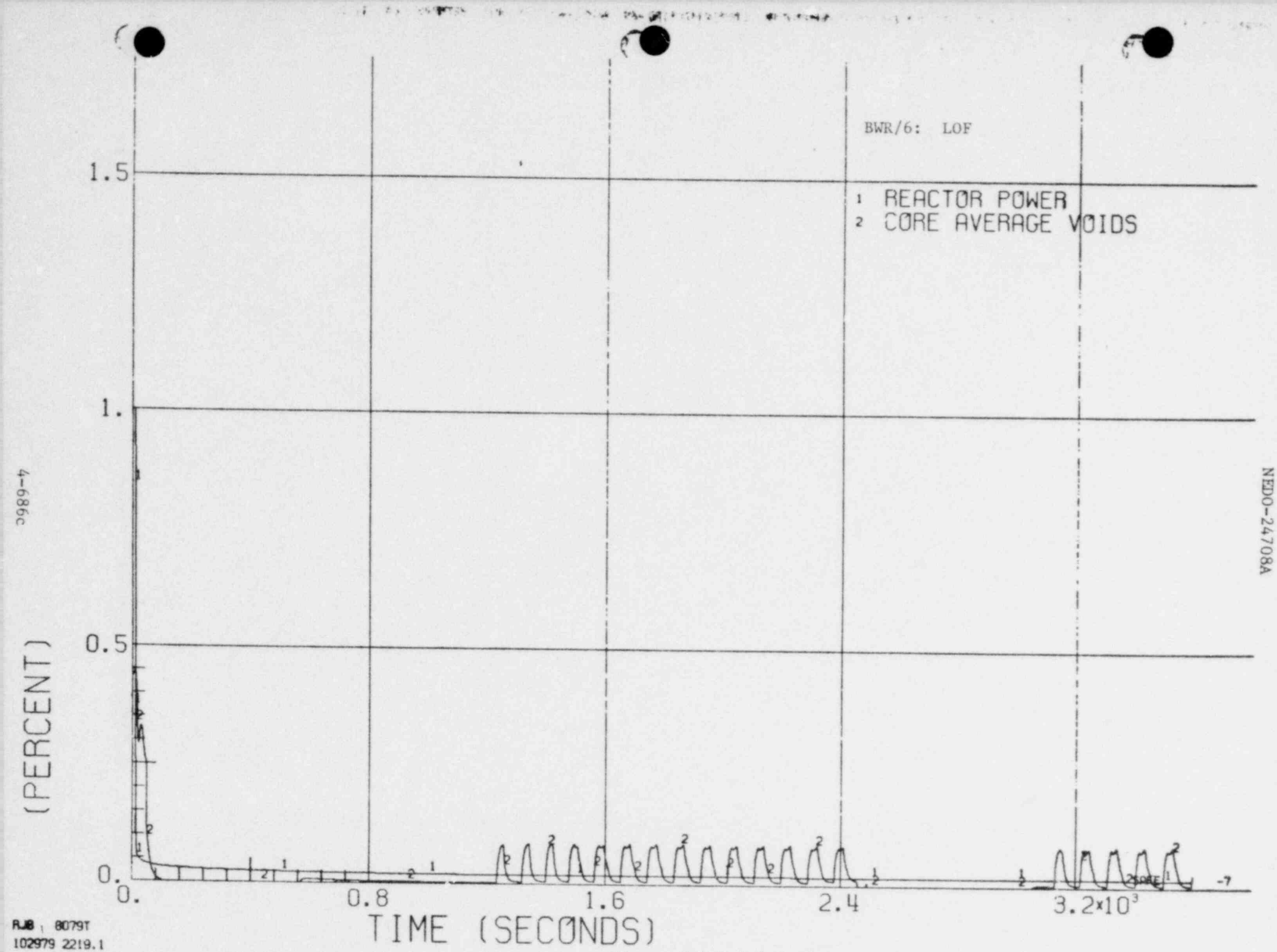


Figure 3.2.1.1.5-4A.4

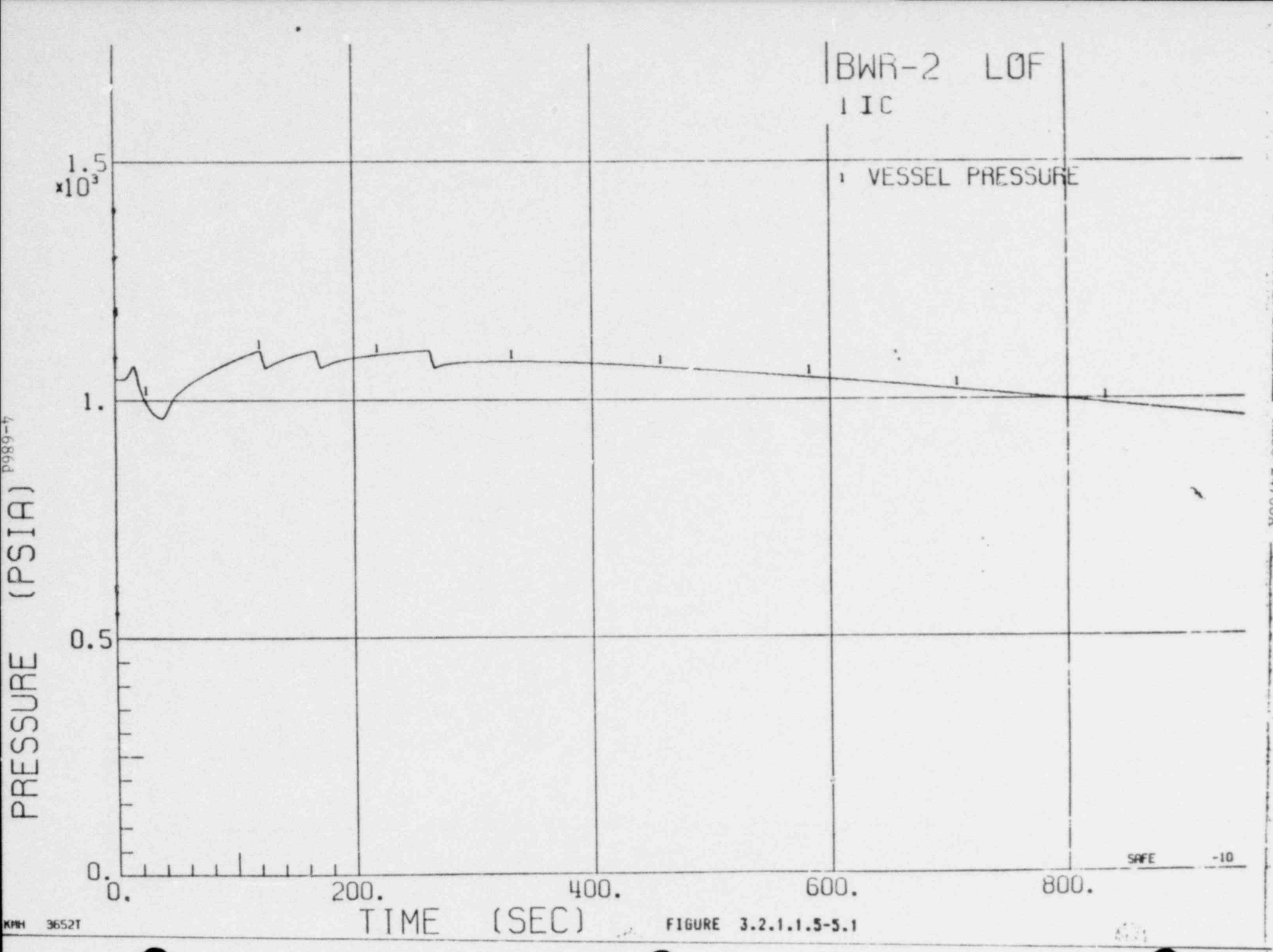


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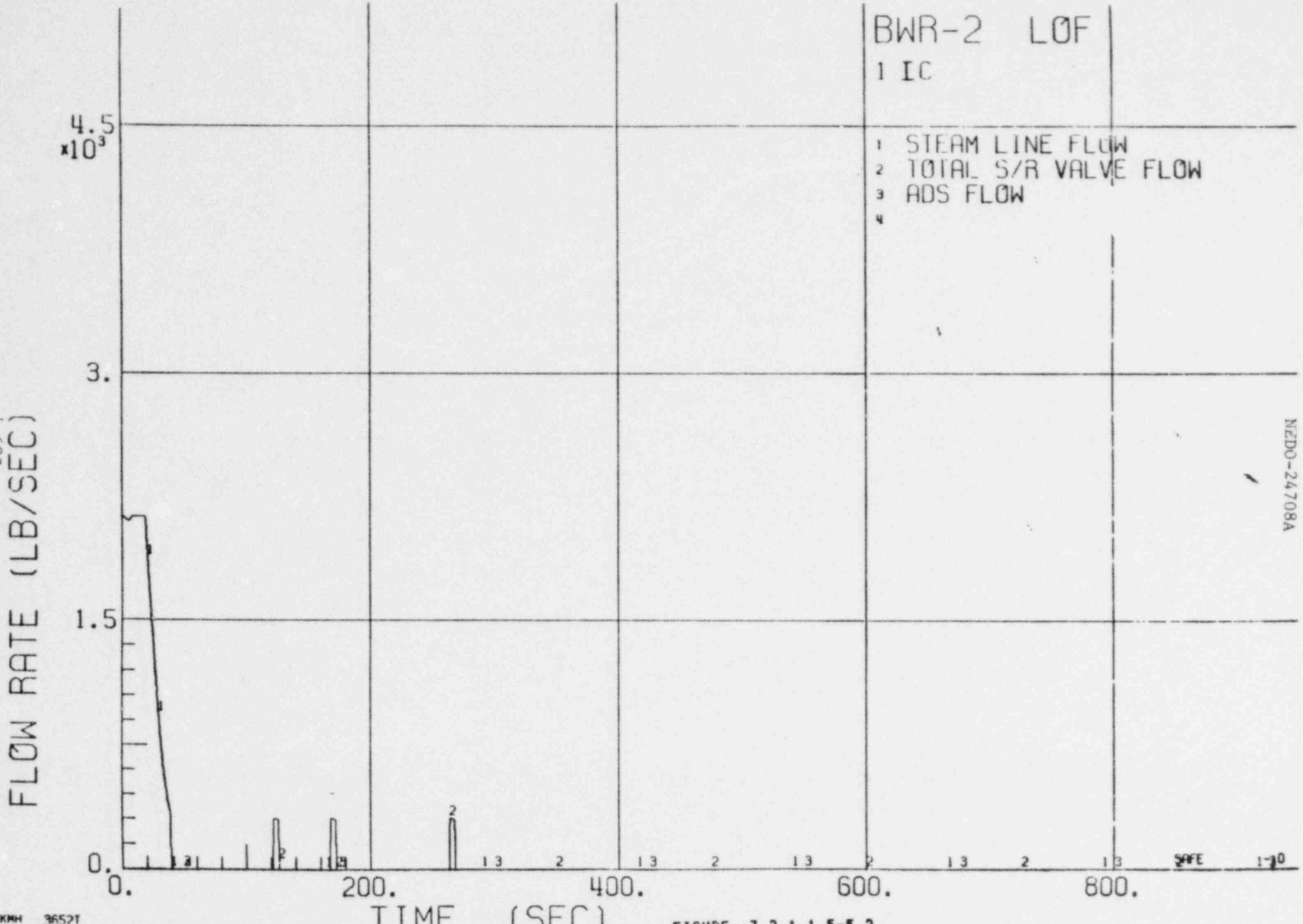
FIGURE 3.2.1.1.5-5.1



KMH 3652T

FIGURE 3.2.1.1.5-3.2

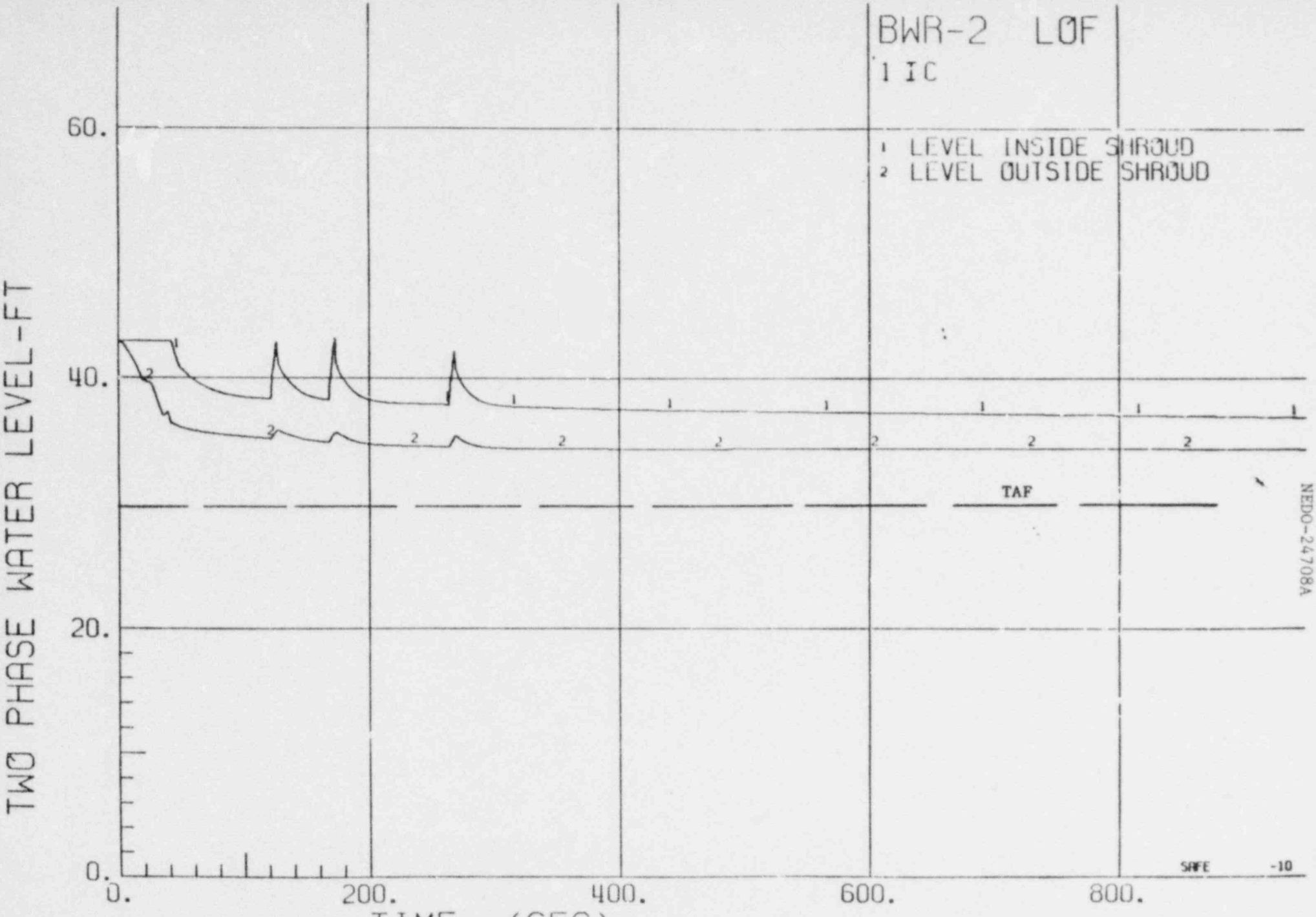


FIGURE 3.2.1.1.5-5.3

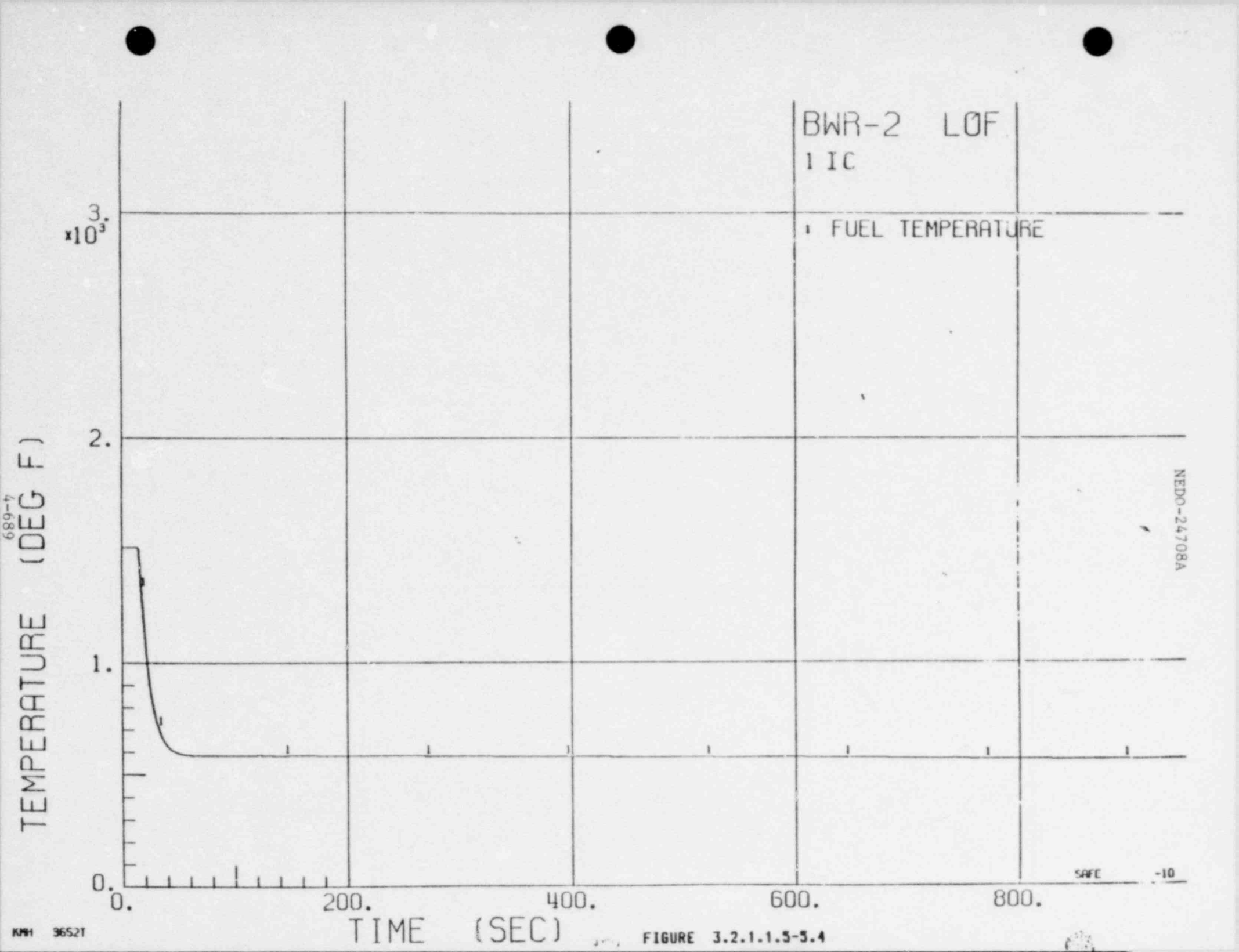


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FIGURE 3.2.1.1.5-5.4

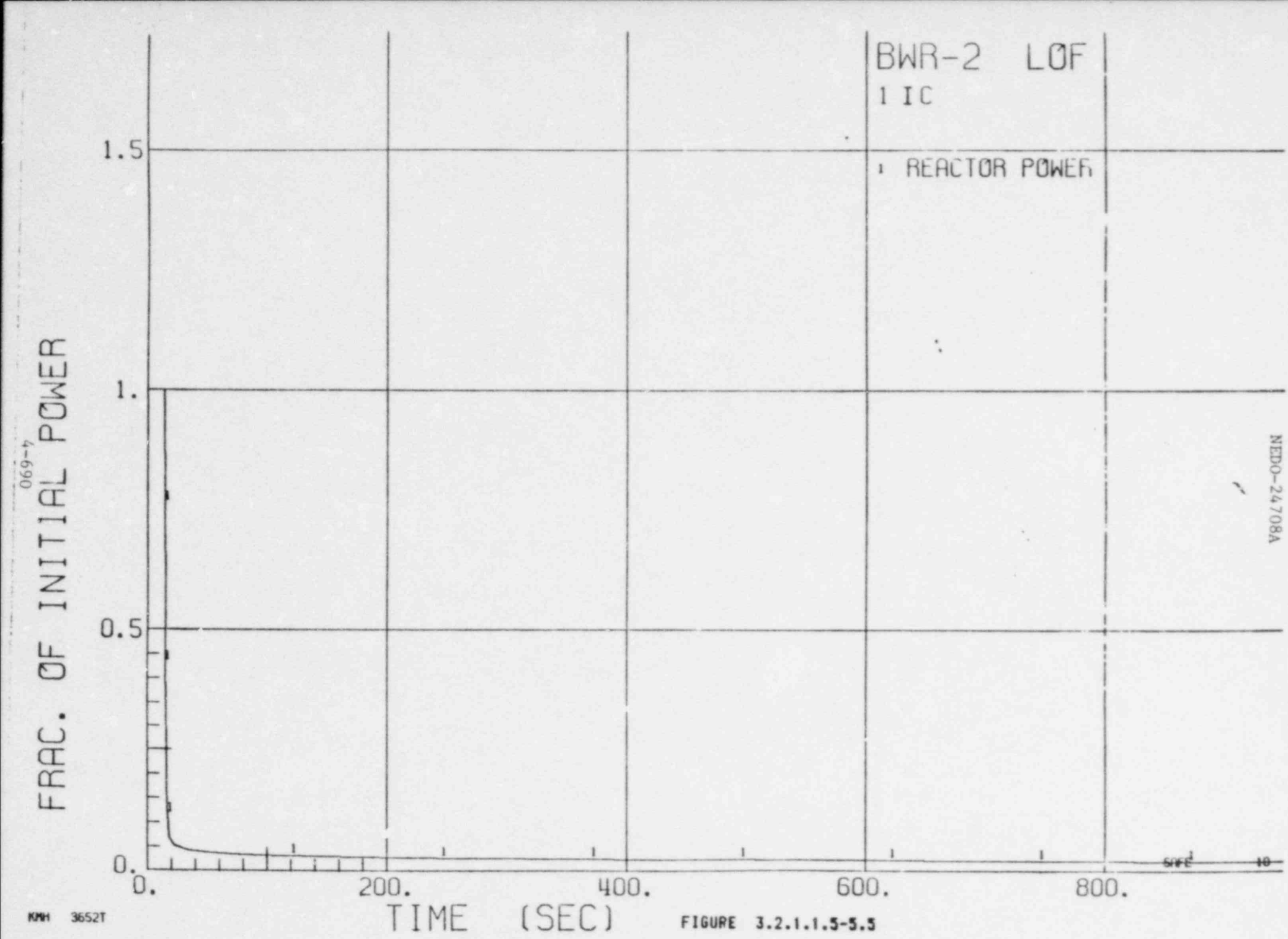

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FIGURE 3.2.1.1.3-3.3

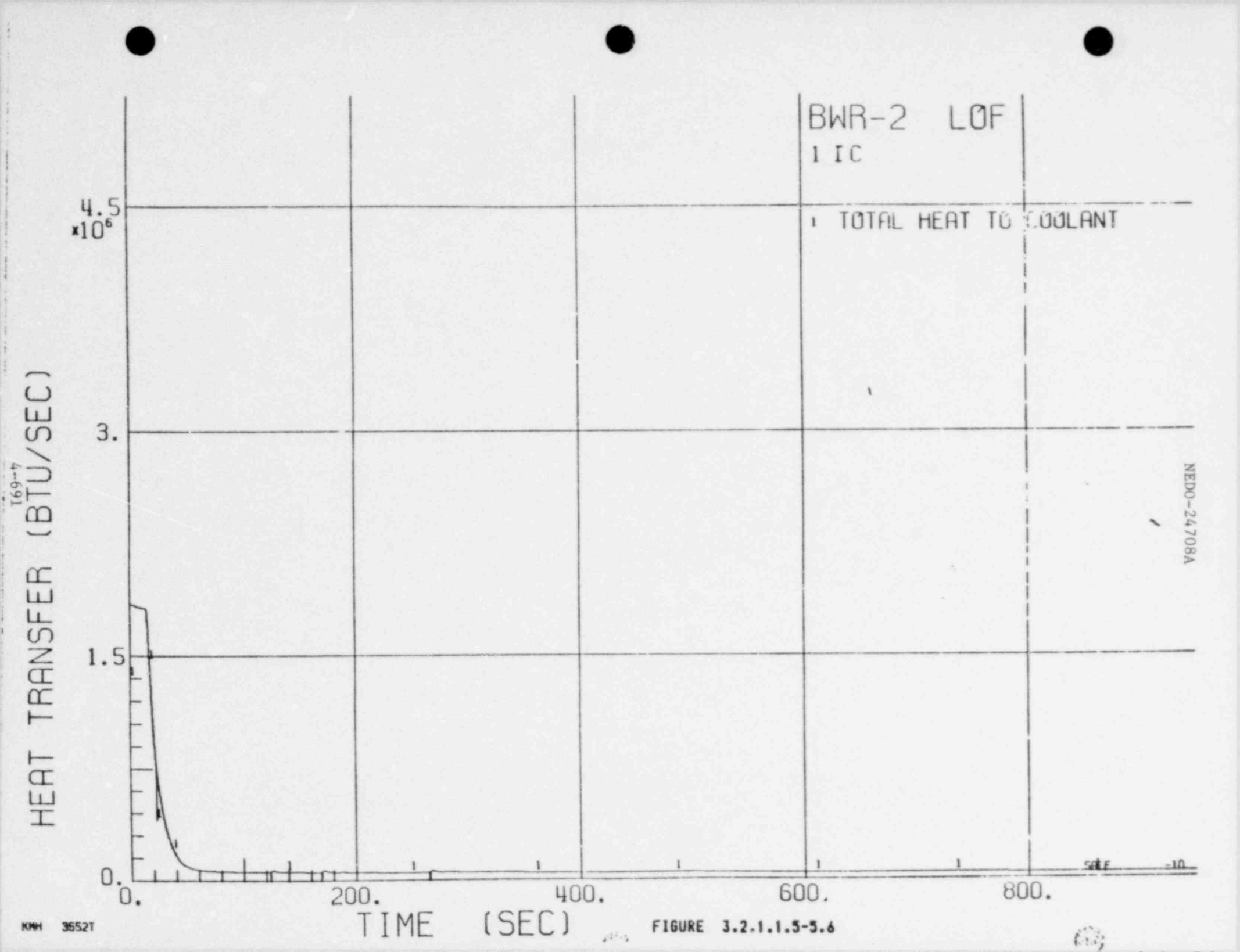

FIGURE 3.2.1.1.5-5.6

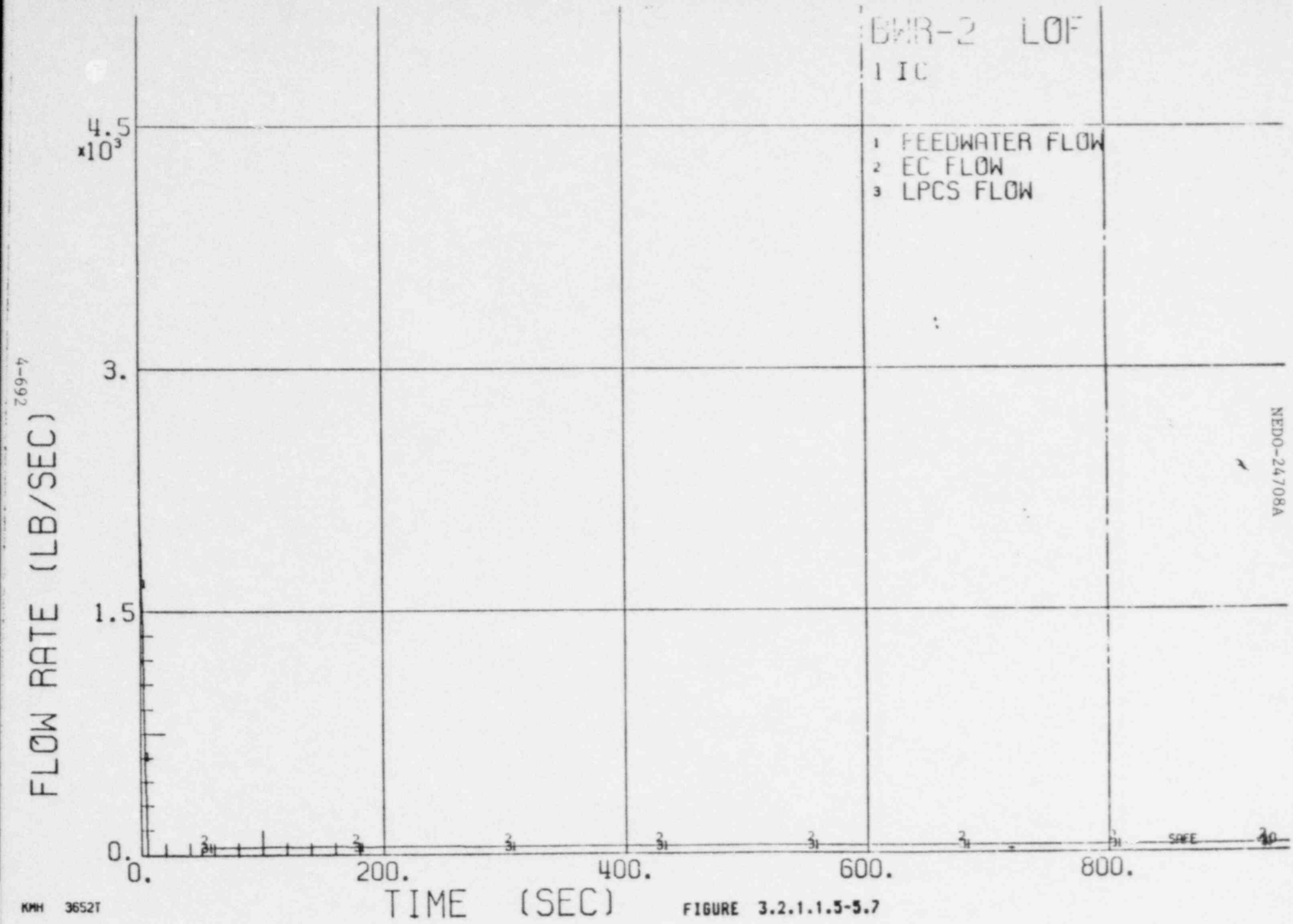

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FIGURE 3.2.1.1.5-5.7

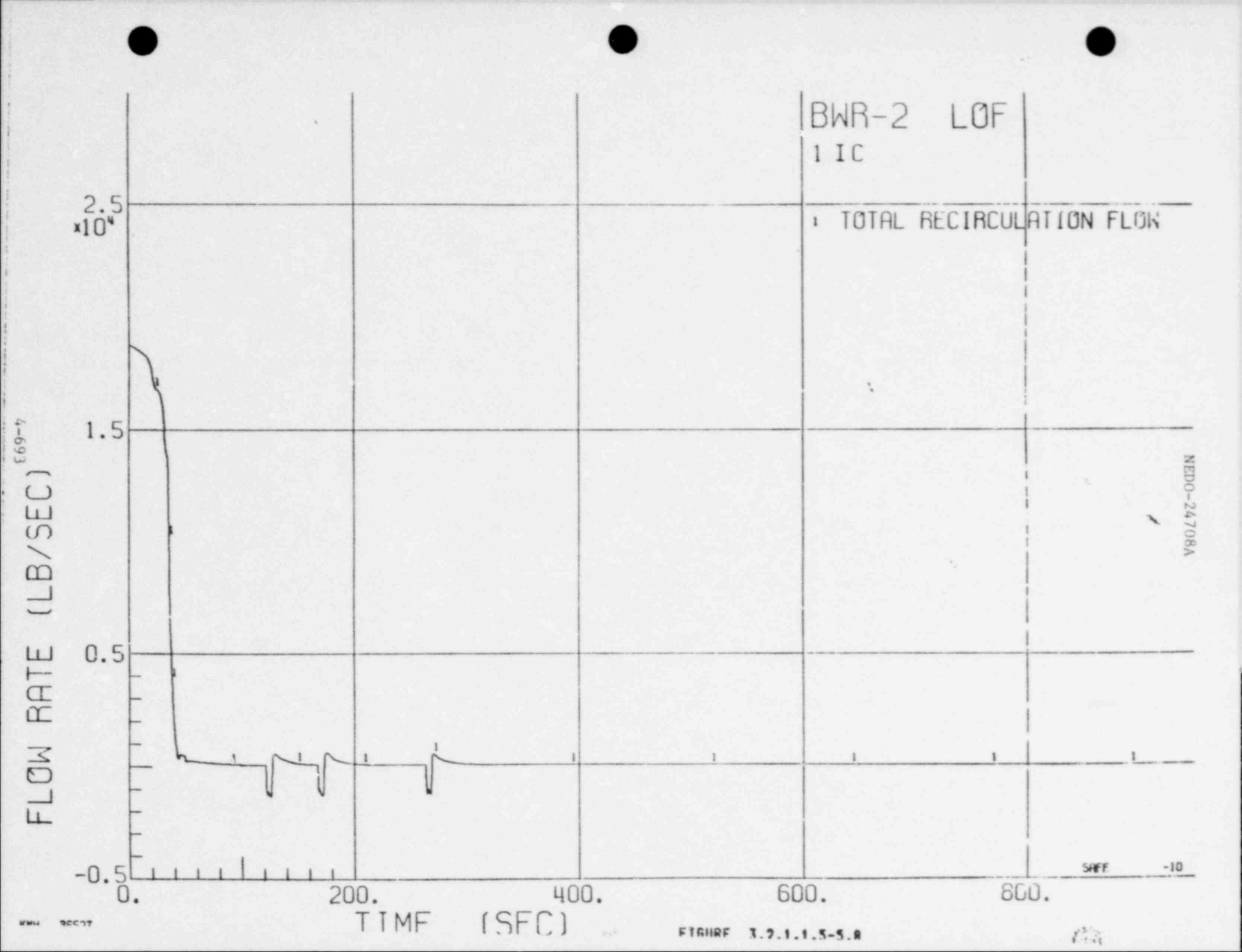

FIGURE 3.2.1.1.5-5.8

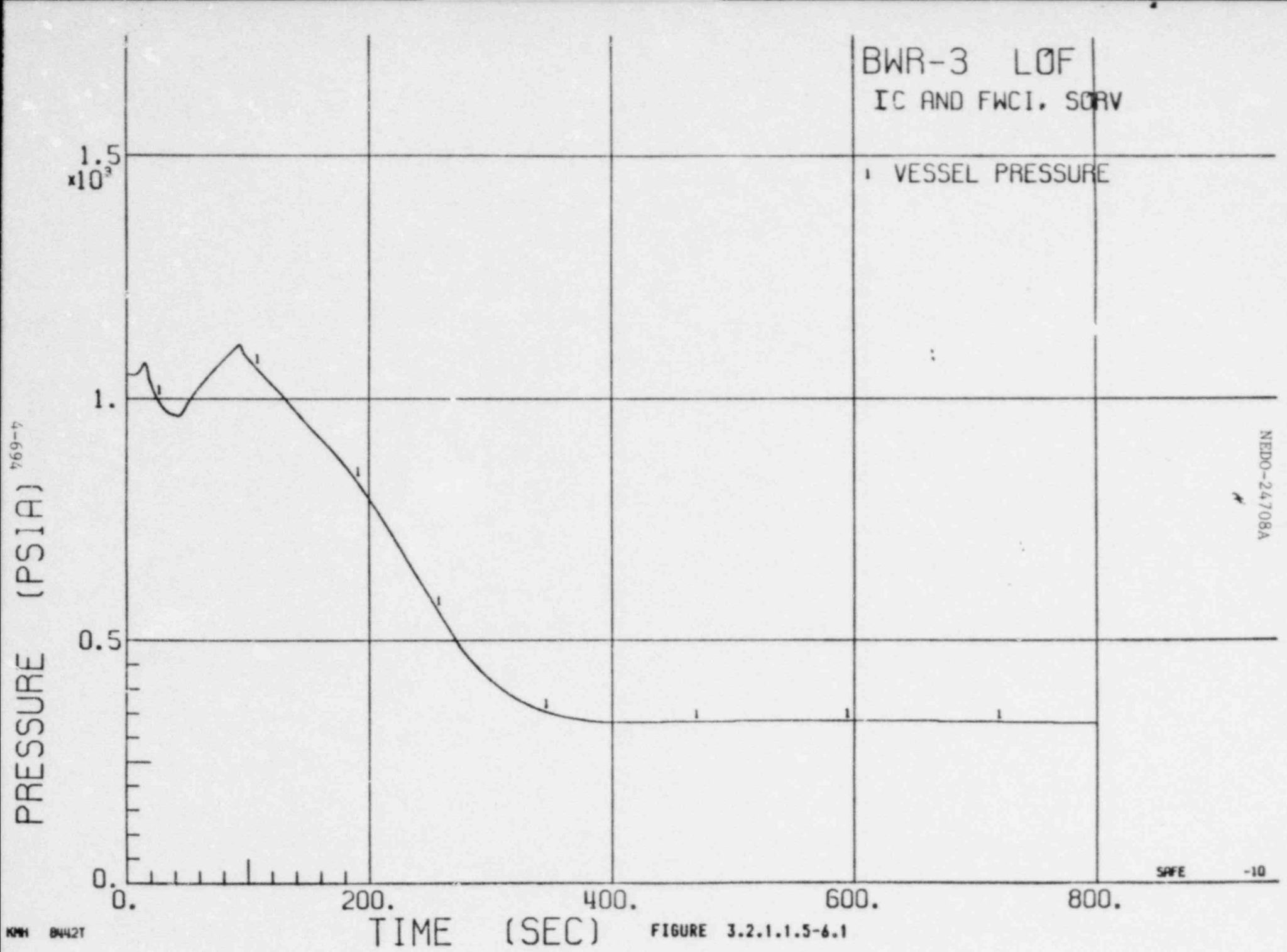

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FIGURE 3.2.1.1.5-6.1

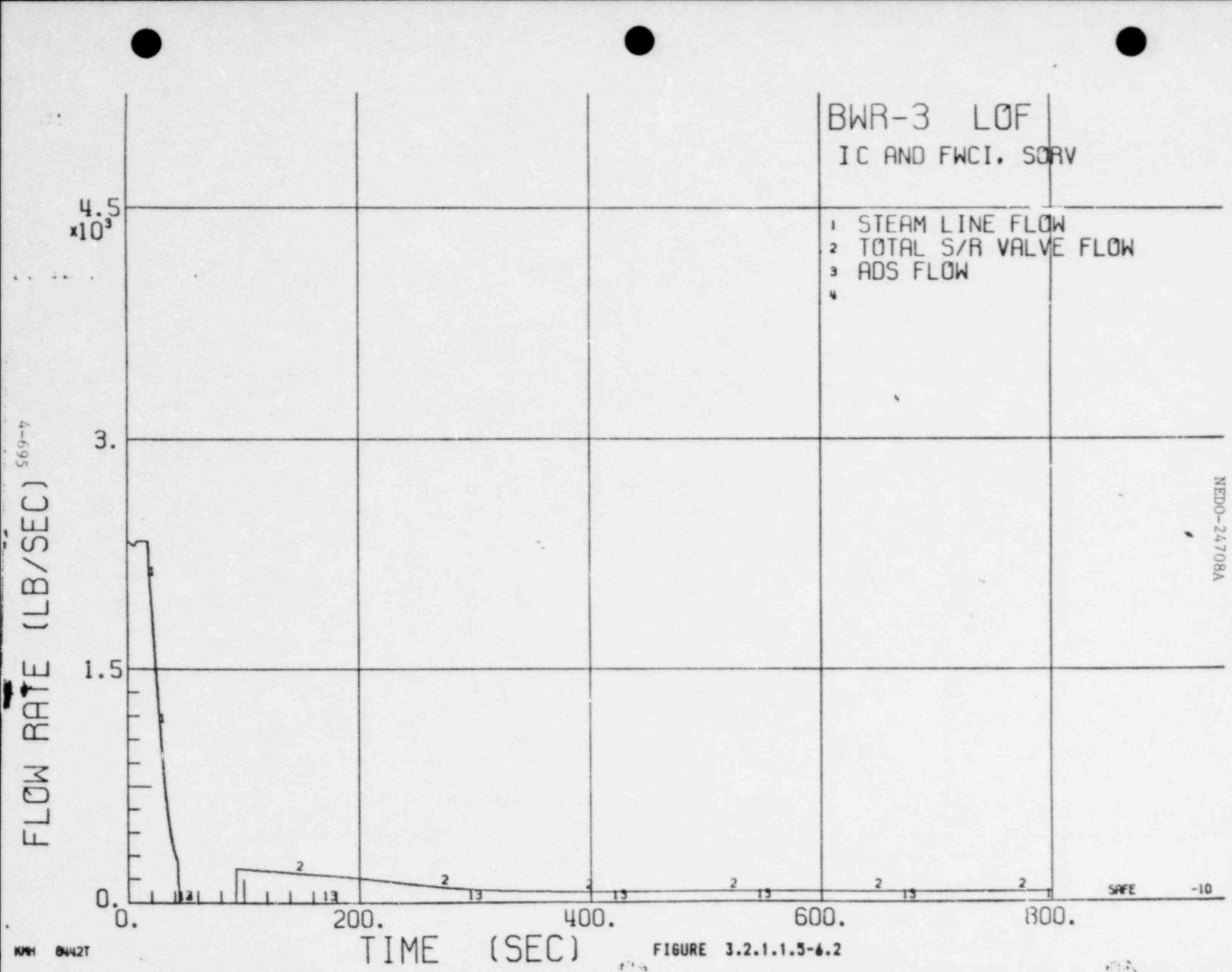

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FIGURE 3.2.1.1.5-6.2

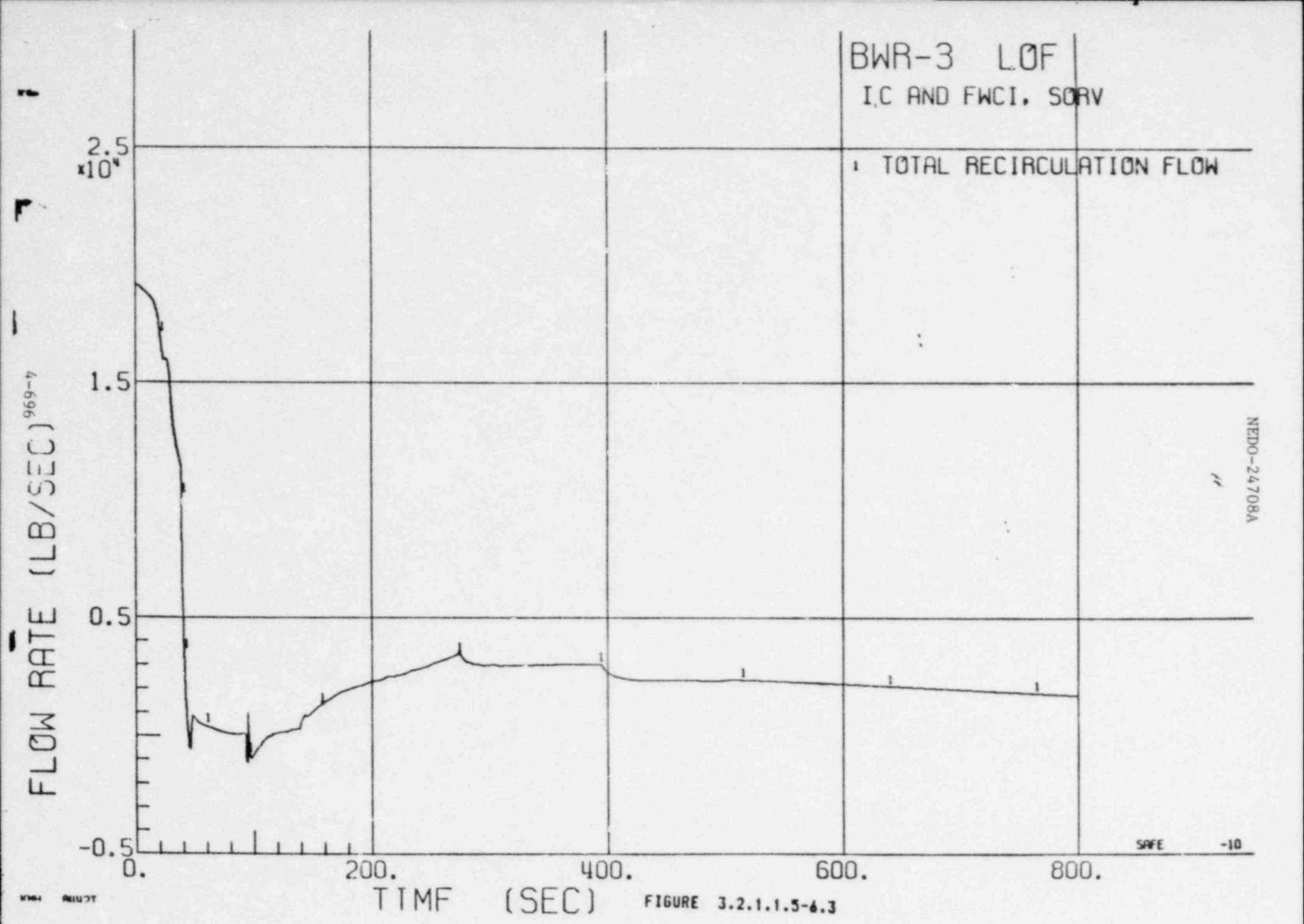

FIGURE 3.2.1.1.5-6.3

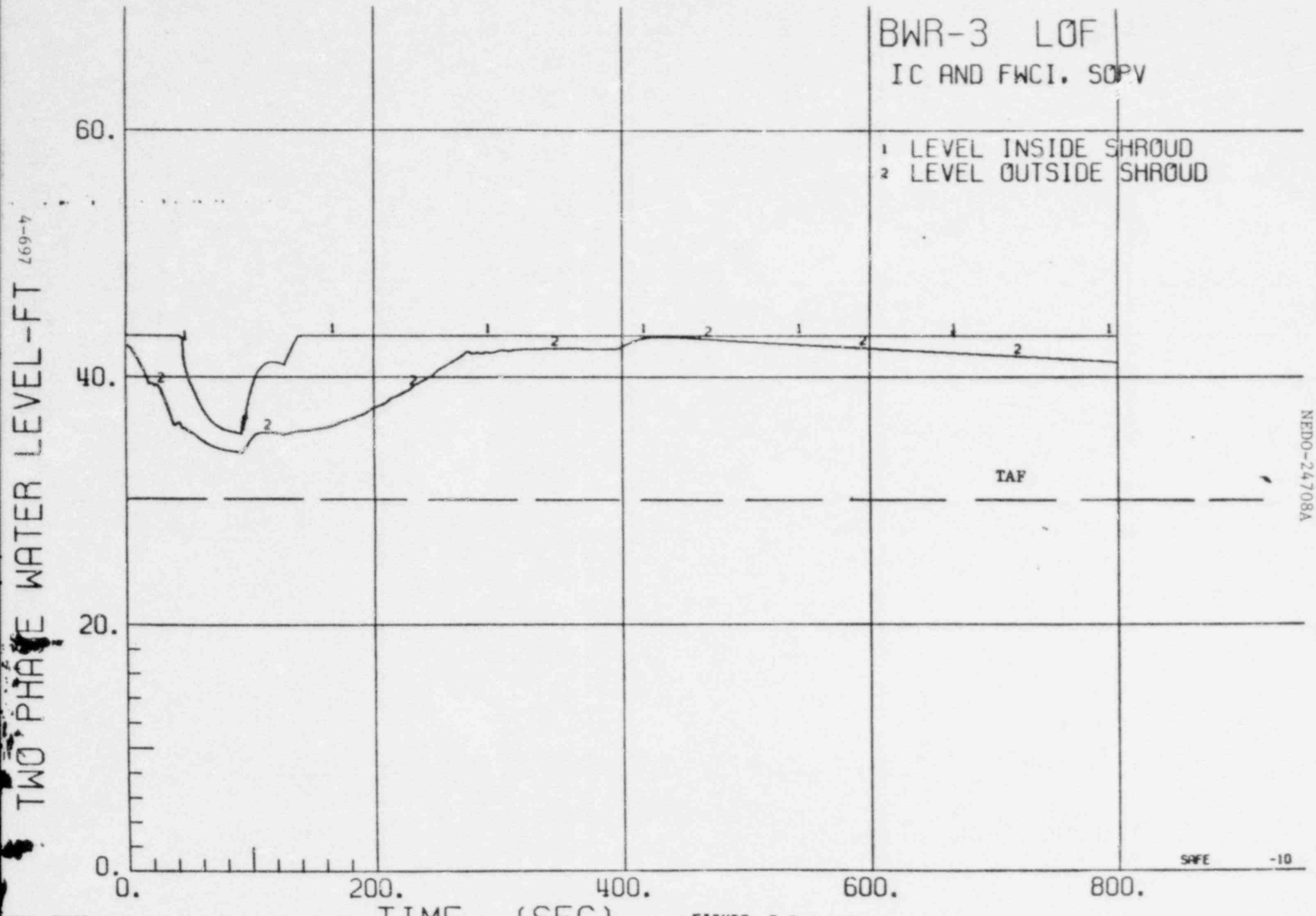

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FIGURE 3.2.1.1.5-6.4

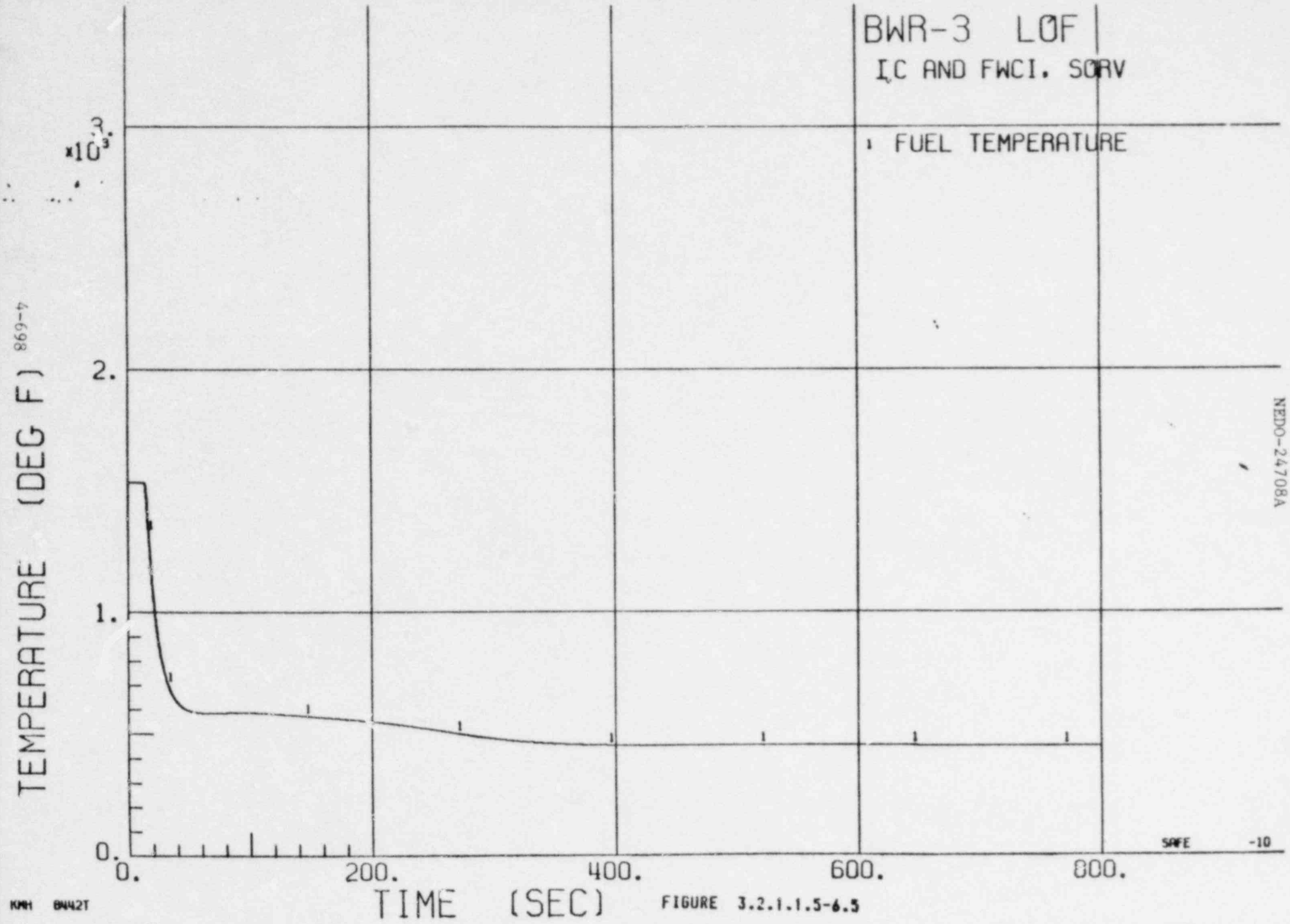

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FIGURE 3.2.1.1.5-6.5

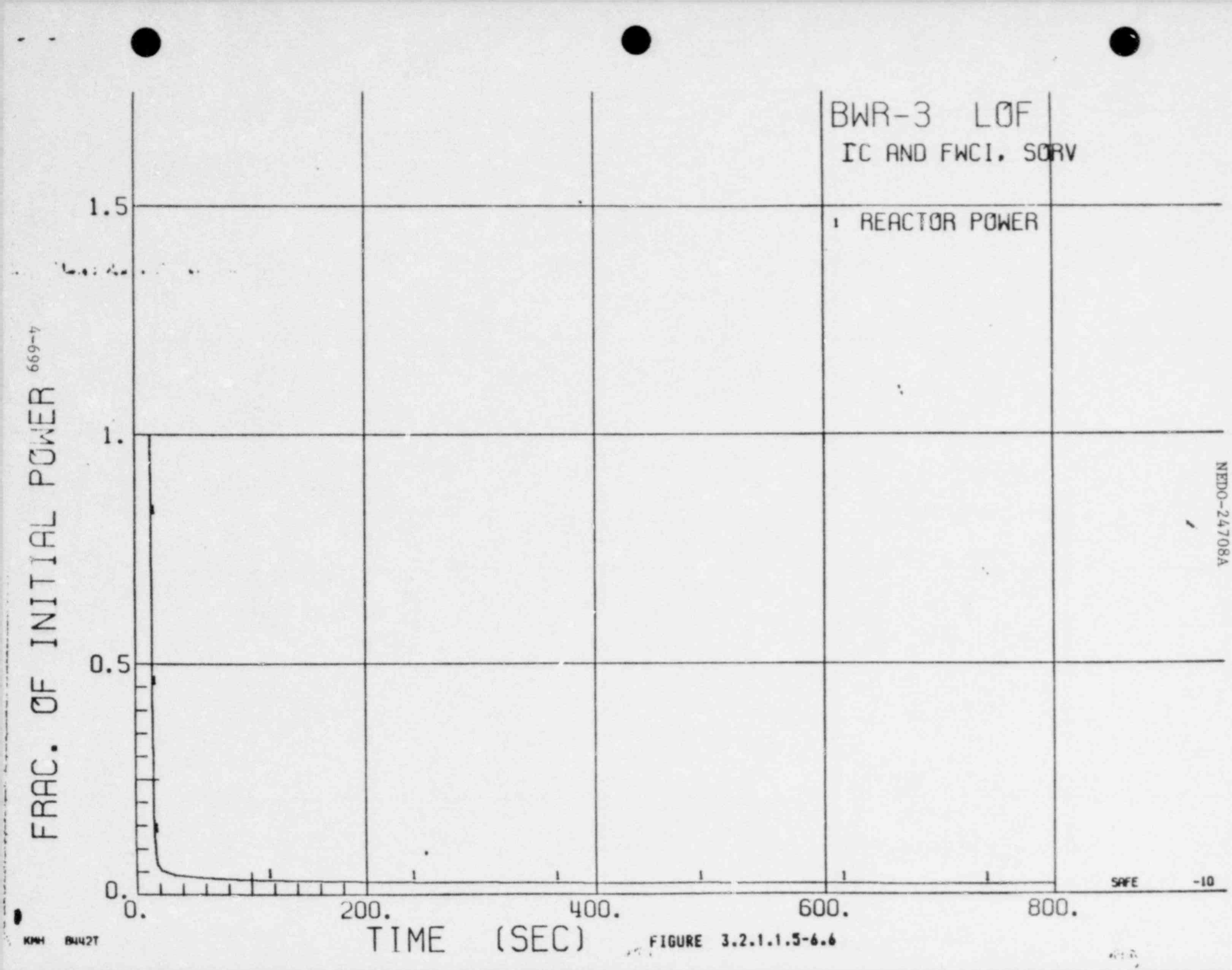

FIGURE 3.2.1.1.5-6.6

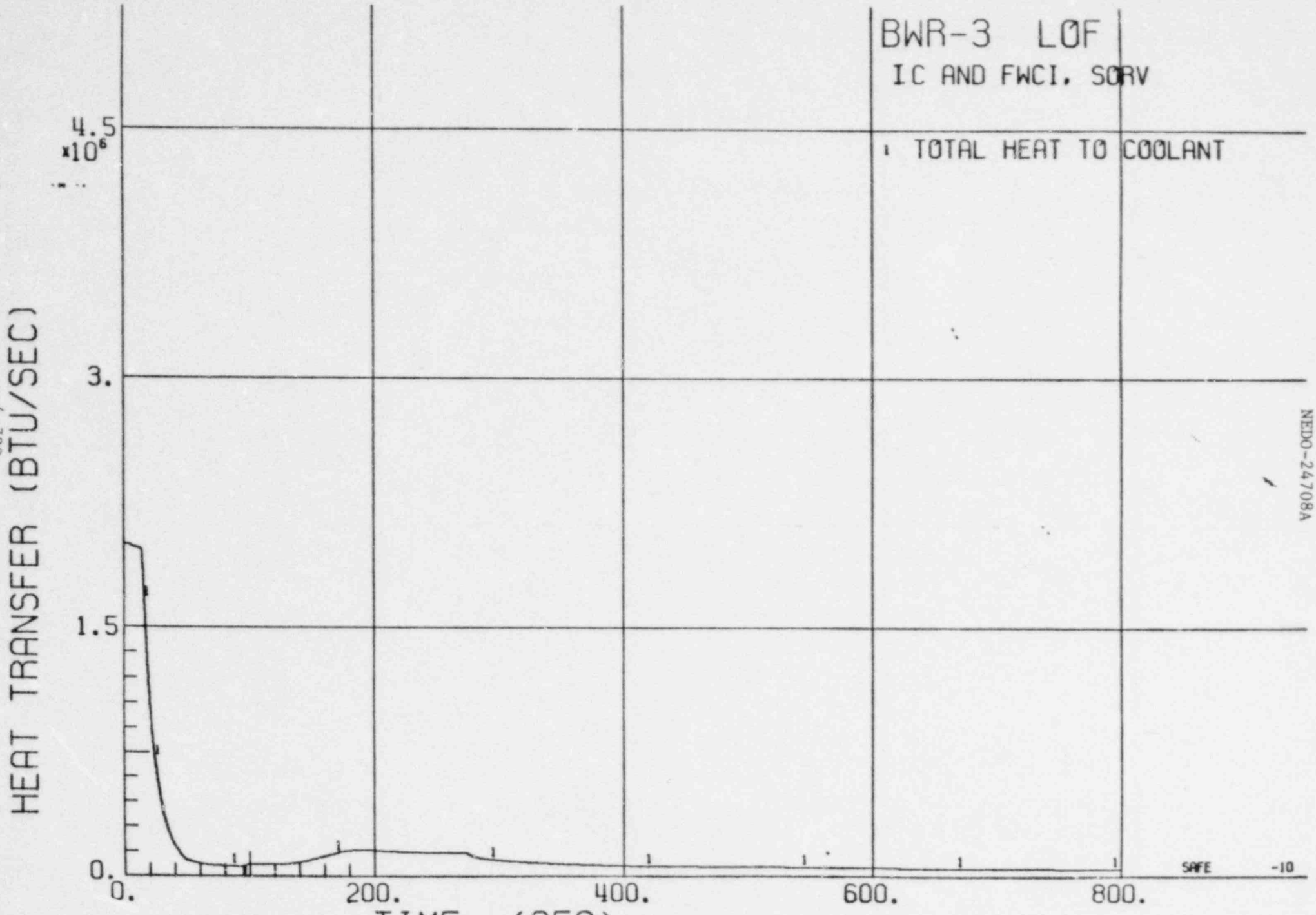

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FIGURE 3.2.1.1.5-6.7

FIGURE 3.2.1.1.5-6.8

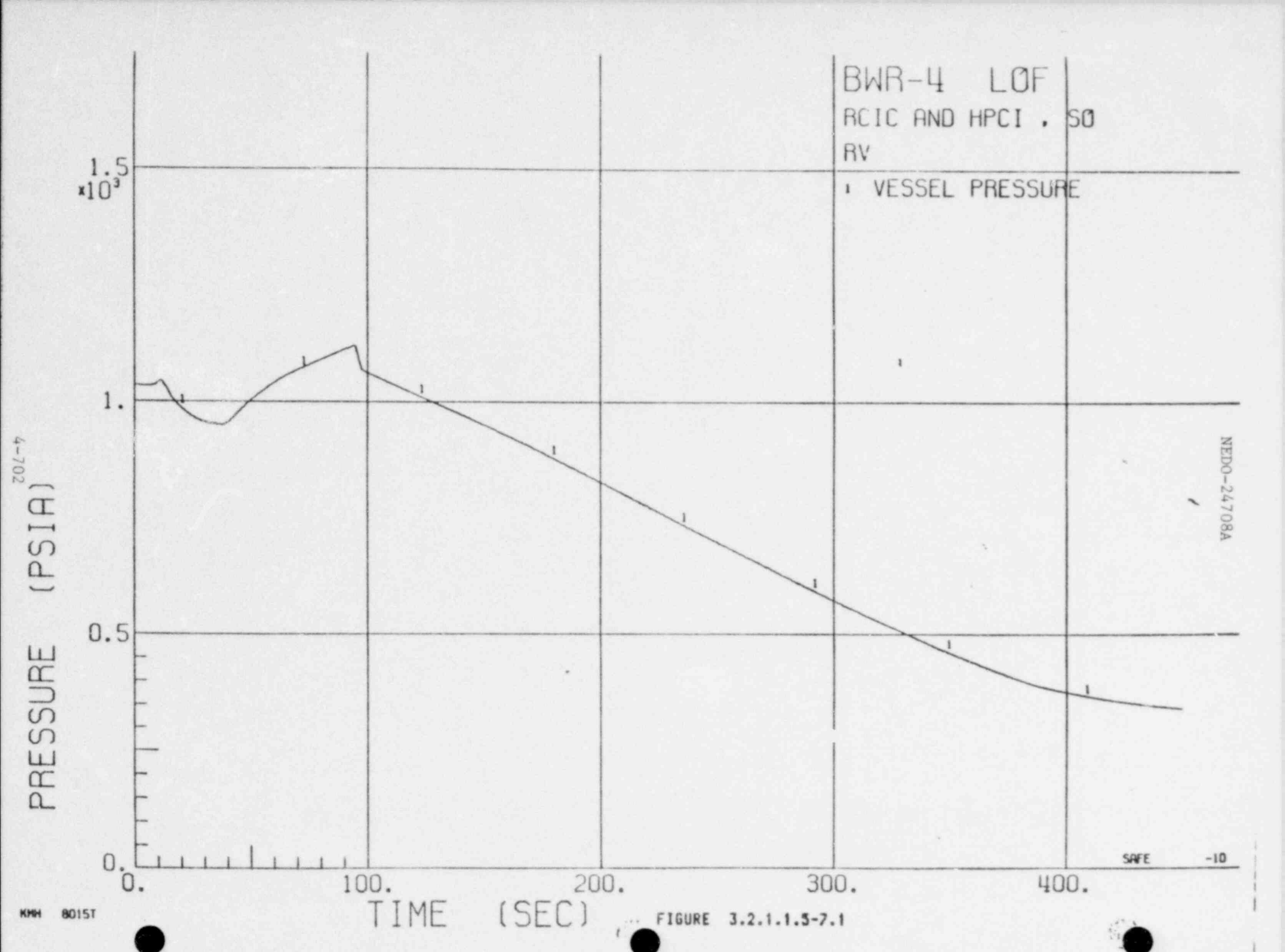

FIGURE 3.2.1.1.5-7.1

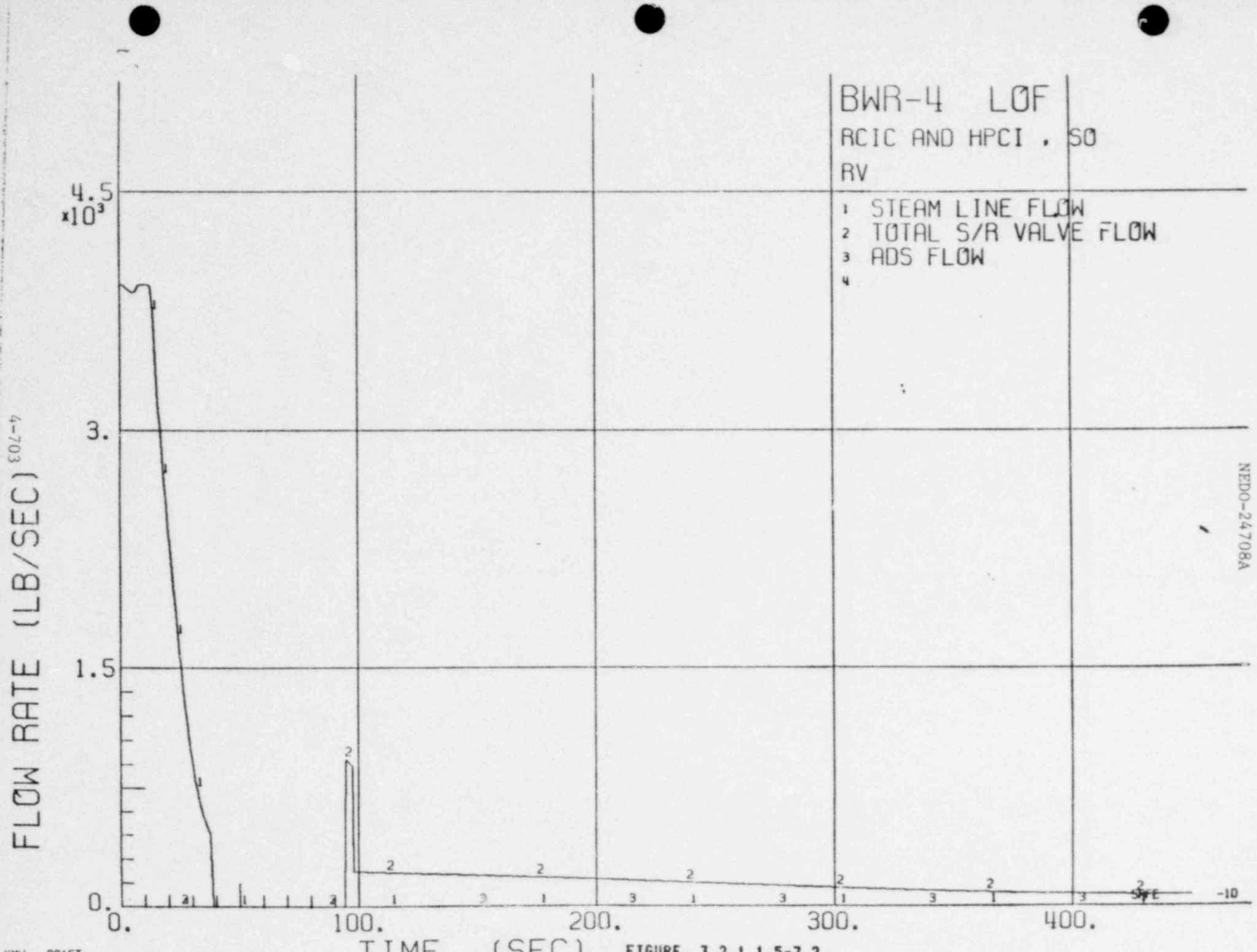

FIGURE 3.2.1.1.5-7.2

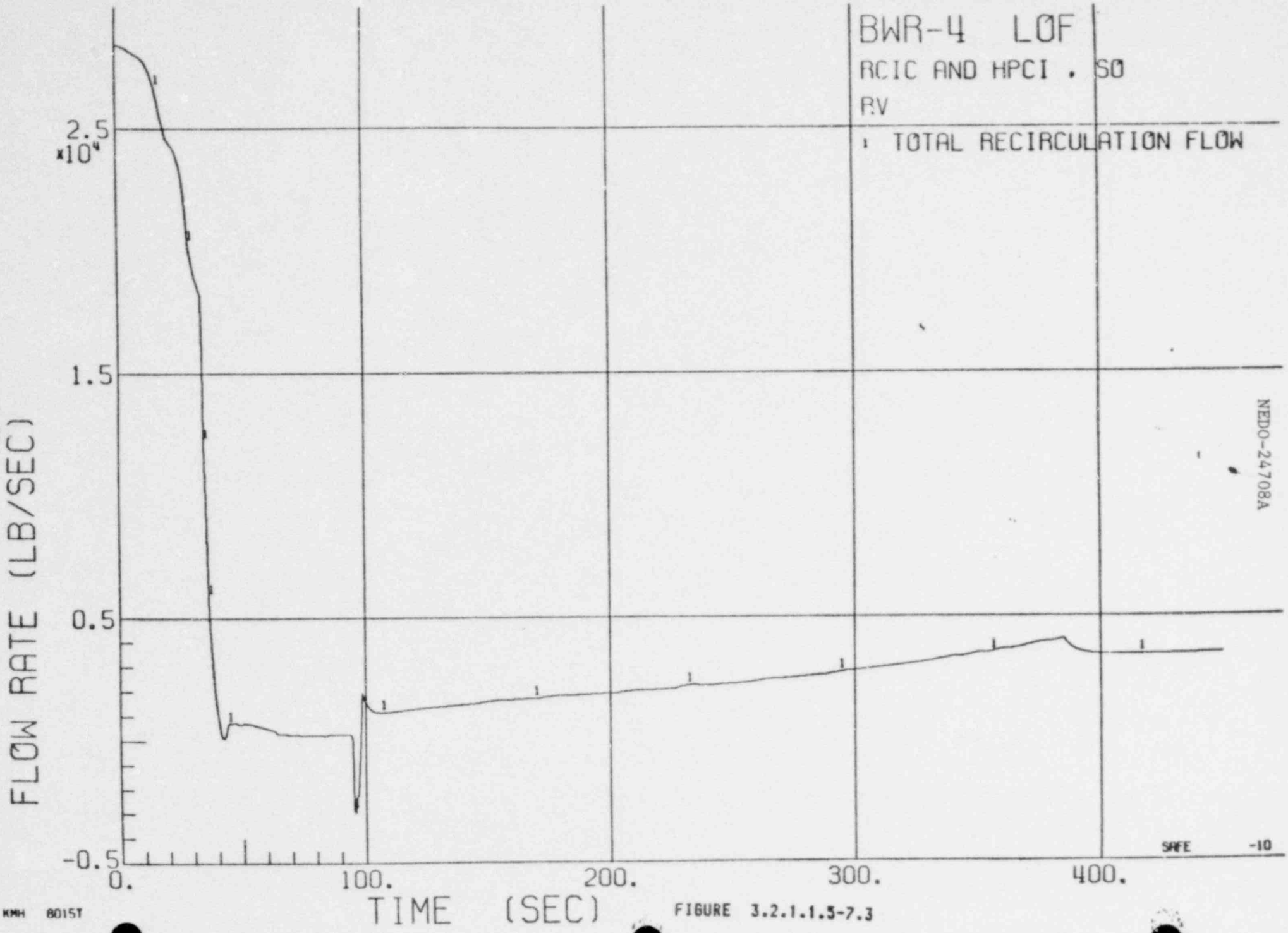

FIGURE 3.2.1.1.5-7.3

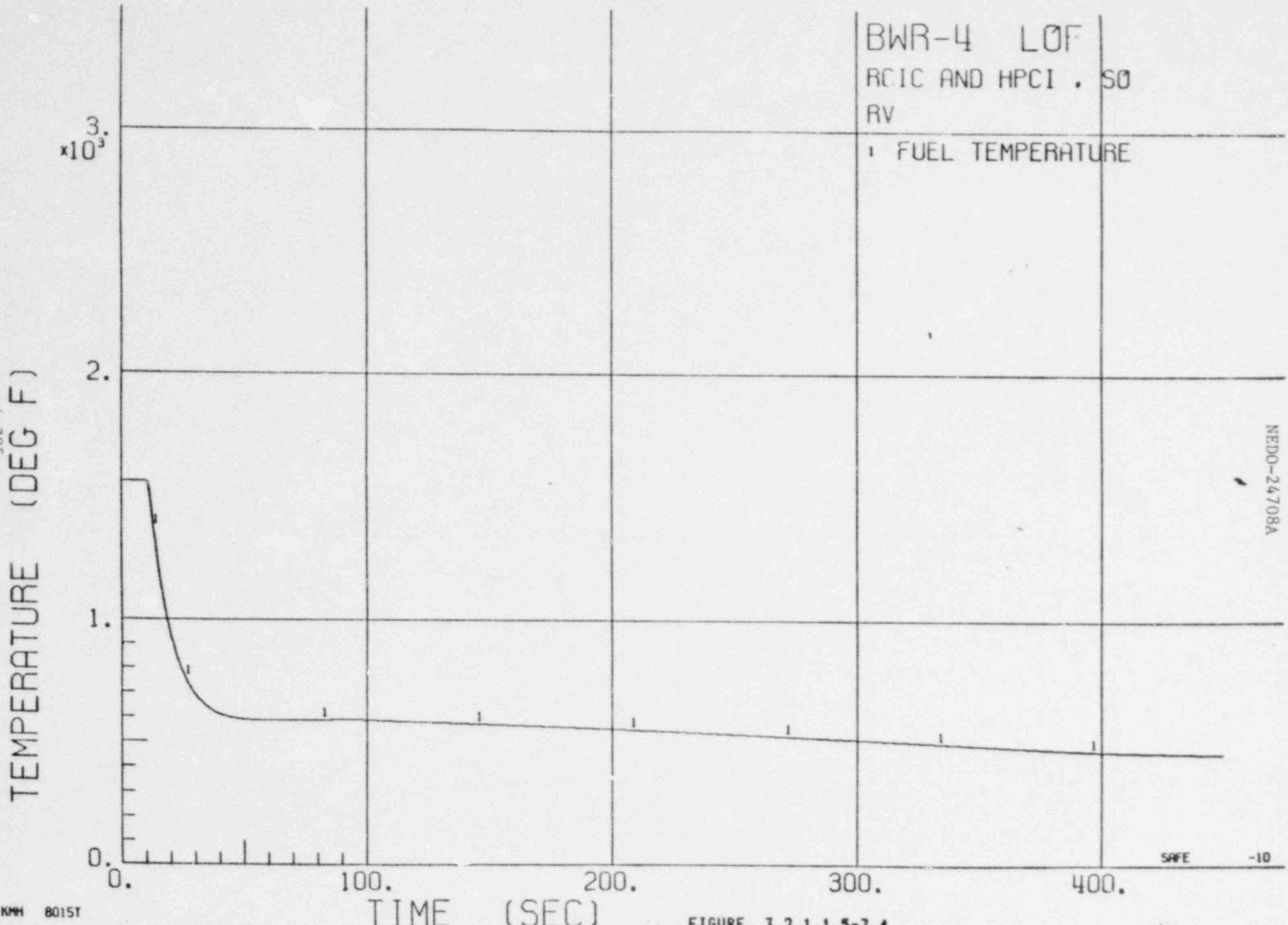

FIGURE 3.2.1.1.5-7.4

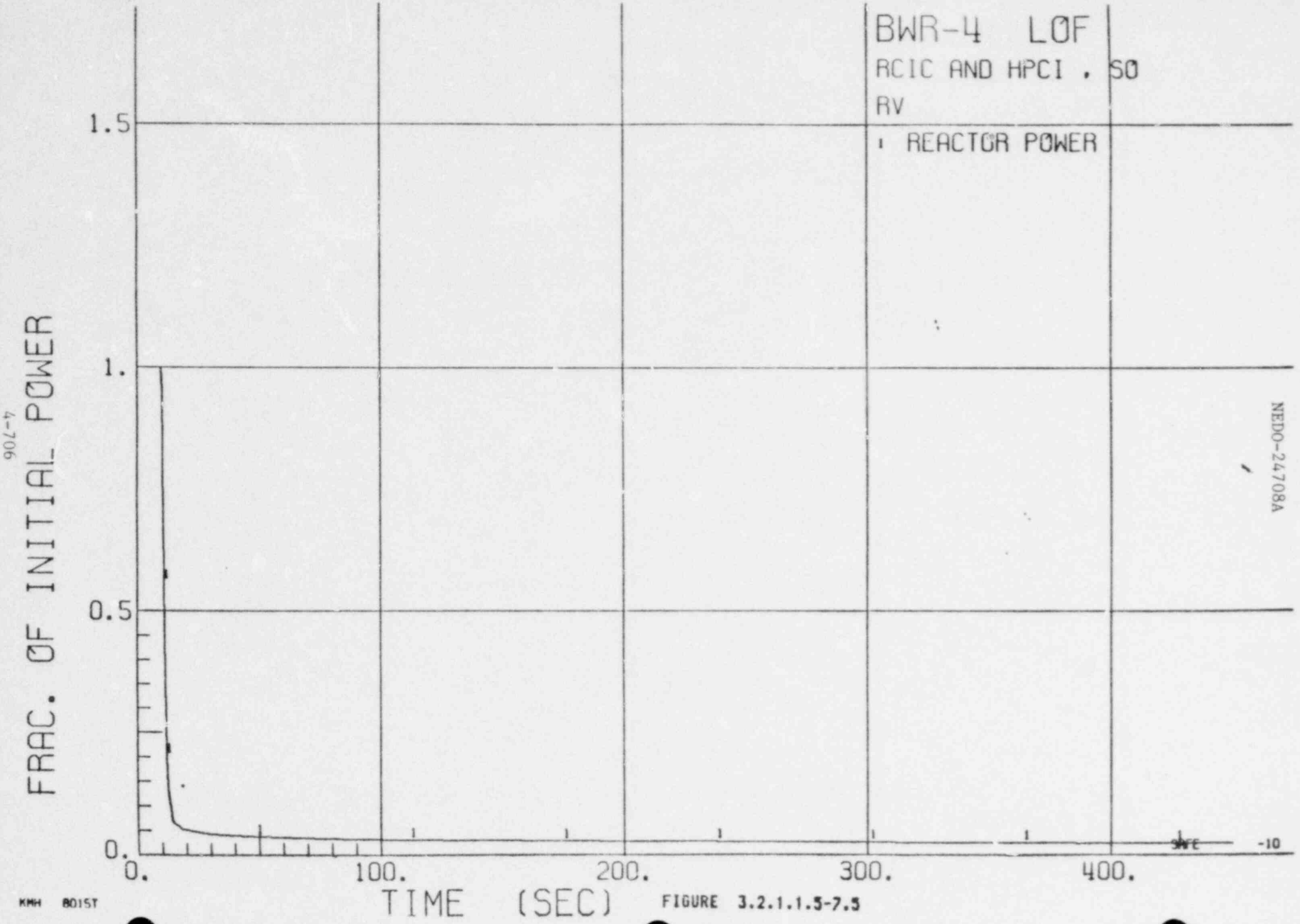

FIGURE 3.2.1.1.5-7.5

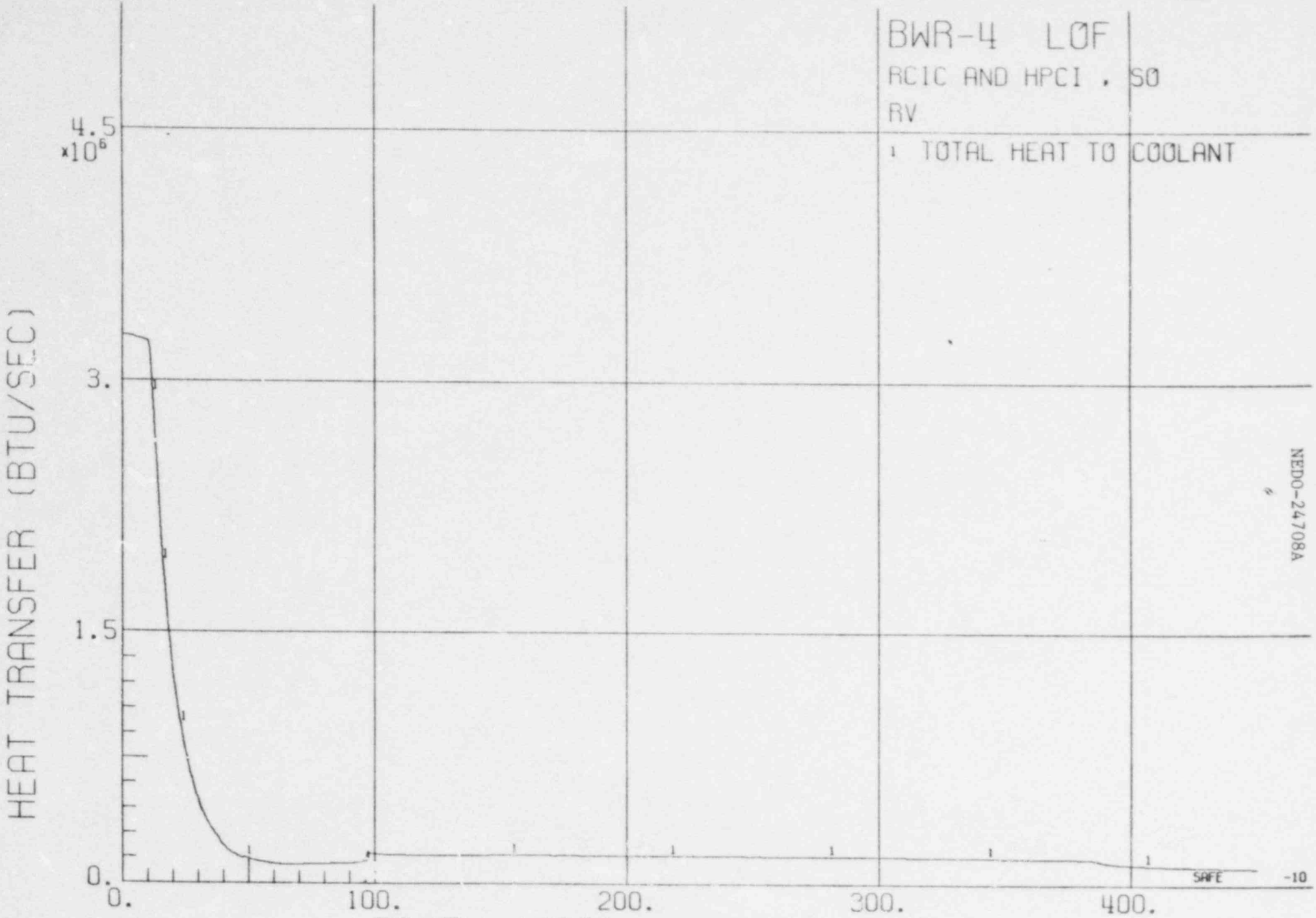

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FIGURE 3.2.1.1.5-7.6

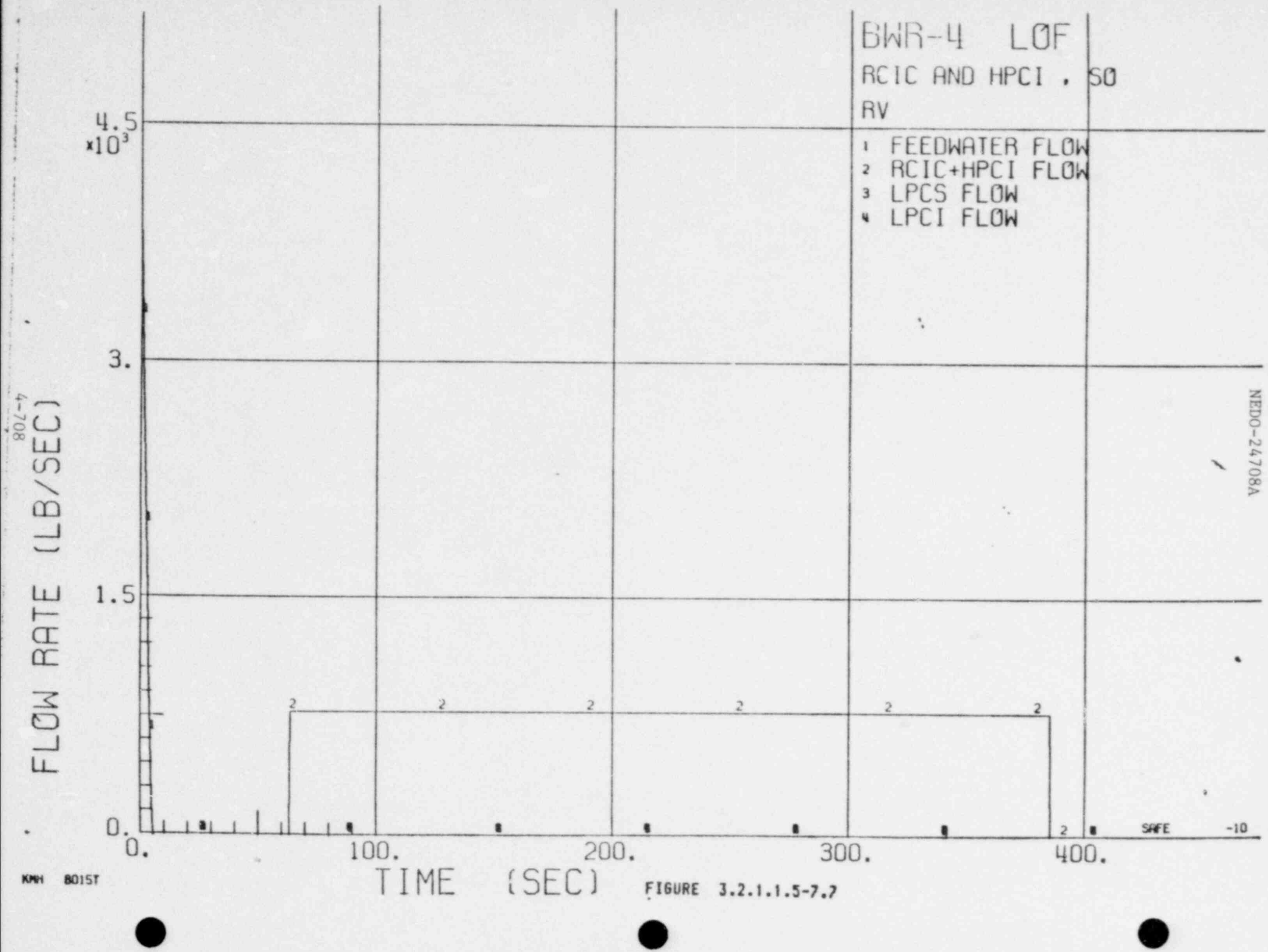

FIGURE 3.2.1.1.5-7.7

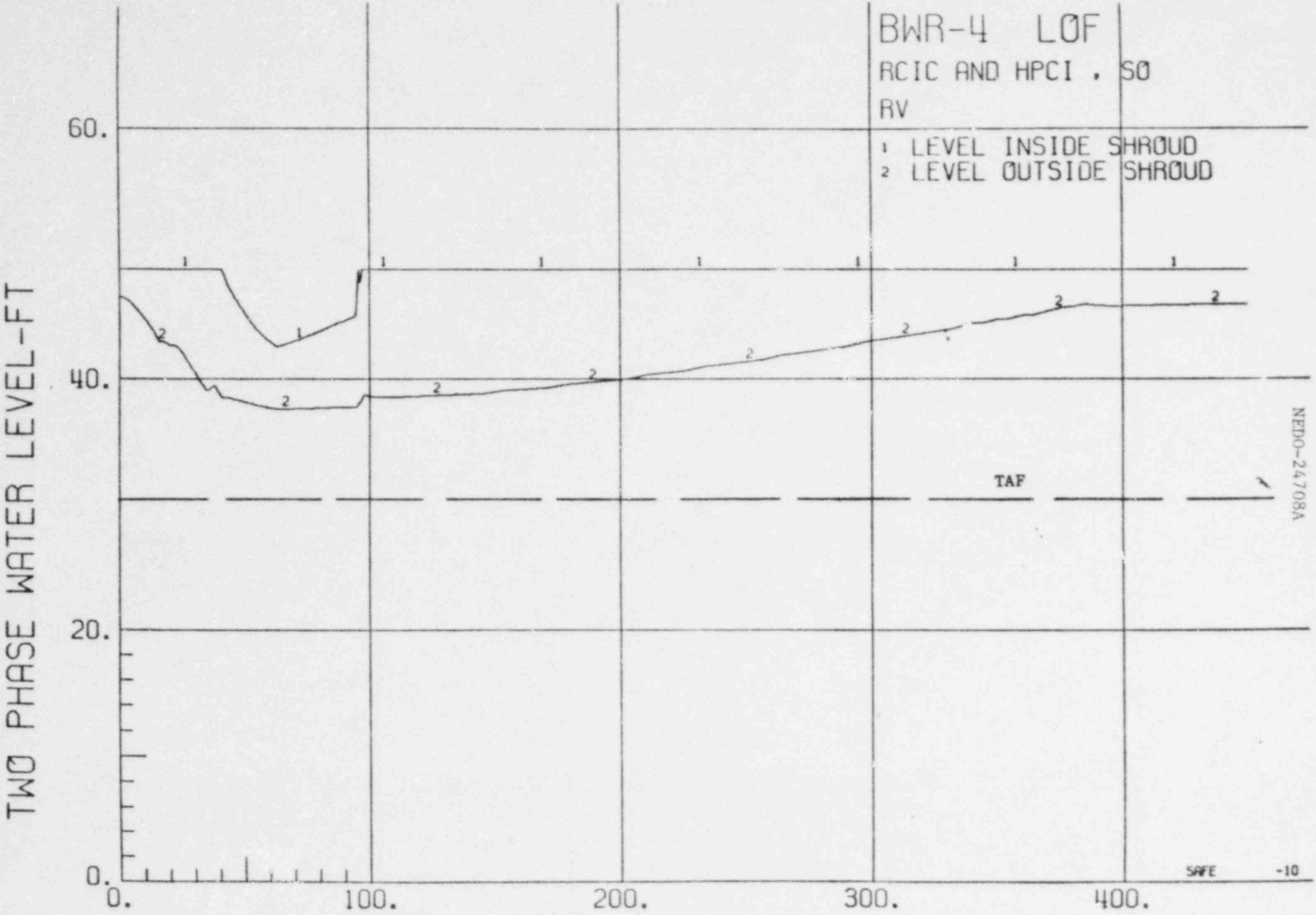

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FIGURE 3.2.1.1.5-7.8

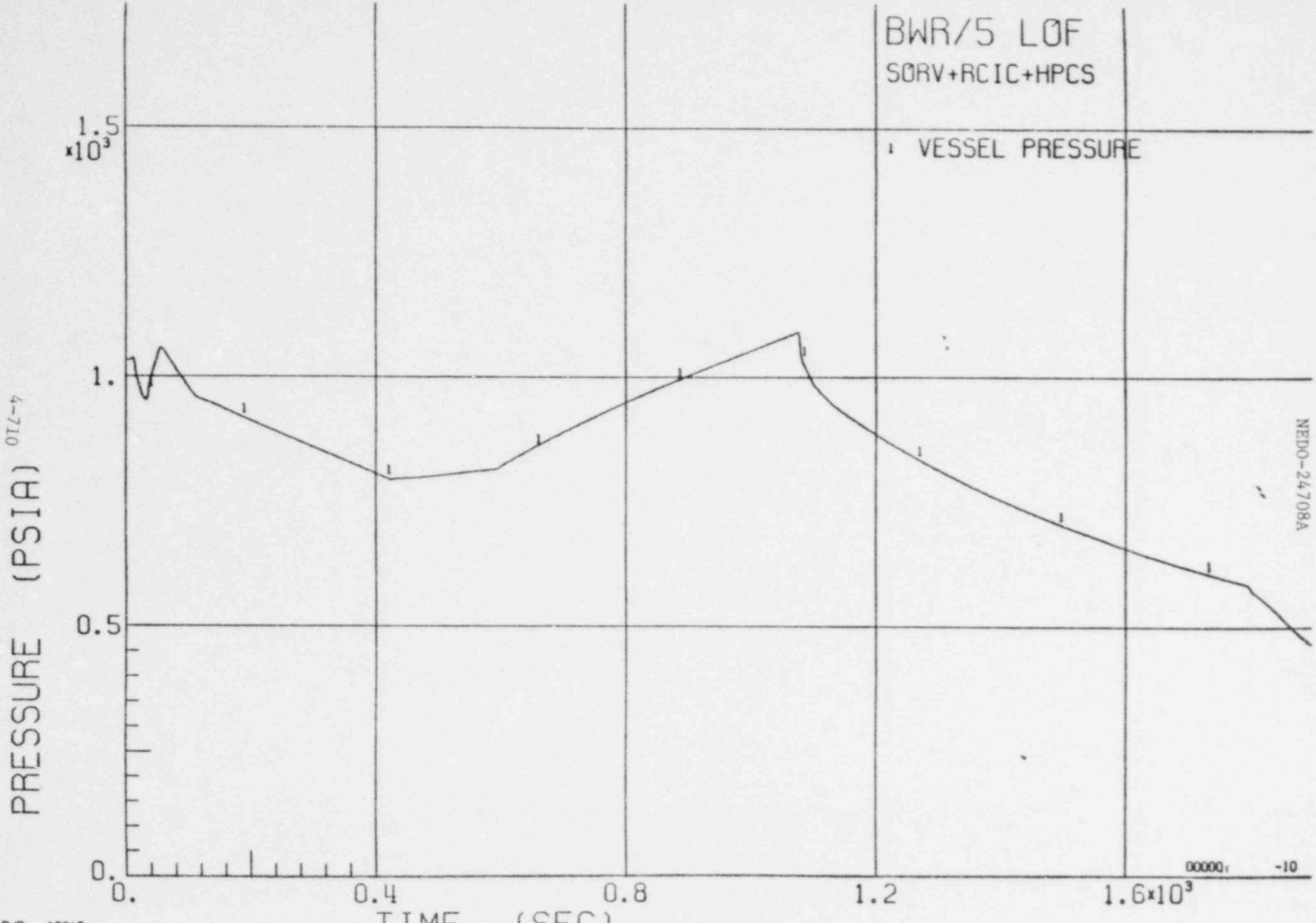

FIGURE 3.2.1.1.5-8.1

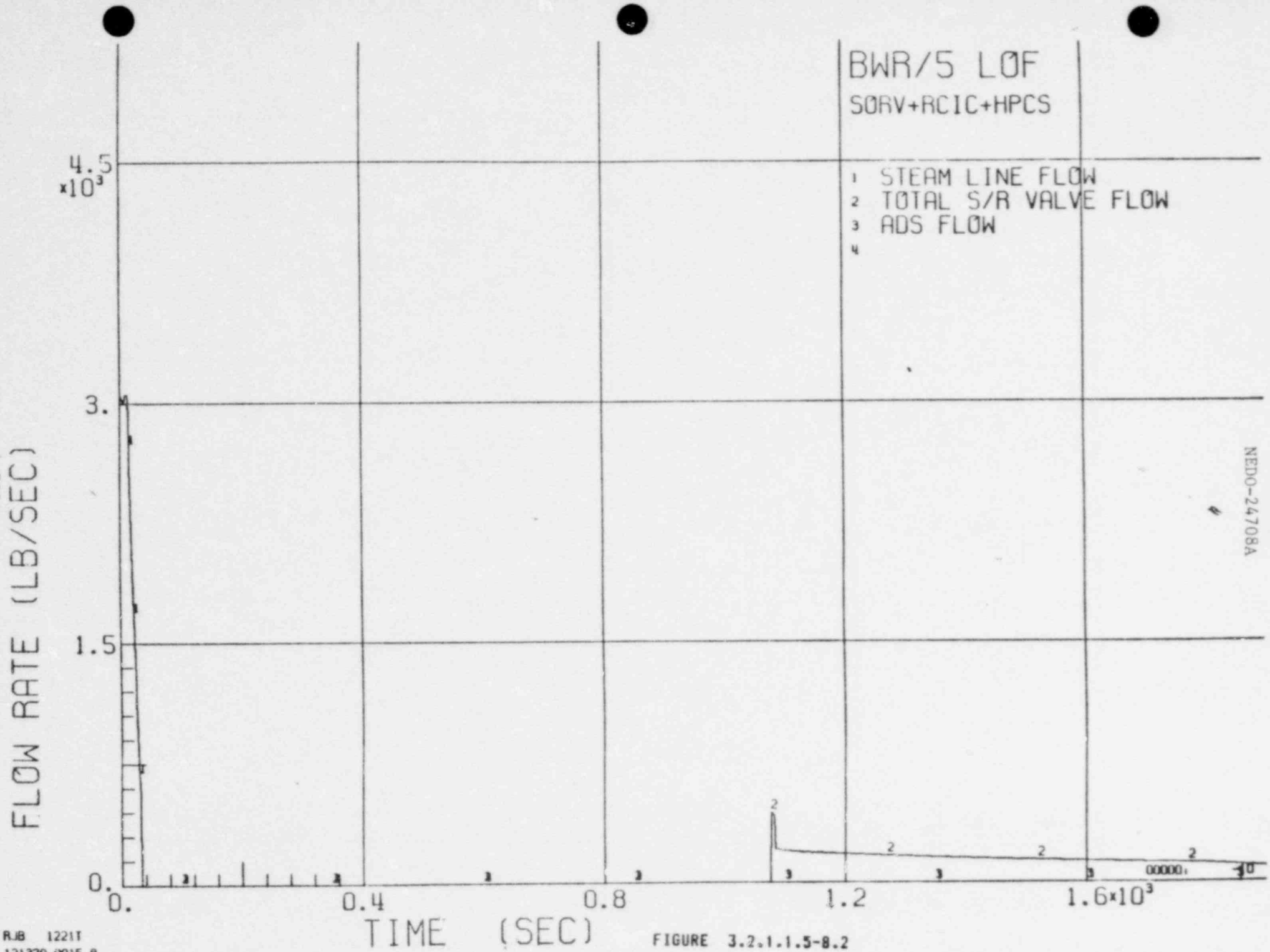

FIGURE 3.2.1.1.5-8.2

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121379 0015.8

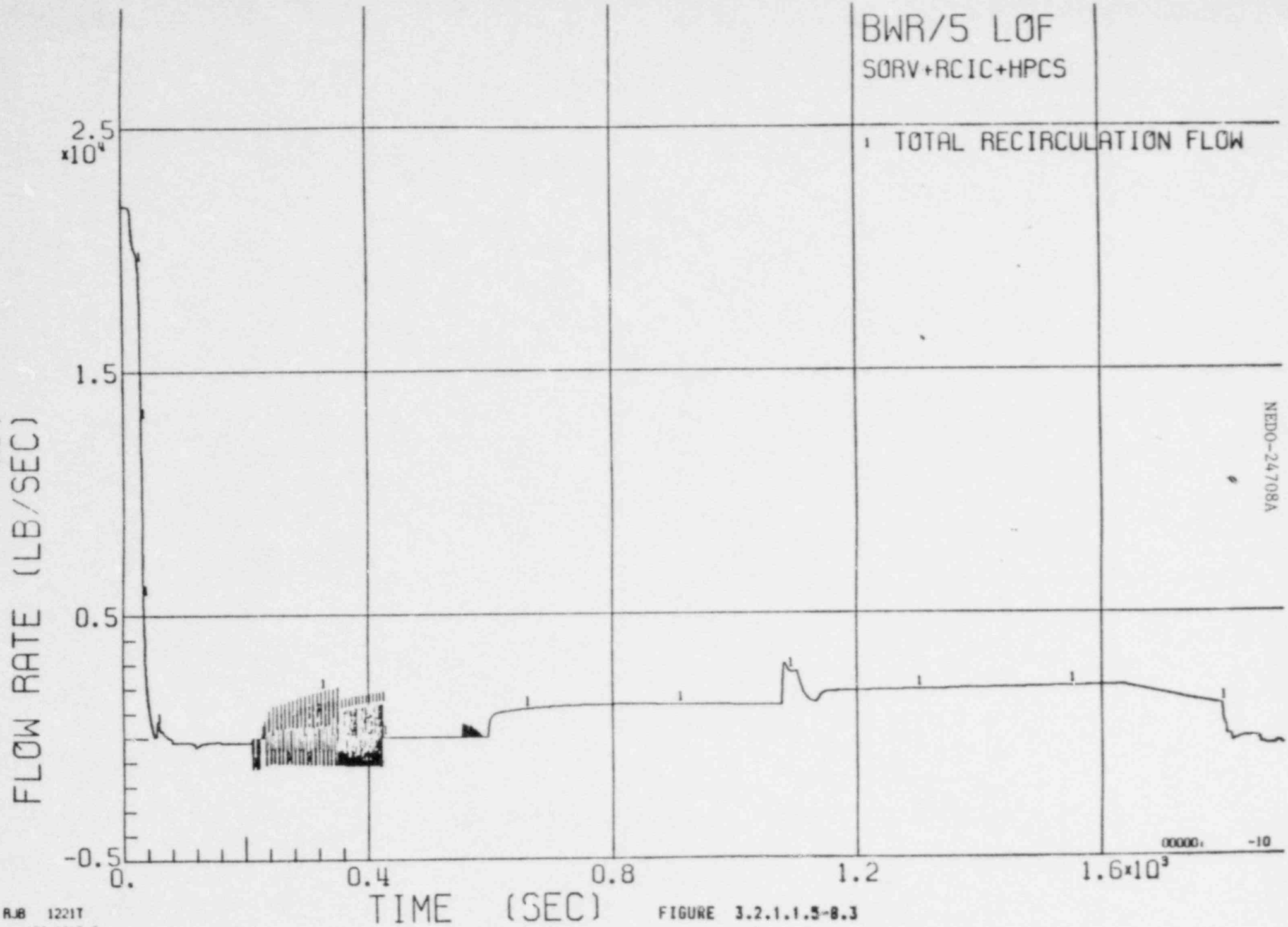


FIGURE 3.2.1.1.5-8.3

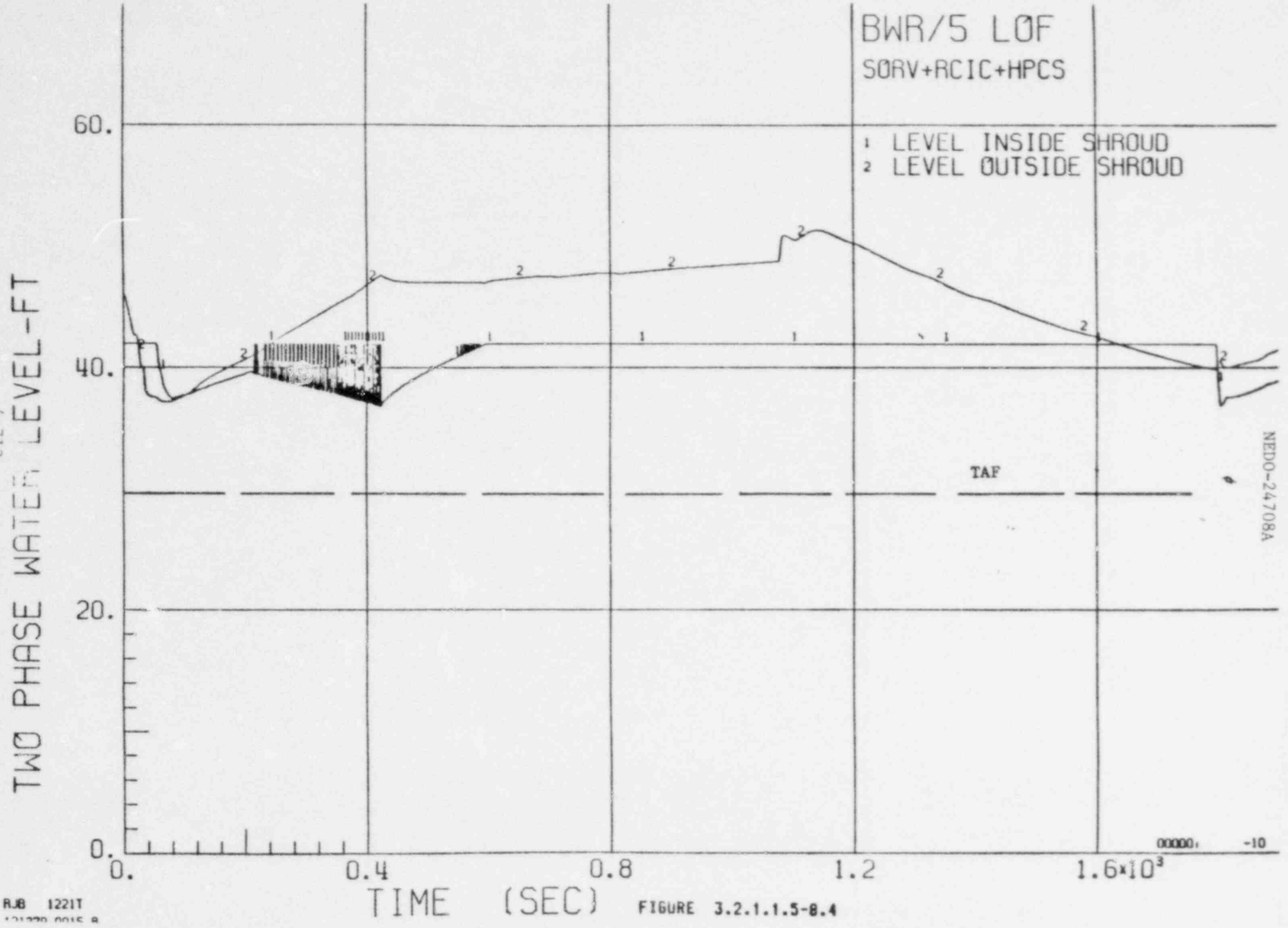


FIGURE 3.2.1.1.5-8.4

RJB 1221T

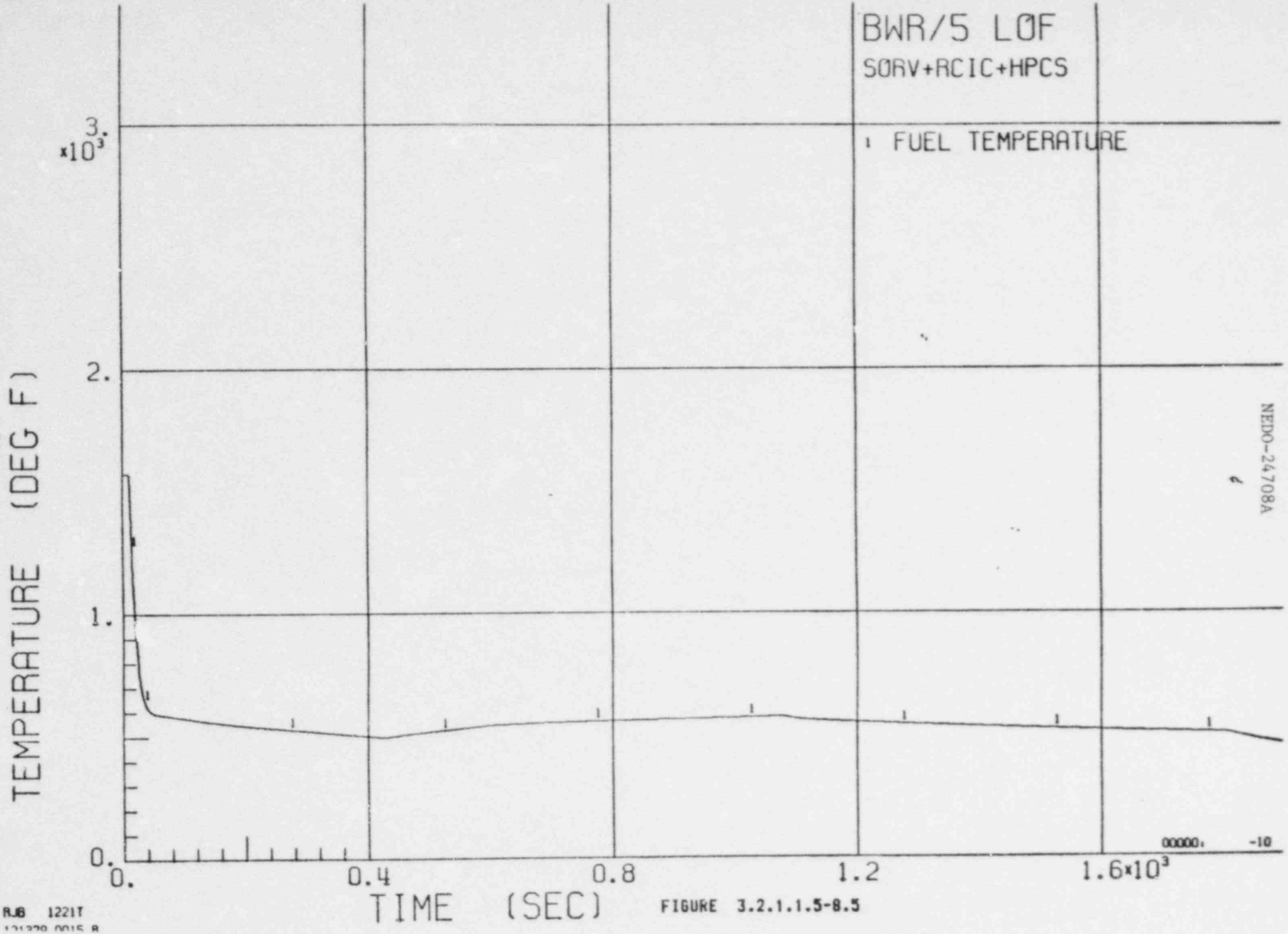


FIGURE 3.2.1.1.5-8.5

RJB 1221T

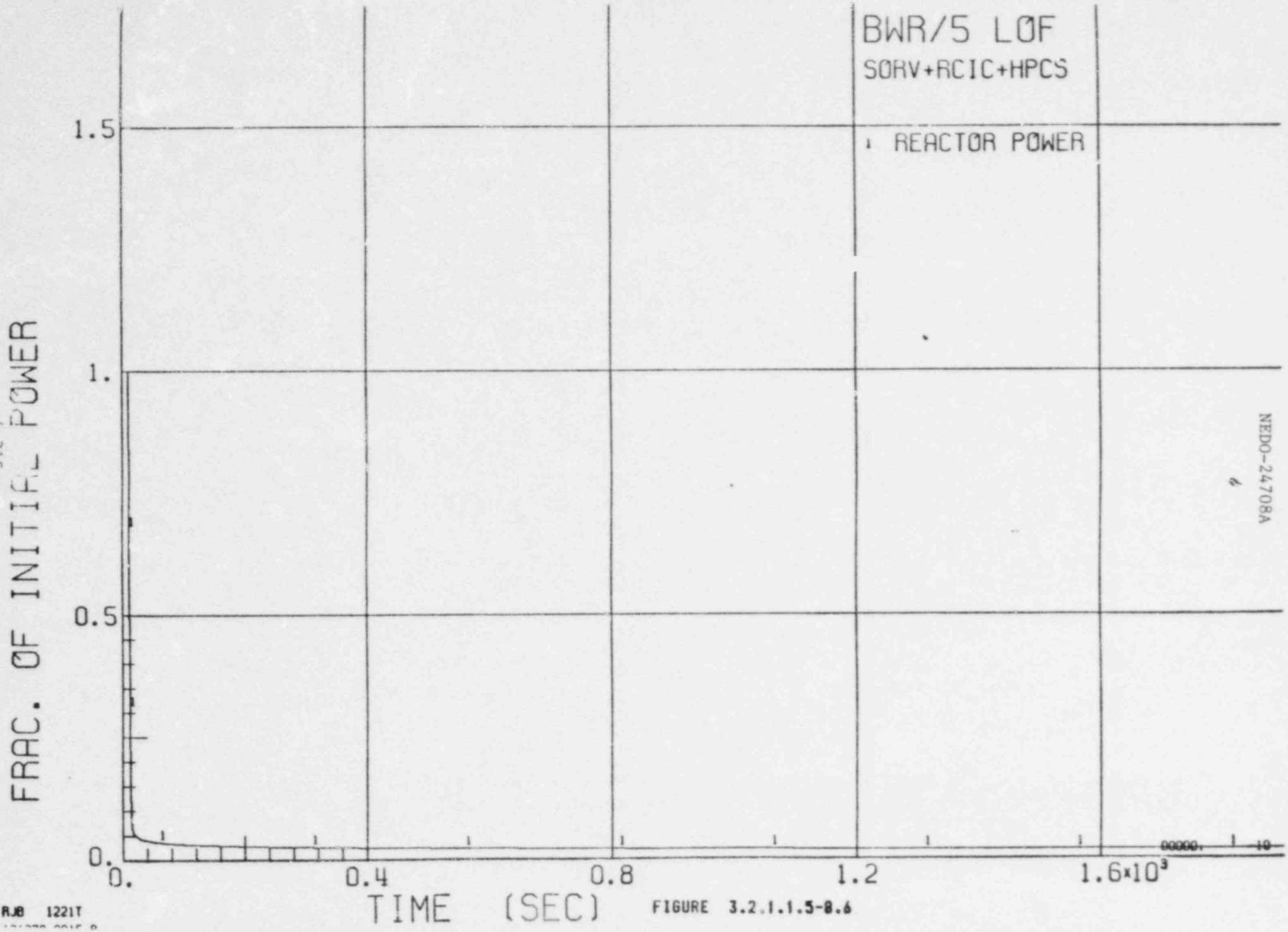


FIGURE 3.2.1.1.5-8.6

RJB 1221T

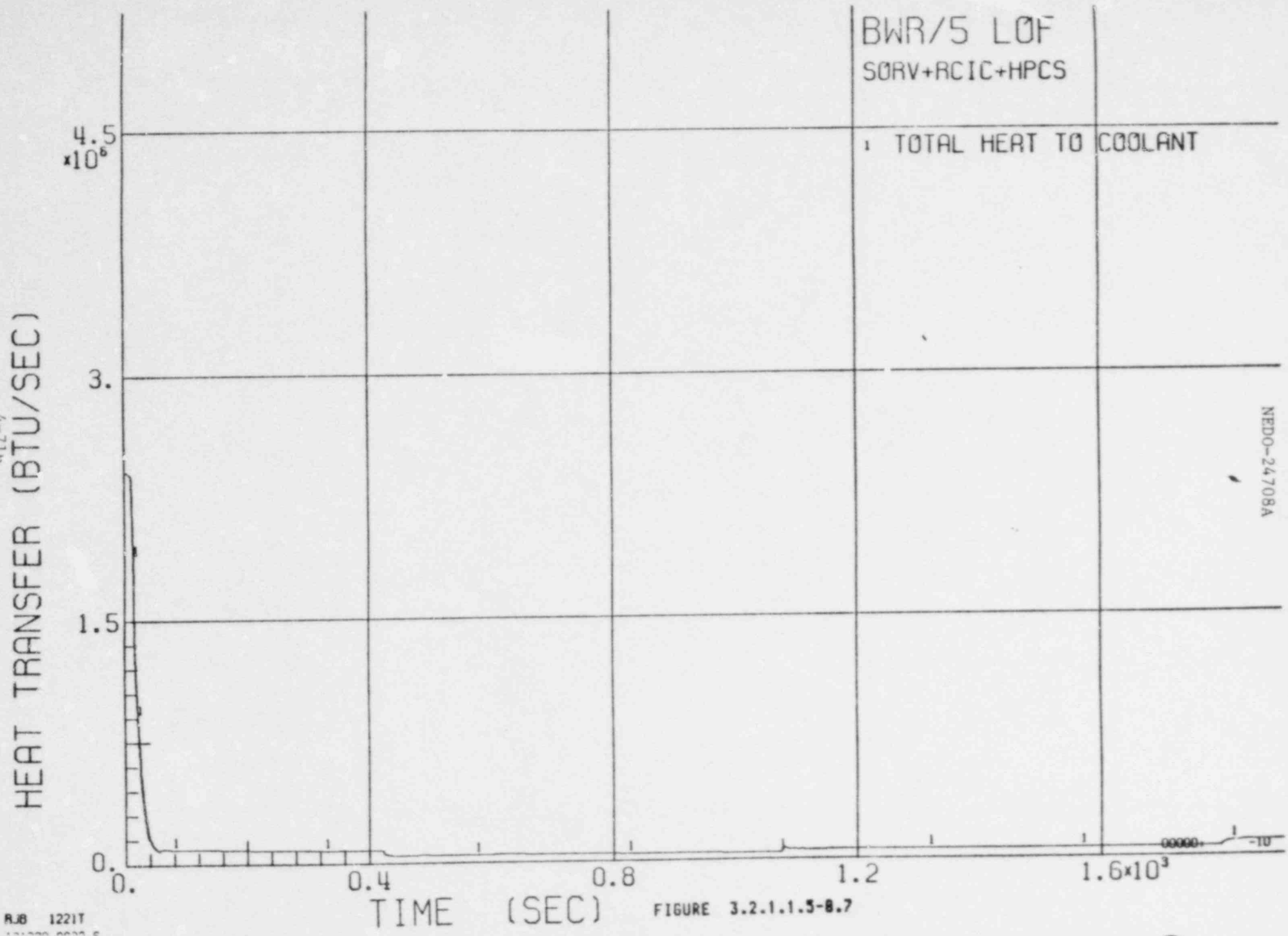


FIGURE 3.2.1.1.5-8.7

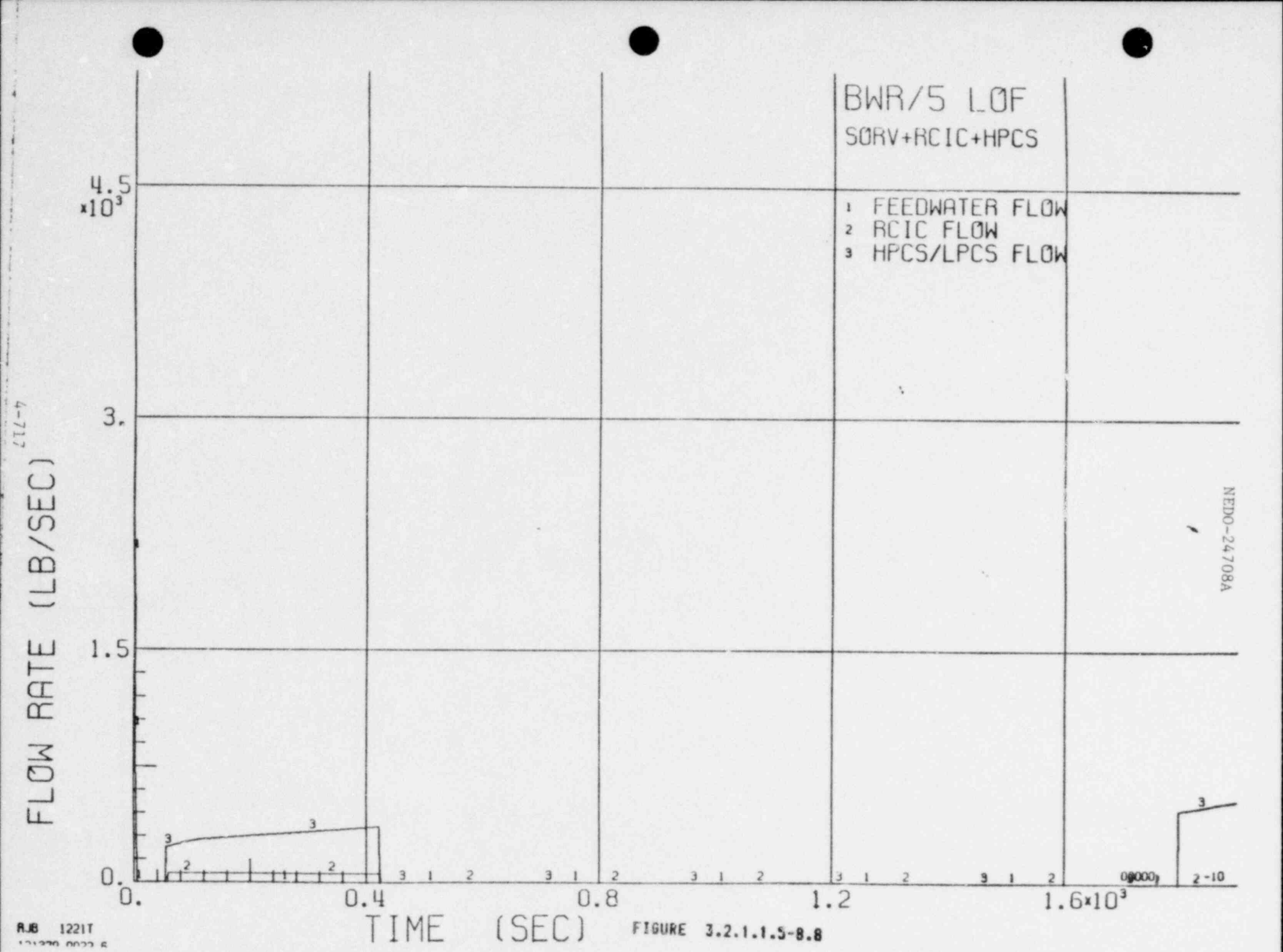


FIGURE 3.2.1.1.5-8.8

RJB 1221T

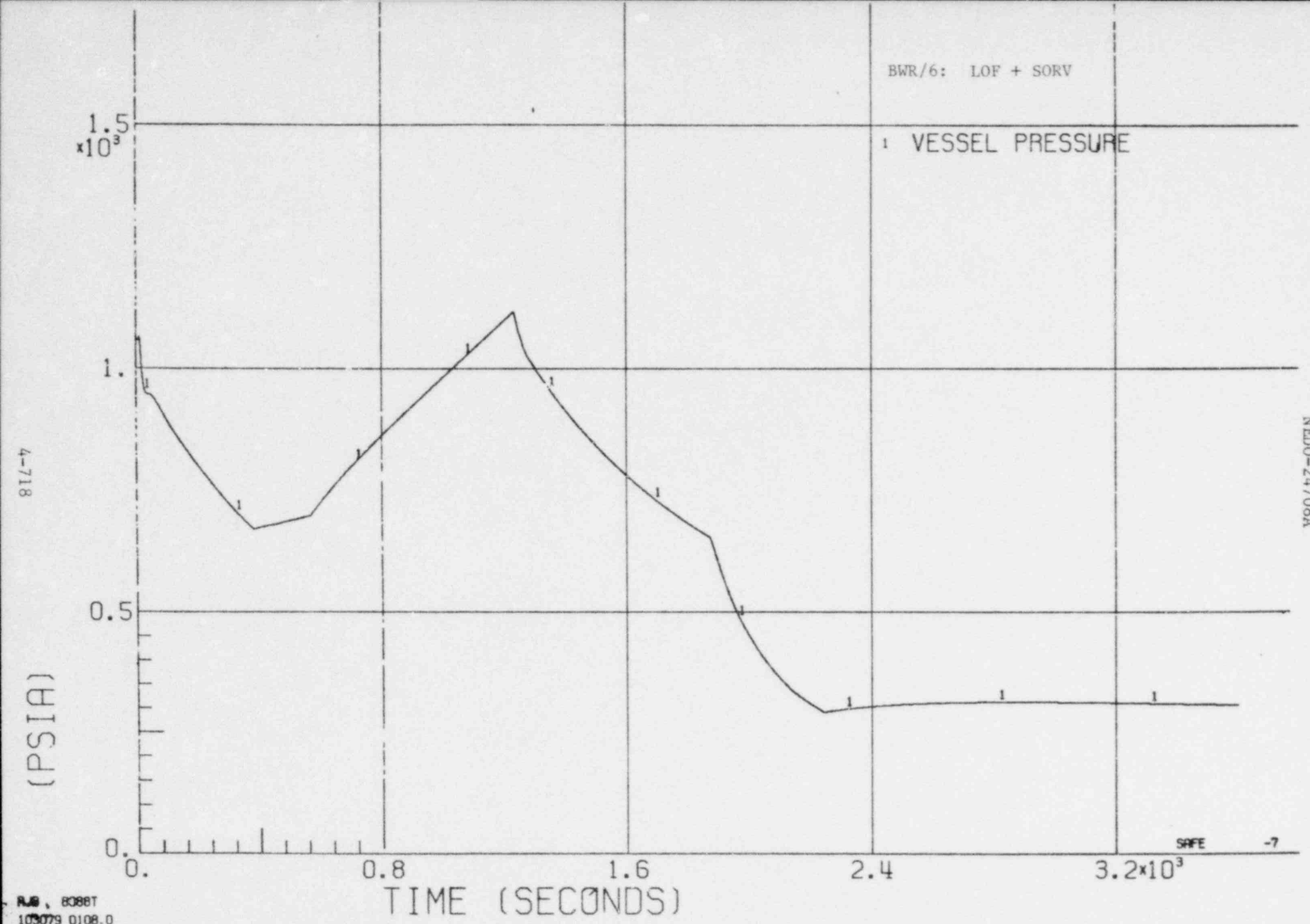


Figure 3.2.1.1.5-8A.1

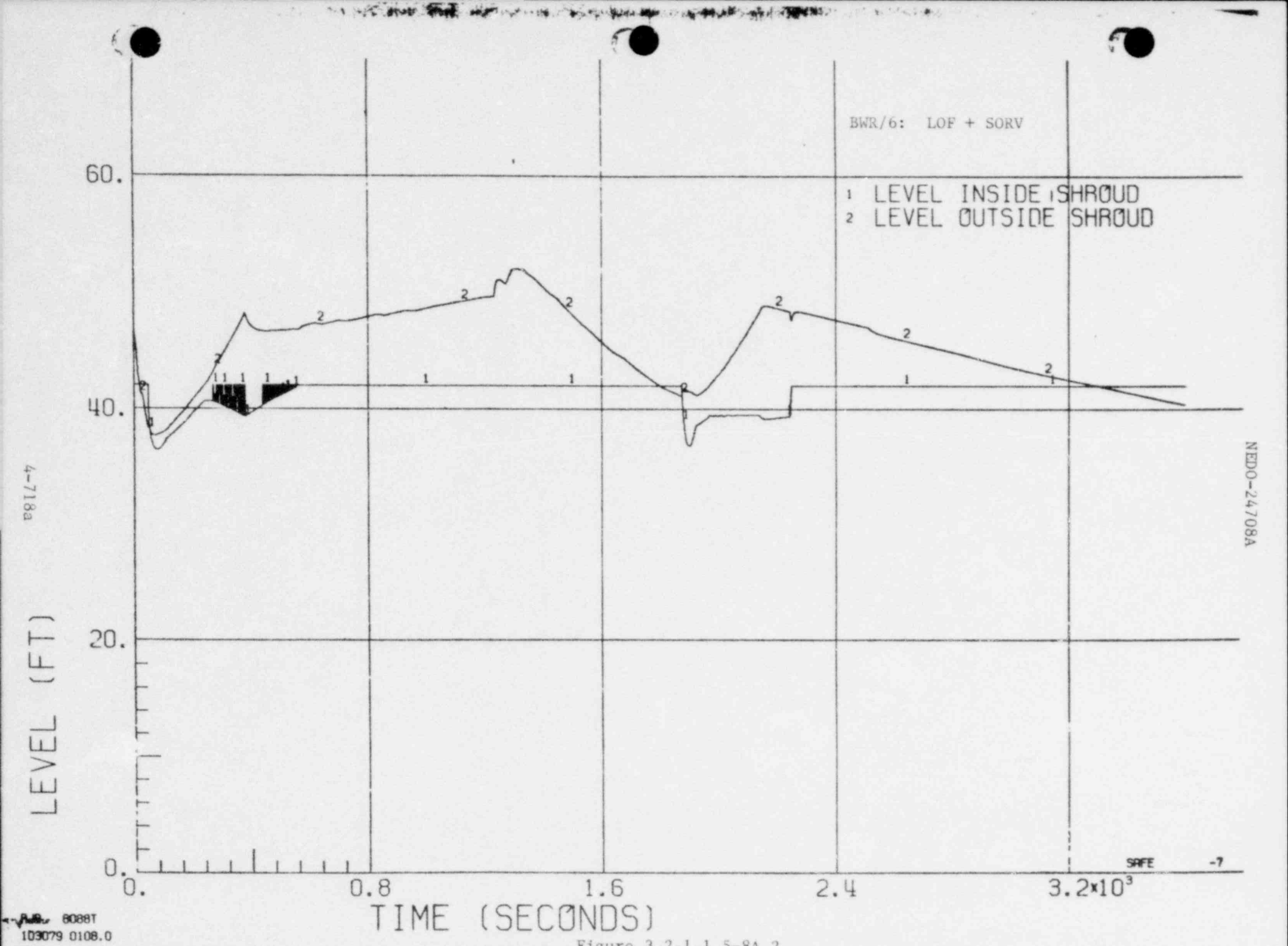


Figure 3.2.1.1.5-8A.2

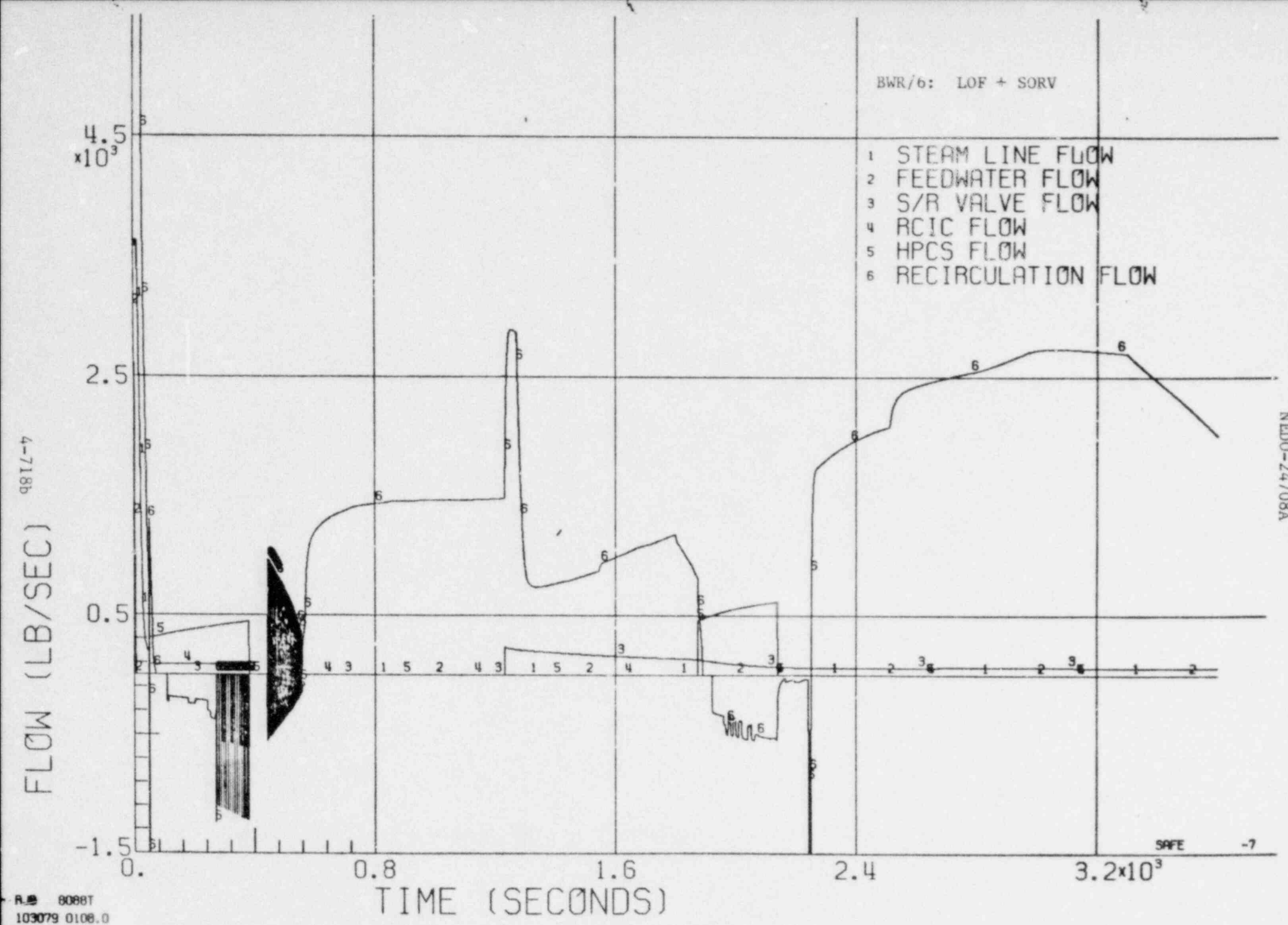


Figure 3.2.1.1.5-8A.3

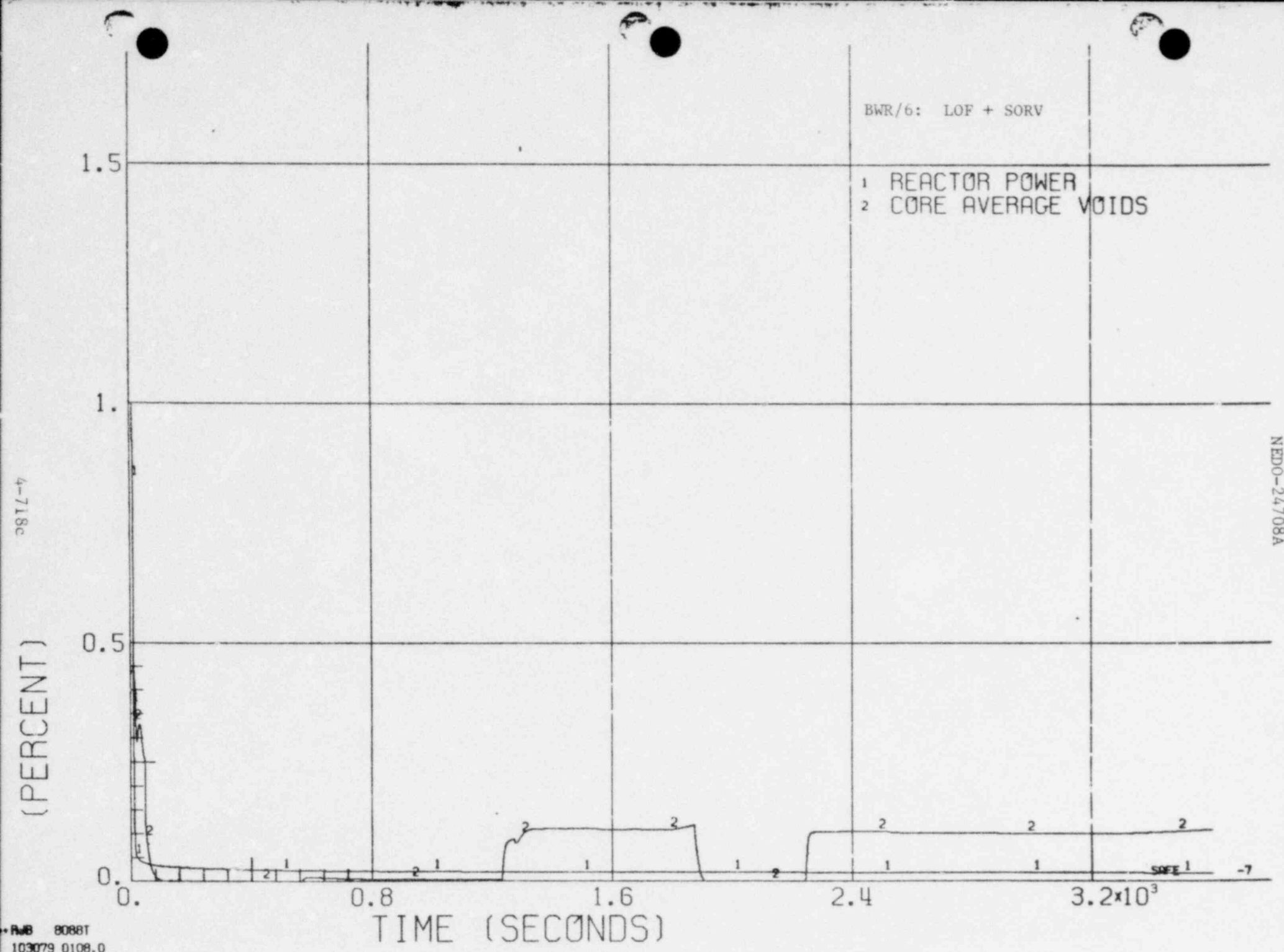


Figure 3.2.1.1.5-8A.4

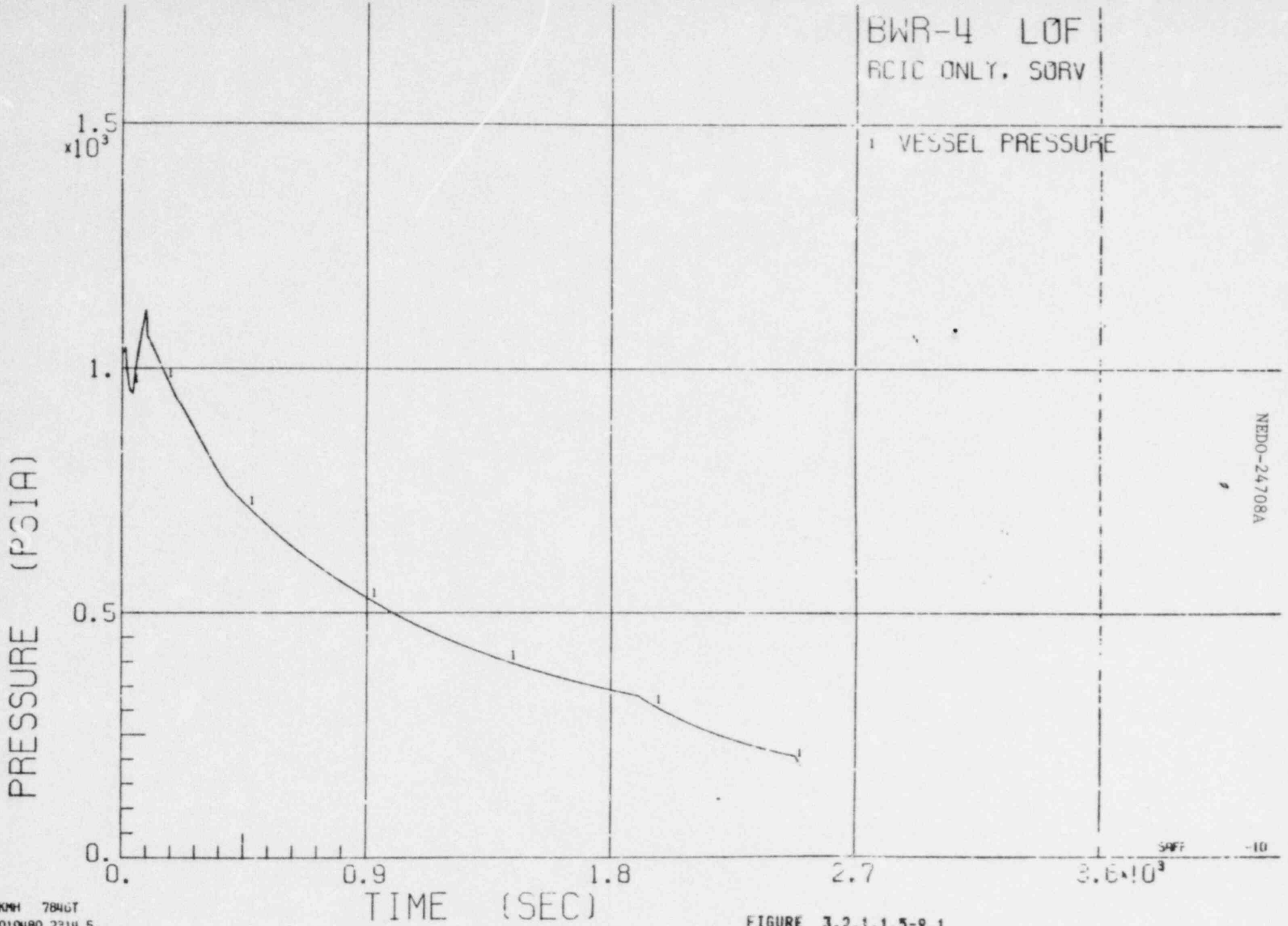
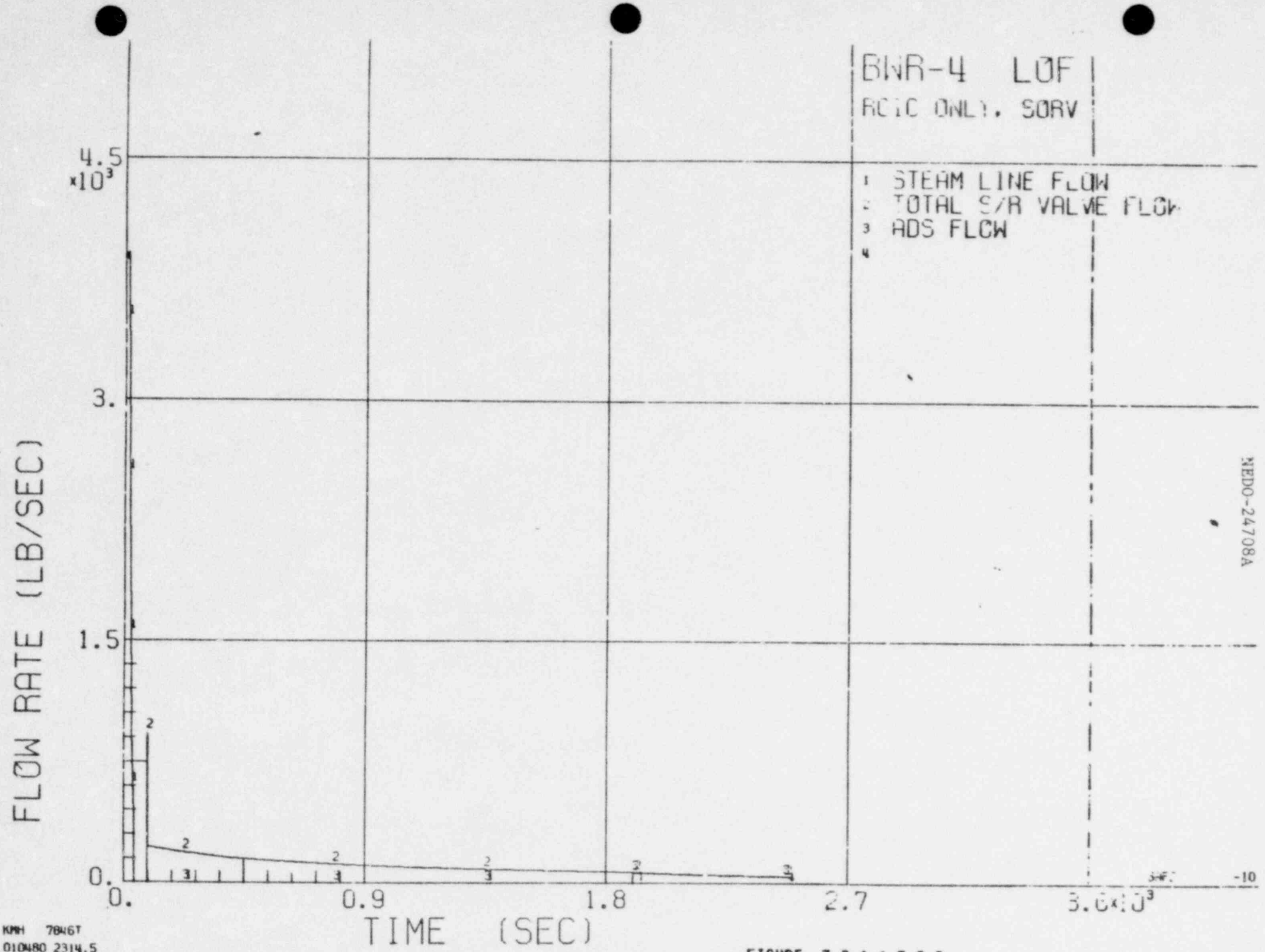


FIGURE 3.2.1.1.5-9.1



KMH 7846T
010480 2314.5

FIGURE 3.2.1.1.5-9.2

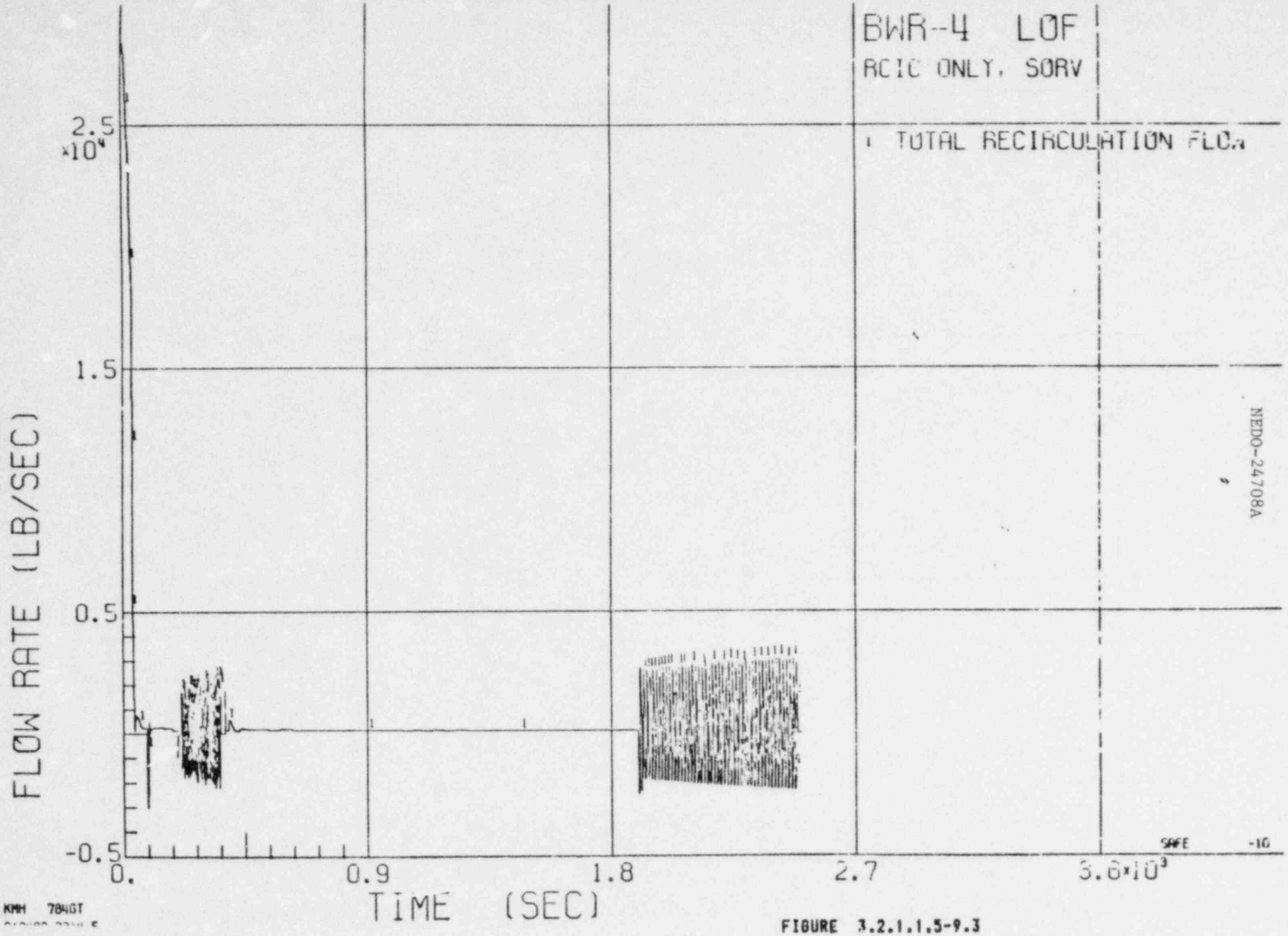
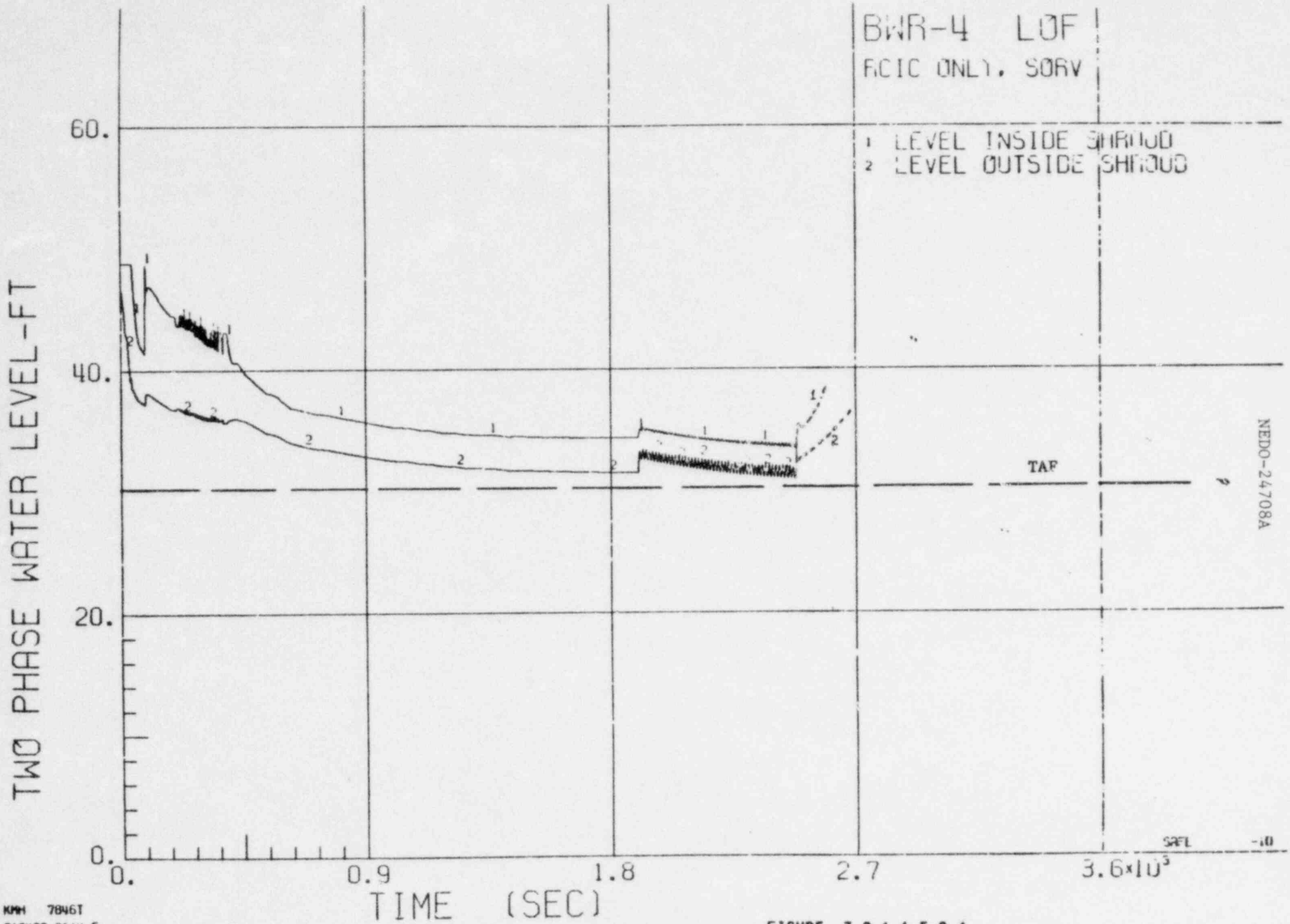


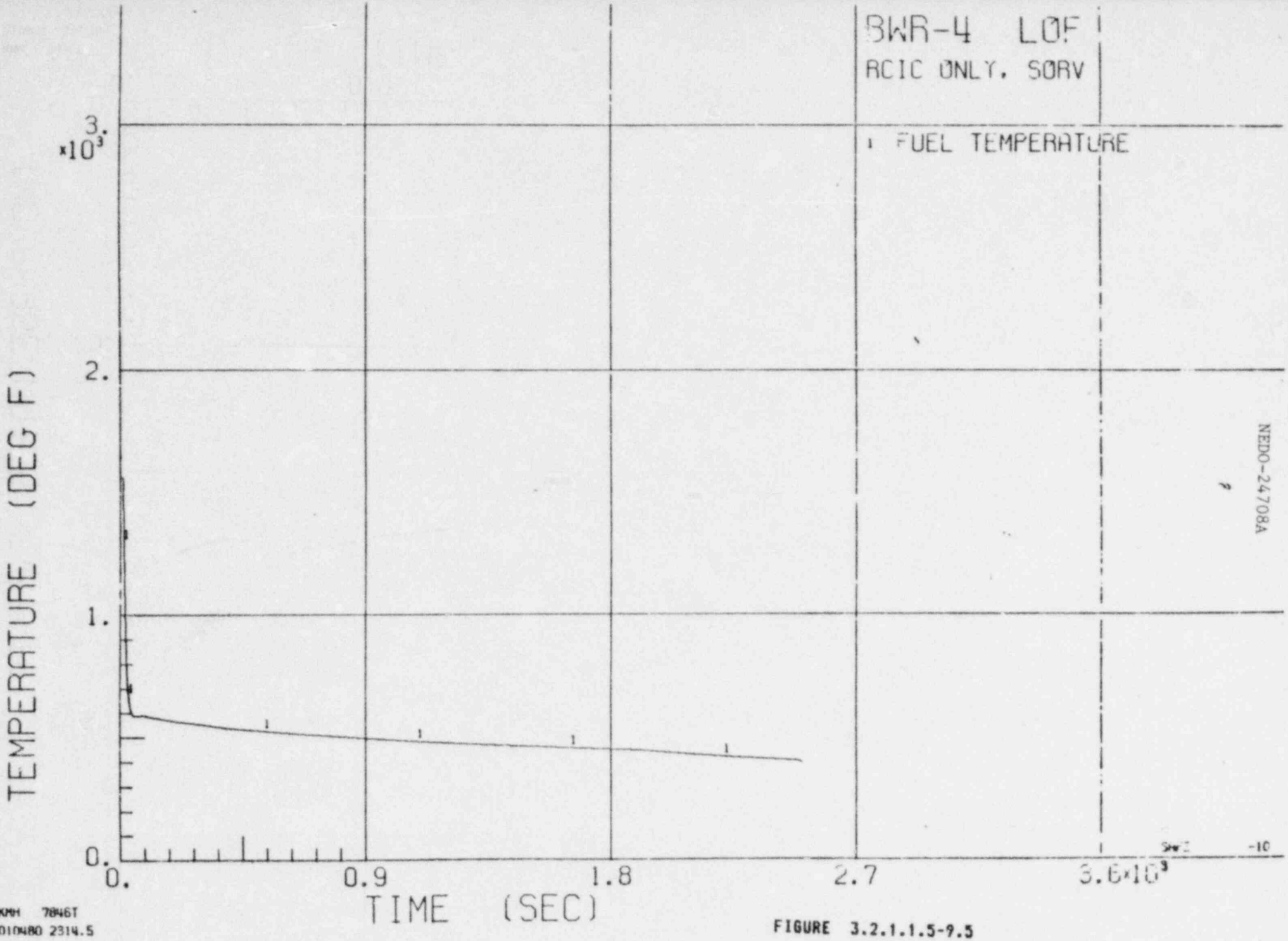
FIGURE 3.2.1.1.5-9.3



4-721

KMH 7846T
010480 2514.5

FIGURE 3.2.1.1.5-9.4



4-722

KMH 7846T
010480 2314.5

FIGURE 3.2.1.1.5-9.5

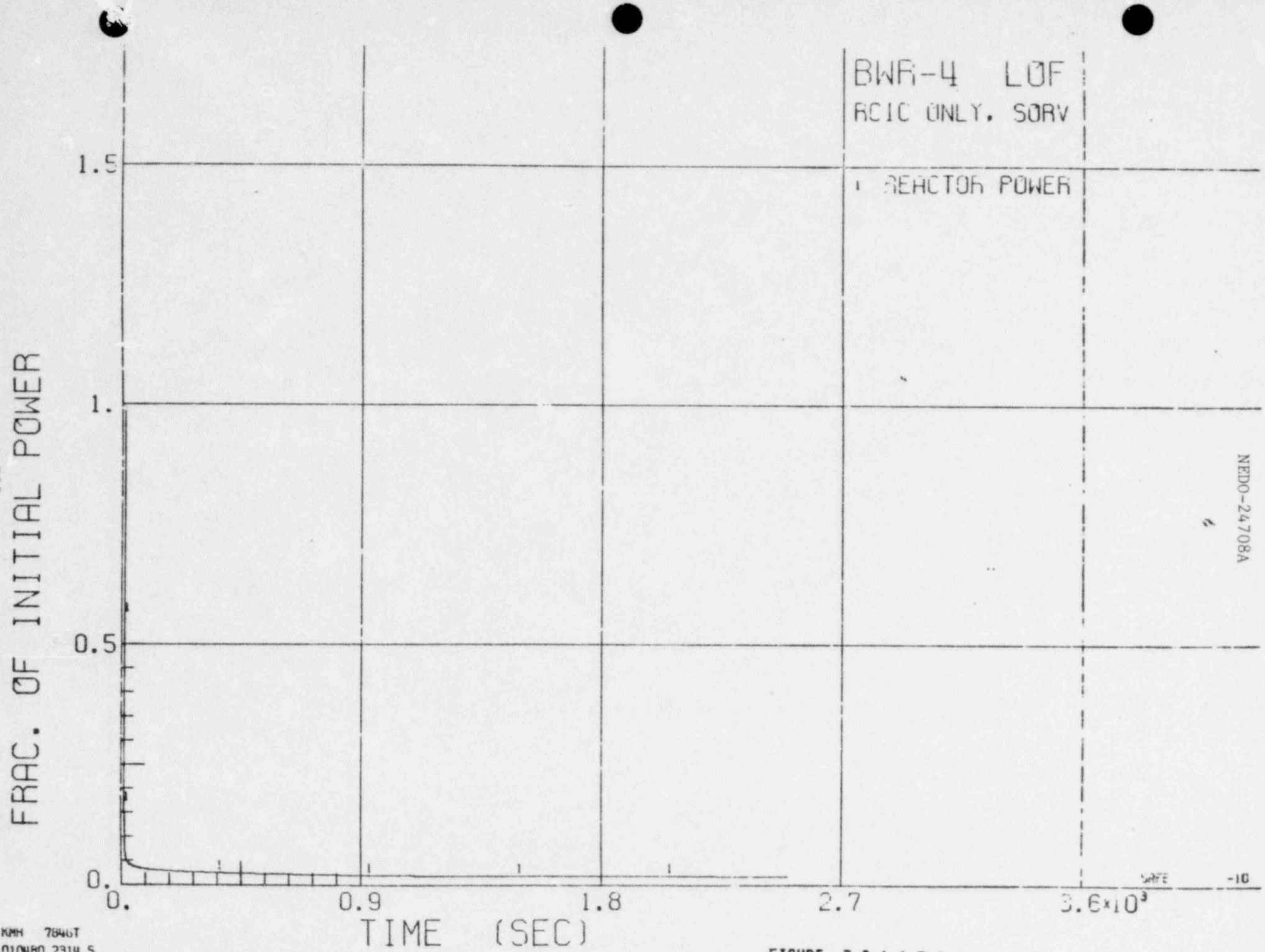
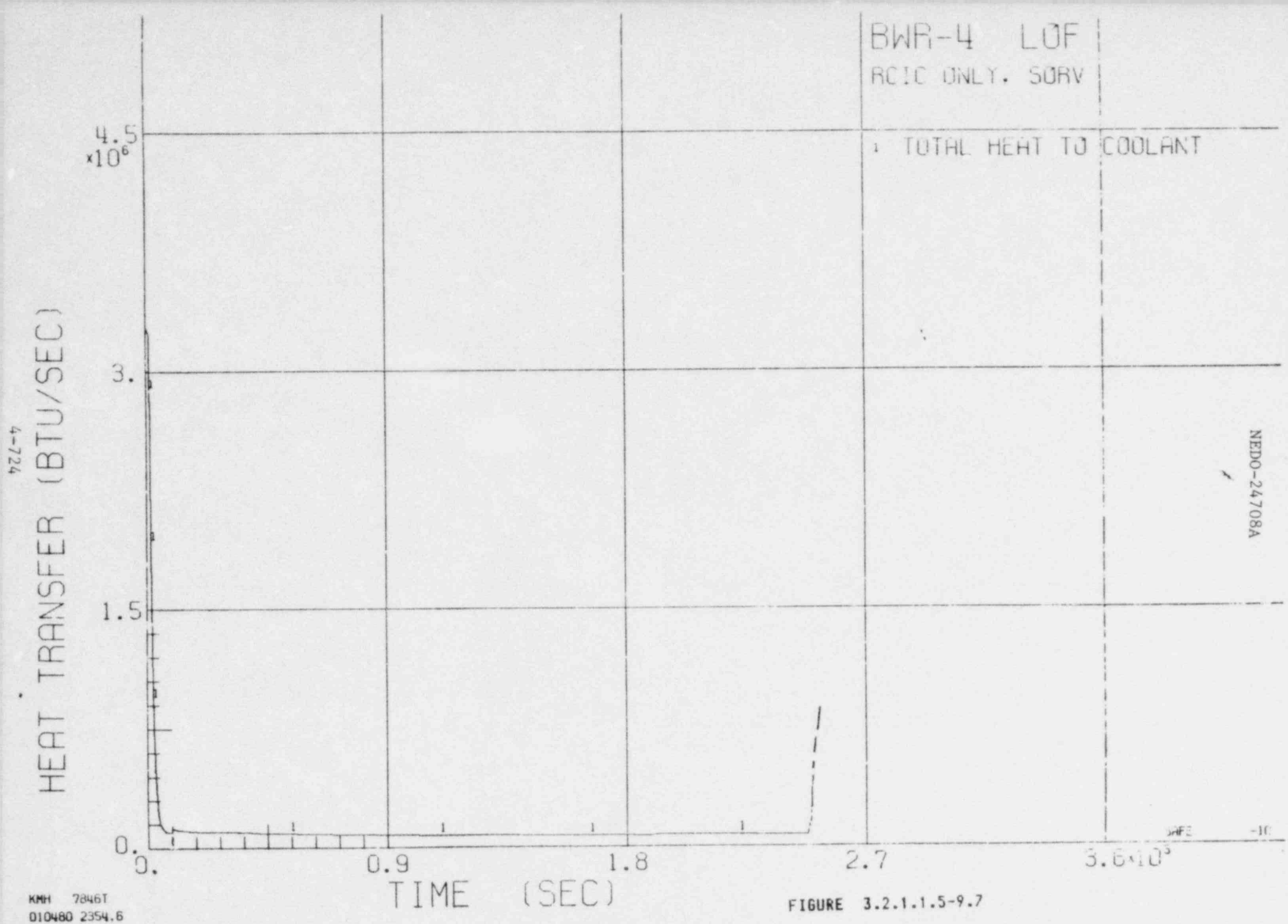


FIGURE 3.2.1.1.3-9.6



KMH 7846T
010480 2354.6

FIGURE 3.2.1.1.5-9.7

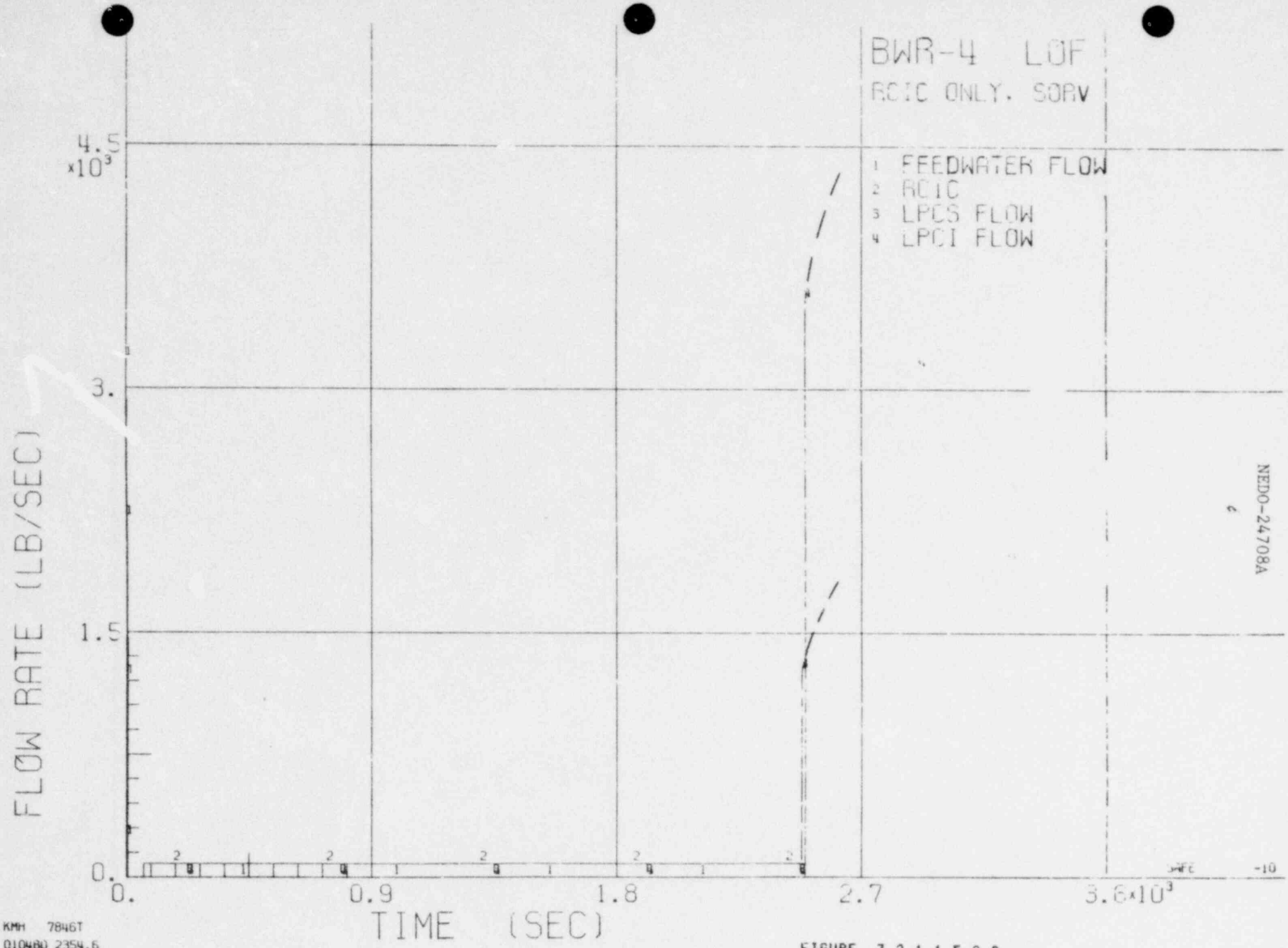


FIGURE 3.2.1.1.5-9.8

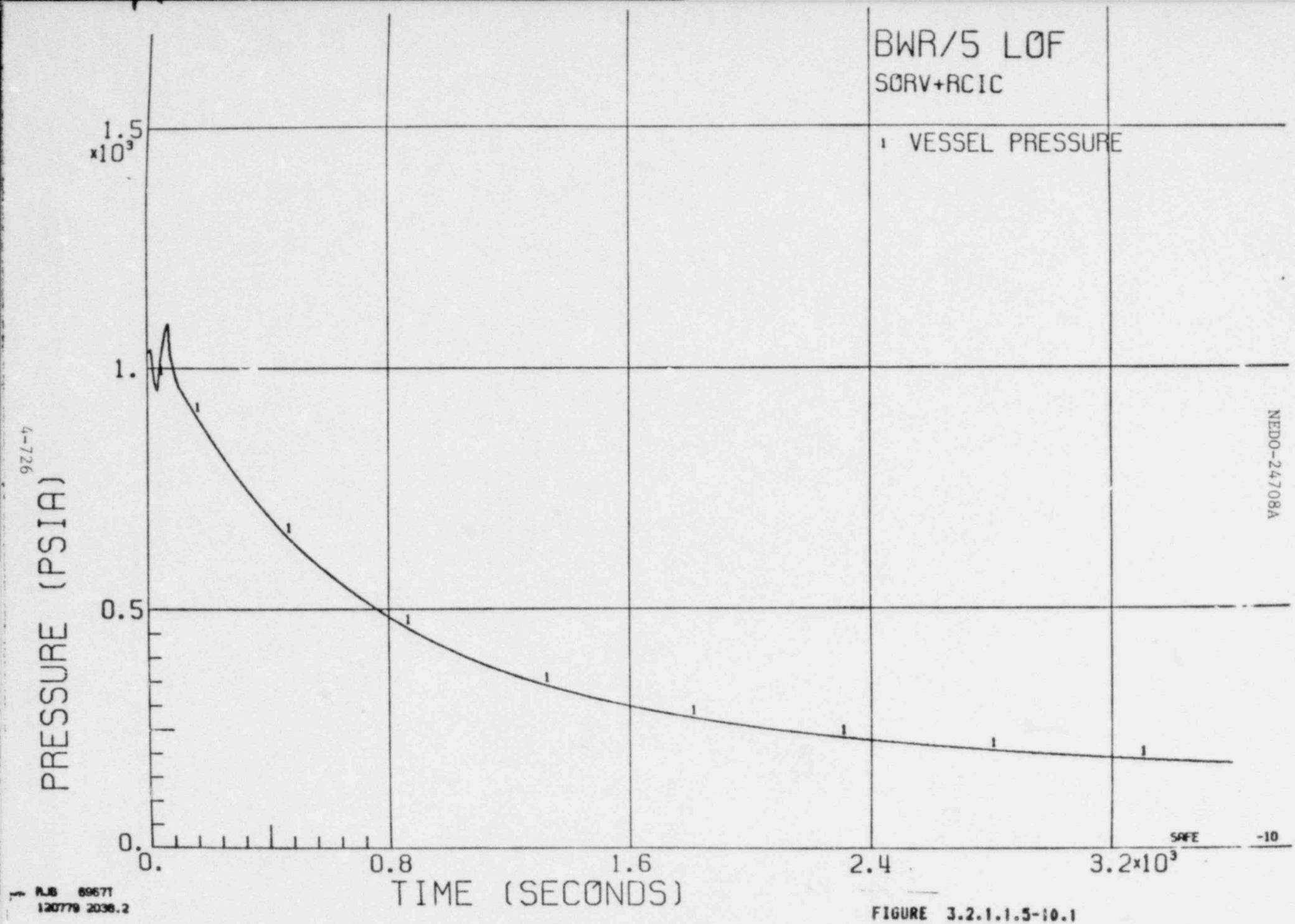
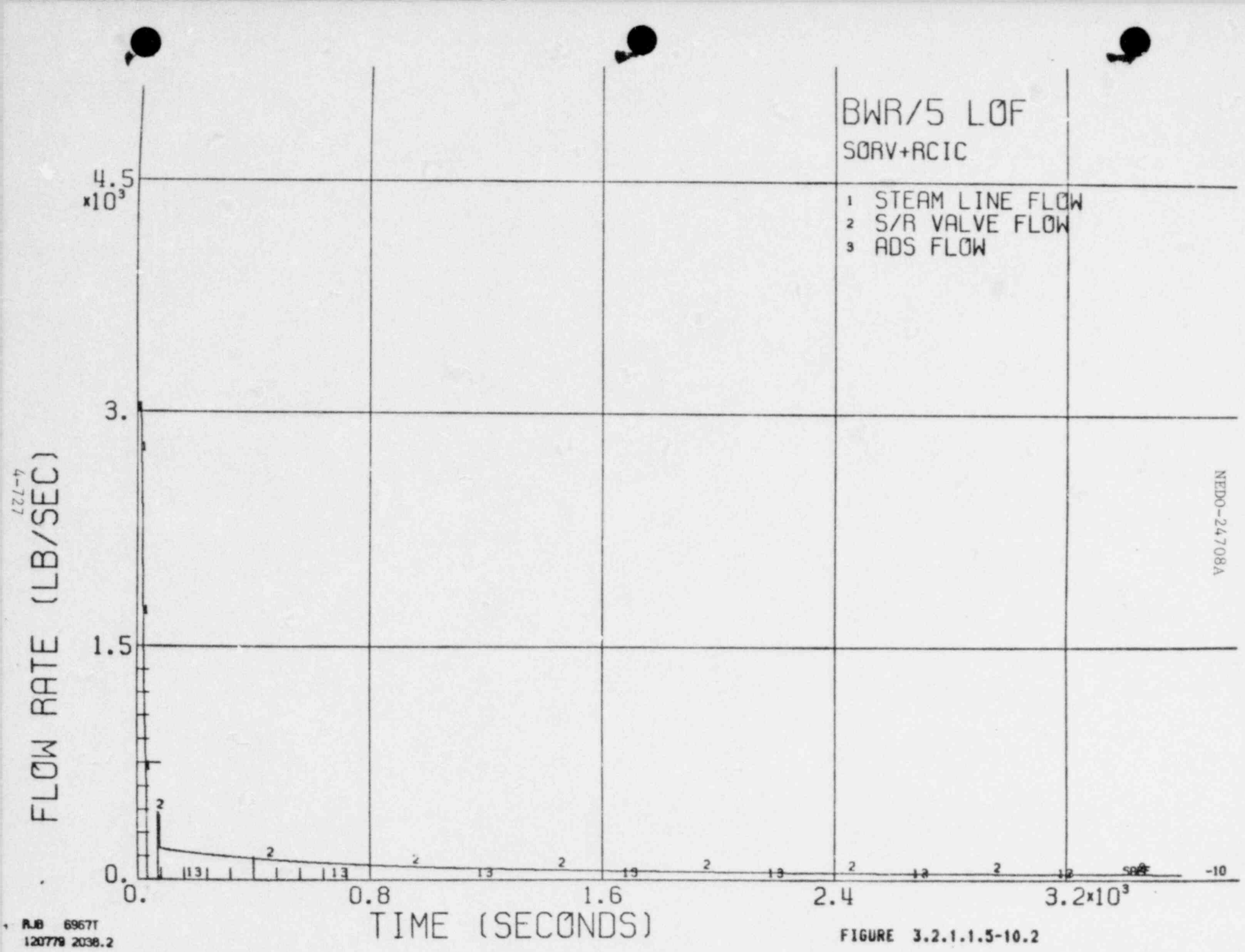
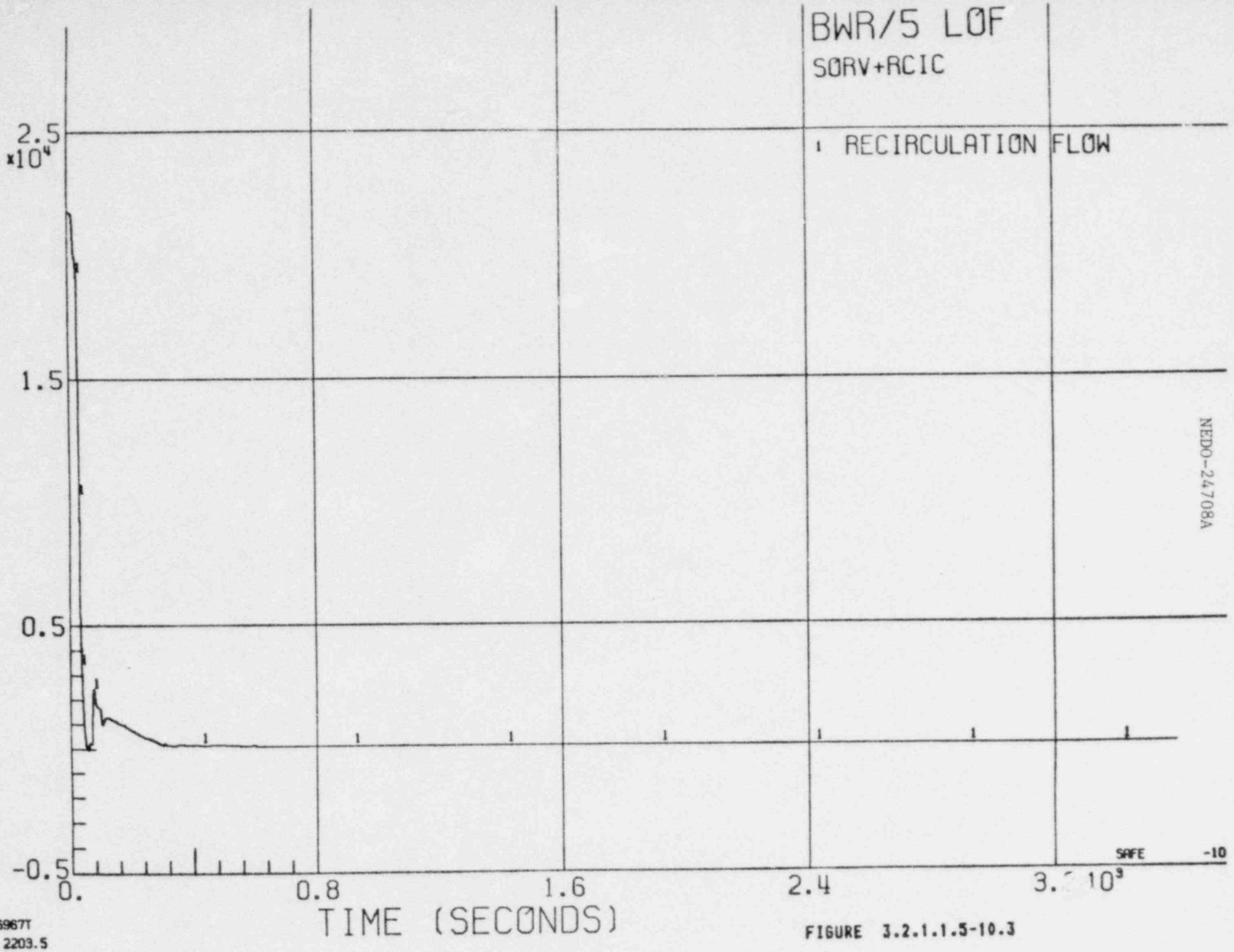


FIGURE 3.2.1.1.5-10.1



RJB 6967T
120779 2038.2

FIGURE 3.2.1.1.5-10.2

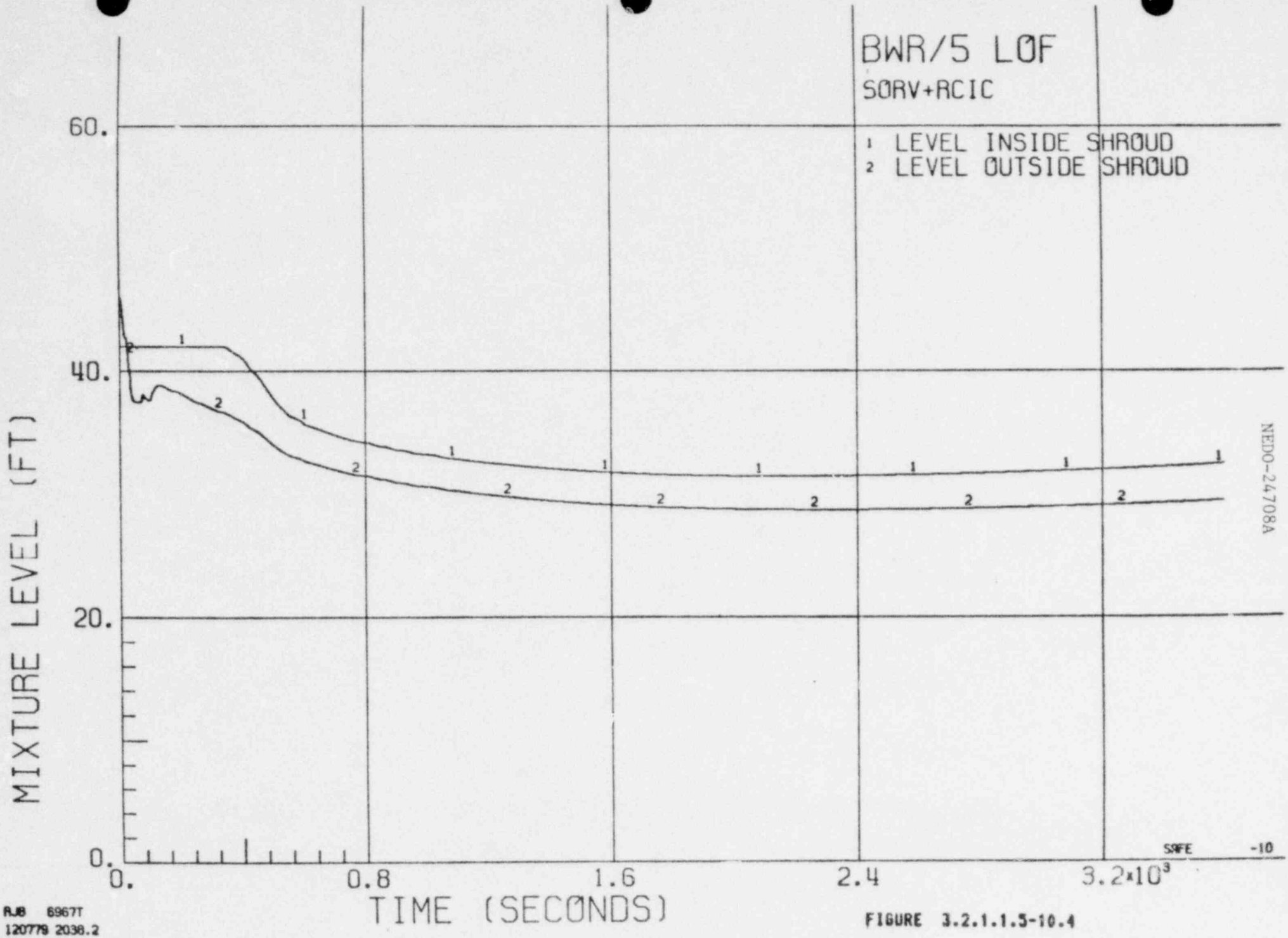


4-728

NEDO-24708A

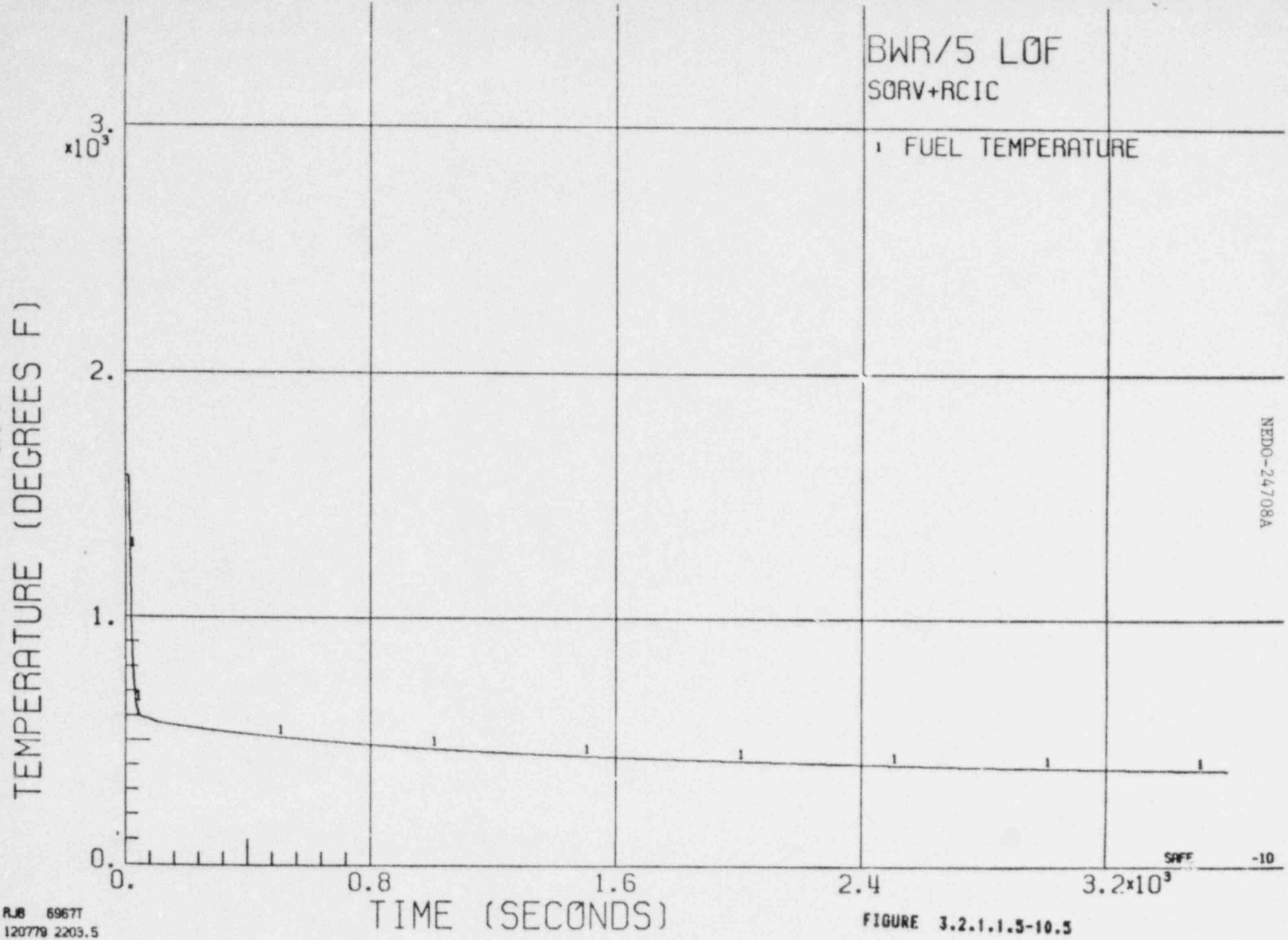
RJB 6967T
120779 2203.5

FIGURE 3.2.1.1.5-10.3



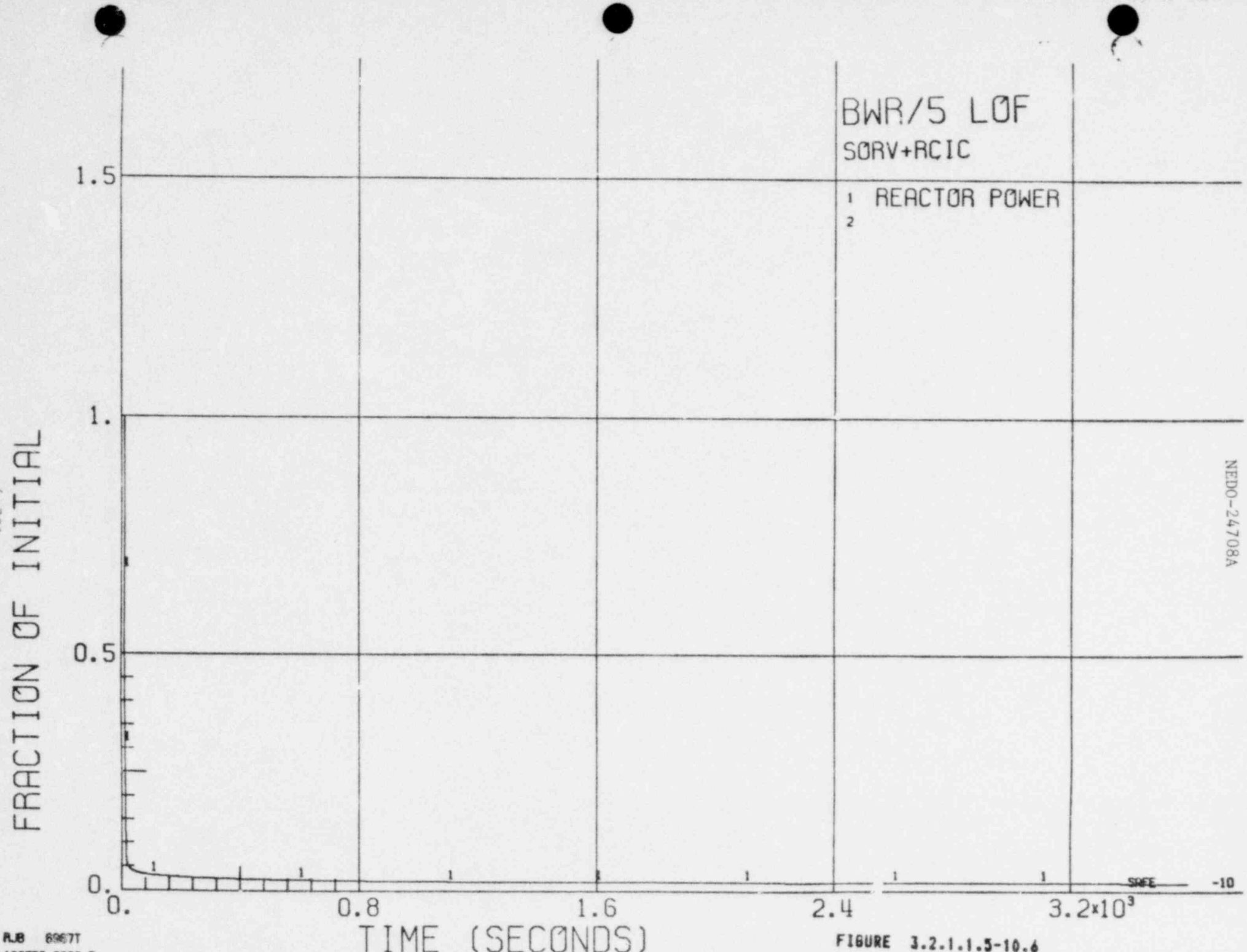
RJB 6967T
120779 2038.2

FIGURE 3.2.1.1.5-10.4



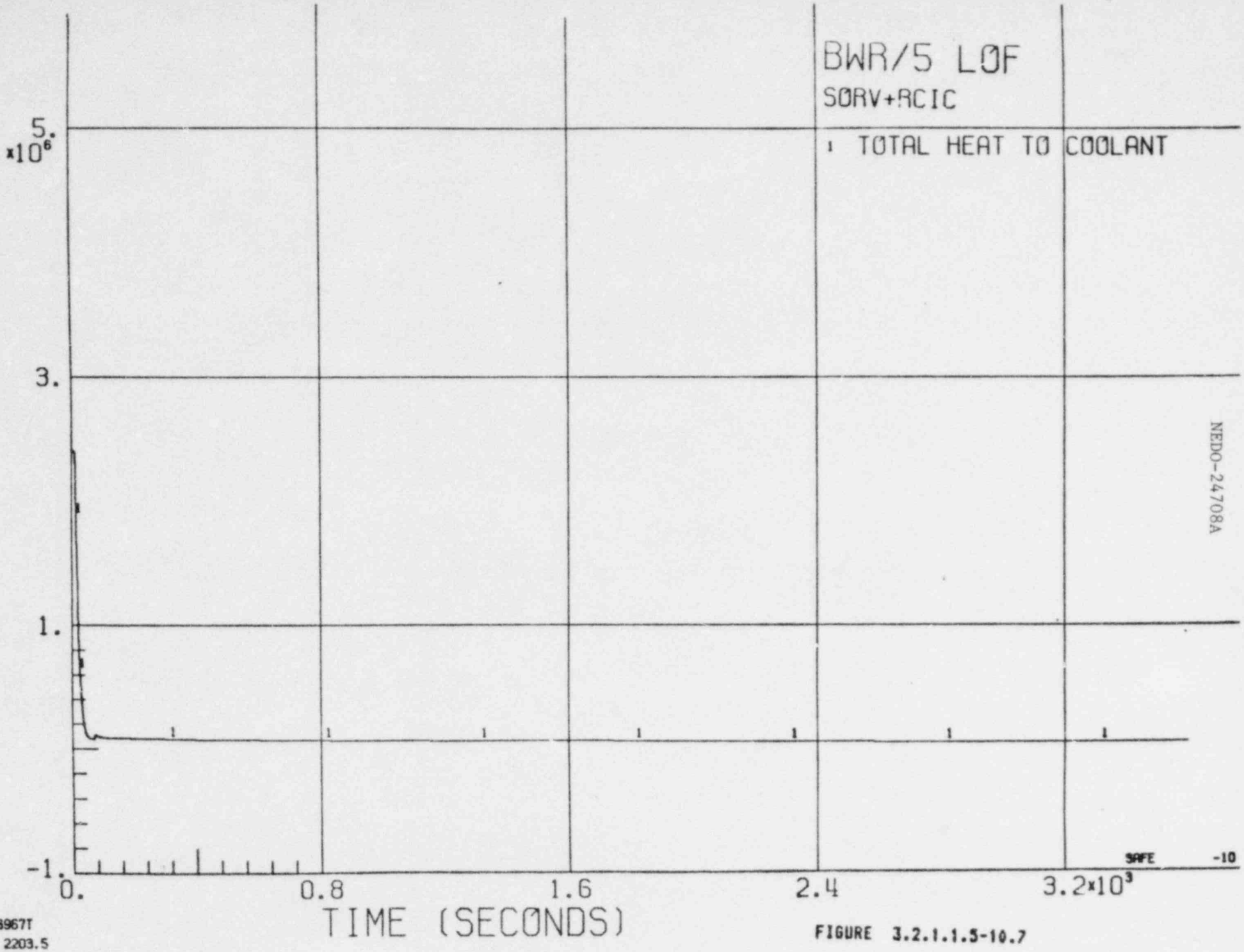
RJB 6967T
120779 2203.5

FIGURE 3.2.1.1.5-10.5



RJB 69677
120779 2203.5

FIGURE 3.2.1.1.5-10.6



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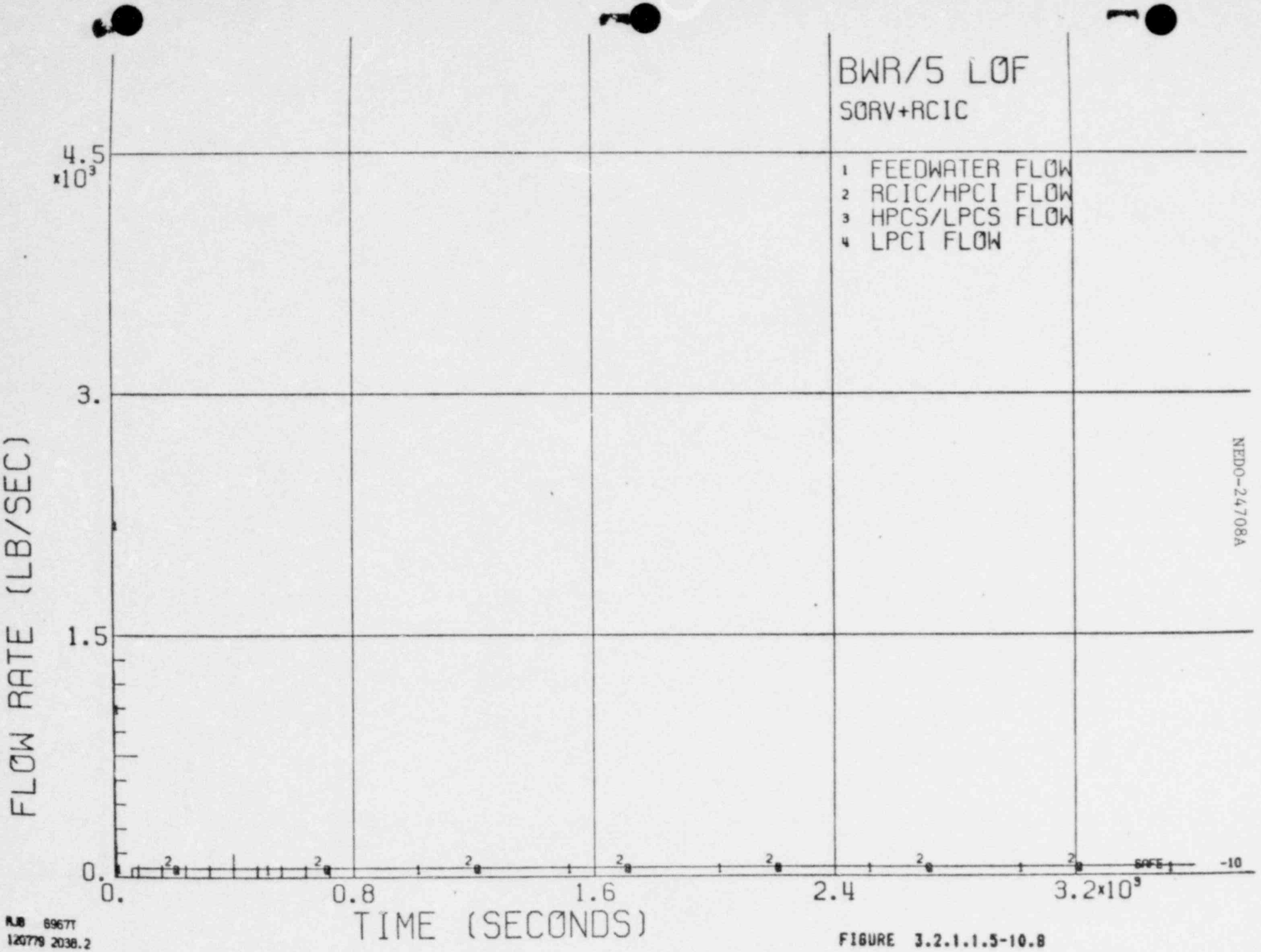
RJB 8967T
120779 2203.5

FIGURE 3.2.1.1.5-10.7



RJB 69677
120778 2038.2

FIGURE 3.2.1.1.5-10.8

Figure 3.2.1.1.5-10A.1

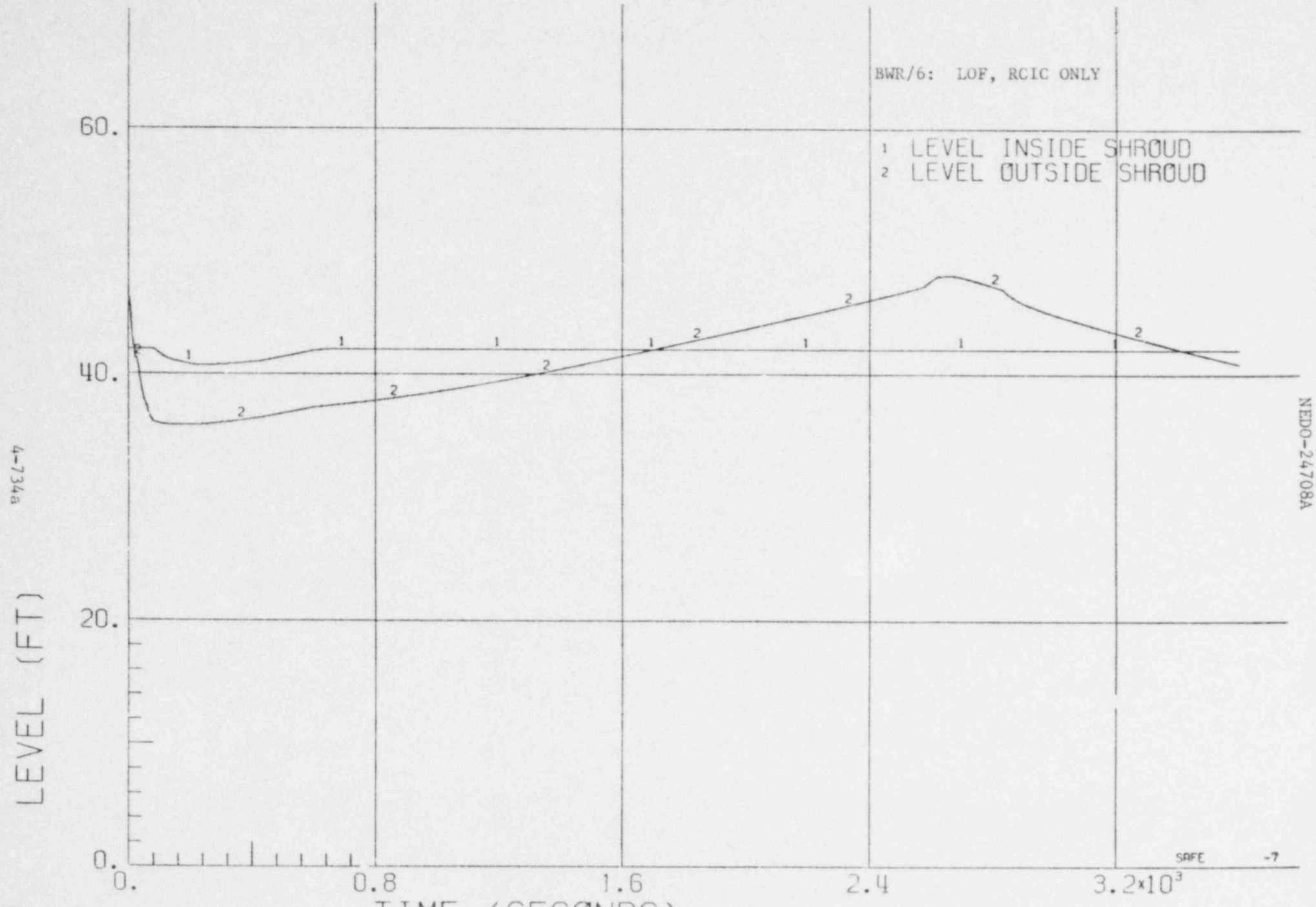


Figure 3.2.1.1.5-10A.2

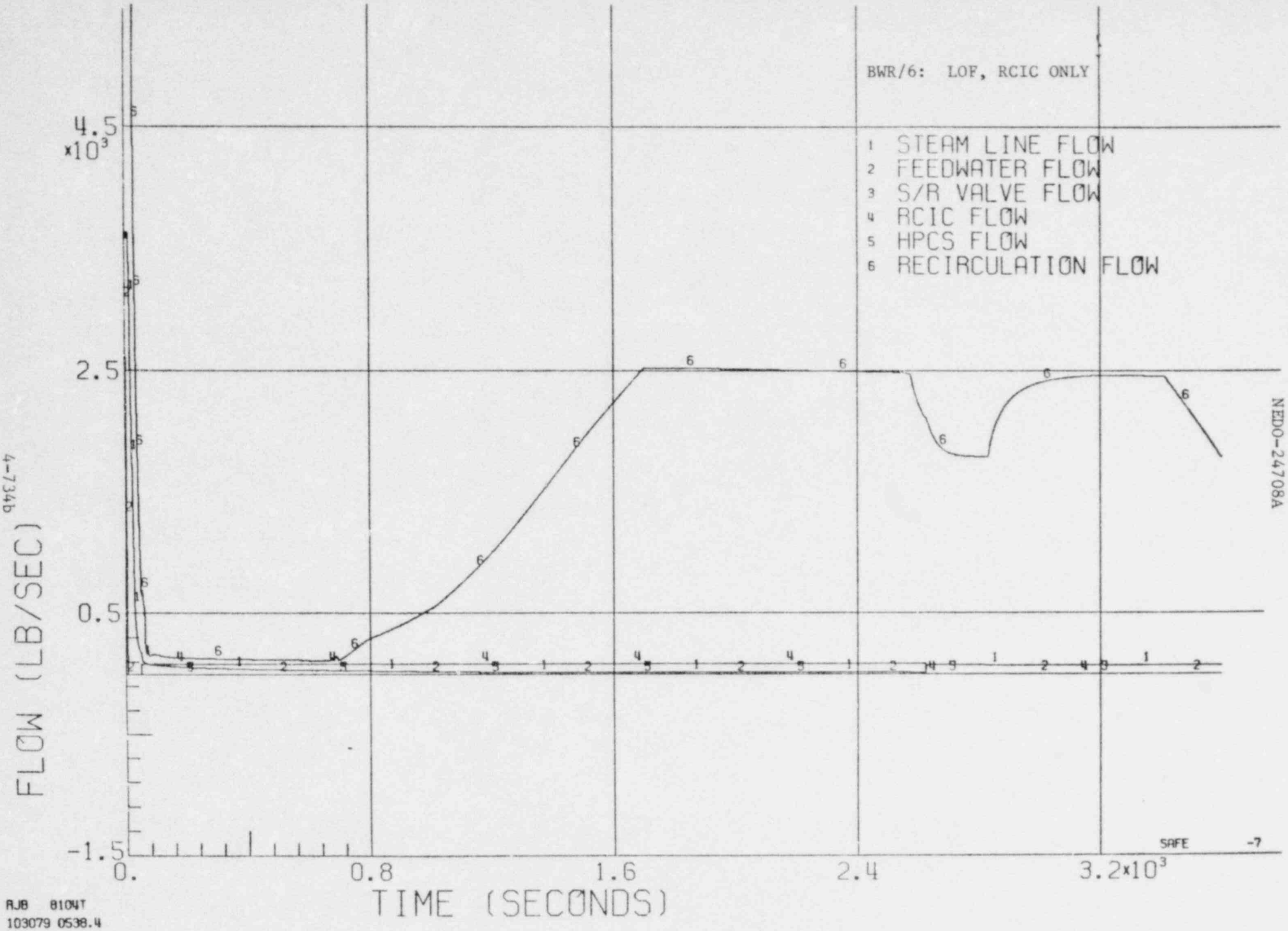


Figure 3.2.1.1.5-10A.3

Figure 3.2.1.1.5-10A.4

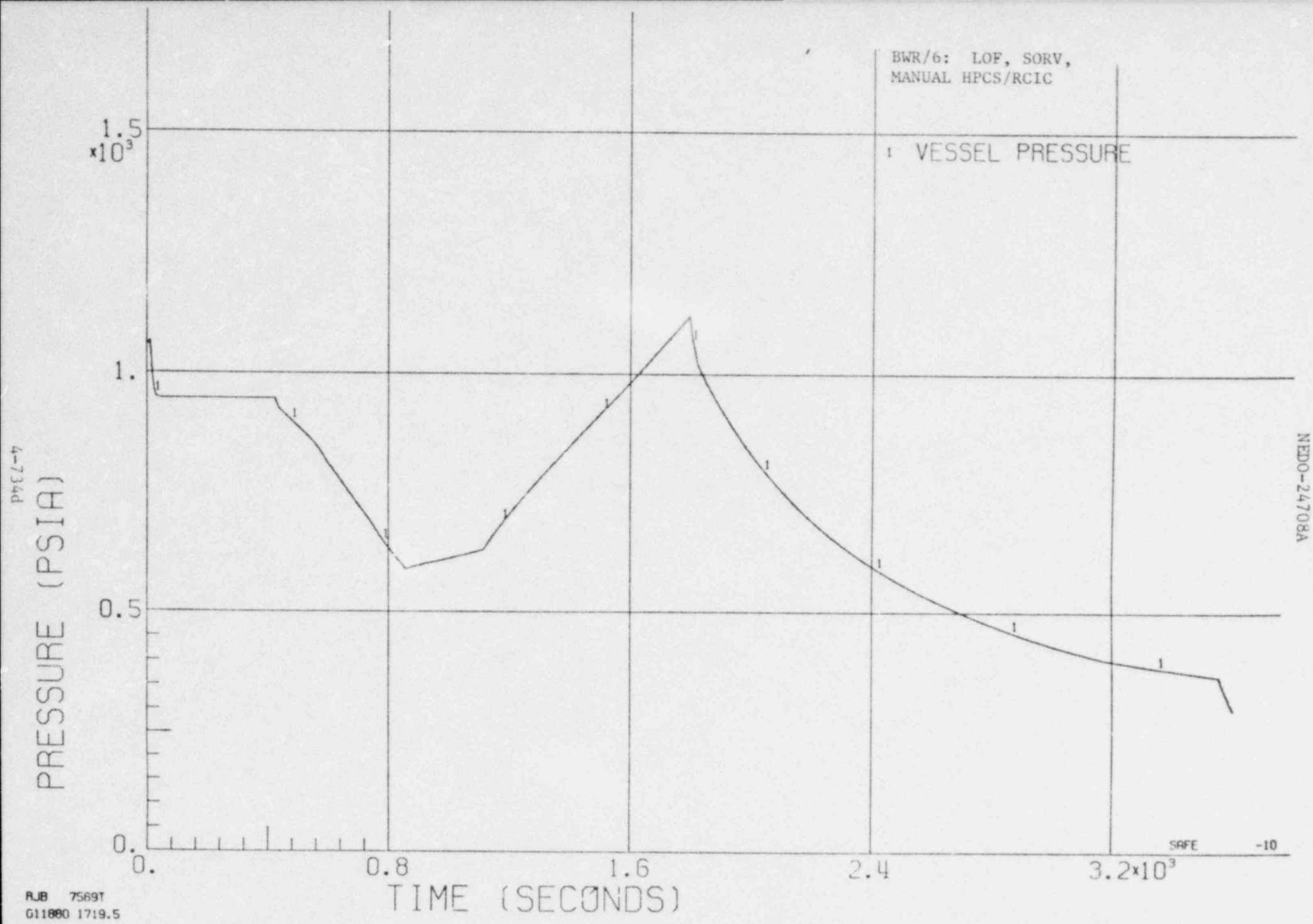
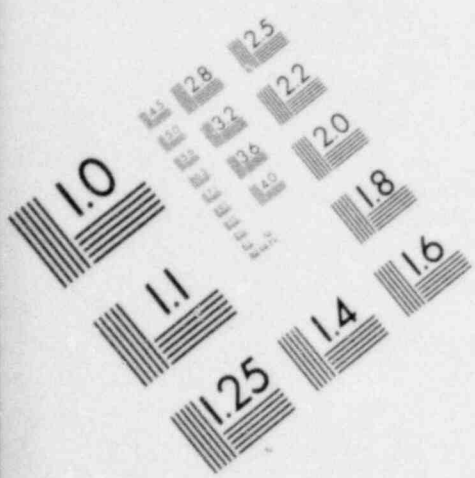


Figure 3.2.1.1.5-10B.1



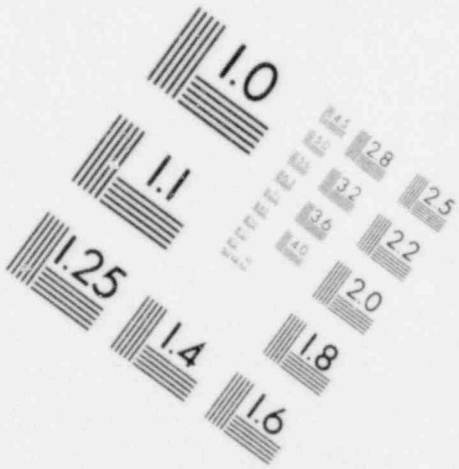
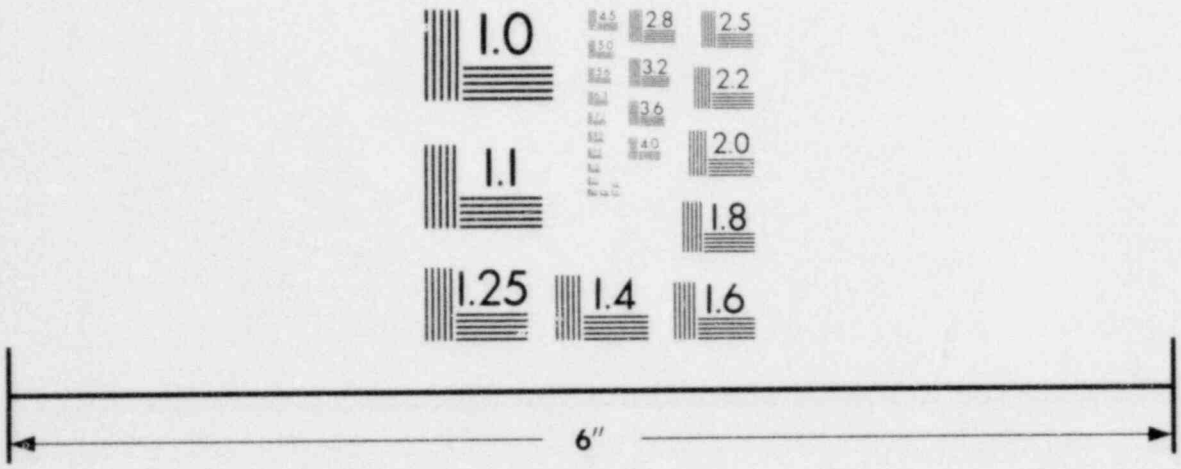
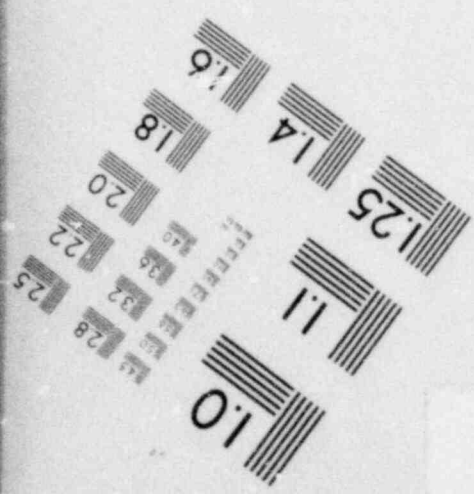
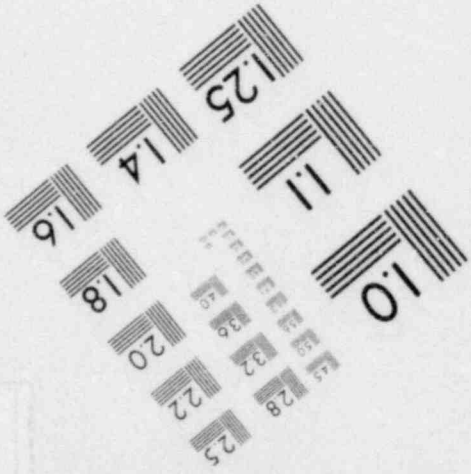
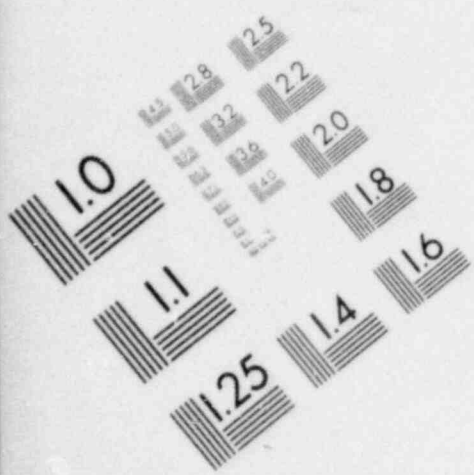


IMAGE EVALUATION TEST TARGET (MT-3)









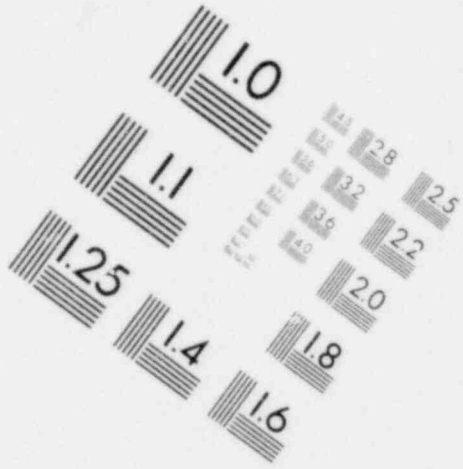
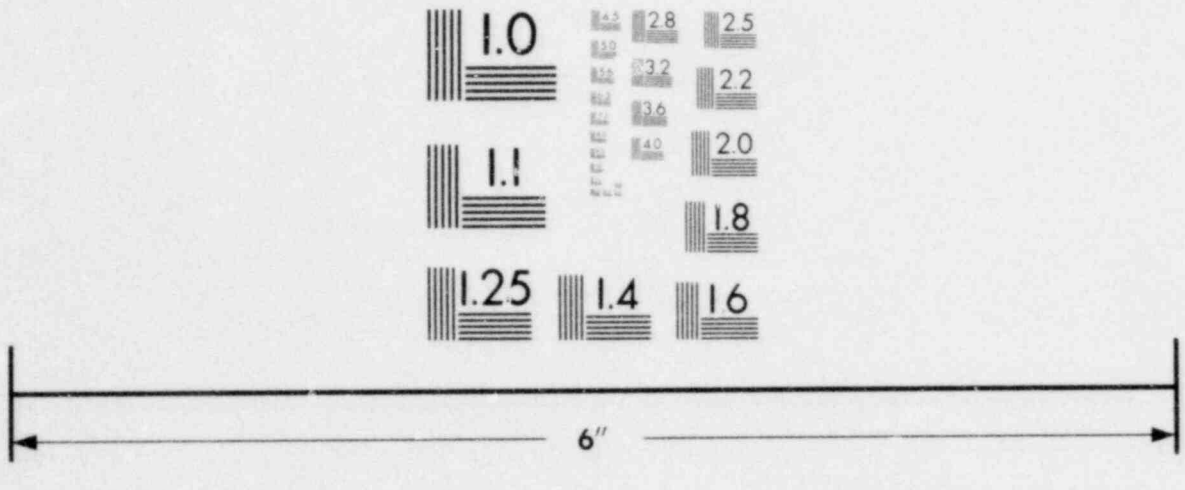
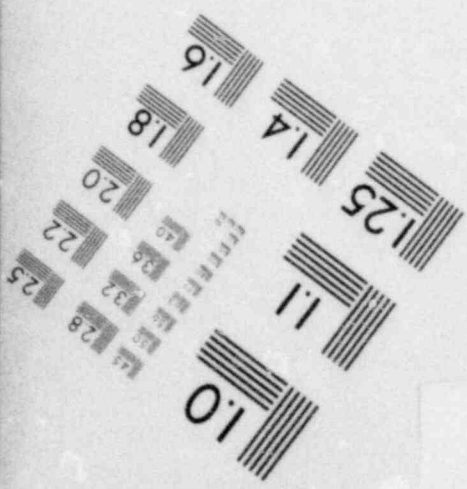
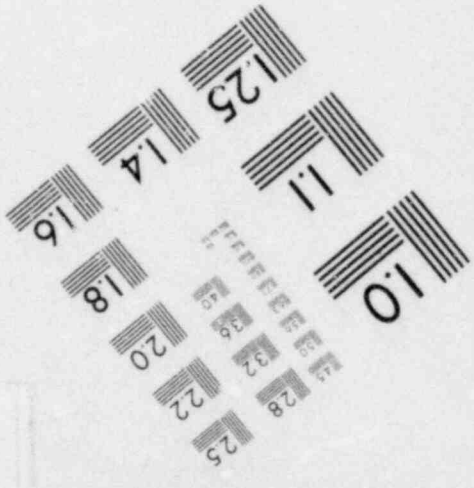


IMAGE EVALUATION TEST TARGET (MT-3)







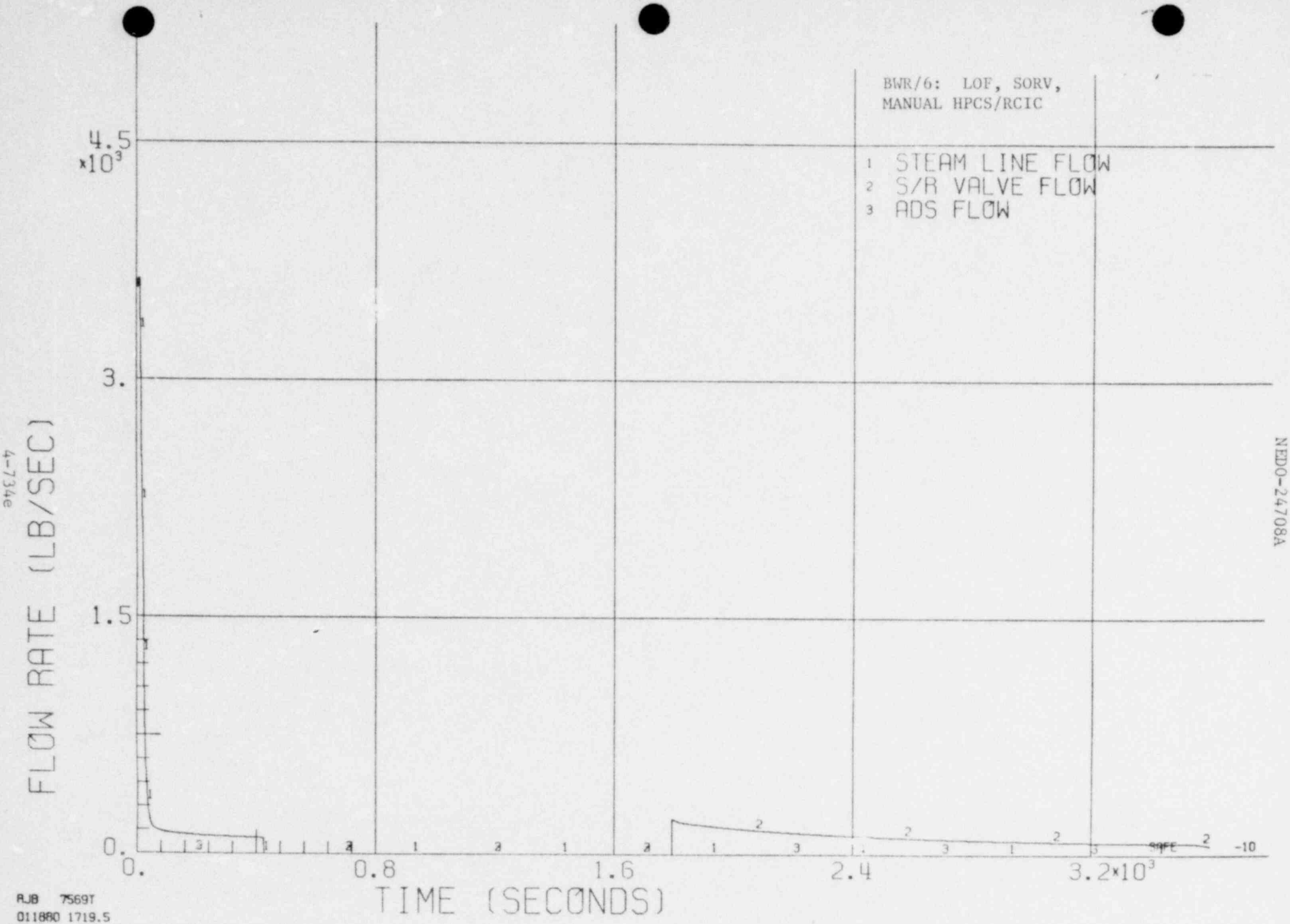


Figure 3.2.2.2.5-10B.2

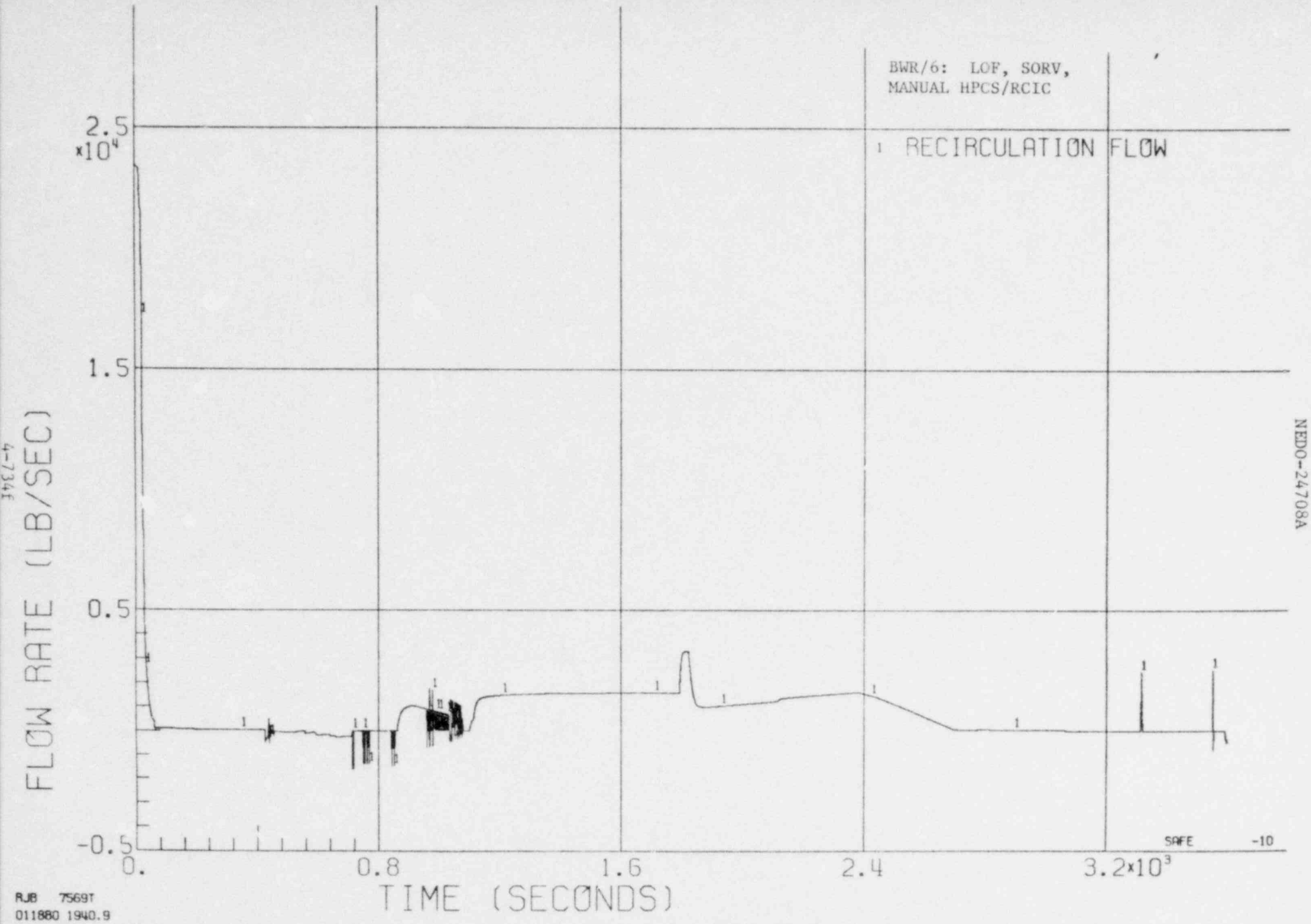


Figure 3.2.1.1.5-10B.3

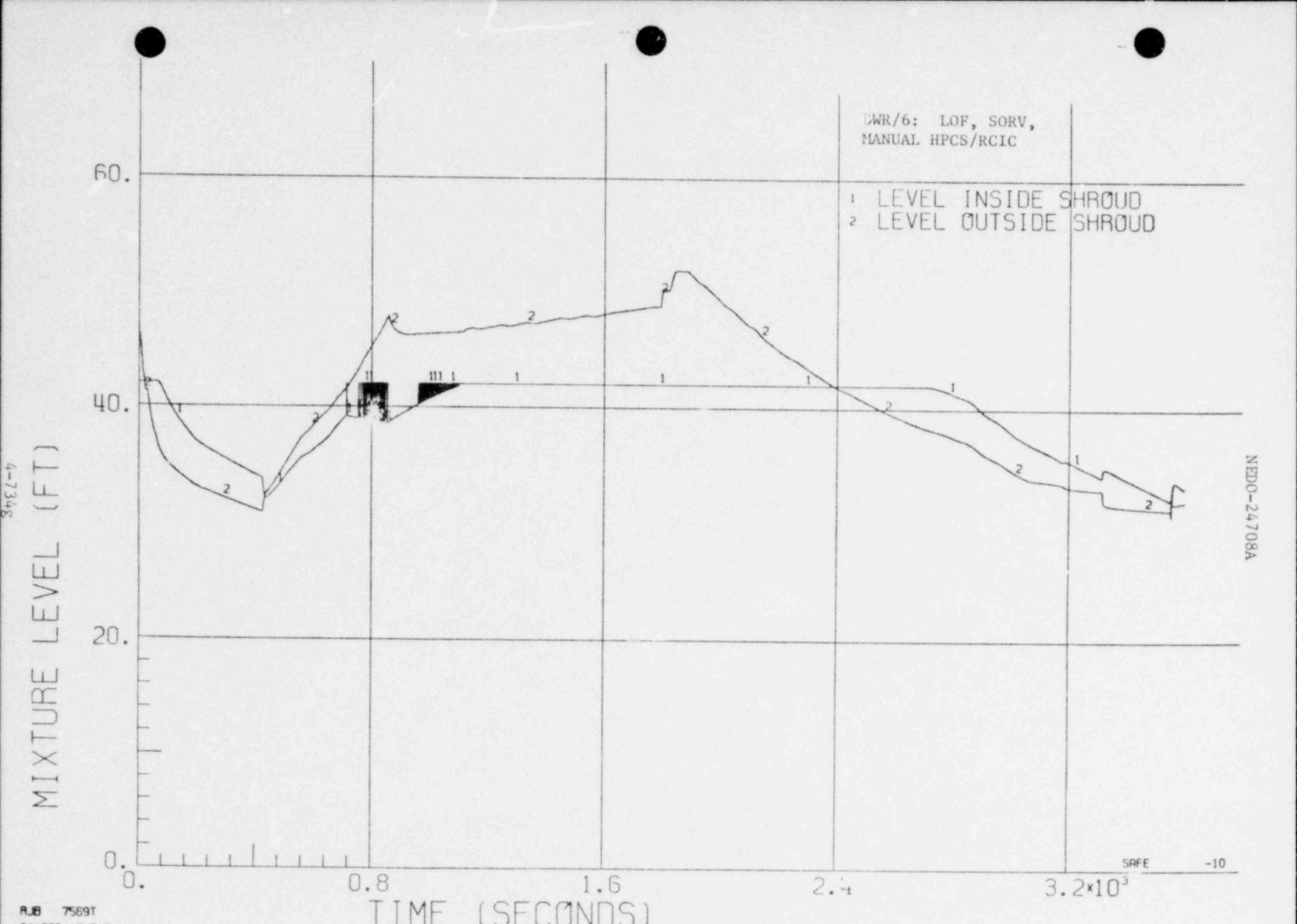


Figure 3.2.1.1.5-10B.4

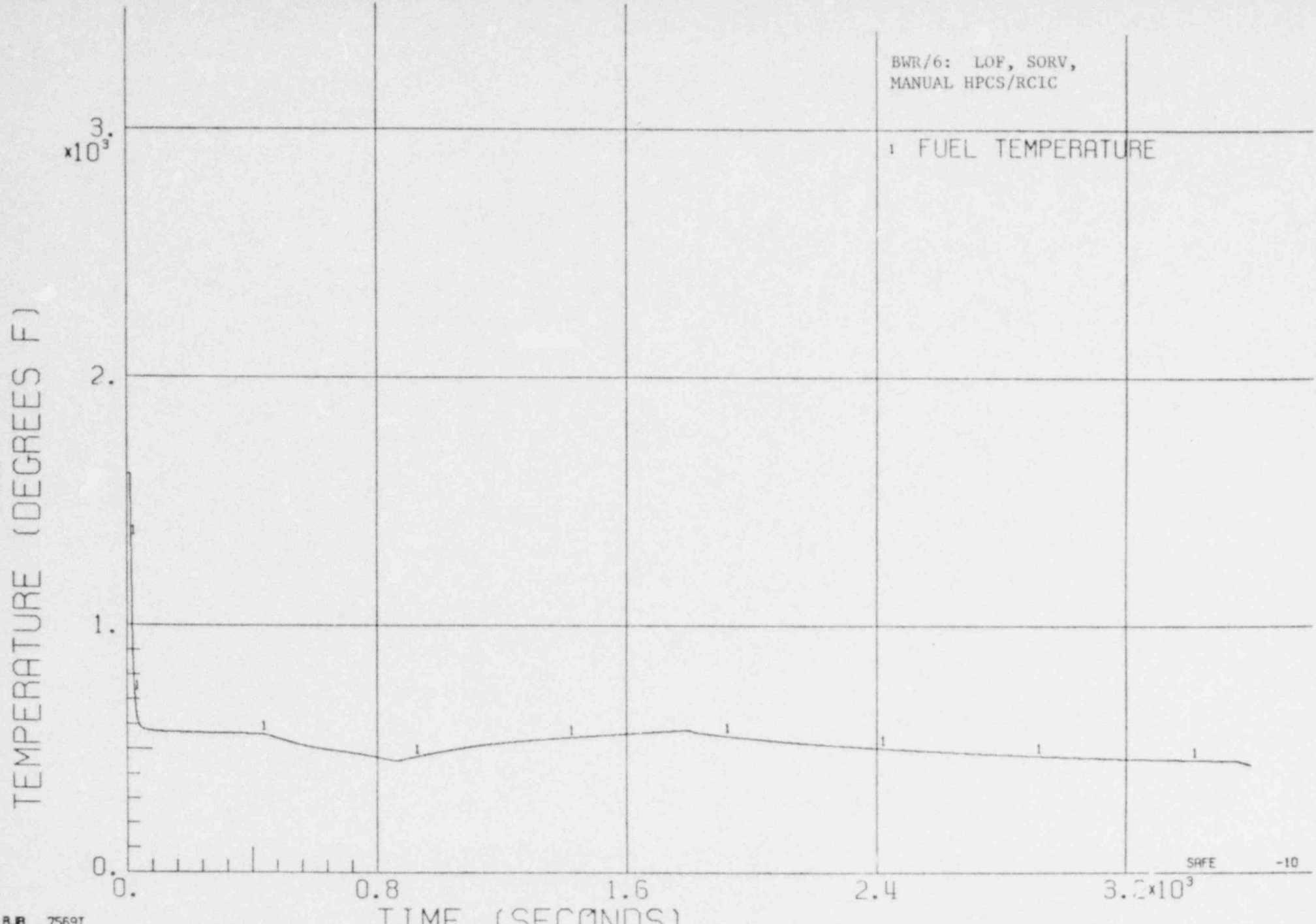
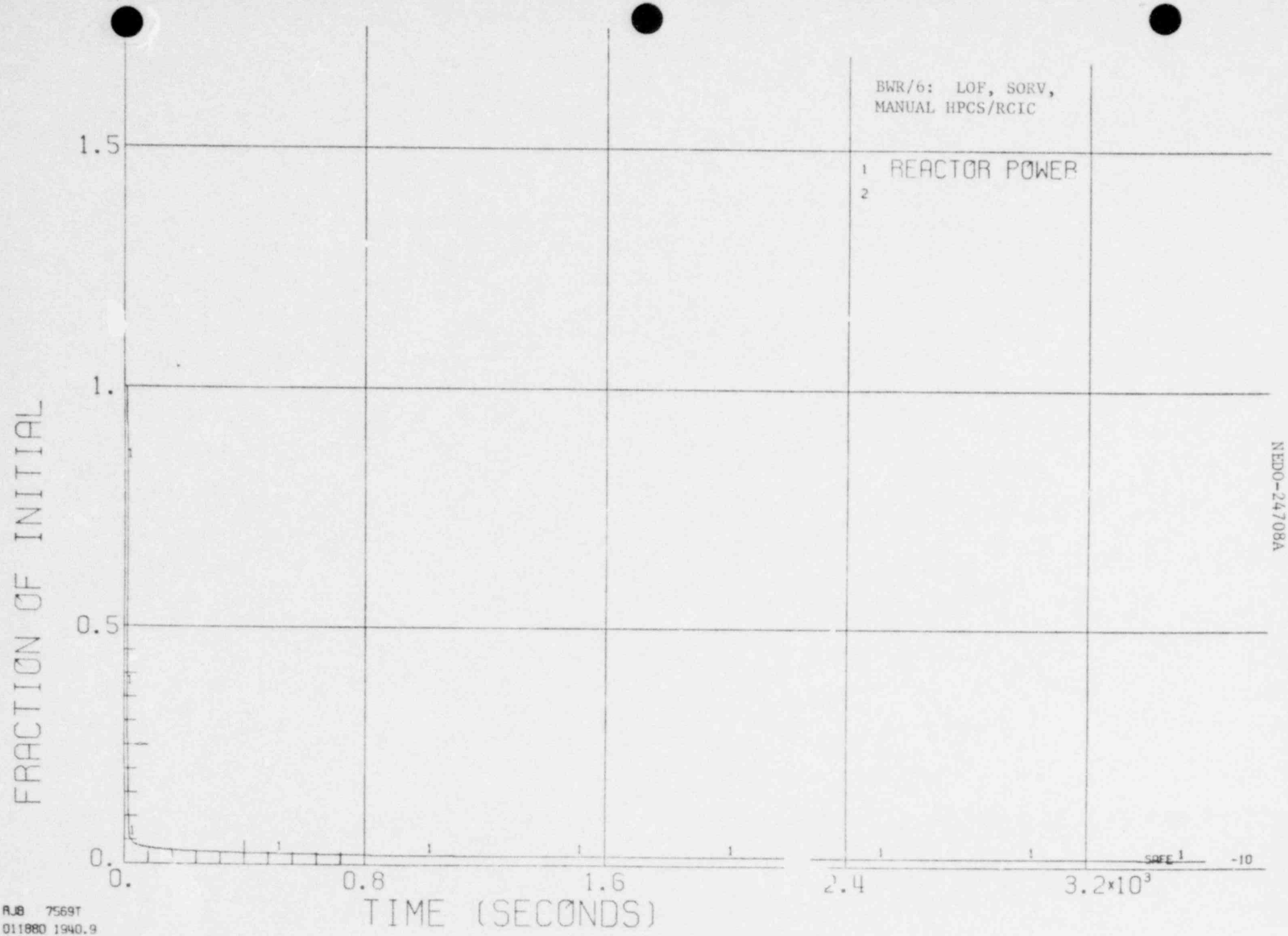


Figure 3.2.1.1.5-10B.5



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RJB 7569T
011880 1940.9

Figure 3.2.1.1.5-10B.6

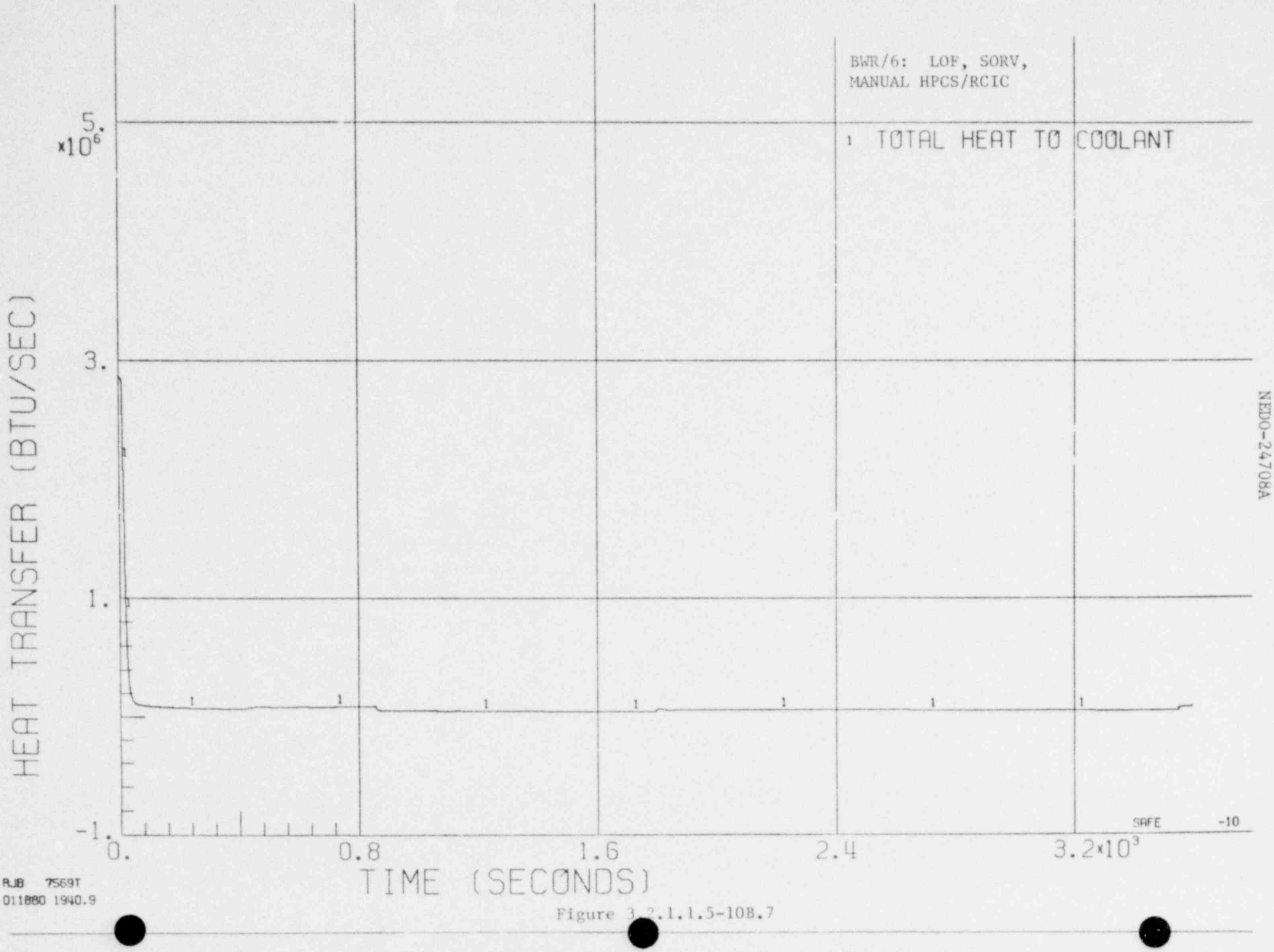
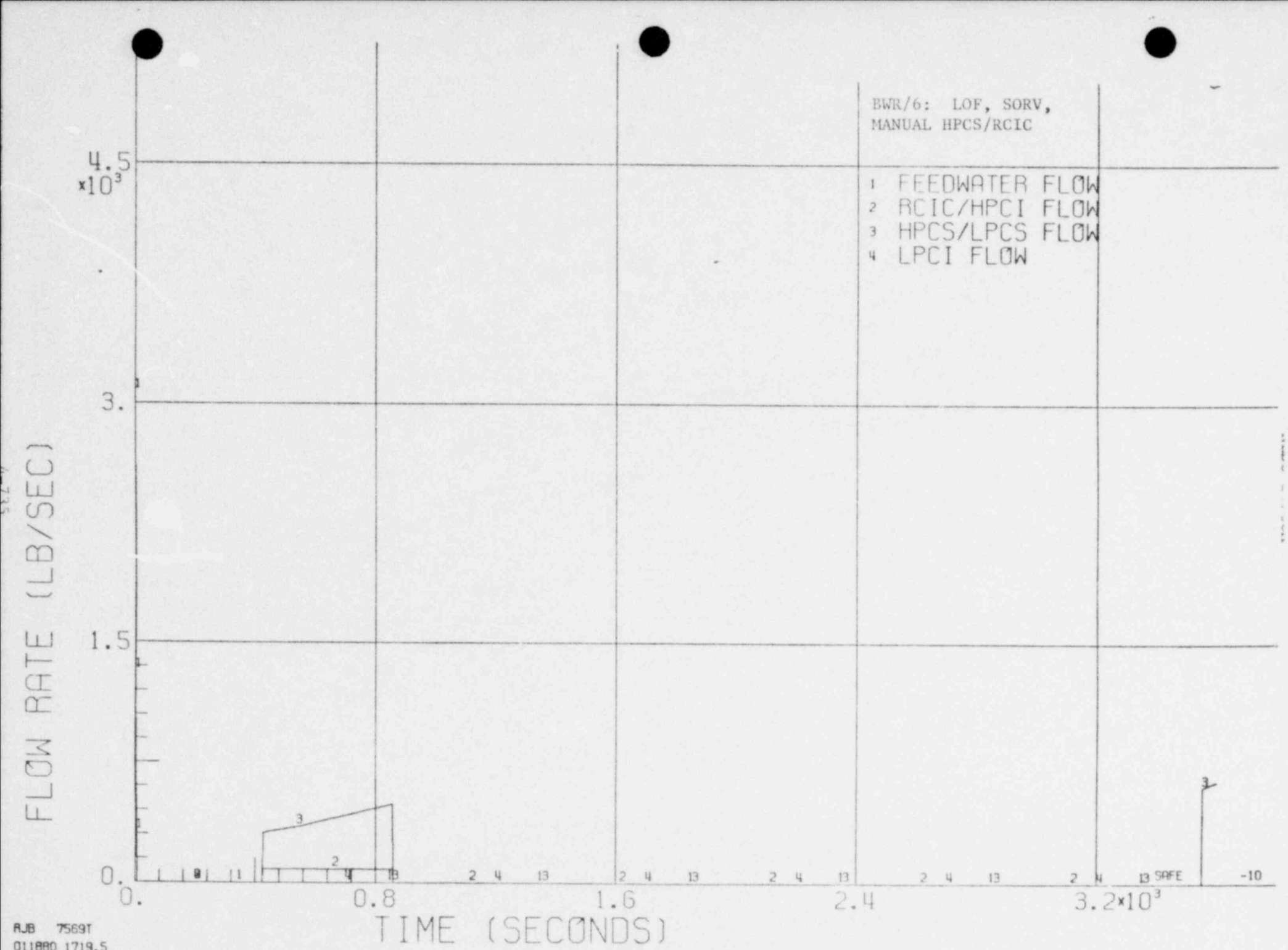


Figure 3.2.1.1.5-108.7



RJB 7569T
011880 1719.5

Figure 3.2.1.1.5-10B.8

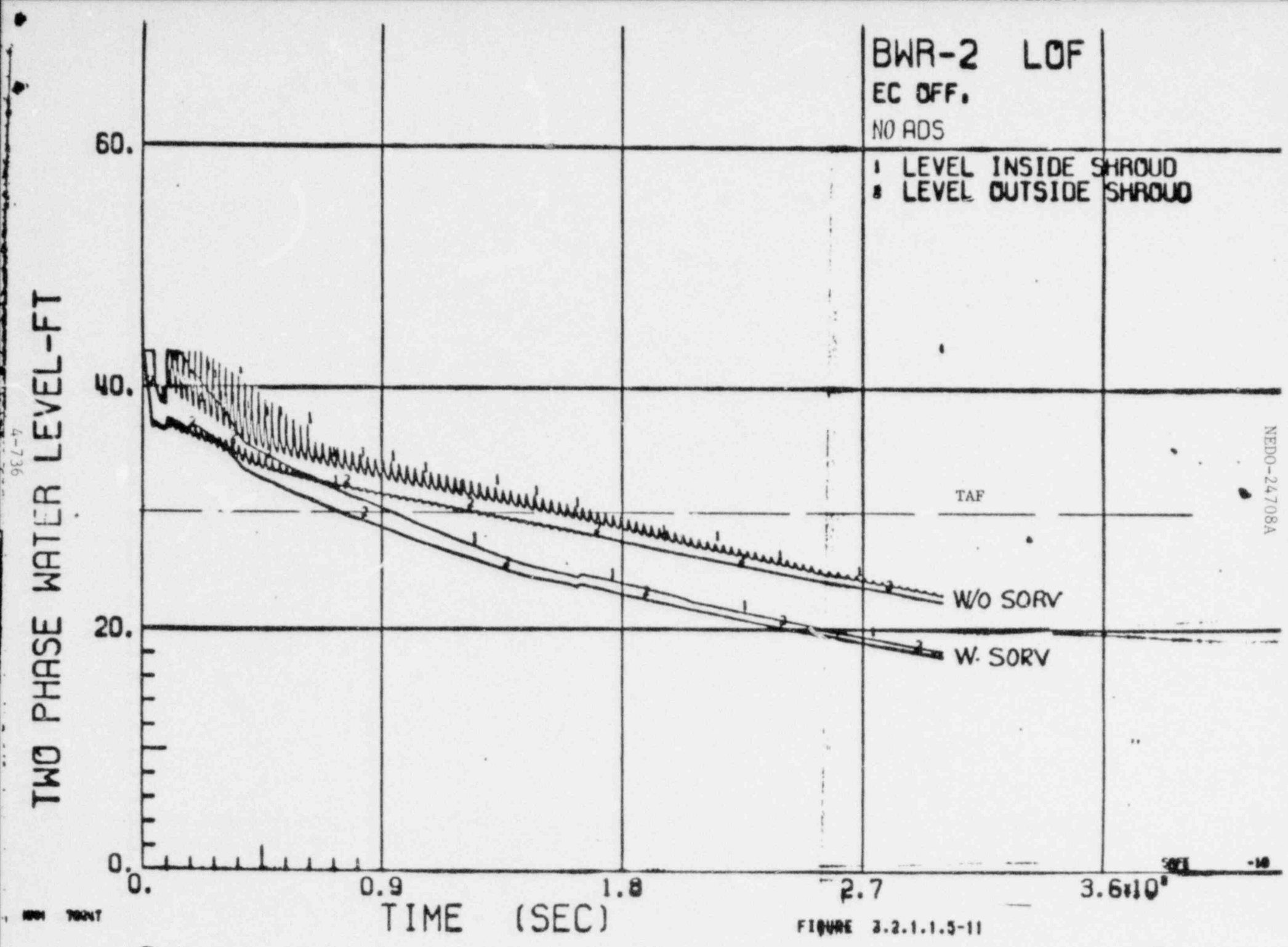
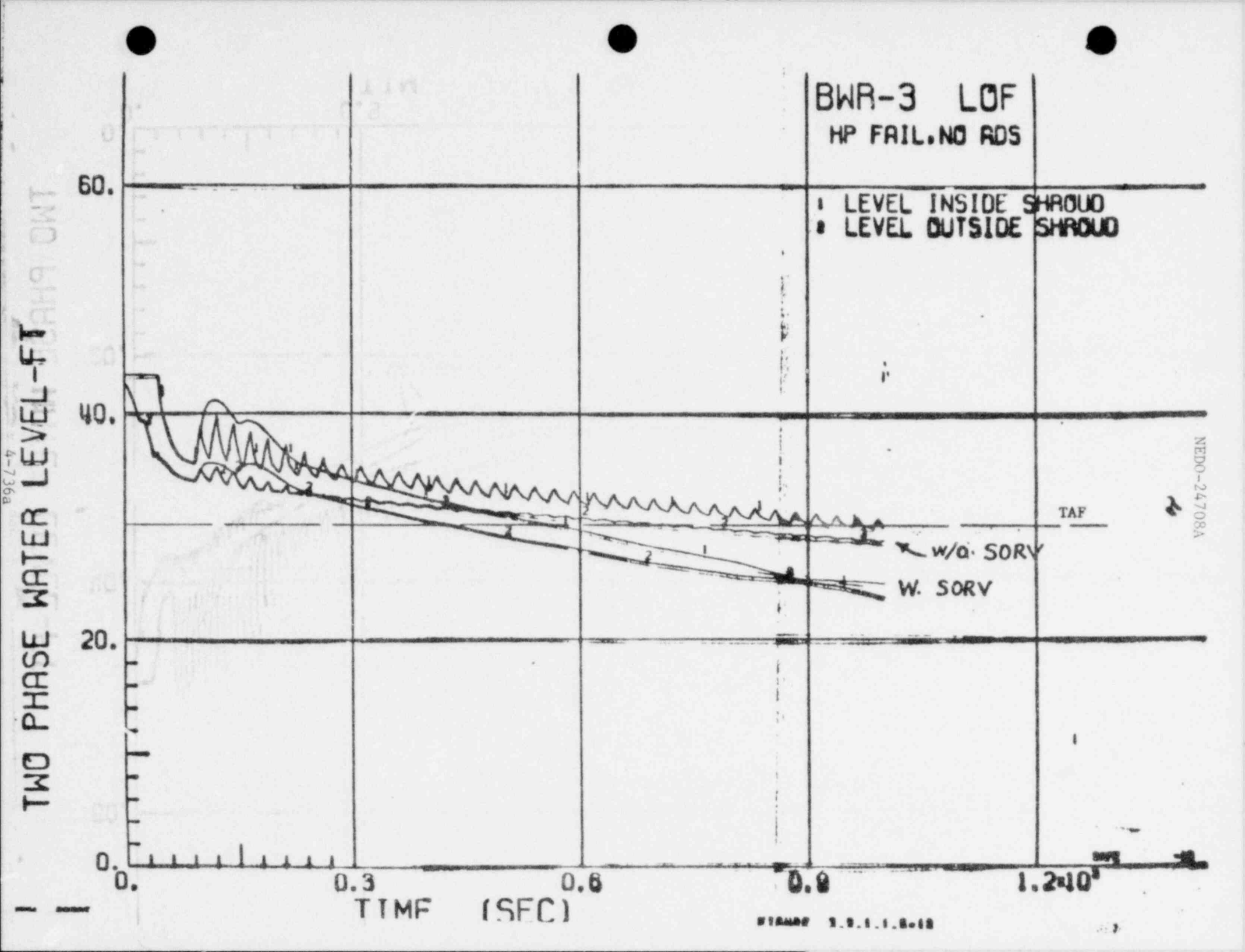


FIGURE 3.2.1.1.3-11


BWR-3 LOF
HP FAIL.NO ADS
1 LEVEL INSIDE SHROUD
2 LEVEL OUTSIDE SHROUD
TAF
w/o SORV
W. SORV
TWO PHASE WATER LEVEL-FT
60.
40.
20.
0.
0.
0.3
0.6
0.9
1.2×10³
TIME (SEC)
NEDO-24708A
4-736a

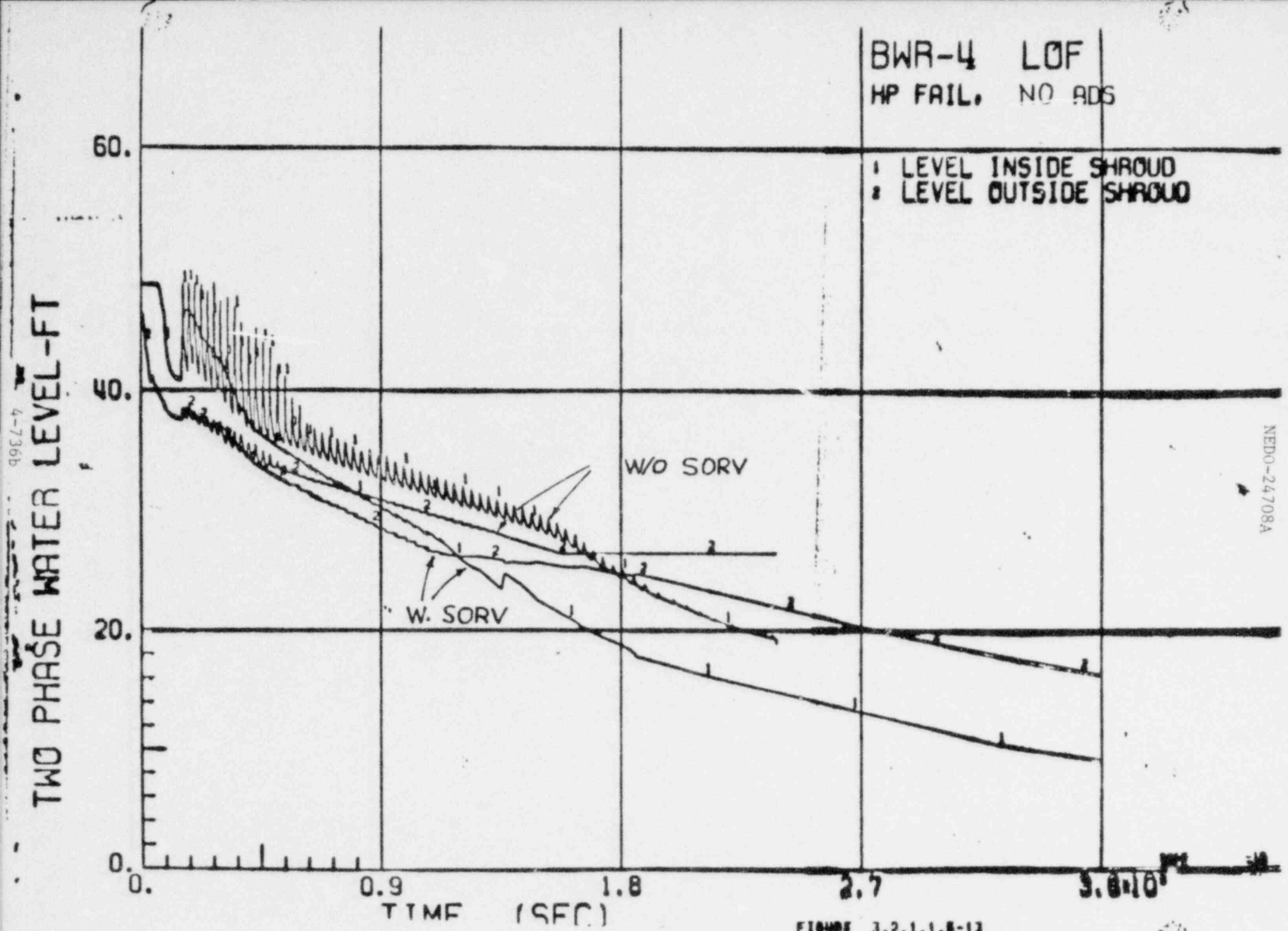


FIGURE 3.2.1.1.8-13

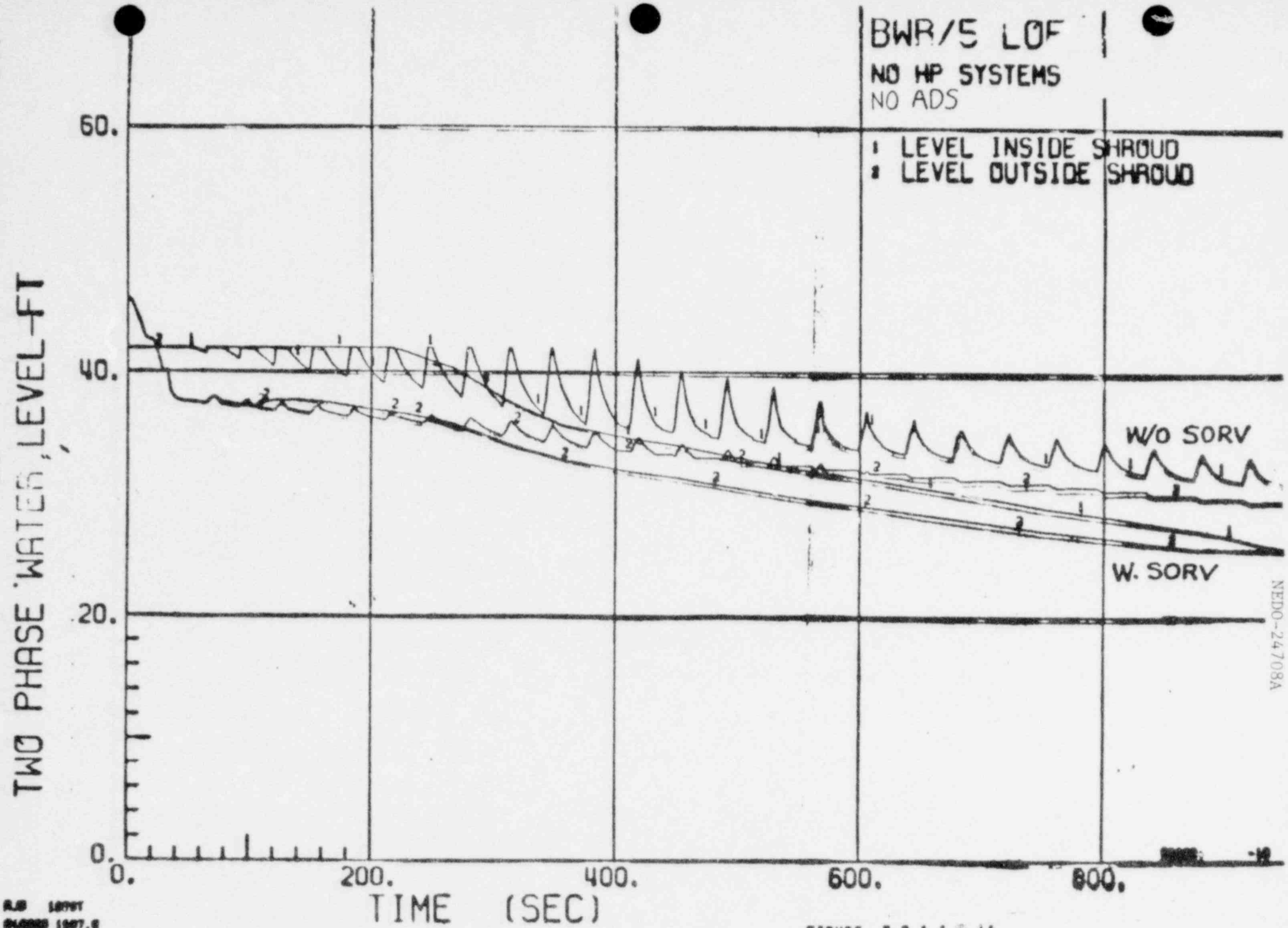
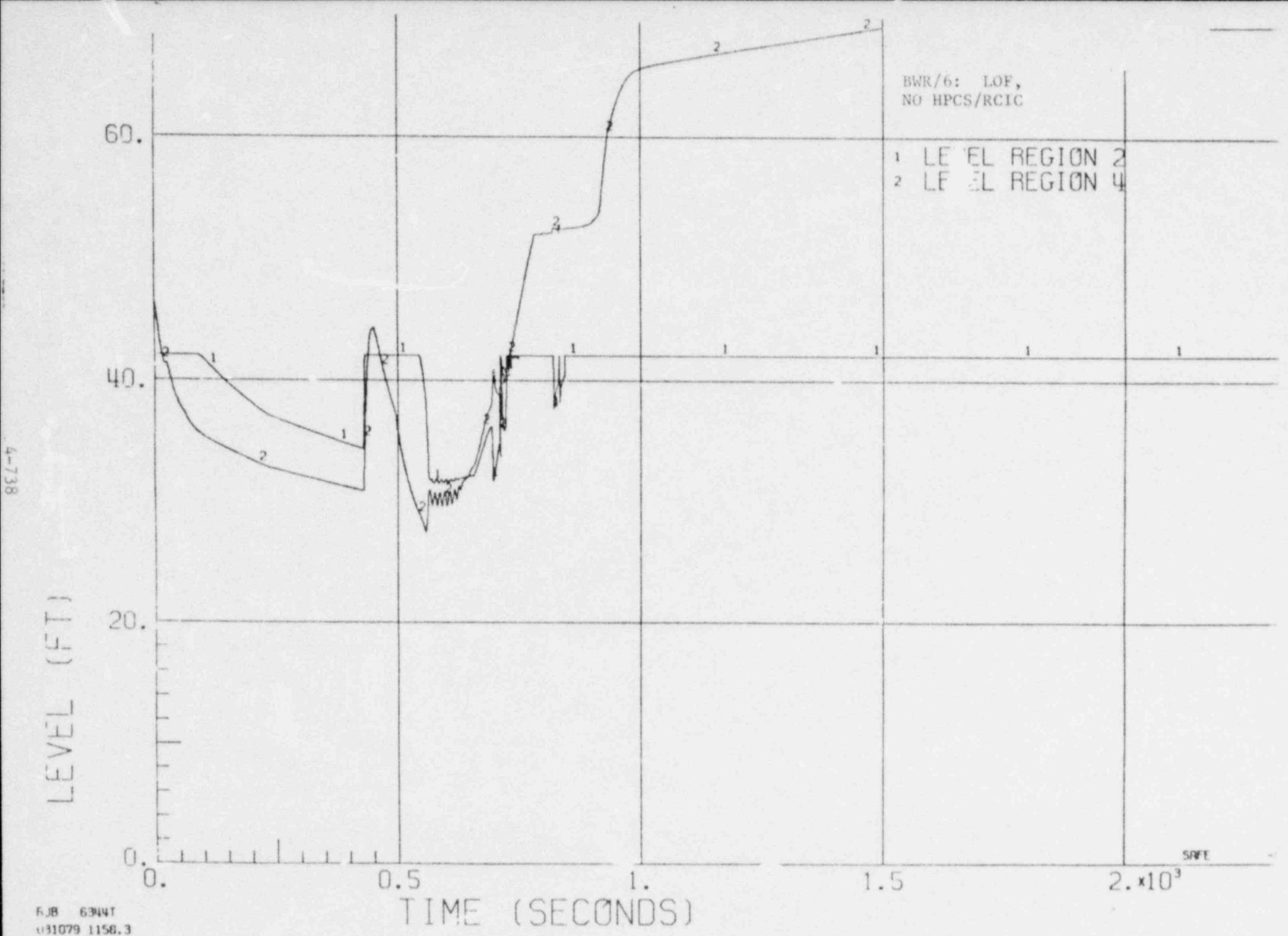


FIGURE 3.2.1.1.5-14



BJB 63944T
031079 1158.3

Figure 3.2.1.1.5-14A

(There are no Figures 3.2.1.1.5-15 through 18.)

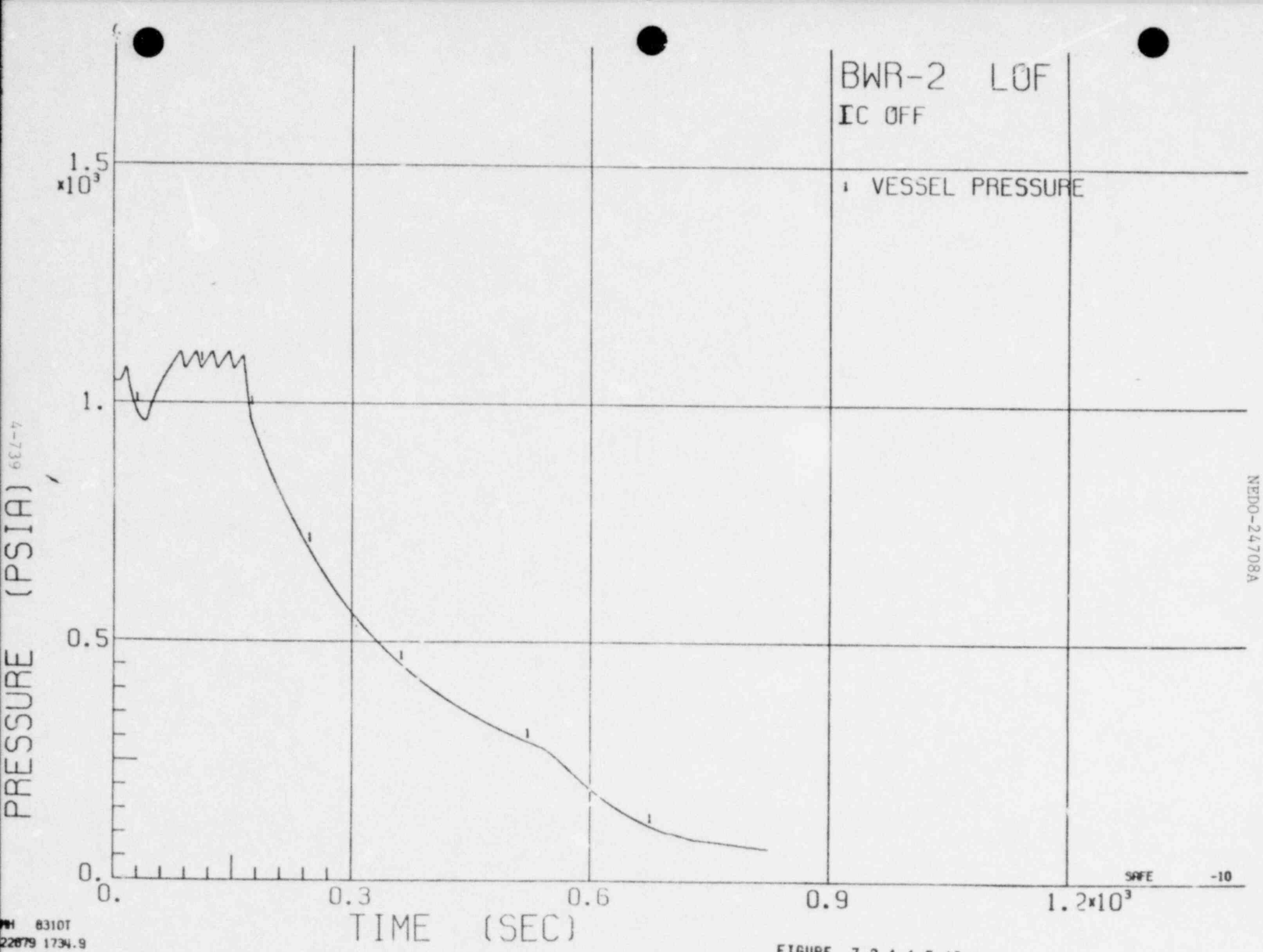


FIGURE 3.2.1.1.5-19.1

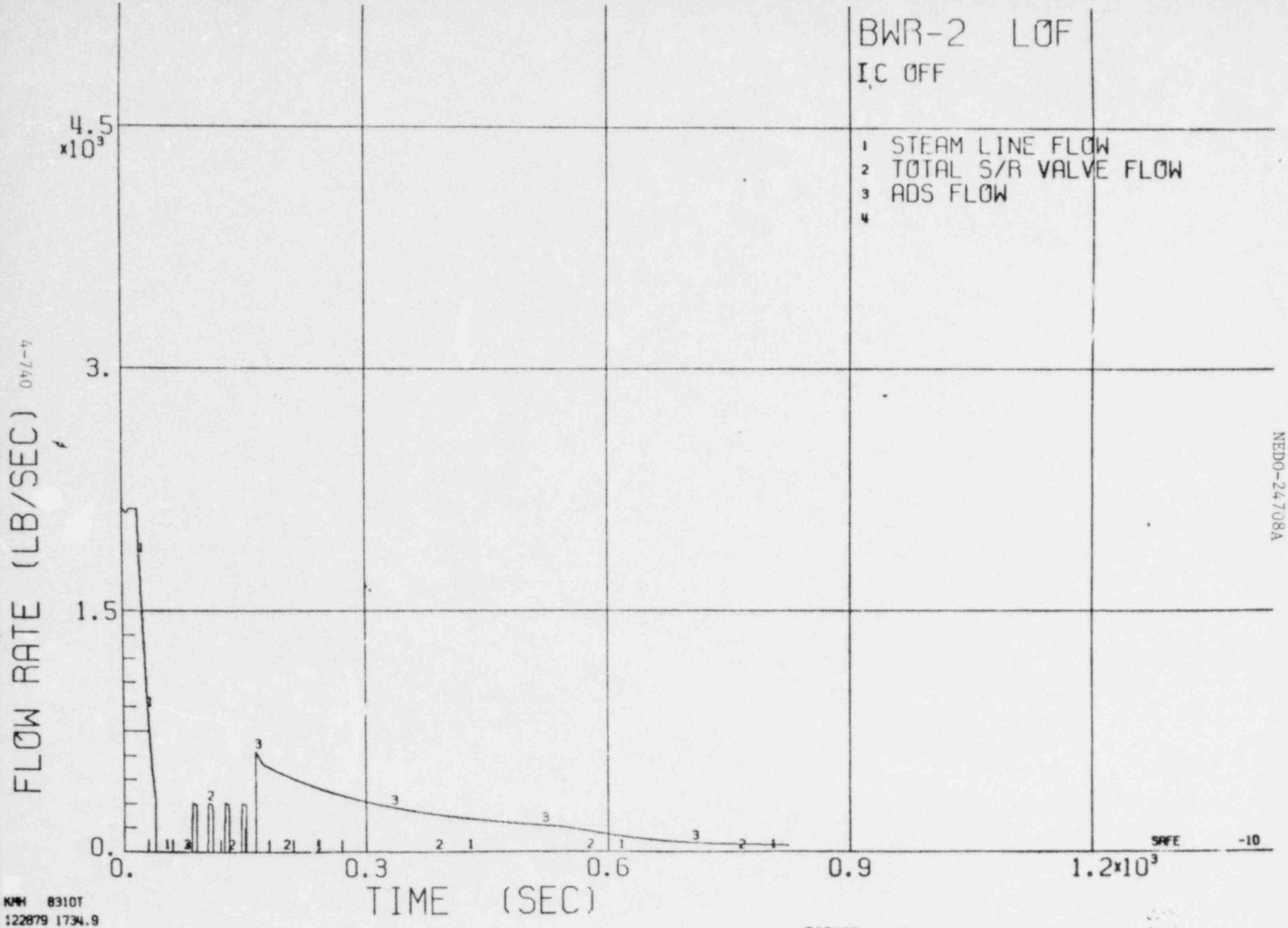
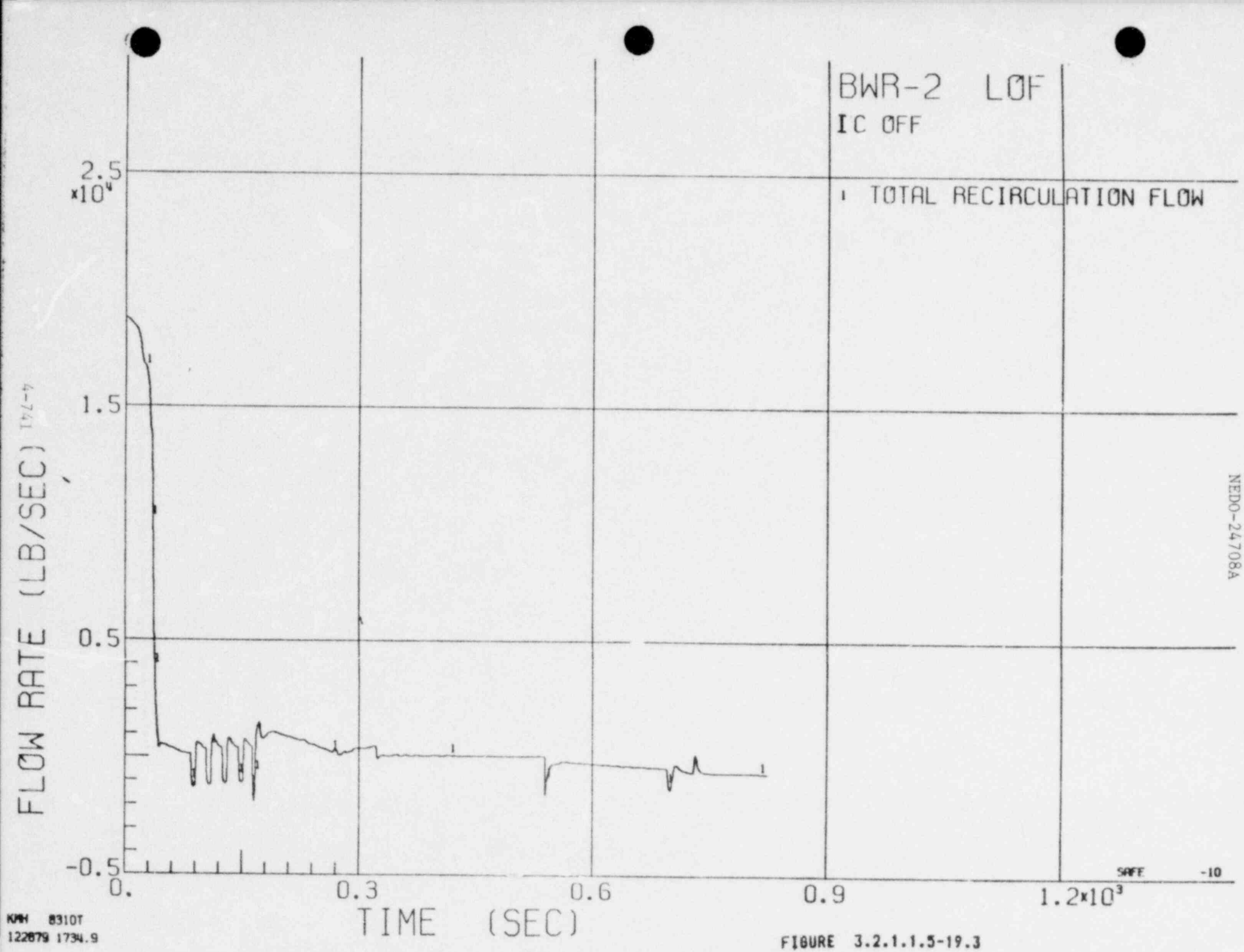


FIGURE 3.2.1.1.5-19.2



KMH 8310T
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FIGURE 3.2.1.1.5-19.3

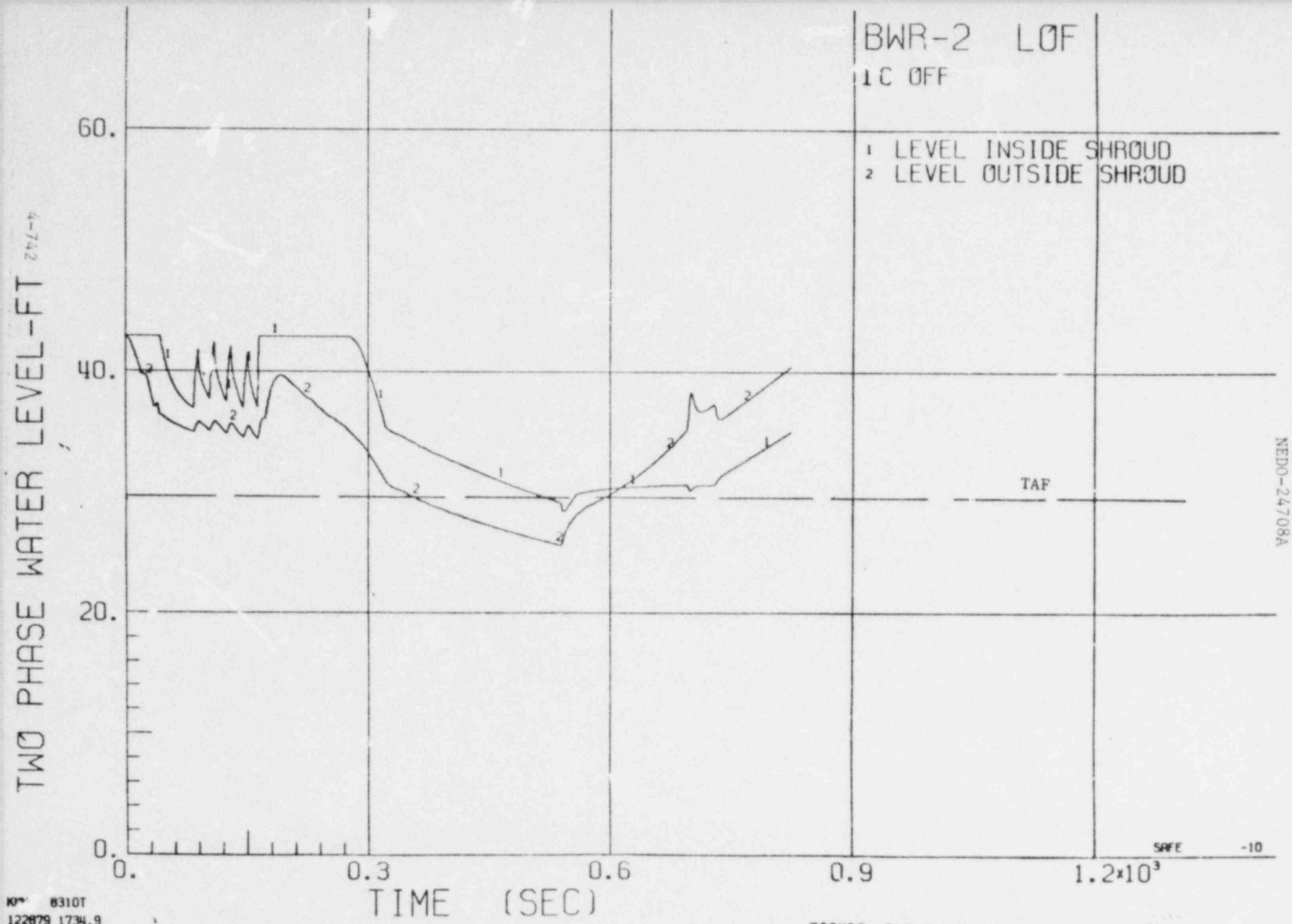
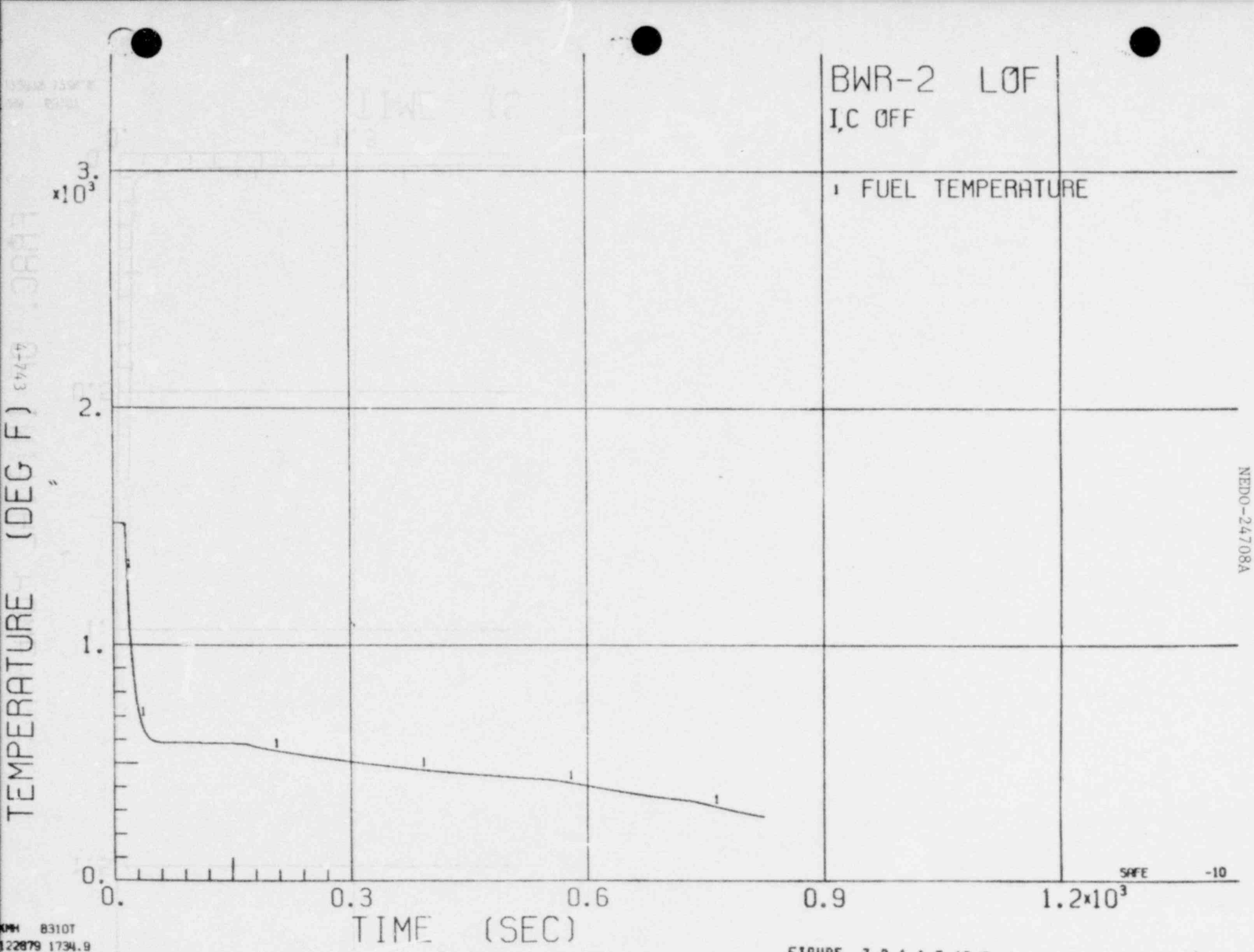


FIGURE 3.2.1.1.5-19.4



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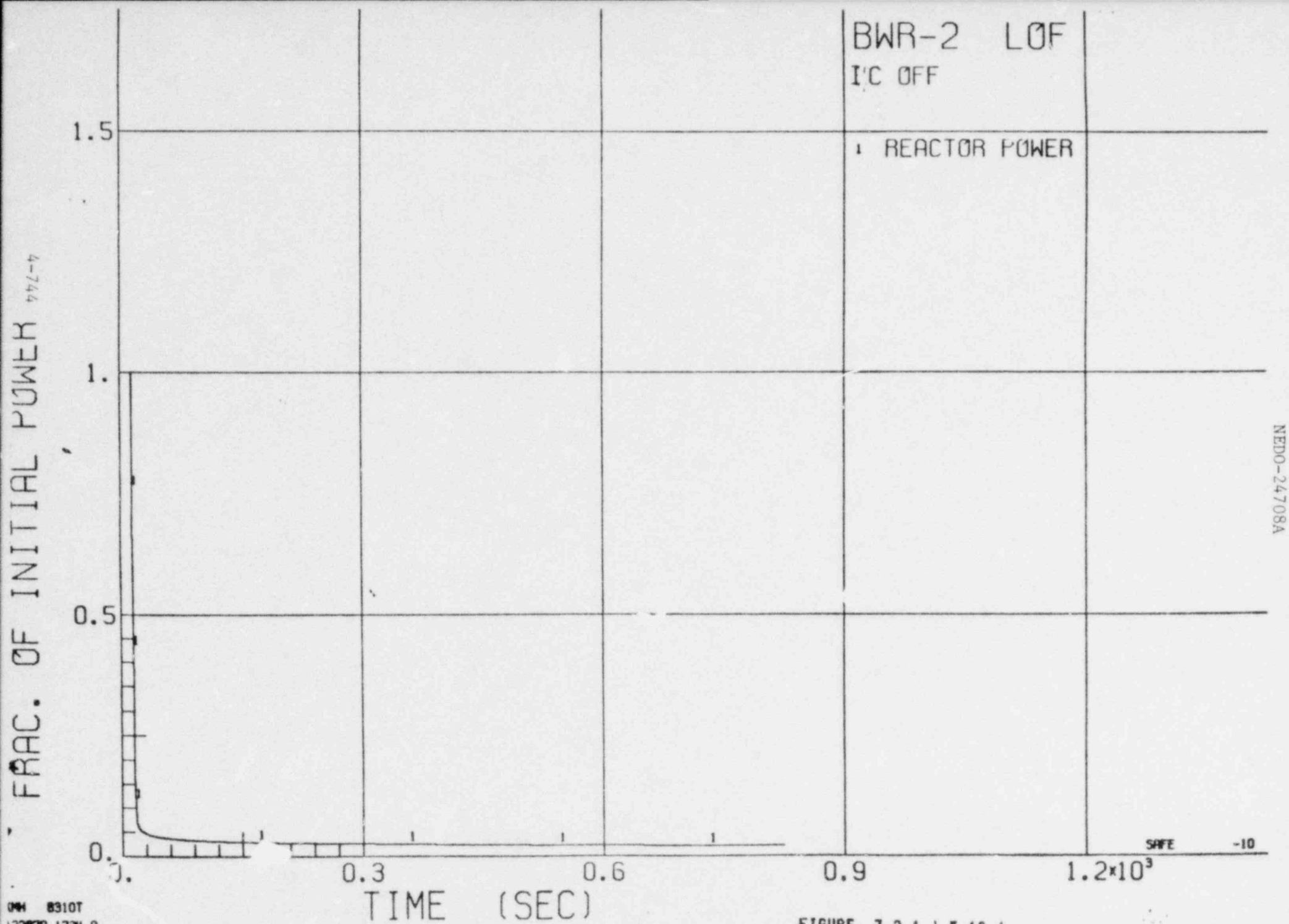
122879 1734.9

FIGURE 3.2.1.1.5-19.5



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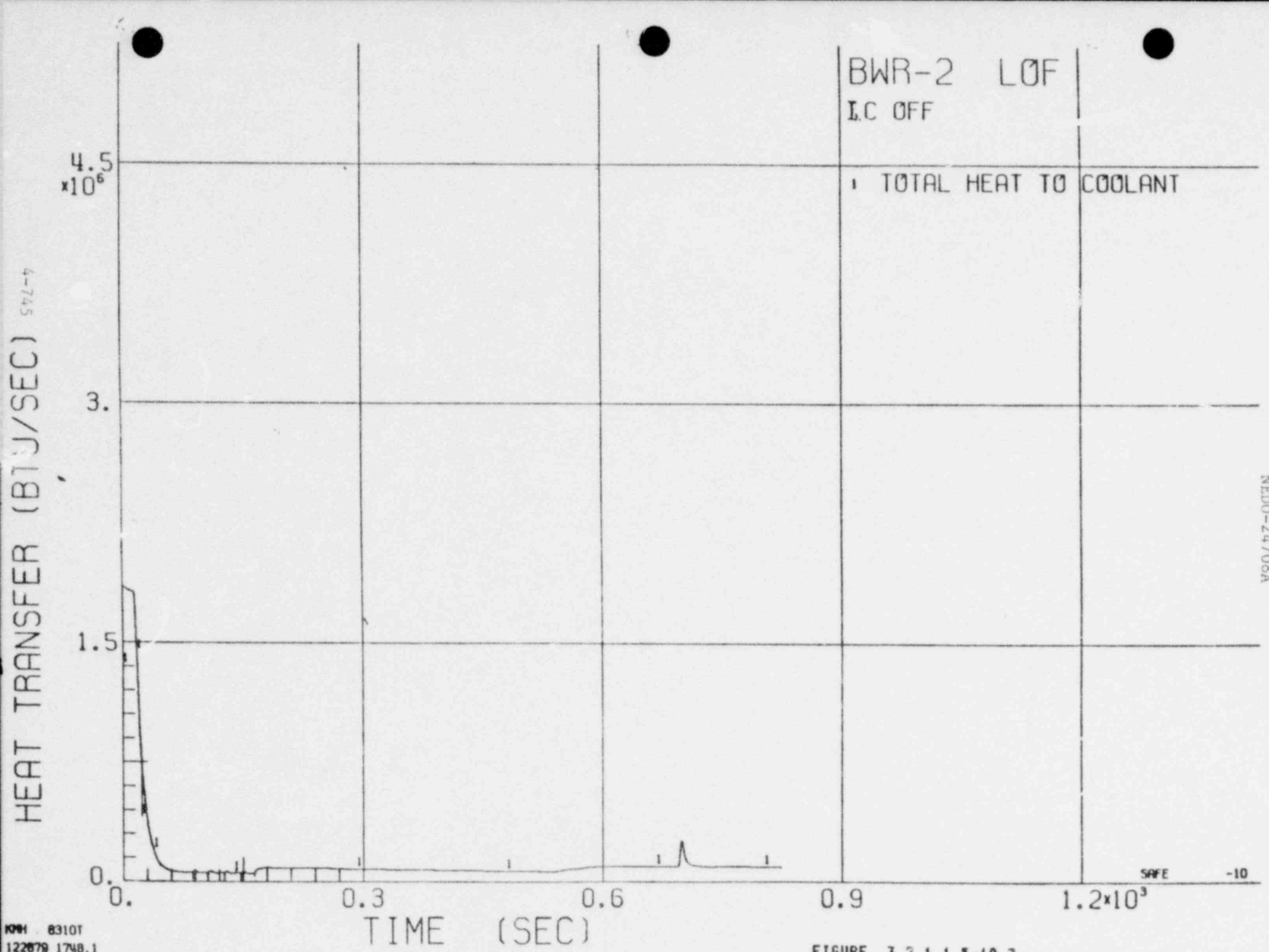
DMH 8310T
122879 1734.9

FIGURE 3.2.1 1.5-19.6



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122879 1748.1

FIGURE 3.2.1.1.5-19.7

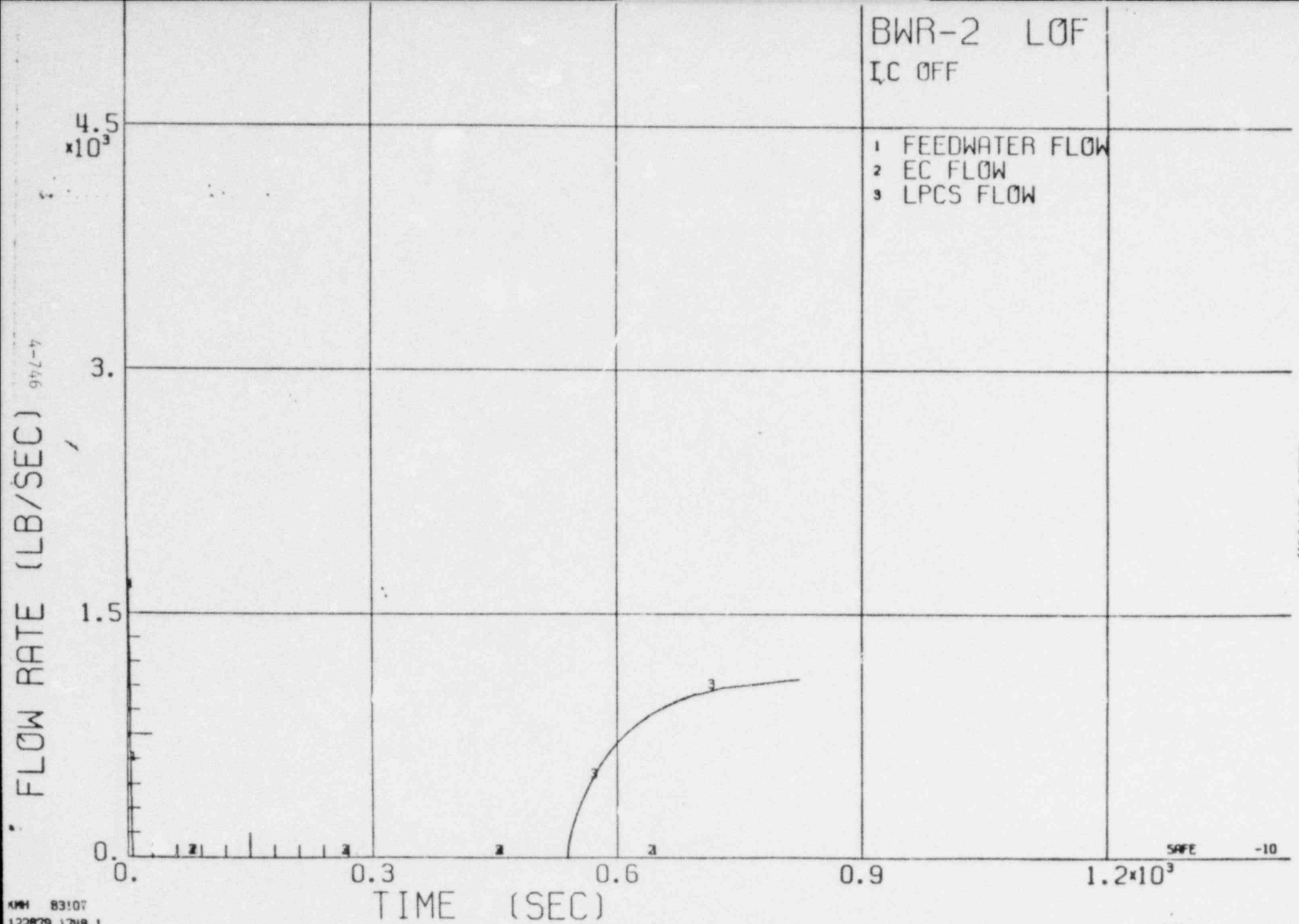
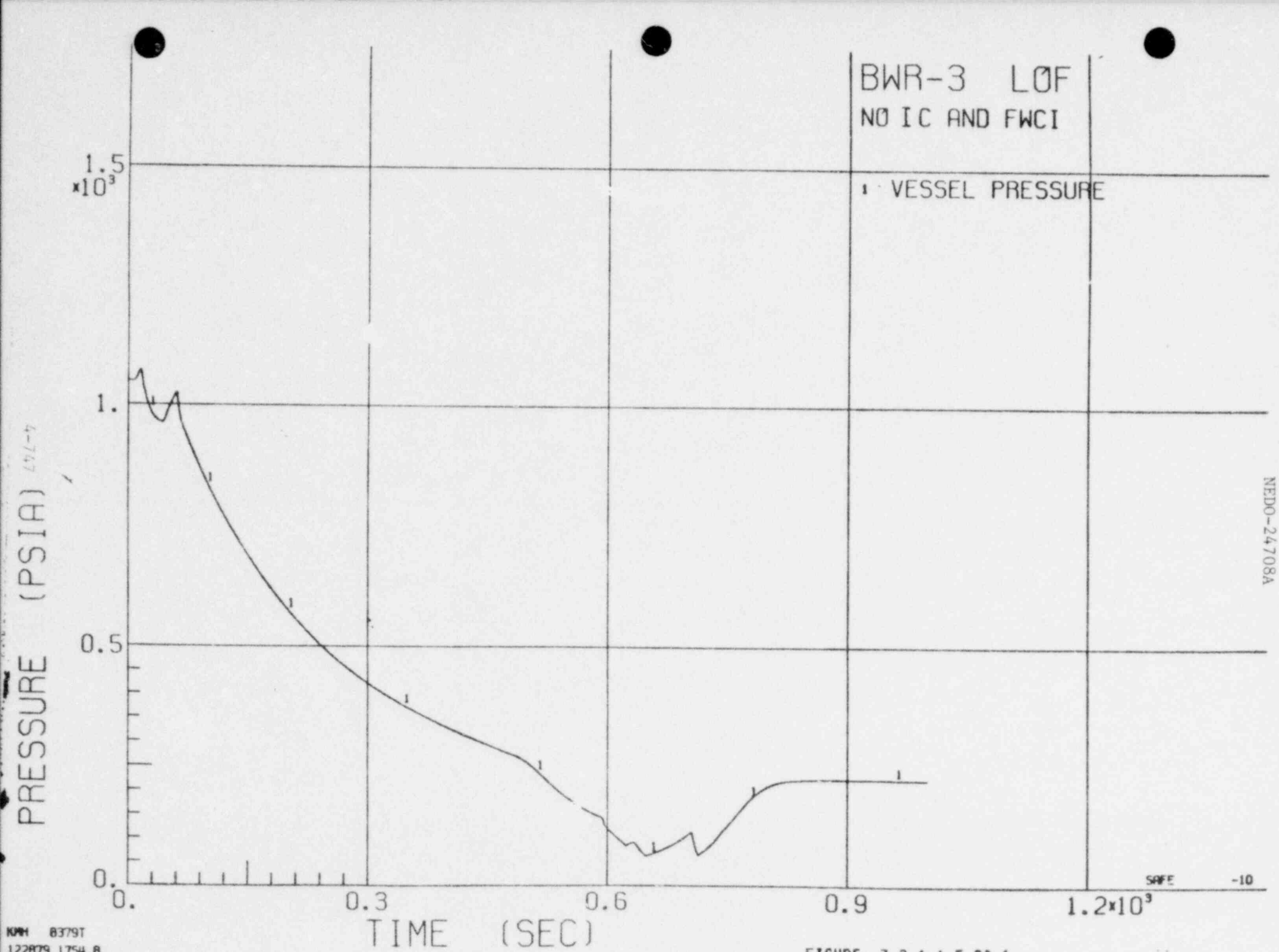
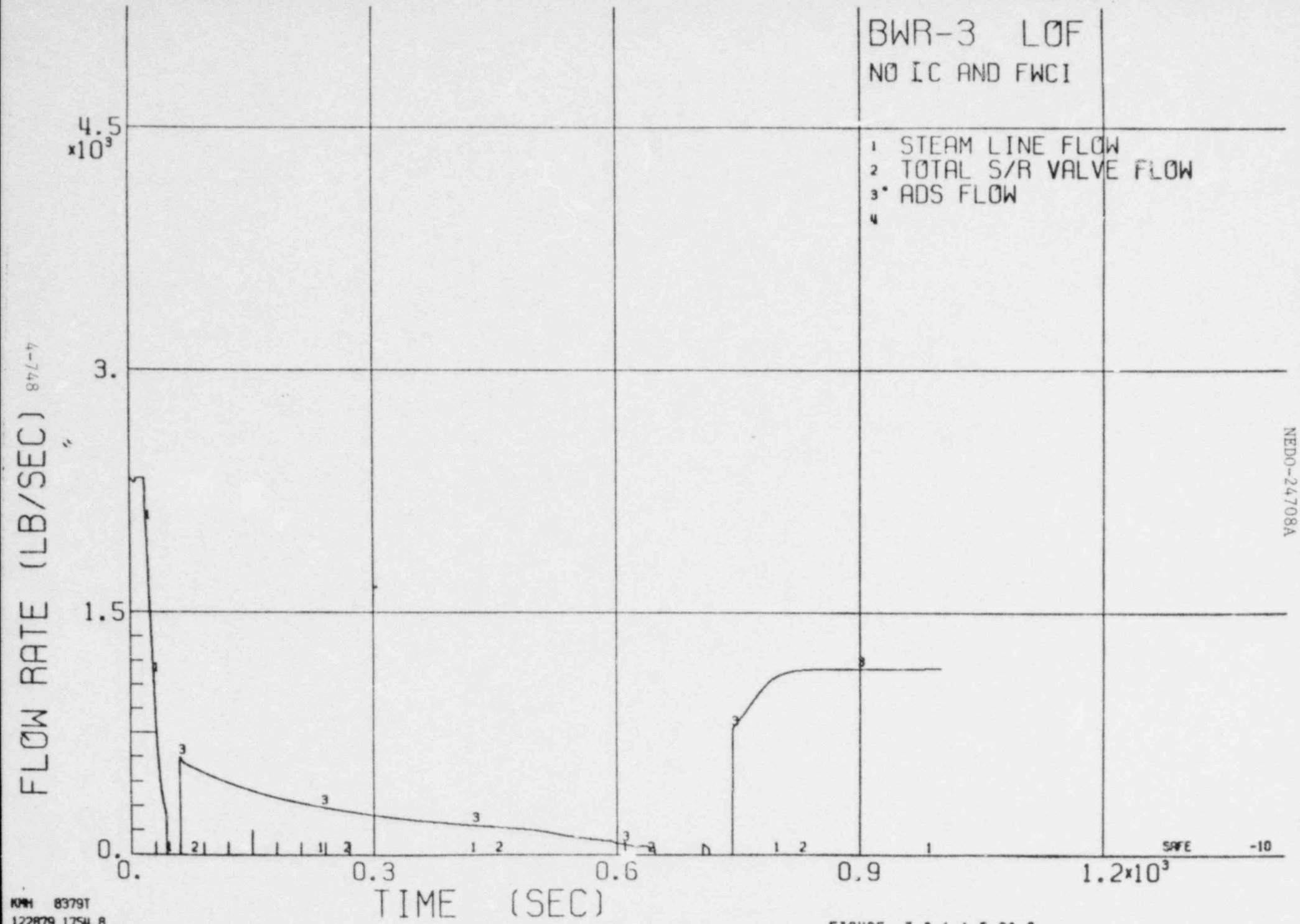


FIGURE 3.2.1.1.5-19.8



KMH 8379T
122879 1754.8

FIGURE 3.2.1.1.5-20.1



KMH 8379T
122879 1754.8

FIGURE 3.2.1.1.5-20.2

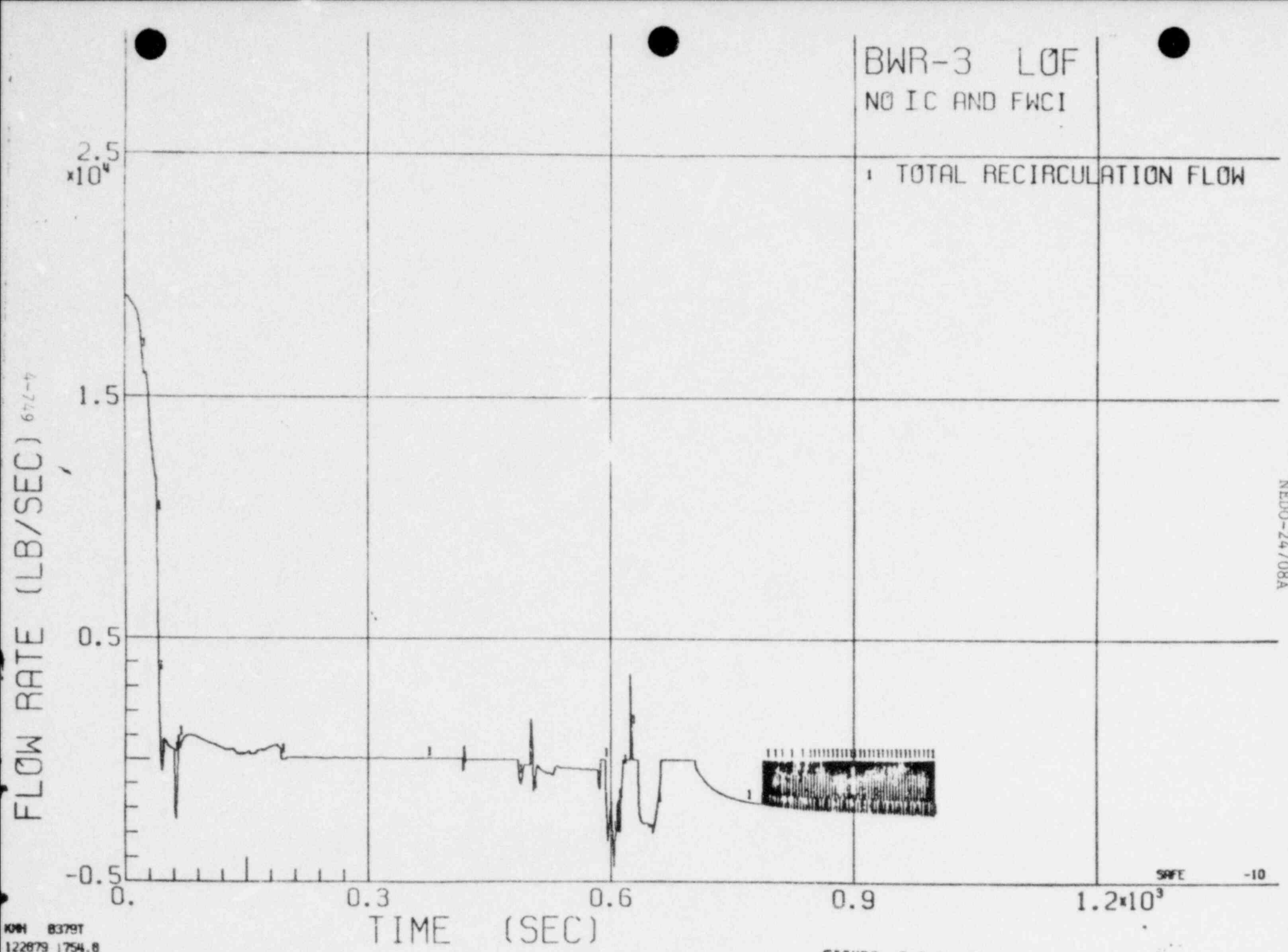
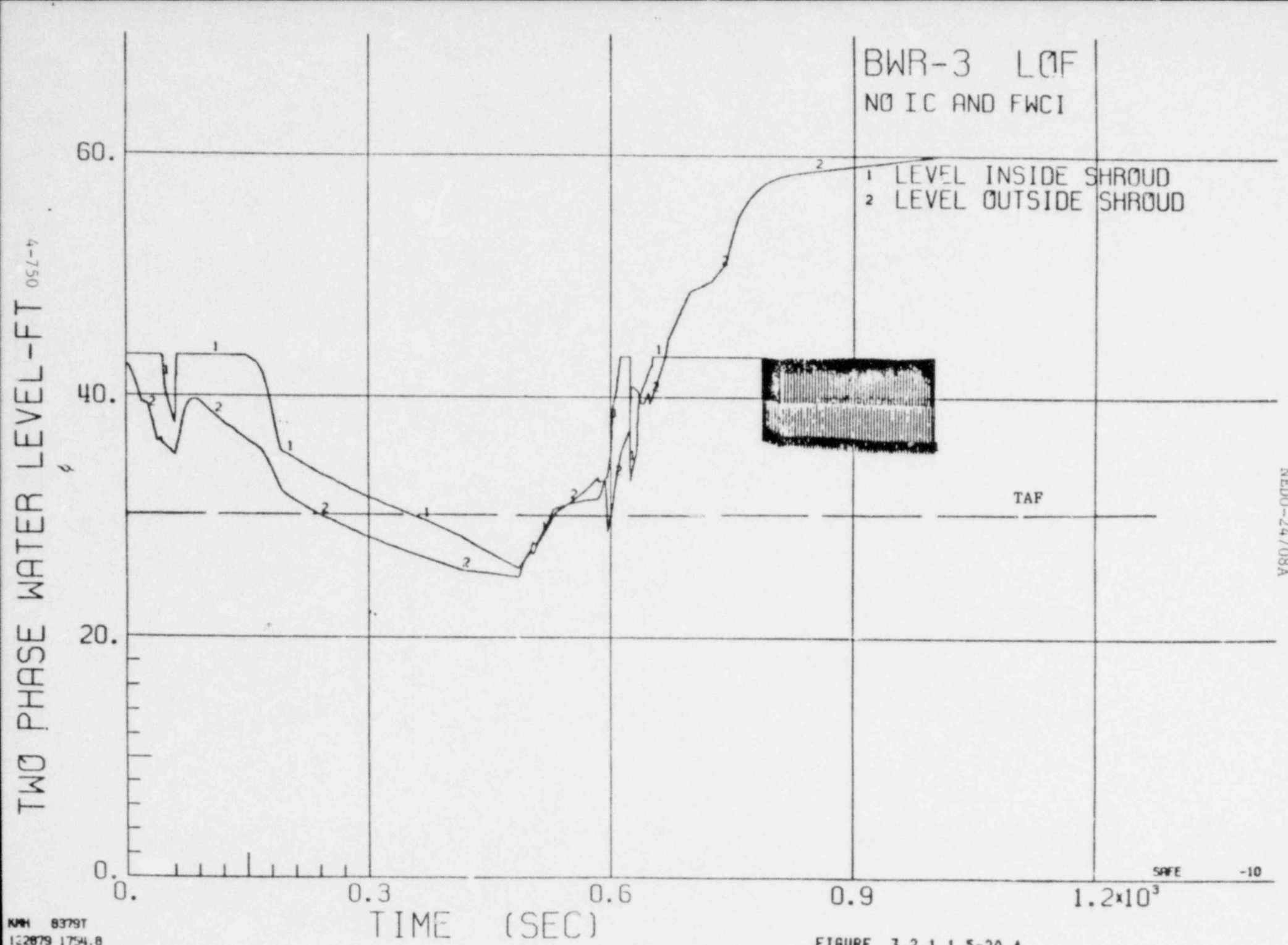


FIGURE 3.2.1.1.5-20.3



KMH 83797
122879 1754.8

FIGURE 3.2.1.1.5-20.4

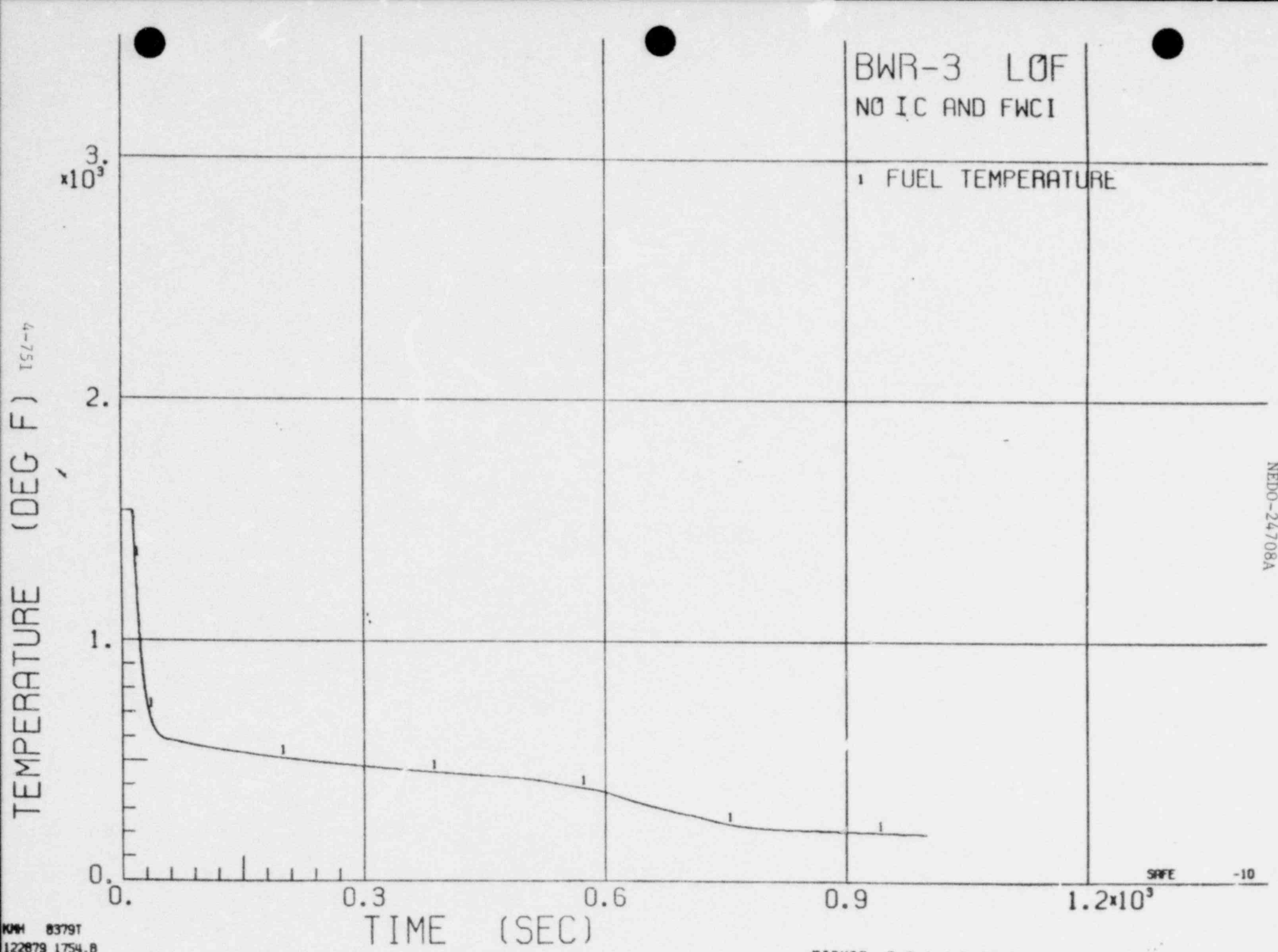
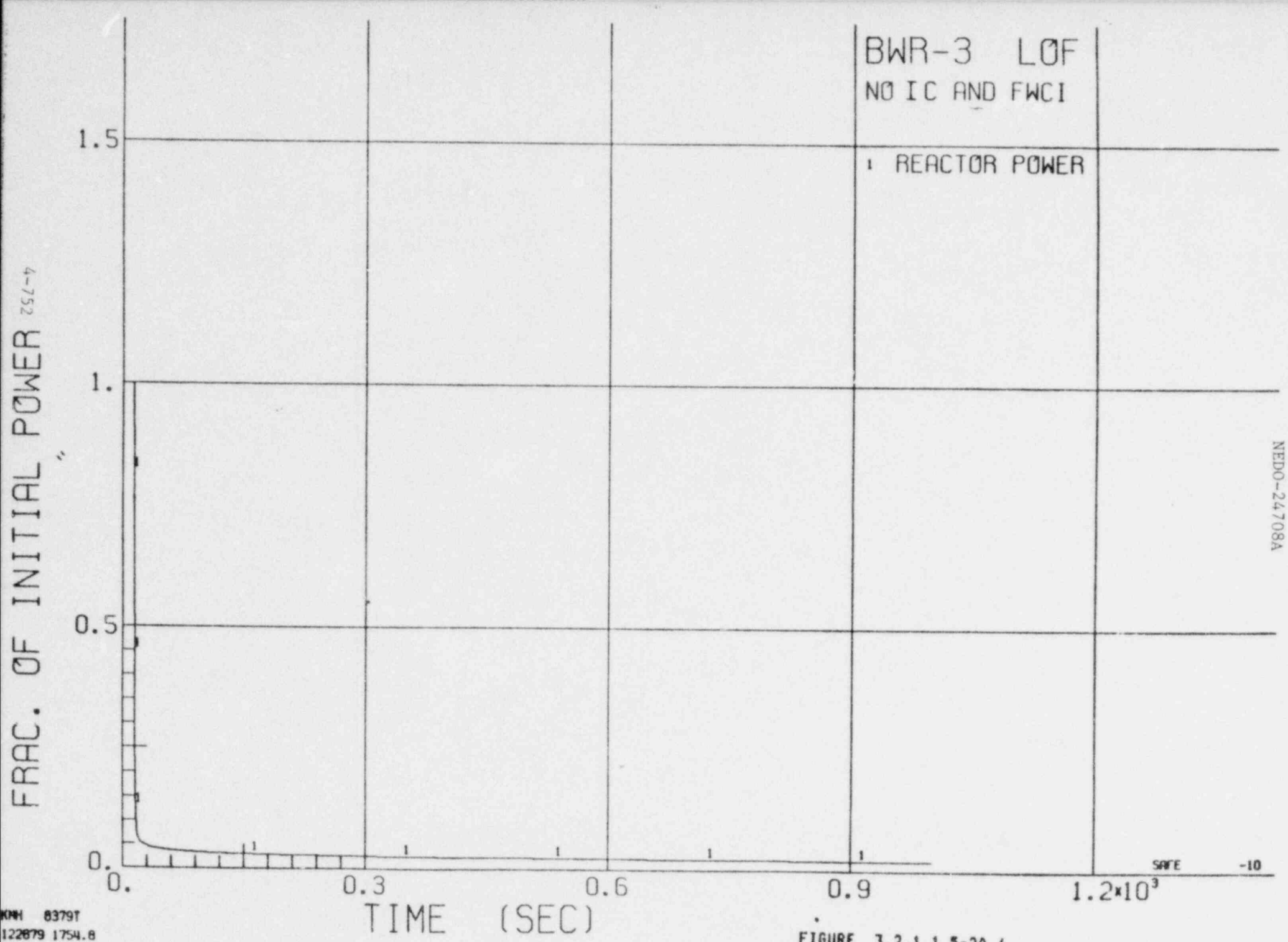
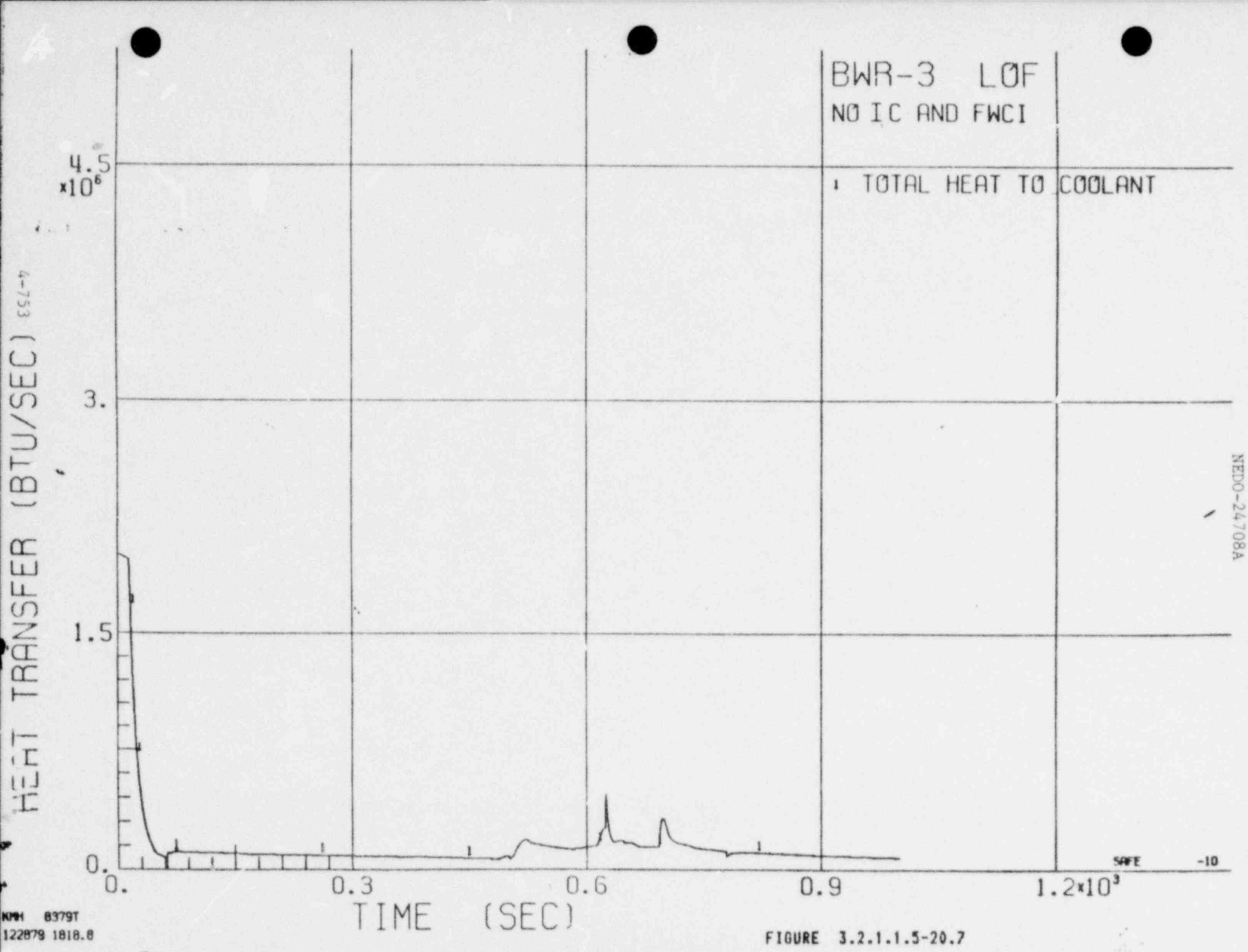


FIGURE 3.2.1.1.5-20.5



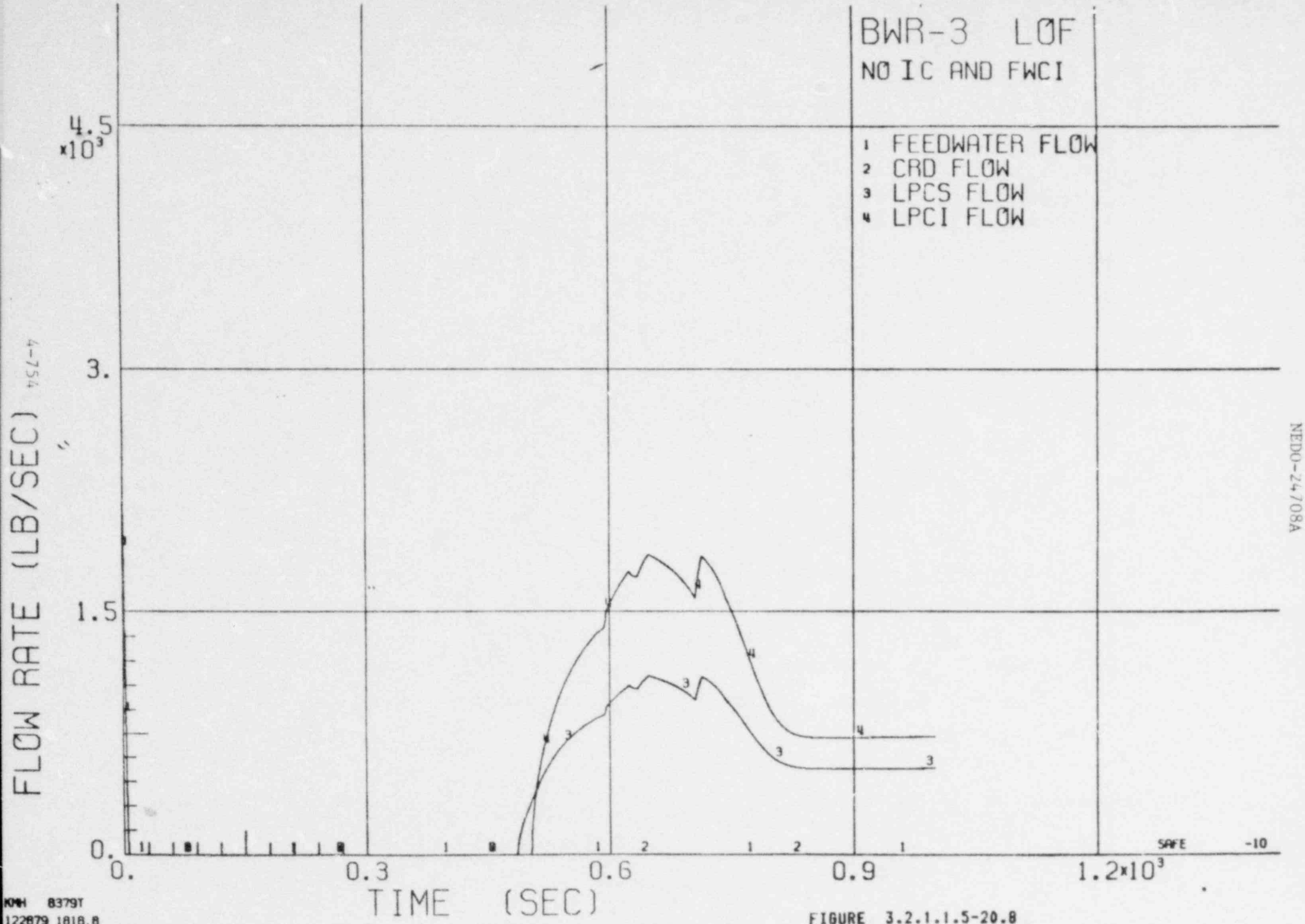
KMH 8379T
122879 1754.8

FIGURE 3.2.1.1.5-20.6



KMH 8379T
122879 1818.8

FIGURE 3.2.1.1.5-20.7



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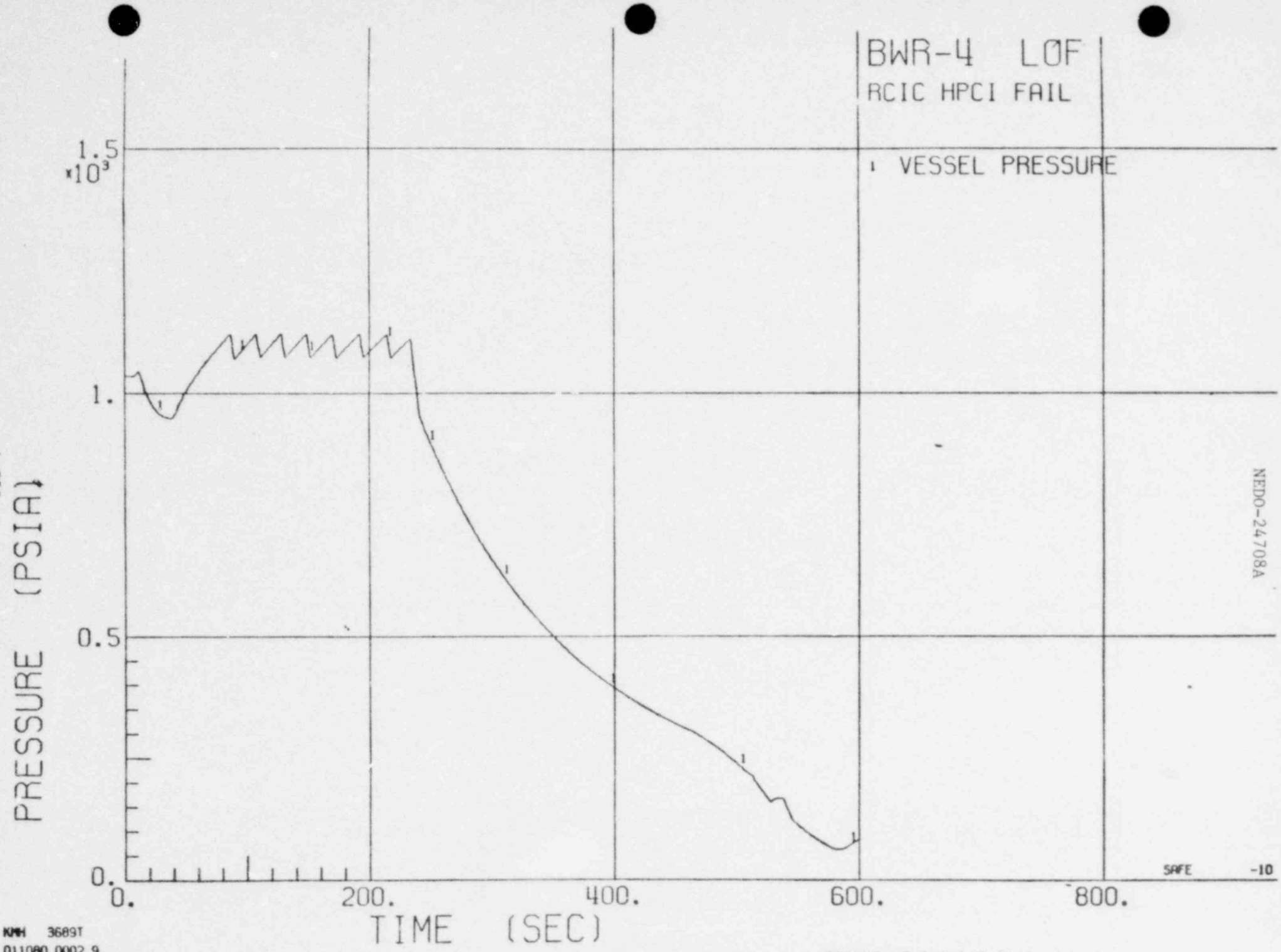
KMH 8379T
122879 1818.8

FIGURE 3.2.1.1.5-20.8



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KMH 3689T
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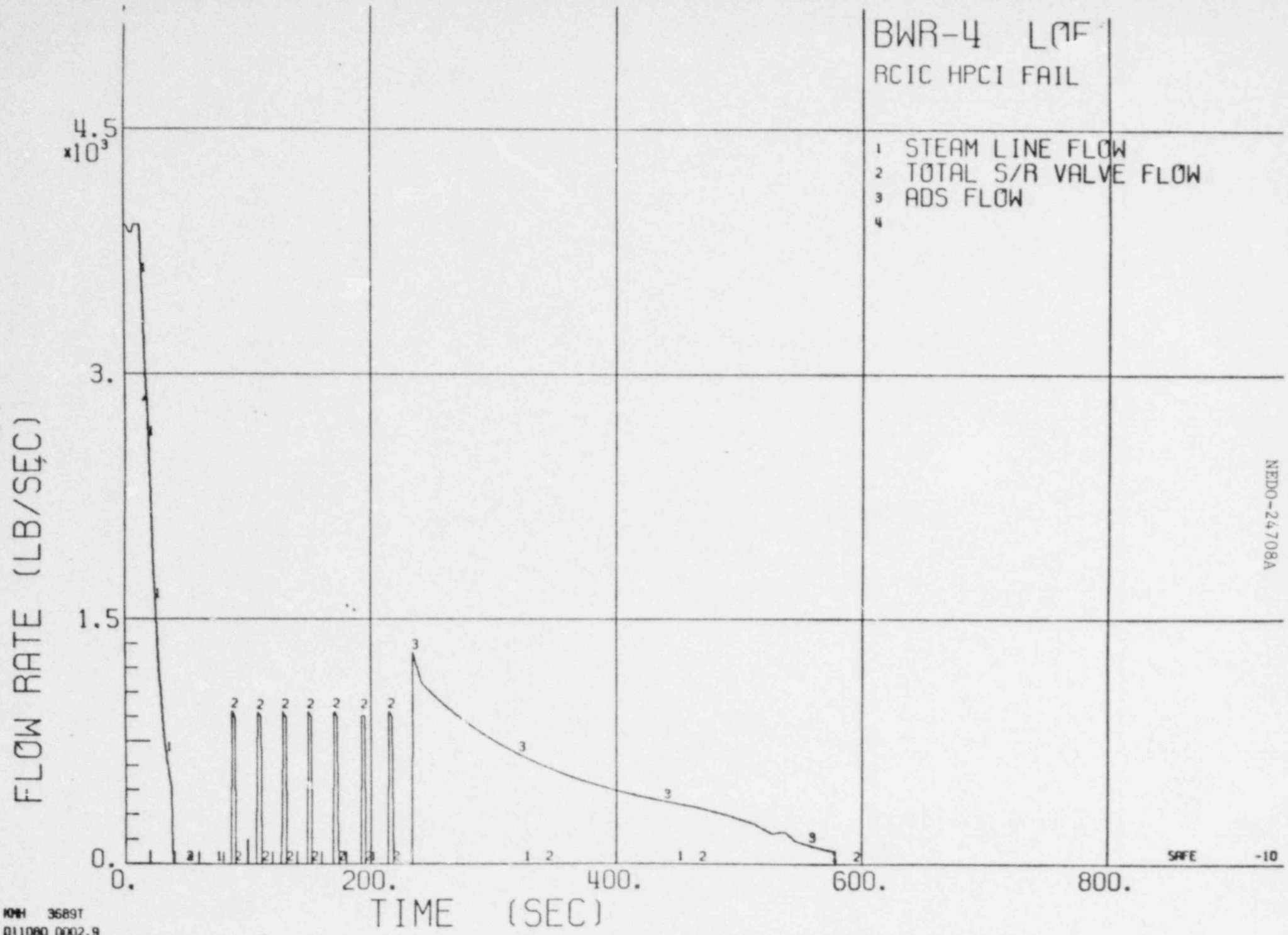
FIGURE 3.2.1.1.5-21.1



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NEDO-24708A
KMH 3689T
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FIGURE 3.2.1.1.5-21.2

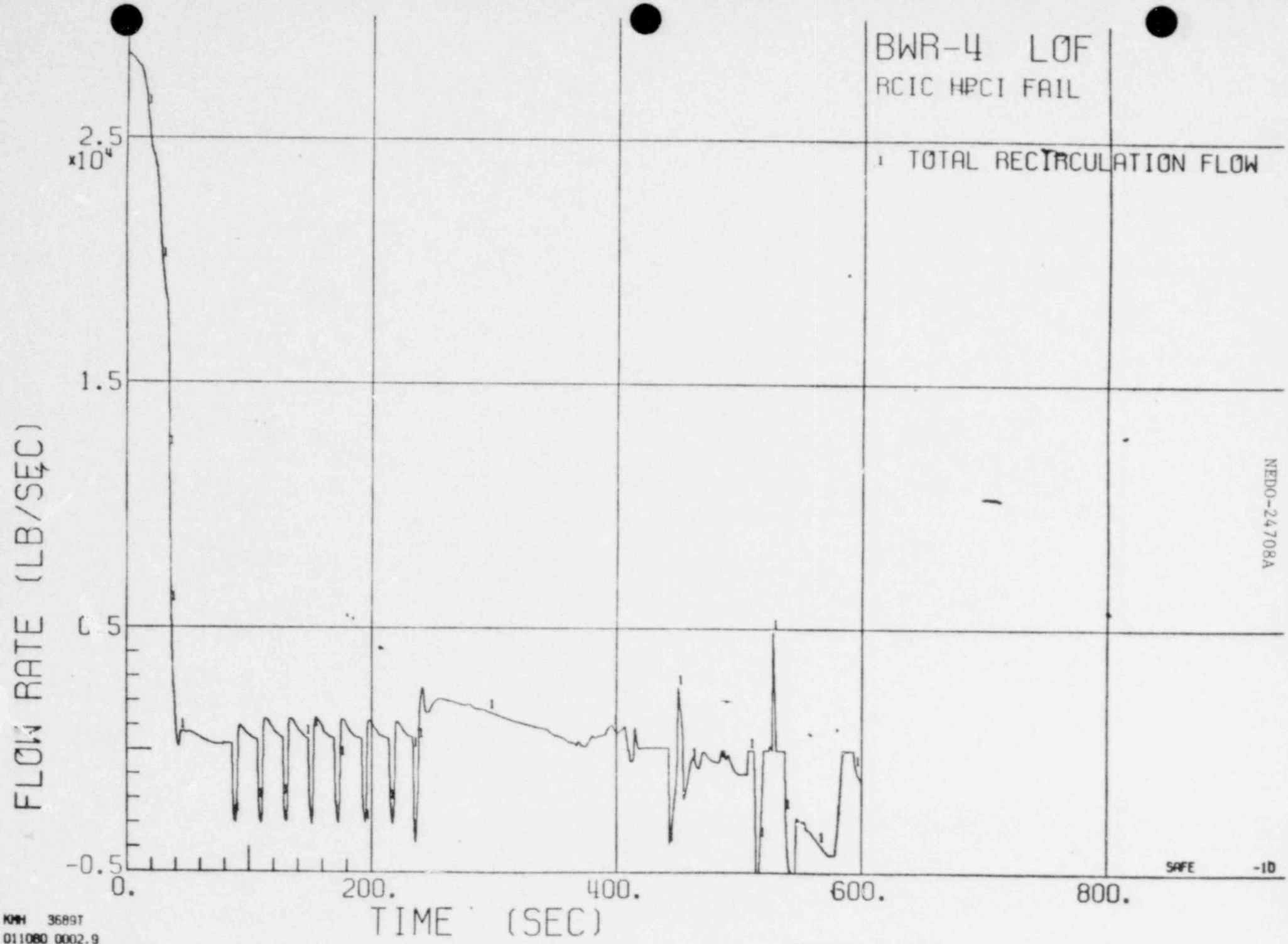

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FIGURE 3.2.1.1.5-21.3

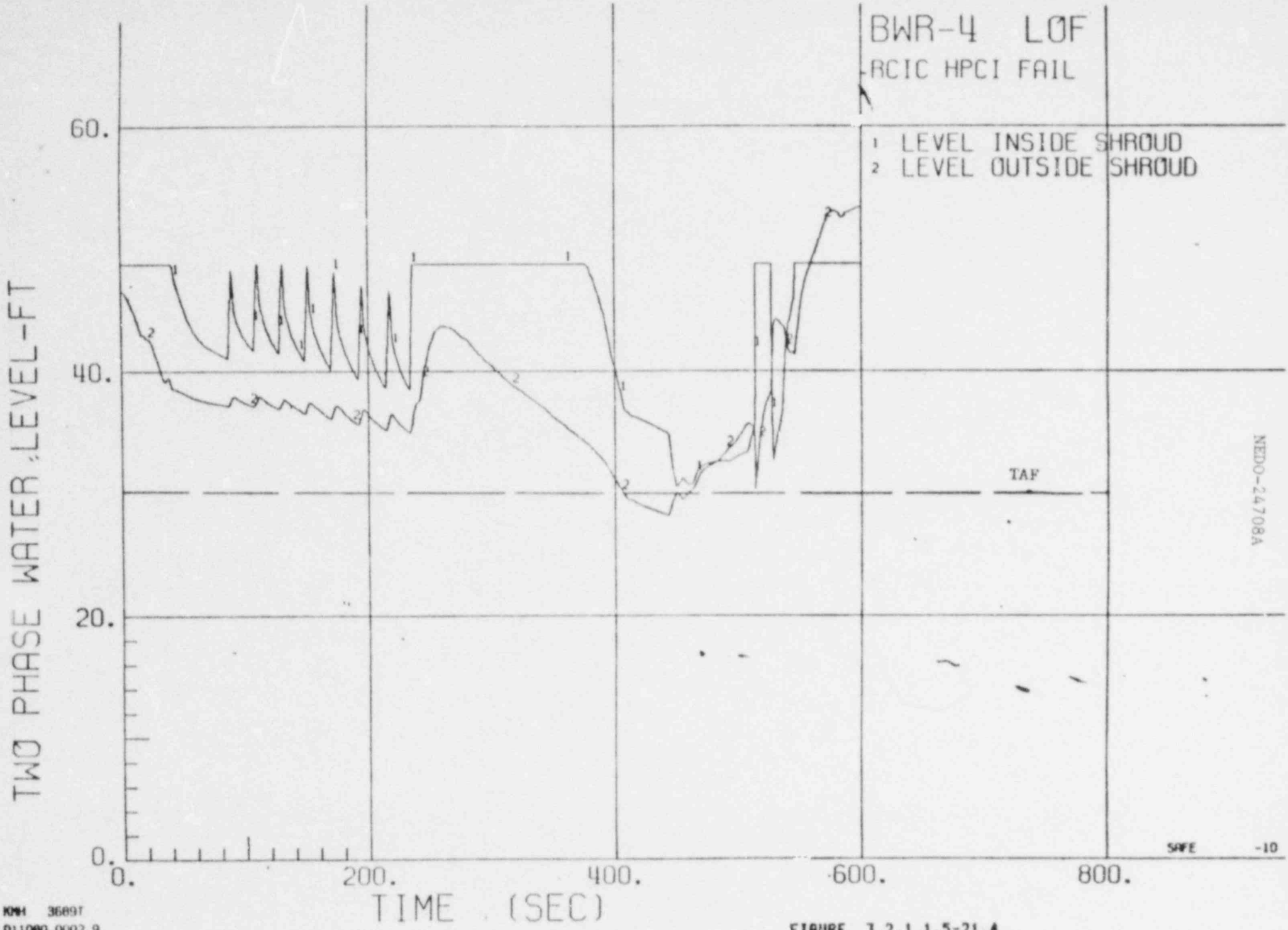

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FIGURE 3.2.1.1.5-21.4

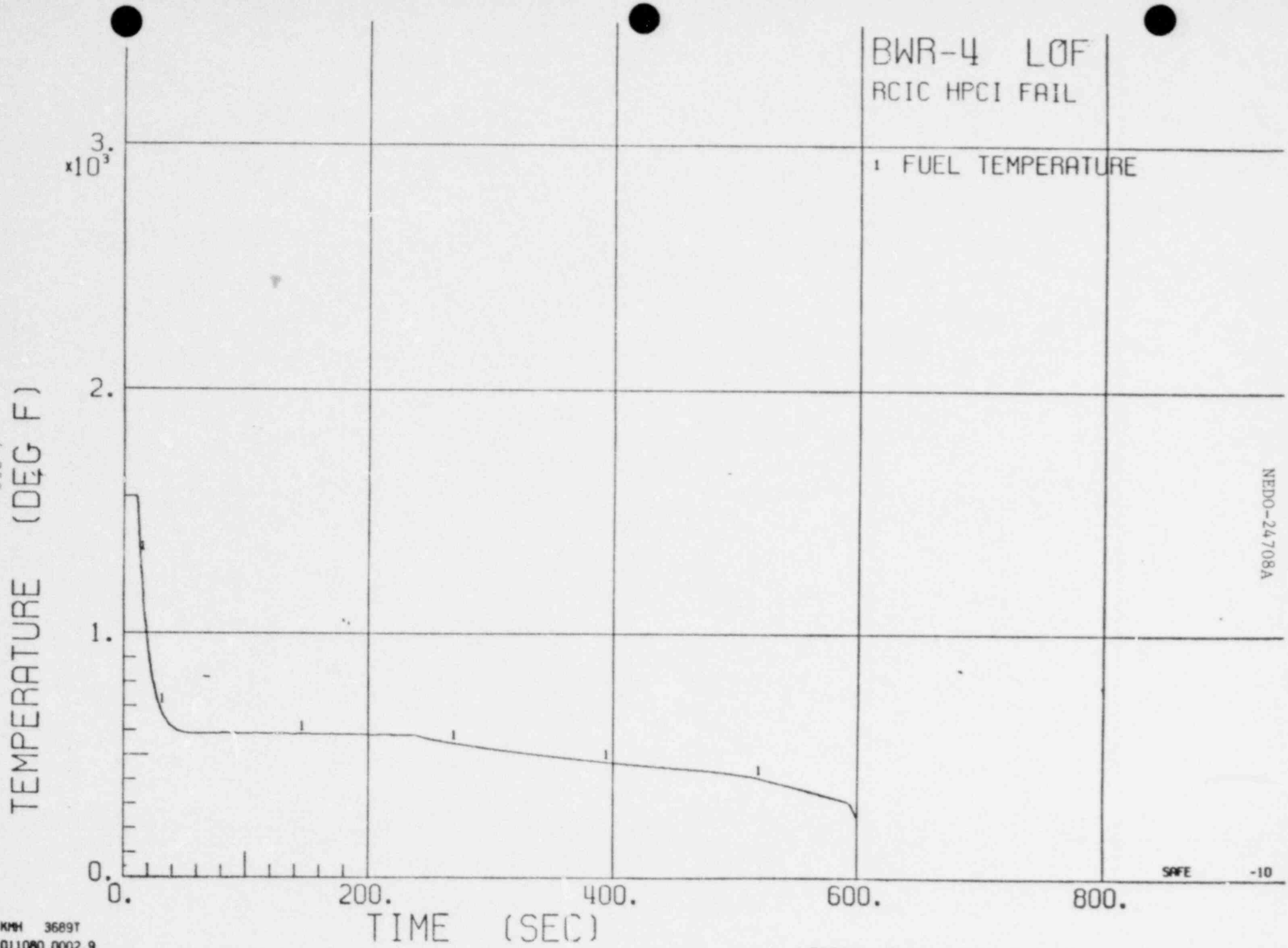

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FIGURE 3.2.1.1.5-21.5

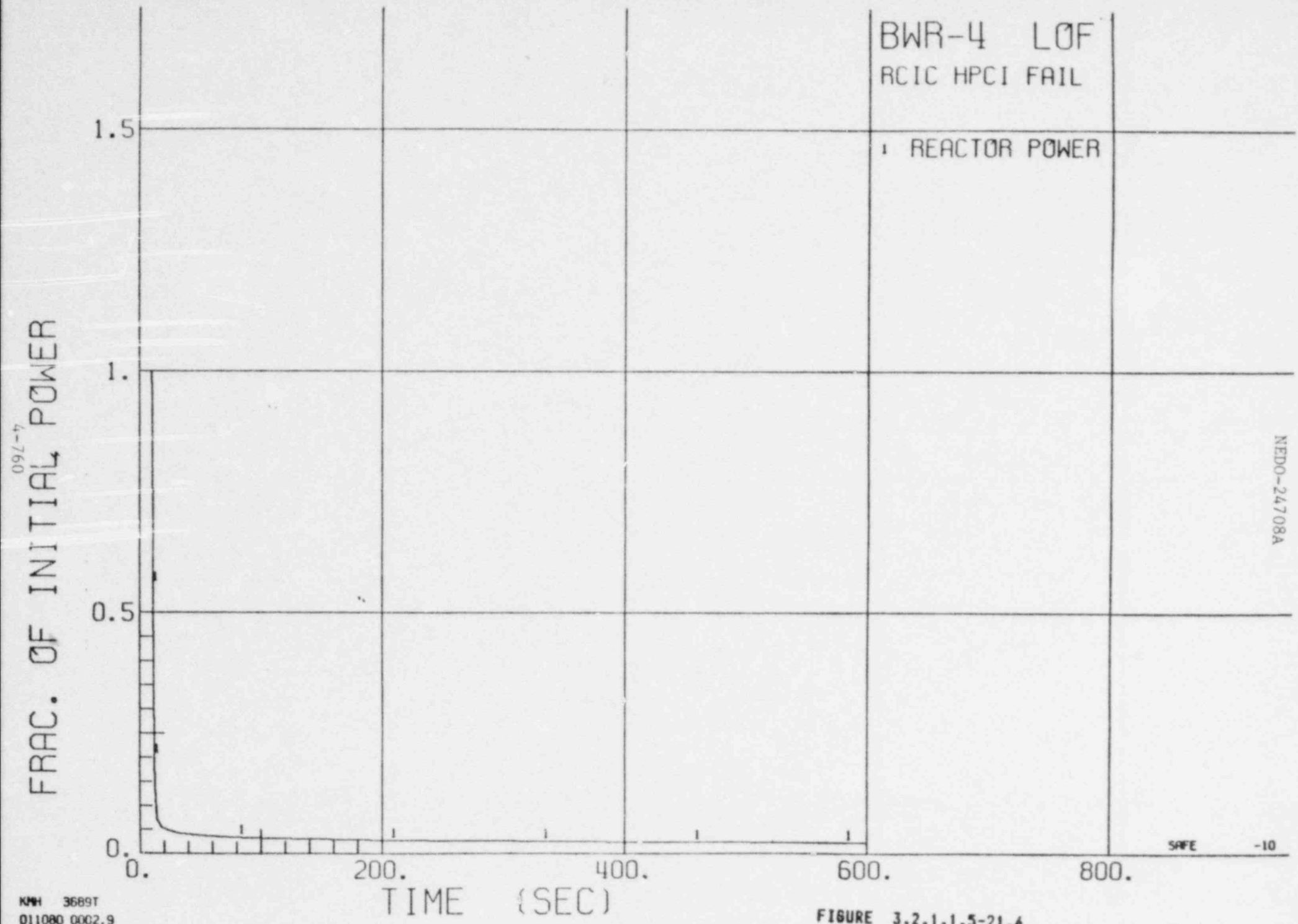

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FIGURE 3.2.1.1.5-21.6

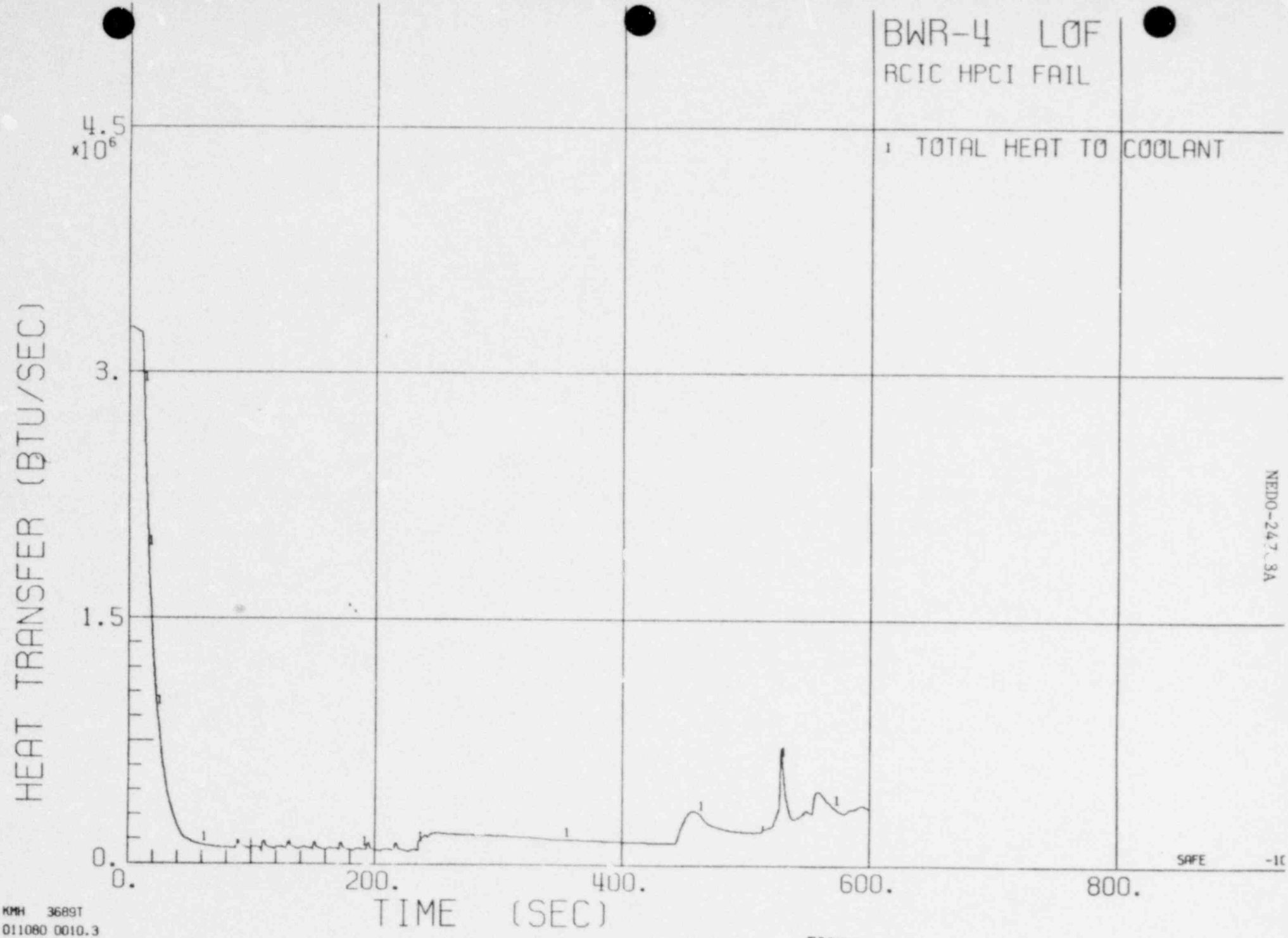


FIGURE 3.2.1.1.5-21.7

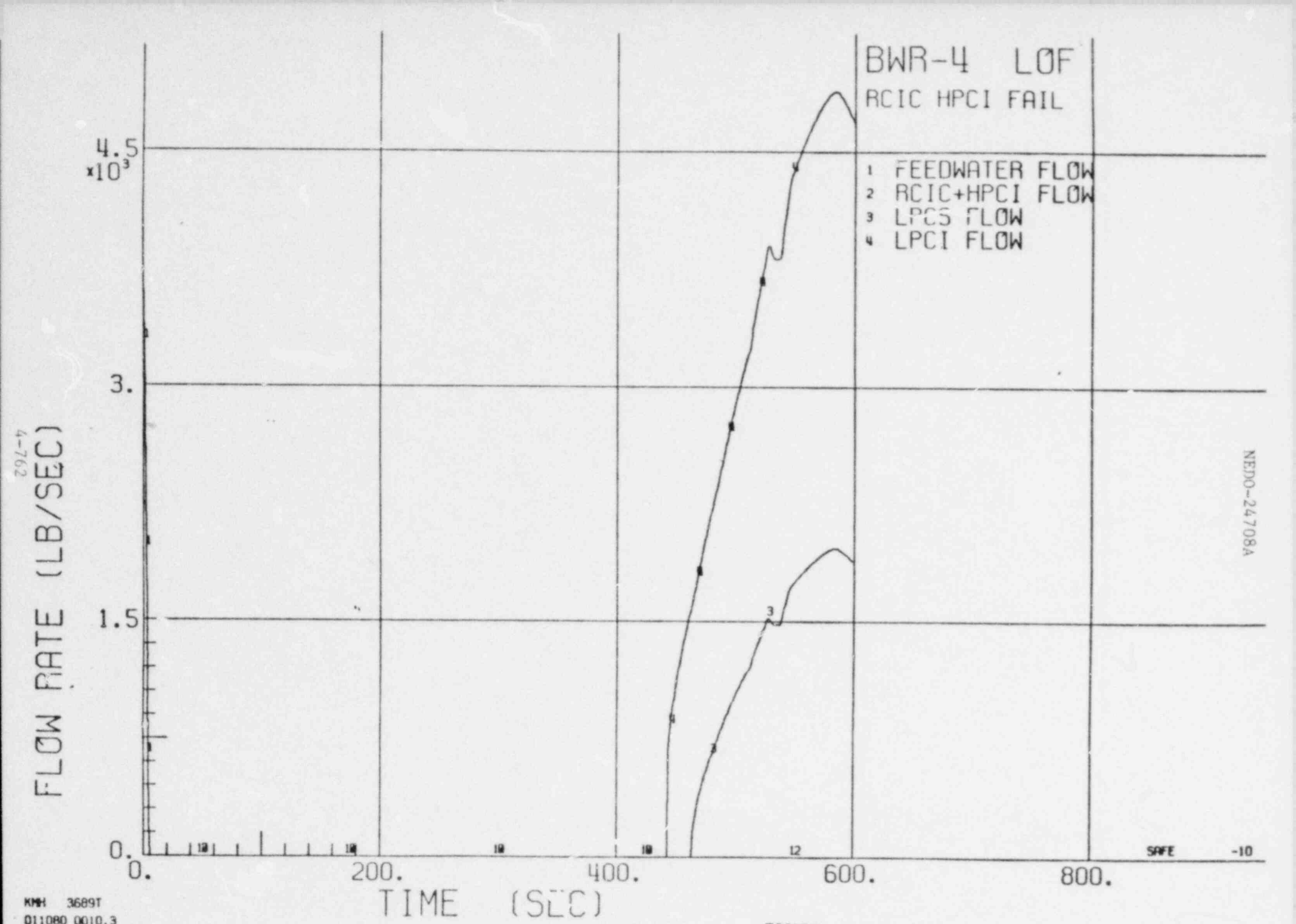
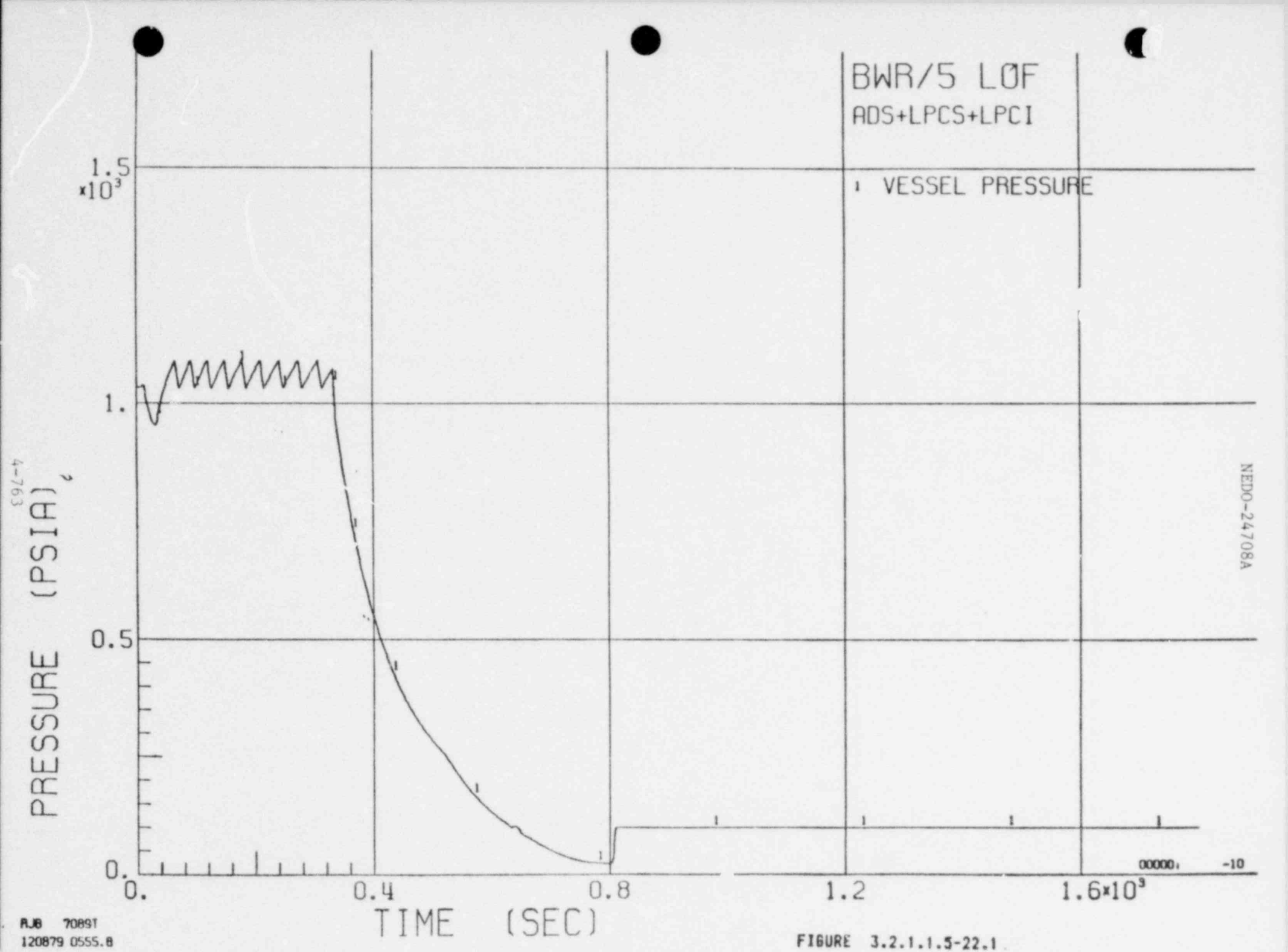


FIGURE 3.2.1.1.5-21.8



RJB 70891
120879 0555.8

FIGURE 3.2.1.1.5-22.1

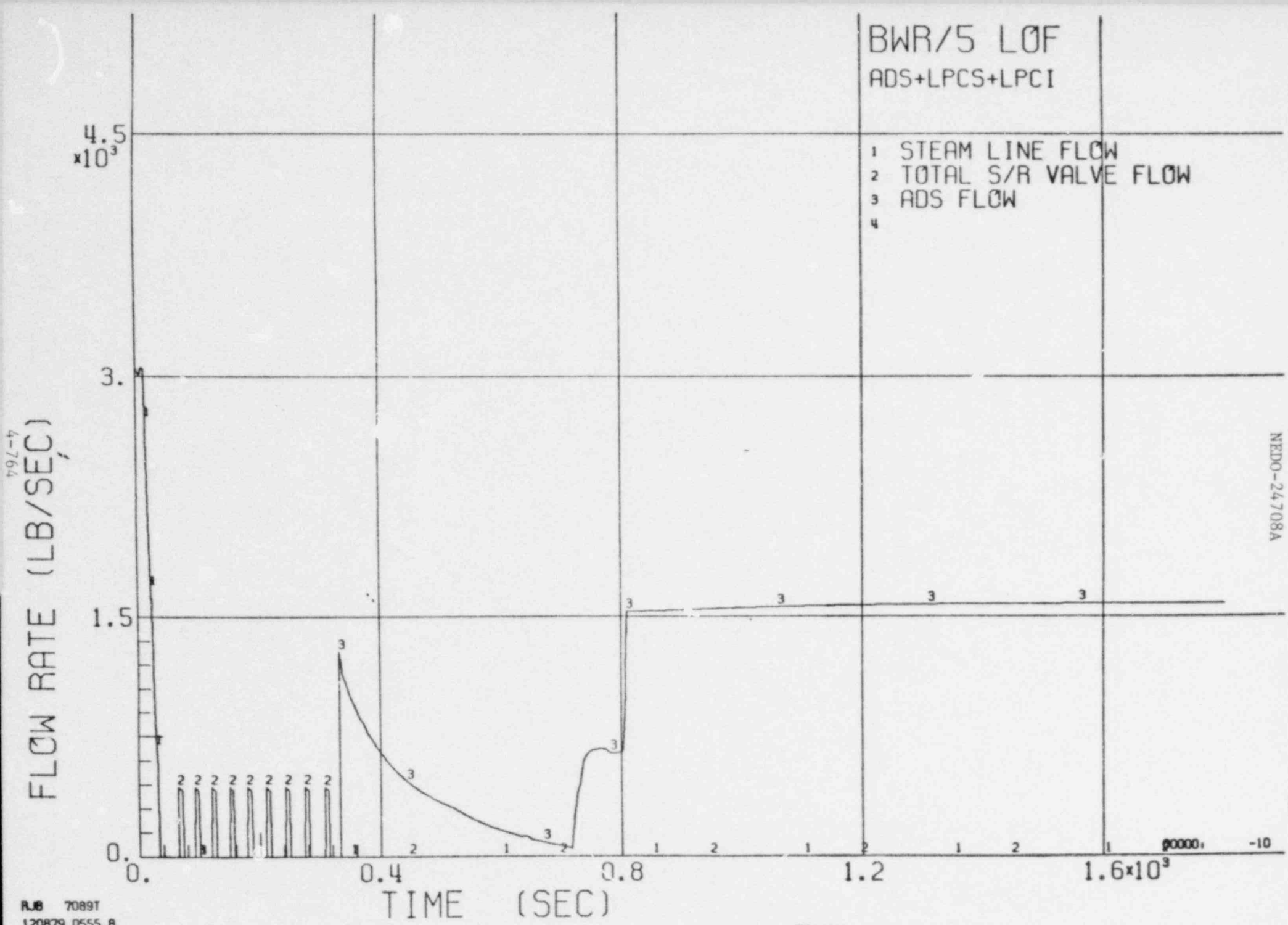


FIGURE 3.2.1.1.5-22.2

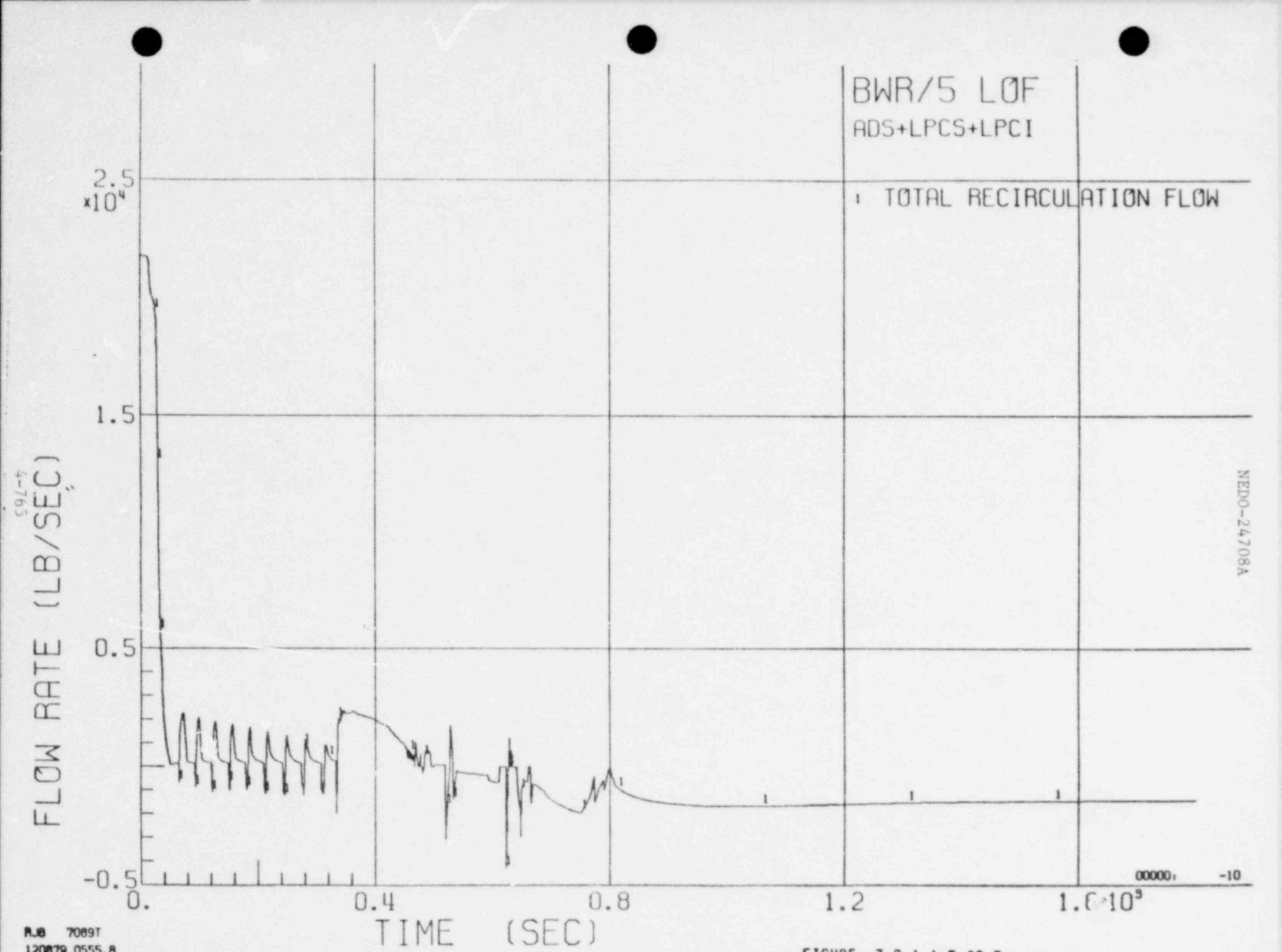


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FIGURE 3.2.1.1.5-22.3

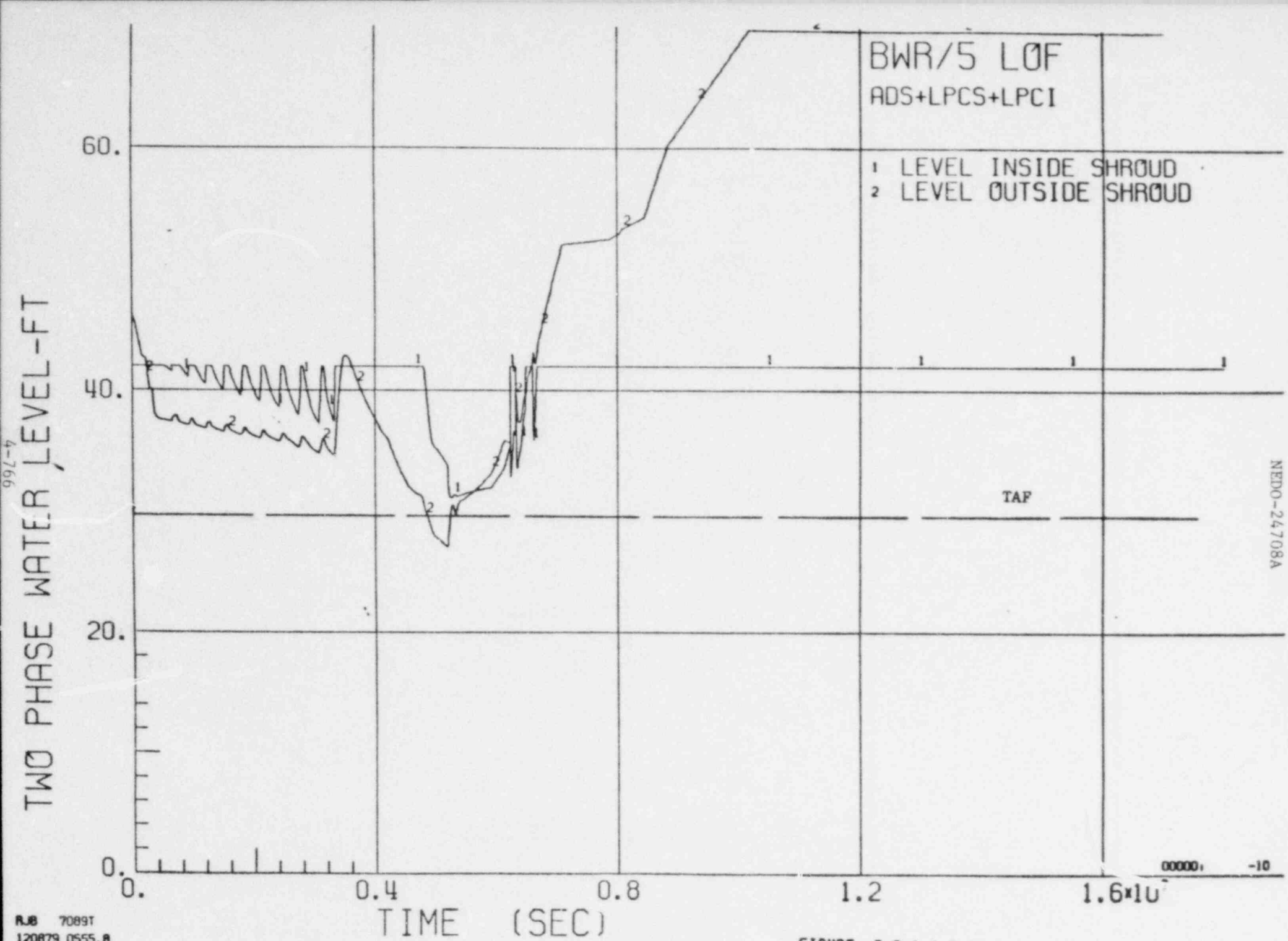

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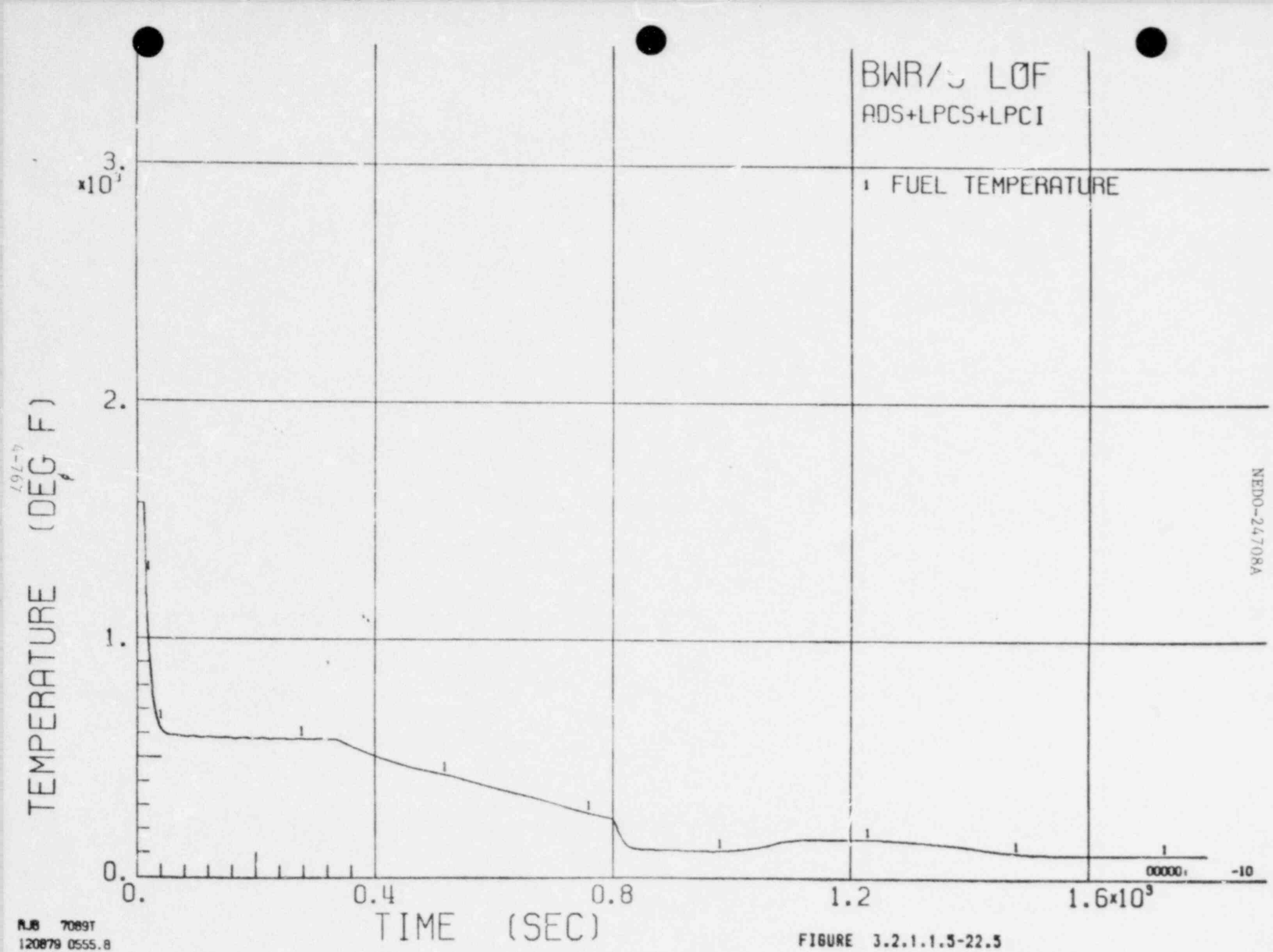
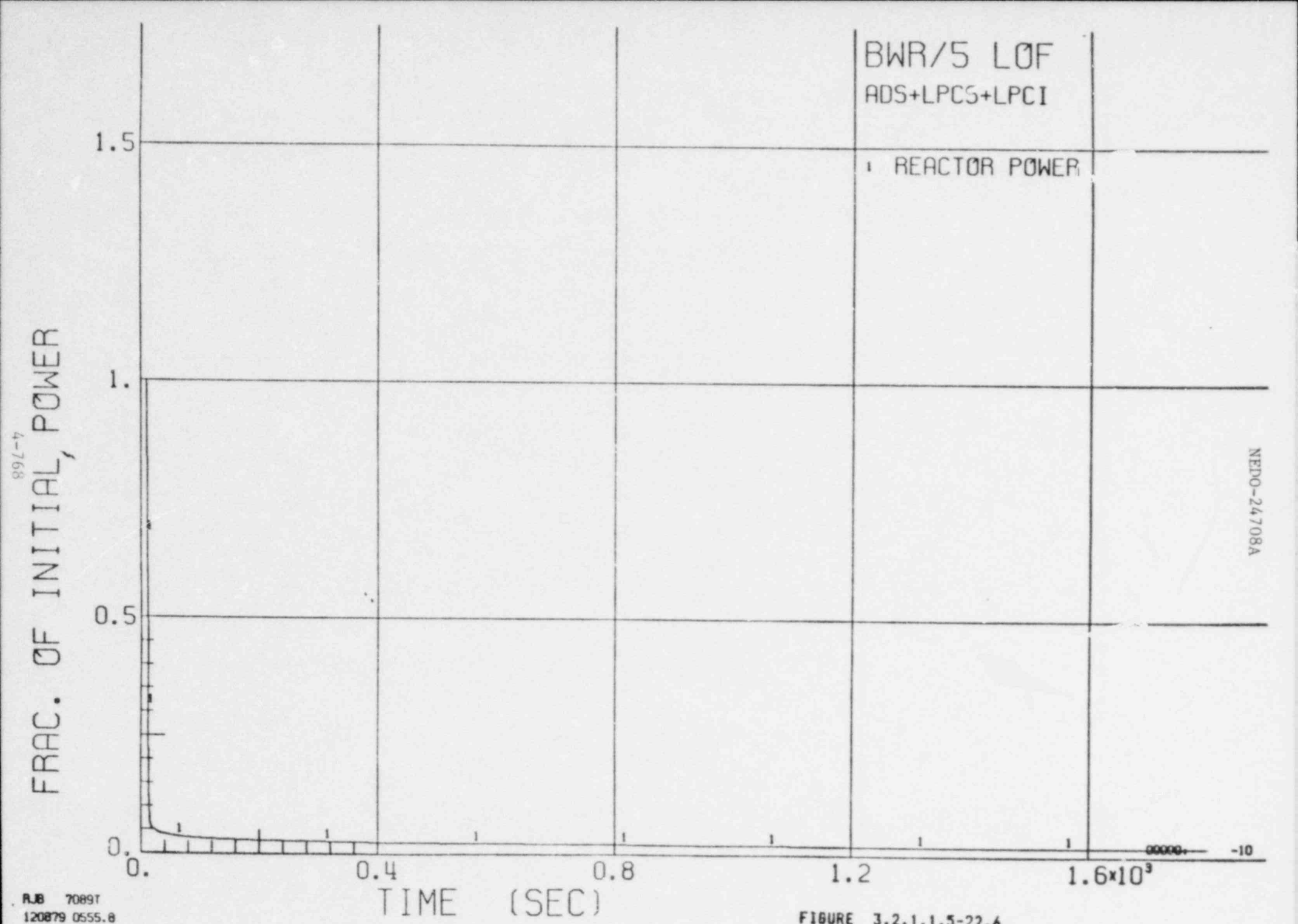
FIGURE 3.2.1.1.5-22.4



RJB 7089T
120879 0555.8

FIGURE 3.2.1.1.5-22.5



RJB 70897
120879 0555.8

FIGURE 3.2.1.1.5-22.6

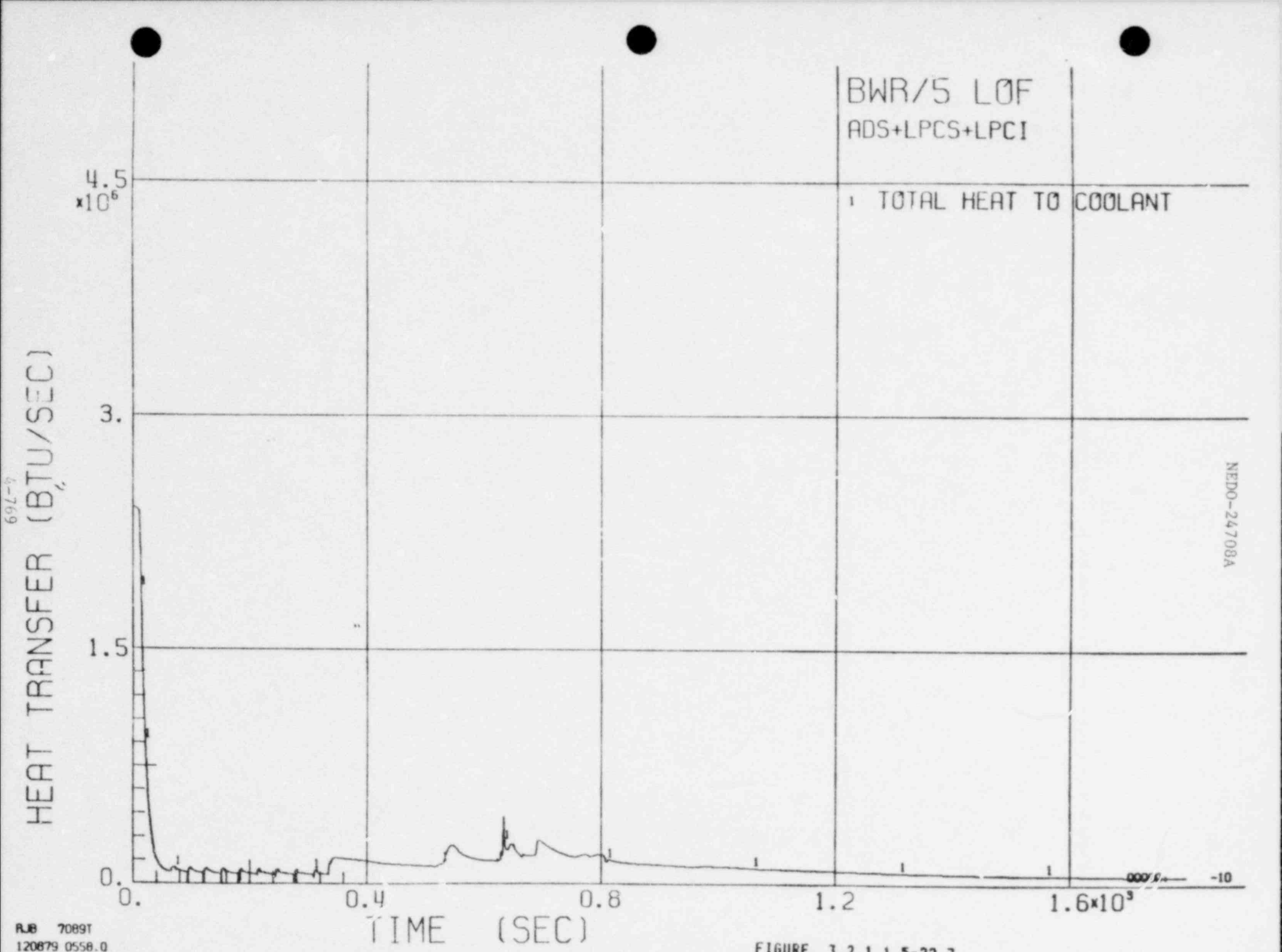


FIGURE 3.2.1.1.5-22.7

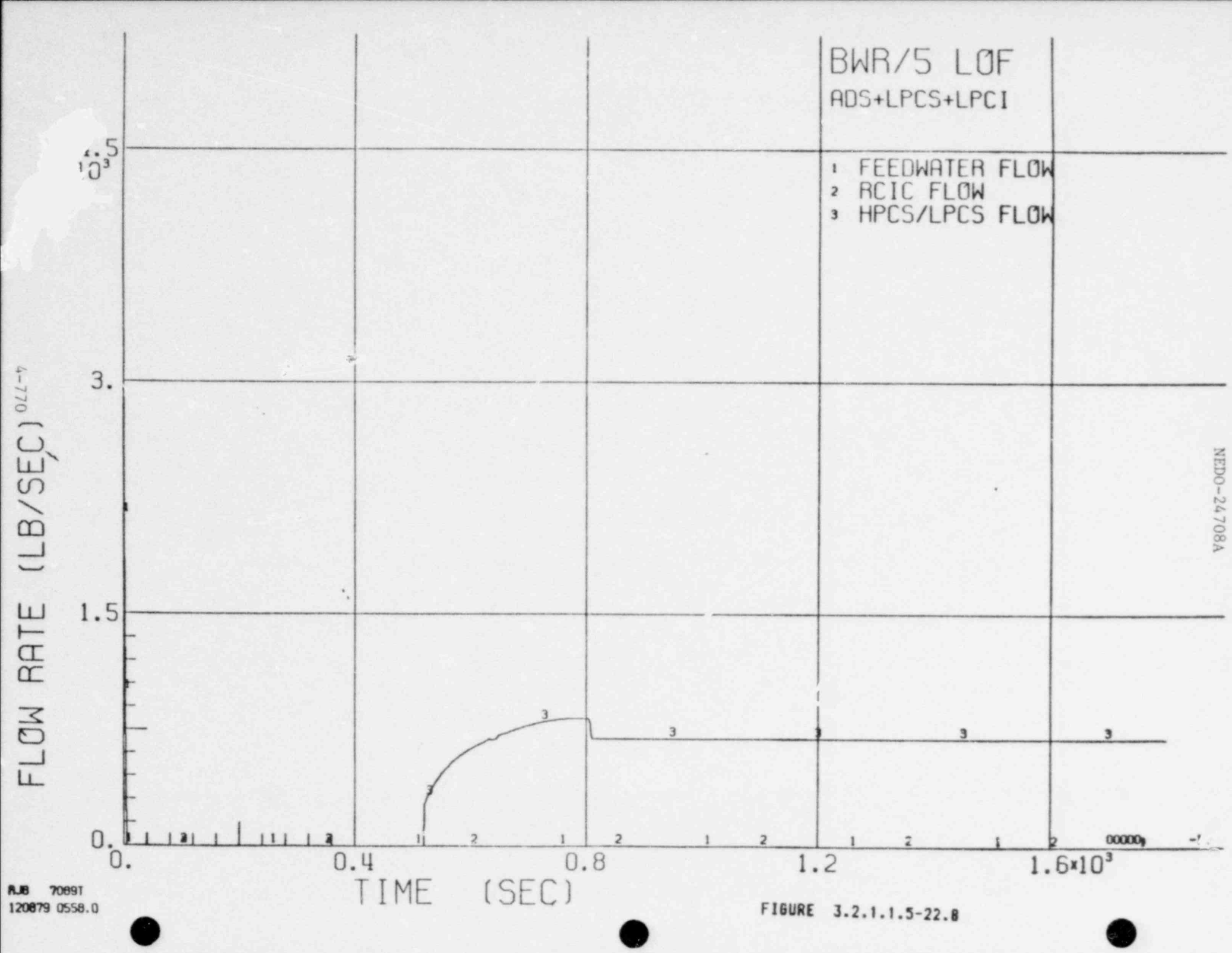


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FIGURE 3.2.1.1.5-22.8

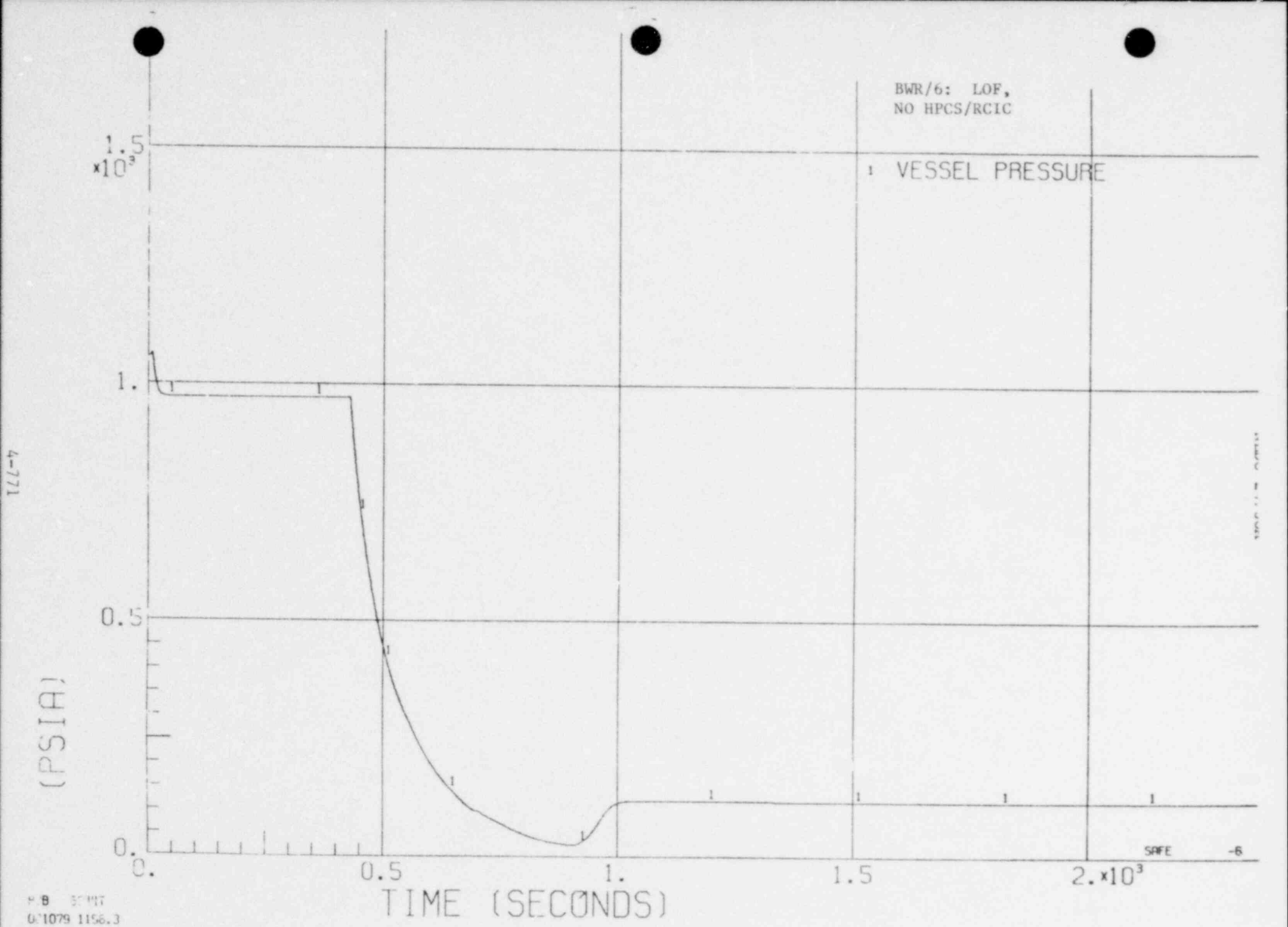

Figure 3.2.1.1.5-22A.1

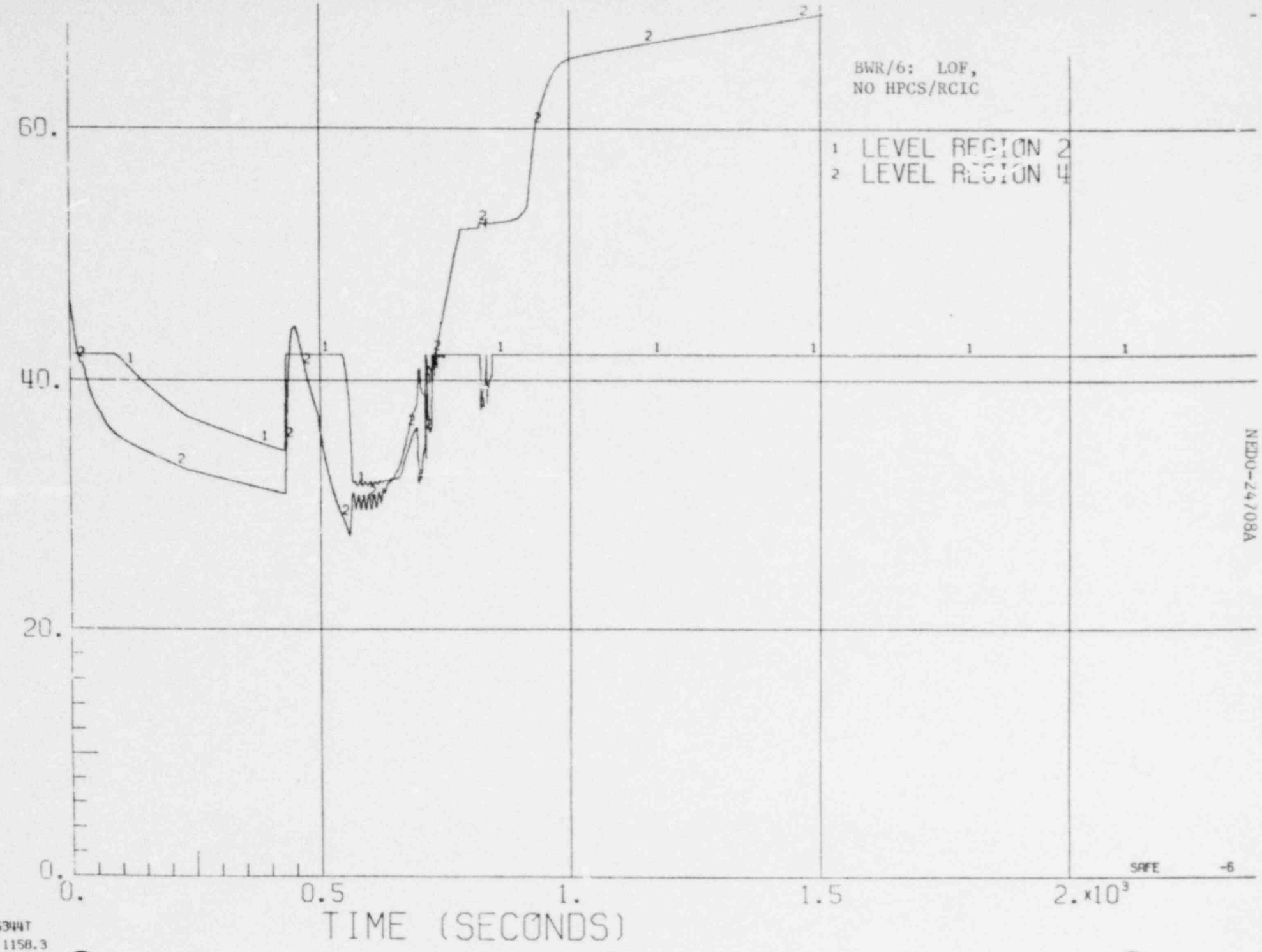

Figure 6.1.1.5-22A.2

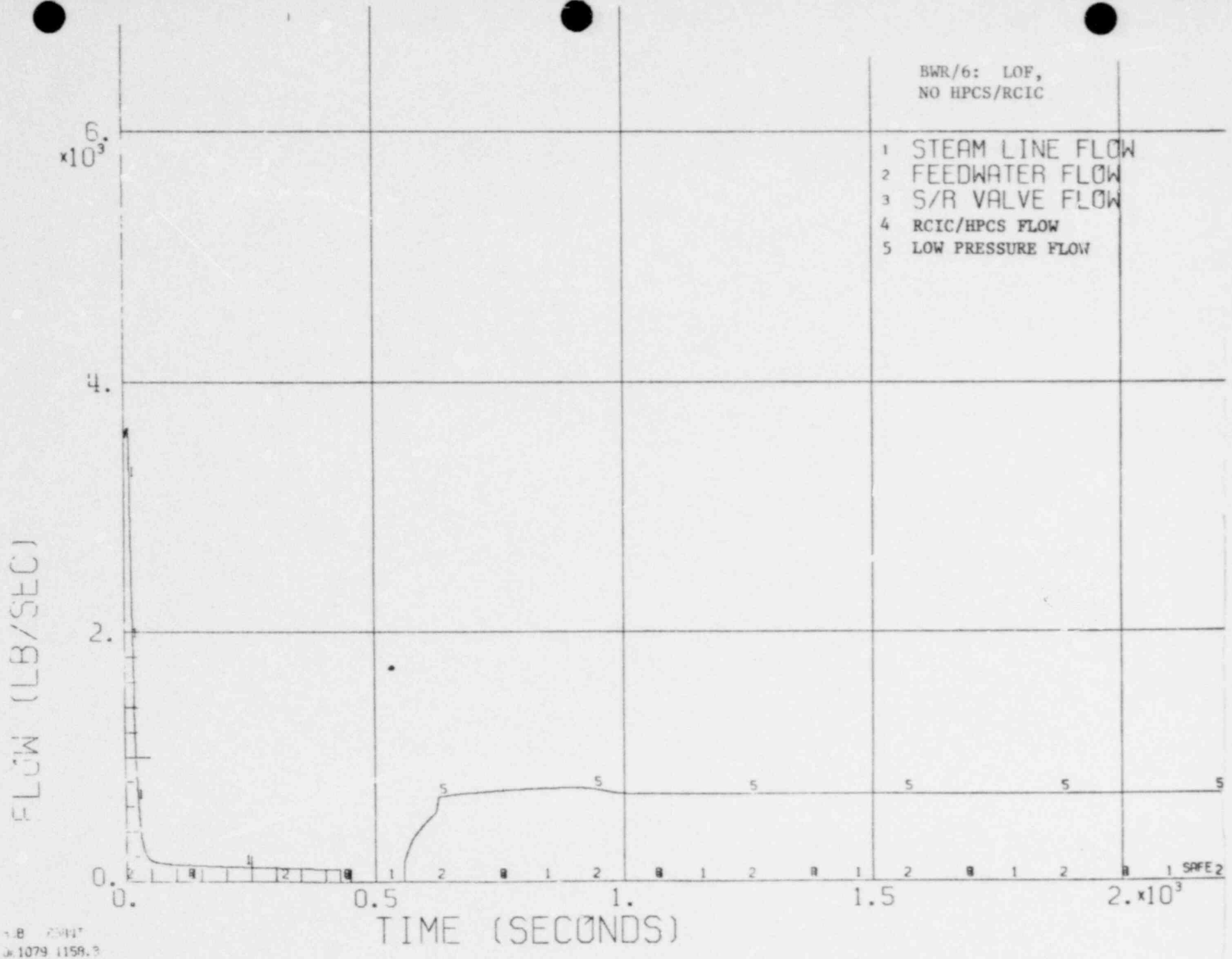

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Figure 3.2.1.1.5-22A.3

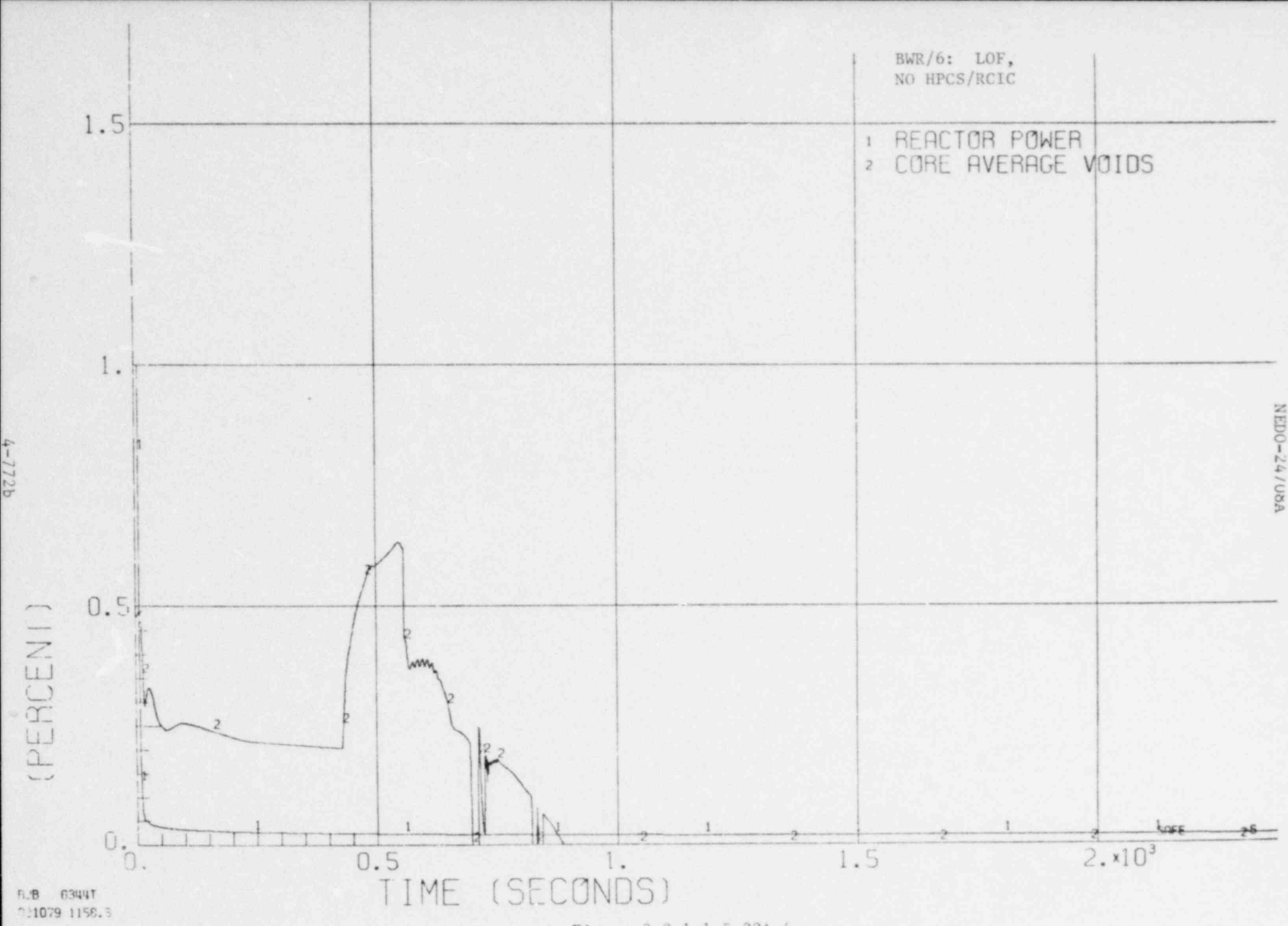
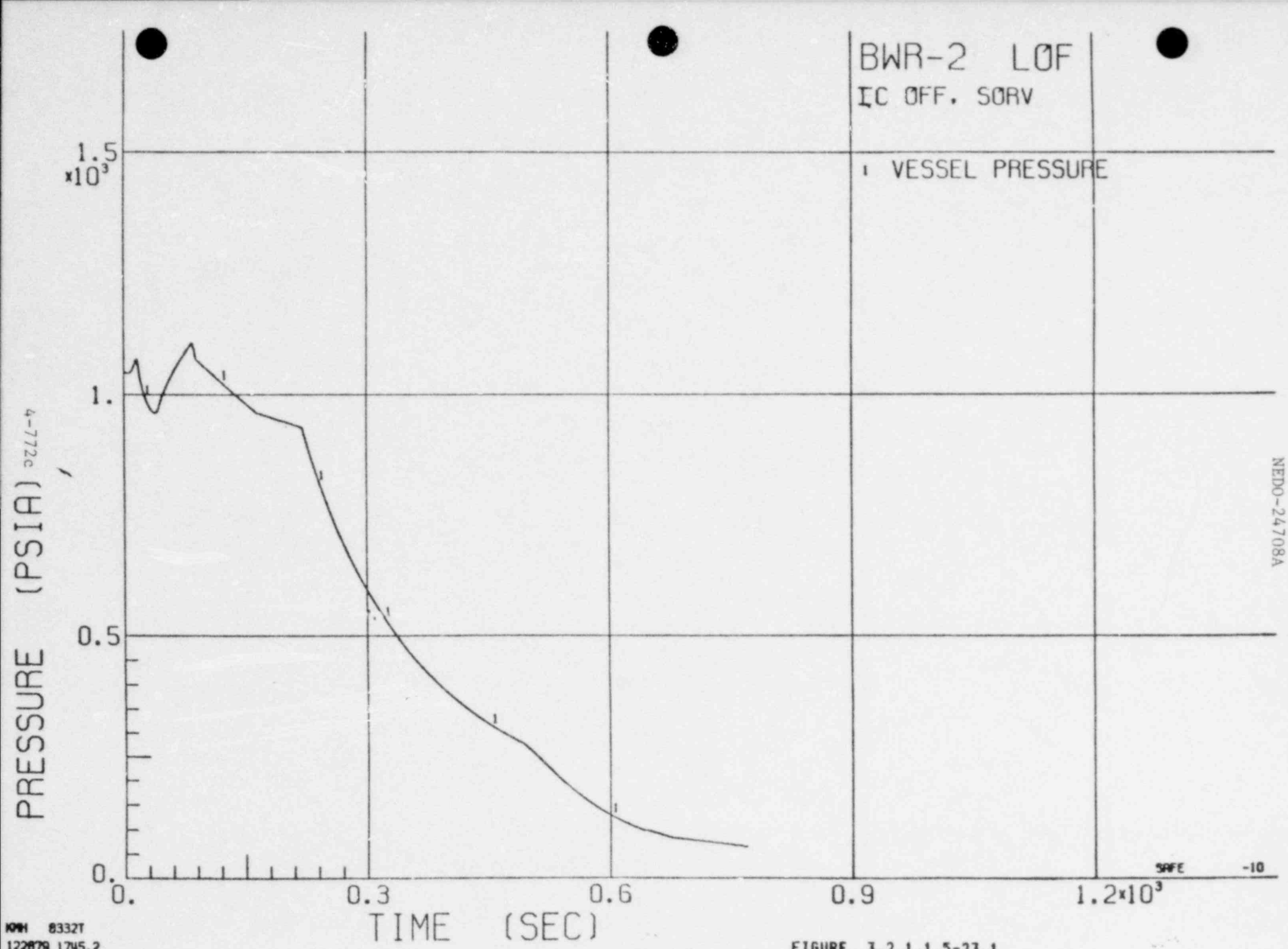
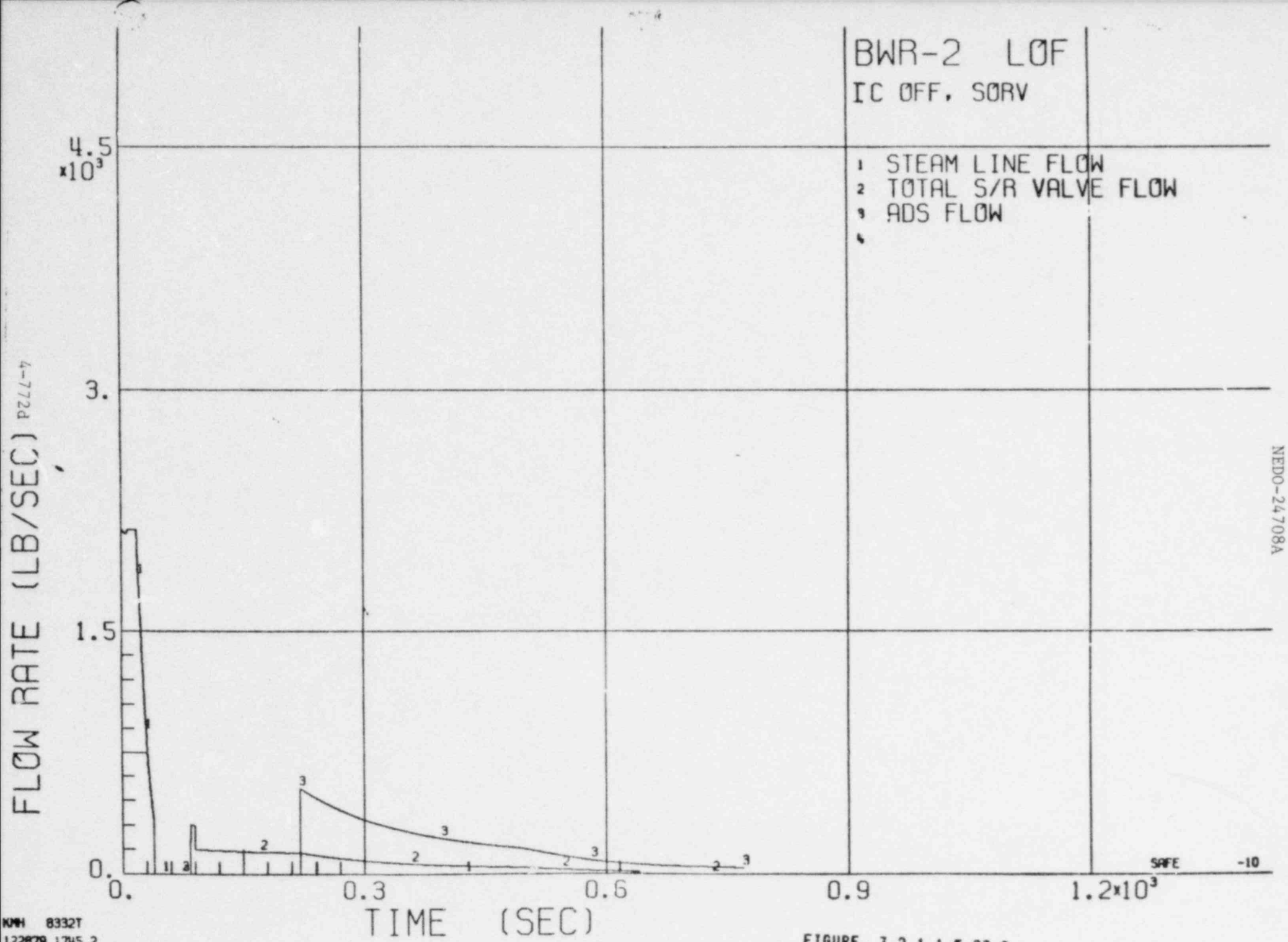


Figure 3.2.1.1.5-22A.4



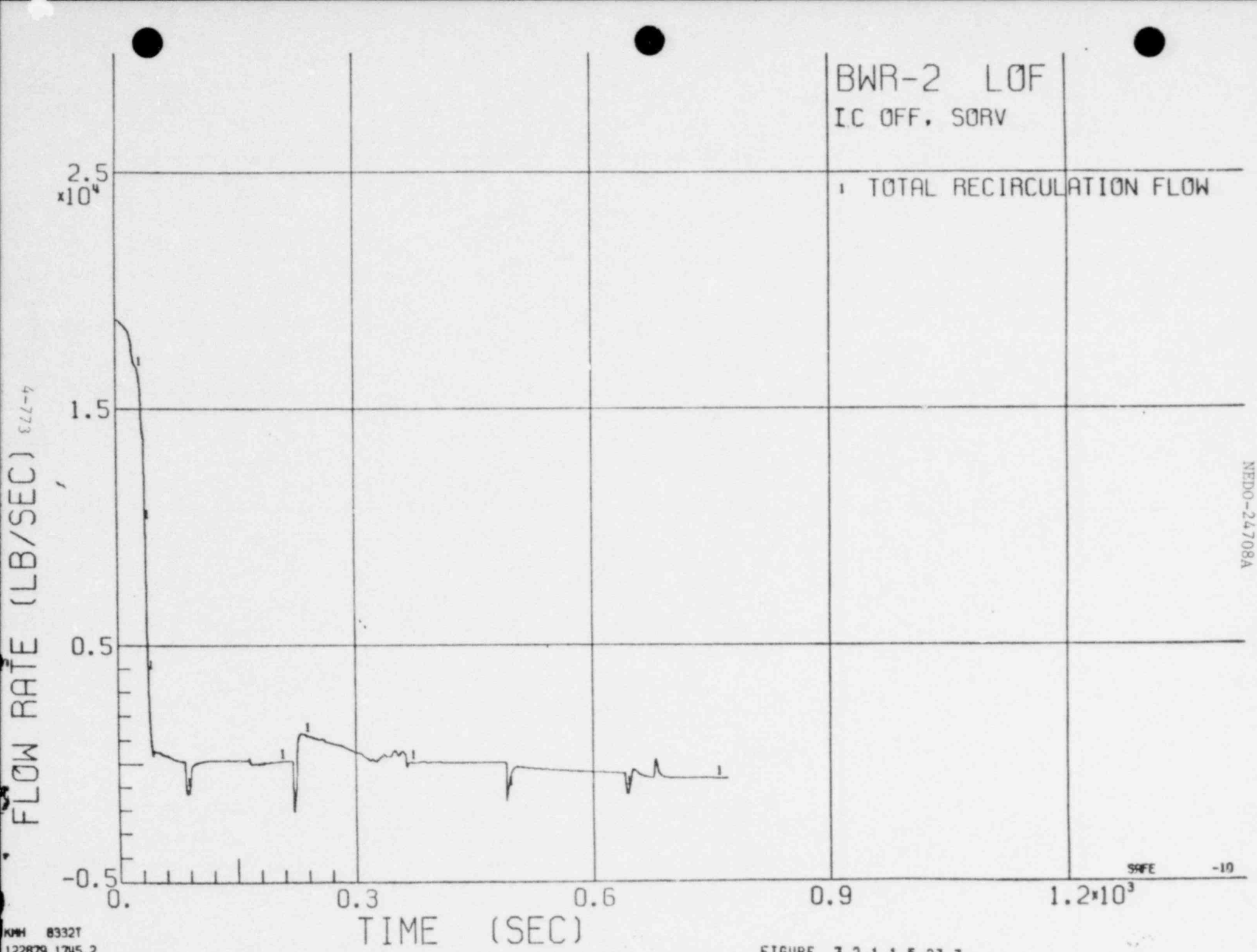
KMH 8332T
122879 1745.2

FIGURE 3.2.1.1.5-23.1



KMH 8332T
122879 1745.2

FIGURE 3.2.1.1.5-23.2



KMH 8332T
122879 1745.2

FIGURE 3.2.1.1.5-23.3

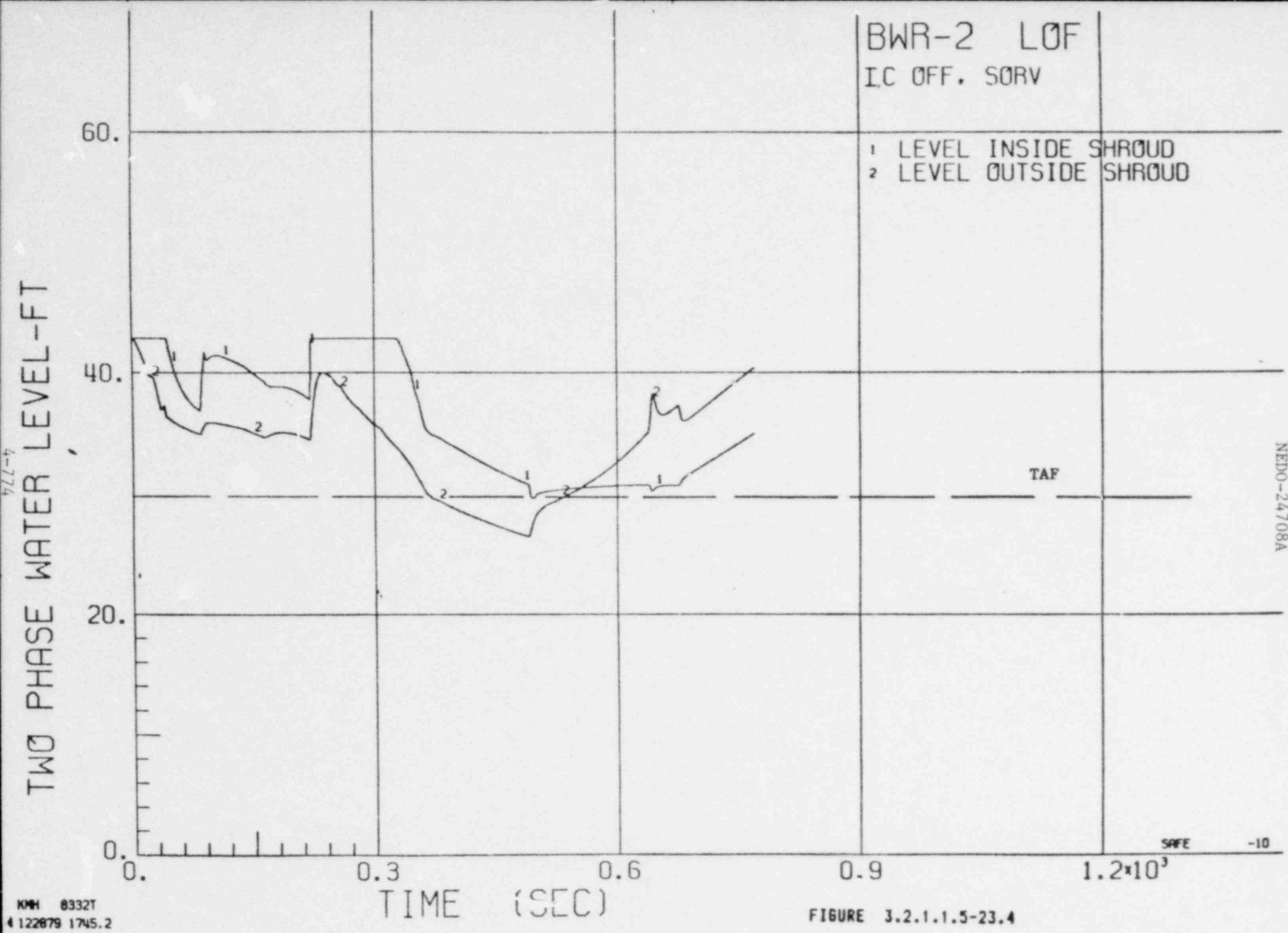


FIGURE 3.2.1.1.5-23.4

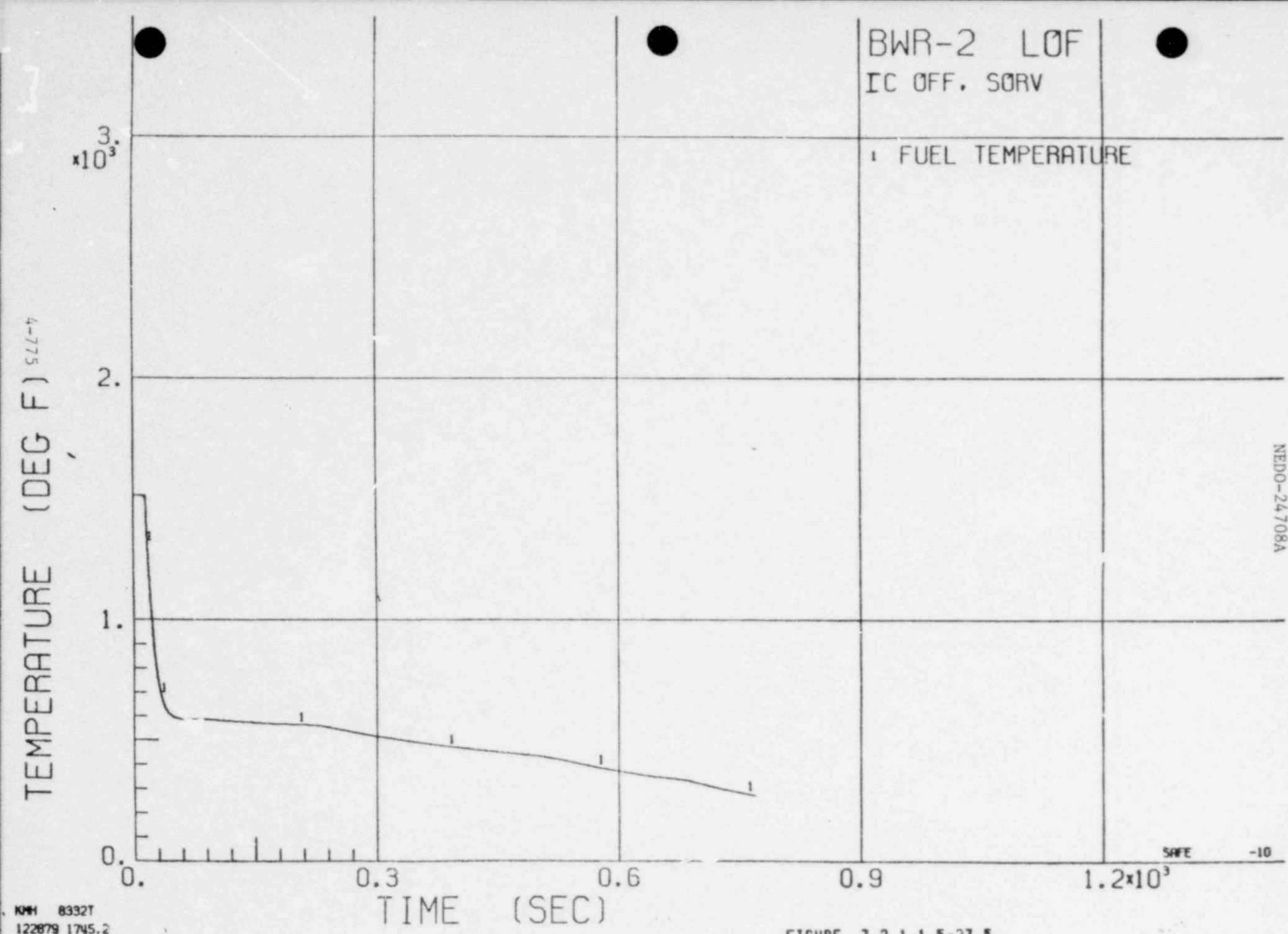
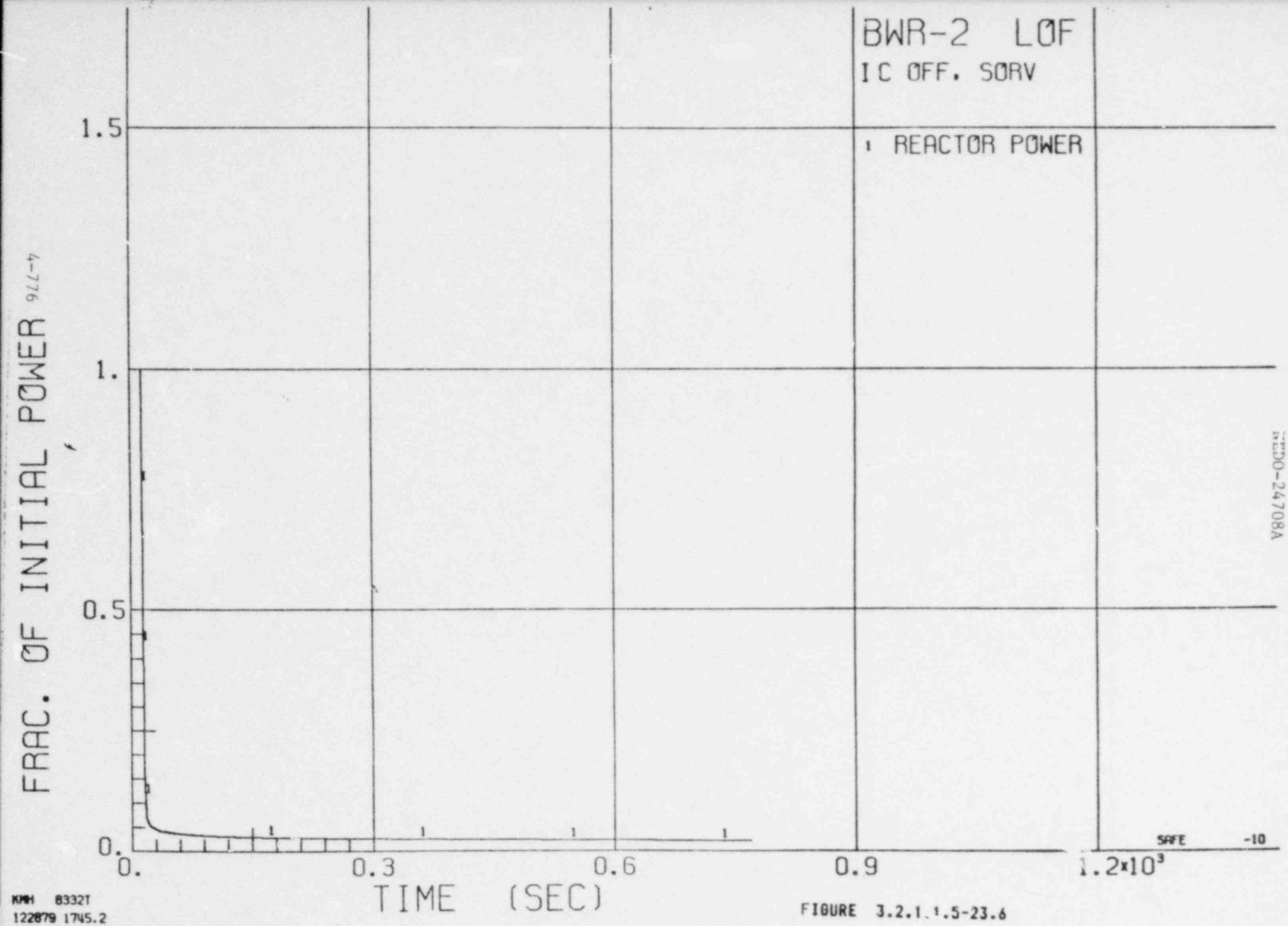


FIGURE 3.2.1.1.5-23.5



KMH 8332T
122879 1745.2

FIGURE 3.2.1.1.5-23.6

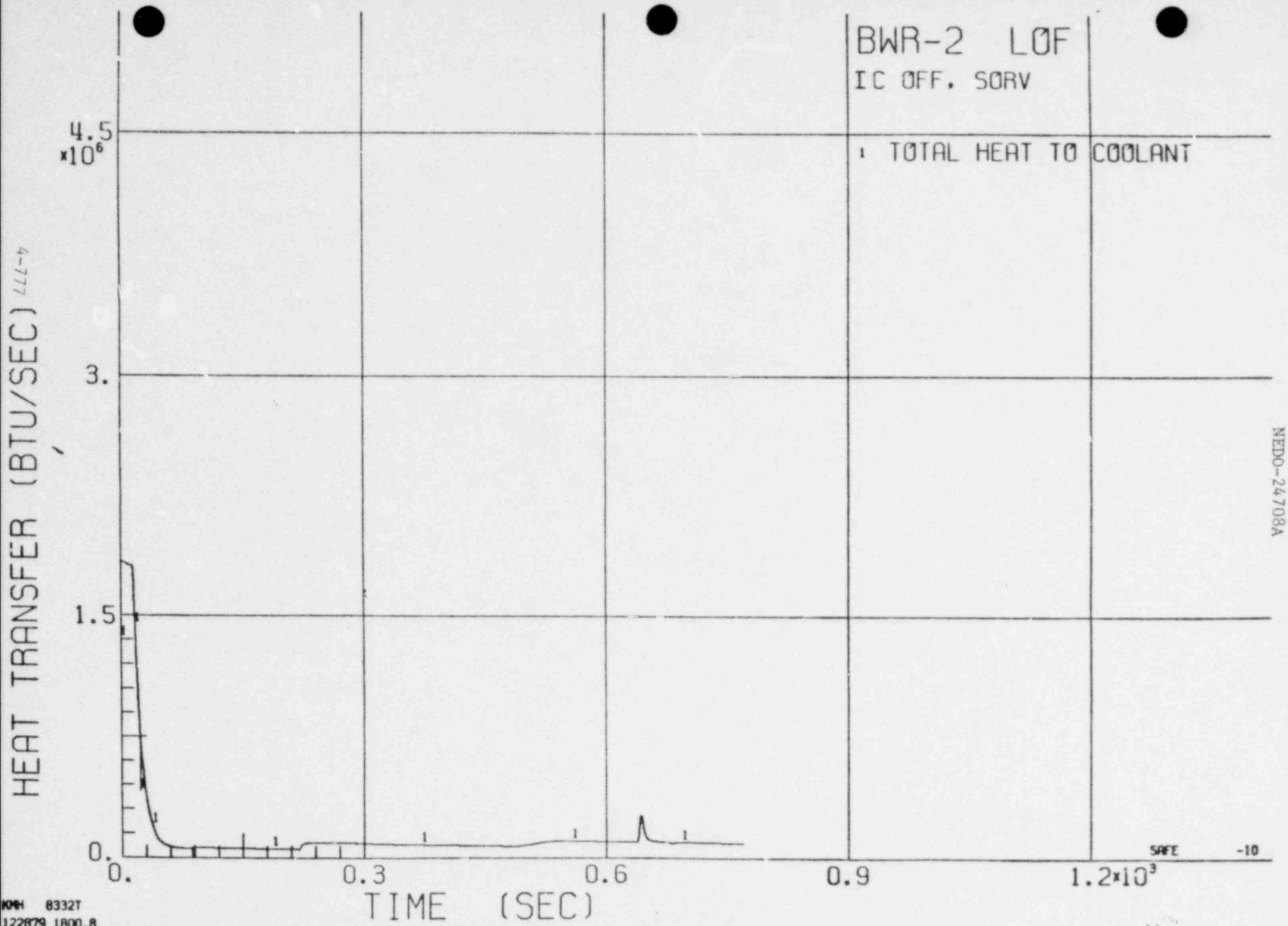
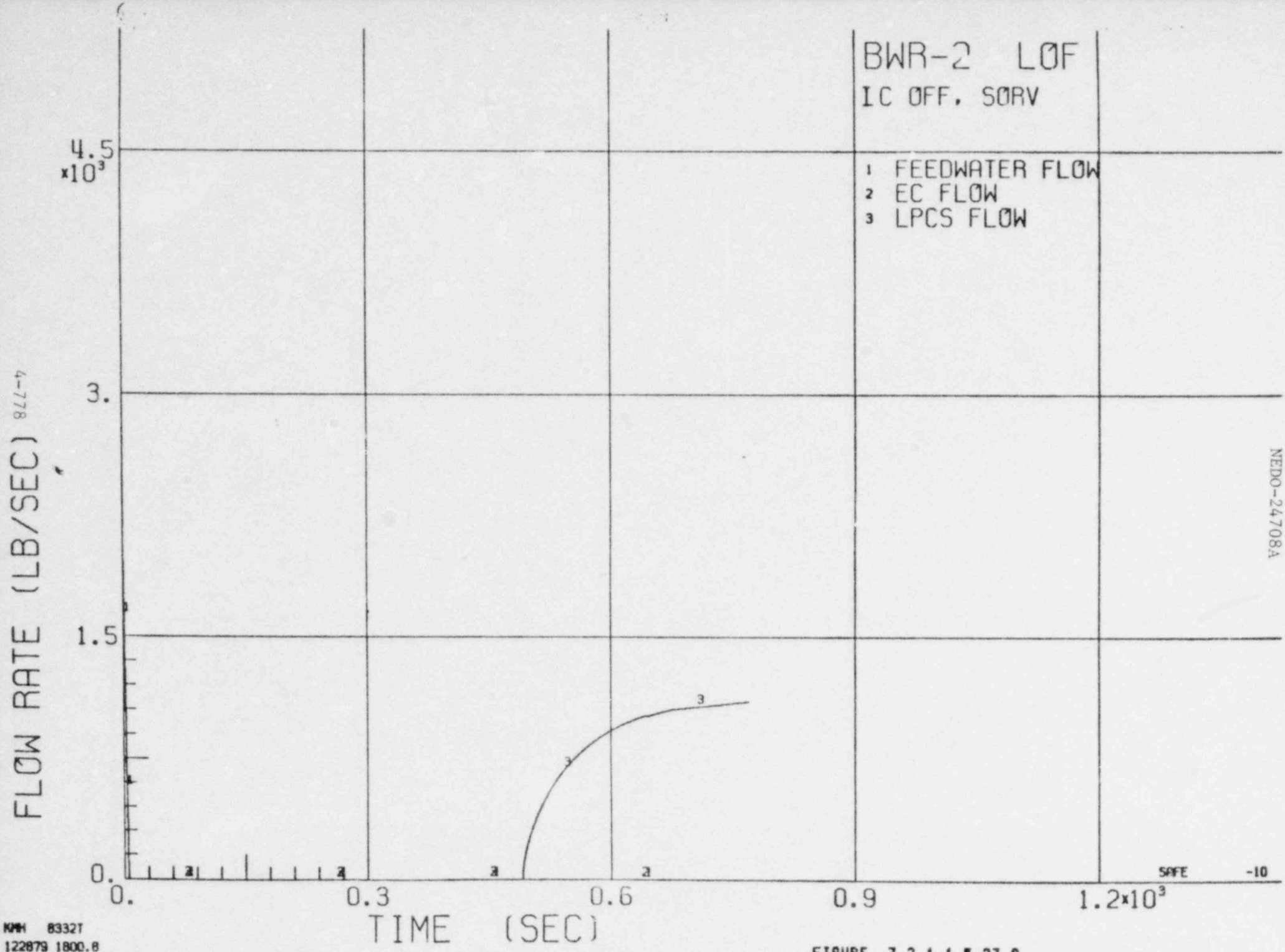


FIGURE 3.2.1.1.5-23.7



KMH 83327
122879 1800.8

FIGURE 3.2.1.1.5-23.8

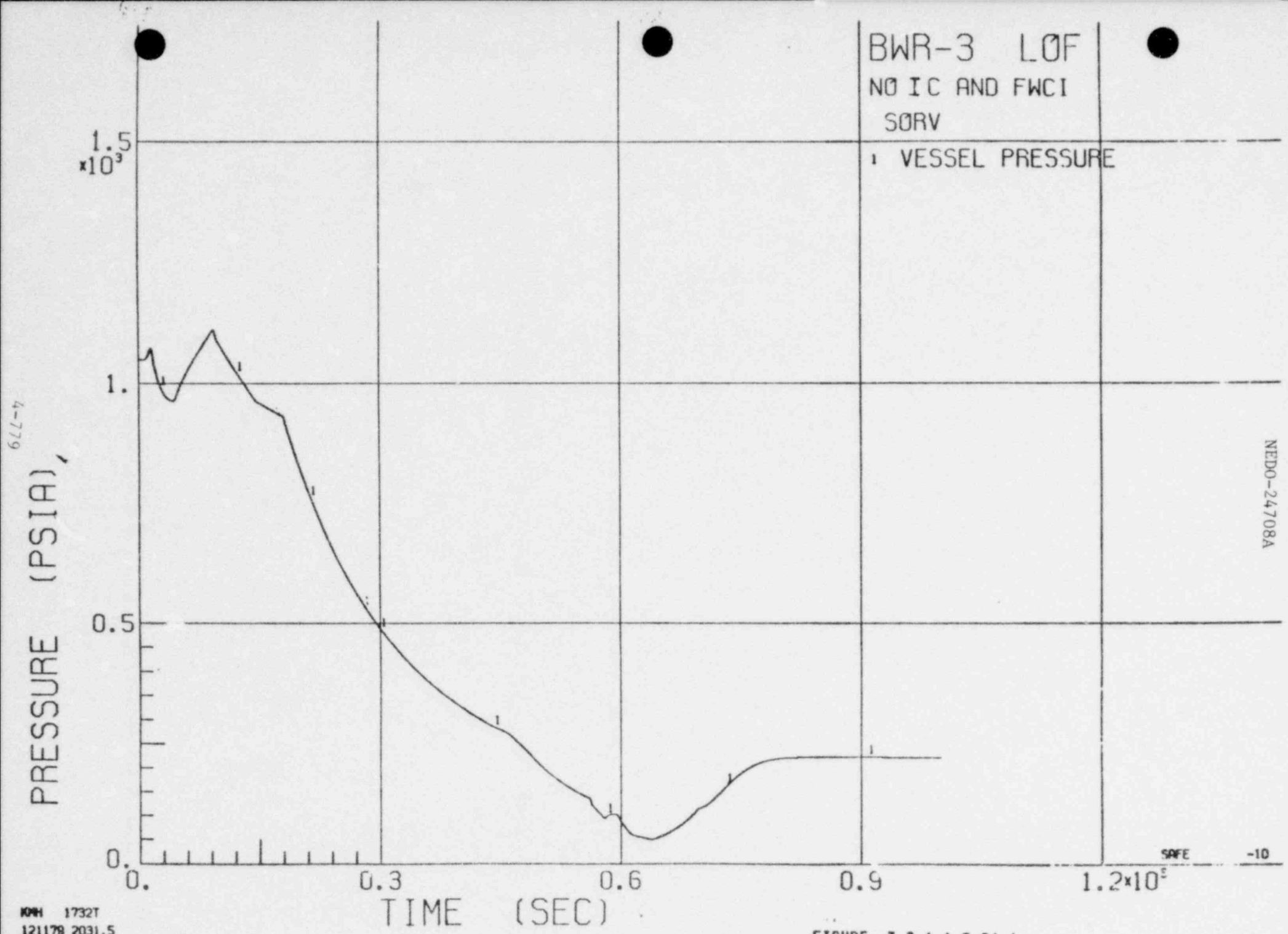
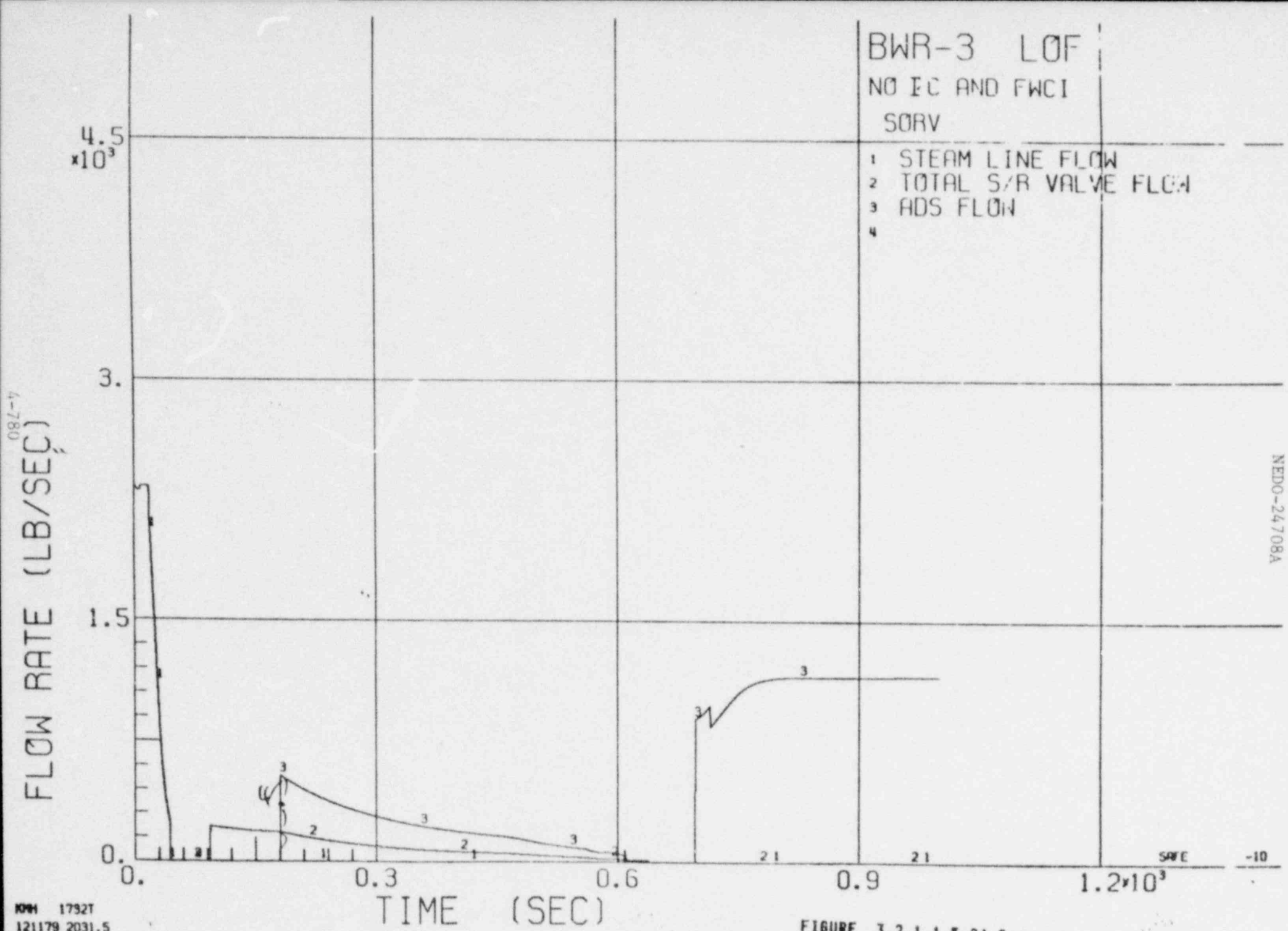


FIGURE 3.2.1.1.3-24.1



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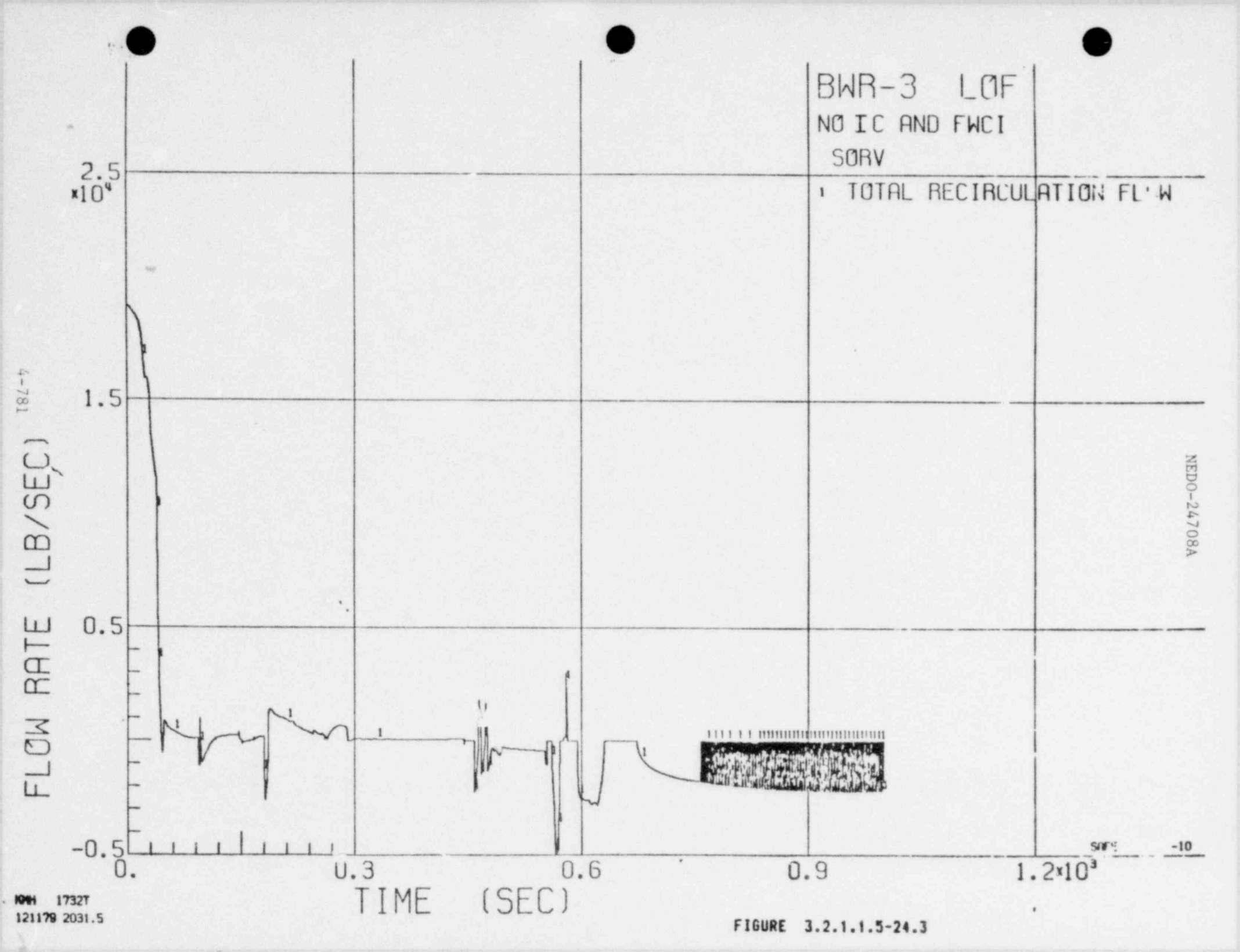
KMH 17927
121179 2031.5

FIGURE 3.2.1.1.5-24.2



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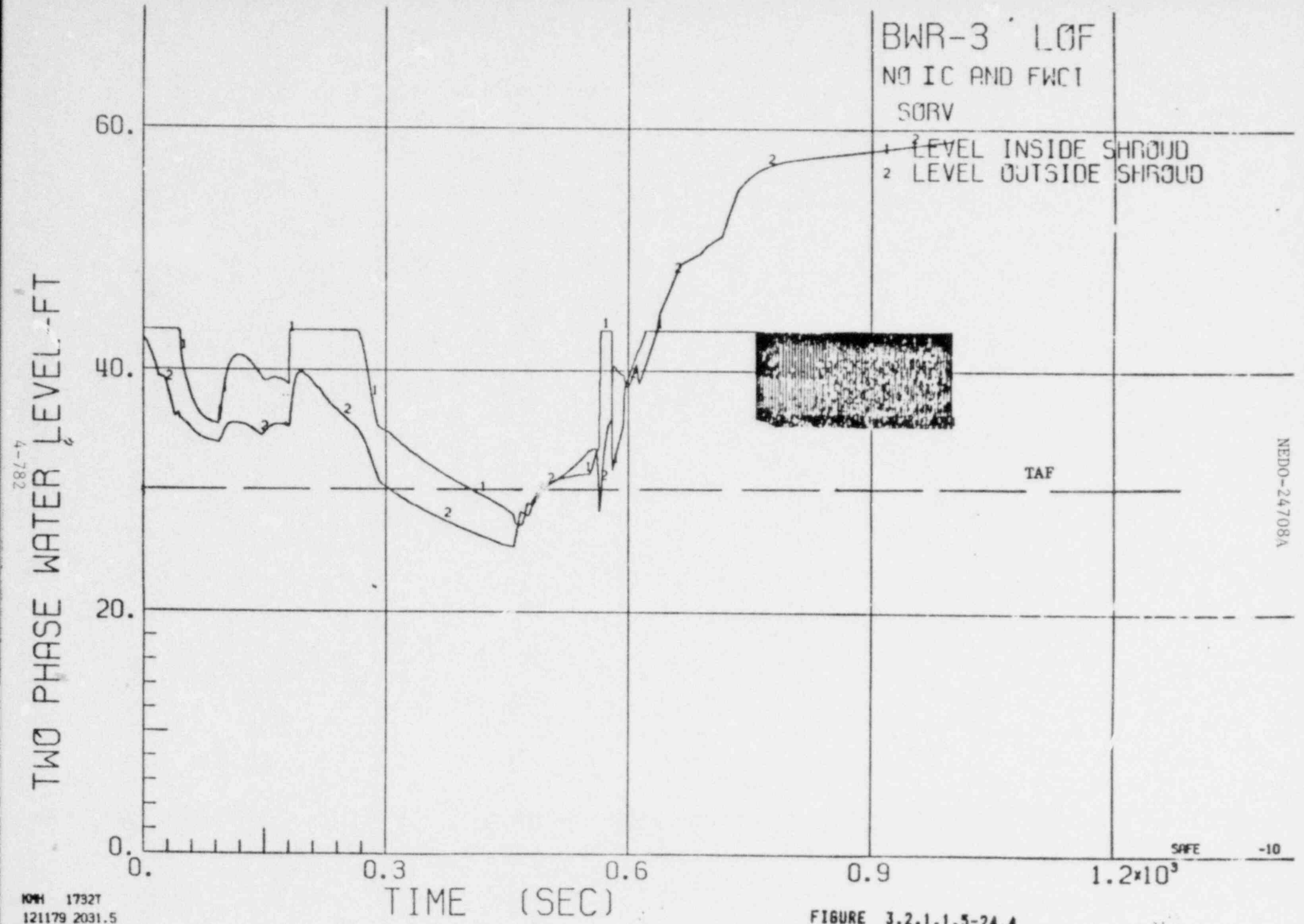
121179 2031.5

FIGURE 3.2.1.1.5-24.3



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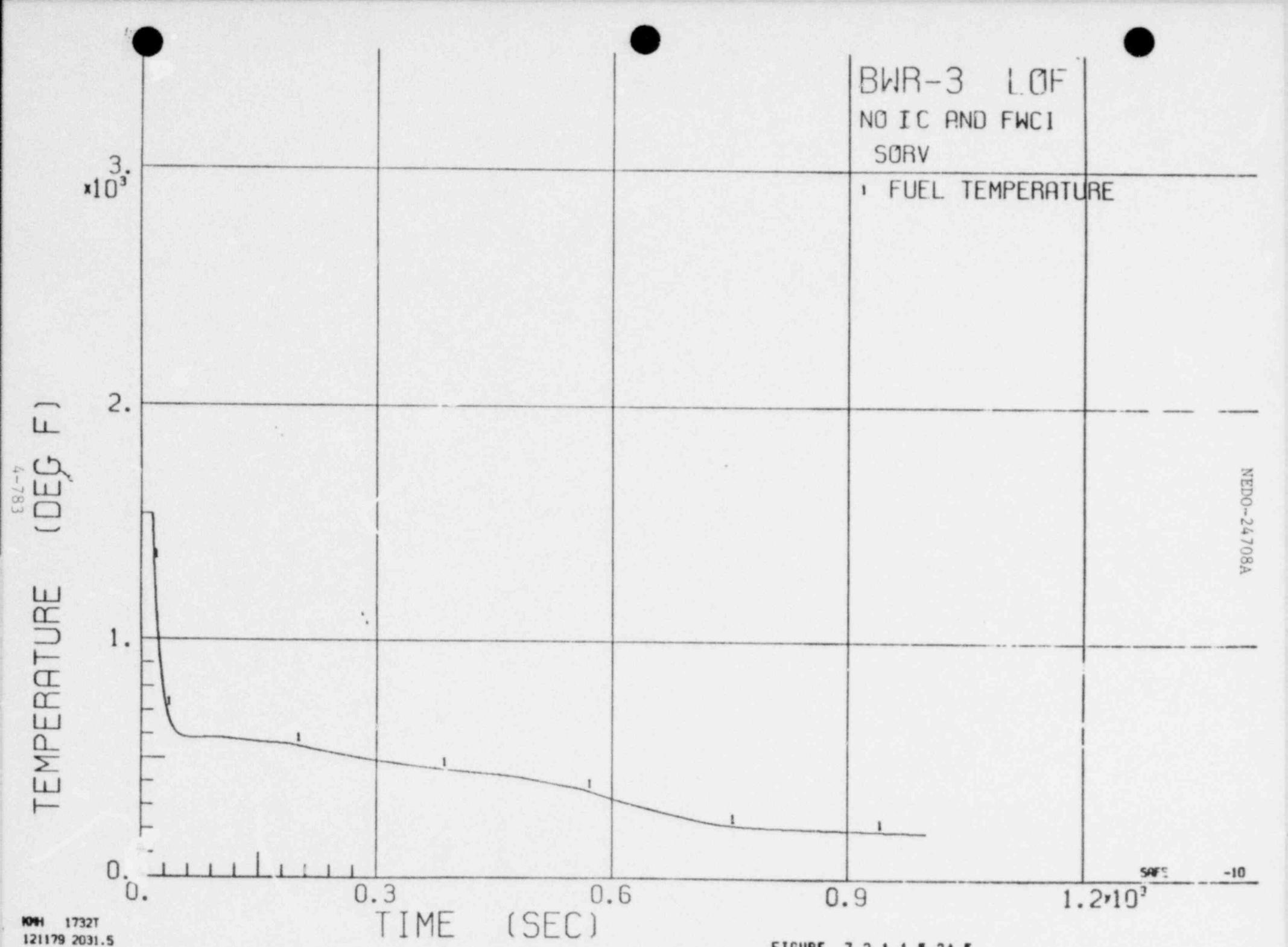
121179 2031.5

FIGURE 3.2.1.1.5-24.4



KMH 1732T
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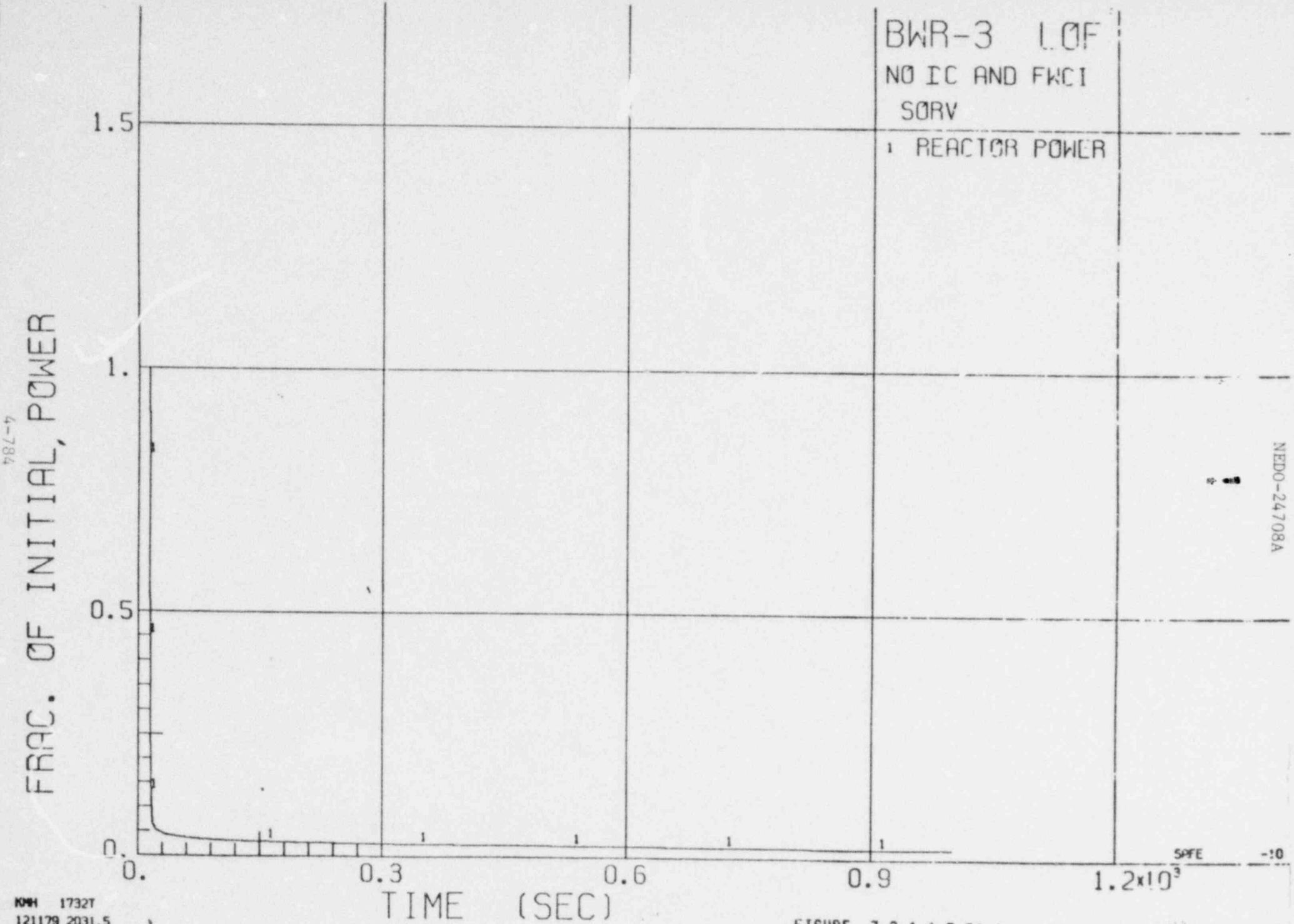
FIGURE 3.2.1.1.3-24.5



KMH 17327
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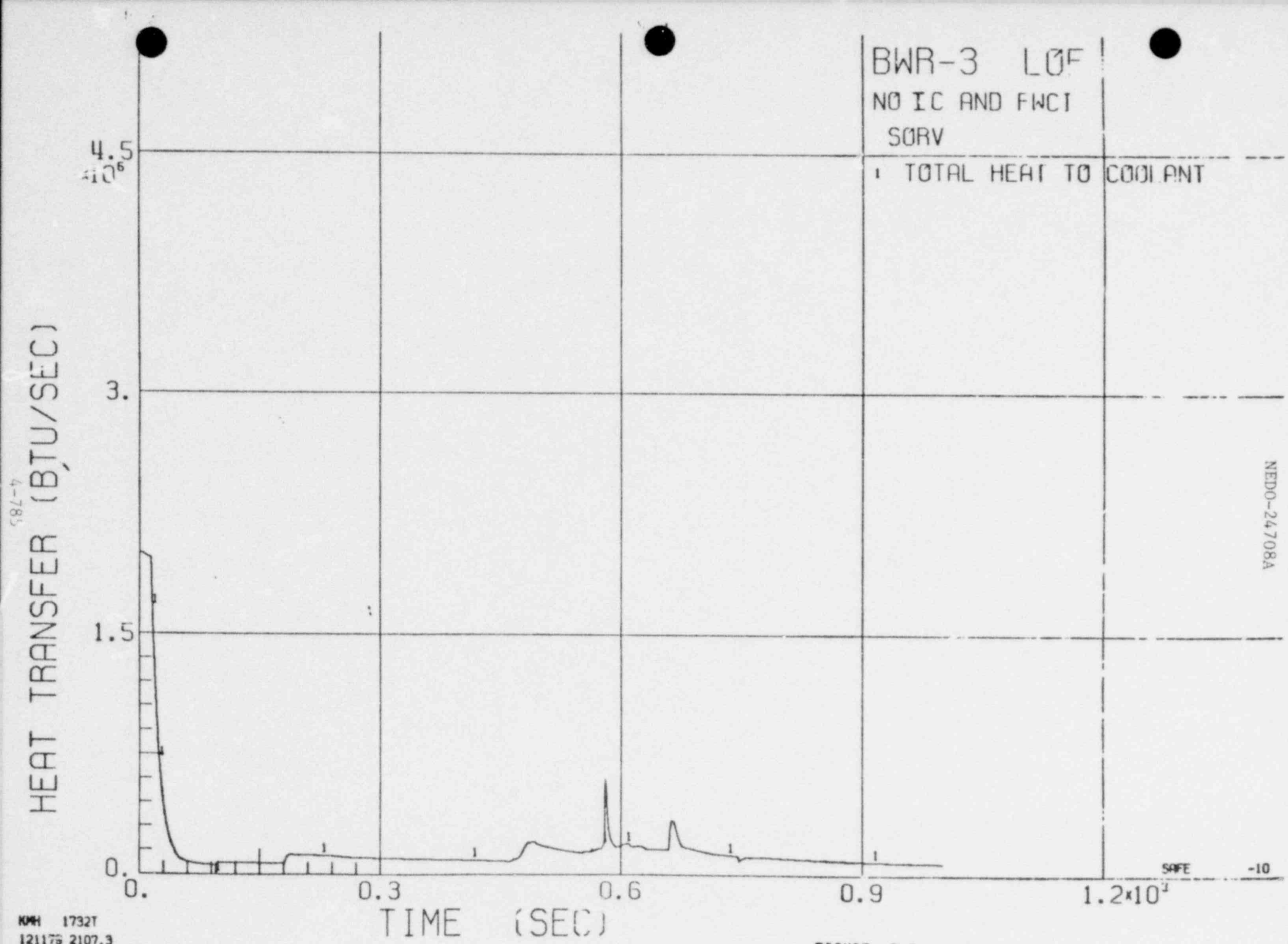
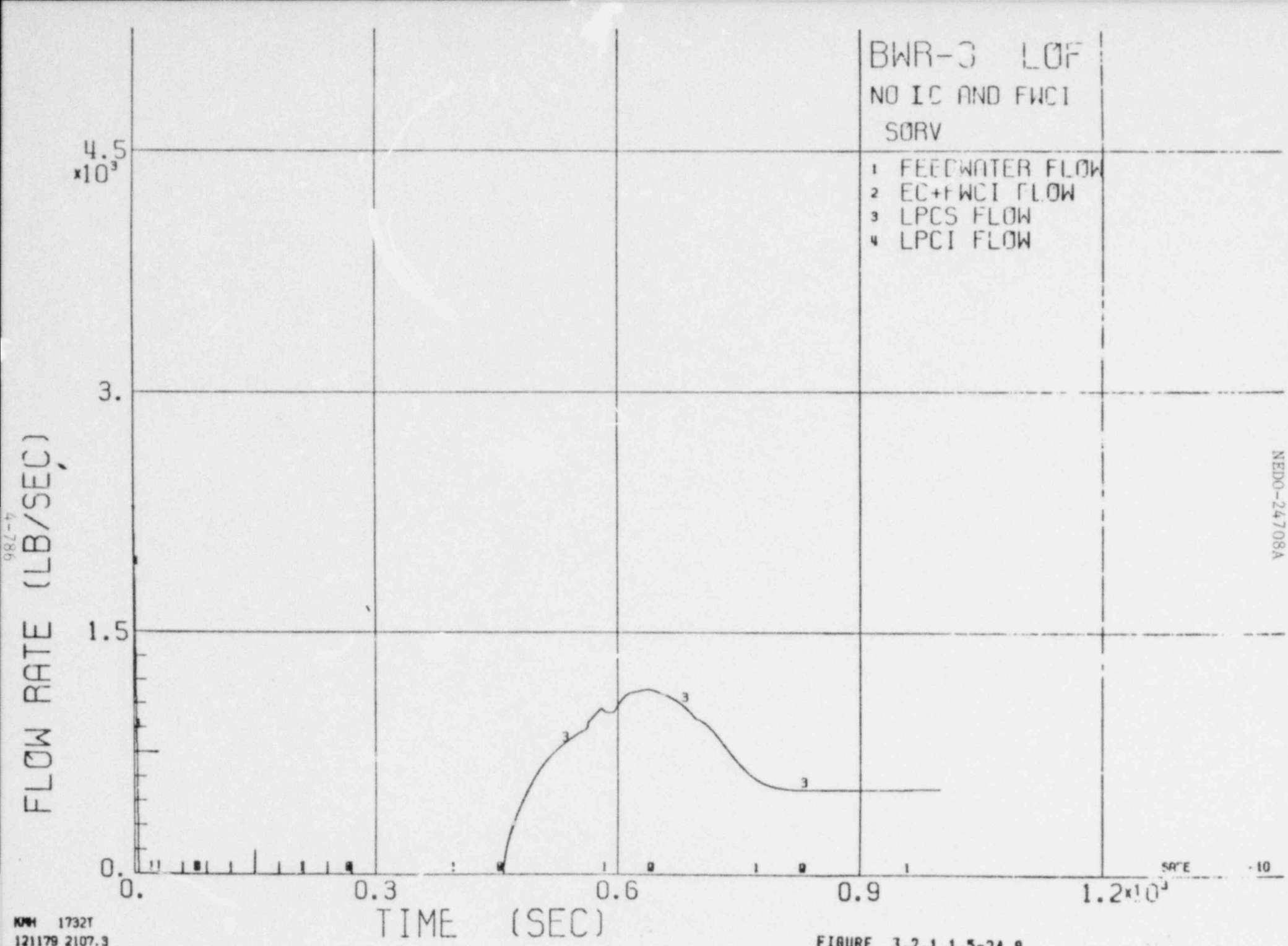
FIGURE 3.2.1.1.5-24.6



KMH 1732T
121176 2107.3

FIGURE 3.2.1.1.3-24.7



KMH 1732T
121179 2107.3

FIGURE 3.2.1.1.5-24.8

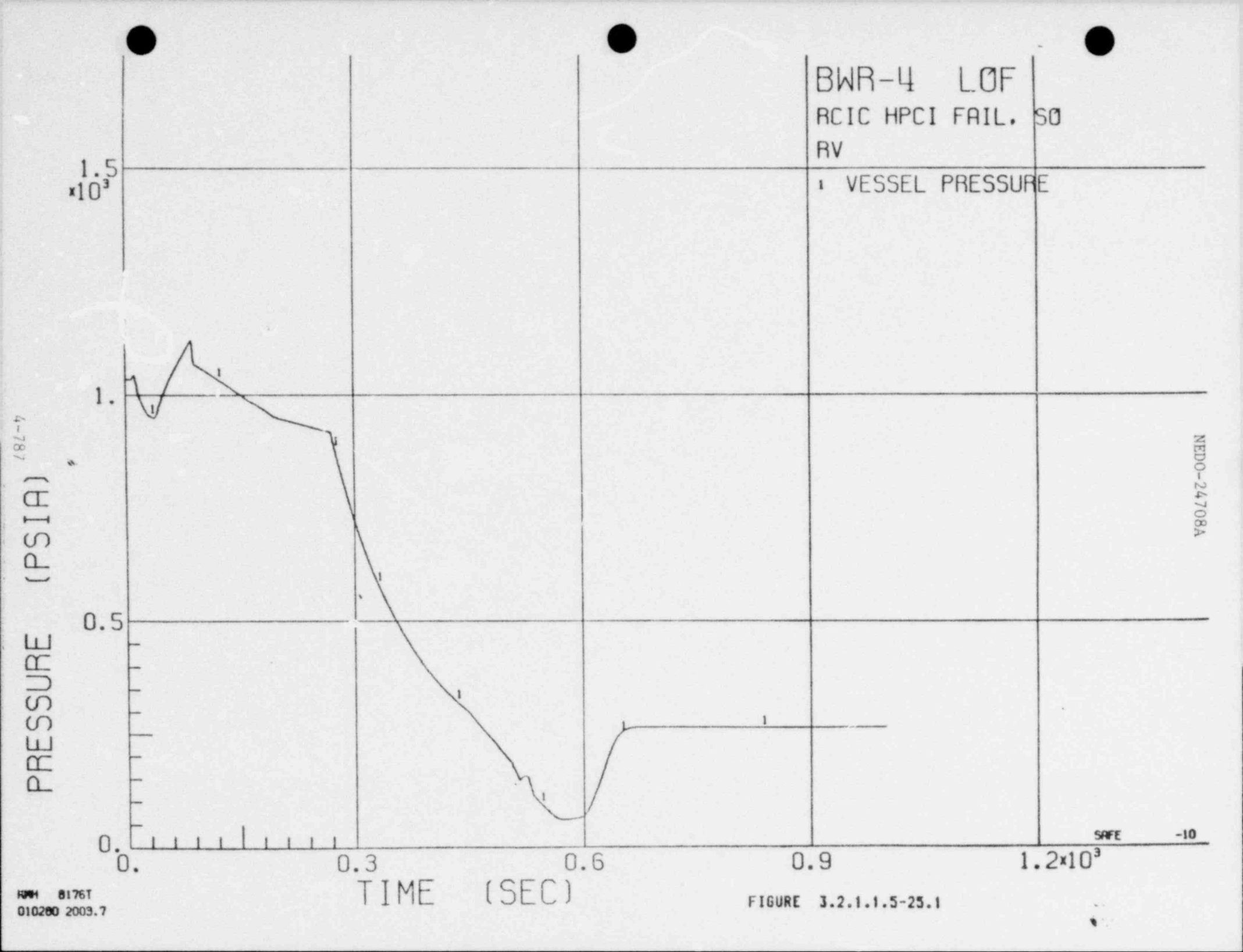


FIGURE 3.2.1.1.5-25.1

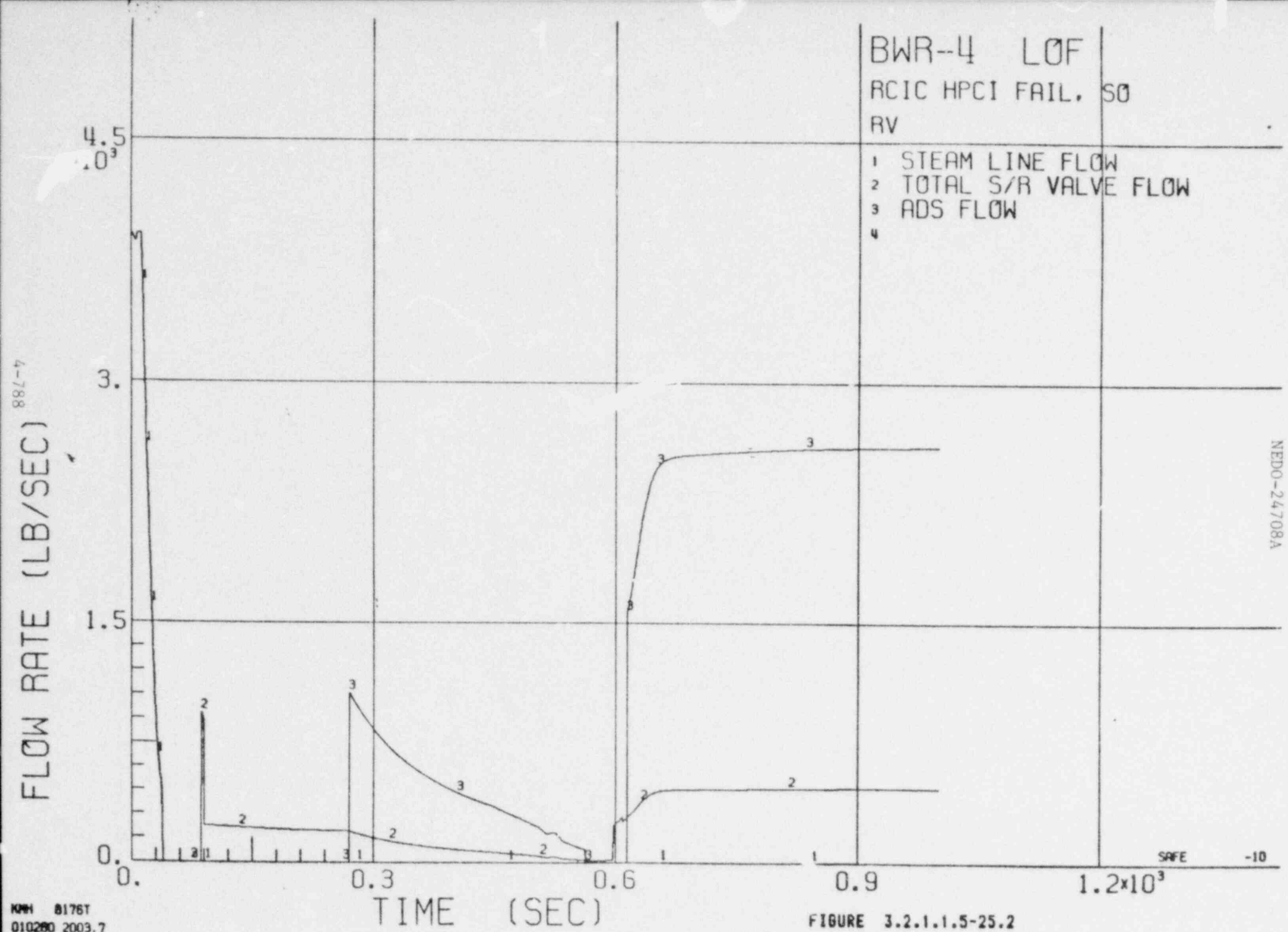


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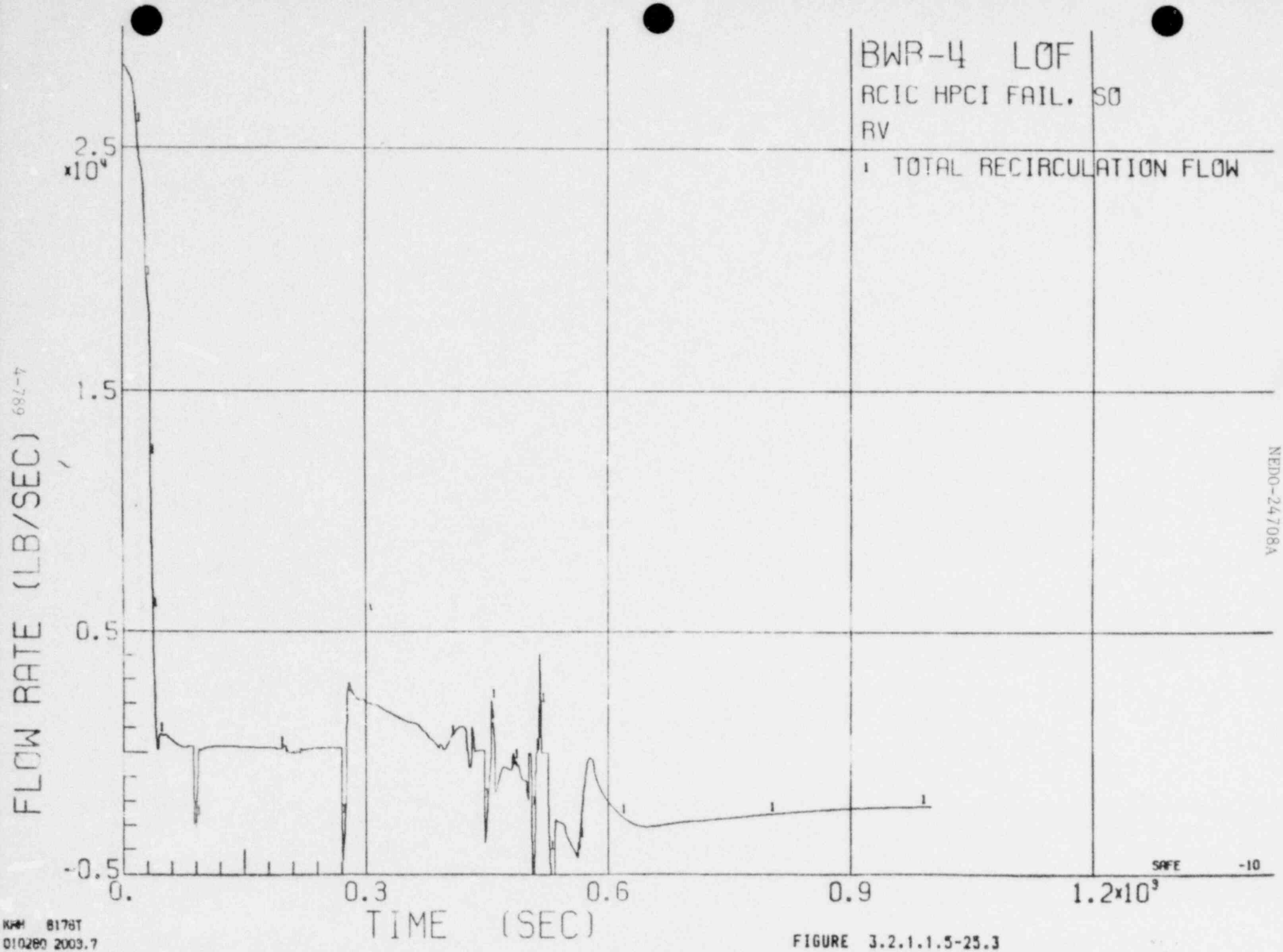
FIGURE 3.2.1.1.5-25.2



KAH 8178T
010280 2003.7

FIGURE 3.2.1.1.5-25.3

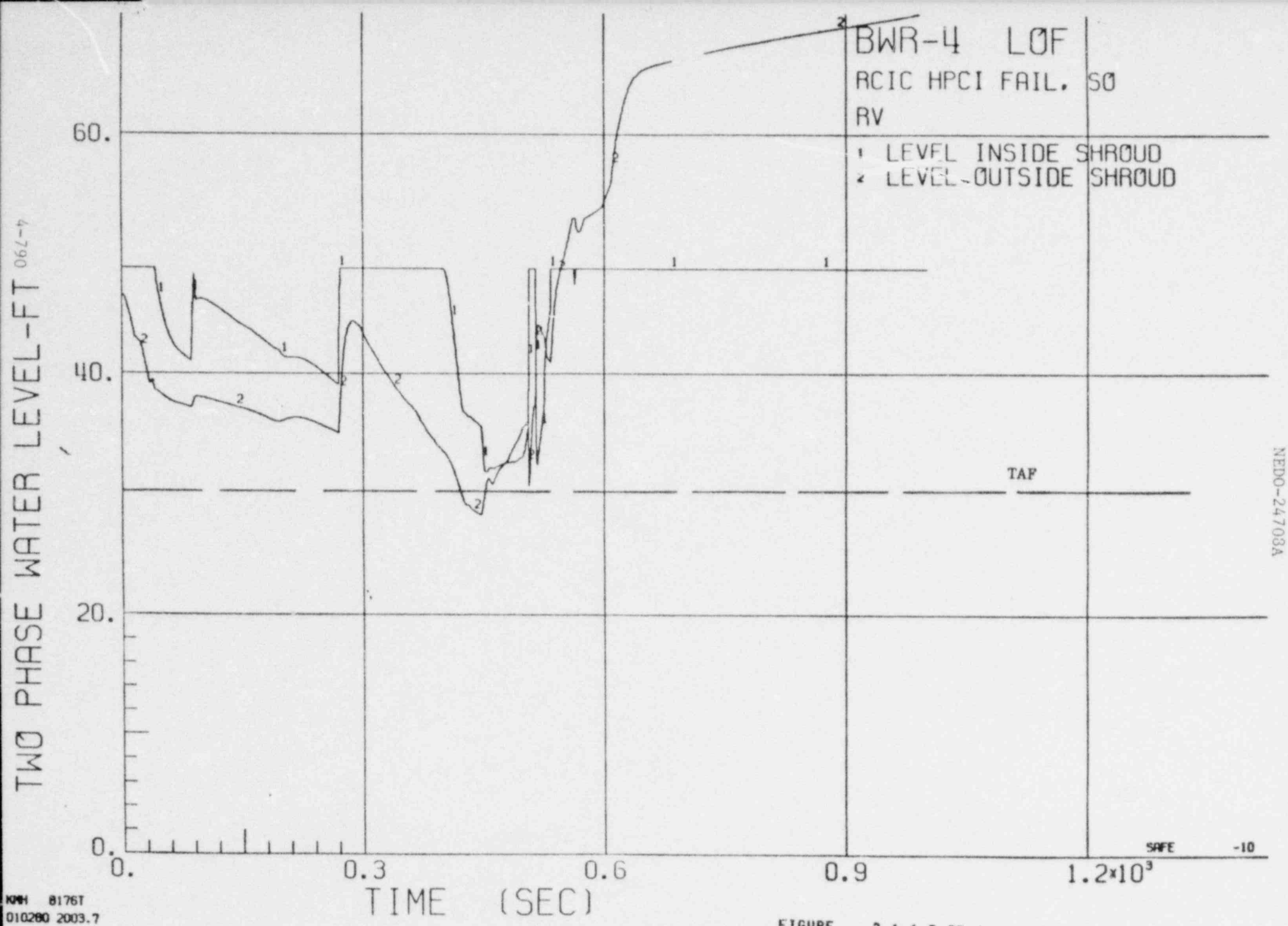
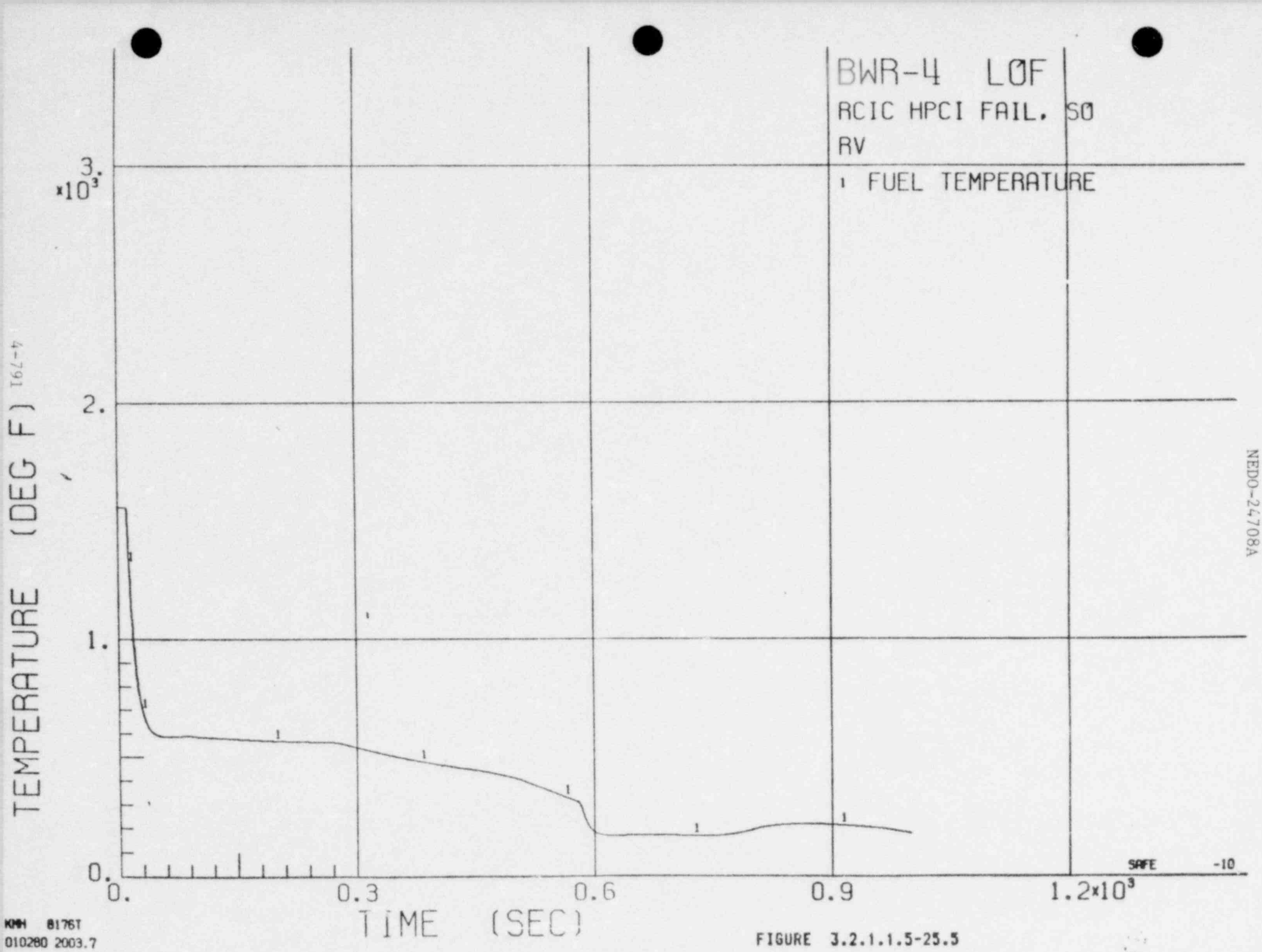
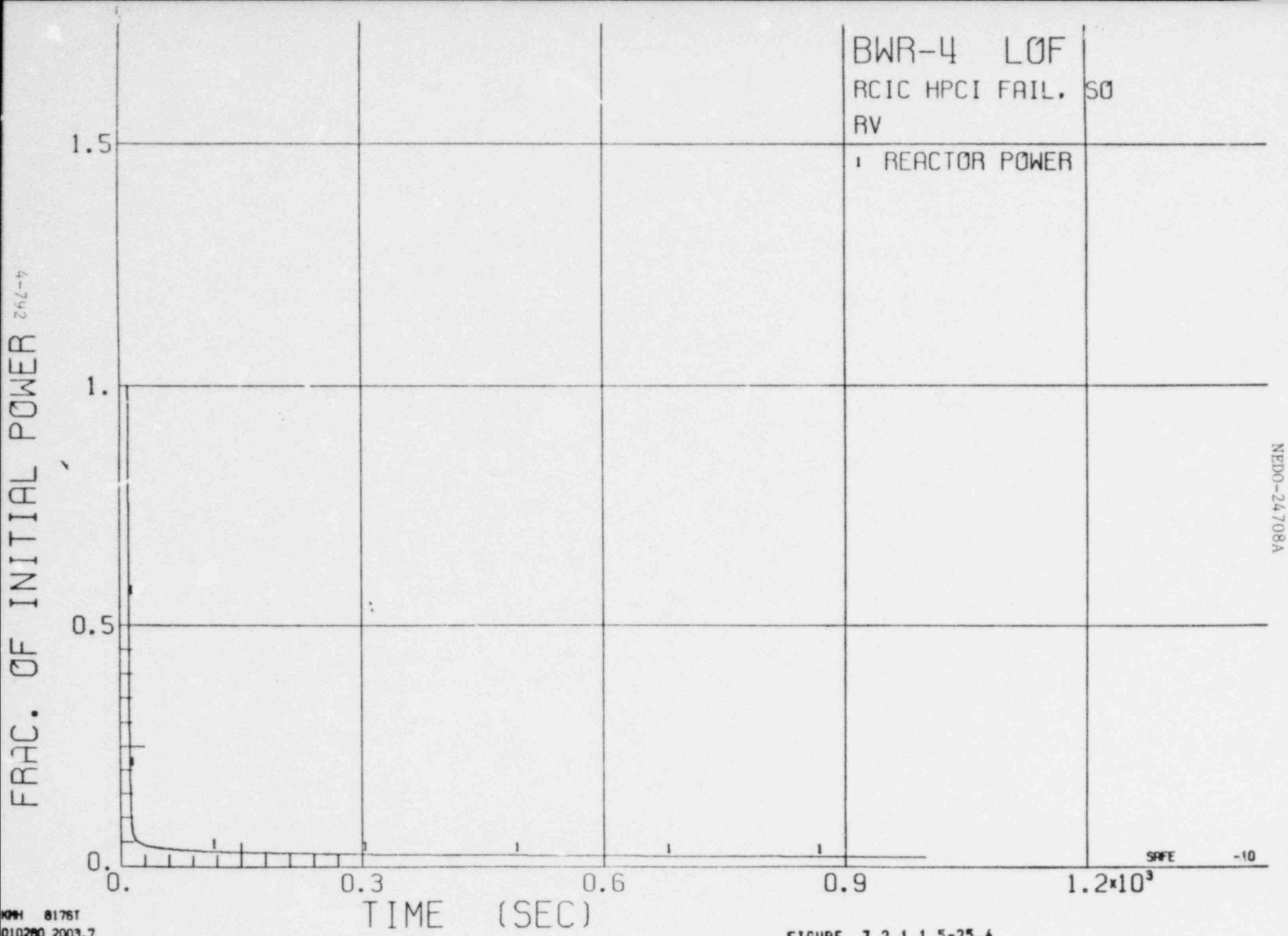


FIGURE 2.1.1.5-25.4



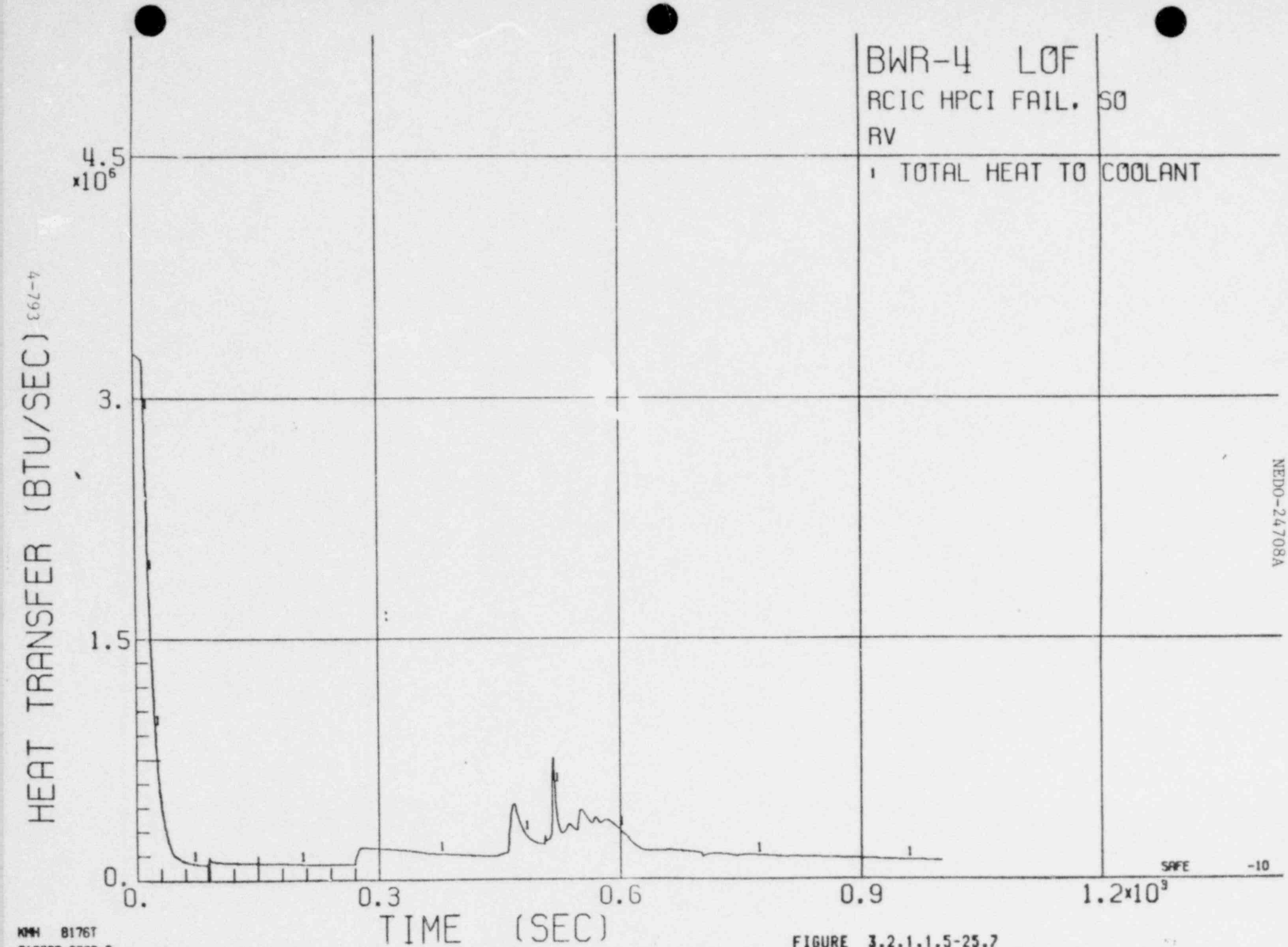
KMH 8176T
010280 2003.7

FIGURE 3.2.1.1.5-25.5



KMH 8176T
010280 2003.7

FIGURE 3.2.1.1.5-25.6



KMH 8176T
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FIGURE 3.2.1.1.5-25.7

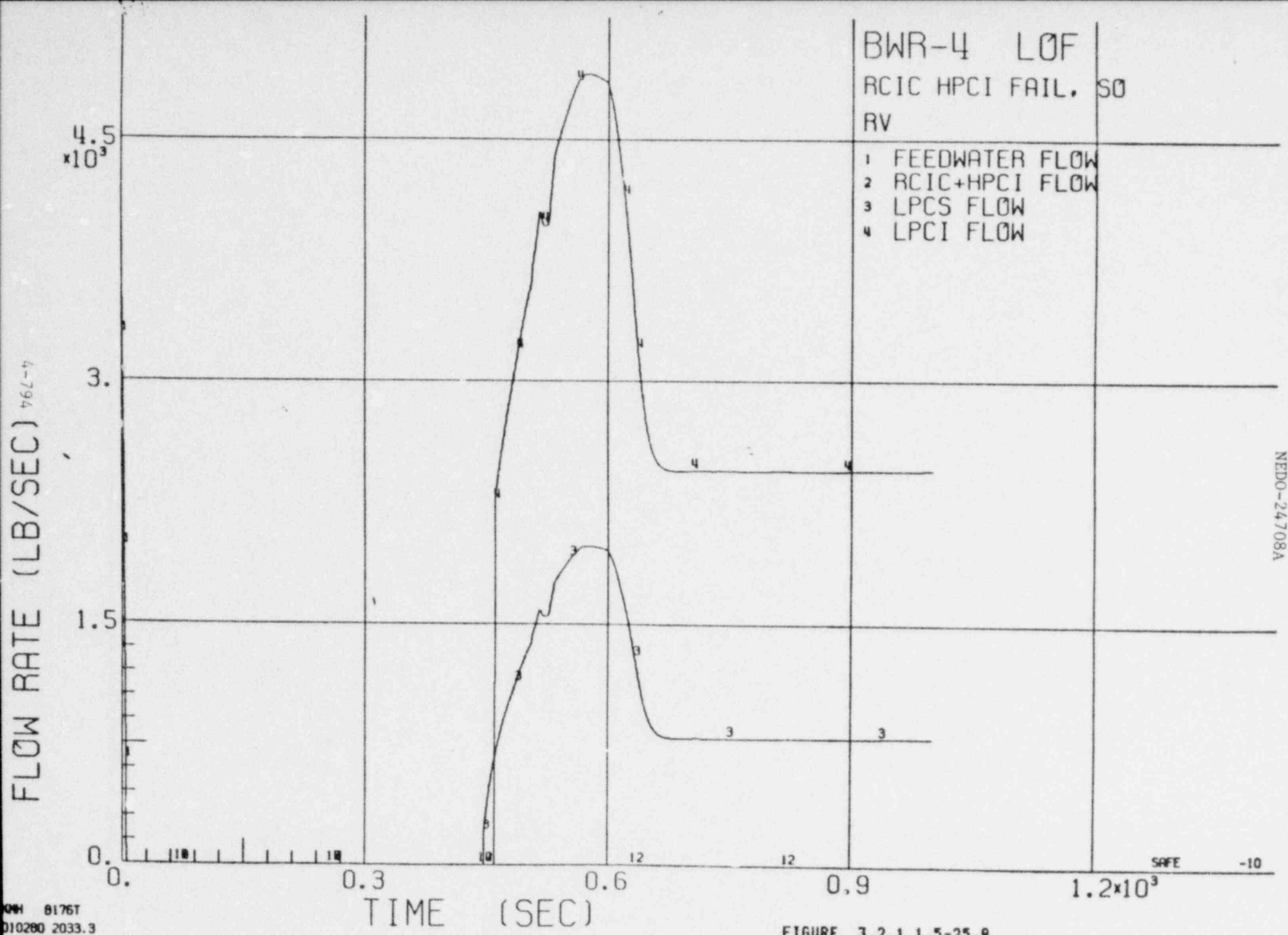

FIGURE 3.2.1.1.5-25.8

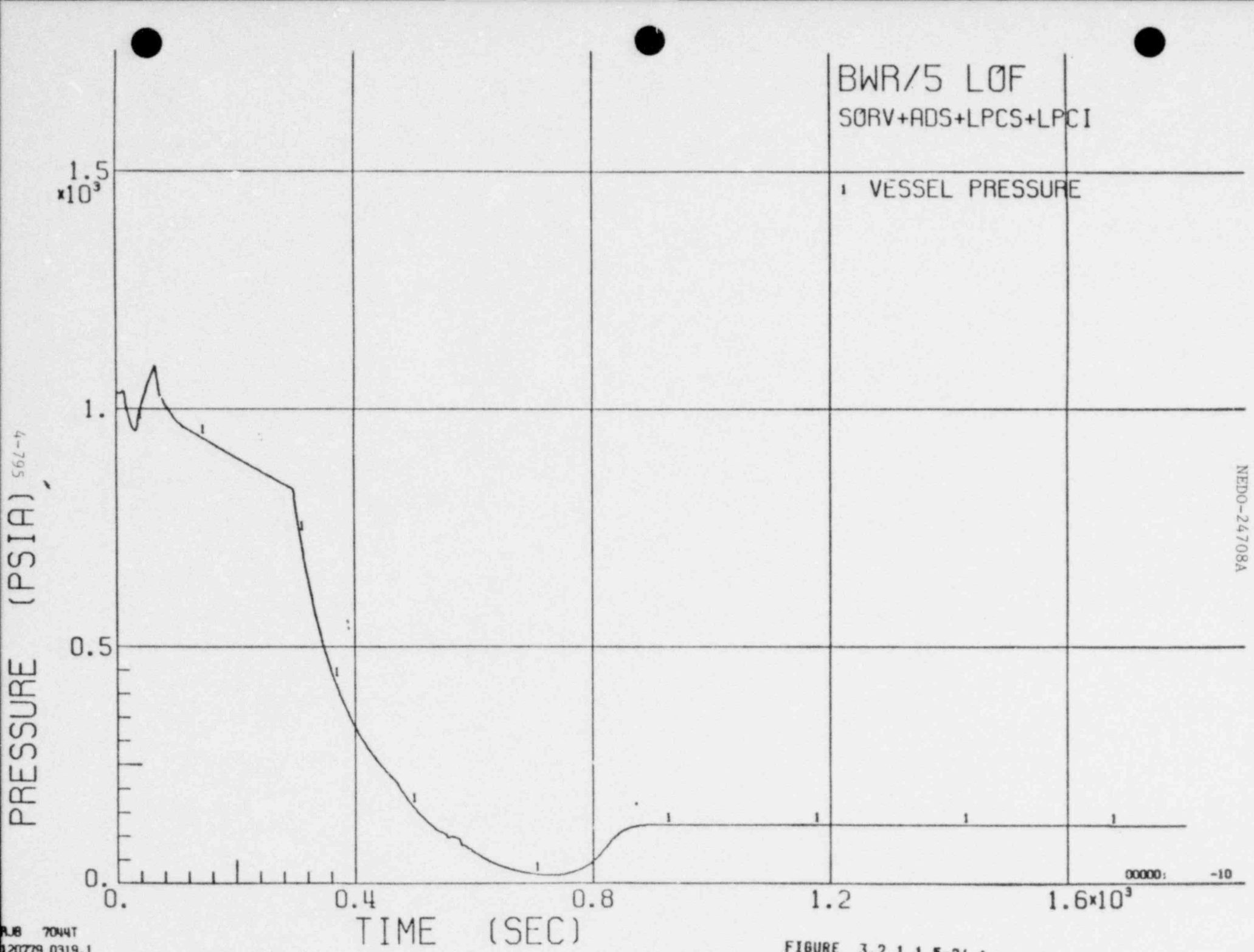

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FIGURE 3.2.1.1.5-26.1

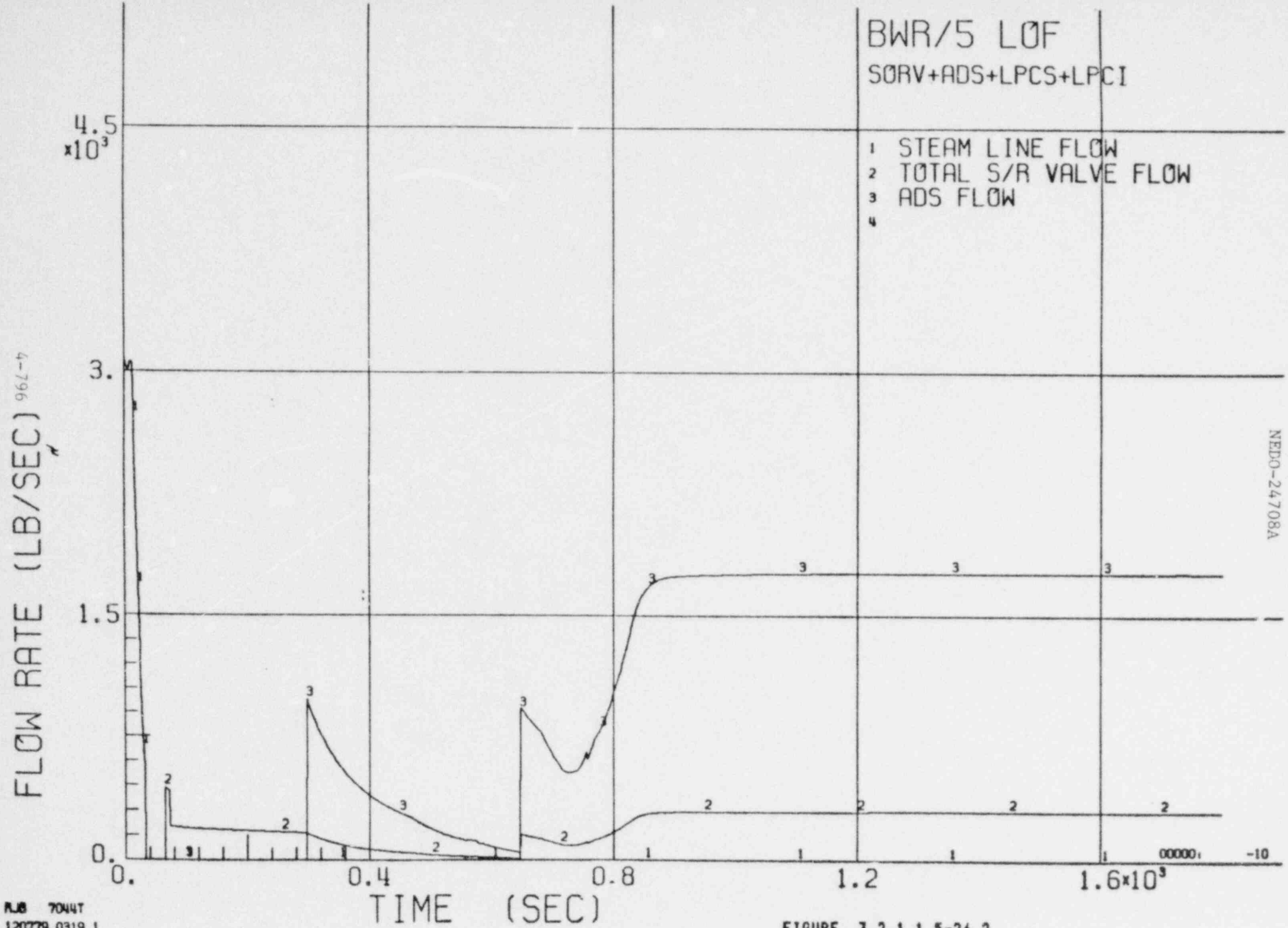
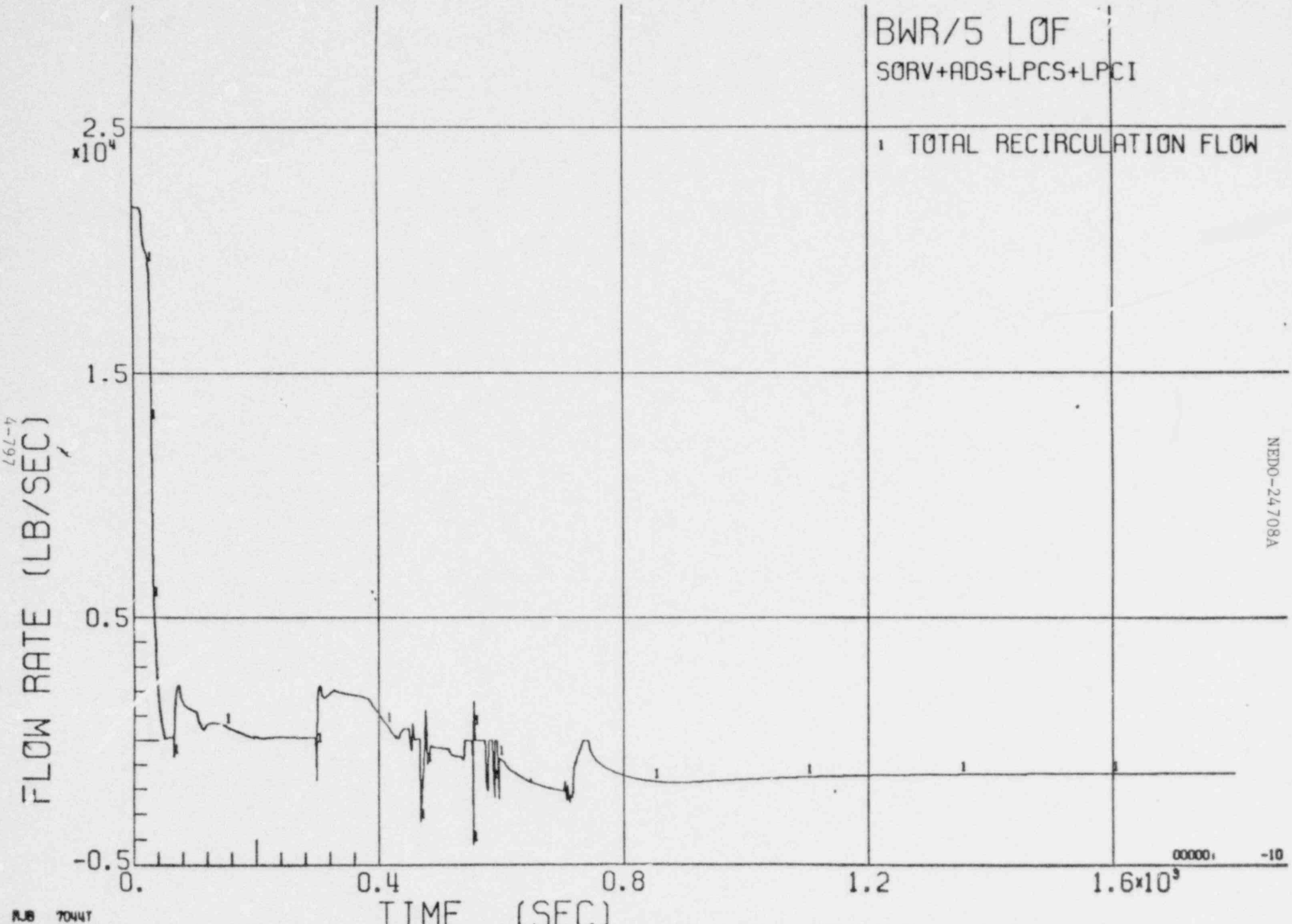


FIGURE 3.2.1.1.5-26.2



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120779 0319.1

FIGURE 3.2.1.1.5-26.3

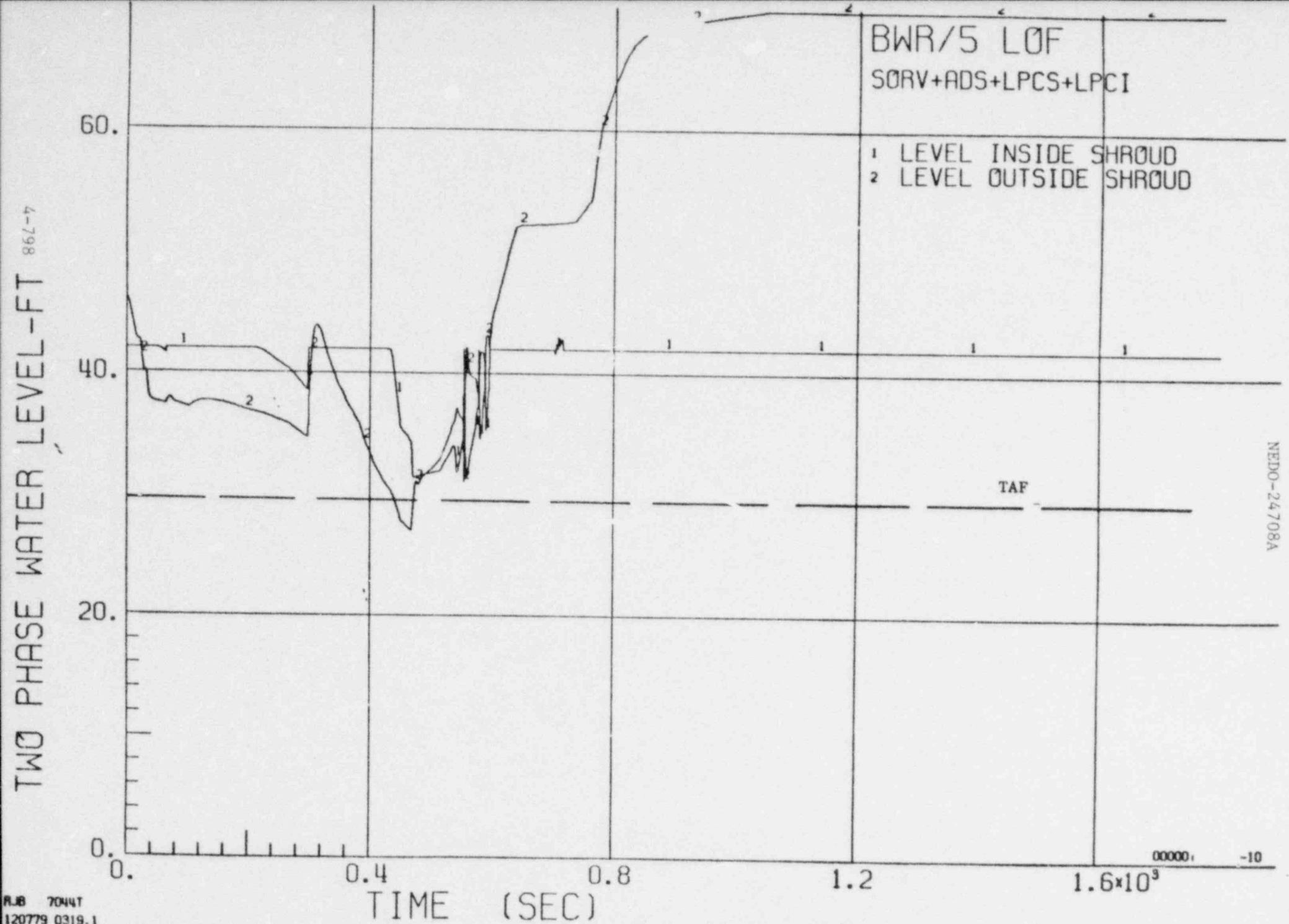

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FIGURE 3.2.1.1.5-26.4

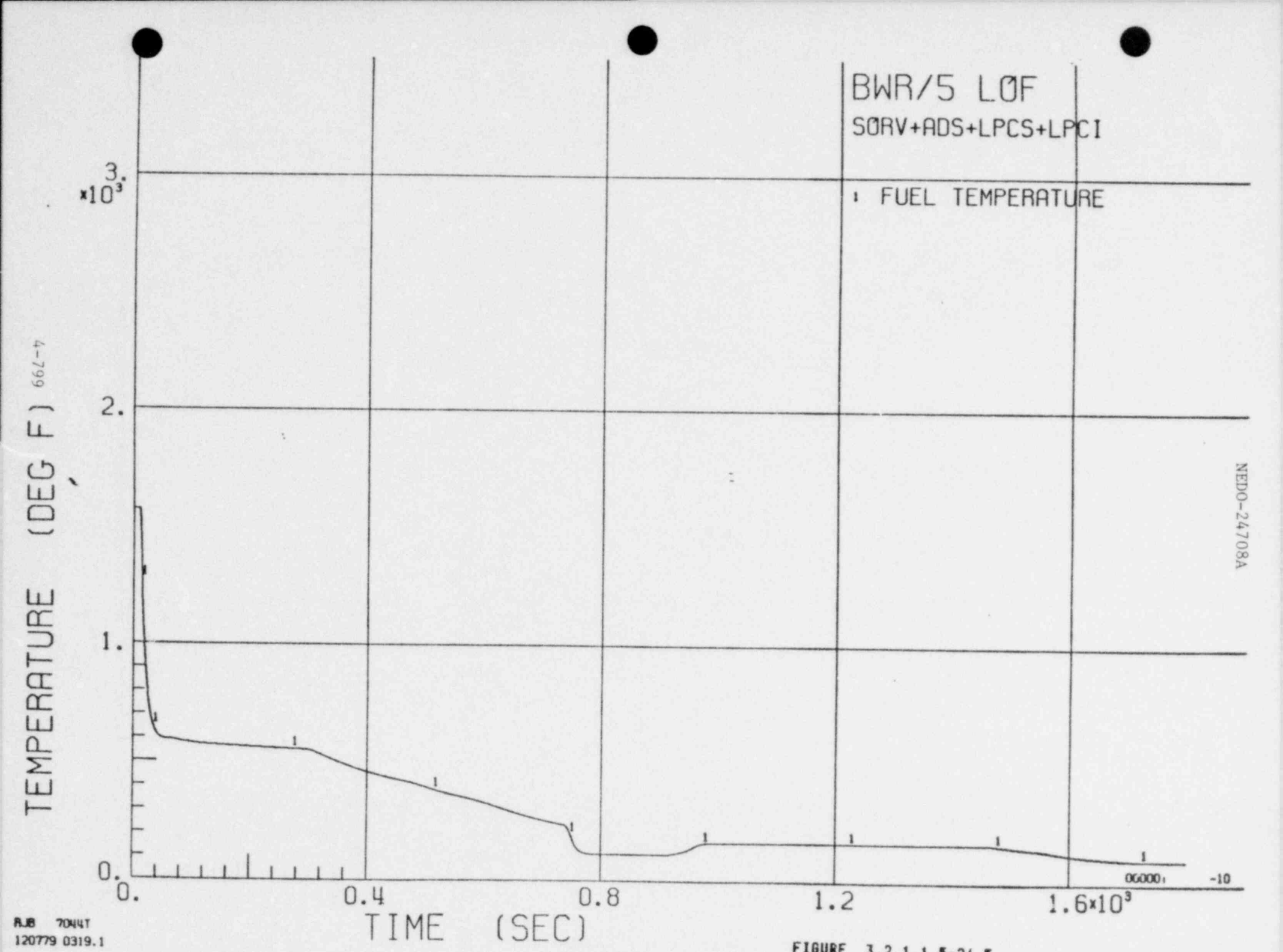

FIGURE 3.2.1.1.5-26.5

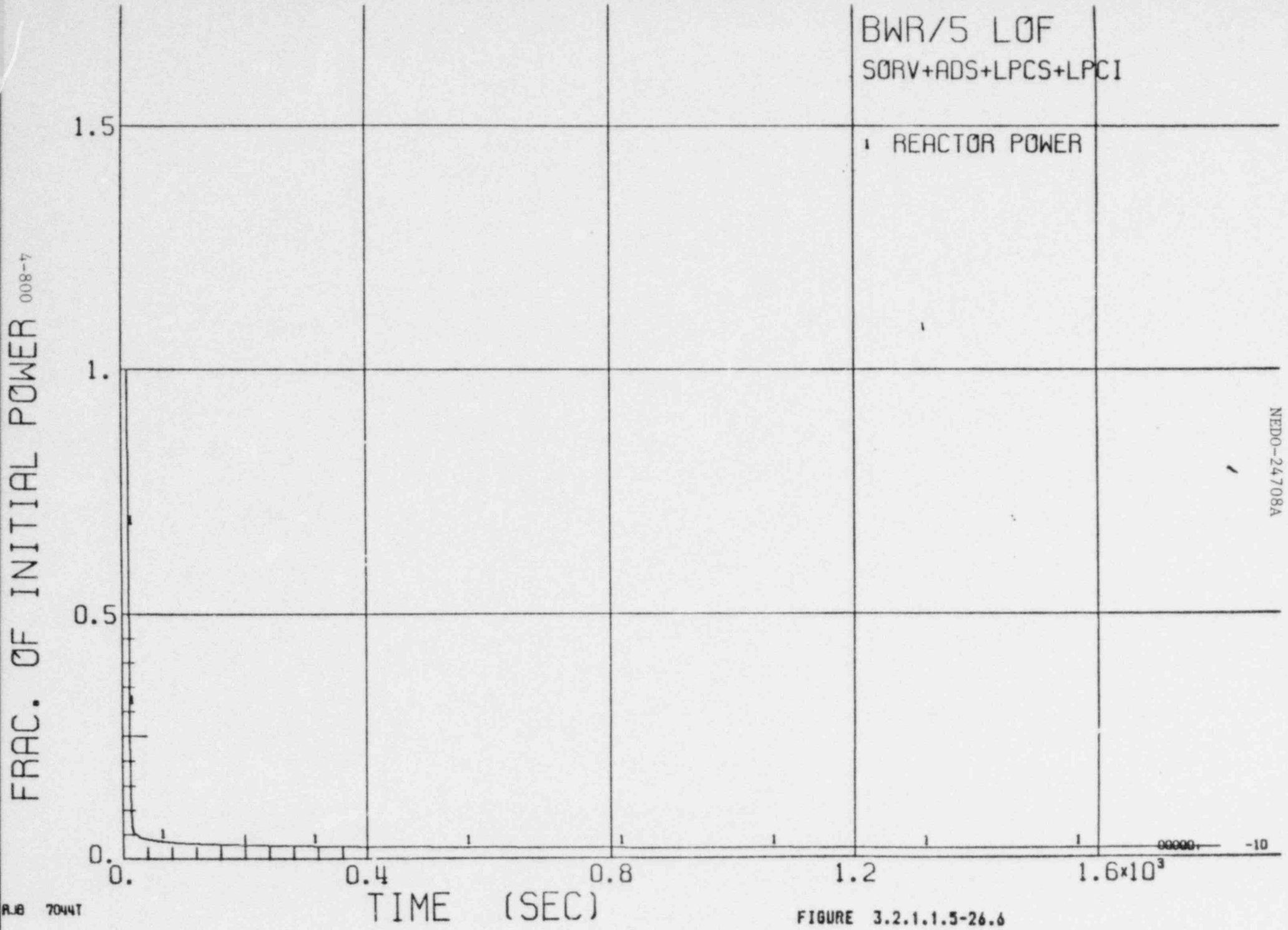

FIGURE 3.2.1.1.5-26.6

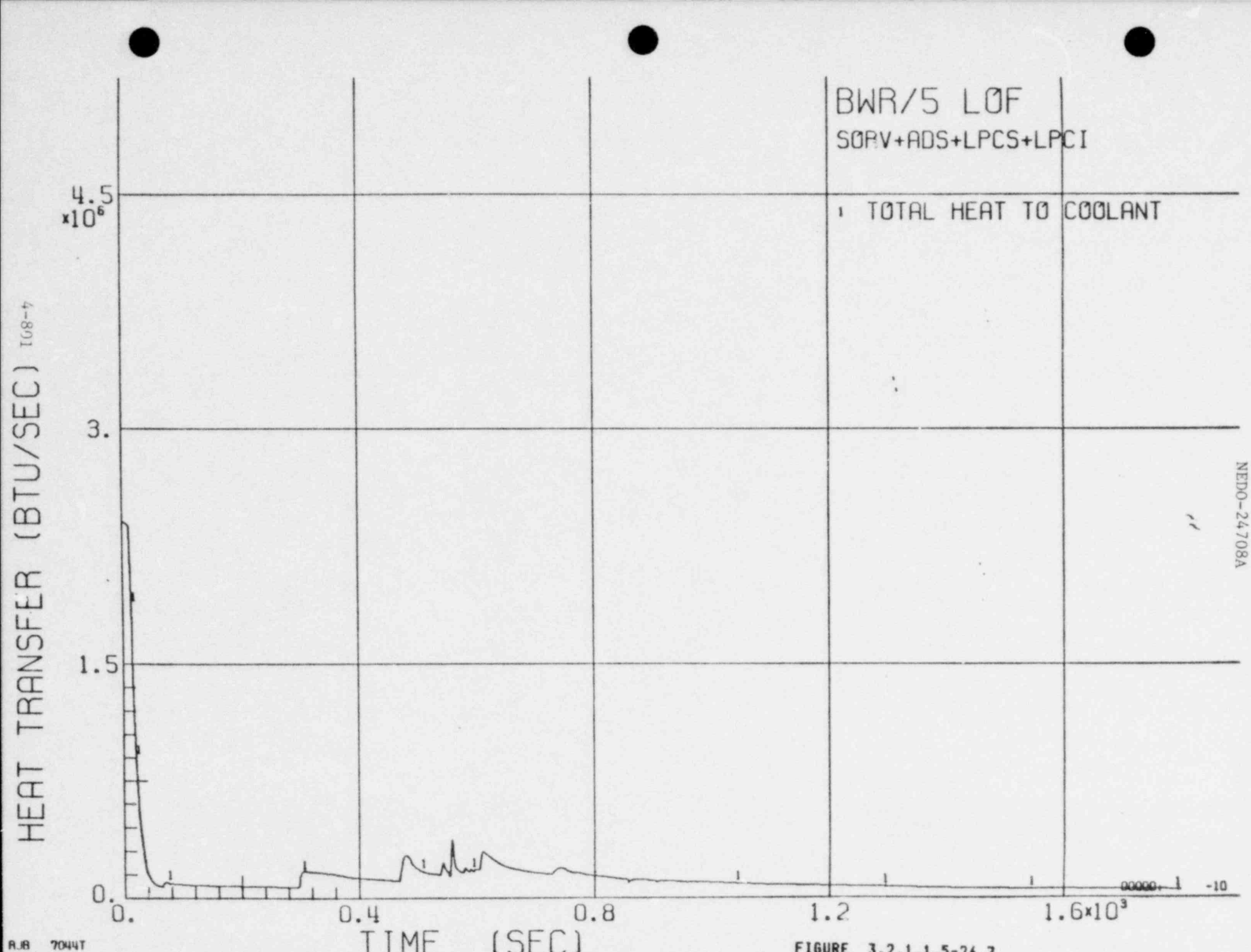

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FIGURE 3.2.1.1.5-26.7

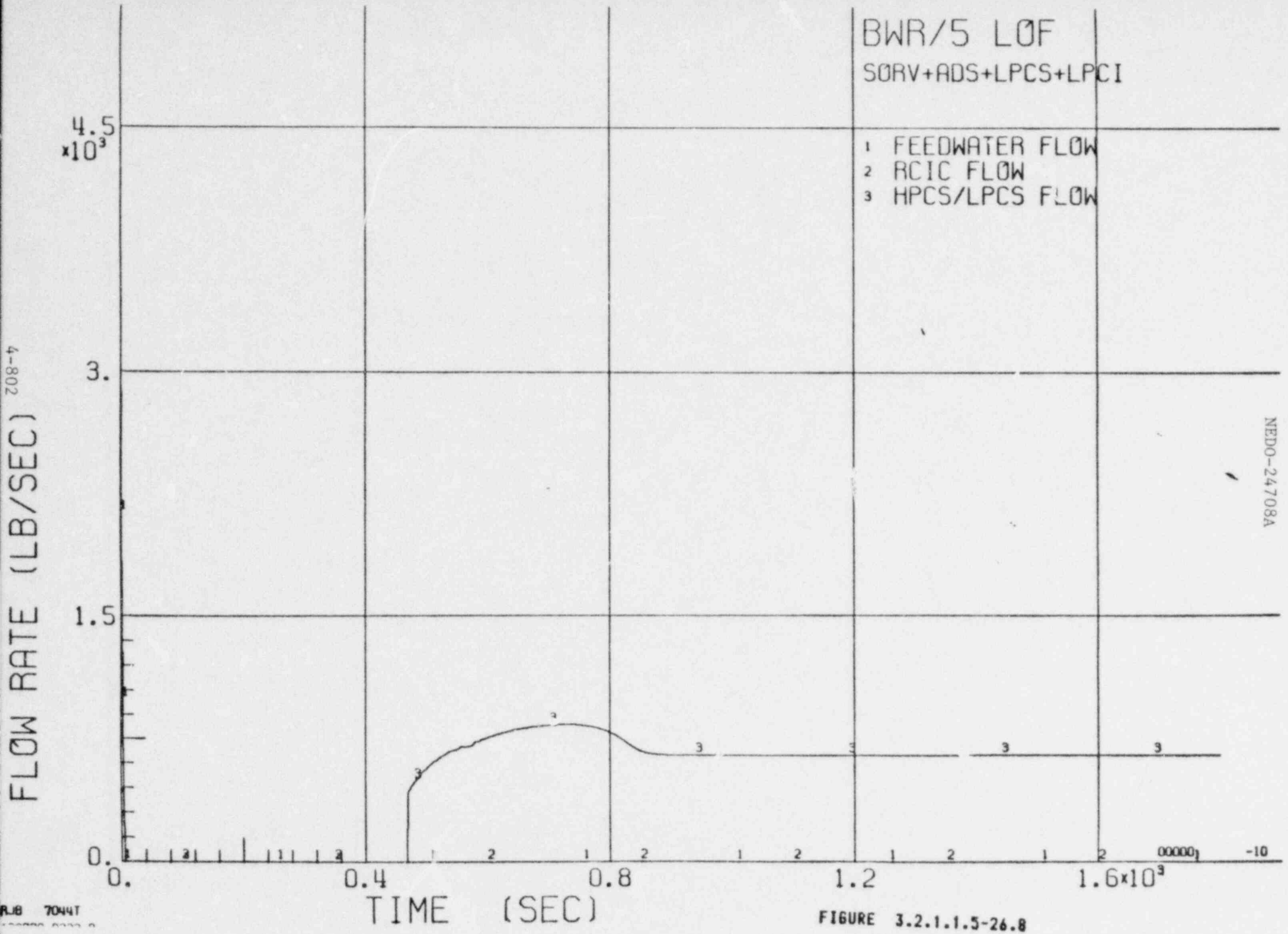

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FIGURE 3.2.1.1.5-26.8

Table 3.2.1.3-1

COMPARISON OF INITIAL LOF TRANSIENT PREDICTED BY REDY AND SAFE

Parameter	REDY	SAFE	Comments
Feedwater 5 seconds coast down	Yes	Yes	
Core inlet enthalpy - increase	Yes	Yes	
Recirc. runback	Yes	No	
Reactivity feedback	Yes, thermal power decrease	No, constant thermal power until scram	SAFE has no neutronics model
Mainsteam flow	Dynamically calculated	Nearly constant until MSIV's close	SAFE uses simple main steam flow model
Dome Pressure	Decreasing, due to thermal power decrease	Increasing, due to constant thermal power and increasing inlet enthalpy	
L3 Scram	Yes, scram at lower power	Yes, scram at initial power	
Decay Heat	78 ANS Standard	78 ANS Standard	
L2 Trip	Yes	Yes	
MSIV 5 Seconds closure	Yes	Yes	
RPT	Yes	Yes	
Natural Recirculation Model	Yes	Yes	

Table 3.2.1.3-2

SUMMARY OF LOF ANALYSIS FOR OFF-RATED REACTOR CONDITIONS

Point	% Thermal Power (NBR)/% Core Flow	Timing for Manual ADS at 5 ft above TAF (sec)	Minimum In-Shroud Level (ft)
O	104.2/100	234.0	30.6
A	79.2/64.9	673.0	32.0
B	57.0/37.7	1095.0	32.1
C	54.5/37.9	1121.0	32.6
D	44.0/38.5	1488.0	32.2
E	33.1/38.7	2083.0	32.4
F	21.9/38.1	3230.0	36.2

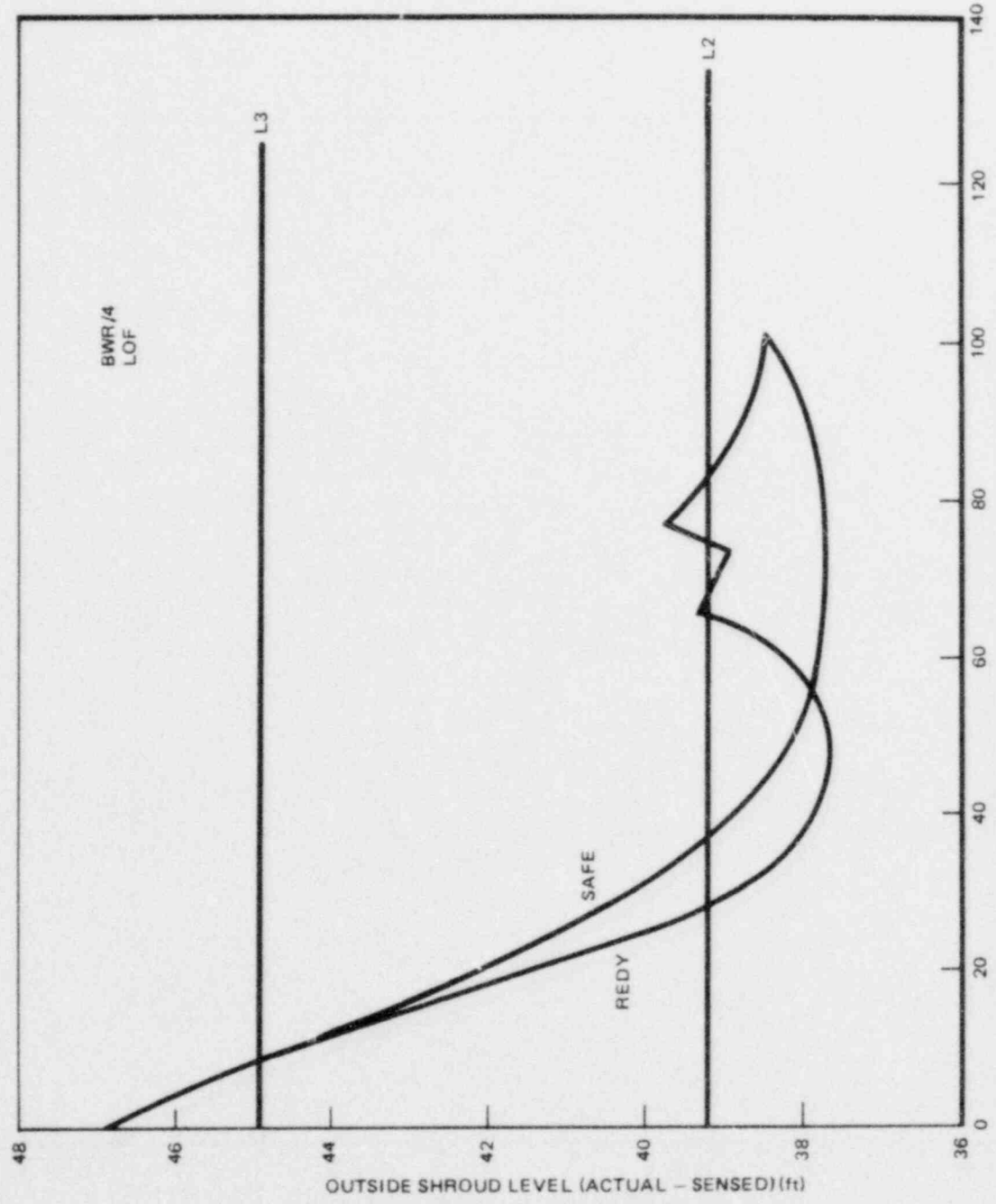

Figure 3.2.1.3.1-1. Comparison of LOF Initial Transient Predicted by REDY

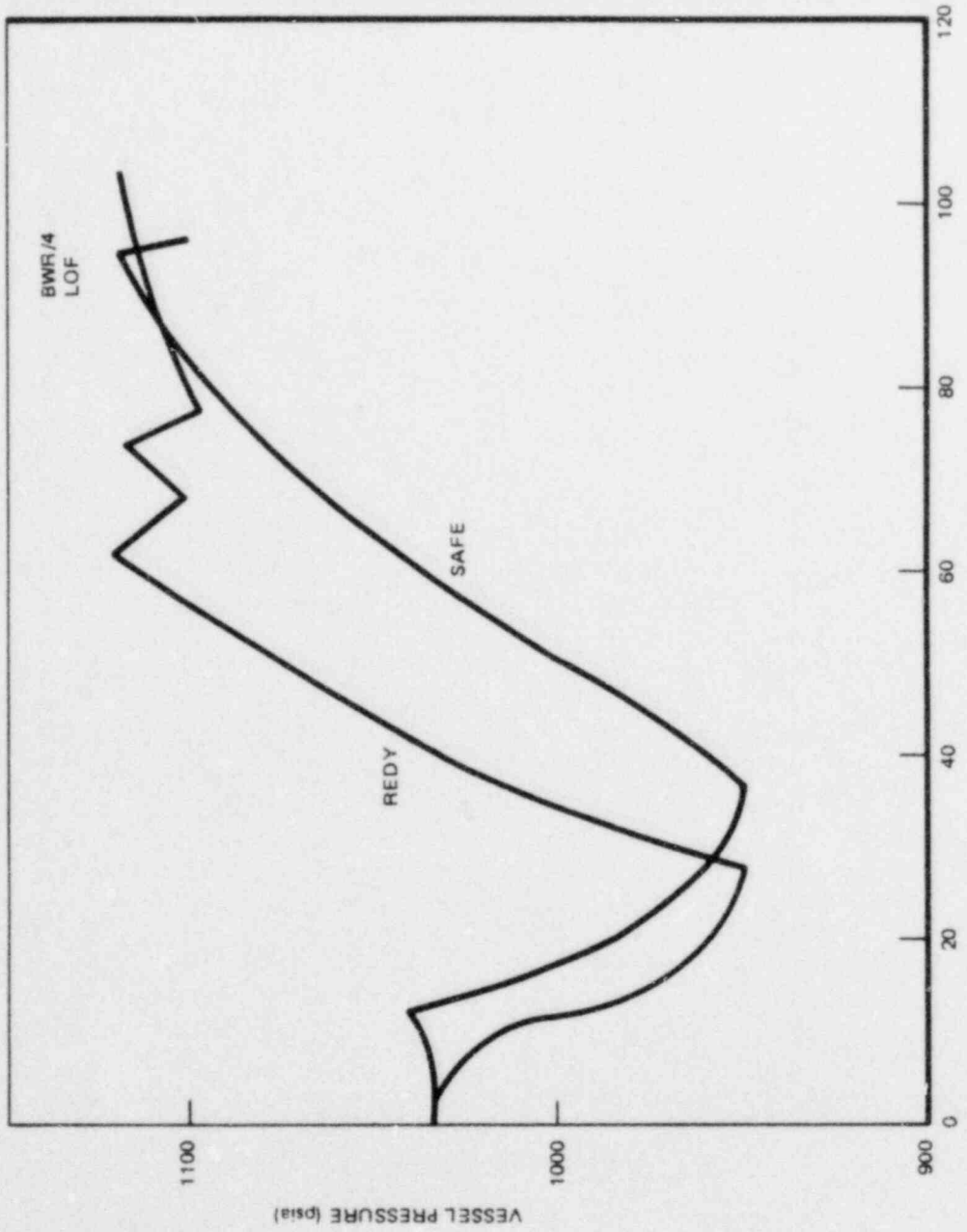

Figure 3.2.1.3.1-2. Comparison of LOF Initial Transient Predicted by REDY and SAFE

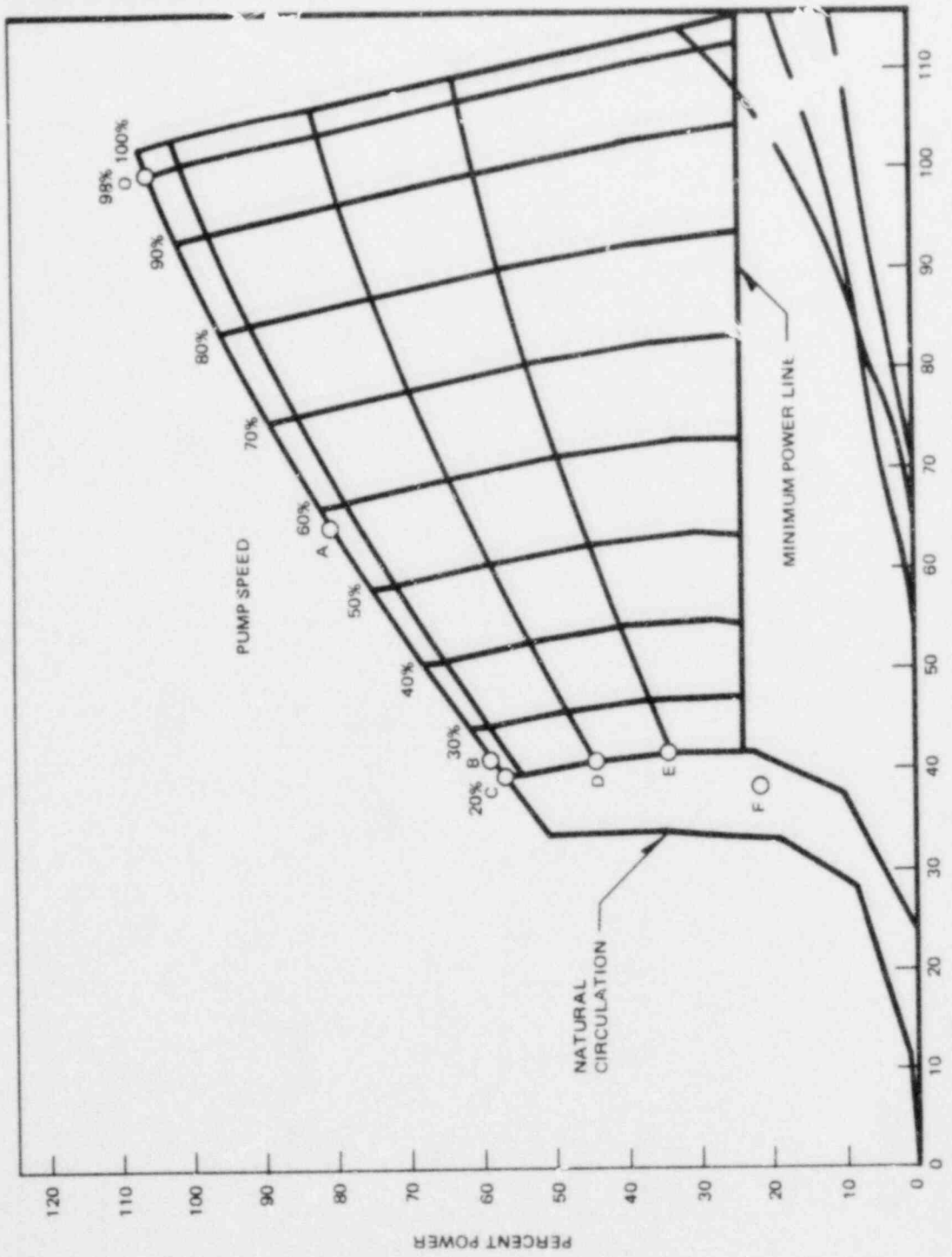

Figure 3.2.1.3.2-1 Operating Map

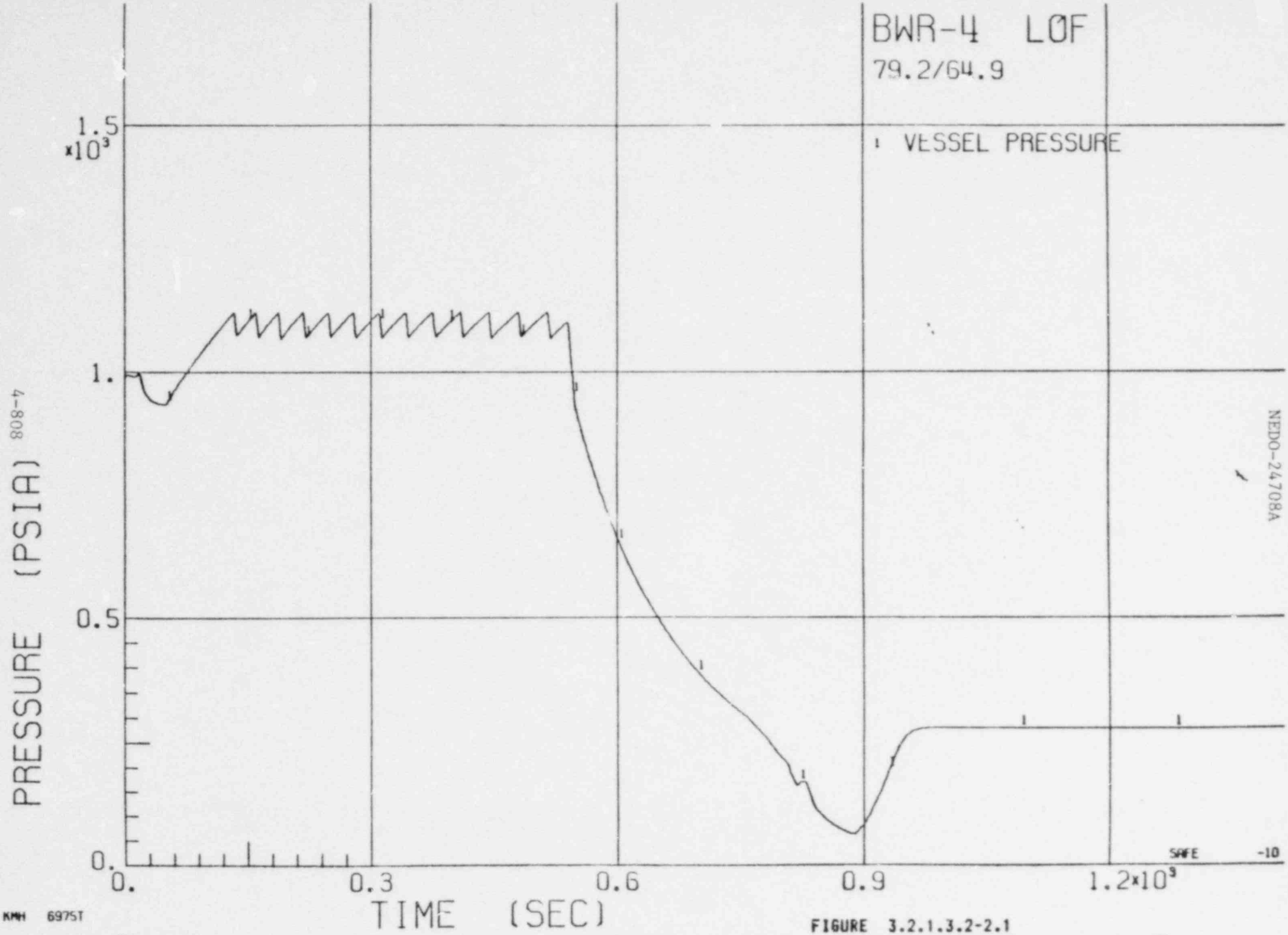

FIGURE 3.2.1.3.2-2.1

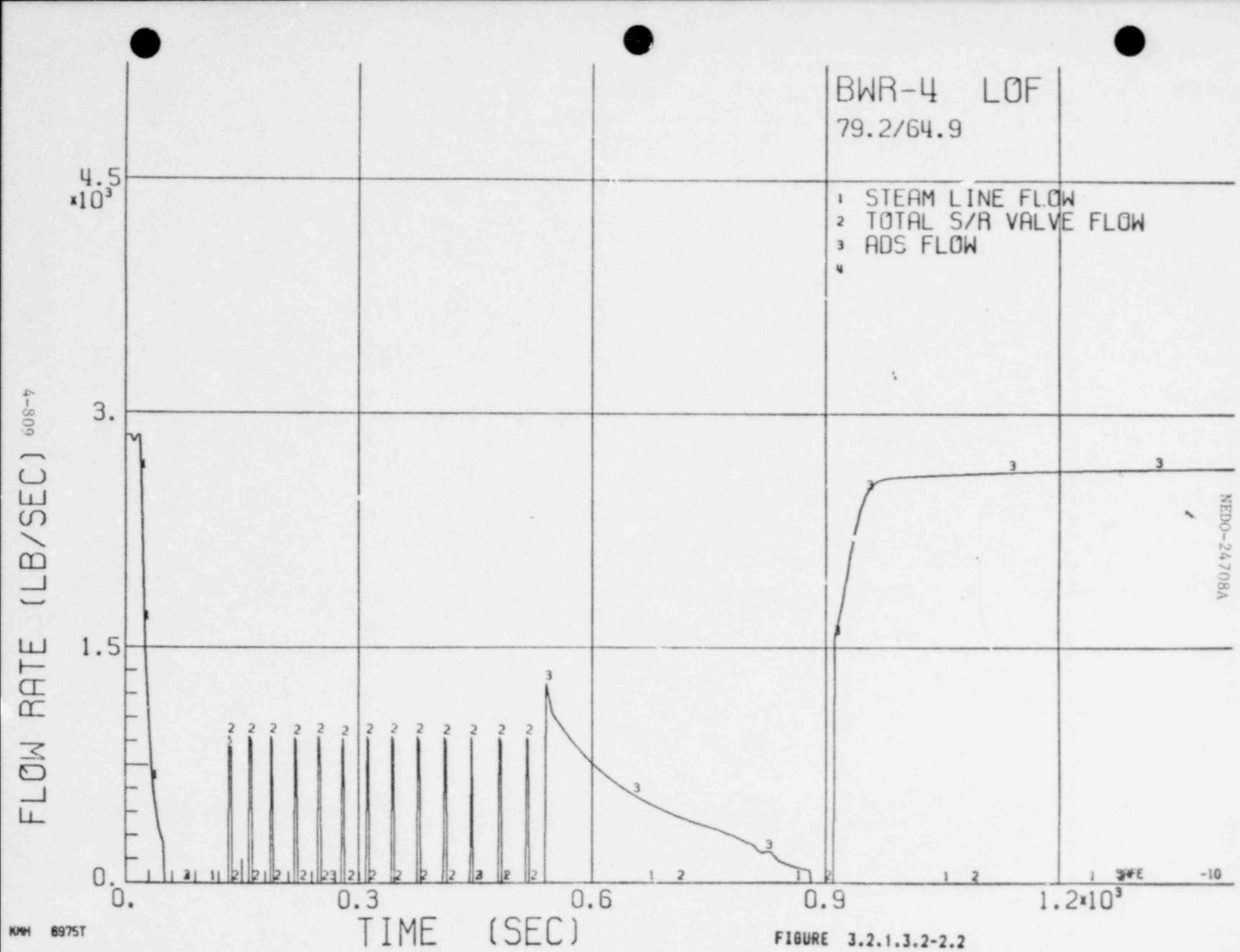

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FIGURE 3.2.1.3.2-2.2

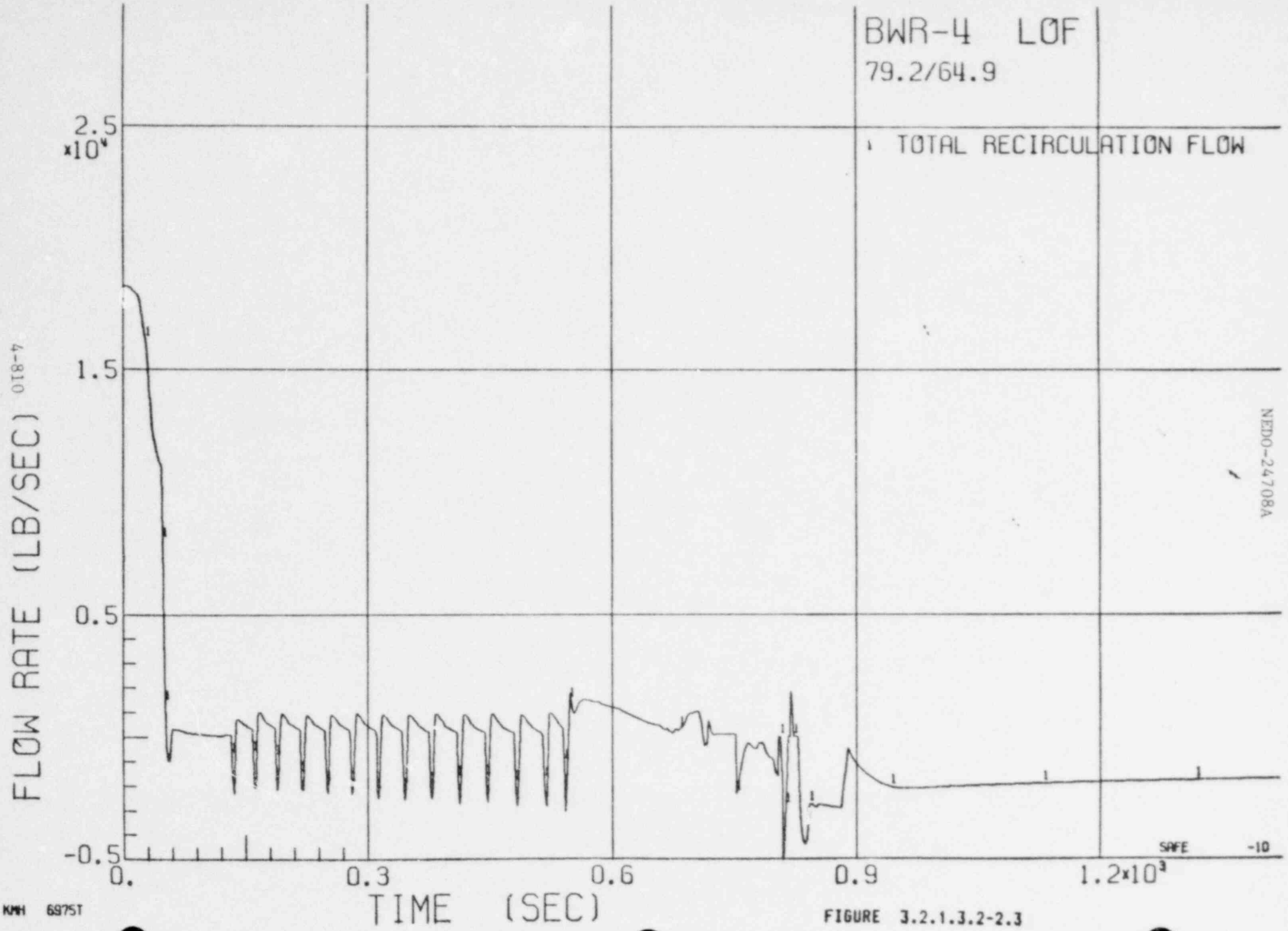

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FIGURE 3.2.1.3.2-2.3

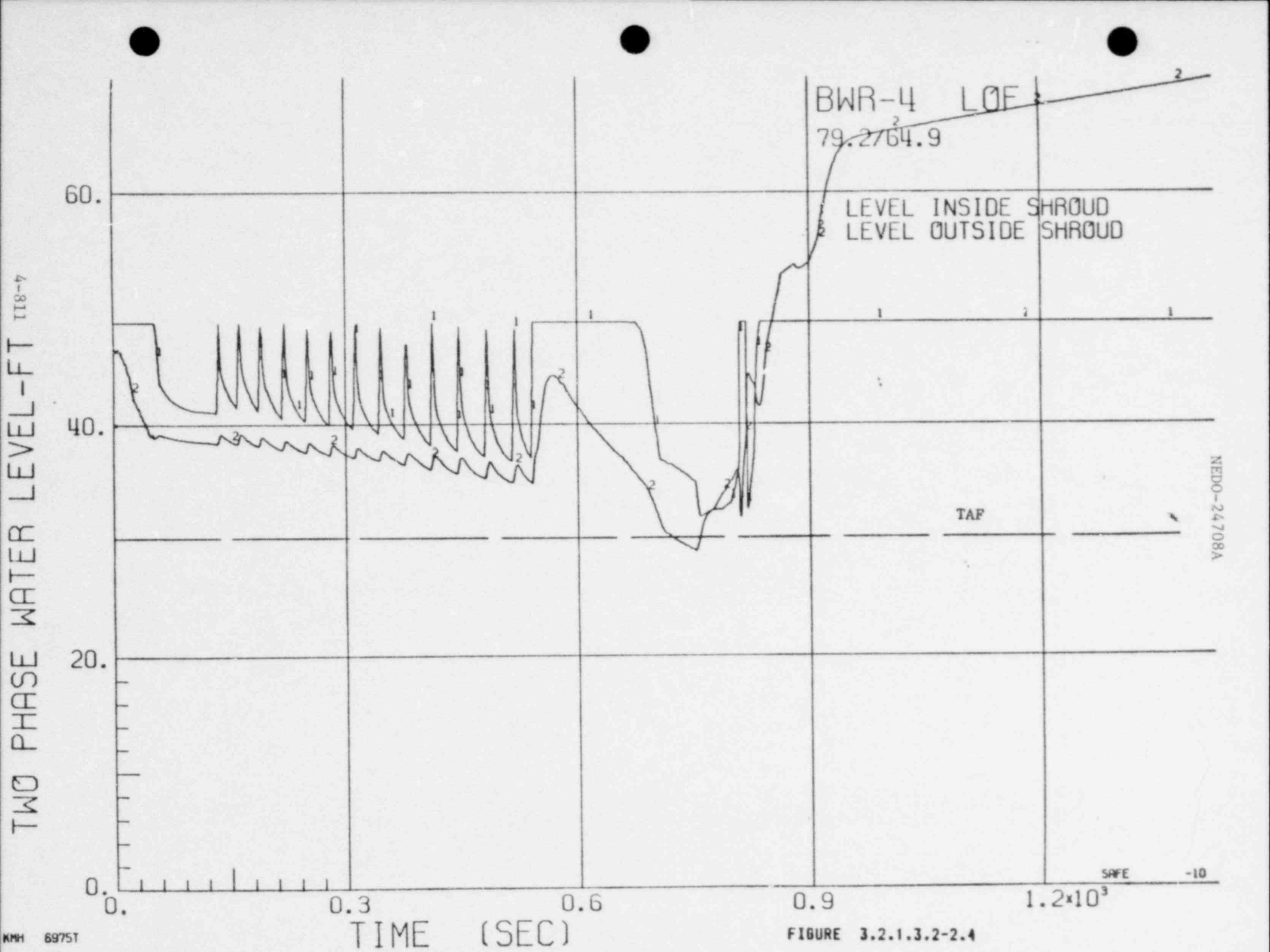

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FIGURE 3.2.1.3.2-2.4

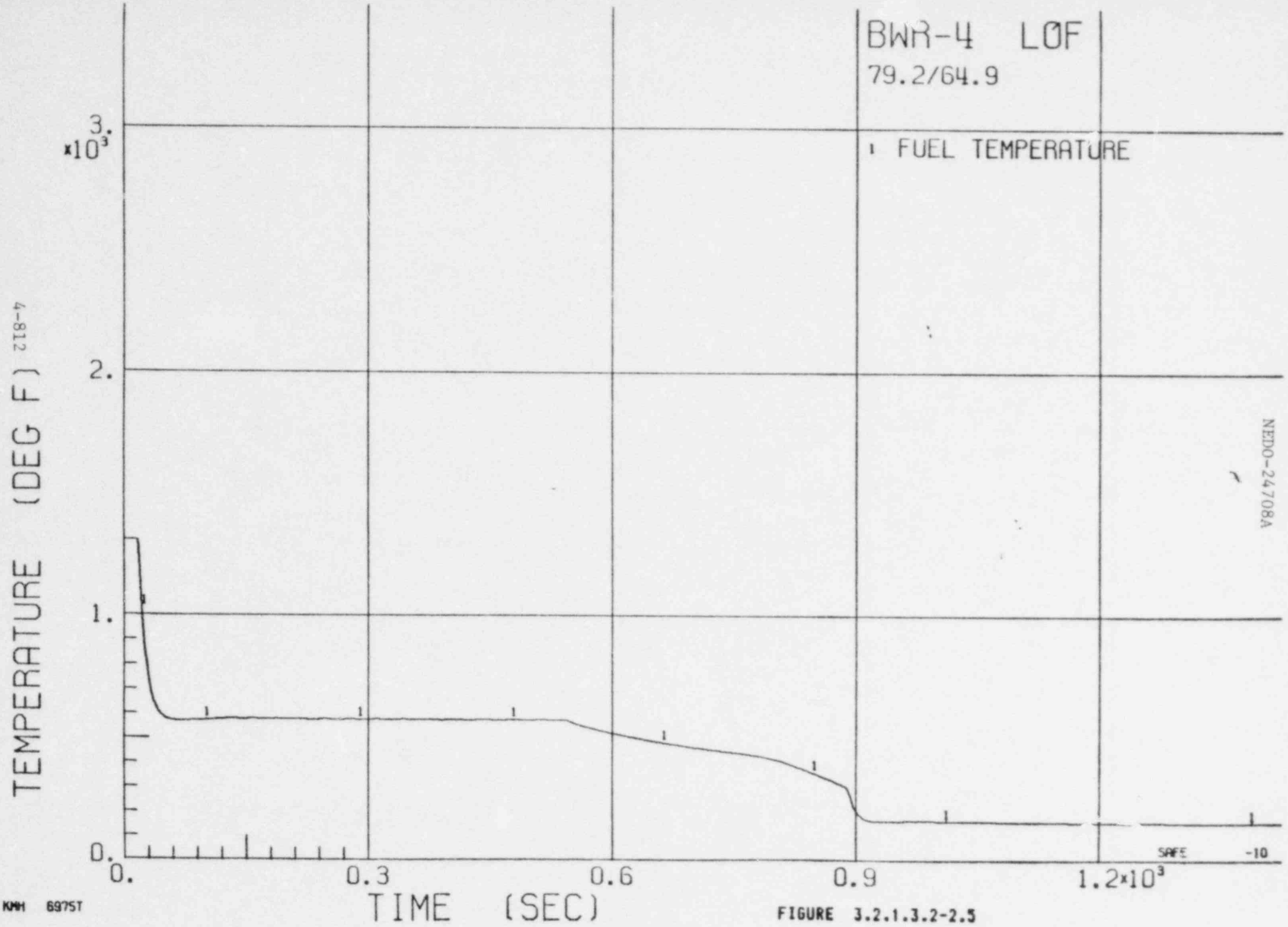

FIGURE 3.2.1.3.2-2.5

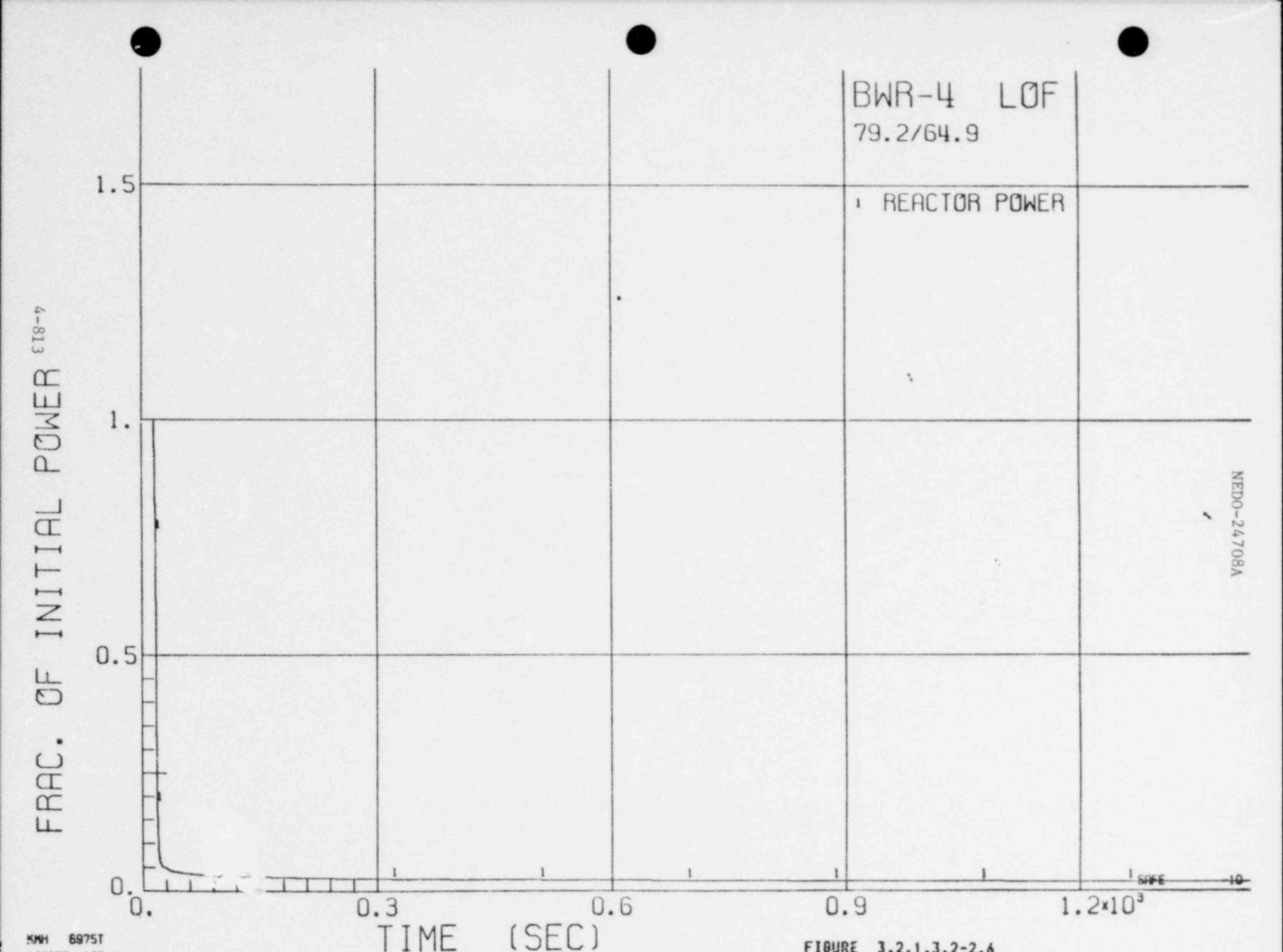

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FIGURE 3.2.1.3.2-2.6

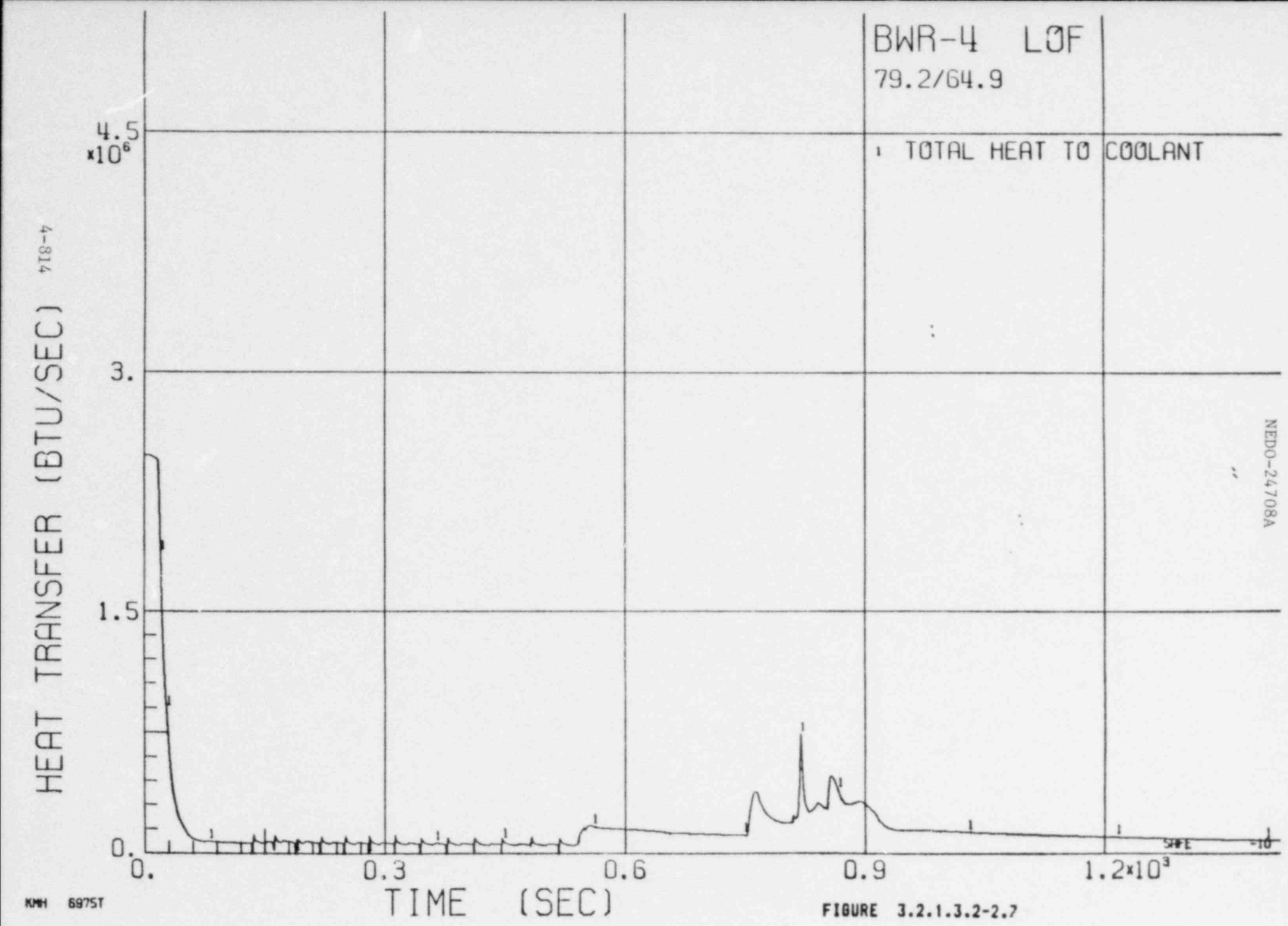

FIGURE 3.2.1.3.2-2.7

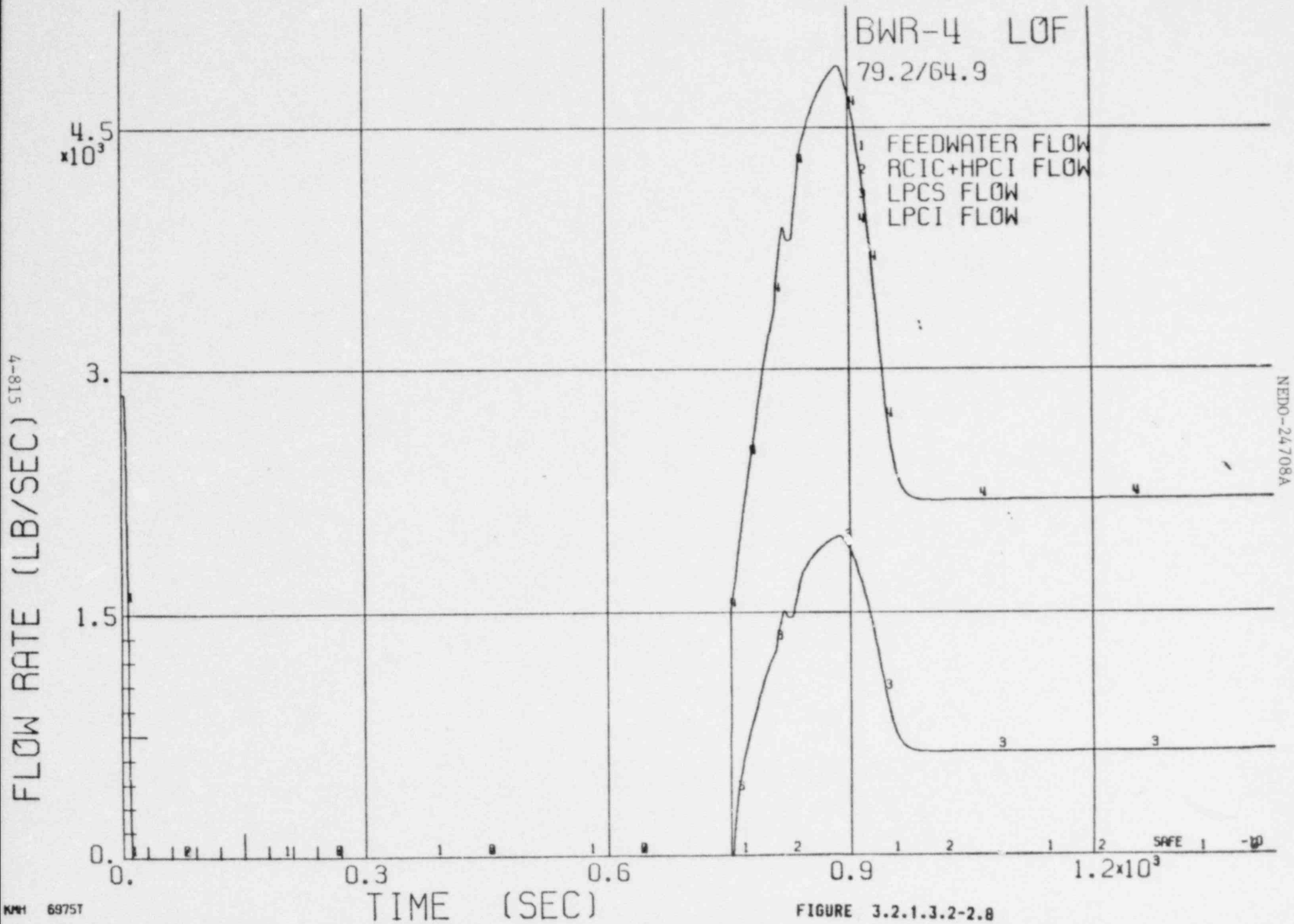

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FIGURE 3.2.1.3.2-2.8

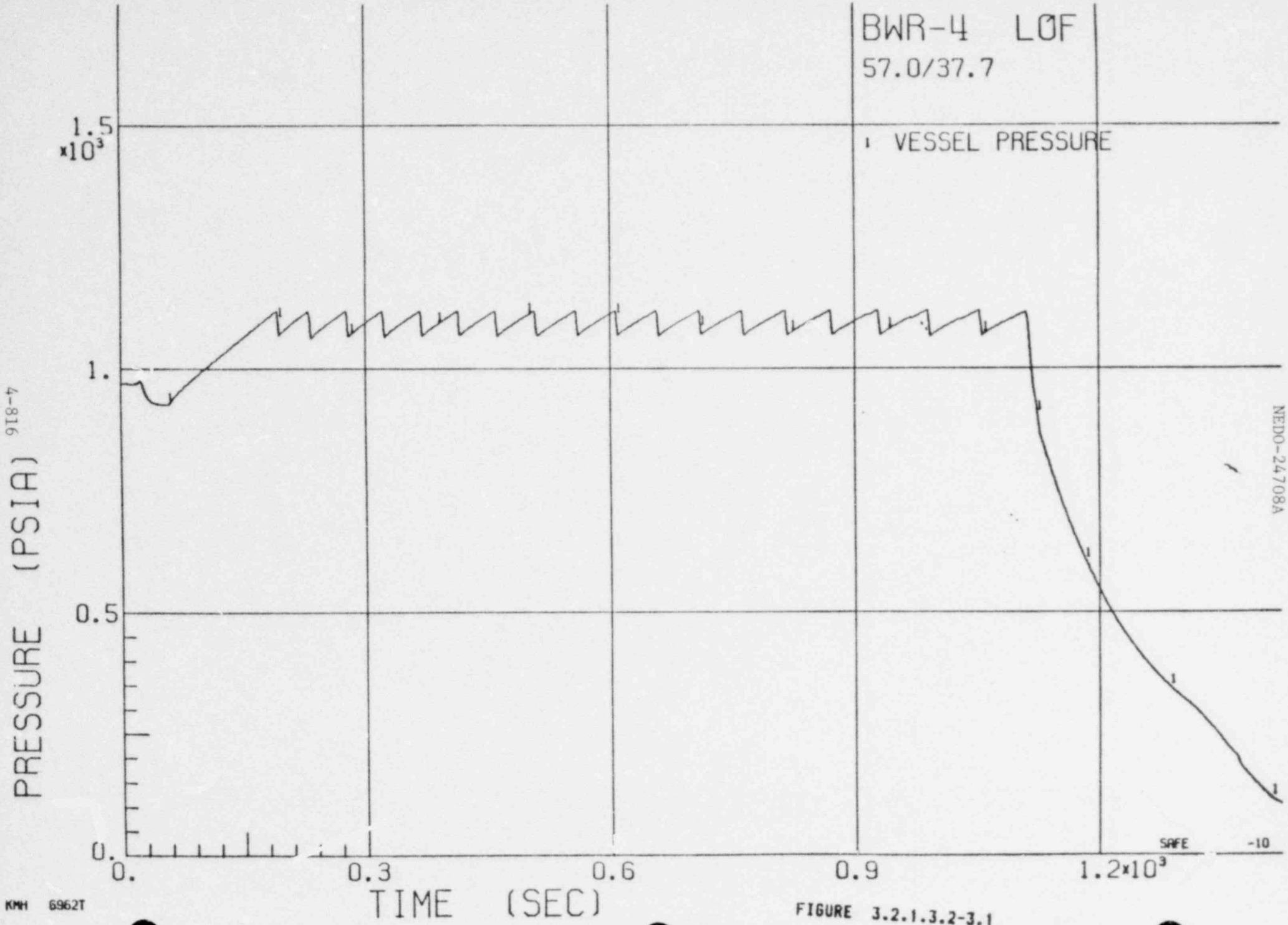
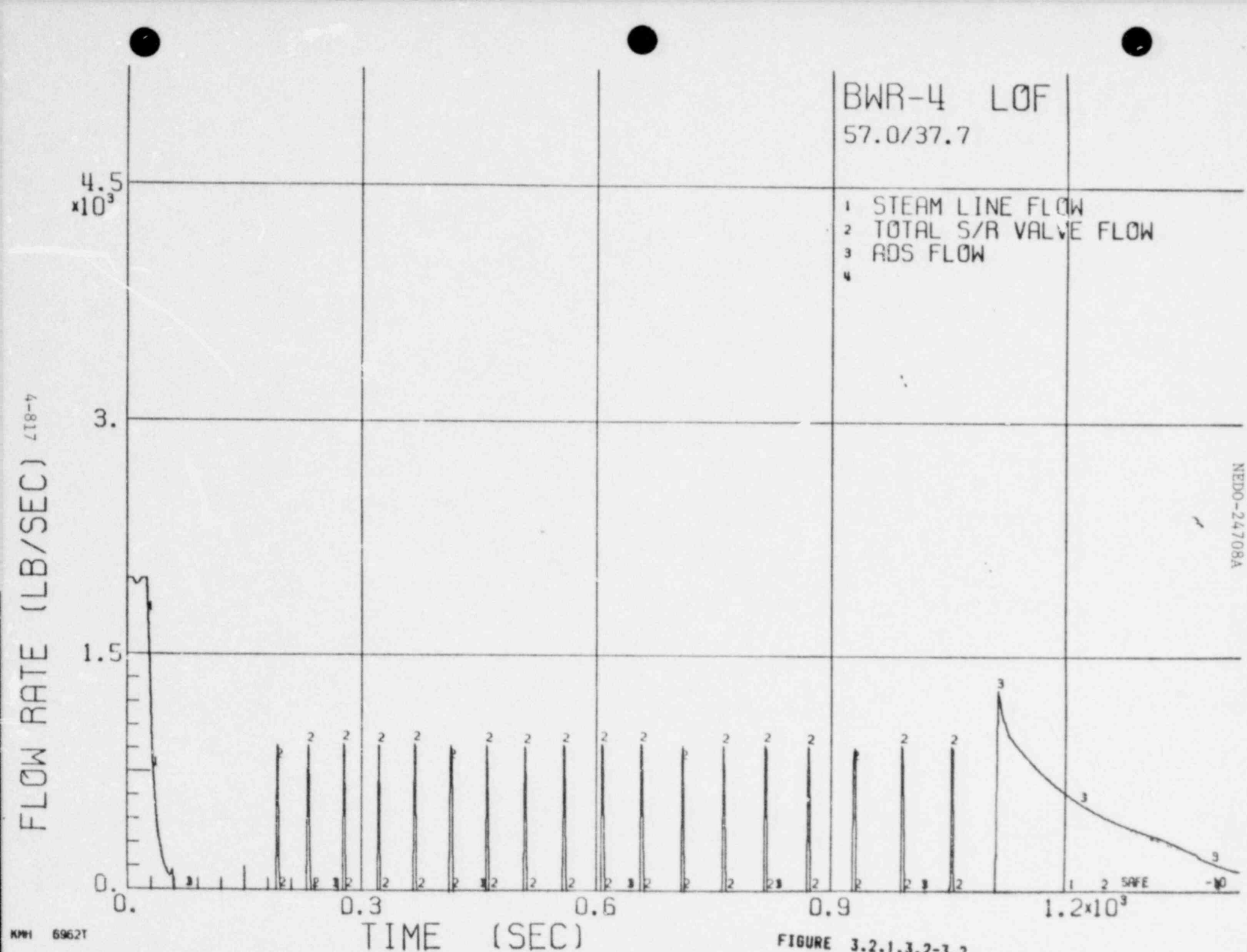
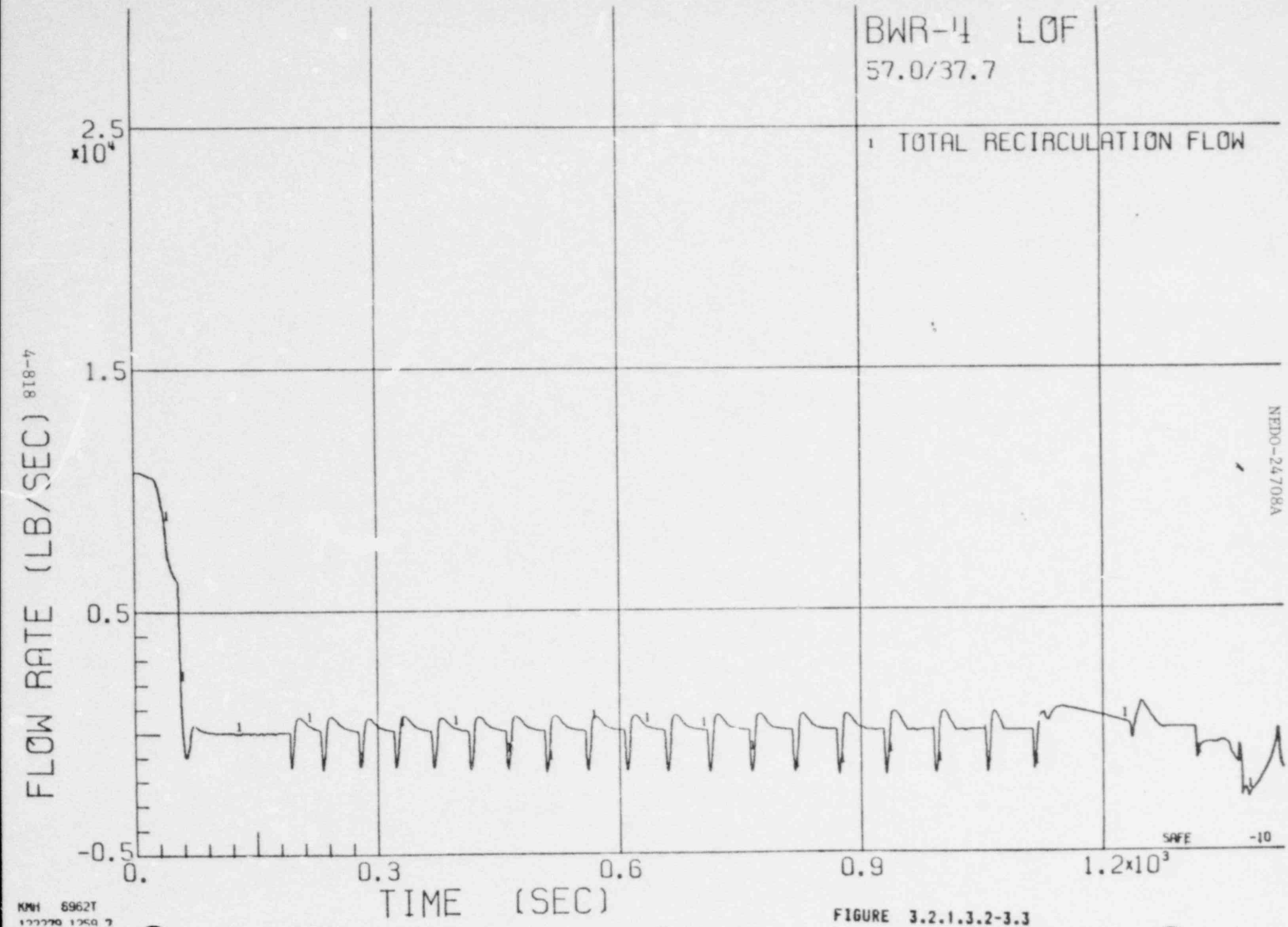


FIGURE 3.2.1.3.2-3.1



KMH 6962T

FIGURE 3.2.1.3.2-3.2



KMH 6962T

FIGURE 3.2.1.3.2-3.3

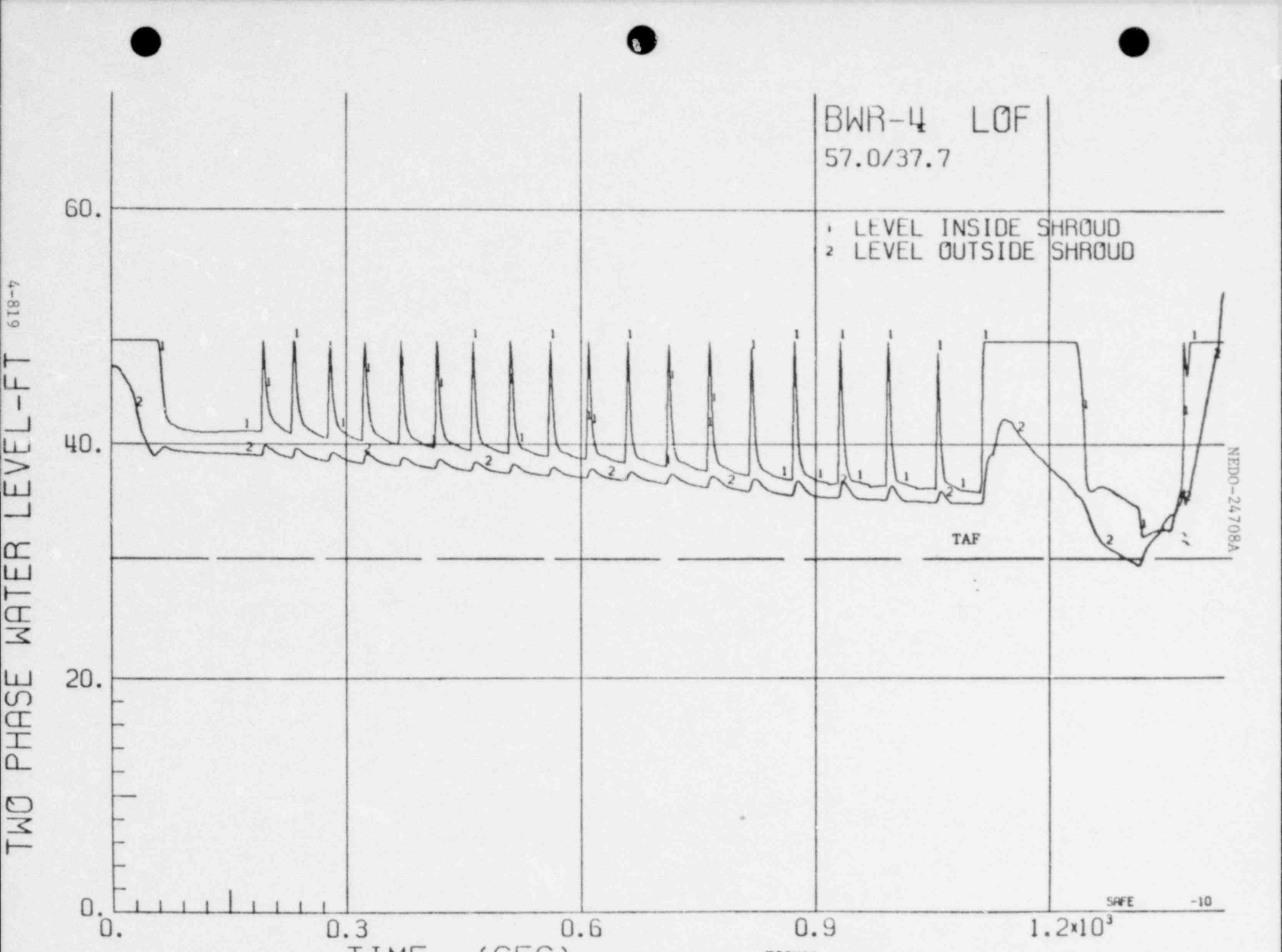


FIGURE 3.2.1.3.2-3.4

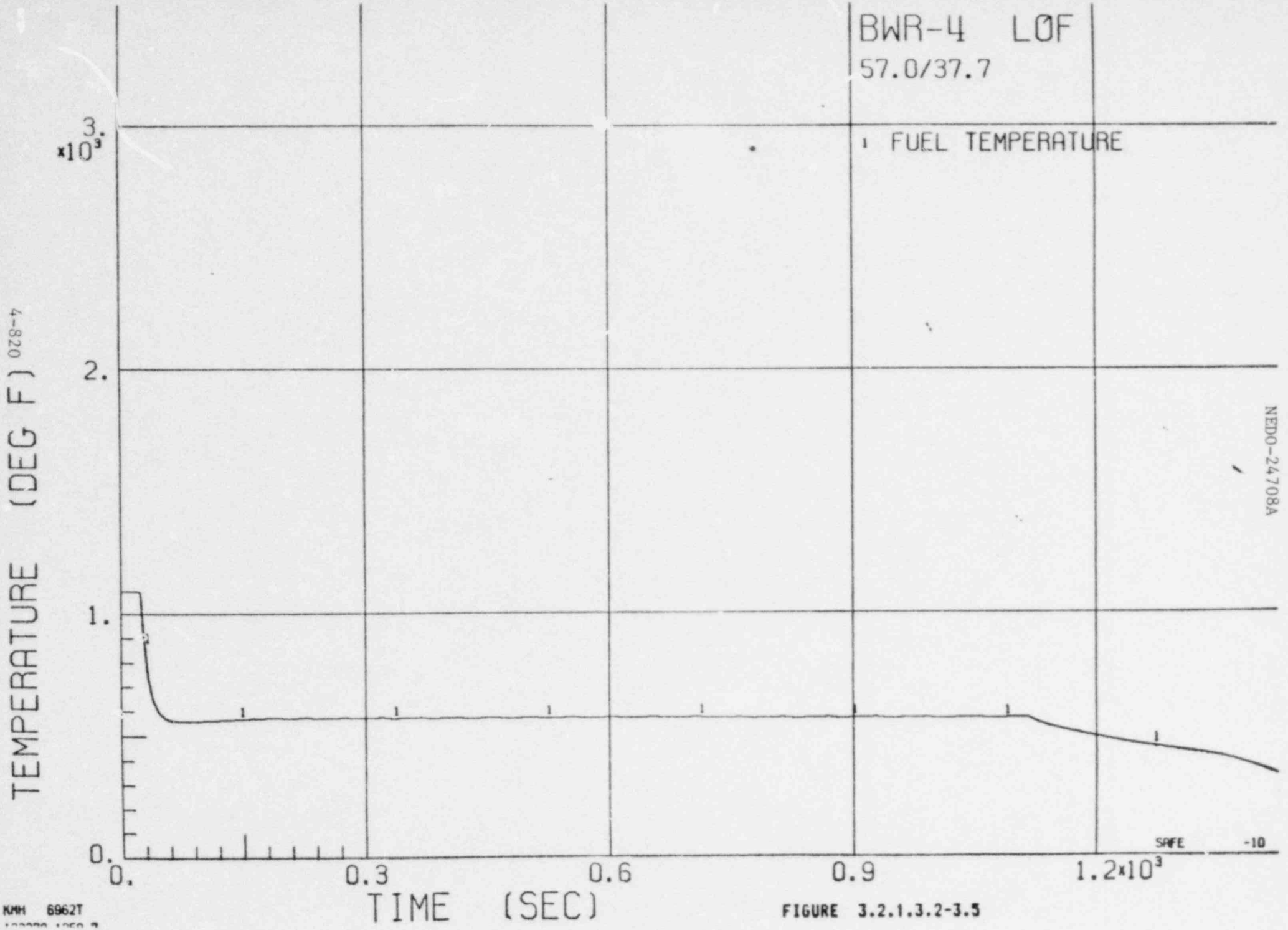


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FIGURE 3.2.1.3.2-3.5

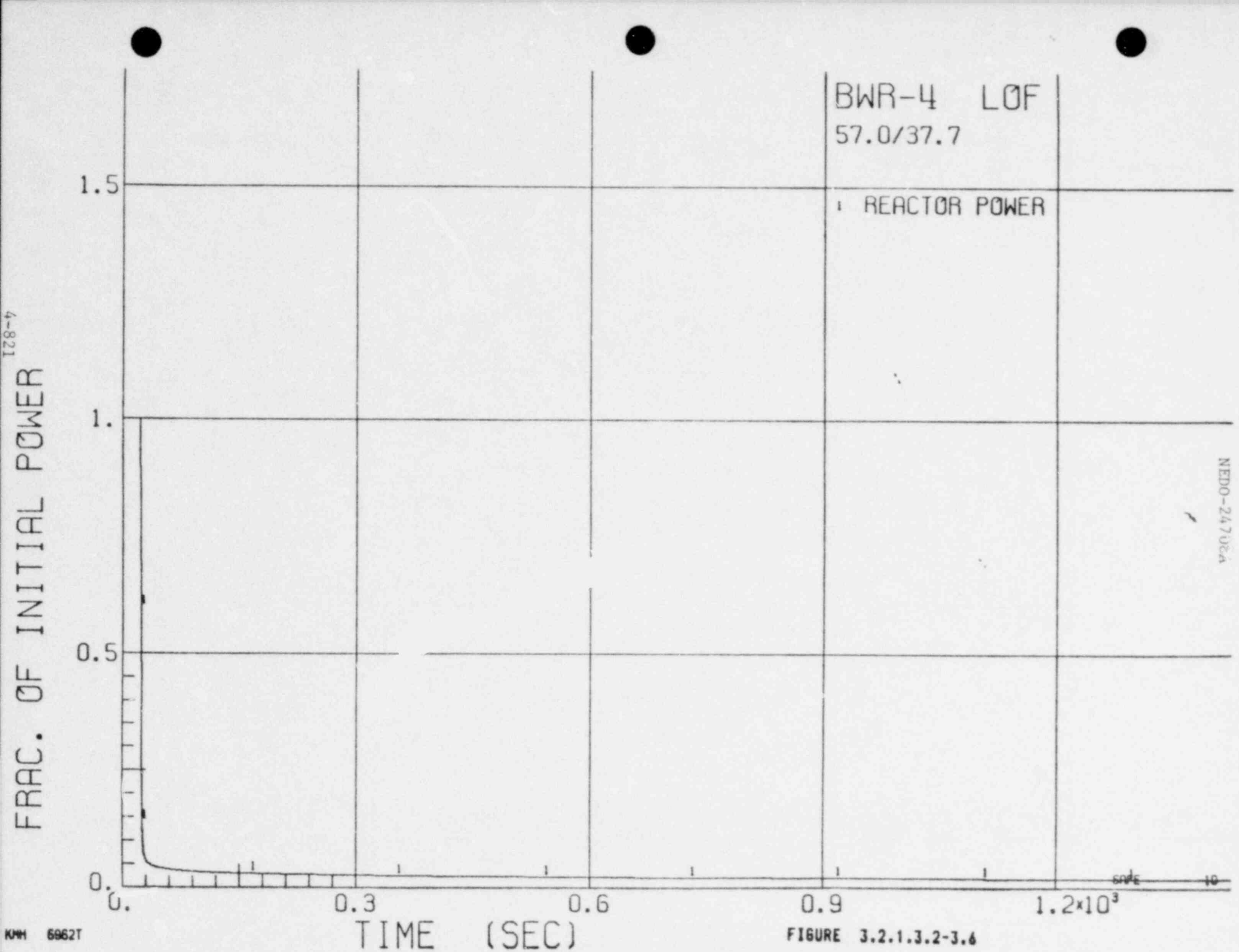

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FIGURE 3.2.1.3.2-3.6

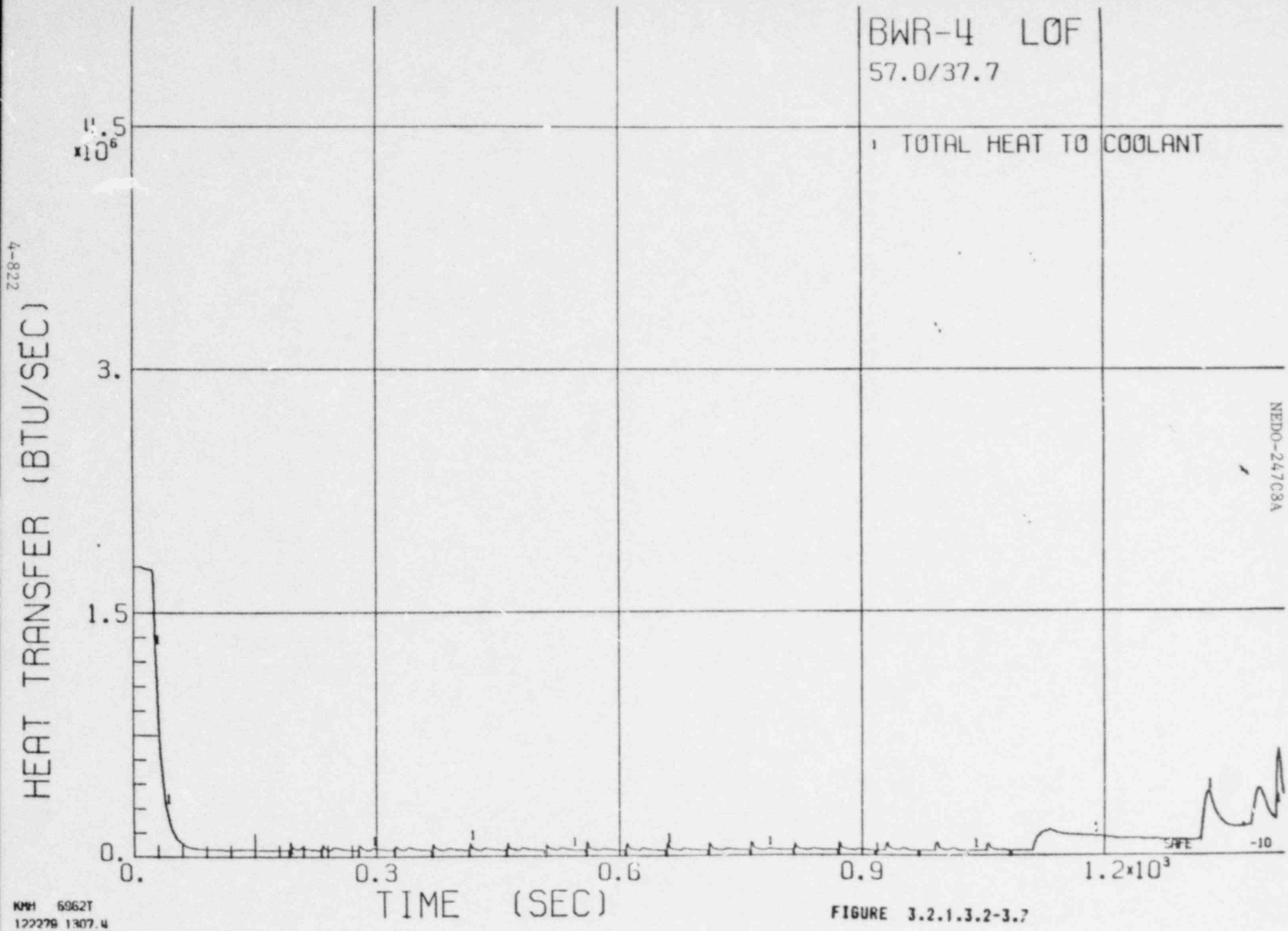

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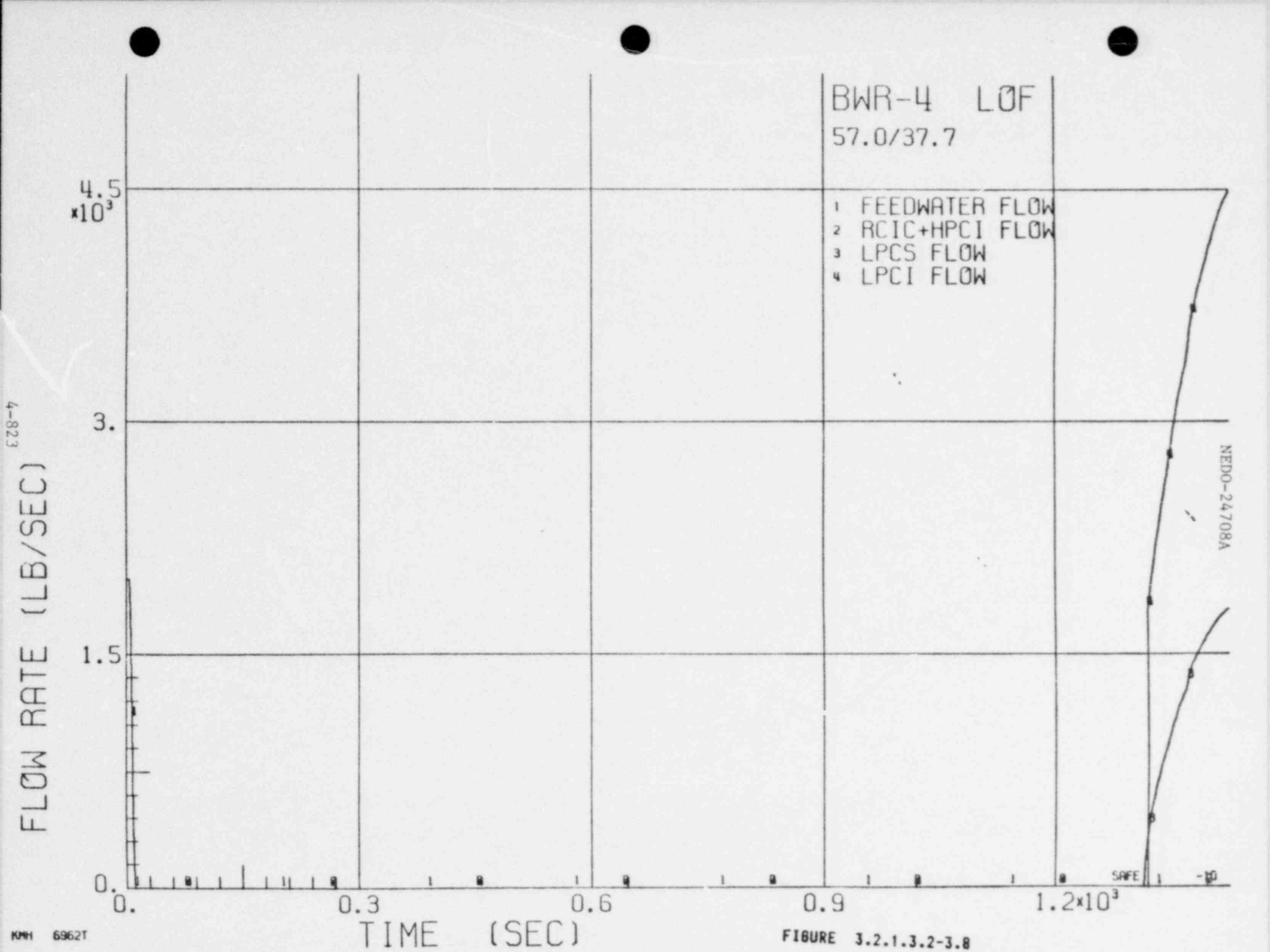
FIGURE 3.2.1.3.2-3.7



KMH 6962T

FIGURE 3.2.1.3.2-3.8

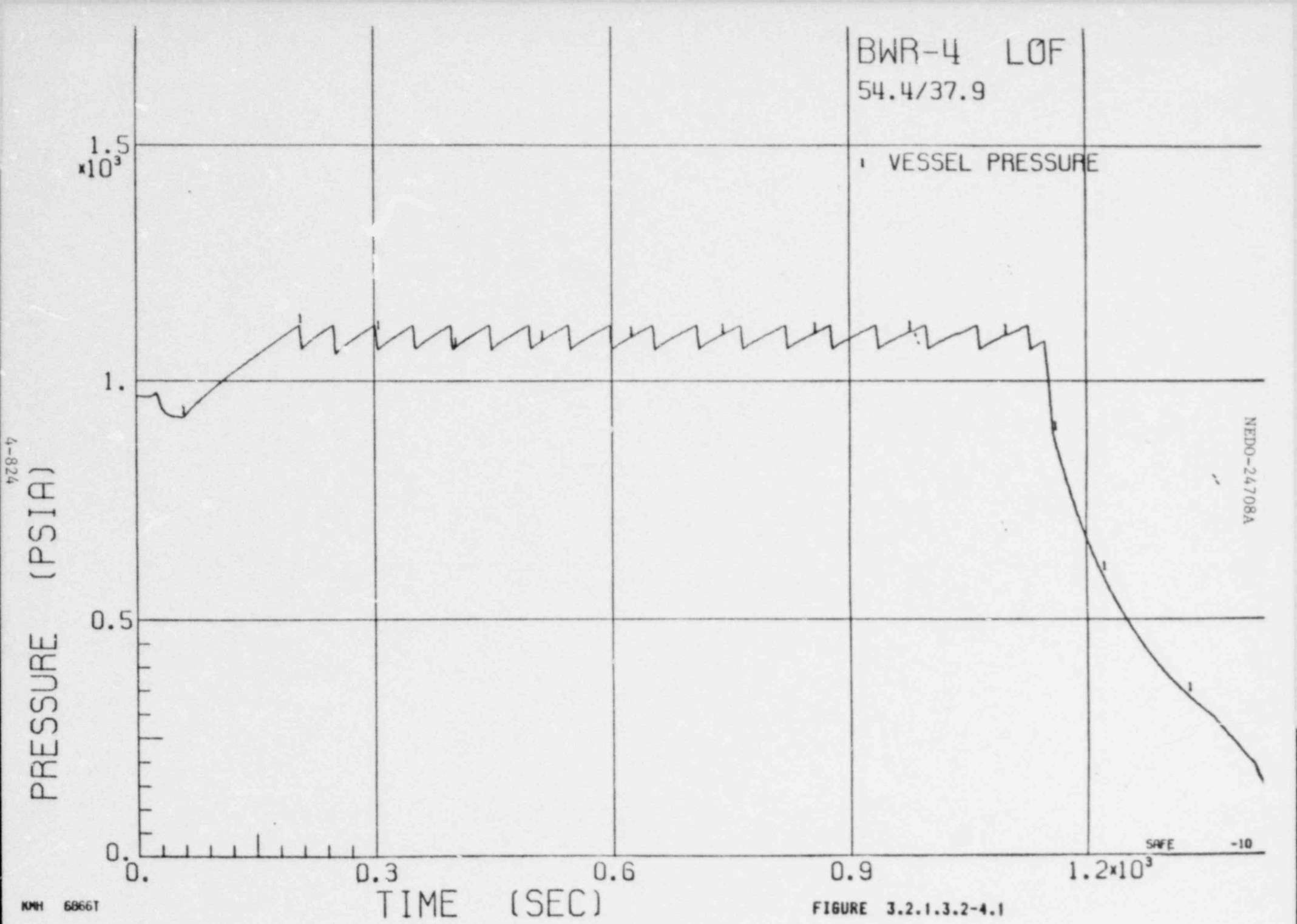


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FIGURE 3.2.1.3.2-4.1

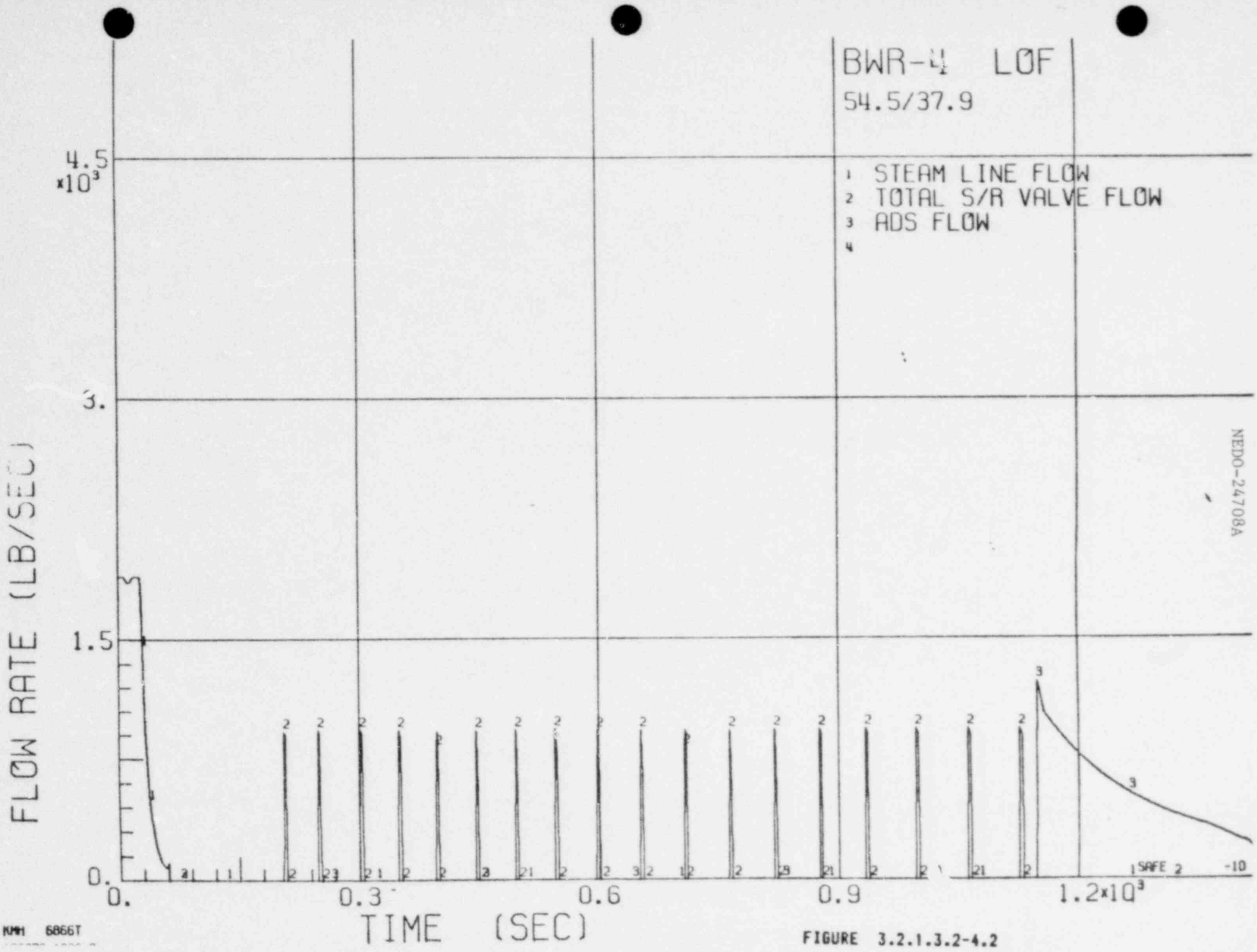

FIGURE 3.2.1.3.2-4.2

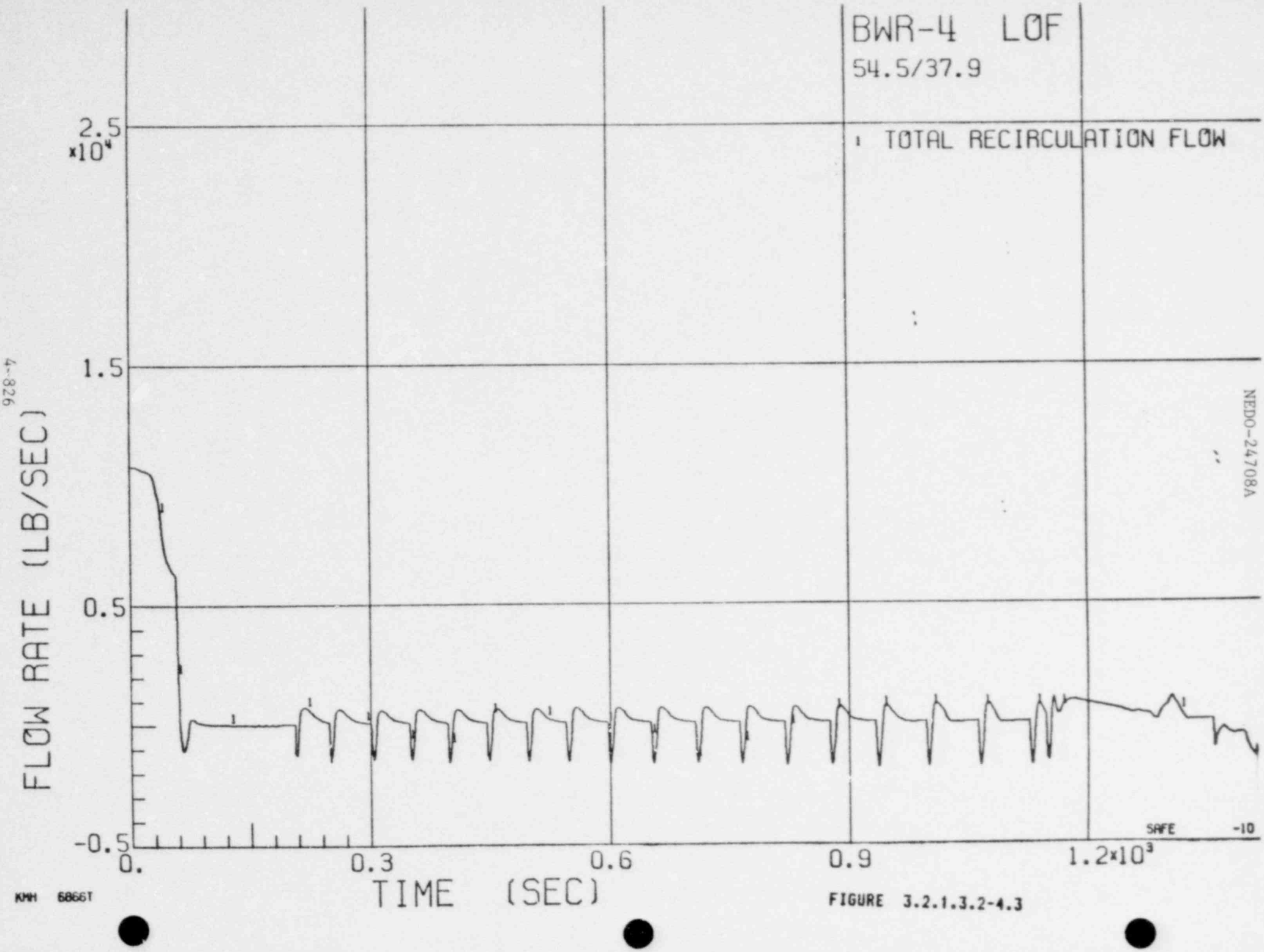

FIGURE 3.2.1.3.2-4.3

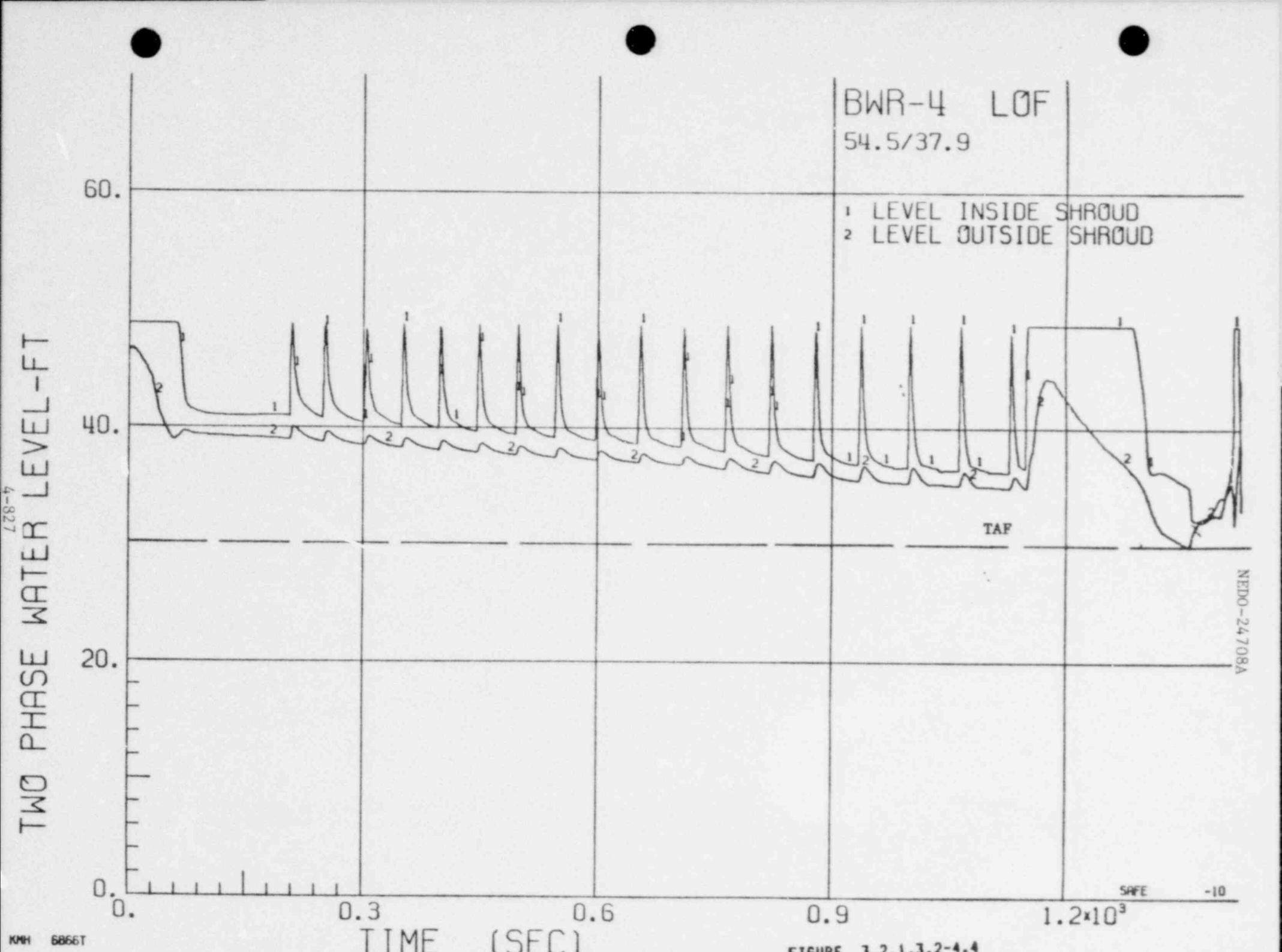

FIGURE 3.2.1.3.2-4.4

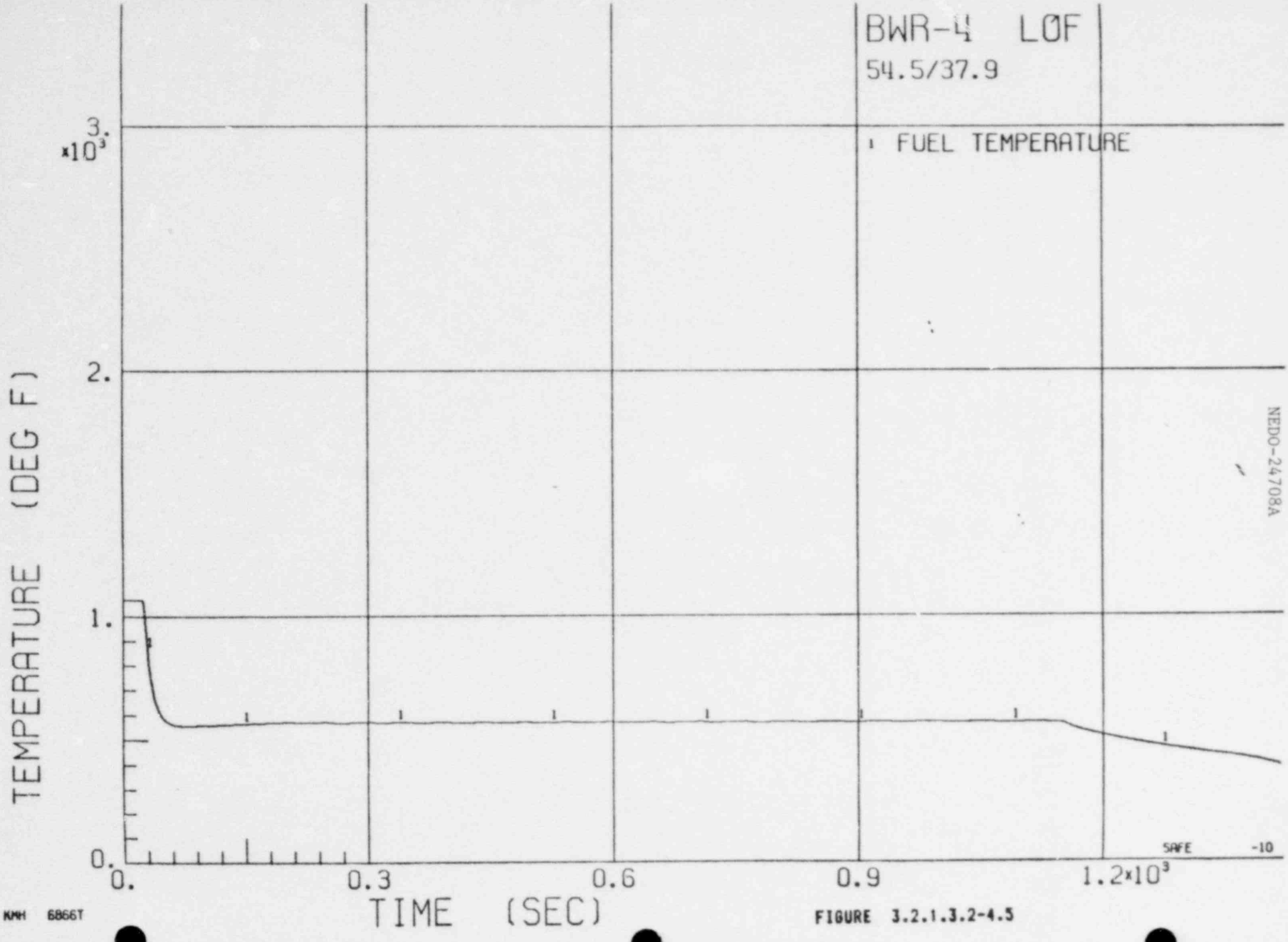

FIGURE 3.2.1.3.2-4.5

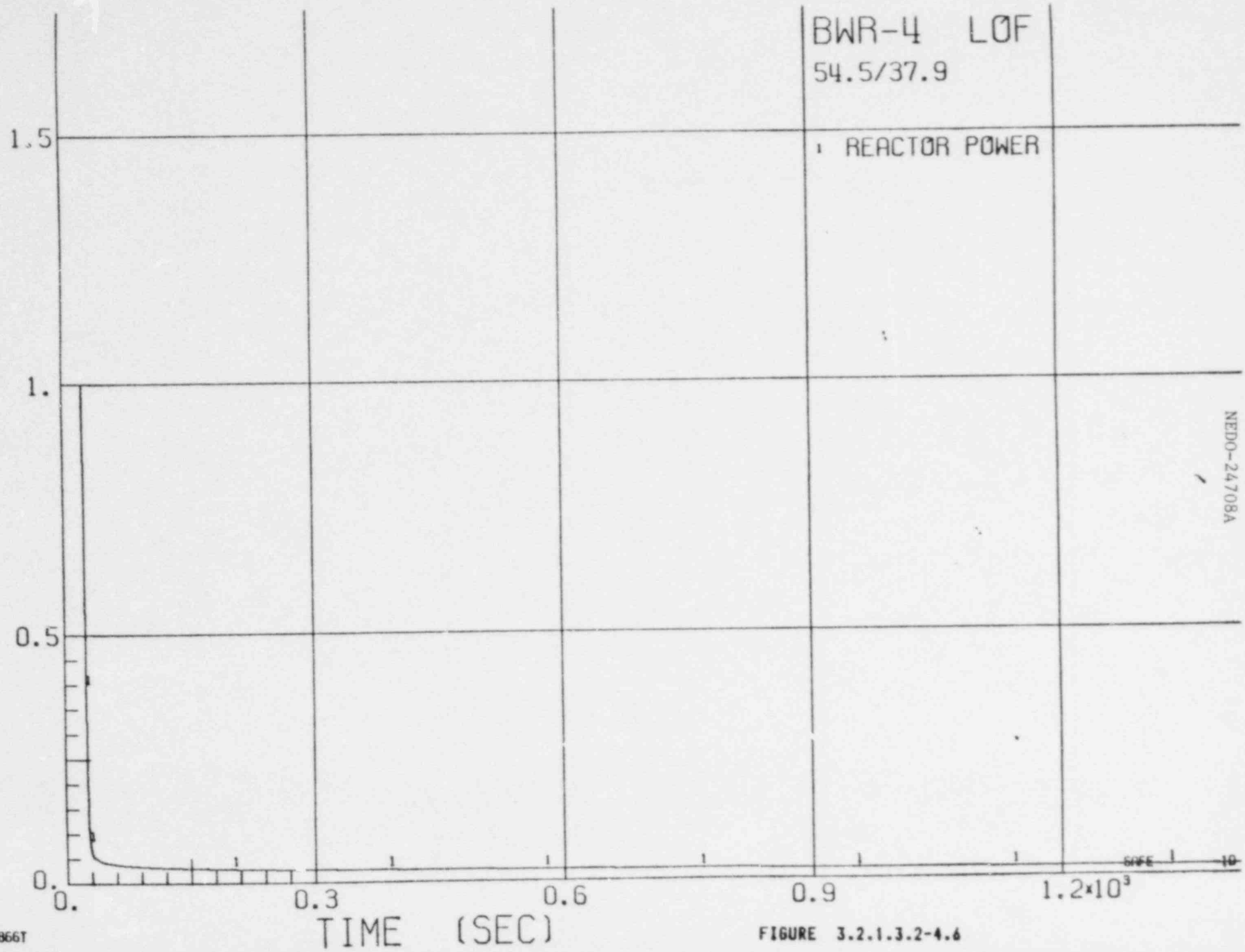

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FIGURE 3.2.1.3.2-4.6

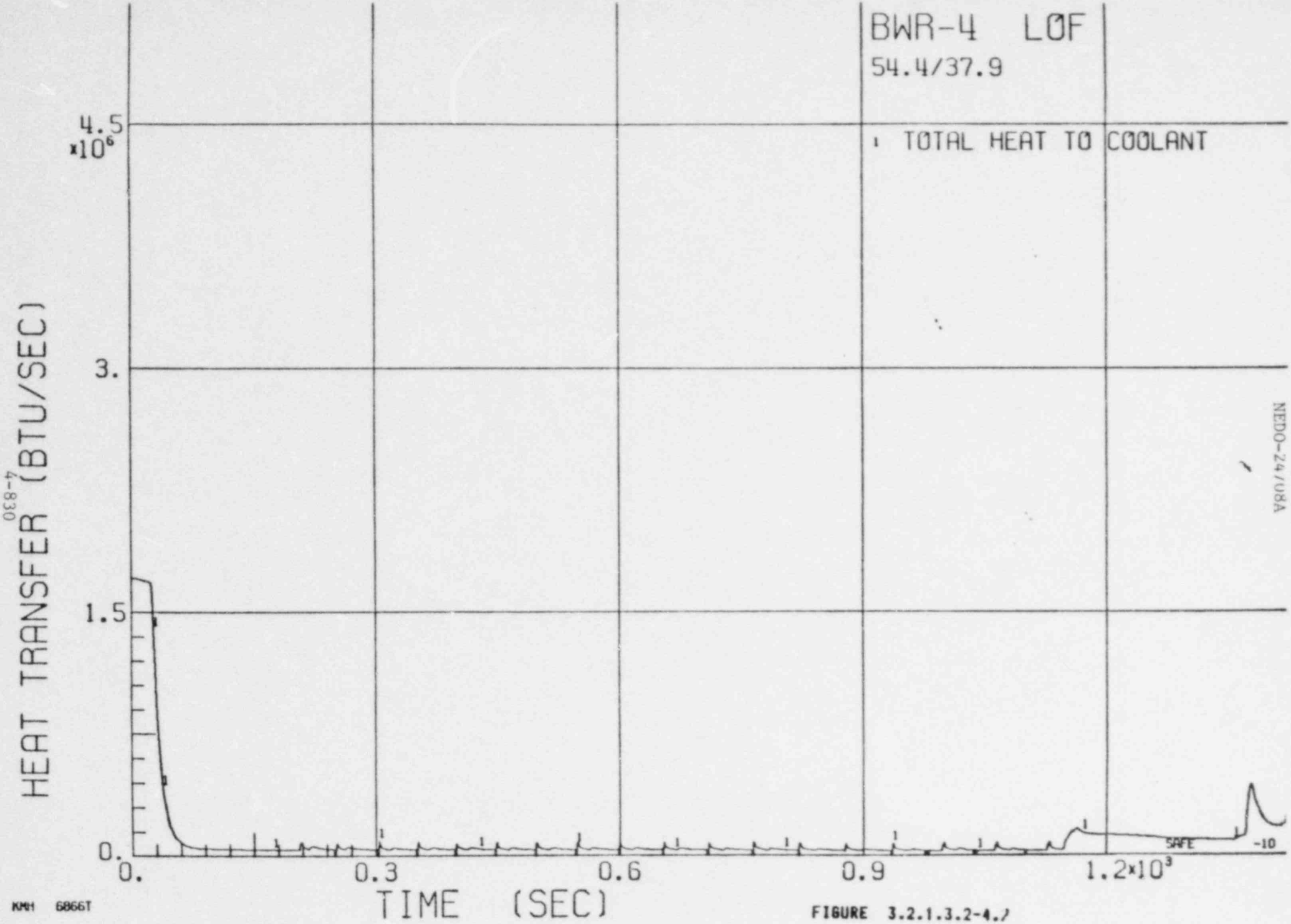

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FIGURE 3.2.1.3.2-4.1

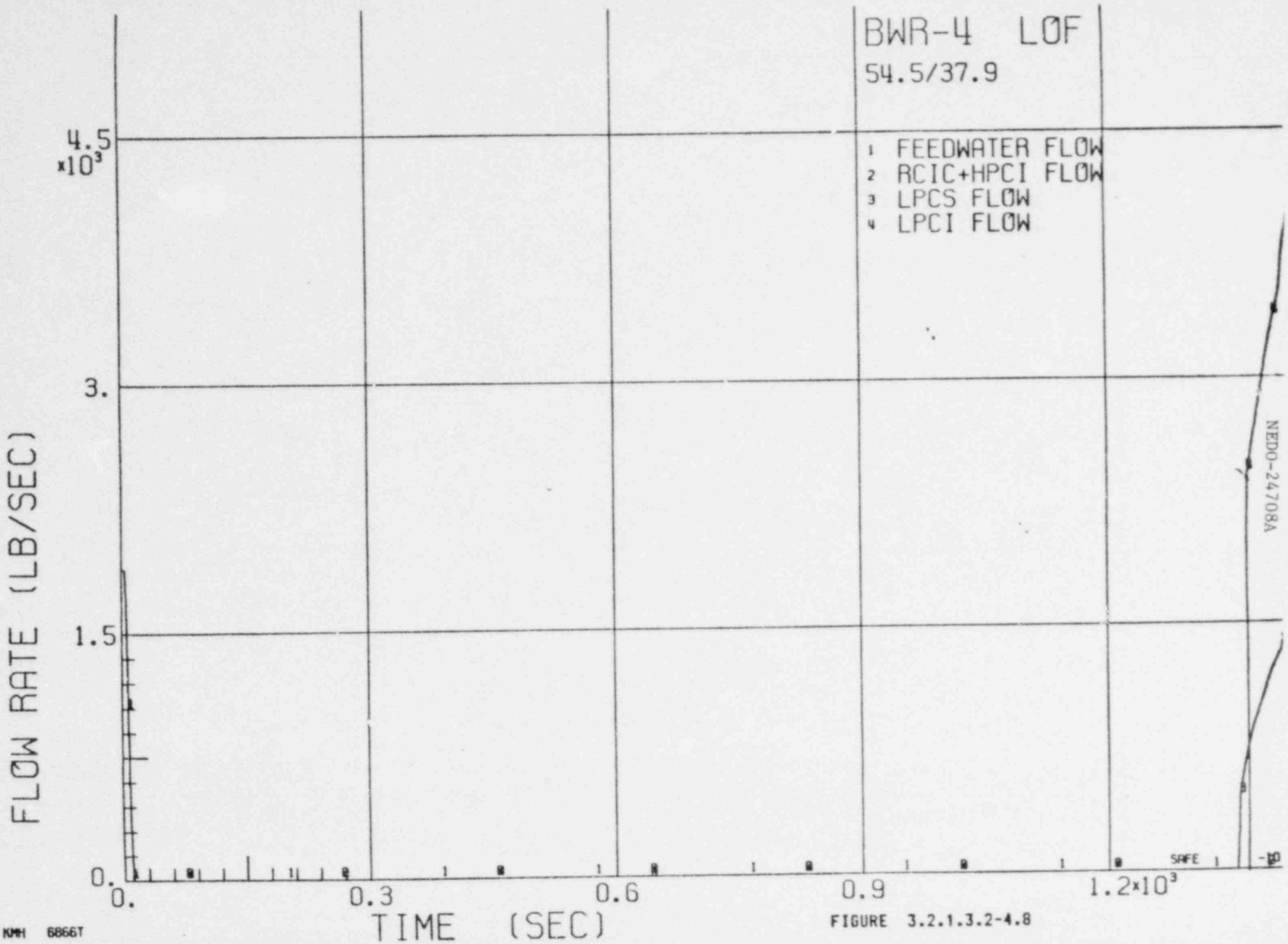

FIGURE 3.2.1.3.2-4.8

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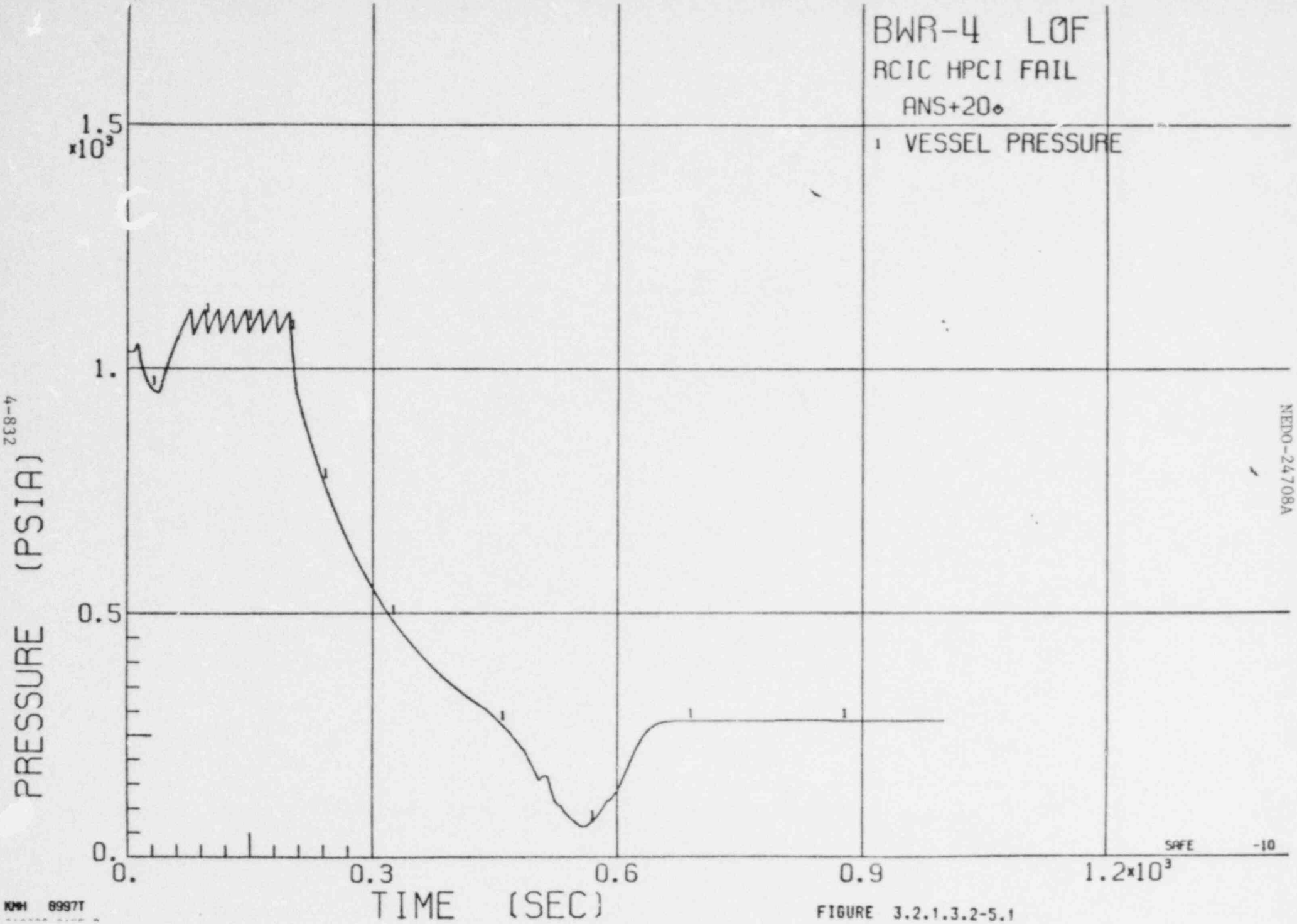

FIGURE 3.2.1.3.2-5.1

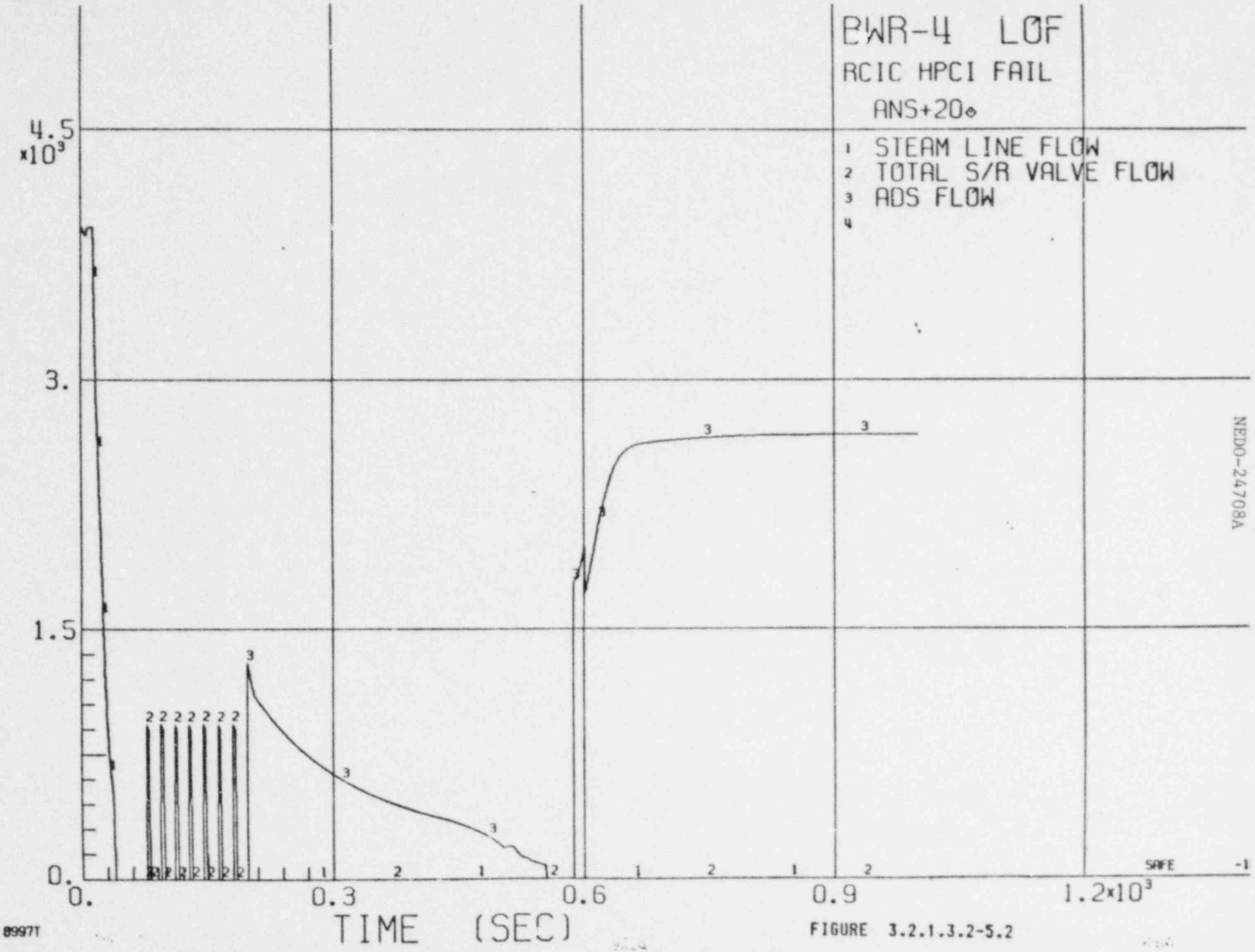

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FIGURE 3.2.1.3.2-5.2

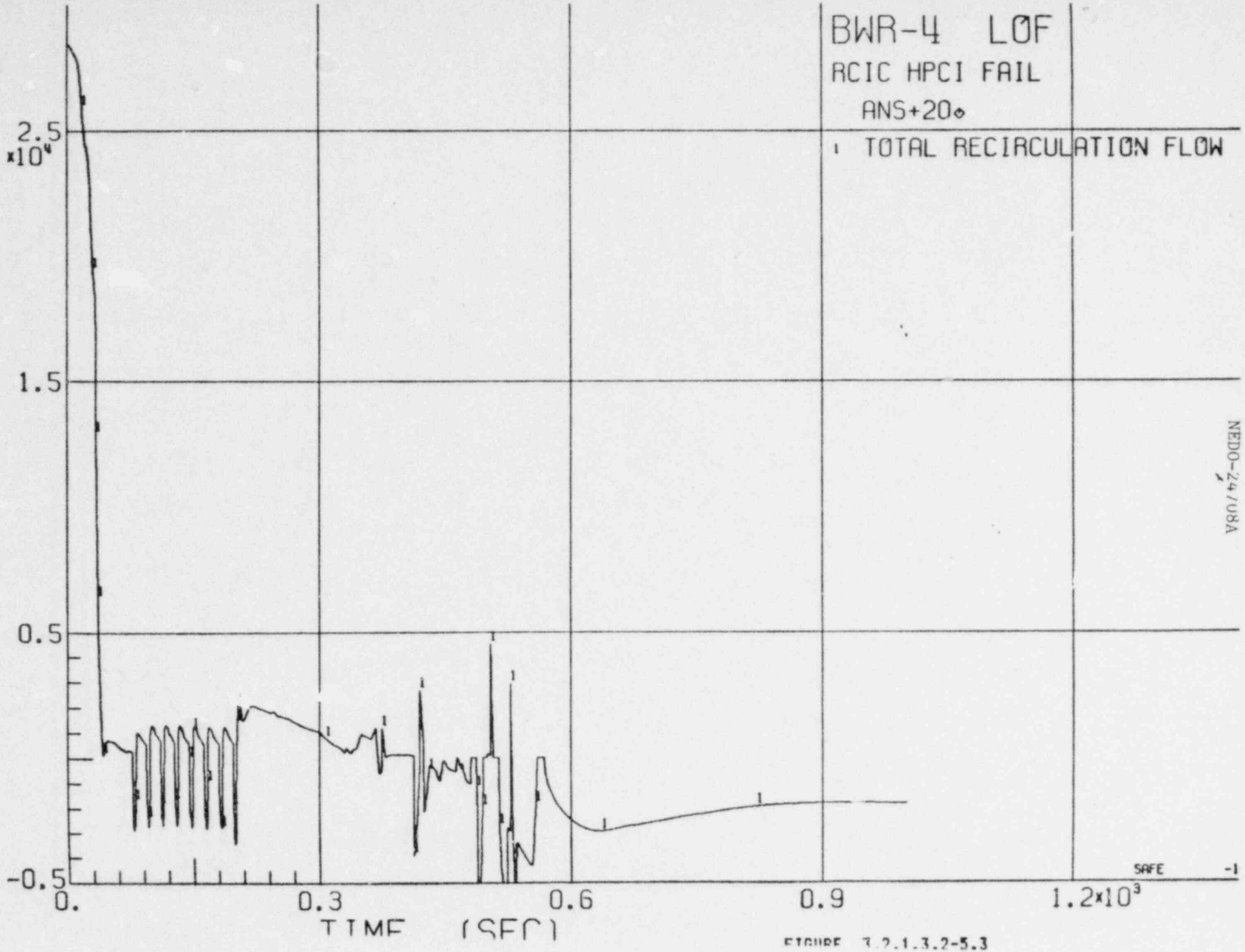

FIGURE 3.2.1.3.2-5.3

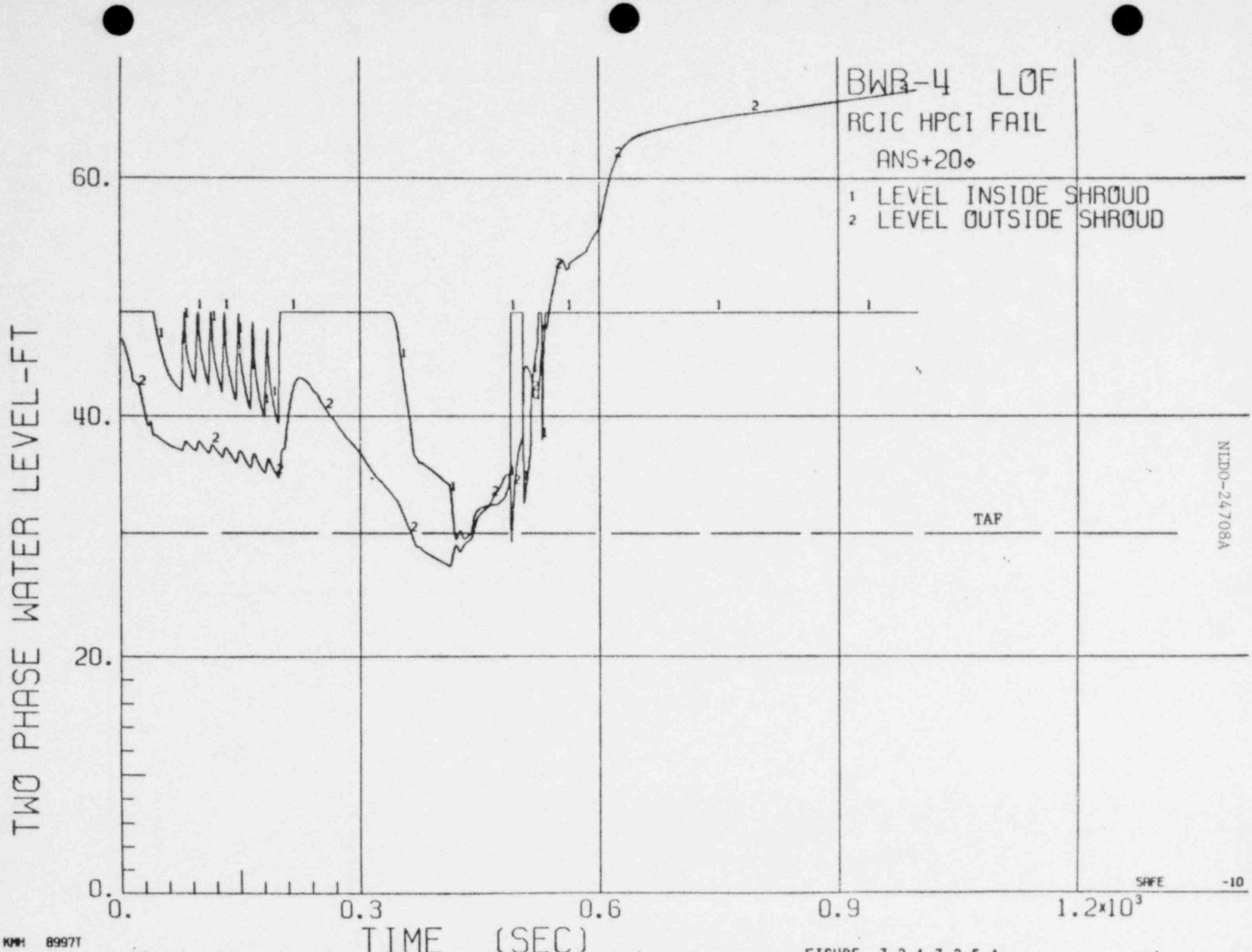

FIGURE 3.2.1.3.2-5.4

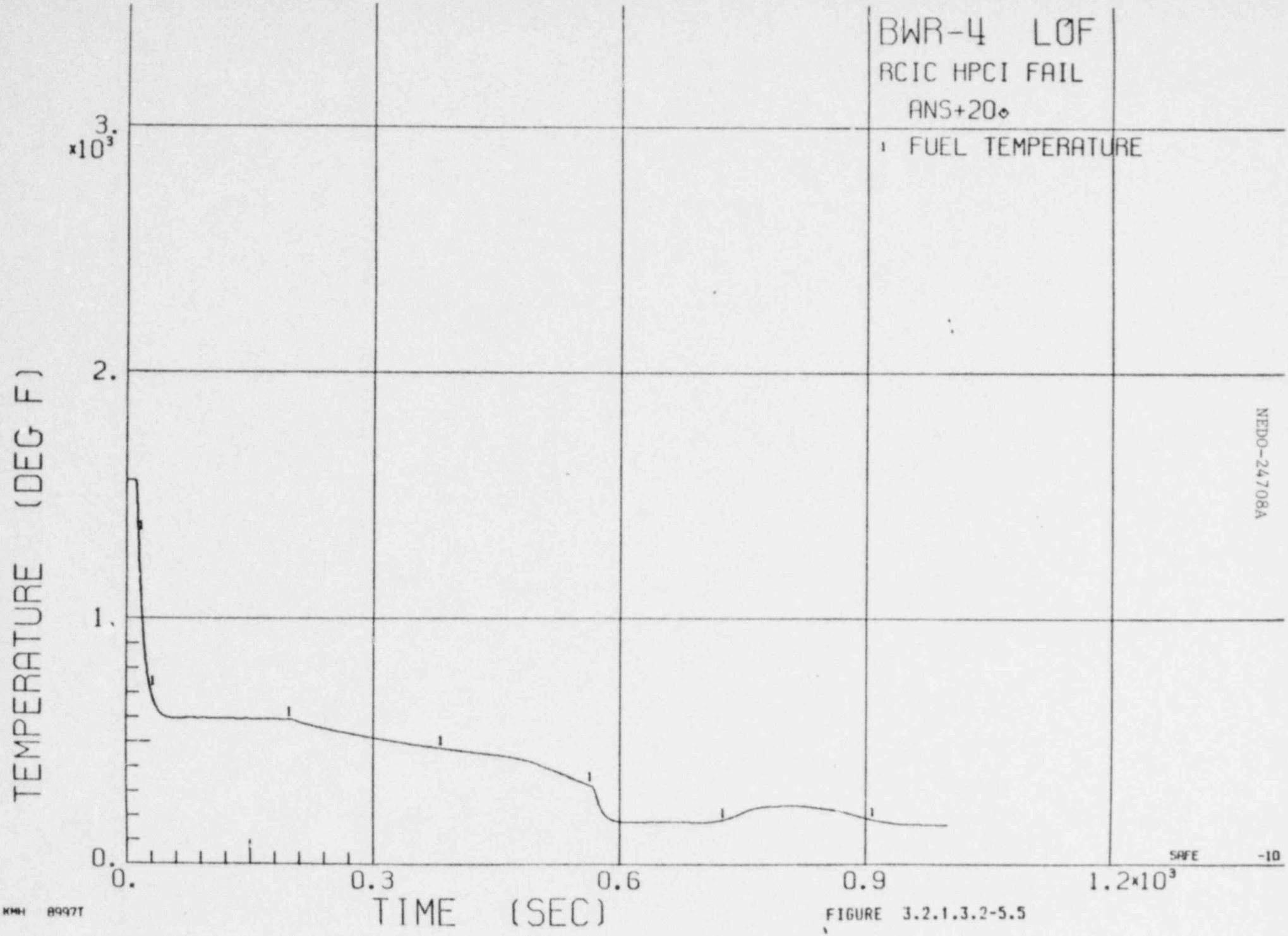

FIGURE 3.2.1.3.2-5.5

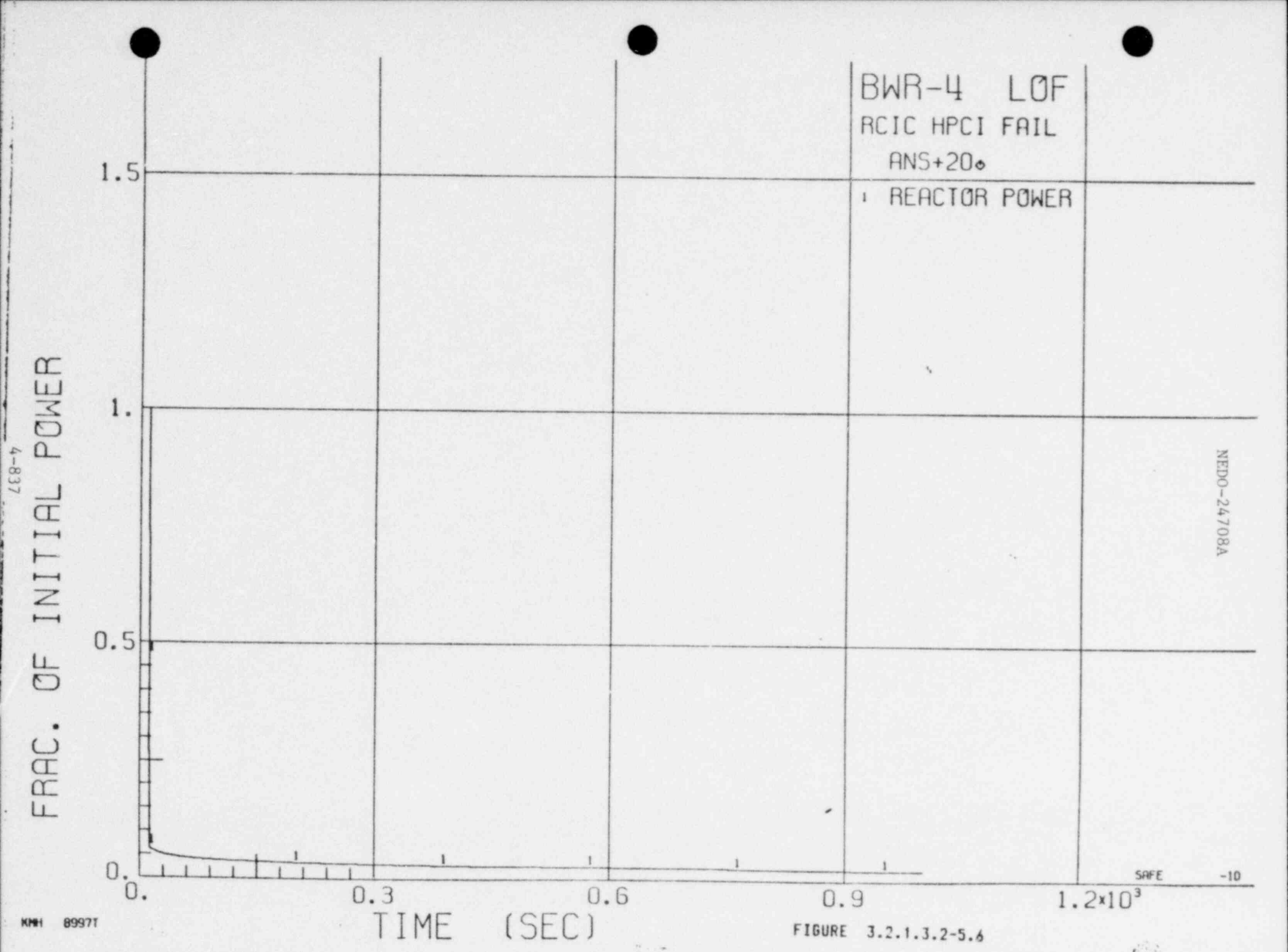

FIGURE 3.2.1.3.2-5.6

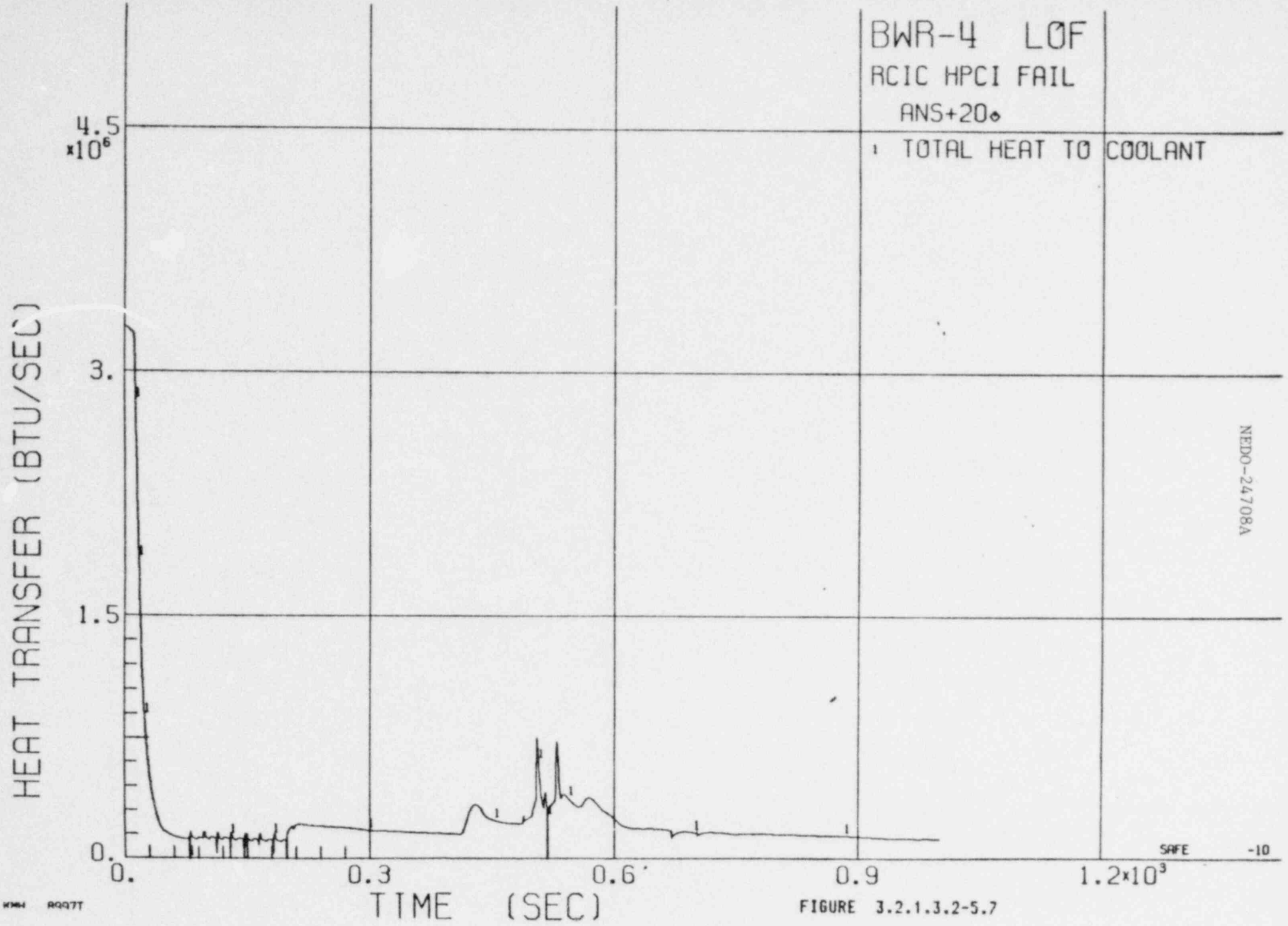

FIGURE 3.2.1.3.2-5.7

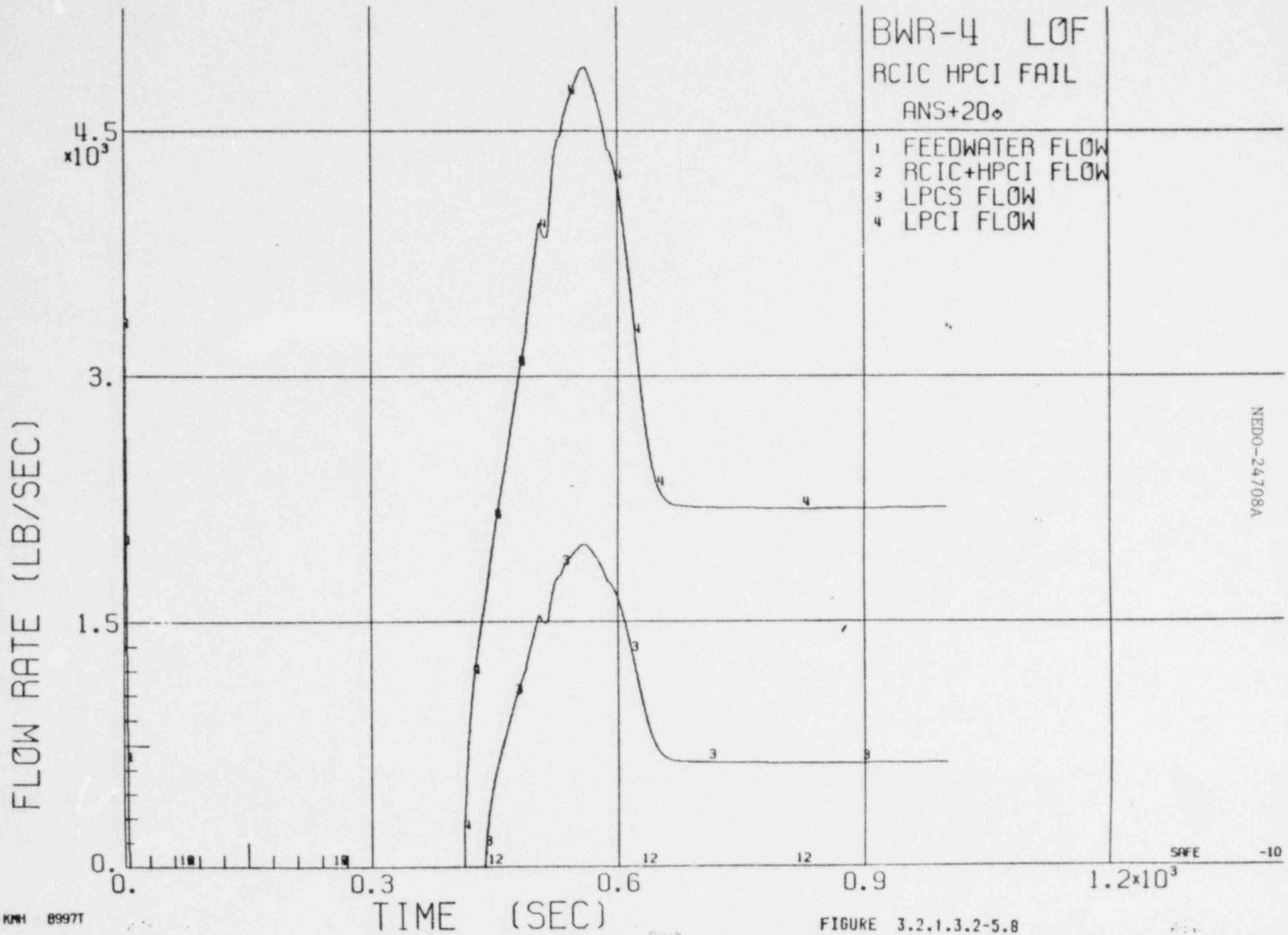

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FIGURE 3.2.1.3.2-5.8

Table 3.2.2.1.1-1

SEQUENCE OF EVENTS*

LOSS OF FEEDWATER HEATING (AUTOMATIC CONTROL)

Time-sec	Event
0	Initiate a 100°F temperature reduction in the feedwater system.
4	Initial effect of unheated feedwater starts to raise core power level but flow control system automatically reduces core flow to maintain initial steam flow.
80	Reactor settles out at a higher thermal power level.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.1.1-2

SEQUENCE OF EVENTS*

LOSS OF FEEDWATER HEATING (MANUAL CONTROL)

Time-sec	Event
0	Initiate a 100°F temperature reduction into the feedwater system.
4	Initial effect of unheated feedwater starts to raise core power level and steam flow.
44	APRM initiates reactor scram on high thermal power.
50	L8 vessel level set point trips main turbine and feedwater pumps.
50.01	Recirculation pump trip (RPT) is actuated by turbine stop valve position switches.
>100 (est)	L2 vessel level set point initiates main steam line isolation, and HPCI and RCIC operation.
>100 (est)	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.1.1.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS LOSS OF FEEDWATER HEATING

Event	Time, sec	
	LOF	LOFH
Feedwater pumps trip	0	50
Reactor scram	7	44
HPCI/RCIC low-level initiation	16	~100
MSIV isolation initiation	16	~100
SRV actuation	30	~100
HPCI/RCIC injection	46	~130

Table 3.2.2.1.2-1

SEQUENCE OF EVENTS*

FEEDWATER CONTROLLER FAILURE - MAXIMUM DEMAND

Time-Sec	Event
0	Initiate simulated failure of 129% upper limit on feedwater flow.
16.65	L8 vessel level set point trips main turbine and feedwater pumps.
16.66 (est)	Reactor scram initiated from main turbine stop valve position switches.
16.66	Recirculation pump trip (RPT) actuated by stop valve position switches.
16.70	Main turbine bypass valves open.
18.30	First group of safety/relief valves open due to high pressure.
24.60	First group of safety/relief valves close.
>50 (est)	Turbine bypass valves closed.
>50 (est)	L2 vessel level set point initiates main steam line isolation and HPCI and RCIC operation.
>50 (est)	SRVs cycle to release decay heat.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumption made.

Table 3.2.2.1.2.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS FEEDWATER CONTROLLER FAILURE - MAXIMUM DEMAND

Event	Time, sec	
	LOF	FCF-MD
Feedwater pumps trip	0	17
Reactor scram	7	17
HPCI/RCIC low-level initiation	16	>50
MSIV isolation initiation	16	>50
SRV actuation	30	>18
HPCI/RCIC injection	46	>80

Table 3.2.2.1.3-1

SEQUENCE OF EVENTS*

PRESSURE REGULATOR FAILURE - OPEN

Time-sec	Event
0	Maximum limit on steam flow to main turbine initiated.
0.2	Main turbine bypass opens.
19.97	L8 vessel level set point trips main turbine and feedwater pumps.
19.98 (est)	Reactor scram initiated from main turbine stop valve position switches.
19.98	Recirculation pump trip (RPT) actuated by stop valve position switches.
>50 (est)	Main steam line isolation valves closed on low turbine inlet pressure.
>50 (est)	SRVs cycle to release decay heat.
>50 (est)	L2 vessel level set point initiates RCIC and HPCI operation.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.1.3.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS PRESSURE REGULATOR FAILURE - OPEN

Event	Time, sec	
	LOF	PRF-0
Feedwater pumps trip	0	20
Reactor scram	7	20
HPCI/RCIC low-level initiation	16	>50
MSIV isolation initiation	16	>50
SRV actuation	30	>50
HPCI/RCIC injection	46	>80

Table 3.2.2.2.2-1

SEQUENCE OF EVENTS*

GENERATOR LOAD REJECTION

Time-sec	Event
(-)0.015 (Approx.)	Turbine-generator detection of loss of electrical load.
0	Turbine-generator power load unbalance (PLU) devices trip to initiate turbine control valve fast closure.
0	Turbine-generator PLU trip initiates main turbine bypass system operation.
0.01	Fast control valve closure (FCV) initiates scram trip and recirculation pump trip.
0.1	Turbine bypass valves start to open.
0.15	Turbine control valves closed.
1.8	Group 1 relief valves actuated.
1.9	Group 2 relief valves actuated.
2.1	Group 3 relief valves actuated.
4.3	L8 vessel level set point initiates feedwater pump trips.
7.9	All relief valves close.
47.0 (est)	L2 vessel level set point initiates main steamline isolation, and HPCI and RCIC operation.
>50 (est)	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence only as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.2-2

SEQUENCE OF EVENTS*

GENERATOR LOAD REJECTION WITH BYPASS FAILURE

Time-sec	Event
(-)0.015 (Approx.)	Turbine-generator detection of loss of electrical load.
0	Turbine-generator power load unbalance (PLU) devices trip to initiate turbine control valve fast closure.
0	Turbine bypass valves fail to operate.
0.01	Fast control valve closure (FCV) initiates scram trip and recirculation pump trip.
0.15	Turbine control valves closed.
1.3	Group 1 relief valves actuated.
1.4	Group 2 relief valves actuated.
1.5	Group 3 relief valves actuated.
6.7	L8 vessel level set point initiates feedwater pump trips.
14.5	All relief valves close.
20	SRVs actuate and then close.
32.8	L2 vessel level set point initiates main steamline isolation and HPCI and RCIC operations.
>35	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence only as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.2.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS GENERATOR LOAD REJECTION

Event	Time, sec	
	LOF	LR
Feedwater pumps trip	0	4*-7
Reactor scram	7	0.01
HPCI/RCIC low-level initiation	16	32-47
MSIV isolation initiation	16	32-47
SRV actuation	30	1-2
HPCI/RCIC injection	46	62-77

*Shorter times are with failure of bypass

Table 3.2.2.2.3-1

SEQUENCE OF EVENTS*

TURBINE TRIP

Time-sec	Events
0	Turbine trip initiates closure of main stop valves.
0	Turbine trip initiates bypass operation.
0.1	Main turbine stop valves reach 90% open position and initiate reactor scram trip and recirculation pump trip.
0.1	Turbine stop valves closed.
0.1	Turbine bypass valves start to open to regulate pressure.
1.8	Group 1 relief valves actuated.
2.0	Group 2 relief valves actuated.
2.2	Group 3 relief valves actuated.
4.3	L8 vessel level set point initiates feedwater pump trips.
7.7	All relief valves close.
47.5 (est)	L2 vessel level set point initiates main steamline isolation, and HPCI and RCIC operation.
>50 (est)	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.3-2

SEQUENCE OF EVENTS*

TURBINE TRIP WITH BYPASS FAILURE

Time-sec	Event
0	Turbine trip initiates closure of main stop valves.
0	Turbine bypass valves fail to operate.
0.01	Main turbine stop valves reach 90% open position and initiate reactor scram trip and recirculation pump trip.
0.1	Turbine stop valves closed.
1.4	Group 1 relief valves actuated.
1.5	Group 2 relief valves actuated.
1.6	Group 3 relief valves actuated.
6.6	L8 vessel level set point initiates feedwater pump trips.
19.3	All relief valves actuated again.
20	SRVs actuate and then close.
33.0	L2 vessel level set point initiates main steamline isolation, and HPCI and RCIC operations.
>35	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.3.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS TURBINE TRIP

Event	Time, sec	
	LOF	TT
Feedwater pumps trip	0	4*-7
Reactor scram	7	0.1
HPCI/RCIC low-level initiation	16	33-48
MSIV isolation initiation	16	33-48
SRV actuation	30	1-2
HPCI/RCIC injection	46	63-78

*Shorter times are with failure of bypass.

Table 3.2.2.2.4-1

SEQUENCE OF EVENTS*

CLOSURE OF ALL MAIN STEAM LINE ISOLATION VALVES

Time-sec	Event
0	Initiate closure of all main steam line isolation valves (MSIV).
0.3	MSIVs reach 90% position.
0.3	MSIV position trip scram initiated.
2.62	High pressure set point reached.
2.7	Relief valves open (3 groups) due to pressure relief set point action.
2.92	High pressure recirculation pump trip initiated.
15.9	All relief valves close.
20	SRVs actuate and then close.
28.5	L2 vessel level set point initiate HPCI and RCIC systems operation.
>30	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.4.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS CLOSURE OF ALL MSIVs

Event	Time, sec	
	LOF	MSIVC
Feedwater pumps trip	0	>5
Reactor scram	7	0.3
HPCI/RCIC low-level initiation	16	29
MSIV isolation initiation	16	0
SRV actuation	30	3
HPCI/RCIC injection	46	59

Table 3.2.2.2.5-1

TYPICAL RATES OF DECAY FOR CONDENSER VACUUM

	Cause	Estimated Vacuum Decay Rate
a.	Failure or Isolation of Steam Jet Air Ejectors	<1 inch Hg/minute
b.	Loss of Sealing Steam to Shaft Gland Seals	~1 to 2 inches Hg/minute
c.	Opening of Vacuum Breaker Valves	~2 to 12 inches Hg/minute

Table 3.2.2.2.5-2

TRIP SIGNALS ASSOCIATED WITH LOSS OF CONDENSER VACUUM

Vacuum (inches of Hg)	Protective Action Initiated
27 to 28	Normal Vacuum Range
20 to 23	Main Turbine Trip and Feedwater Turbine Trip (Stop Valve Closure)
7 to 10	Main Steam Line Isolation Valve (MSIV) Closure and Bypass Valve Closure

Table 3.2.2.2.5-3

SEQUENCE OF EVENTS*

LOSS OF CONDENSER VACUUM

Time-sec	Event
<0	Initiate simulated loss of condenser vacuum at 2 inches Hg per second.
0	Low condenser vacuum main turbine trip actuated.
0	Low condenser vacuum feedwater trip actuated.
0.01	Main turbine trip initiates reactor scram and recirculation pump trip.
1.9	Group 1 relief valves set points actuated.
2.1	Group 2 relief valves set points actuated.
2.2	Group 3 relief valves set points actuated.
5.0	Low condenser vacuum initiates main steam line isolation valve closure.
5.0	Low condenser vacuum initiates bypass valve closure.
13.6	All relief valves close.
17	SRVs actuate and then close.
26.0 (est)	HPCI/RCIC system initiation on low level (L2).
>26	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.5.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS LOSS OF CONDENSER VACUUM

Event	Time, sec	
	LOF	LCV
Feedwater pumps trip	0	0
Reactor scram	7	0.01
HPCI/RCIC low-level initiation	16	26
MSIV isolation initiation	16	5
SRV actuation	30	2
HPCI/RCIC injection	46	56

Table 3.2.2.2.6-1

SEQUENCE OF EVENTS*

LOSS OF AUXILIARY POWER TRANSFORMER

Time-sec	Event
0	Loss of auxiliary power transformer occurs.
0	Recirculation system pump motors are tripped.
0	Booster pumps are tripped.
0	Condenser circulating water pumps tripped.
2.0	Reactor scram initiated.
2.0	Closure of main steam line isolation valves.
4.0	Feedwater pumps are tripped.
5.0	All SRVs actuated.
12.0	All SRVs close.
>17.0	SRVs cycle to release decay heat.
43 (est)	L2 vessel level set point initiates HPCI and RCIC operation.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.6-2

SEQUENCE OF EVENTS*

LOSS OF ALL GRID CONNECTIONS

Time-sec	Event
(-)0.015 (Approx.)	Loss of grid causes turbine-generator to detect a loss of electrical load.
0	Generator load rejection is initiated (control valve fast closure).
0	Turbine-generator PLU trip initiates main turbine bypass system operation.
0	Recirculation system pump motors are tripped.
0	Fast control valve closure (FCV) initiates a reactor scram trip.
0.1	Turbine bypass valves open.
0.15	Turbine control valves closed.
1.8	Group 1 safety relief valves actuated.
2.0	Closure of main steam line isolation valves.
2.0	Group 2 safety relief valves actuated.
2.2	Group 3 safety relief valves actuated.
4.0	Feedwater pump trips initiated.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.2.6-2 (Continued)

Time-sec	Event
14.1	All safety relief valves close.
>17.0	SRVs cycle to release decay heat.
41.9 (est)	L2 vessel level set point initiates HPCI and RCIC.

Table 3.2.2.2.6.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS LOSS OF AC POWER

Event	Time, sec	
	LOF	LOACP
Feedwater pumps trip	0	4
Reactor scram	7	0-2*
HPCI/RCIC low-level initiation	16	42-43
MSIV isolation initiation	16	2
SRV actuation	30	2-5
HPCI/RCIC injection	46	72-73

*Shorter times are due to loss of all grid connections; longer times are due loss of auxiliary power.

Table 3.2.2.3.1-1

SEQUENCE OF EVENTS*

TRIP OF ONE RECIRCULATION PUMP

Time-sec	Event
0	Trip of one recirculation pump initiated.
5.0	Vessel water level (L8) trip initiates turbine trip.
5.0	Feedwater pumps are tripped off.
5.0	Turbine trip initiates bypass operation.
5.0	Turbine trip initiates reactor scram trip.
5.2	Turbine trip initiates trip of the second recirculation pump.
9.3	Group 1 pressure relief valves open.
12.6	Group 1 pressure relief valves close.
48.0 (est)	L2 vessel level set point initiates main steam line isolation and RCIC and HPCI operation.
>50 (est)	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.3.1-2

SEQUENCE OF EVENTS*

TRIP OF TWO RECIRCULATION PUMPS

Time-sec	Event
0	Trip of both recirculation pumps initiated.
3.4	Vessel water level (L8) trip initiates turbine trip.
3.4	Feedwater pumps are tripped off.
3.4	Turbine trip initiates bypass operation.
3.4	Turbine trip initiates reactor scram trip.
6.7	Group 1 pressure relief valves open.
10.1	Group 1 pressure relief valves open.
46.6 (est)	L2 vessel level set point initiates main steam line isolation and RCIC and HPCI operation.
>50 (est)	SRVs cycle to release decay heat.

*NOTE: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.3.1.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS RECIRCULATION PUMP TRIP

Event	Time, sec	
	LOF	RPT
Feedwater pumps trip	0	2-5*
Reactor scram	7	2-5
HPCI/RCIC low-level initiation	16	45-48
MSIV isolation initiation	16	45-48
SRV actuation	30	5-9
HPCI/RCIC injection	46	75-78

*Shorter times are for recirculation pump seizure and two recirculation pump trips; longer times are for single recirculation pump trip.

Table 3.2.2.3.3-1

SEQUENCE OF EVENTS*

RECIRCULATION PUMP SEIZURE

Time-sec	Event
0	Single pump seizure.
0.77	Jet pump diffuser flow reverses in seized loop.
2.5	Vessel level (L8) trip initiates turbine trip.
2.5	Feedwater pumps are tripped off.
2.5	Turbine trip initiates bypass operation.
2.5	Turbine trip initiates reactor scram trip.
2.7	Turbine trip initiates trip of the second recirculation pump.
5.5	Group 1 pressure relief valves open.
8.7	Group 1 pressure relief valves close.
45.2 (est)	Initiation of L2 vessel level set point isolation of main steam line and HPCI and RCIC operation.
>50 (est)	SRVs cycle to release decay heat.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.4.2-1

SEQUENCE OF EVENTS*

RWE IN POWER RANGE

Elapsed Time	
0	Core is assumed to be operating at rated conditions.
0	Operator selects and withdraws the maximum worth control rod.
1 sec	The total core power and the local power in the vicinity of the control rod increase.
5 sec	The LPRM system indicates excessive localized peaking.
5 sec	The operator ignores warning and continues withdrawal.
15 sec	The RBM system indicates excessive localized peaking.
15 sec	The operator ignores warning and continues withdrawal.
20 sec	The RBM system initiates a rod block inhibiting further withdrawal.
40 sec	Reactor core stabilizes at higher core power level.
60 sec	Operator reinserts control rod to reduce core power level.
80 sec	Core stabilizes at rated conditions.

*NOTE: This sequence of event represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumption made.

Table 3.2.2.4.3-1

SEQUENCE OF EVENTS*

ABNORMAL STARTUP OF IDLE RECIRCULATION PUMP

Time-sec	Event
0	Start pump motor.
9.8	Startup loop flow reverses.
10.3	Reactor high flux scram initiated.
50	Vessel level returns to normal and stabilizes.

*NOTE: This sequence of events represents one possible or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.4.4-1

SEQUENCE OF EVENTS*

RECIRCULATION FLOW CONTROL FAILURE WITH INCREASING FLOW

Time-Sec	Event
0	Simulate failure of single loop control.
2.7	Reactor high flux scram trip initiated.
40	Vessel level returns to normal and stabilizes.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.4.5-1

SEQUENCE OF EVENTS*

CONTROL ROD DROP ACCIDENT

Approximate Elapsed Time	Event
<0	Reactor is operator at 50% rod density pattern.
<0	RWM is not functioning.
<0	Maximum worth control rod blade becomes decoupled from the CRD.
<0	Operator selects and withdraws the control rod drive of the decoupled rod.
<0	Decoupled control rod sticks in the fully inserted or an intermediate bank position.
0	Control rod becomes unstuck and drops to the drive position at the nominal measured velocity plus three standard deviations.
<1 second	Reactor goes on a positive period and the initial power increase is terminated by the Doppler coefficient.
<1 second	APRM 120% power signal scrams reactor.
<5 seconds	Scram terminates accident.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.5.1-1

SEQUENCE OF EVENTS*

INADVERTENT HPCI PUMP START

Time-sec	Event
0	HPCI cold water injection initiated.
1	Full flow established for HPCI.
16.1	Reactor high flux scram initiated.
20.3	L8 vessel level set point trips main turbine, feedwater pumps, and HPCI.
20.3	Turbine trip initiates bypass operation.
21.31	Turbine trip initiates recirculation pump trip (RPT).
>50 (est)	L2 vessel level set point initiates isolation of main steam lines, and HPCI and RCIC operations.
>50 (est)	SRVs cycle to release decay heat.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.

Table 3.2.2.3.1.3-1

COMPARISON OF EVENTS

LOSS OF FEEDWATER VERSUS INADVERTENT HPCI PUMP START

Event	Time, sec	
	LOF	HPCI
Feedwater pumps trip	0	20
Reactor scram	7	16
HPCI/RCIC low-level initiation	16	>50
MSIV isolation initiation	16	>50
SRV actuation	30	>50
HPCI/RCIC injection	46	>80

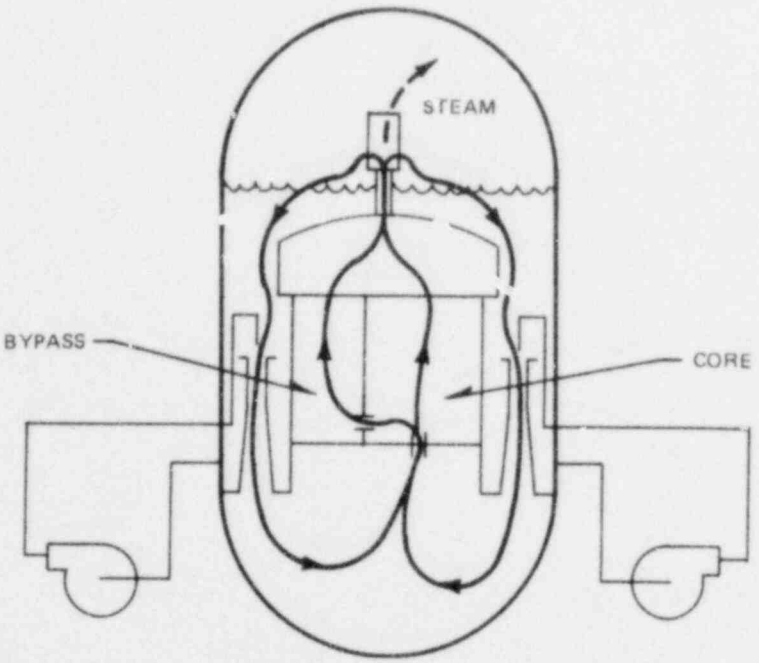
Table 3.2.2.6.1-1

SEQUENCE OF EVENTS*

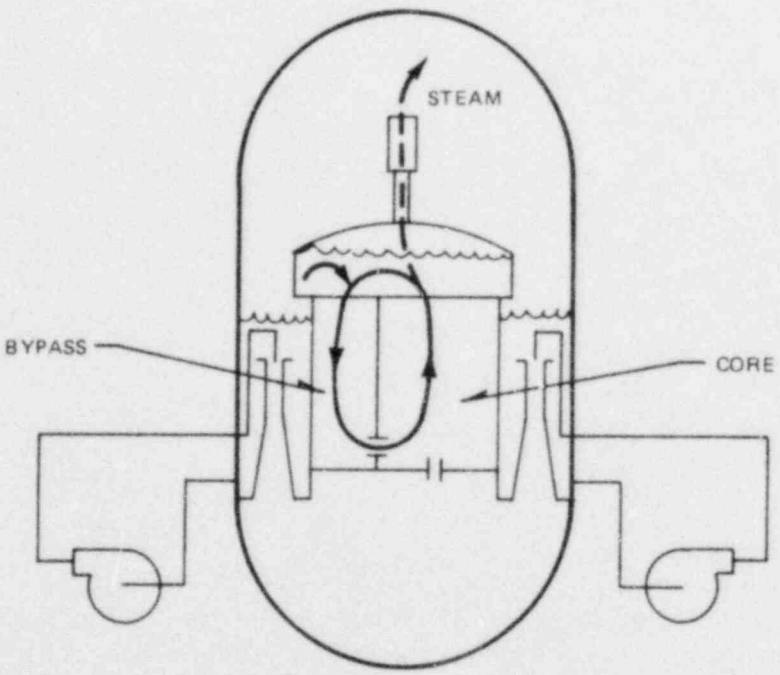
INSTRUMENT LINE BREAK

Time	Event
0	Instrument line fails.
0-10 min	Identification of break attempted.
10 min	Activation of RHR and initiate orderly shutdown.
5 hours	Reactor vessel depressurized and break flow terminated.

*Note: This sequence of events represents one possible sequence or a bounding sequence as defined in Chapter 15. Other event sequences can occur, depending on the assumptions made.



A. NORMAL NATURAL CIRCULATION



B. INTERNAL LOOP CIRCULATION

Figure 3.3.1-1. BWR Natural Circulation

Table 3.3.2-1

POTENTIAL DELAY IN UNCOVERY TIME AFFORDED BY RECIRCULATION PUMP FLOW DURING POSTULATED EXTREMELY DEGRADED SBAs - 218/BWR/4

Case No.	Event	Systems Operable	Uncovery Time, t_{unc} sec.	Pressure @ Uncovery psia	Decay Heat %	Core Heat Rate Btu/Sec	Core Vaporization Potential Btu	Potential Delay Δt_{unc}
1	0.01 ft^2 Recirc Brk with LOF and SORV	RCIC+ADS+CRD	600	160	2.2→1.9	49,000	43,000,000	860
2	0.002 ft^2 Recirc Brk with LOF and SORV	RCIC+ADS+CRD	880	130	2.0→1.85	46,000	44,000,000	950
3	0.08 ft^2 Recirc rk with LOF and SOR	HPCI+ADS	1030	72	1.9→1.8	44,000	46,000,000	1050

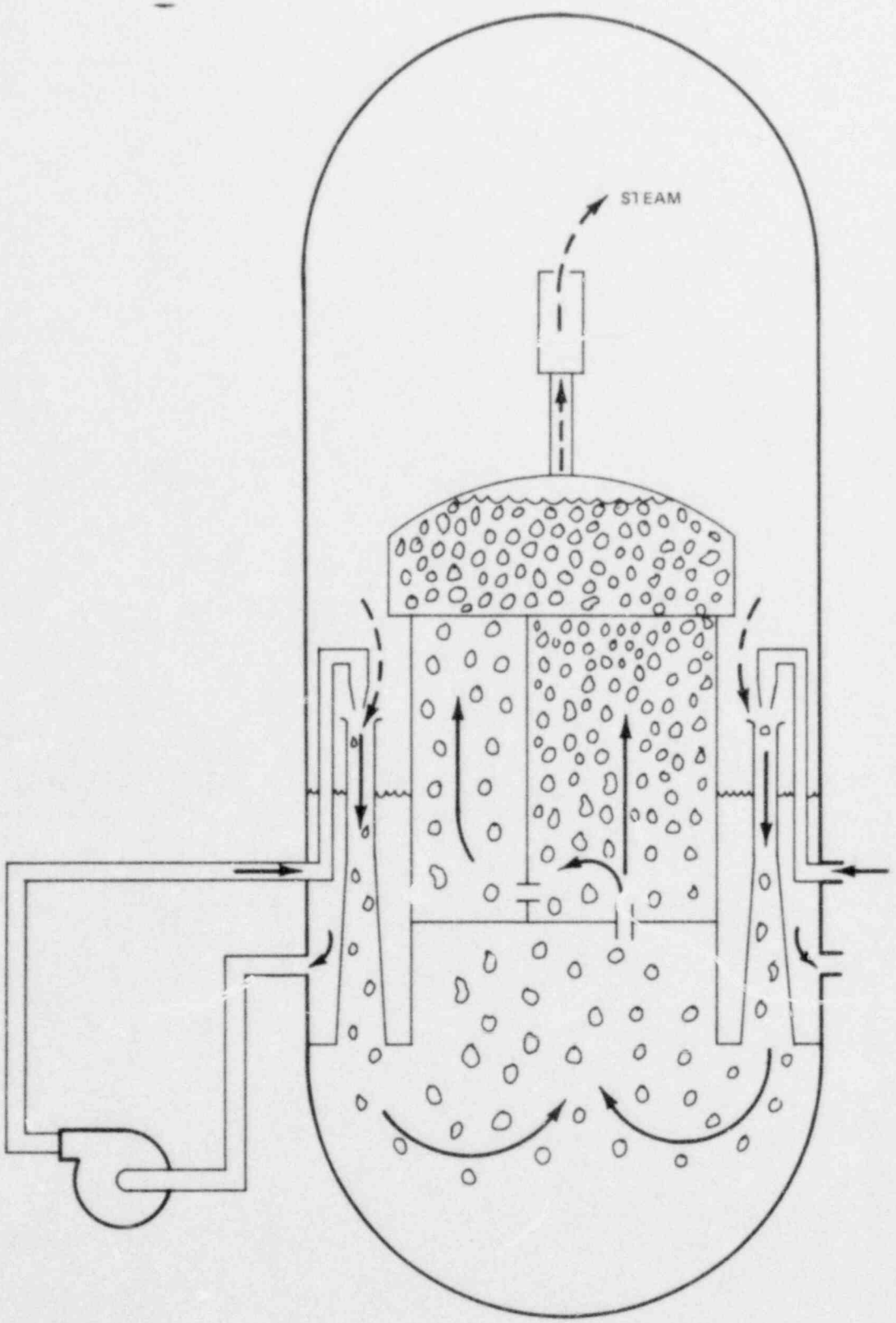


Figure 3.3.2 1. Recirculation Pump Operation with Downcomer Level Below the Jet Pump Suction

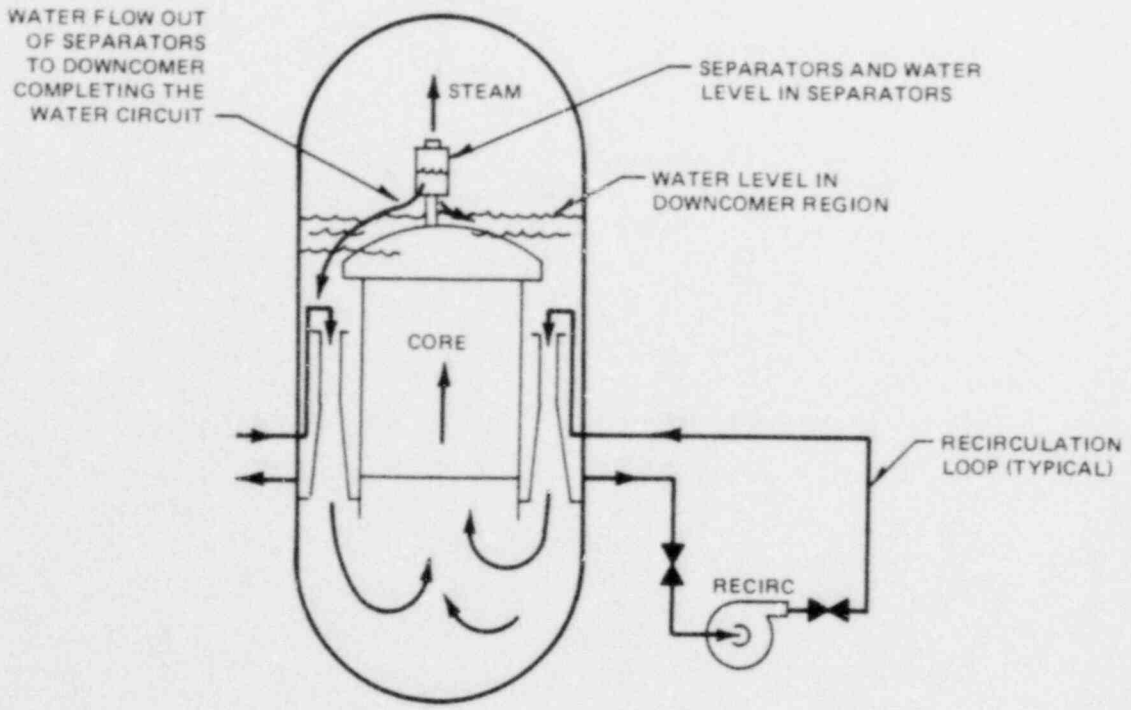


Figure 3.3.2-2. Forced Core Flow Circulation Conditions

Table 3.4-1

BWR 4/5 FREQUENCY OF EVENTS

Events	Design Frequency* (40 Years)	S/R Valves Lifted on Initial Pressure Peak (all to 2/3)	(2/3 to 1/3)	(1/3 to 0)	Isolation Type Event
Turbine Trip (W/BP)	51	x			No
Load Rejection (W/BP)	29	x			No
Pressure Regulator Failure	26		x		Yes
Feedwater Controller Failure	19		x		Yes
Trip of Both Recirculation Pumps	10		x		Yes
Recirculation Controller Failure	10		x		Yes
Loss of Feedwater Flow	29			x	Yes
Loss of Auxiliary Power	10	x			Yes
Closure of All MSIV's	38	x			Yes
Loss of Condenser Vacuum	26	x			Yes
Inadvertent Relief Valve Opening	4			x	No
Turbine Trip (W/O BP)	1	x			Yes
Load Rejection (W/O BP)	1	x			Yes

Table 3.4-1a

BWR/6 EVENTS WHICH ACTIVATE RELIEF VALVES

Events	S/R Valves Lifted on Initial Pressure Peak (all to 2/3)	(2/3 to 1/2)	(1/3 to 0)	Isolation Type Event
Turbine Trip (W/BP)	X			No
Load Rejection (W/BP)	X			No
Pressure Regulator Failures		X		Yes
Feedwater Controller Failure		X		No
Trip of Both Recirculation Pumps		X		No
Recirculation Controller Failure		X		No
Loss of Feedwater Flow			X	No
Loss of Auxiliary Power	X			Yes
Closure of All MSIV's	X			Yes
Loss of Condenser Vacuum	X			Yes
Inadvertent Relief Valve Opening			X	No
Turbine Trip (W/O BP)	X			Yes
Load Rejection (W/O BP)	X			Yes

Table 3.5.2.1-1

SUMMARY OF CASES PRESENTED

3.5.2.1.1 1 LPCS System + ADS Only

3.5.2.1.1.1 Liquid Breaks

BWR/2	0.001 ft^2 Suction Break	Figure Group 3.5.2.1-1
BWR/4	0.001 ft^2 Suction Break	Figure Group 3.5.2.1-2
BWR/2	0.1 ft^2 Suction Break	Figure Group 3.5.2.1-3
BWR/4	0.1 ft^2 Suction Break	Figure Group 3.5.2.1-4
BWR/6	0.1 ft^2 Suction Break	Figure Group 3.5.2.1-5
BWR/2	DBA Recirculation Break	Figure Group 3.5.2.1-6
BWR/4	DBA Suction Break	Figure Group 3.5.2.1-7

3.5.2.1.1.2 Steam Breaks

BWR/2	0.1 ft^2 Steamline Break	Figure Group 3.5.2.1-8
BWR/4	0.1 ft^2 Steamline Break	Figure Group 3.5.2.1-9
BWR/2	0.5 ft^2 Outside Steamline Break	Figure Group 3.5.2.1-10
BWR/4	0.5 ft^2 Outside Steamline Break	Figure Group 3.5.2.1-11

3.5.2.1.2 1 LPCI Pump + ADS Only

3.5.2.1.2.1 Liquid Breaks

BWR/4	0.001 ft^2 Suction Break	Figure Group 3.5.2.1-12
BWR/4	0.1 ft^2 Suction Break	Figure Group 3.5.2.1-13
BWR/6	0.1 ft^2 Suction Break	Figure Group 3.5.2.1-14
BWR/4	DBA Suction Break	Figure Group 3.5.2.1-15

3.5.2.1.2.2 Steam Breaks

BWR/4	0.1 ft^2 Steamline Break	Figure Group 3.5.2.1-16

3.5.2.1.3 Power Source Failure

Table 3.5.2.1-1 (Continued)

3.5.2.1.3.1 Liquid Breaks

BWR/4	0.1 ft^2	Suction Breaks		Figure Group 3.5.2.1-17
BWR/6	0.1 ft^2	Suction Breaks		Figure Group 3.5.2.1-18

3.5.2.1.3.2 Steam Breaks

BWR/4	0.1 ft^2	Inside Steamline Break		Figure Group 3.5.2.1-19
BWR/6	0.1 ft^2	Inside Steamline Break		Figure Group 3.5.2.1-20

3.5.2.1.4 LPCI Diversion

BWR/6	0.022 ft	Core Spray Line Break		Figure Group 3.5.2.1-21

3.5.2.1.5 Failure to Actuate ADS

3.5.2.1.5.1 Liquid Breaks

BWR/2	0.1 ft^2	Suction Break	W/1LPCS	Figure Group 3.5.2.1-22
BWR/6	0.1 ft^2	Suction Break	W/1LPCI	Figure Group 3.5.2.1-23
BWR/6	0.1 ft^2	Suction Break	W/1LPCI (Recirculation Pumps On)	Figure Group 3.5.2.1-24

3.5.2.1.5.2 Steam Breaks

BWR/6	0.1 ft^2	Steamline Break	W/1LPCI	Figure Group 3.5.2.1-25

3.5.2.1.5.3 No Break With Isolation

BWR/6	Isolation Event		W/LPS	Figure Group 3.5.2.1-26

Table 3.5.2.1-1 (Continued)

BWR/6	Isolation Event	W/LPCS (Recirculation Pumps On)	Figure Group 3.5.2.1-27

3.5.2.1.5.4 Mitigating Actions

3.5.2.1.5.4.1 High Pressure Injection

BWR/6	Isolation Event	W/HPCS	Figure Group 3.5.2.1-28

3.5.2.1.5.4.2 Isolation Condensers

BWR/2	Isolation Event	W/Isolation Condensers and 1LPCS	Figure Group 3.5.2.1-29

3.5.2.1.5.4.3 Manual ADS

BWR/6	Isolation Event	W/1LPCI, 1 SRV OPEN*	Figure Group 3.5.2.1-30
BWR/6	Isolation Event	W/1LPCI, 3 SRVs OPEN*	Figure Group 3.5.2.1-31
BWR/6	Isolation Event	W/1LPCI, 5 SRVs	Figure Group 3.5.2.1-32
BWR/6	Isolation Event	W/1LPCI, 7 SRVs OPEN*	Figure Group 3.5.2.1-33

*SRVs actuated at L1 plus 600 seconds

Table 3.5.2.1-1 (Continued)

BWR/6	Isolation Event		W/1LPCI, 7 SRVs OPEN*	Figure Group 3.5.2.1-33
3.5.2.1.6	Failure of Low Pressure Systems to Inject			
BWR/4	0.1 ft^2	Suction Break	W/HPCI, ADS @ 600 SEC	Figure Group 3.5.2.1-34
BWR/6	0.05 ft^2	Suction Break	W/HPCS, ADS @ 600 SEC	Figure Group 3.5.2.1-35
3.5.2.1.7	Stuck Open Relief Valve			
BWR/4	Isolation Event		W/SORV, No ECCS	Figure Group 3.5.2.1-36
BWR/4	Isolation Event		W/SORV and 1LPCI	Figure Group 3.5.2.1-37

*SRVs actuated at L1 plus 600 seconds

Table 3.5.2.1-2

SUMMARY AND CONCLUSIONS

Initiating Event	Systems Failed	Systems Available	Operator Actions
LIQUID BREAK	FDWR, HPCI/HPCS RCIC, CRD, IC	1 LPCI/1 LPCS ADS	NONE
STEAM BREAK INSIDE CONTAINMENT	FDWR, HPCI/HPCS RCIC, CRD, IC	1 LPCI, 1 LPCS ADS	NONE
STEAM BREAK OUTSIDE CONTAINMENT	FDWR, HPCI/HPCS RCIC, CRD, IC	1 LPCI, 1 LPCS ADS	MANUAL ADS
STUCK OPEN RELIEF VALVE	FDWR, HPCI/HPCS RCIC, CRD, IC	1 LPCI, 1 LPCS ADS	MANUAL ADS
LOSS OF FEEDWATER	FDWR, HPCI/HPCS RCIC, CRD, IC	1 LPCI, 1 LPCS ADS	MANUAL ADS
LIQUID BREAK	FDWR, HPCI/HPCS RCIC, CRD, IC, LPCI LPCI or LPCS	1 LPCS, or 1 LPCI ADS	NONE
STEAM BREAK INSIDE CONTAINMENT	FDWR, HPCI/HPCS RCIC, CRD, IC, LPCI	1 LPCS or 1 LPCI ADS	NONE
STUCK OPEN RELIEF VALVE	FDWR, HPCI/HPCS RCIC, CRD, IC, LPCI	1 LPCS or 1 LPCI ADS	MANUAL ADS
STEAMLINE BREAK OUTSIDE CONTAINMENT	FDWR, HPCI/HPCS RCIC, CRD, IC, LPCI	1 LPCS or 1 LPCI ADS	MANUAL ADS
LOSS OF FEEDWATER	FDWR, HPCI/HPCS RCIC, CRD, IC, LPCI LPCI or LPCS	1 LPCS or 1 LPCI ADS	MANUAL ADS

Table 3.5.2.1-2 (Continued)

Initiating Event	Systems Failed	Systems Available	Operator Actions
LIQUID BREAK	FDWR, HPCI/HPCS RCIC, CRD, IC, ADS LPCI or LPCS	1 LPCS or 1 LPCI	MANUALLY DEPRESSURIZE OR RESTART HPS
STEAM BREAK INSIDE CONTAINMENT	FDWR, HPCI/HPCS RCIC, CRD, IC, ADS LPCI or LPCS	1 LPCS or 1 LPCI	MANUALLY DEPRESSURIZE OR RESTART HPS
STEAM BREAK OUTSIDE CONTAINMENT	FDWR, HPCI/HPCS RCIC, CRD, IC, ADS LPCI or LPCS	1 LPCS or 1 LPCI	MANUALLY DEPRESSURIZE OR RESTART HPS
STUCK OPEN RELIEF VALVE	FDWR, HPCI/HPCS RCIC, CRD, IC, ADS LPCI or LPCS	1 LPCS or 1 LPCI	MANUALLY DEPRESSURIZE OR RESTART HPS
LOSS OF FEEDWATER	FDWR, HPCI/HPCS RCIC, CRD, IC, ADS LPCI or LPCS	1 LPCS or 1 LPCI	MANUALLY DEPRESSURIZE OR RESTART HPS
STEAMLINE BREAK OUTSIDE CONTAINMENT OR LOSS OF FEEDWATER	FDWR, HPCI/HPCS RCIC, CRD, ADS LPCI or LPCS	1 LPCI or LPCS IC	NONE

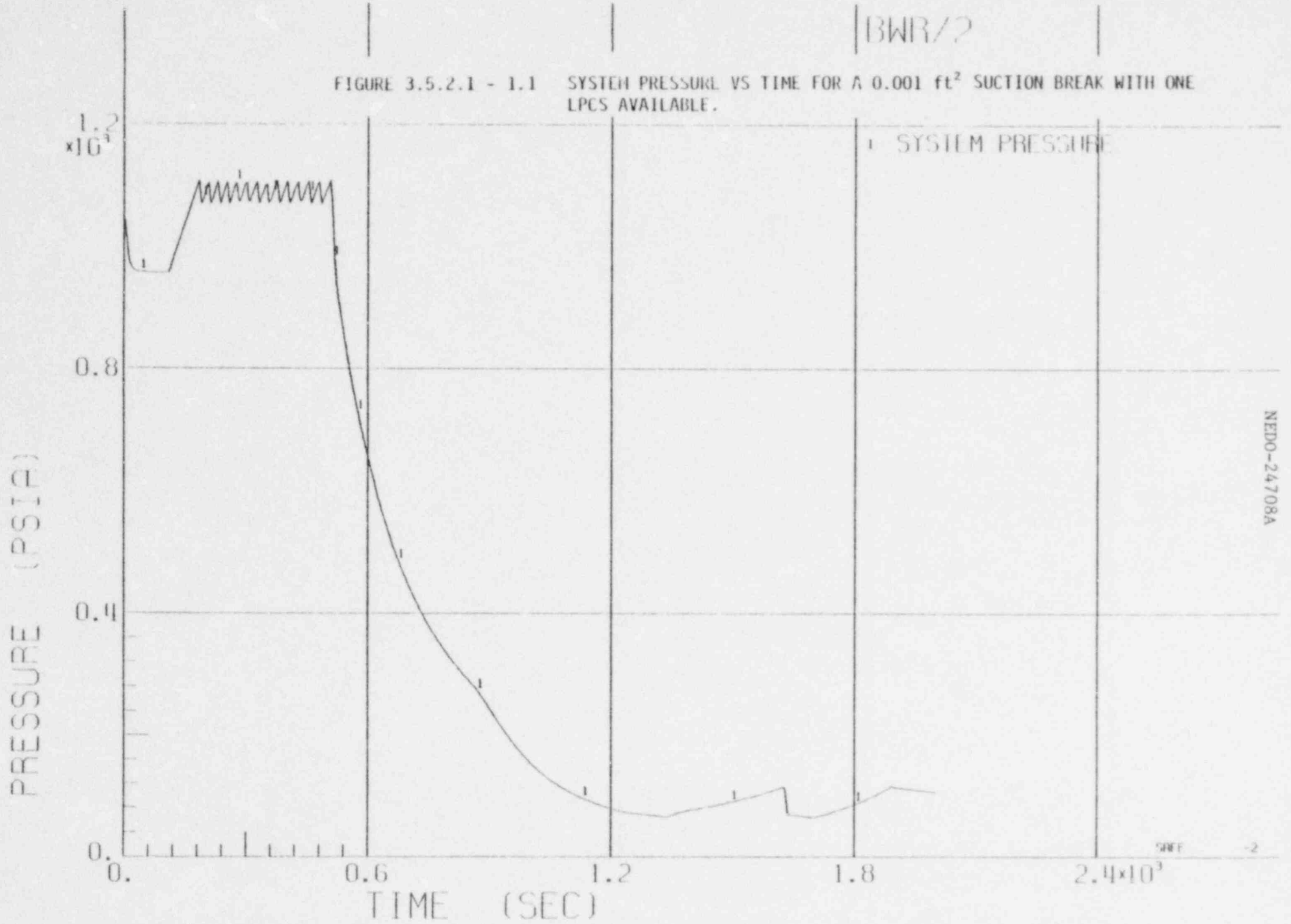
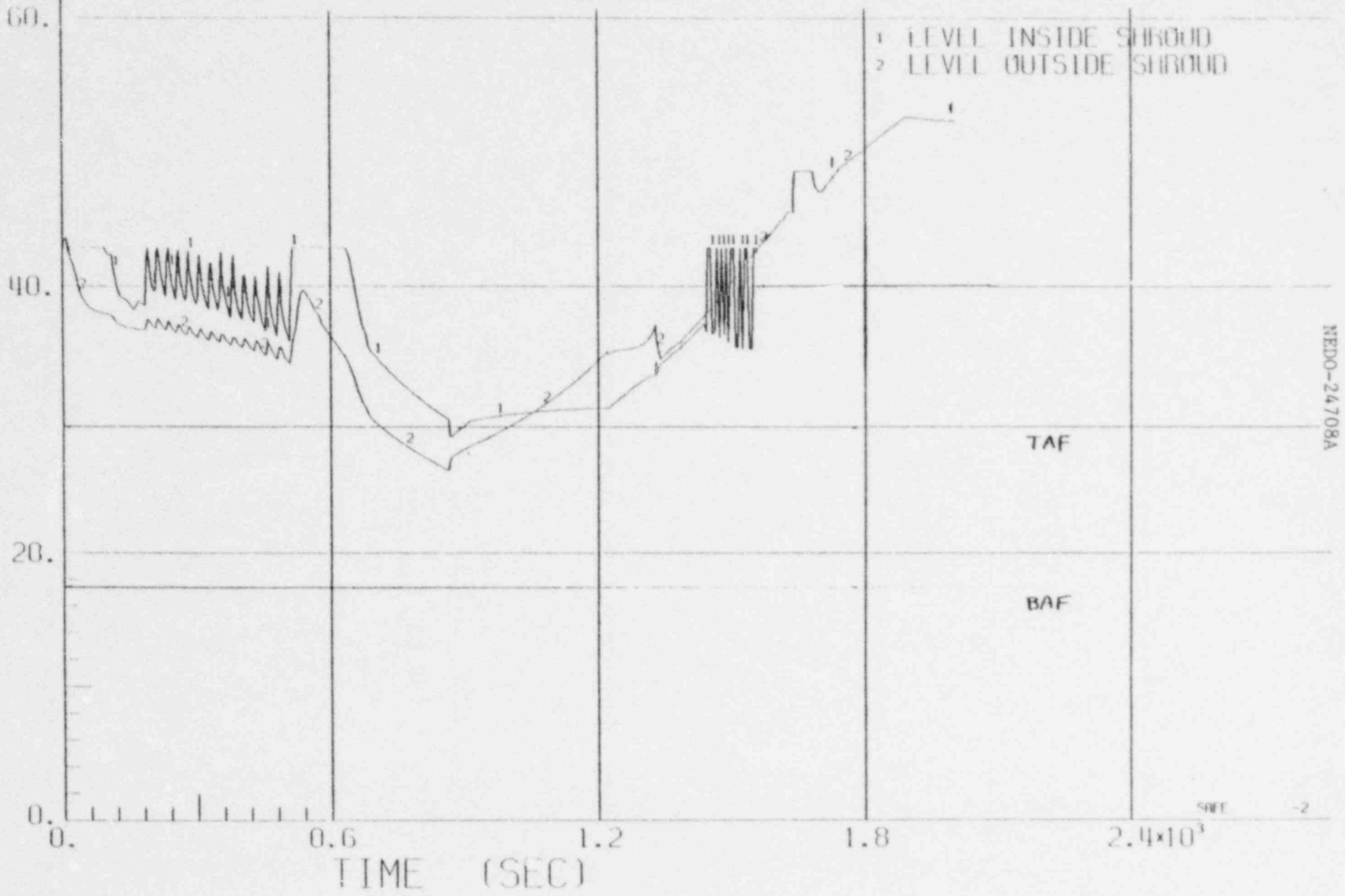


FIGURE 3.5.2.1 - 1.1 SYSTEM PRESSURE VS TIME FOR A 0.001 ft^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.

BWR/2

FIGURE 3.5.2.1 - 1.2 WATER LEVEL VS TIME FOR A 0.001 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.



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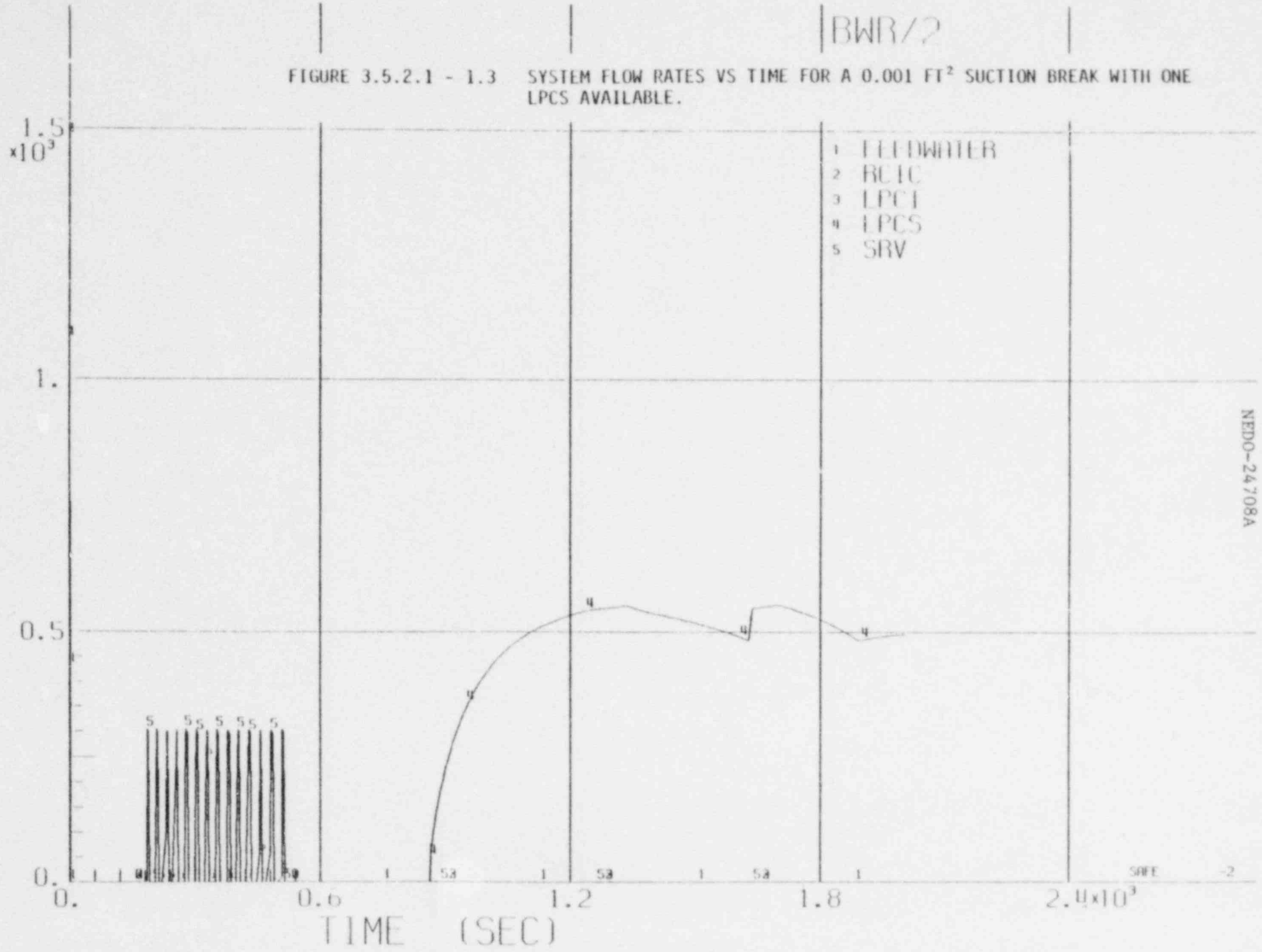

FIGURE 3.5.2.1 - 1.3 SYSTEM FLOW RATES VS TIME FOR A 0.001 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 1.4 FLOW RATES VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

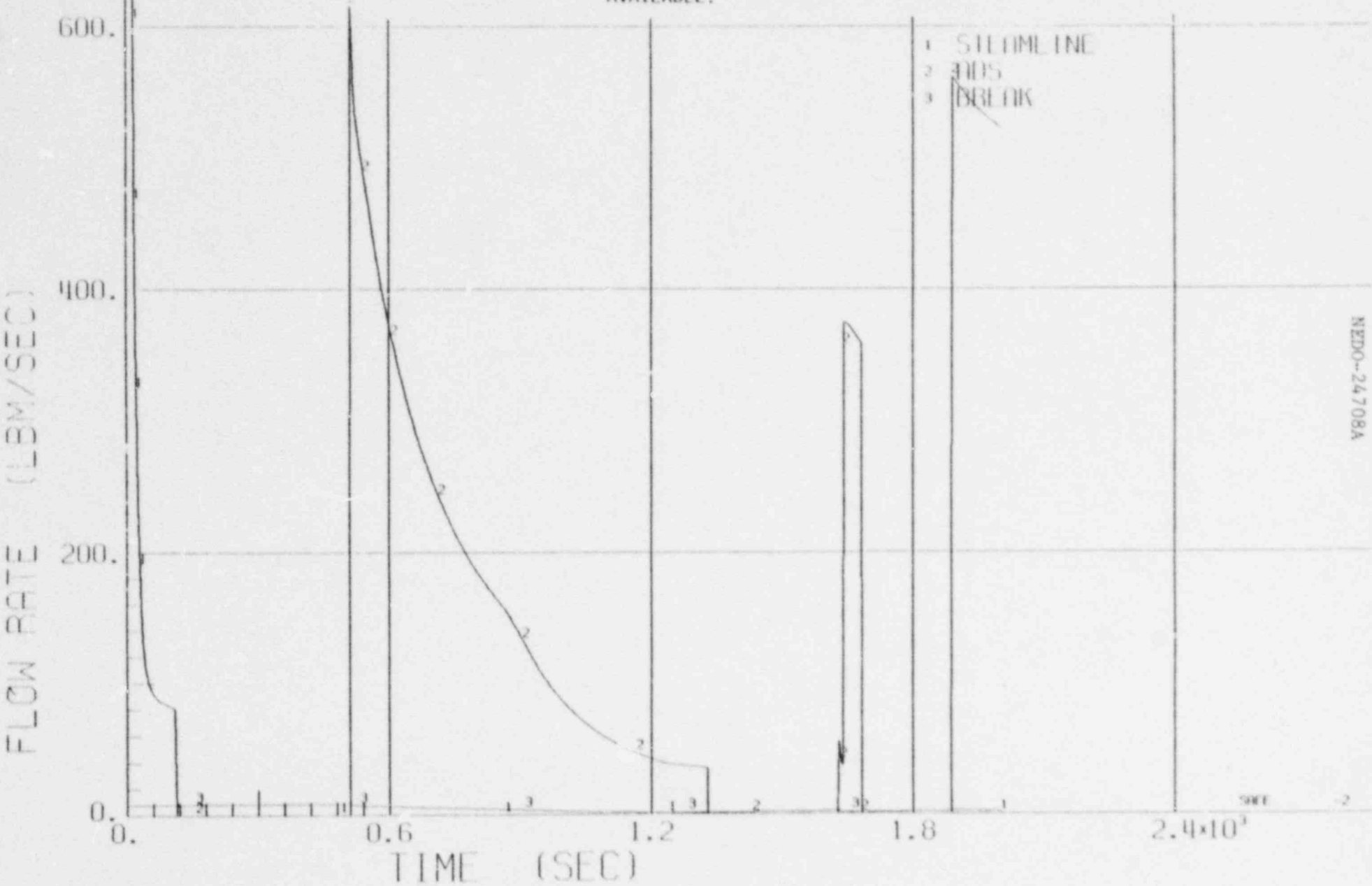


FIGURE 3.5.2.1 - 1.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

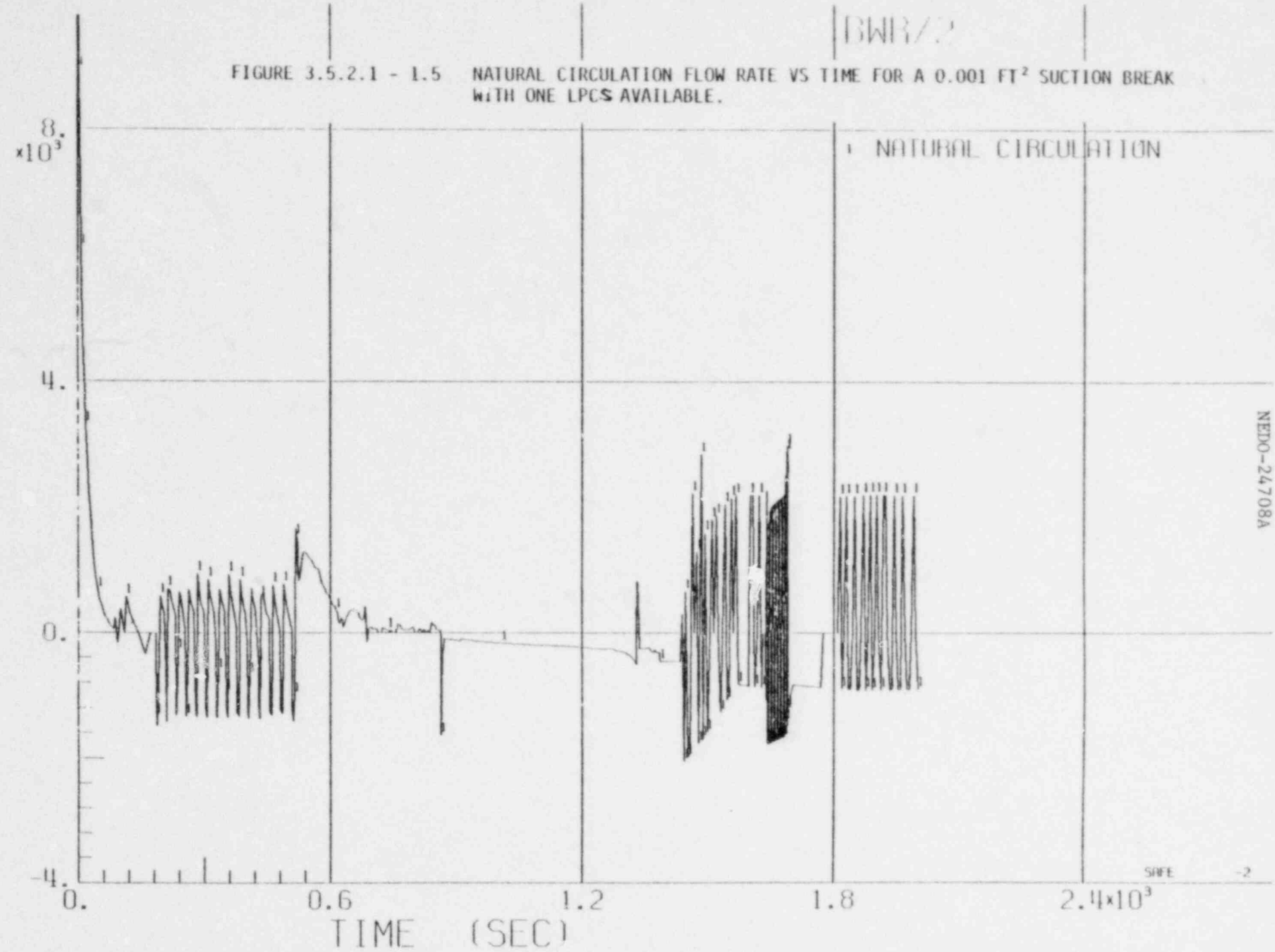
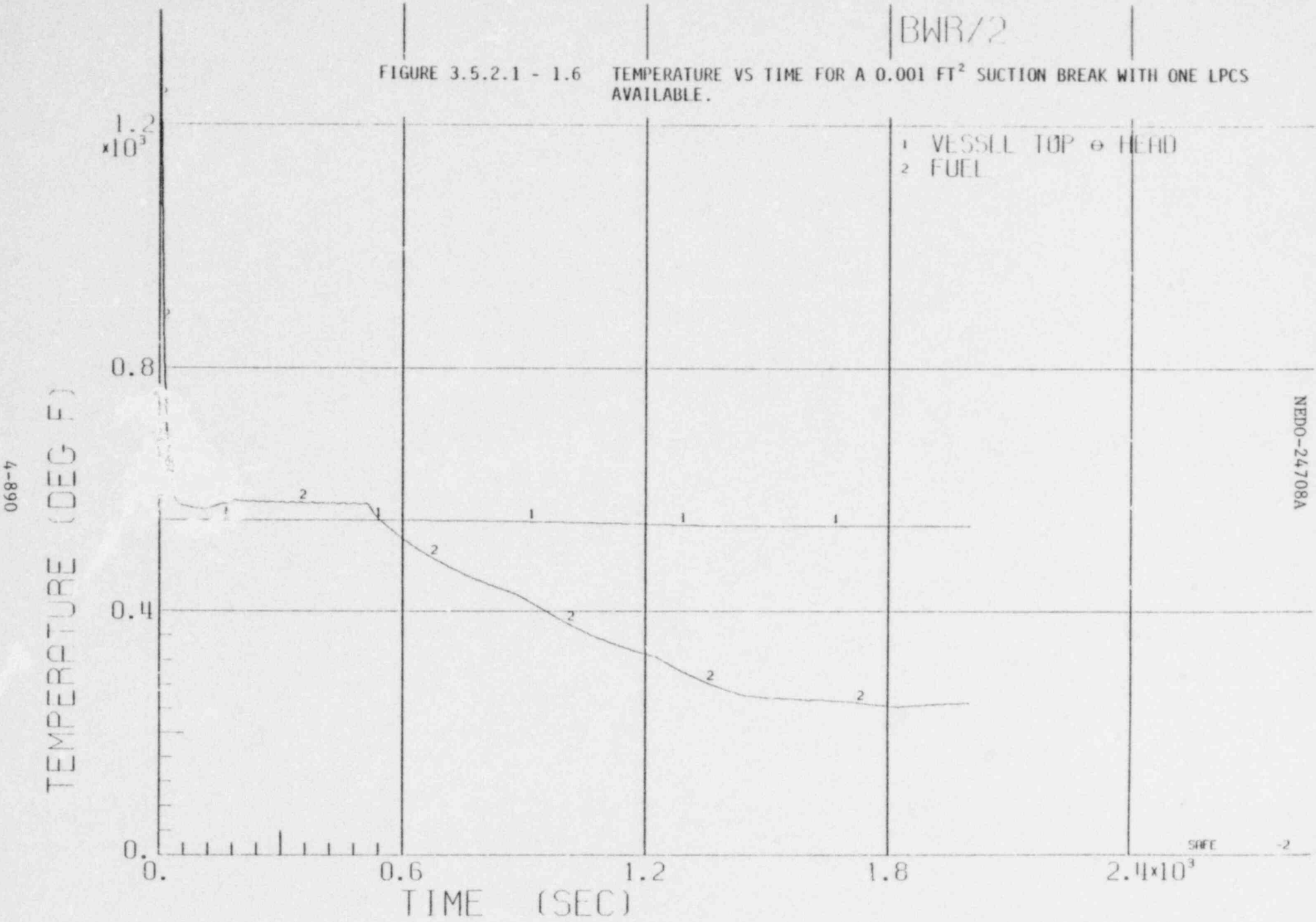


FIGURE 3.5.2.1 - 1.6 TEMPERATURE VS TIME FOR A 0.001 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.



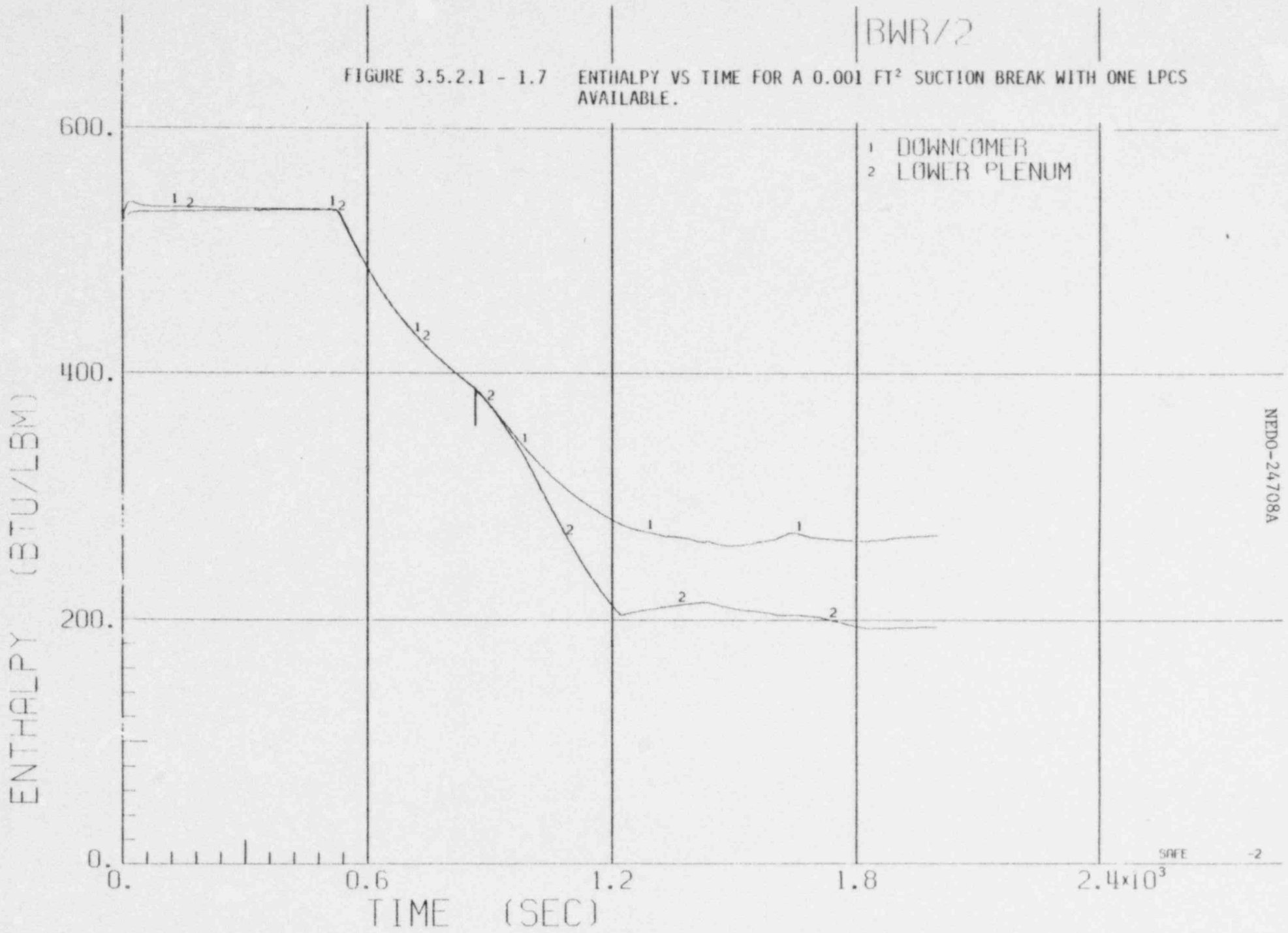


FIGURE 3.5.2.1 - 1.7 ENTHALPY VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 1.8 QUALITY VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

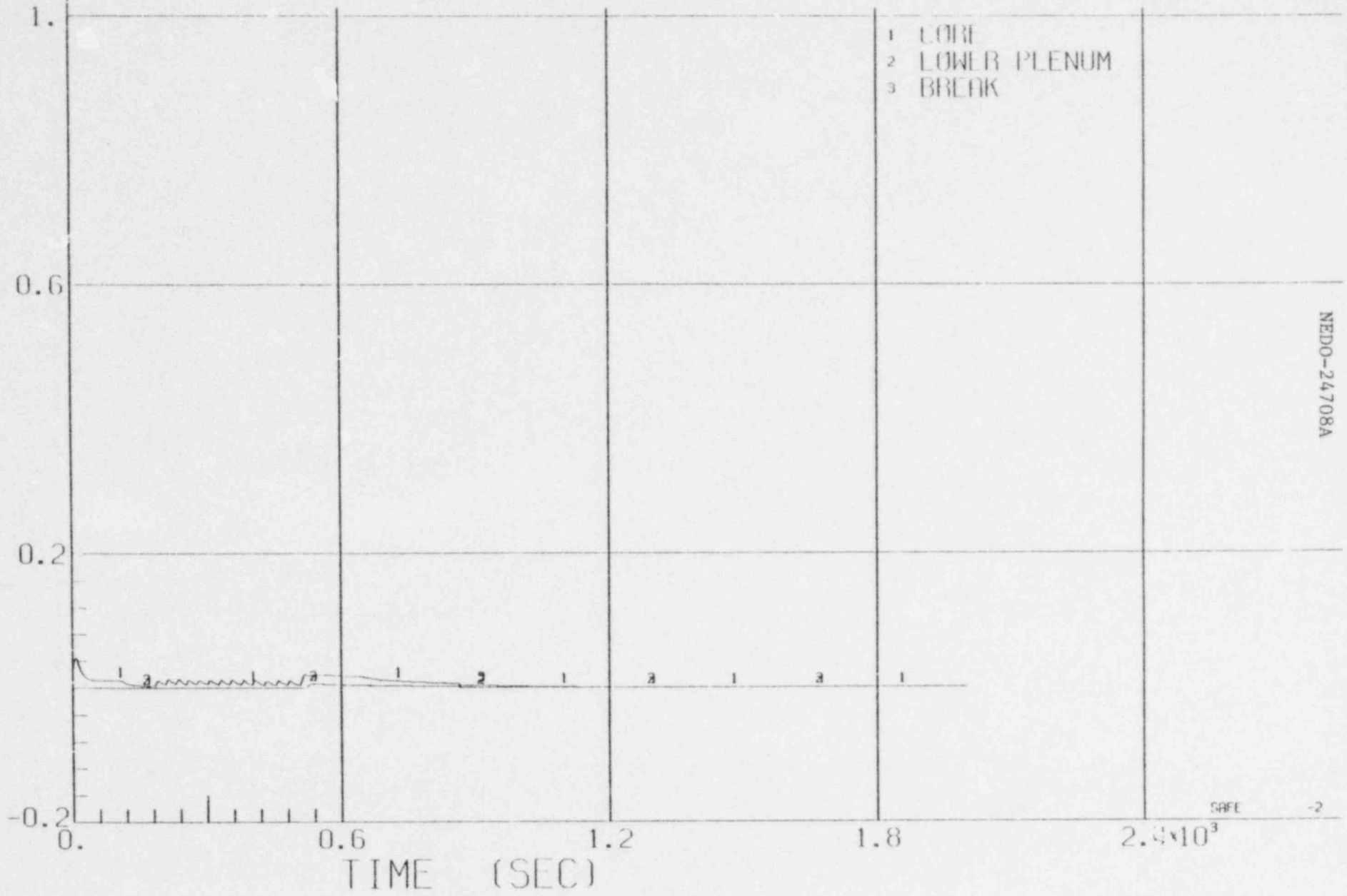

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FIGURE 3.5.2.1 - 2.1 SYSTEM PRESSURE VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

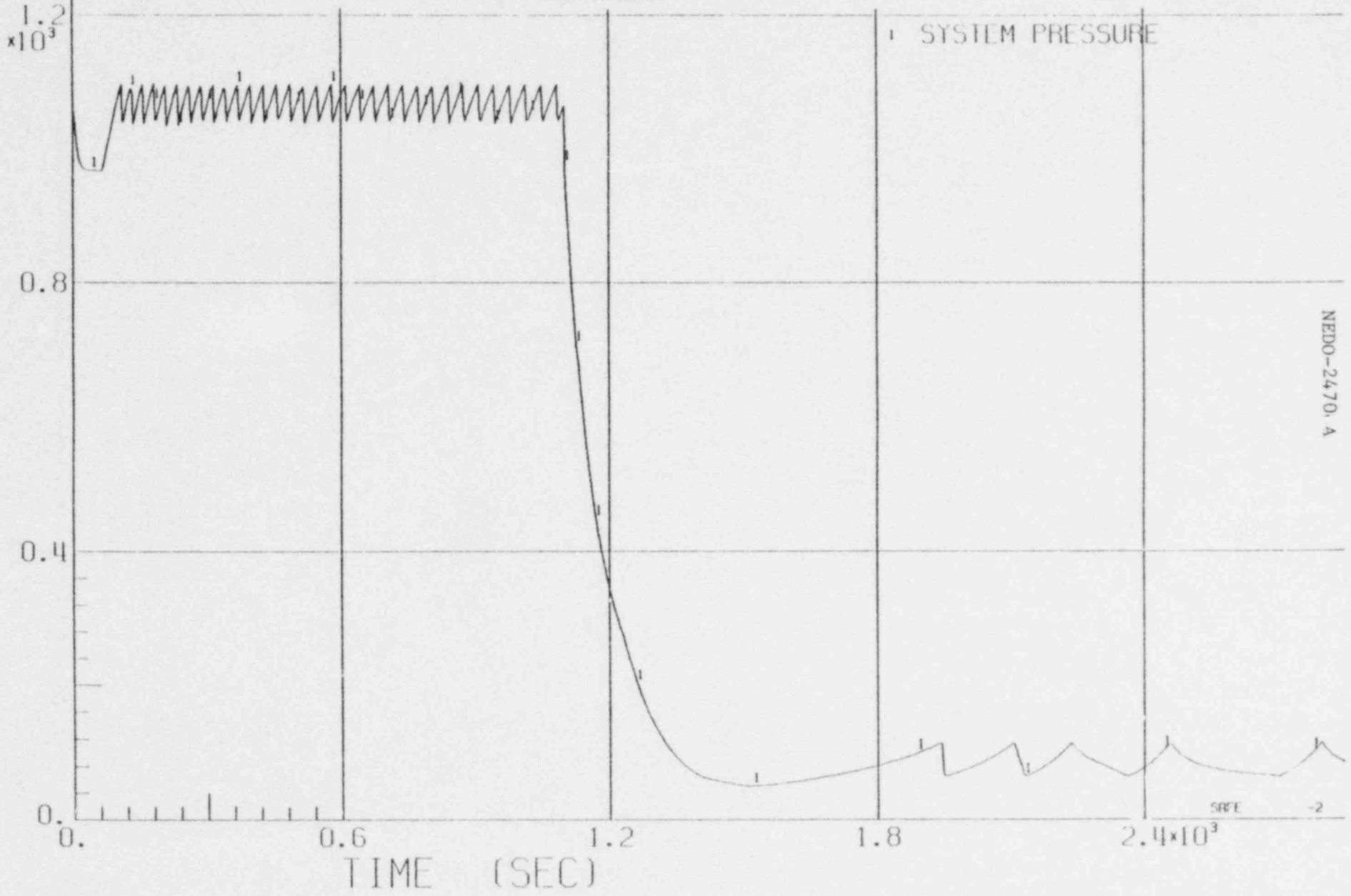

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FIGURE 3.5.2.1 - 2.2 WATER LEVEL VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

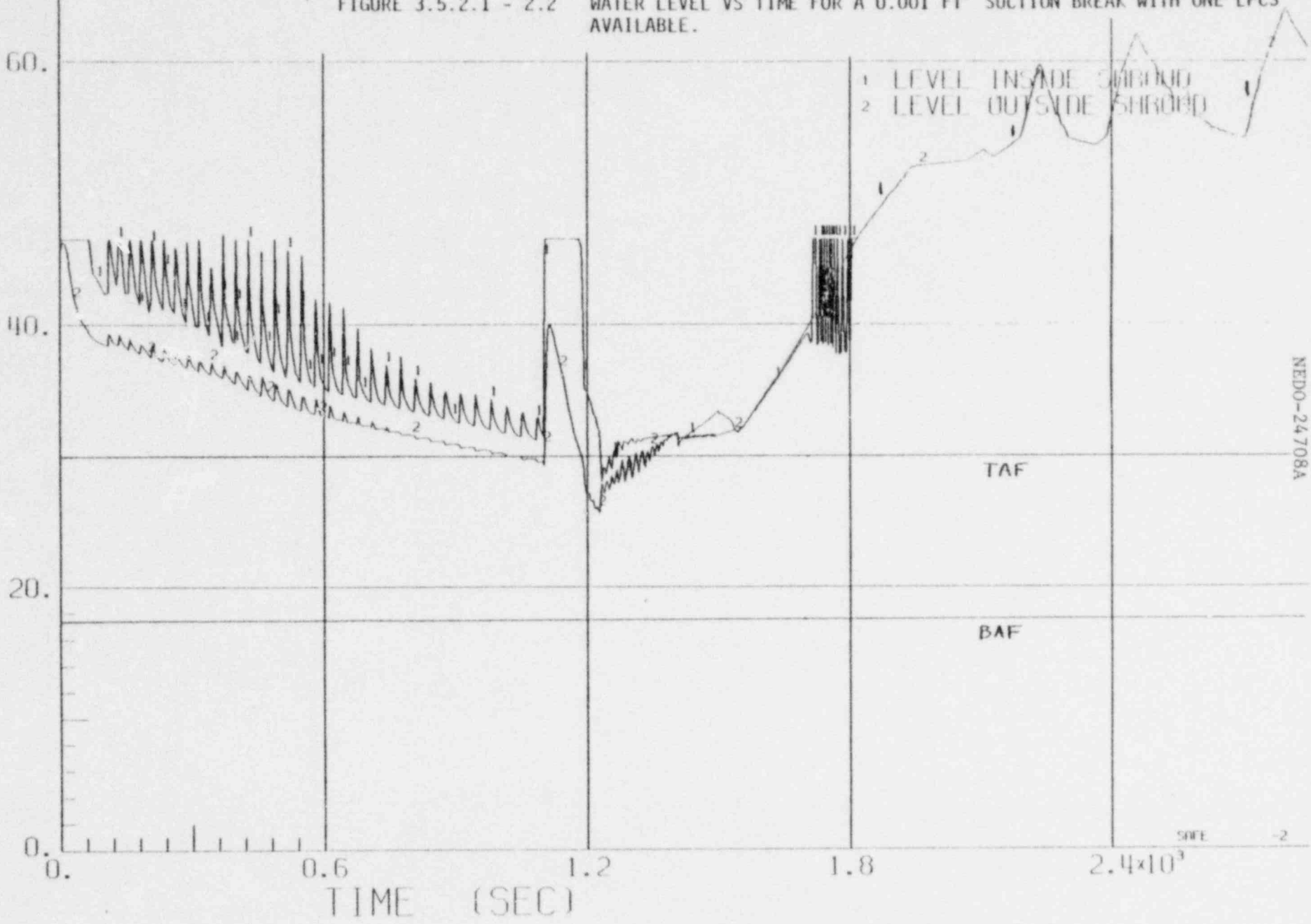

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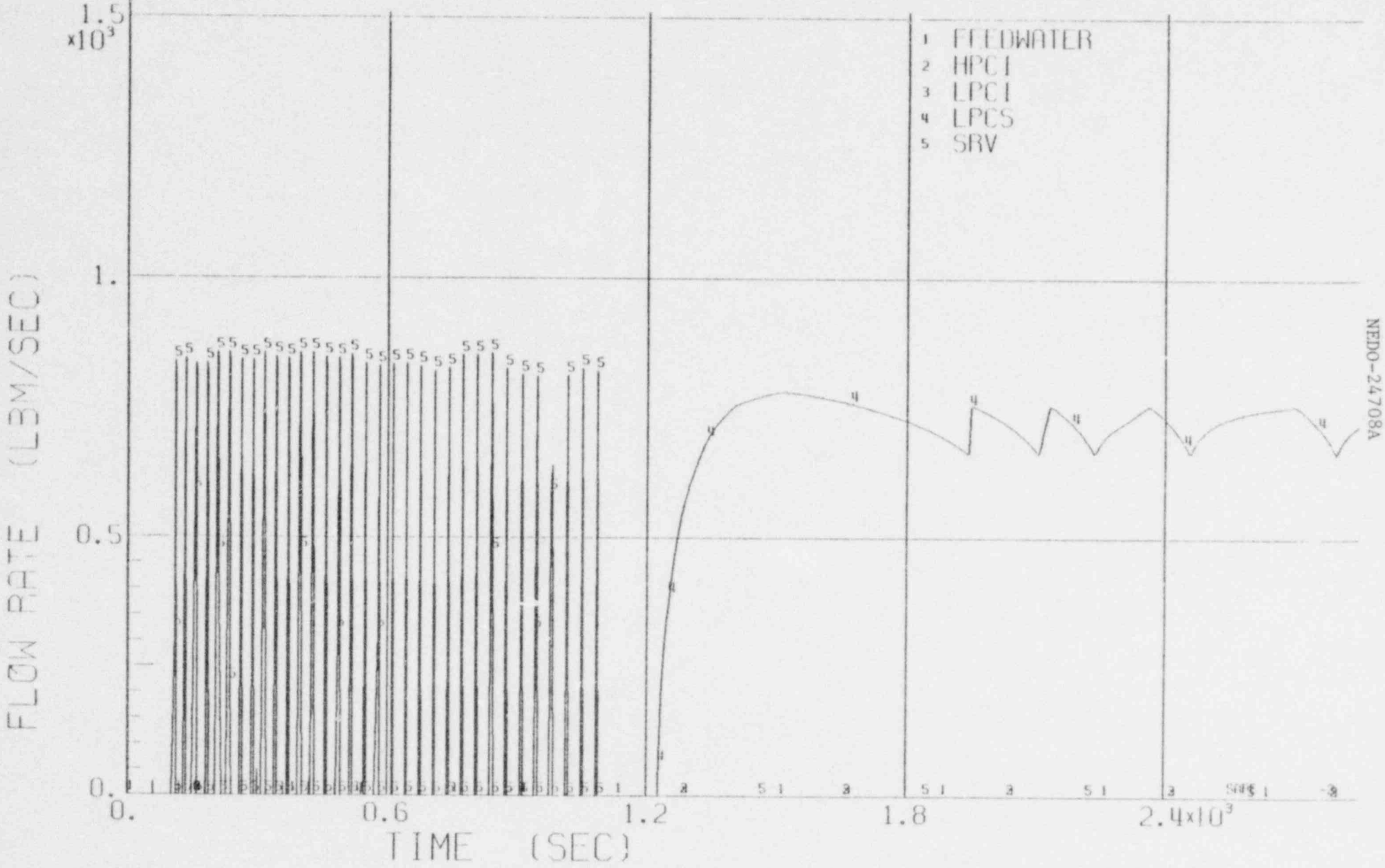
FIGURE 3.5.2.1 - 2.3 SYSTEM FLOW RATES VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.



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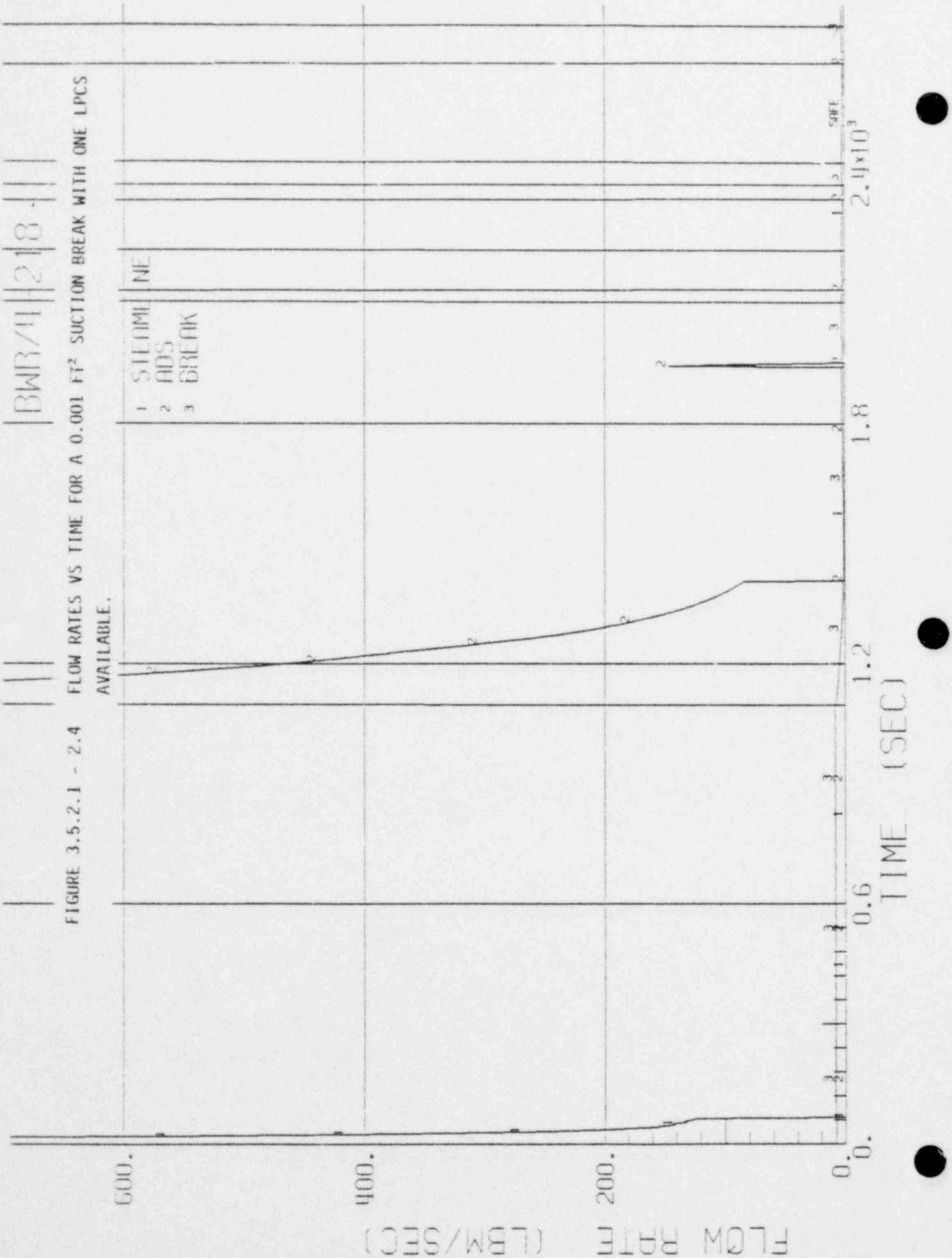

FIGURE 3.5.2.1 - 2.4 FLOW RATES VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 2.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

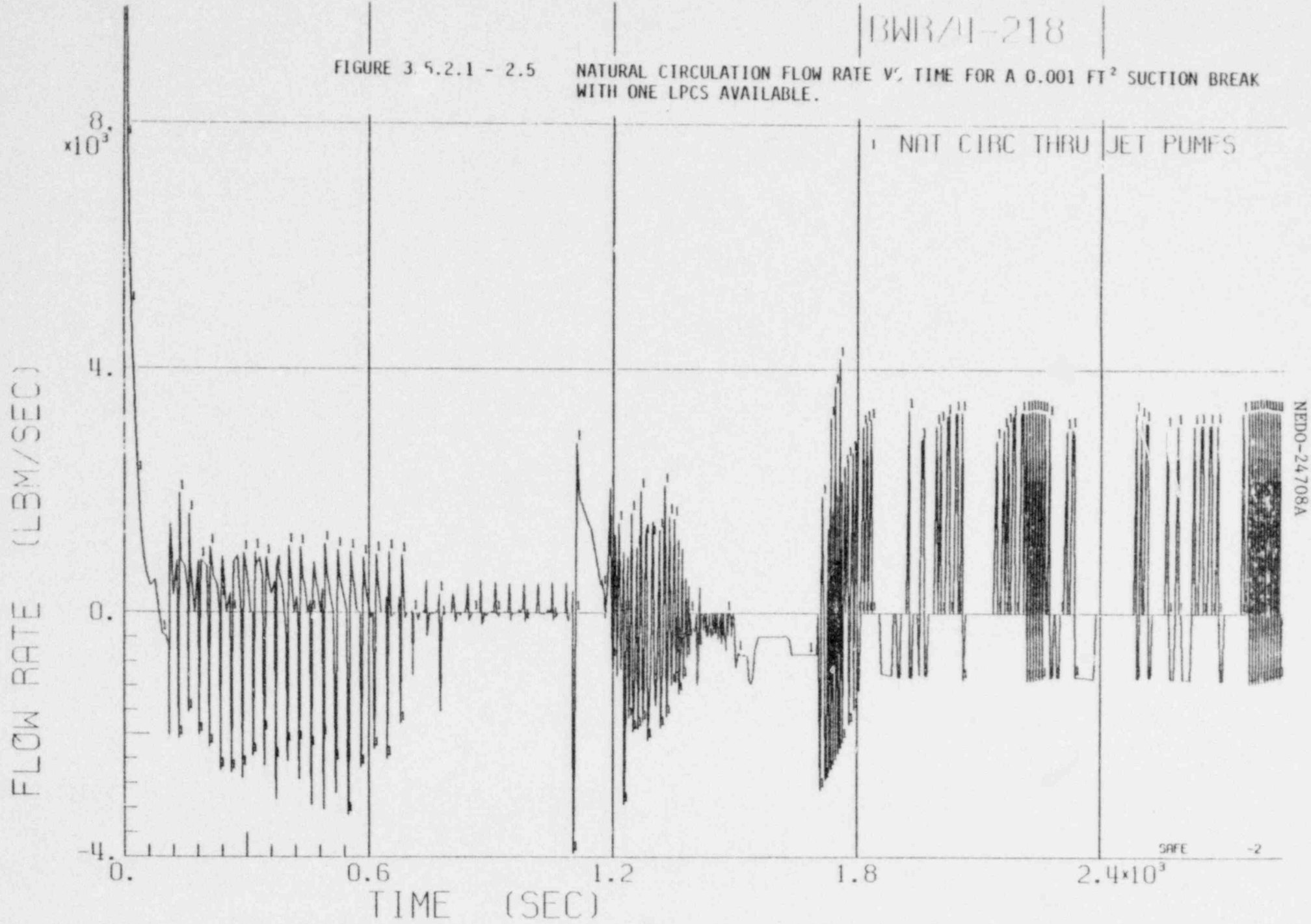

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FIGURE 3.5.2.1 - 2.6 TEMPERATURE VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

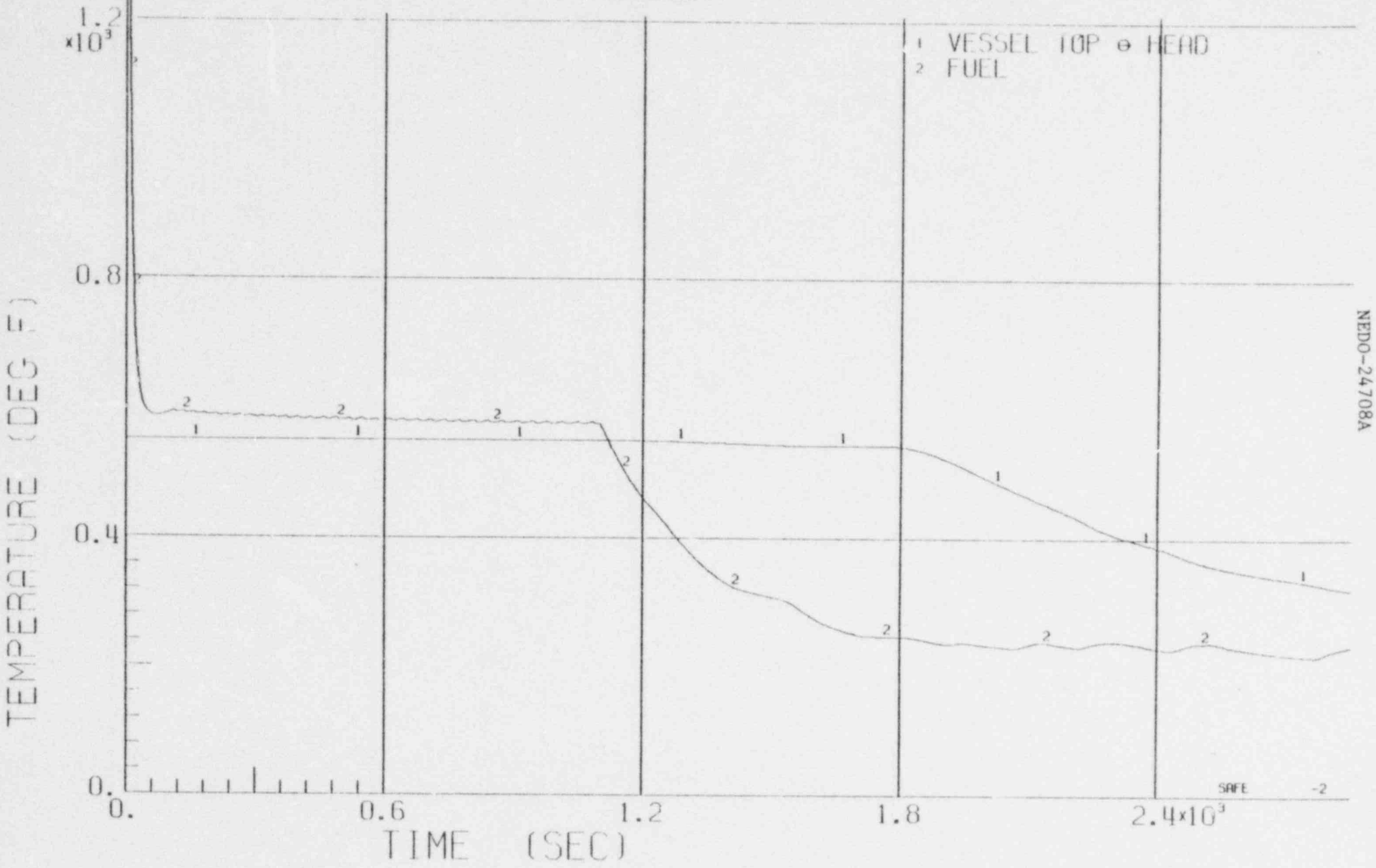

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FIGURE 3.5.2.1 - 2.7 ENTHALPY VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

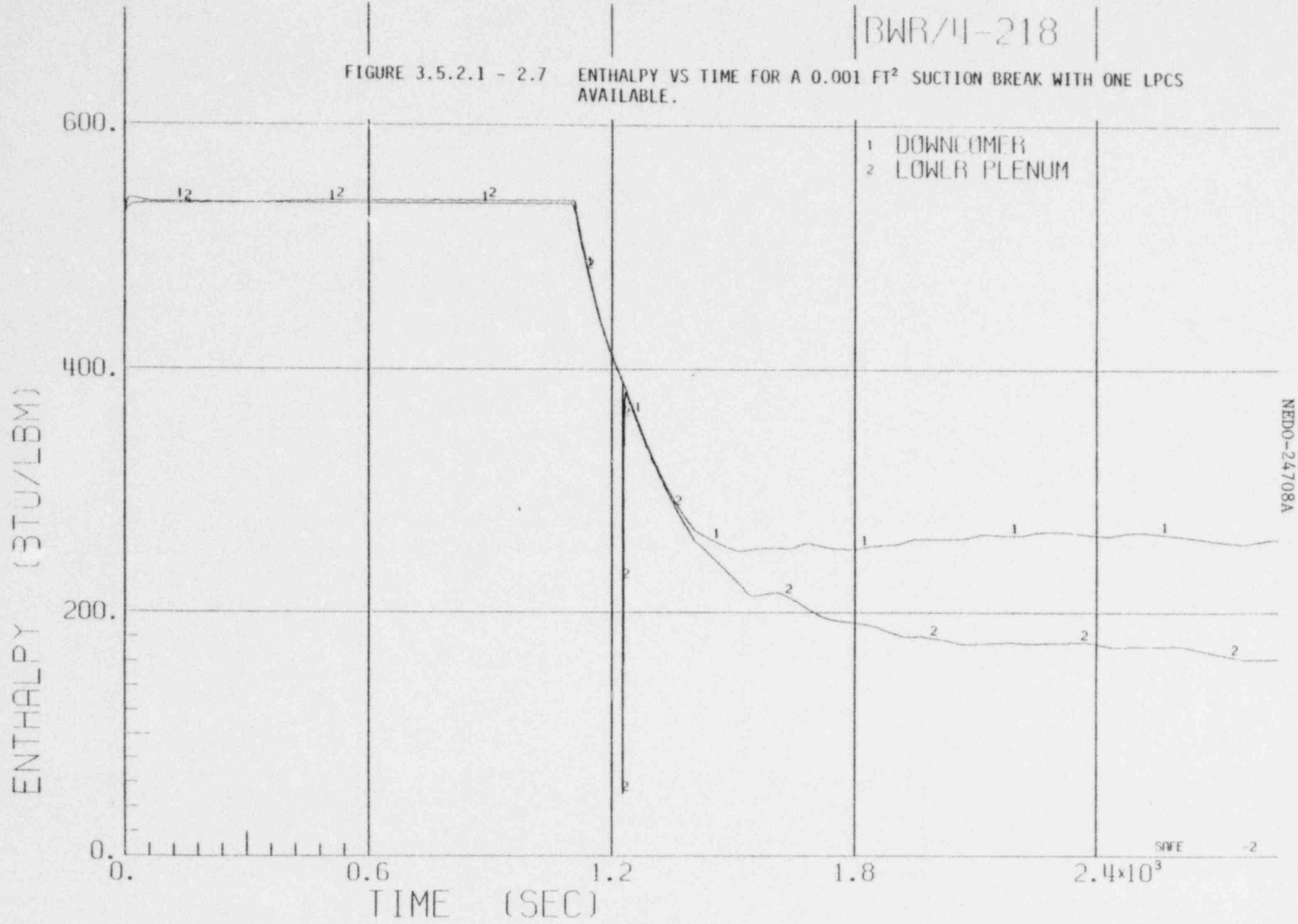
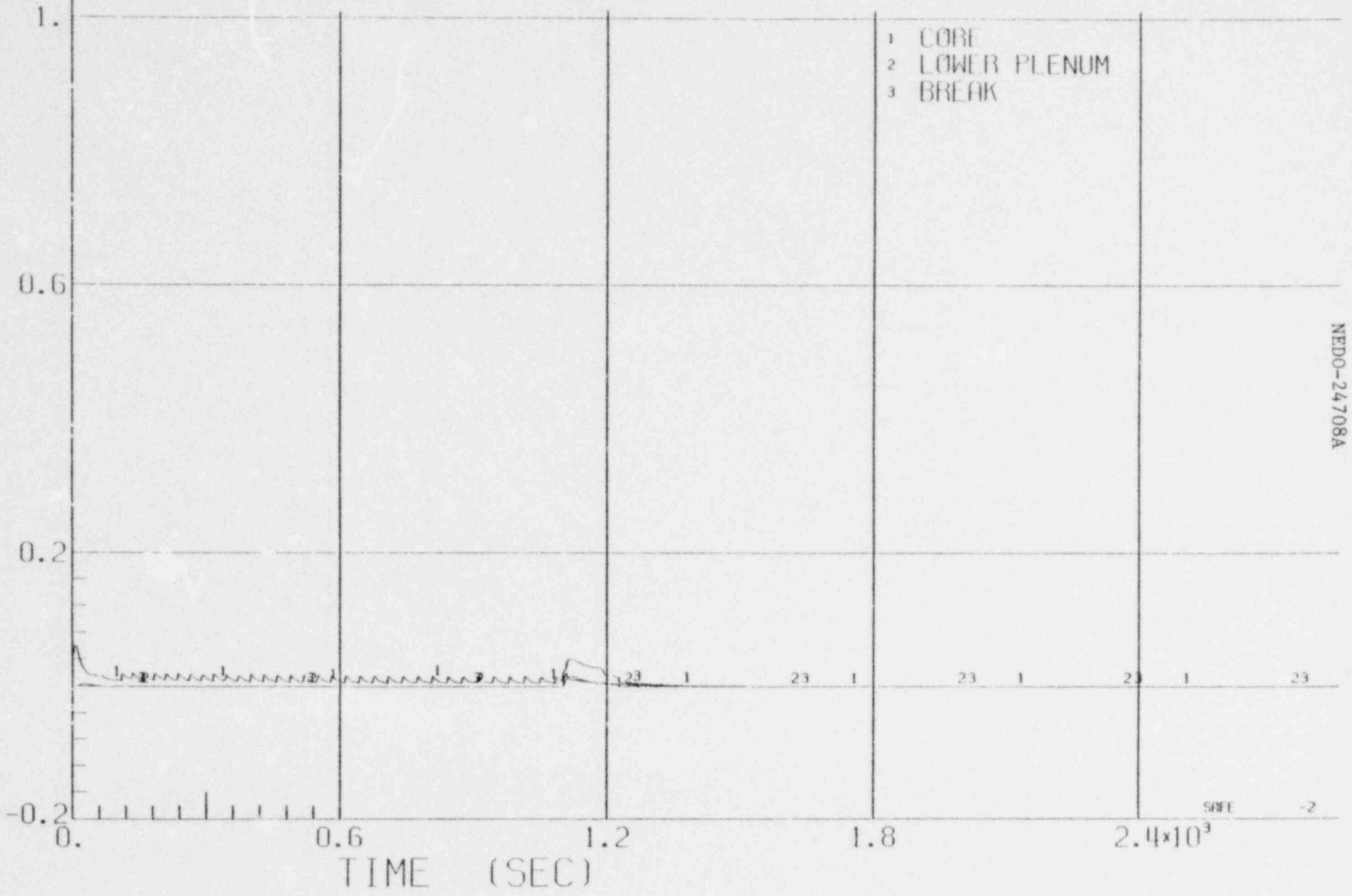


FIGURE 3.5.2.1 - 2.8 QUALITY VS TIME FOR A 0.001 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.



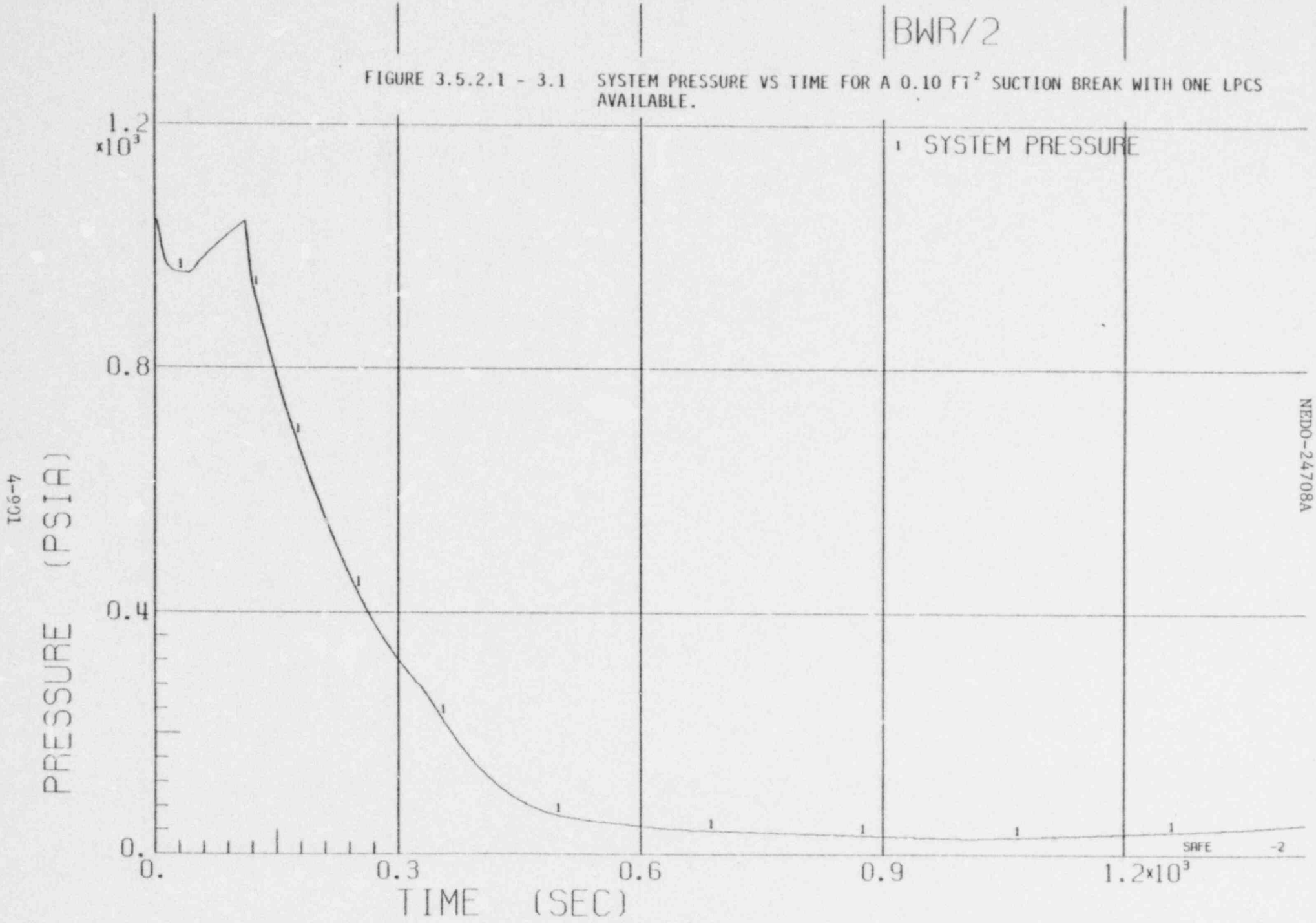


FIGURE 3.5.2.1 - 3.1 SYSTEM PRESSURE VS TIME FOR A 0.10 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.

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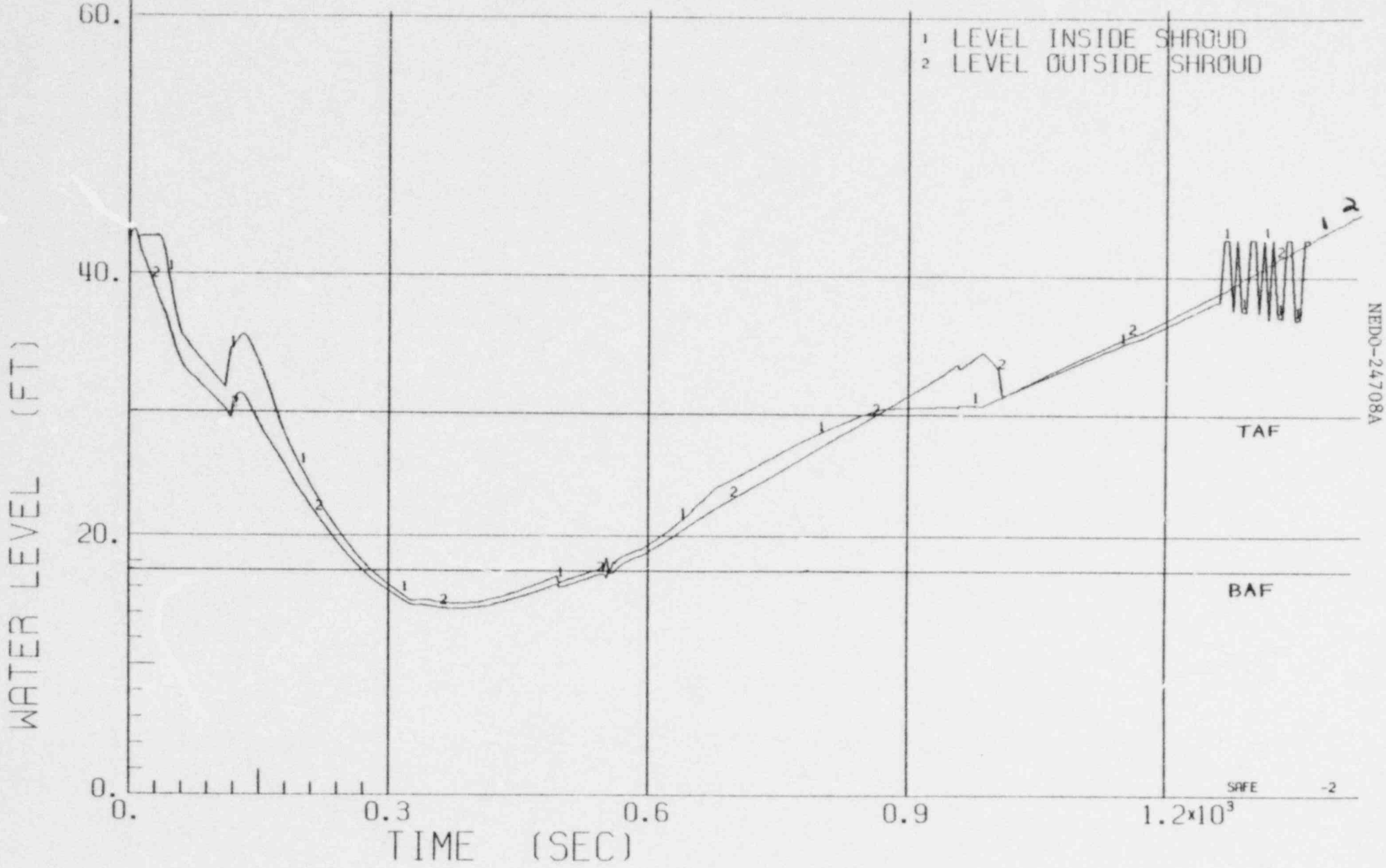
FIGURE 3.5.2.1 - 3.2 WATER LEVEL VS TIME FOR A 0.10 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.



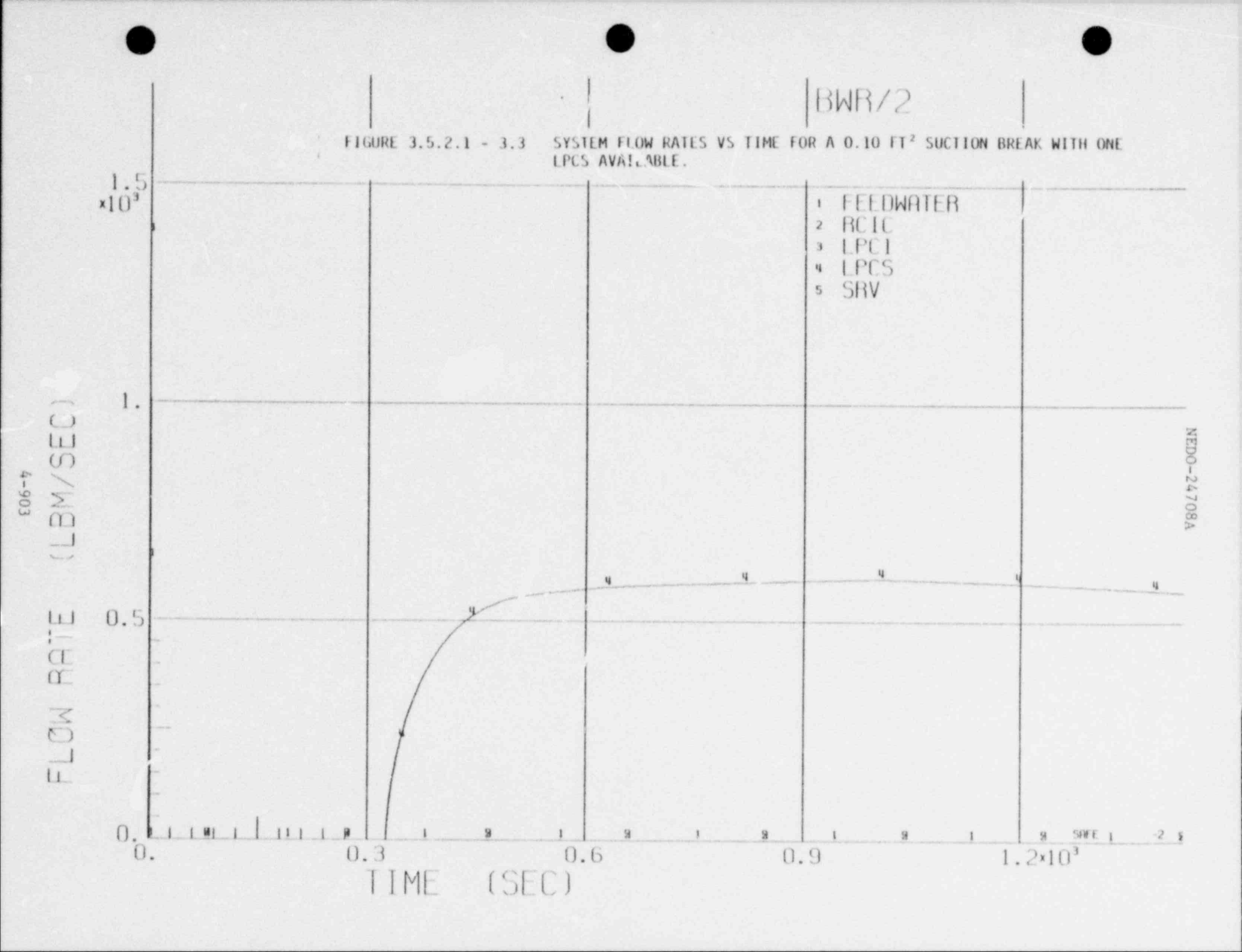


FIGURE 3.5.2.1 - 3.3 SYSTEM FLOW RATES VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

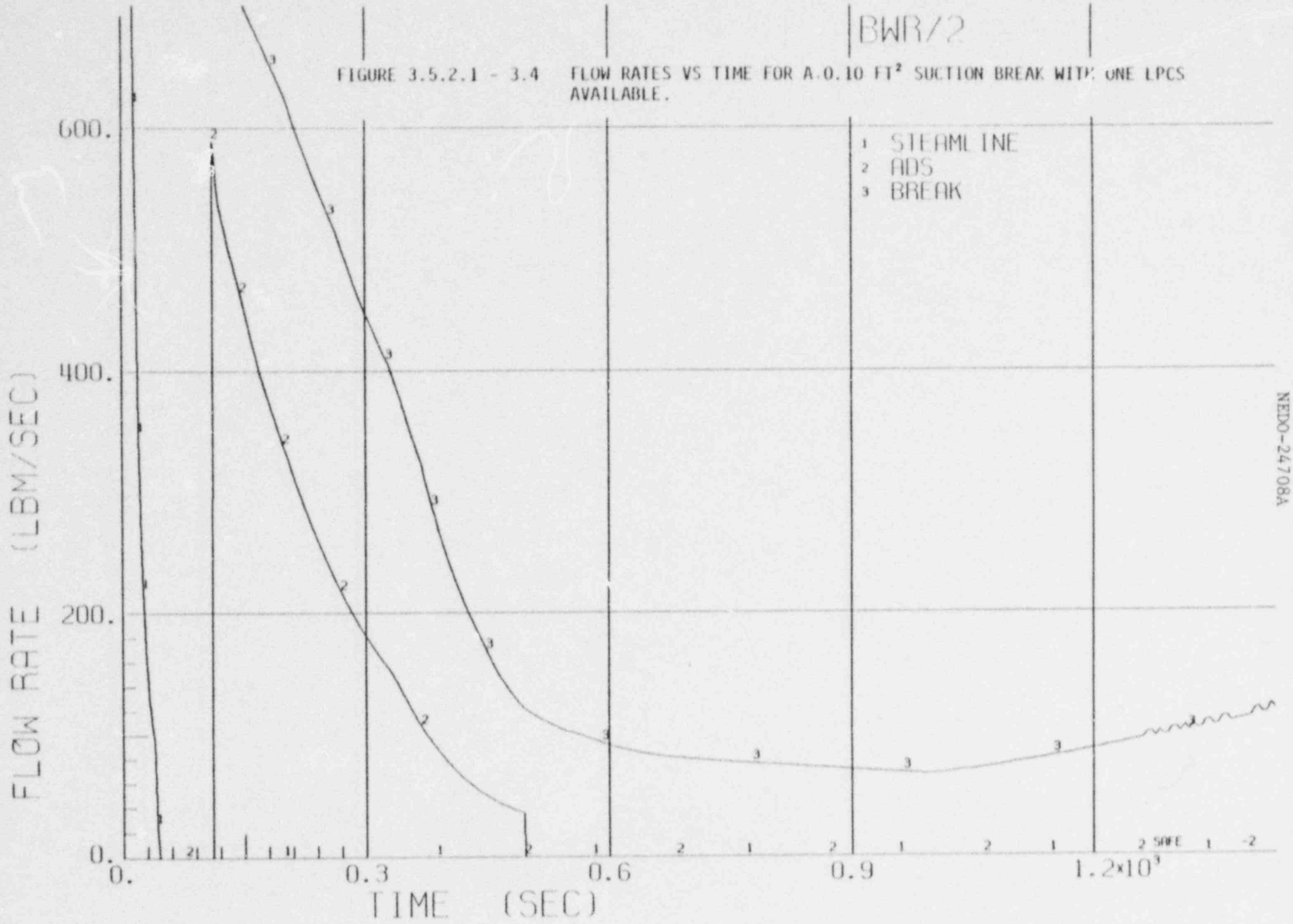


FIGURE 3.5.2.1 - 3.4 FLOW RATES VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 3.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

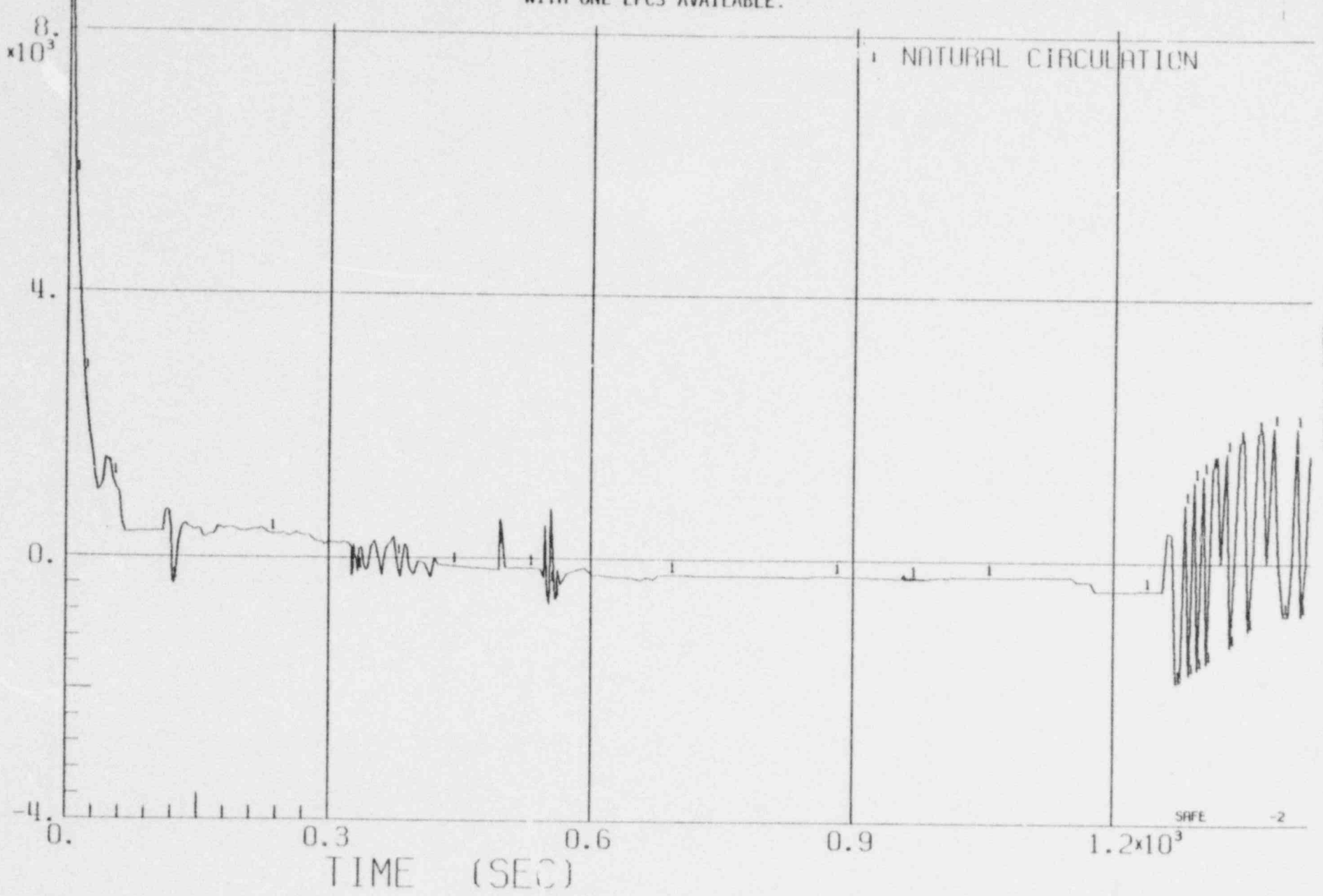

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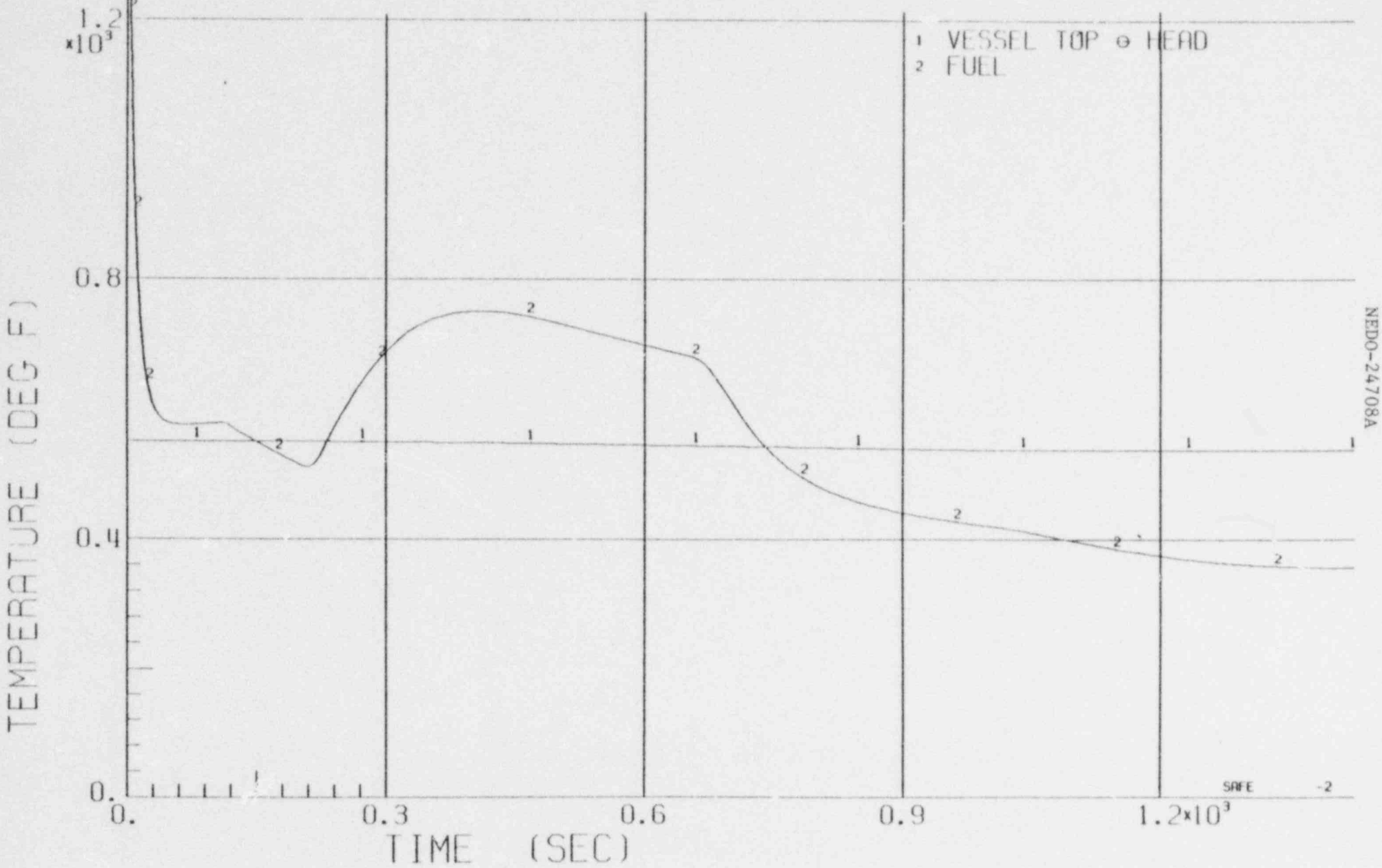
FIGURE 3.5.2.1 - 3.6 TEMPERATURE VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.



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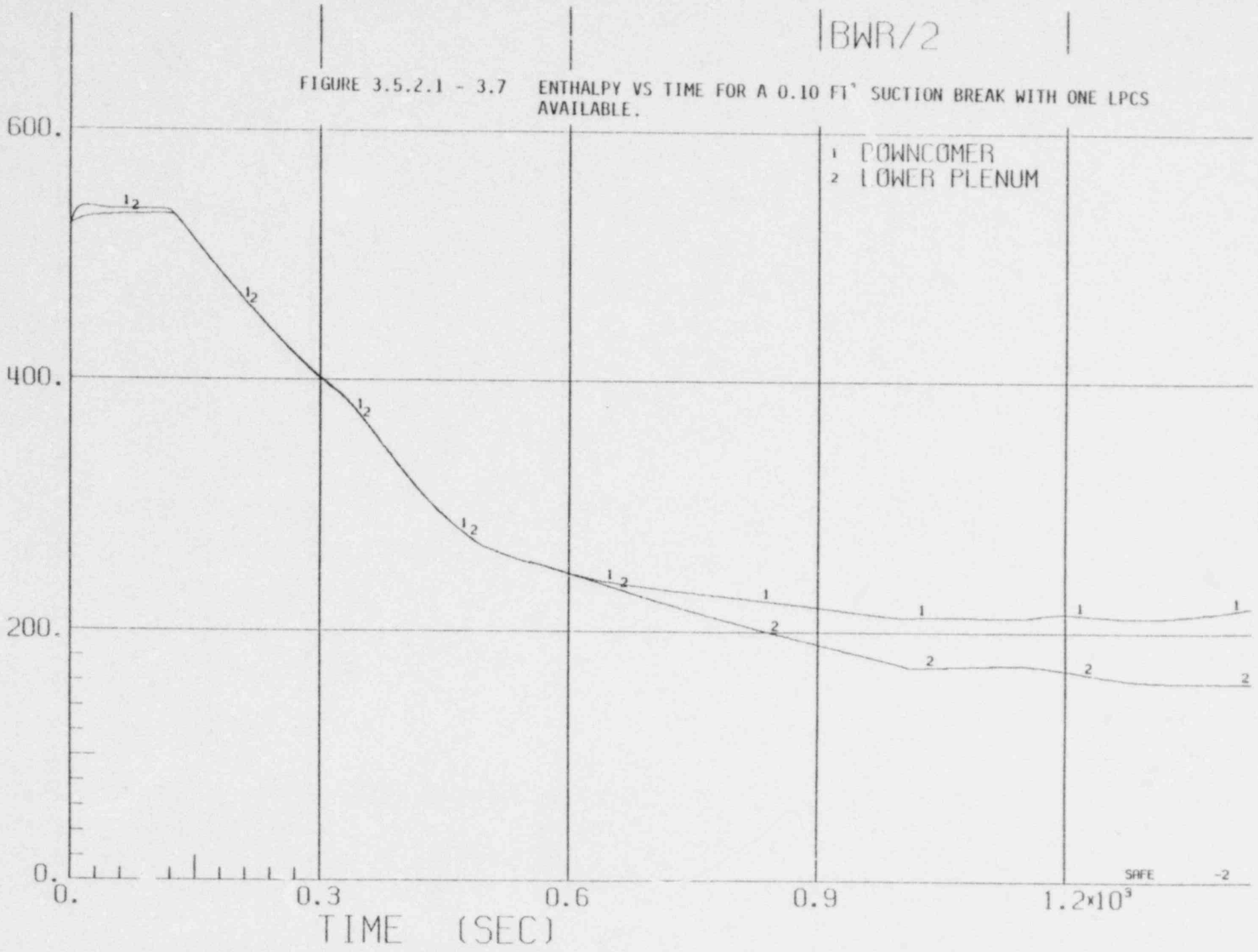

FIGURE 3.5.2.1 - 3.7 ENTHALPY VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

FIGURE 3.5.2.1 - 3.8 QUALITY VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

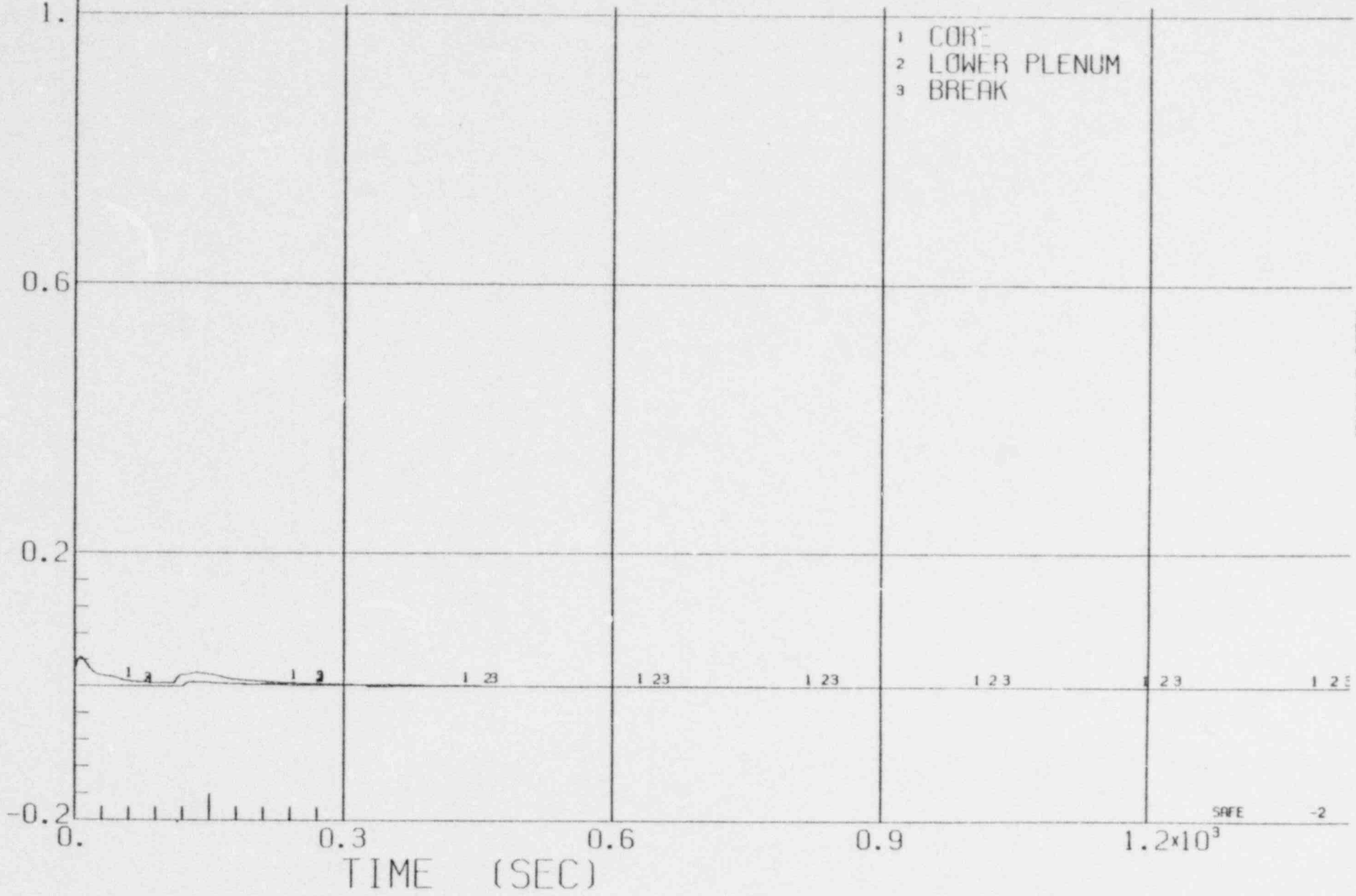

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FIGURE 3.5.2.1 - 4.1 SYSTEM PRESSURE VS TIME FOR A 0.10 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.

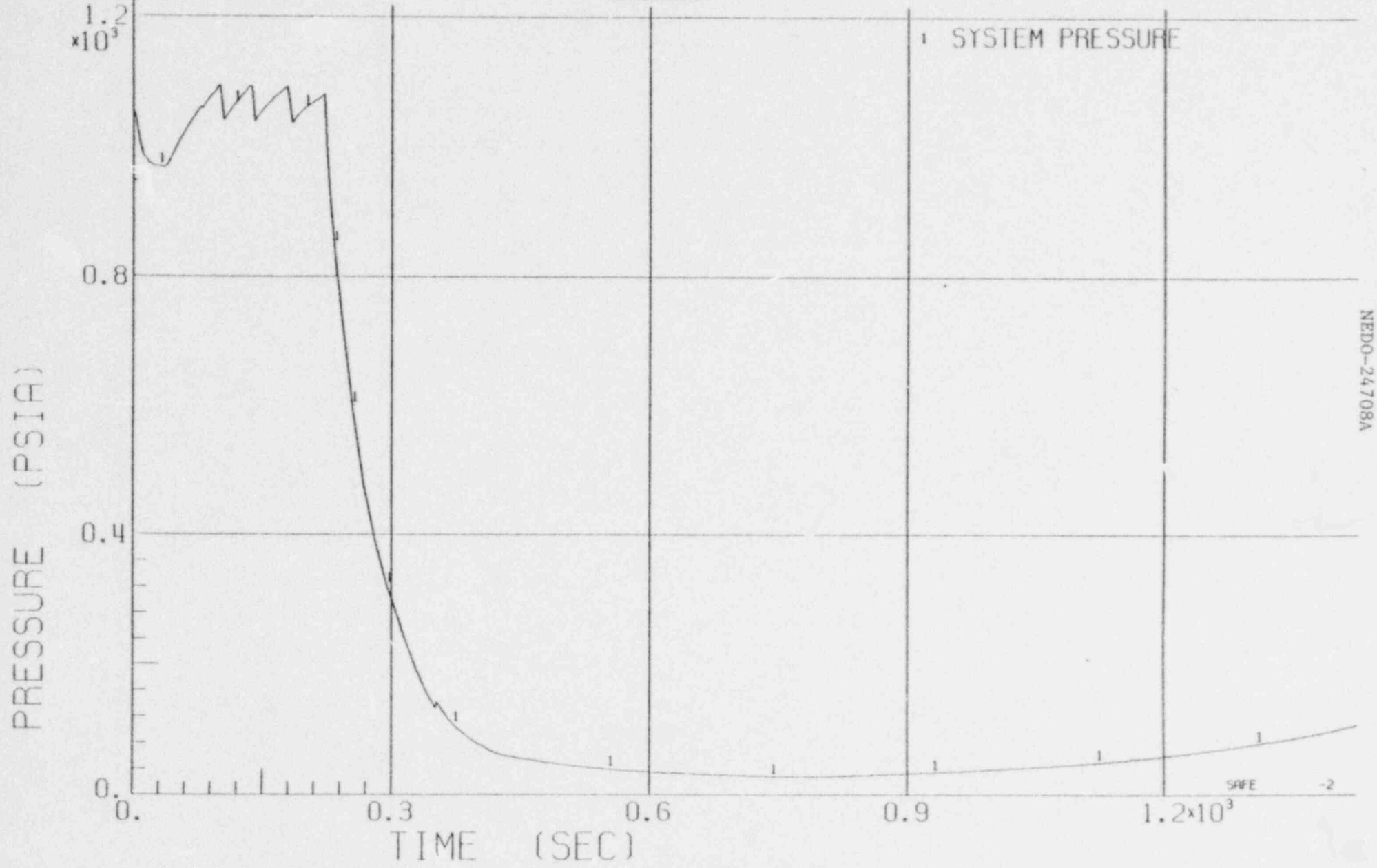

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FIGURE 3.5.2.1 - 4.2 WATER LEVEL VS TIME FOR A 0.10 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.

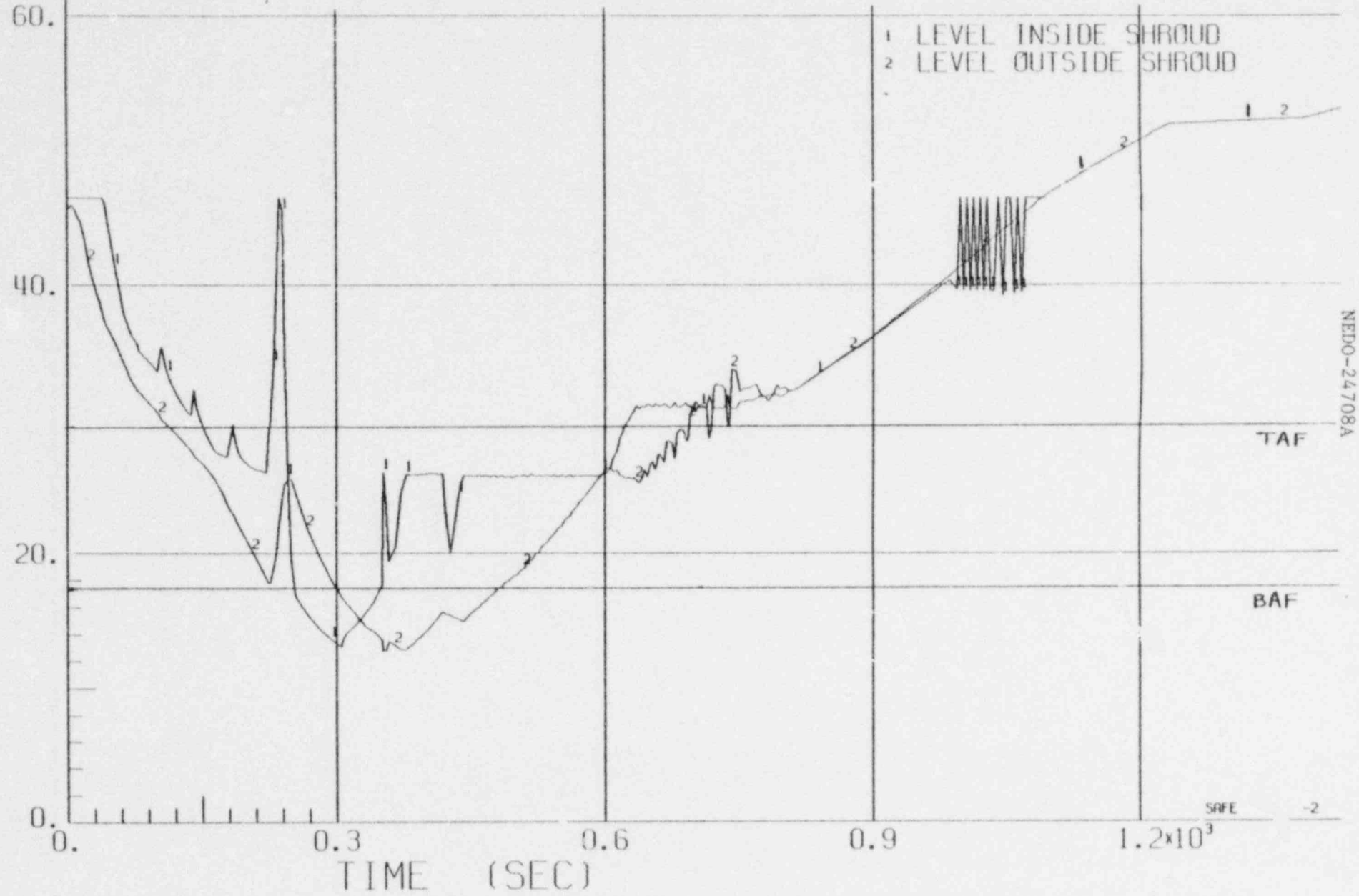

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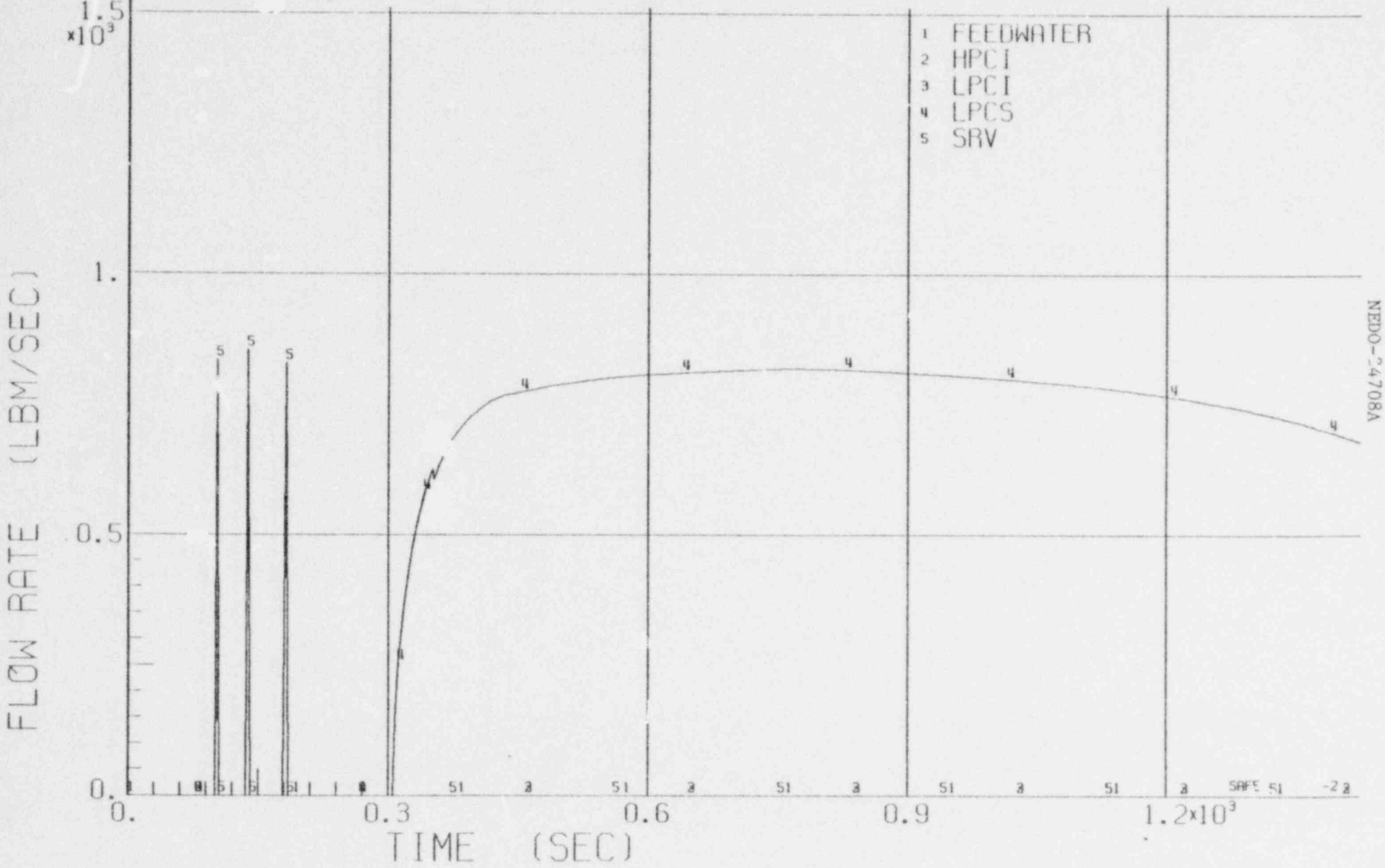
FIGURE 3.5.2.1 - 4.3 SYSTEM FLOW RATES VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.



BWR/4-218

FIGURE 3.5.2.1 - 4.4 FLOW RATES VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

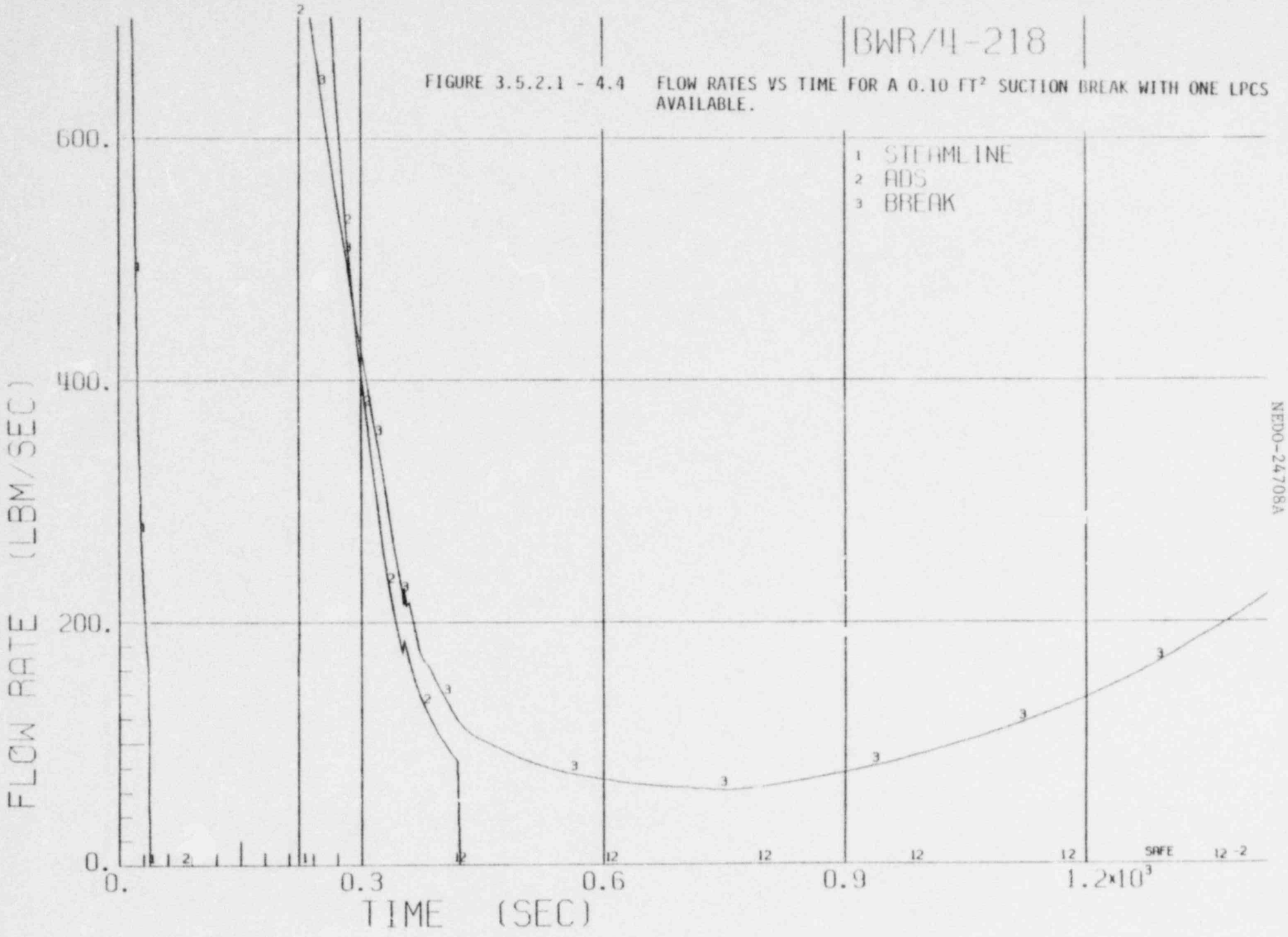


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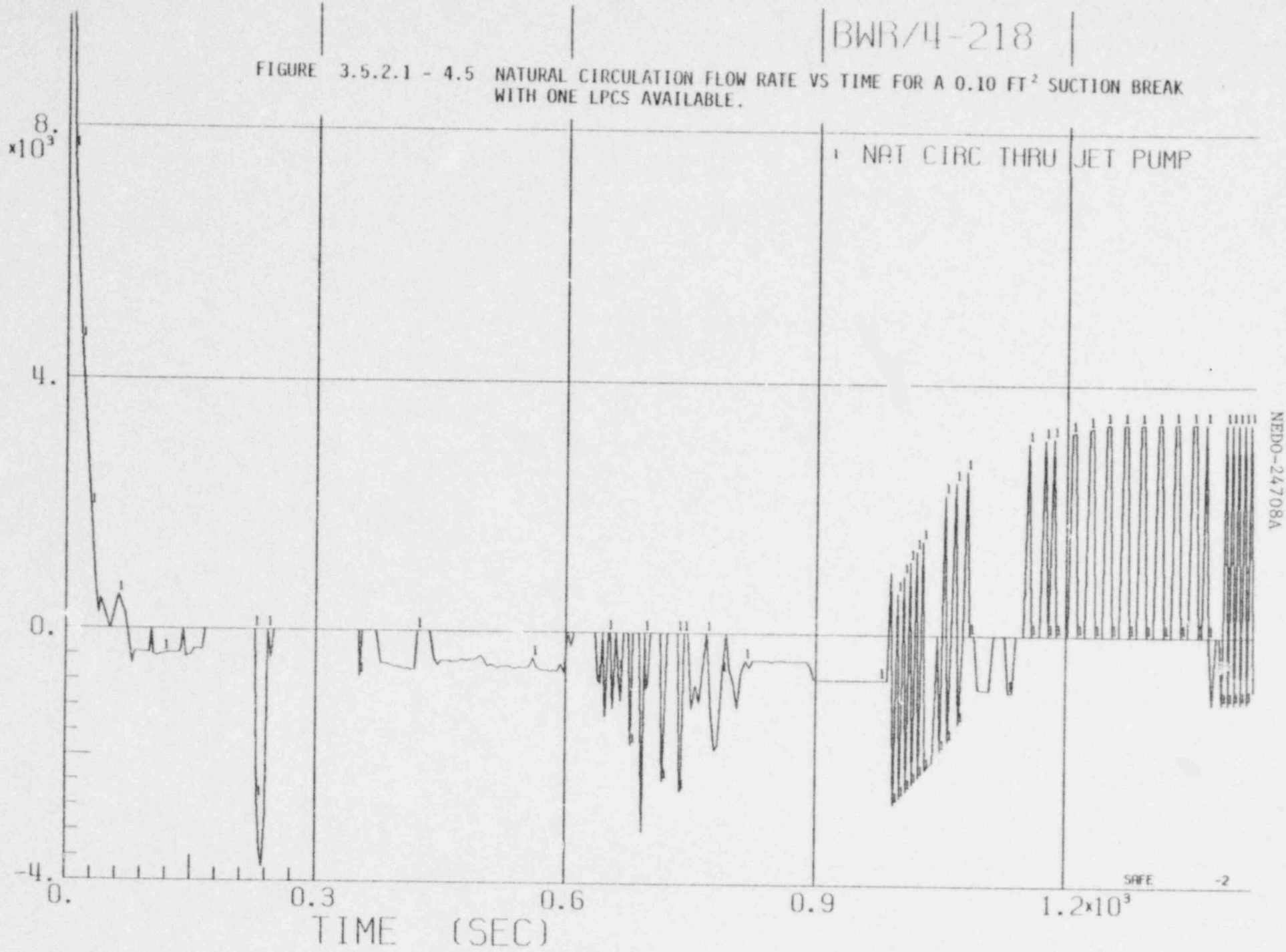
FIGURE 3.5.2.1 - 4.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.10 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.



BWR/4-218

FIGURE 3.5.2.1 - 4.6 TEMPERATURE VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

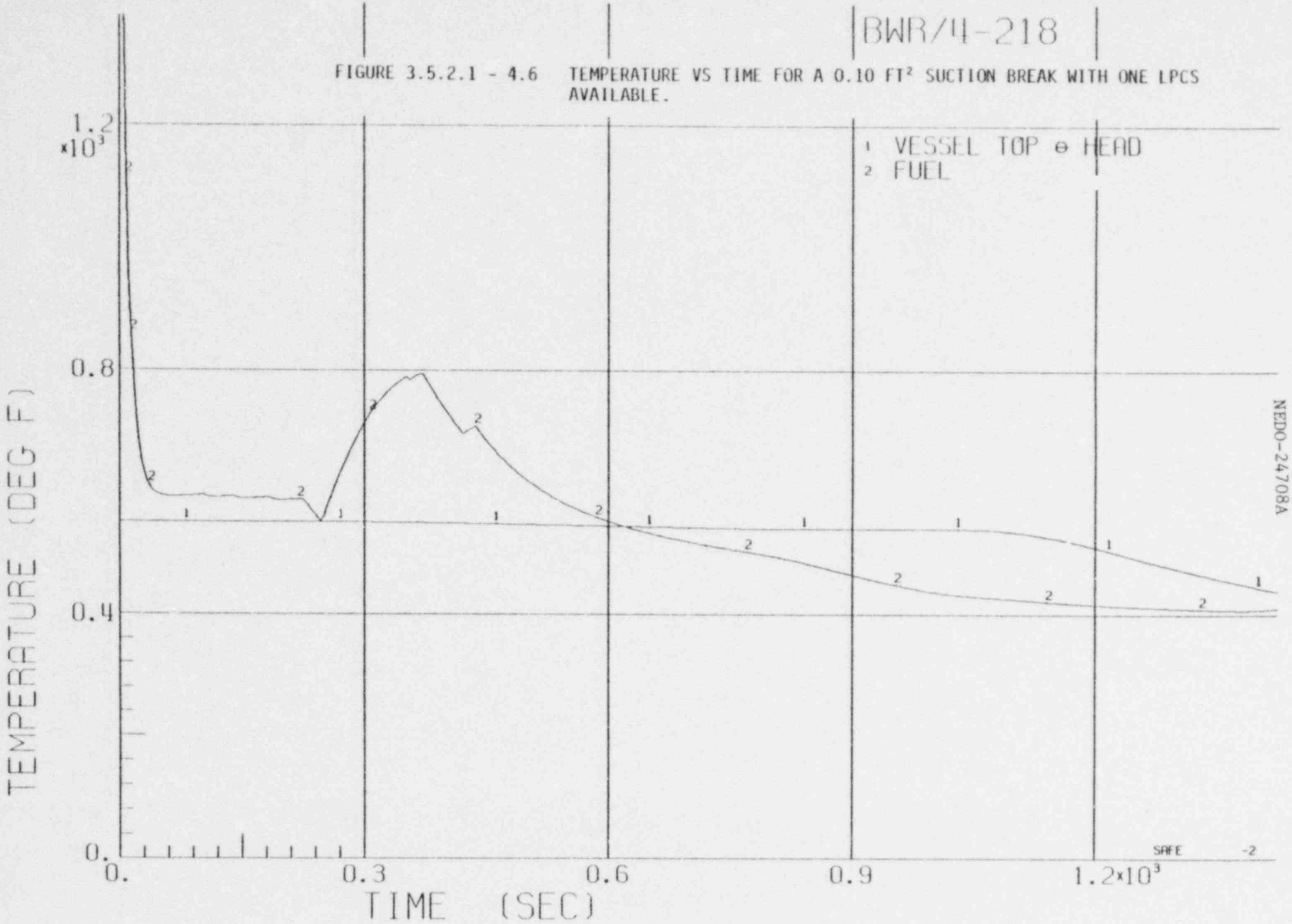


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FIGURE 3.5.2.1 - 4.7 ENTHALPY VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

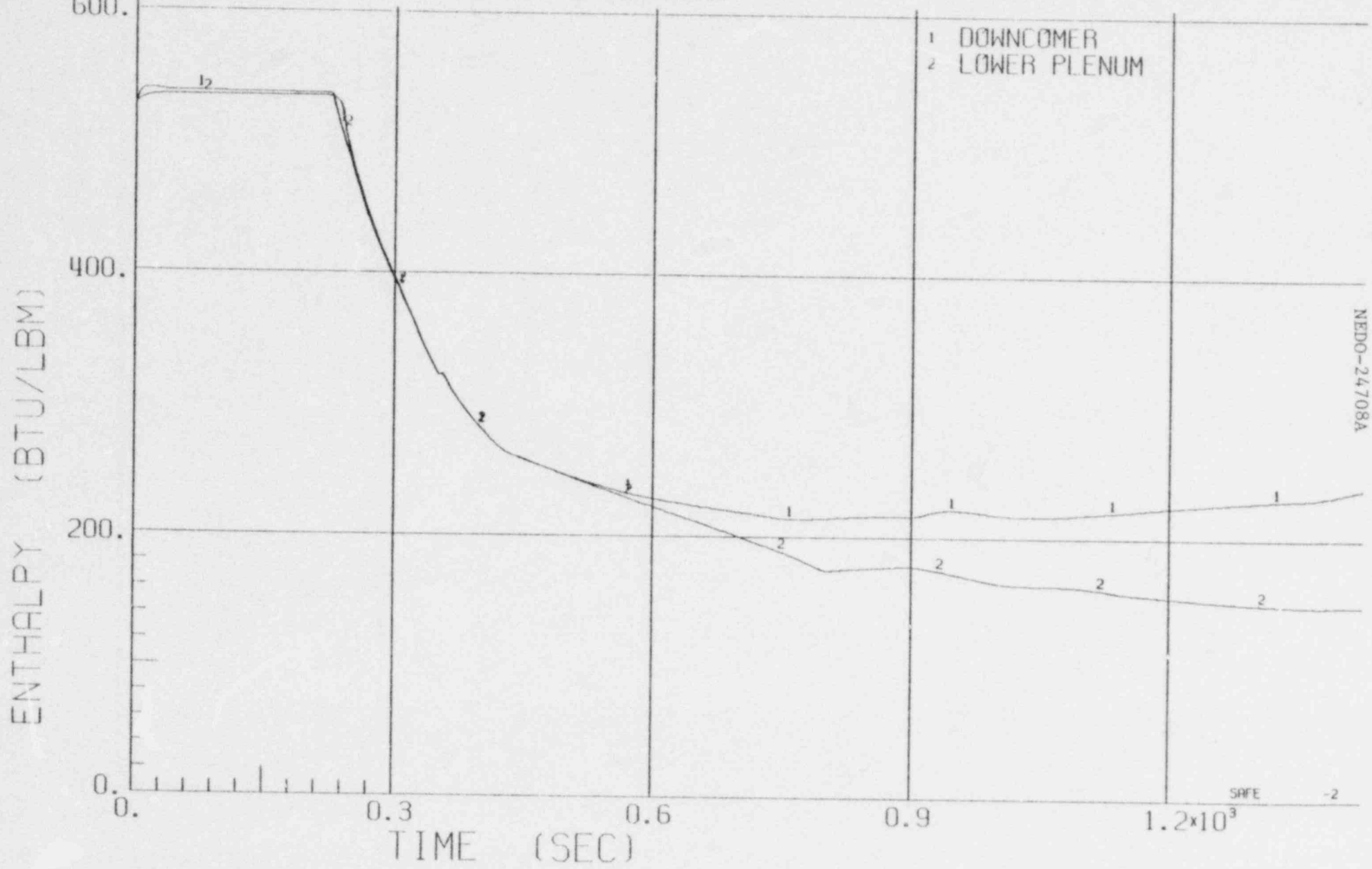

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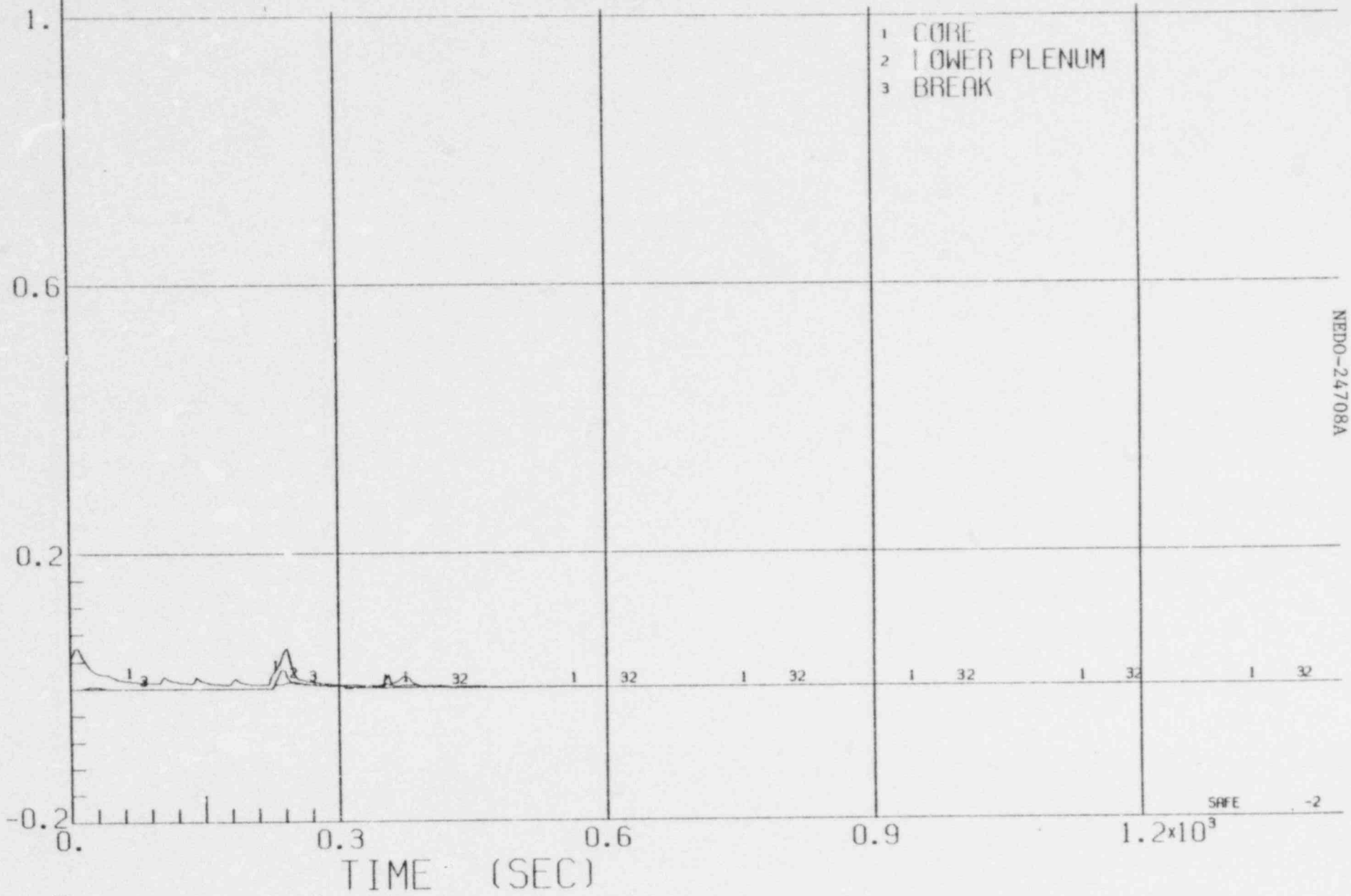
FIGURE 3.5.2.1 - 4.8 QUALITY VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

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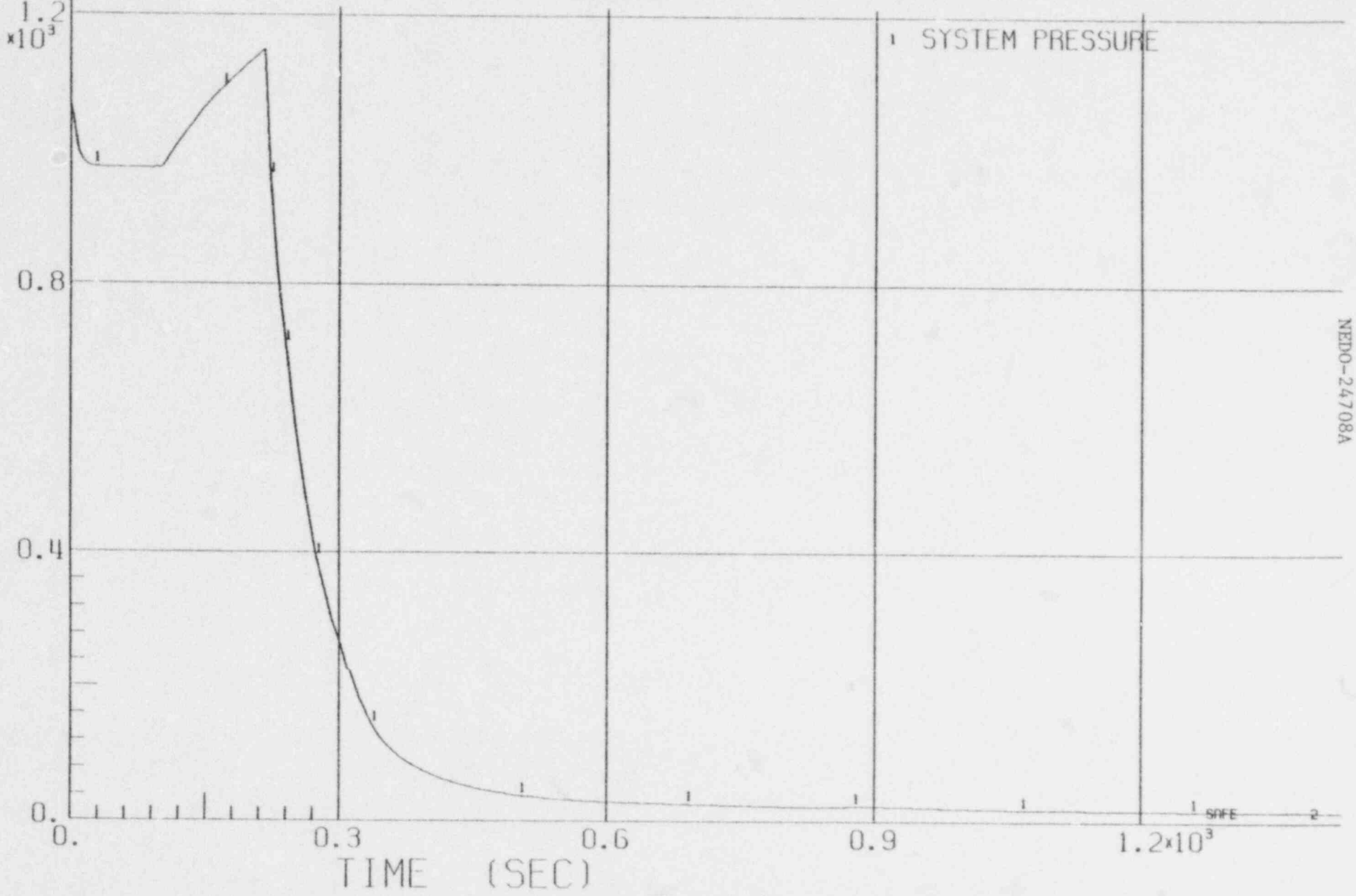
FIGURE 3.5.2.1 - 5.1 SYSTEM PRESSURE VS TIME FOR A 0.10 FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

FIGURE 3.5.2.1 - 5.2 WATER LEVEL VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

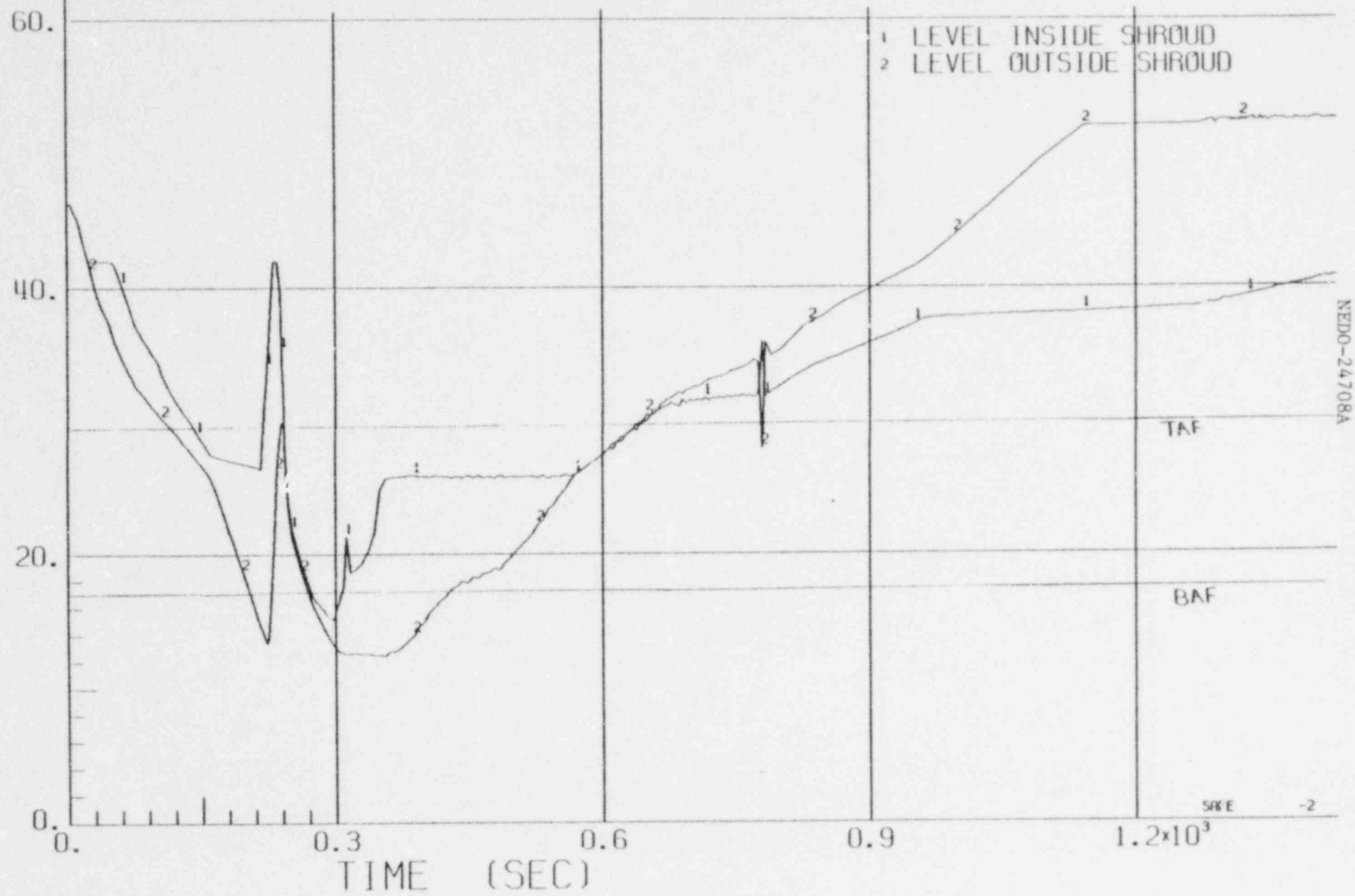


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FIGURE 3.5.2.1 - 5.3 SYSTEM FLOW RATES VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

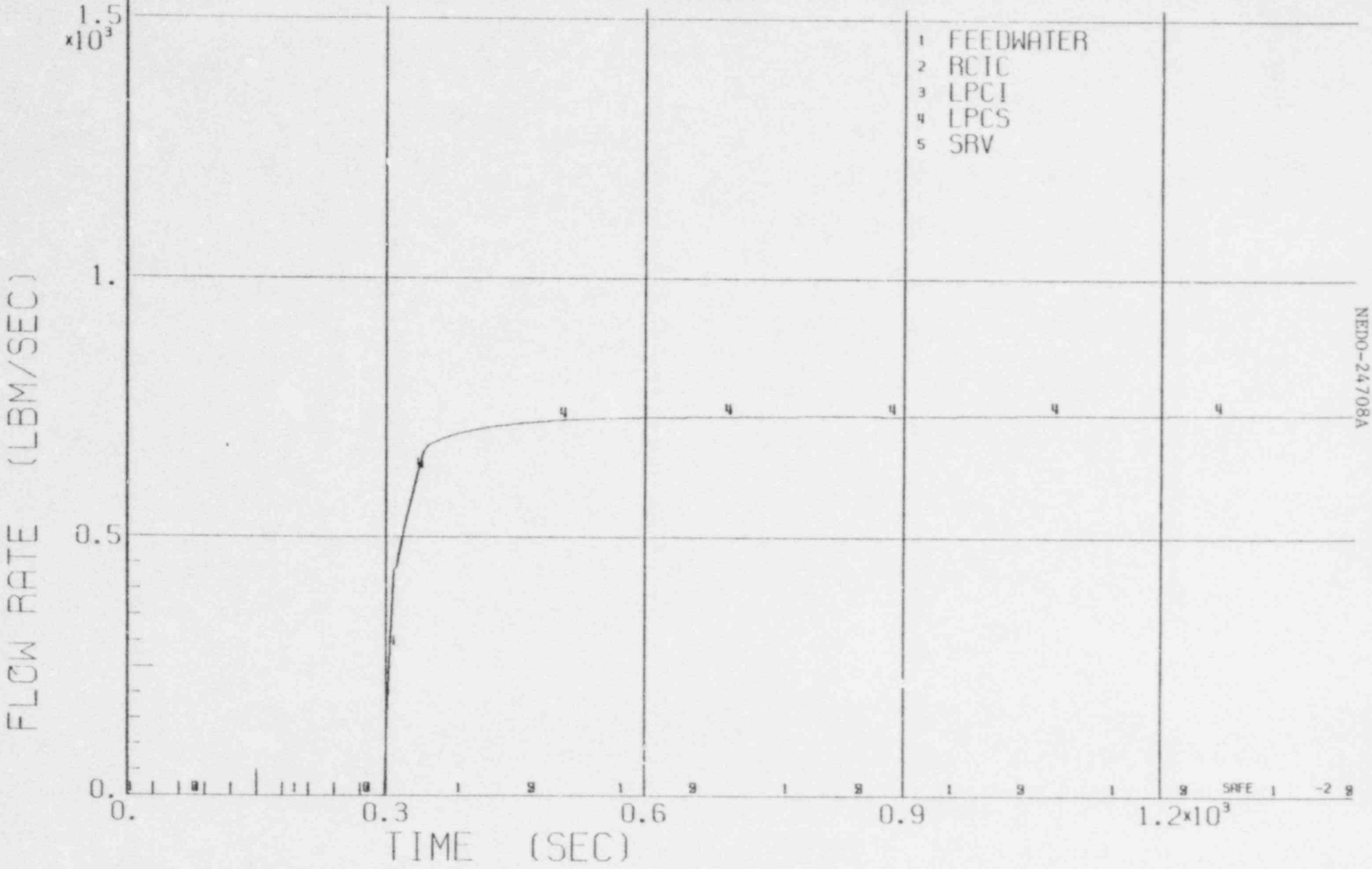

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FIGURE 3.5.2.1 - 5.4 FLOW RATES VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

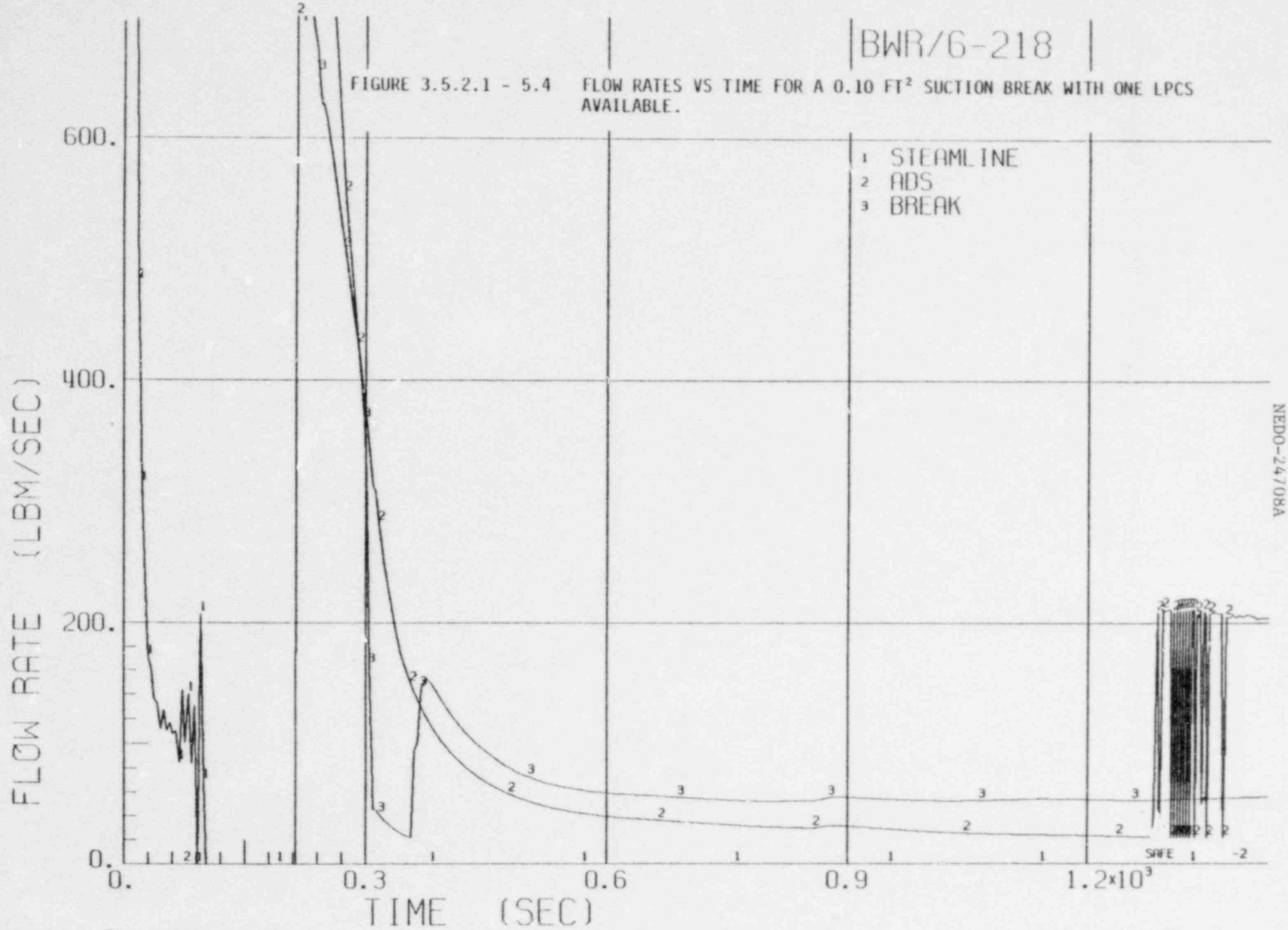

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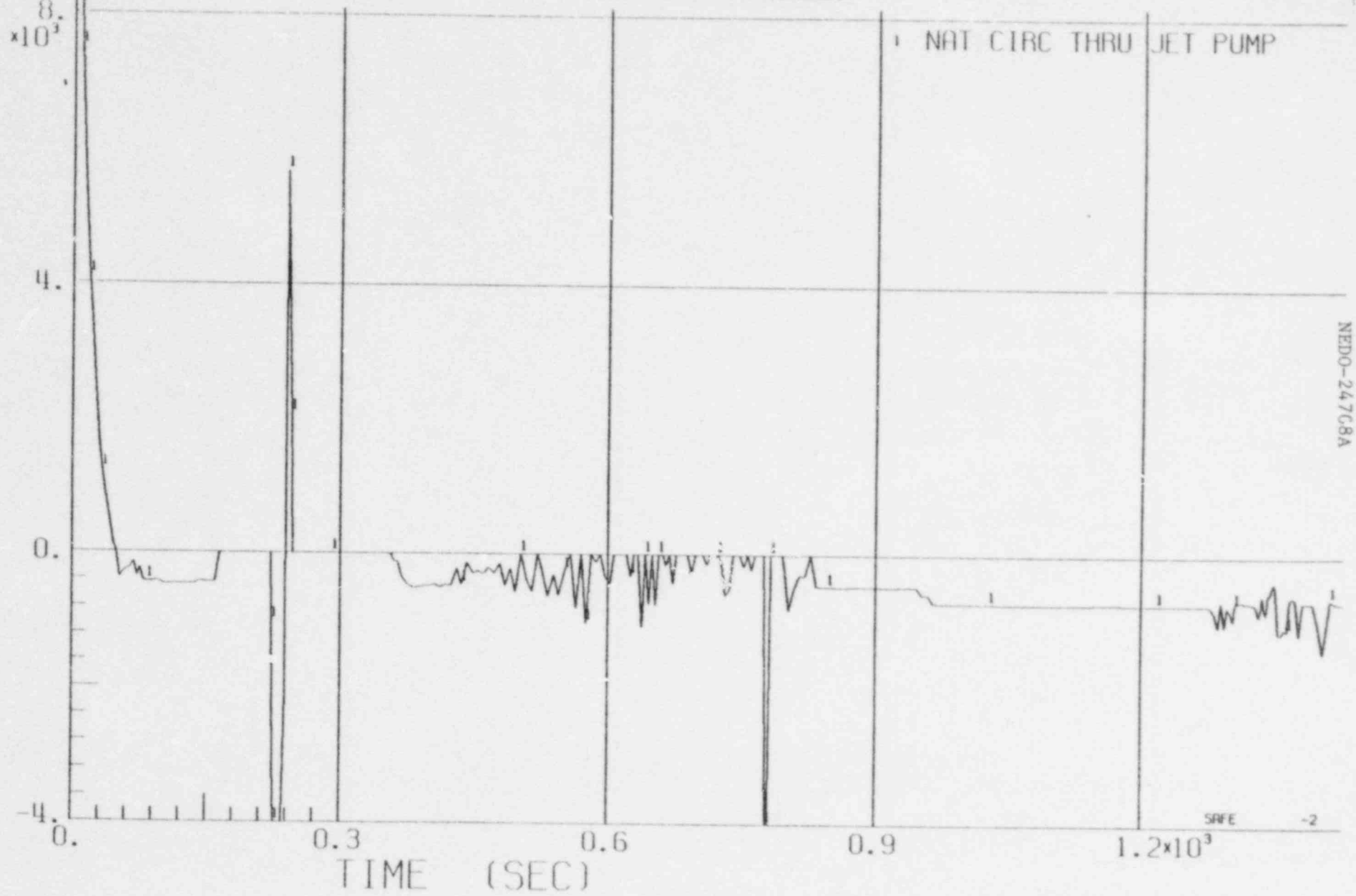
FIGURE 3.5.2.1 - 5.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 2.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

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FIGURE 3.5.2.1 - 5.6 TEMPERATURE VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

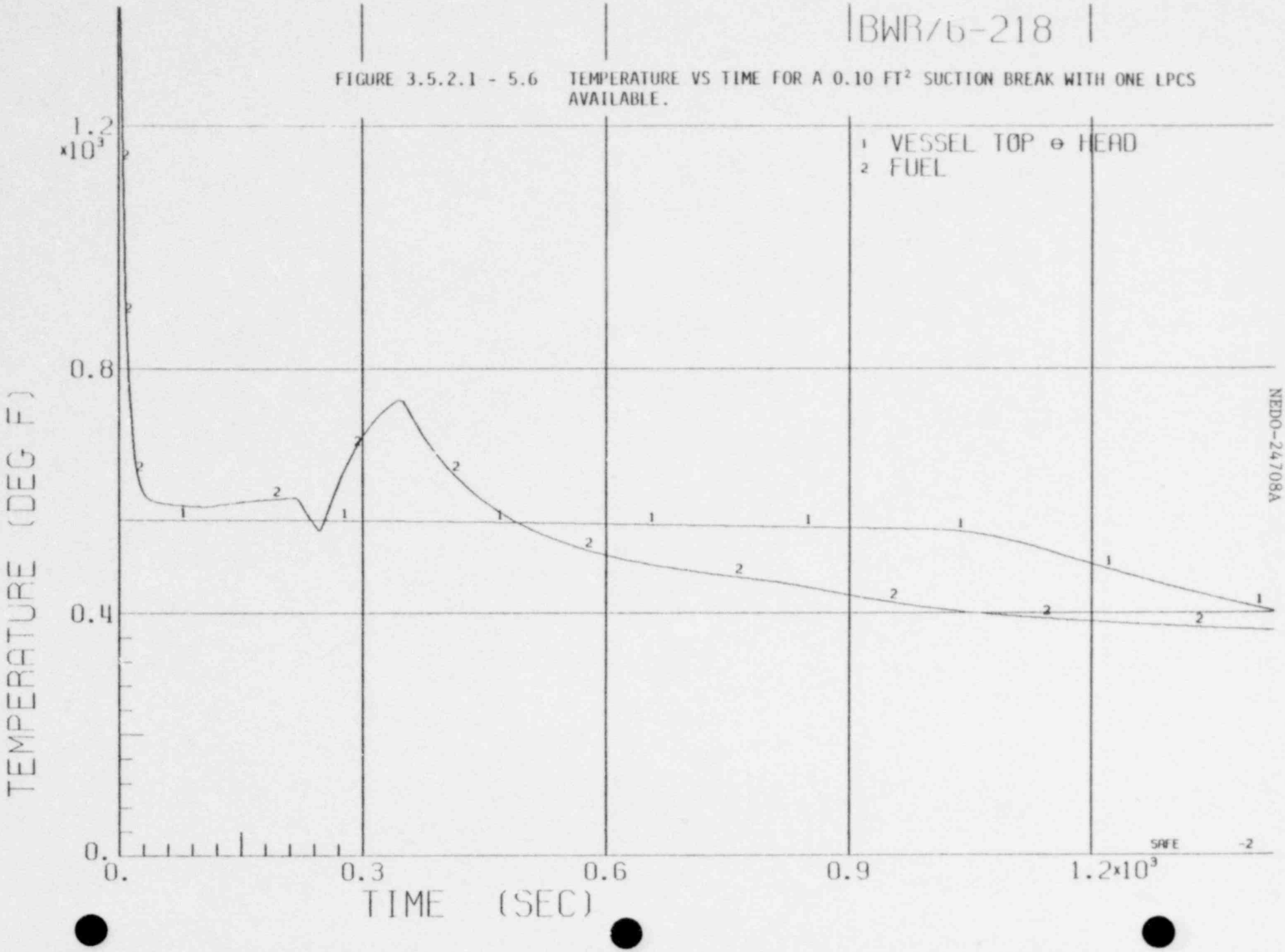

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FIGURE 3.5.2.1 - 5.7 ENTHALPY VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.

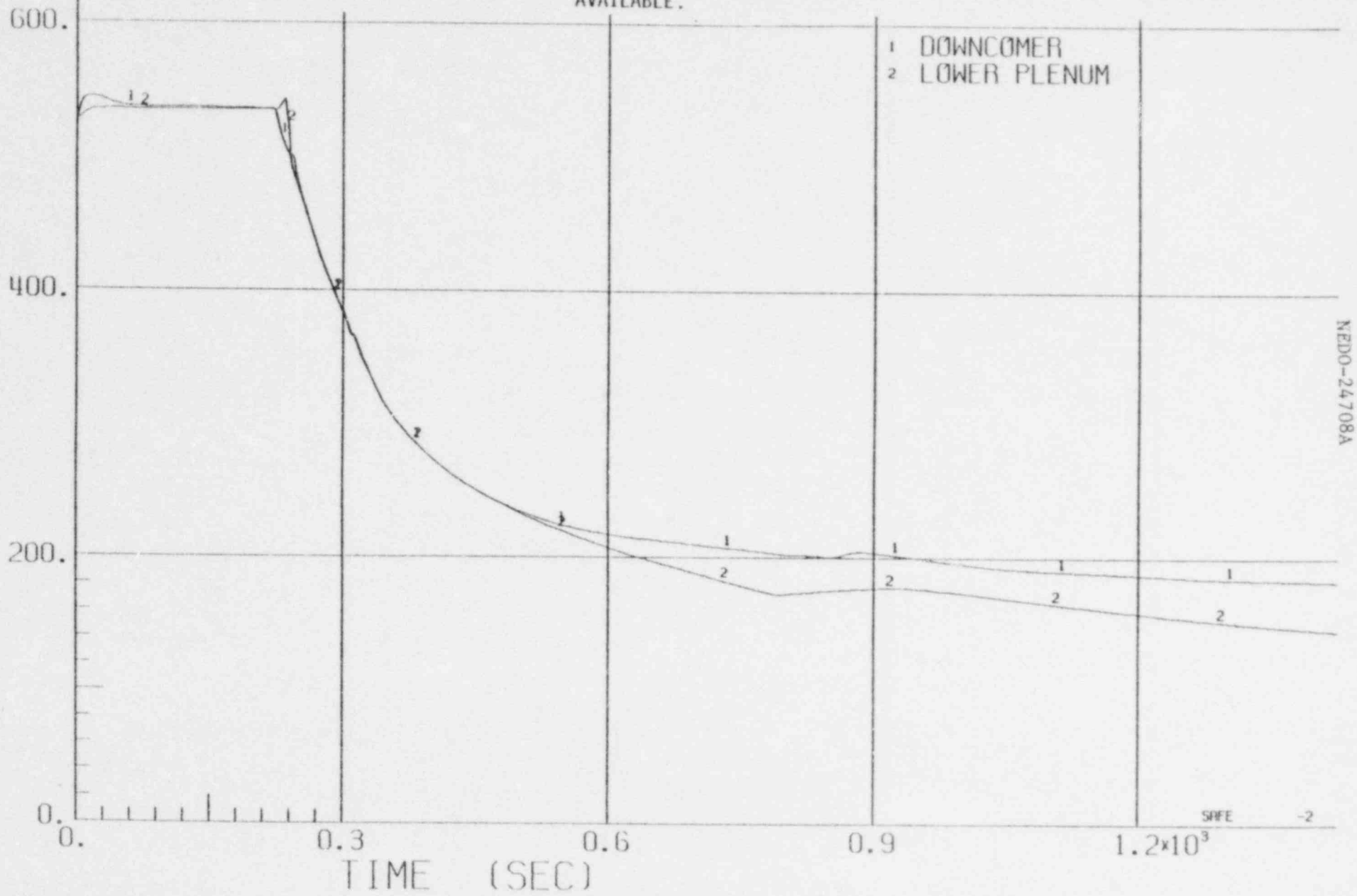

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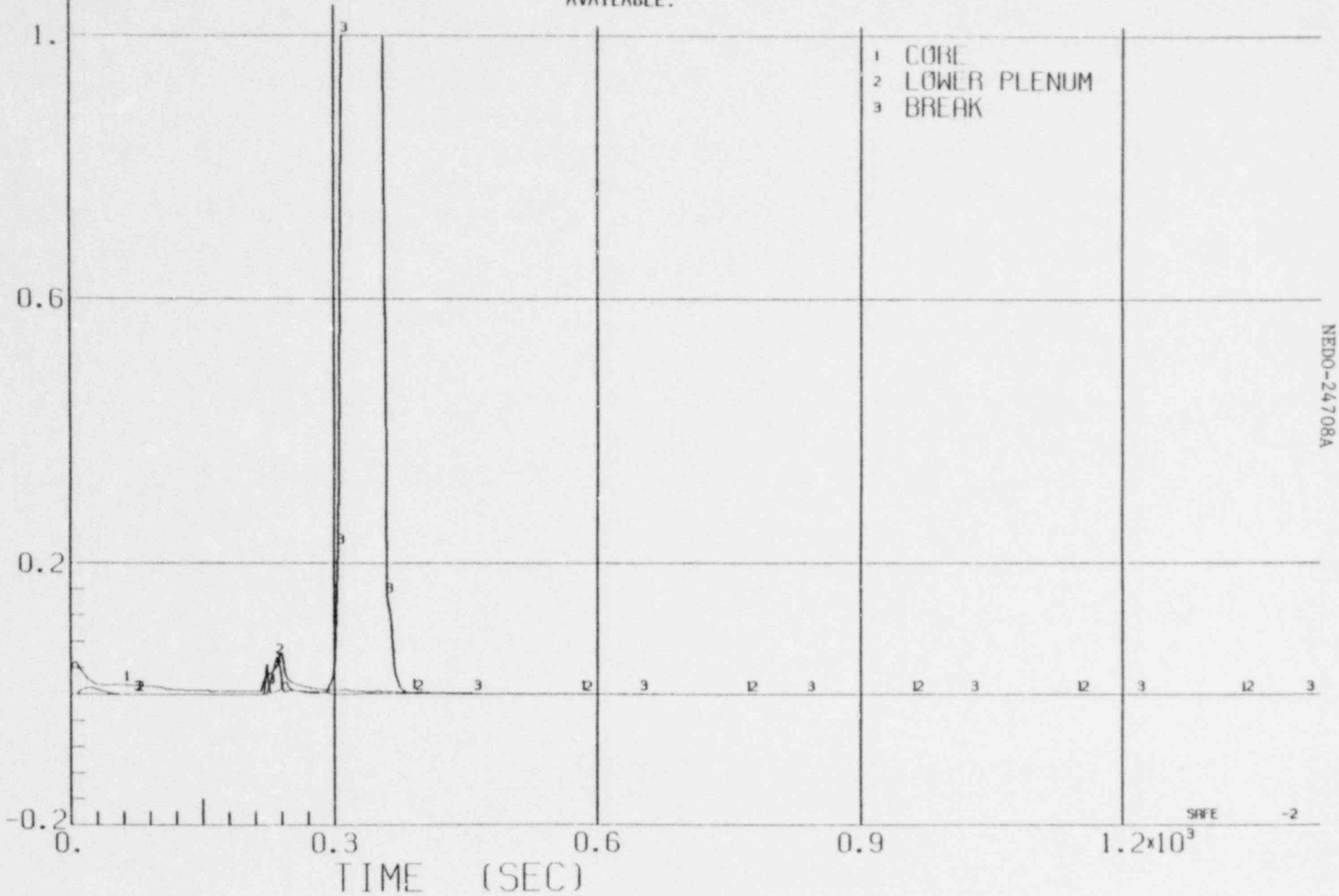
FIGURE 3.5.2.1 - 5.8 QUALITY VS TIME FOR A 0.10 FT² SUCTION BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

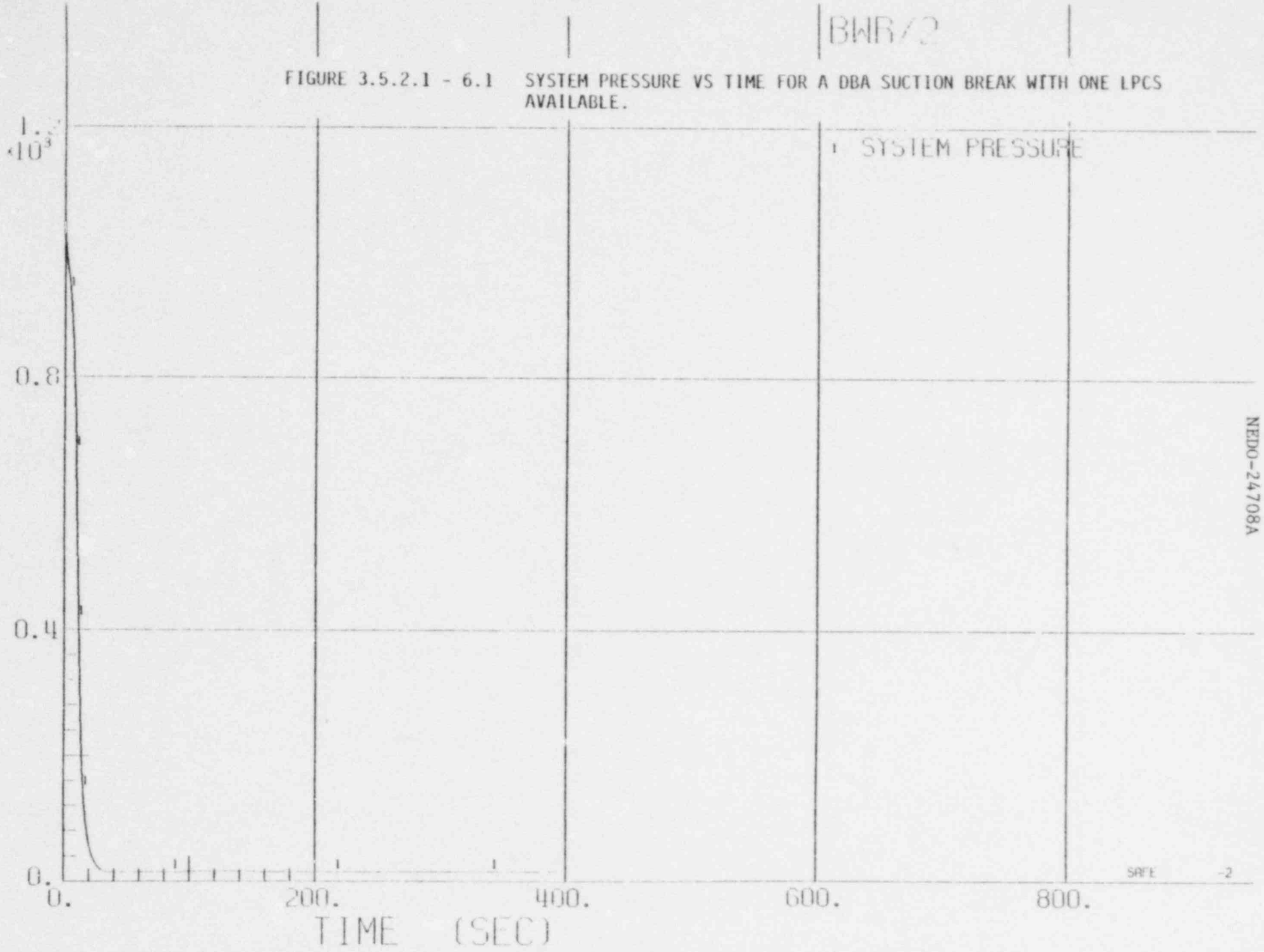
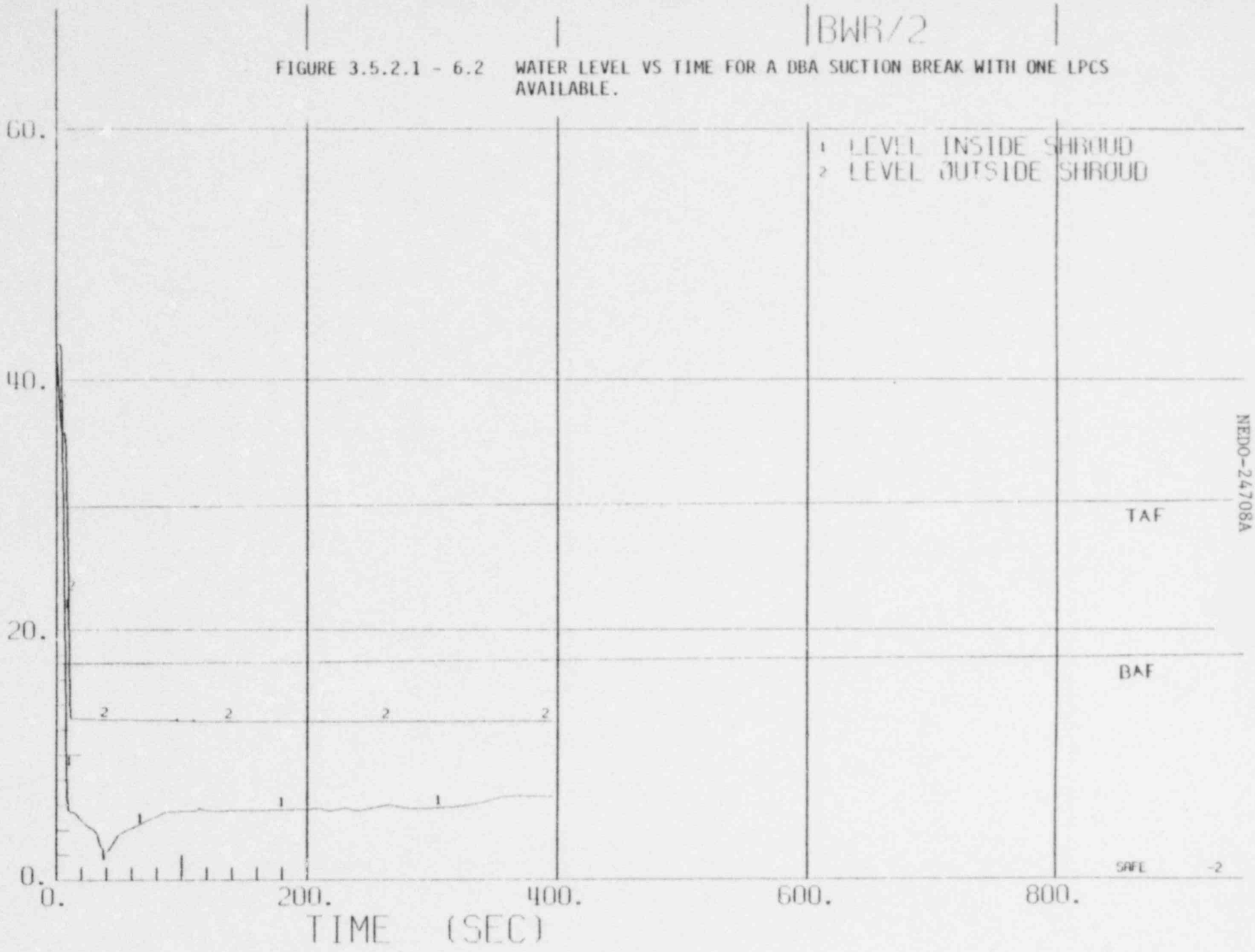


FIGURE 3.5.2.1 - 6.1 SYSTEM PRESSURE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

FIGURE 3.5.2.1 - 6.2 WATER LEVEL VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.



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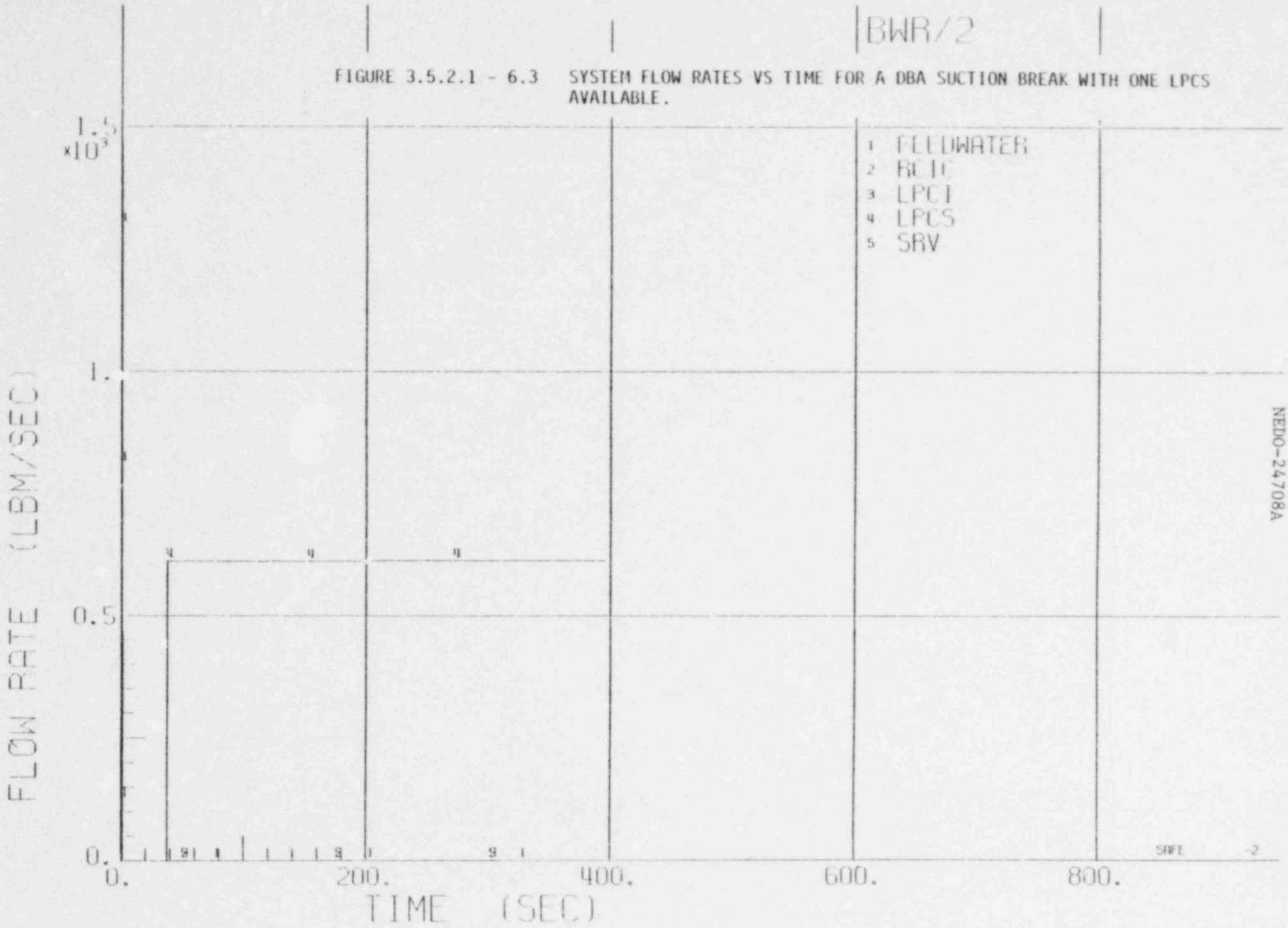

FIGURE 3.5.2.1 - 6.3 SYSTEM FLOW RATES VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

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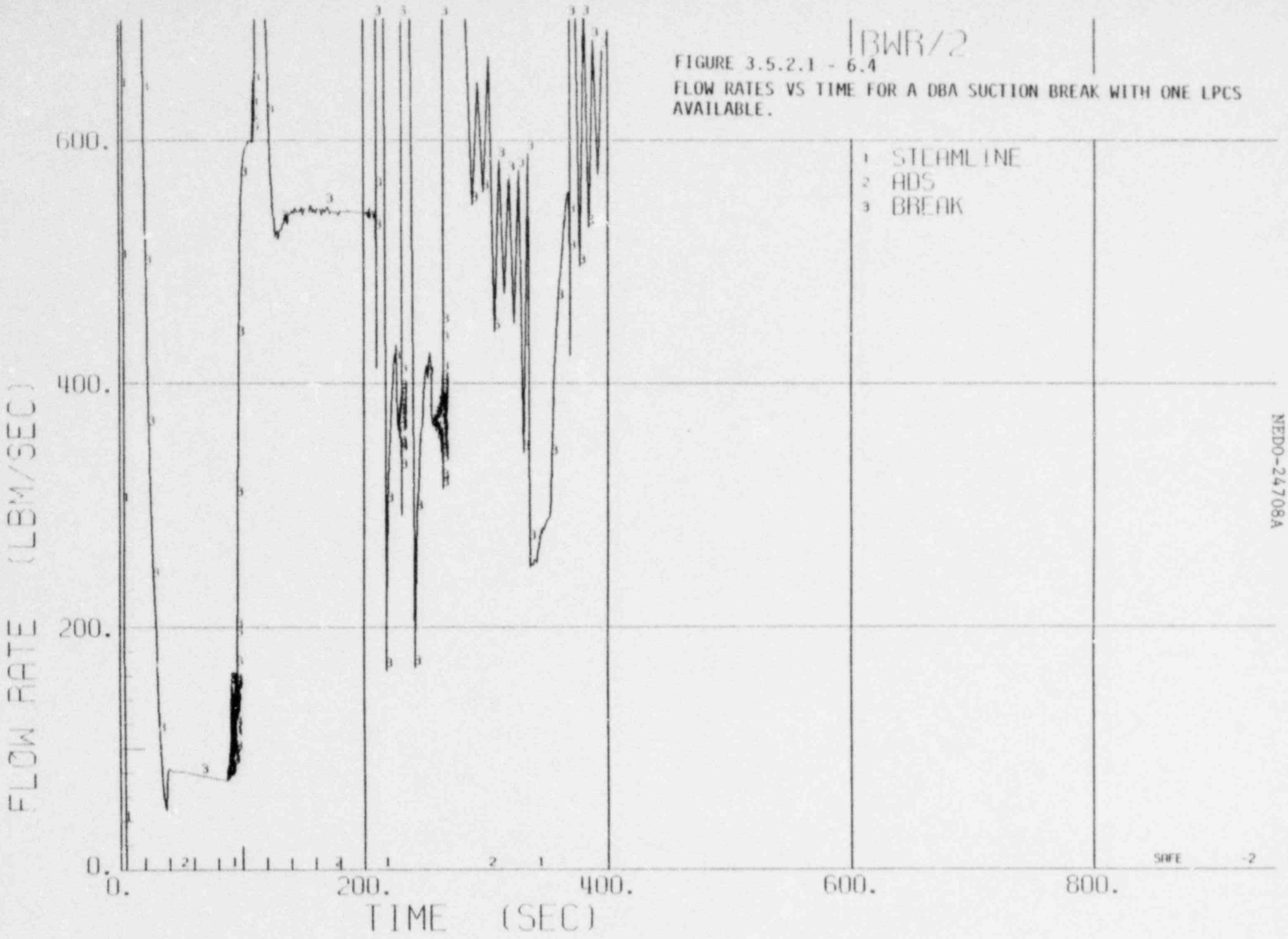
FIGURE 3.5.2.1 - 6.4

FLOW RATES VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

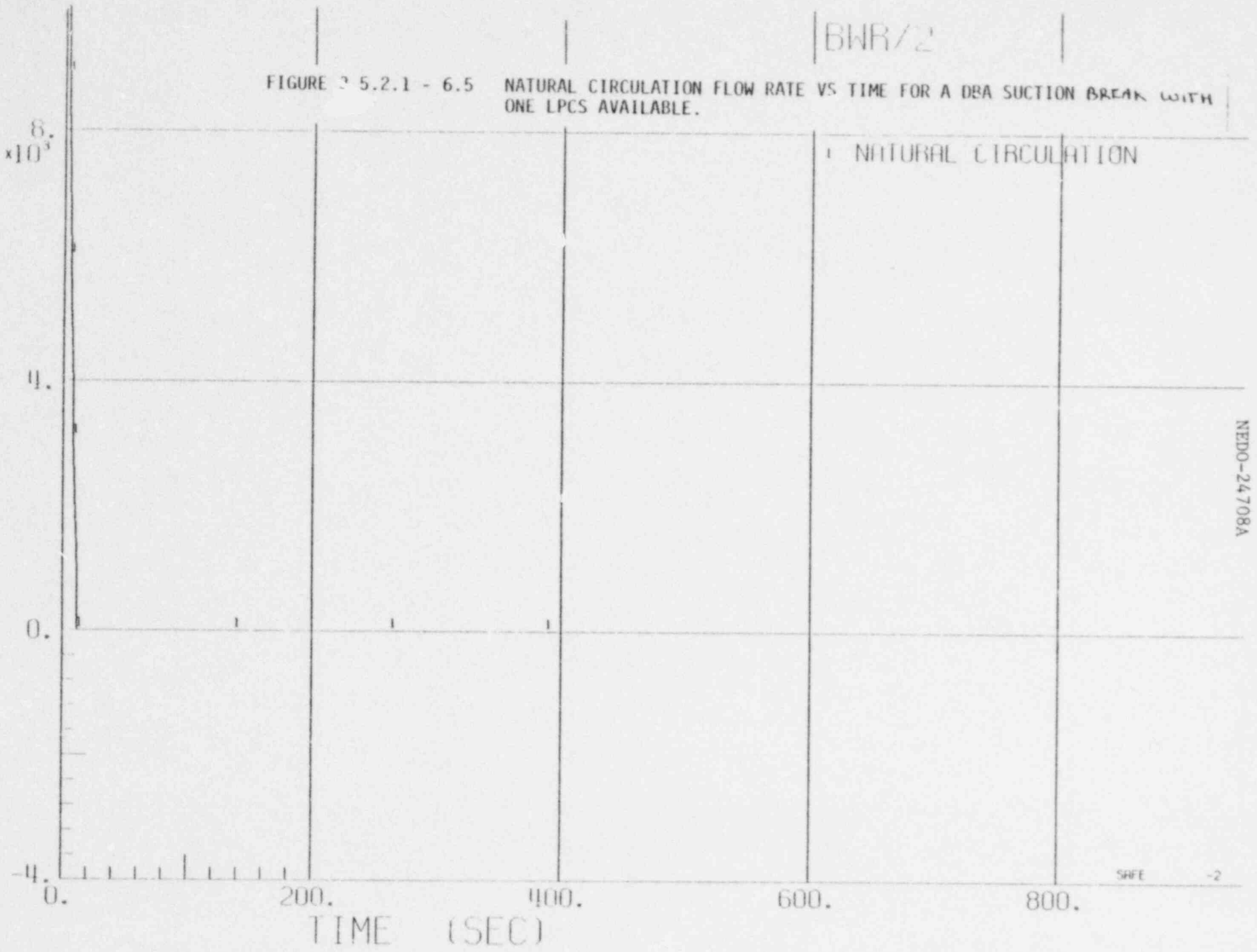


FIGURE 5.2.1 - 6.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

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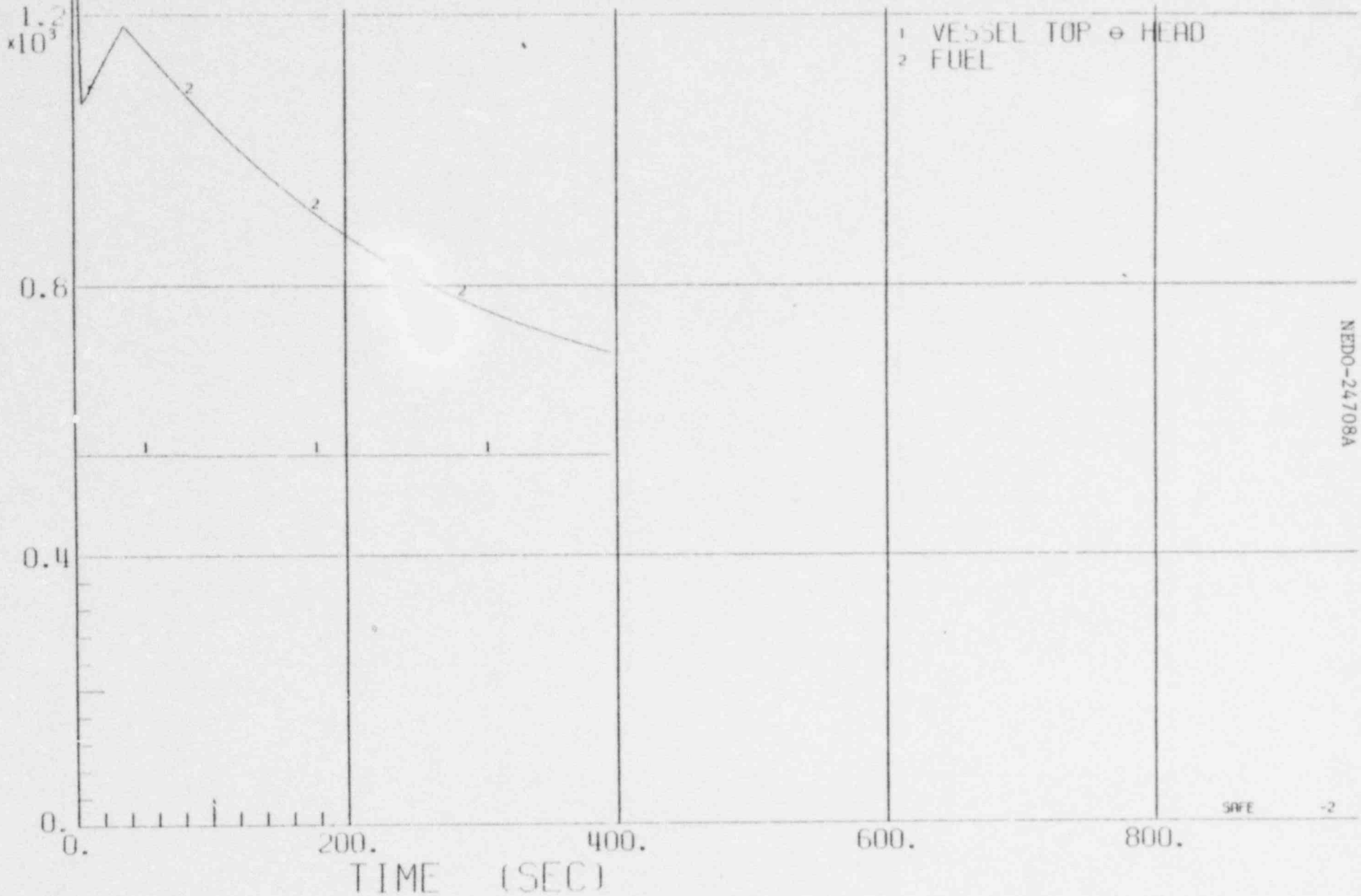
FIGURE 3.5.2.1 - 6.6 TEMPERATURE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.



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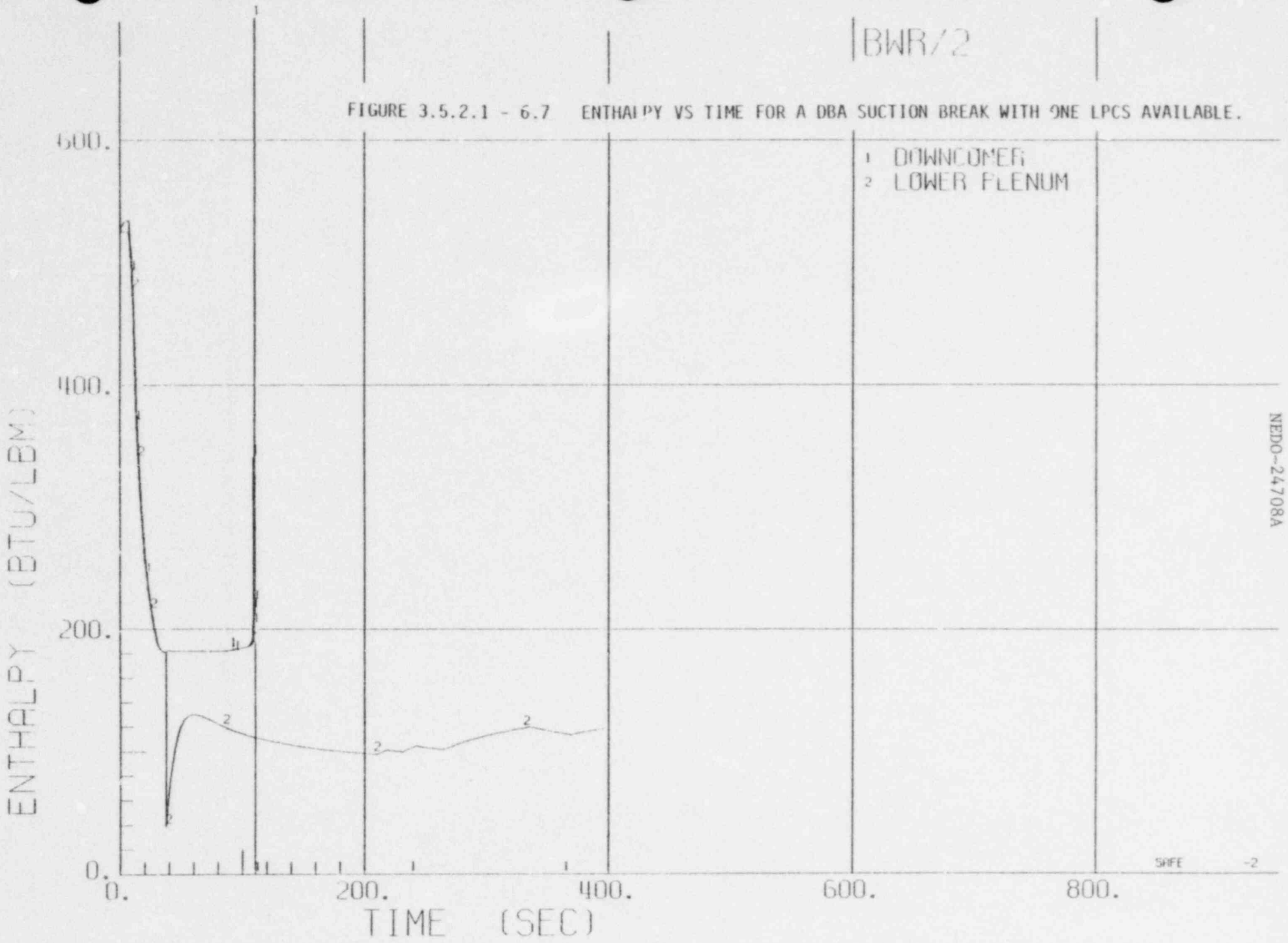

FIGURE 3.5.2.1 - 6.7 ENTHALPY VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

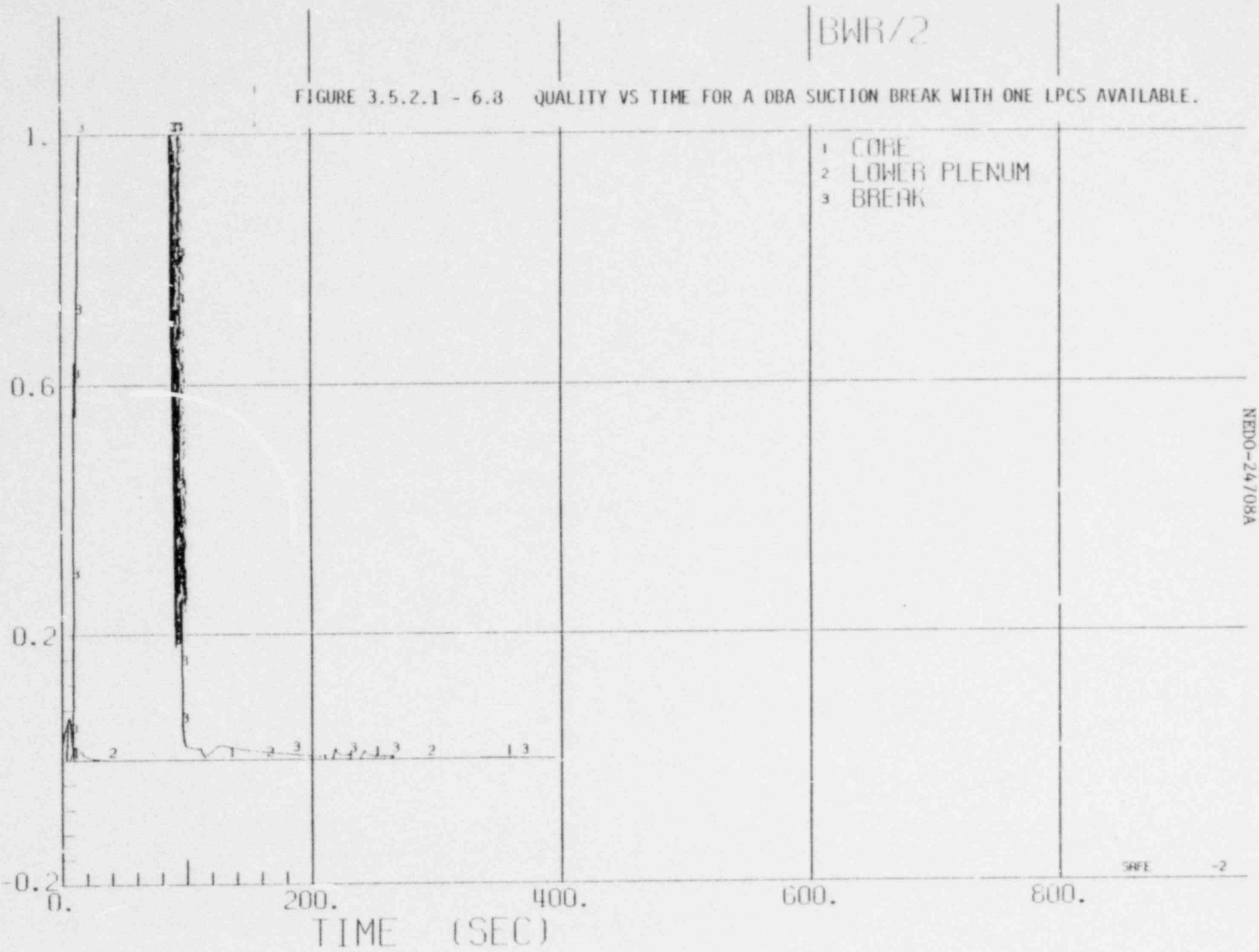

FIGURE 3.5.2.1 - 6.8 QUALITY VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 7.1 SYSTEM PRESSURE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

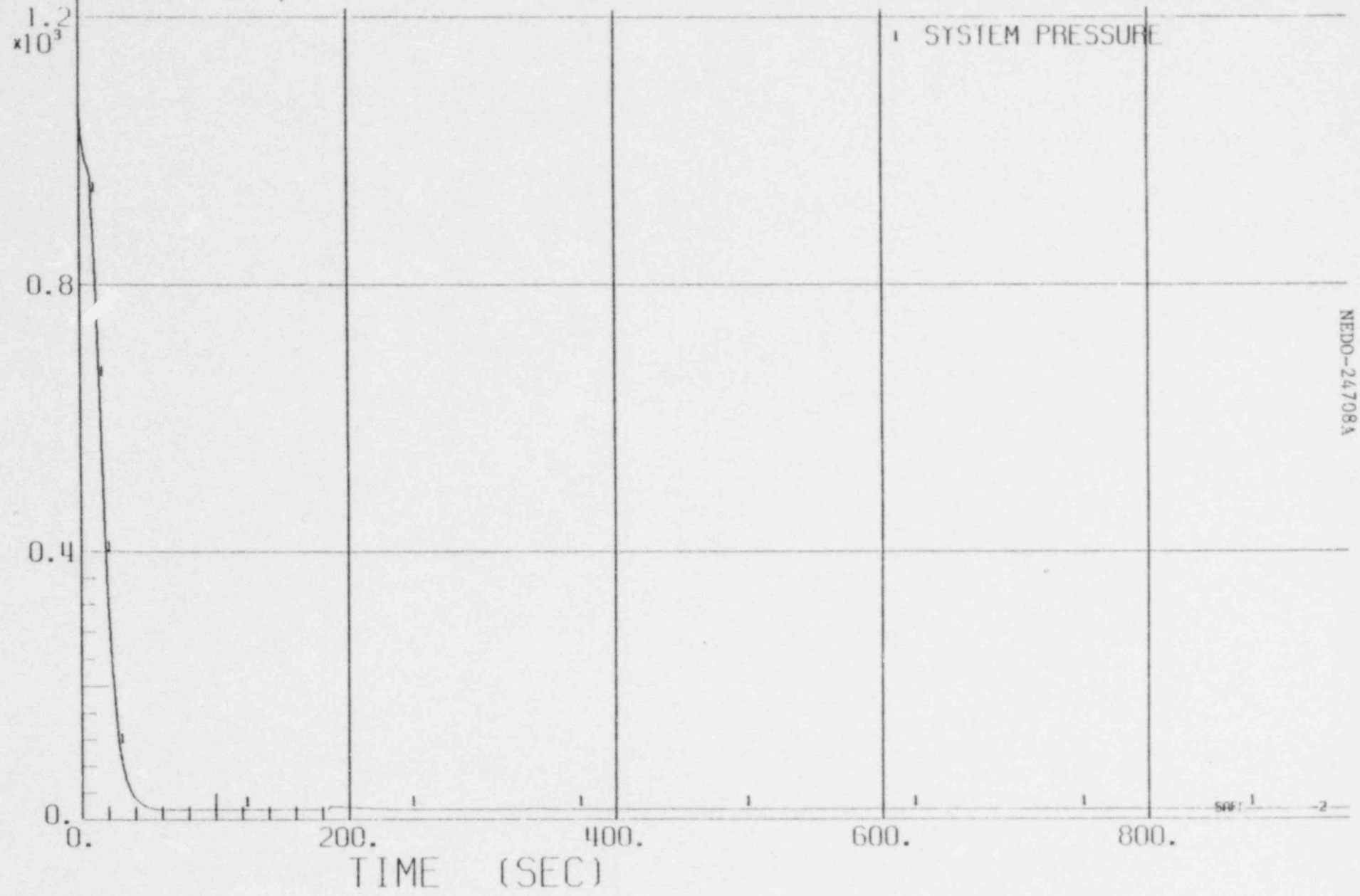

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FIGURE 3.5.2.1 - 7.2 WATER LEVEL VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

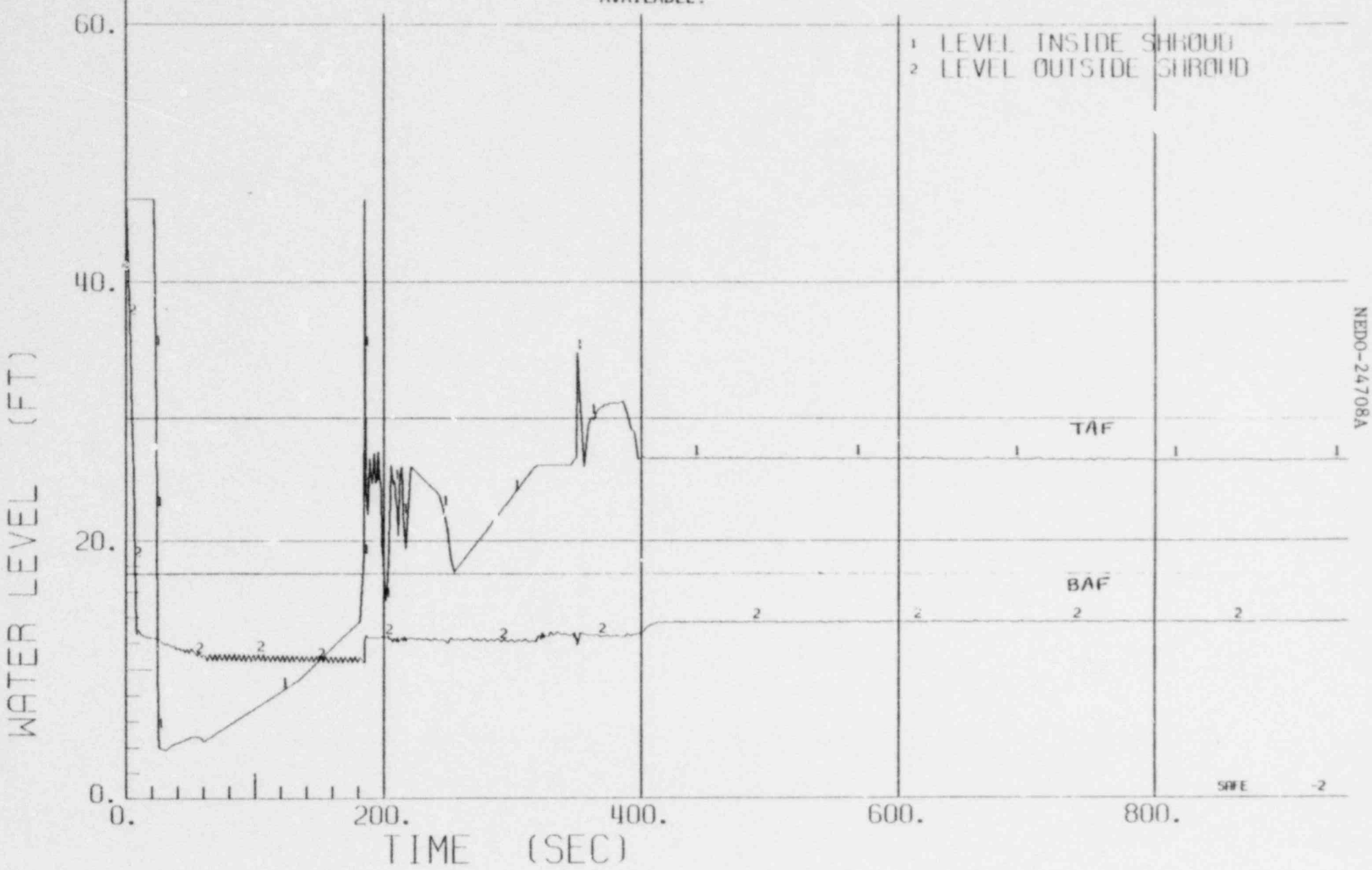

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FIGURE - 2.1 - 7.3 SYSTEM FLOW RATES VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

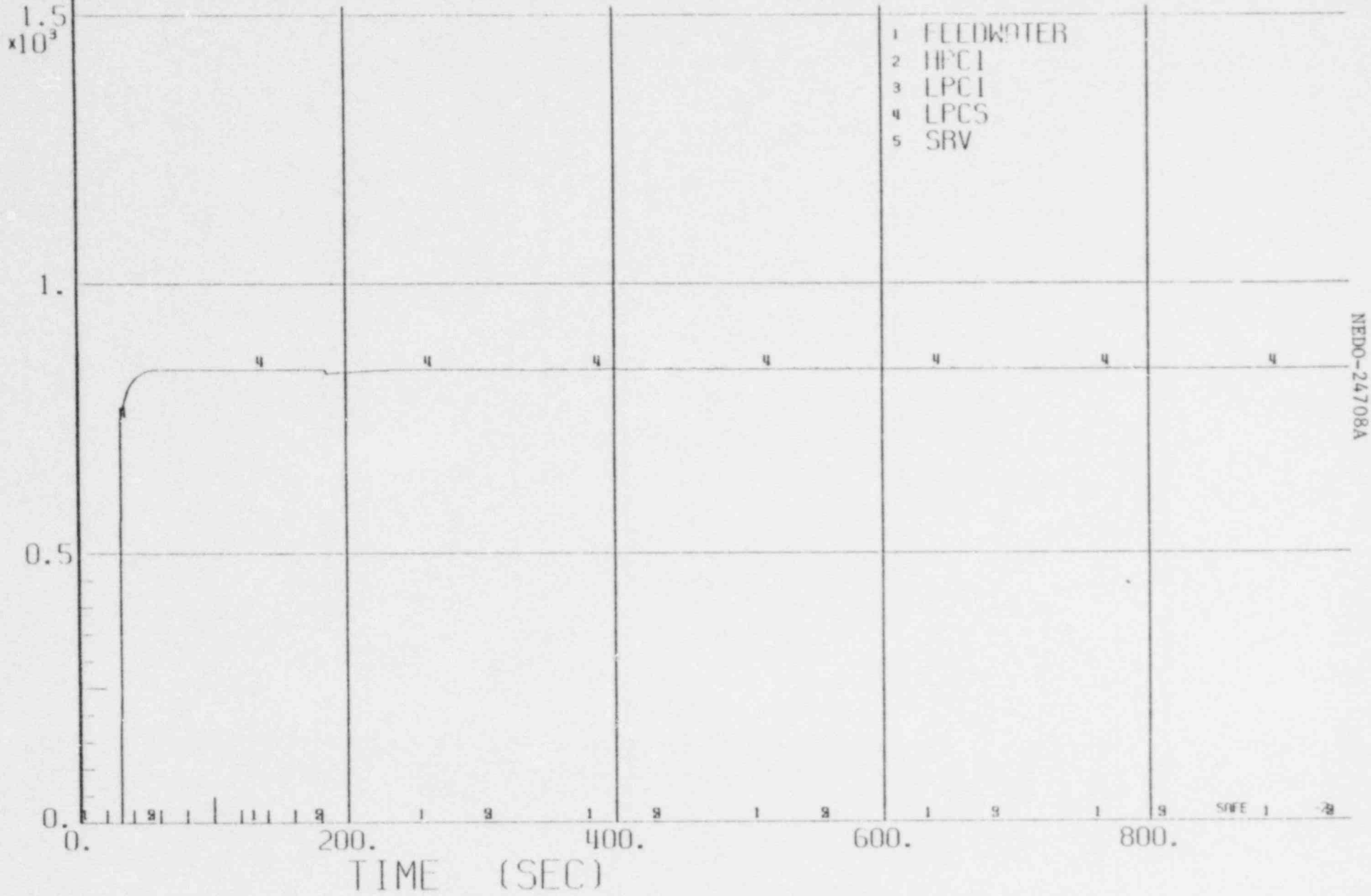

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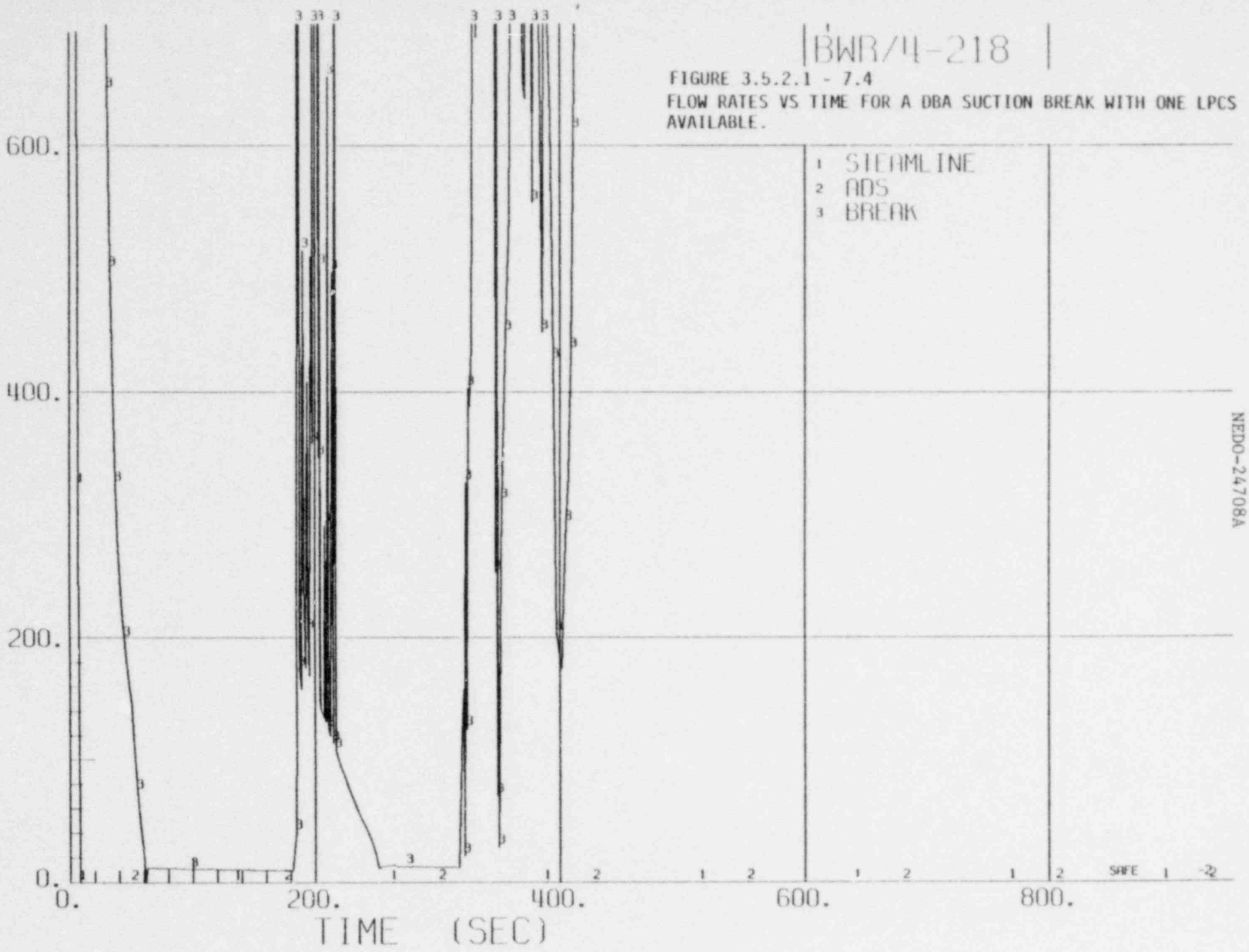
FIGURE 3.5.2.1 - 7.4
FLOW RATES VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

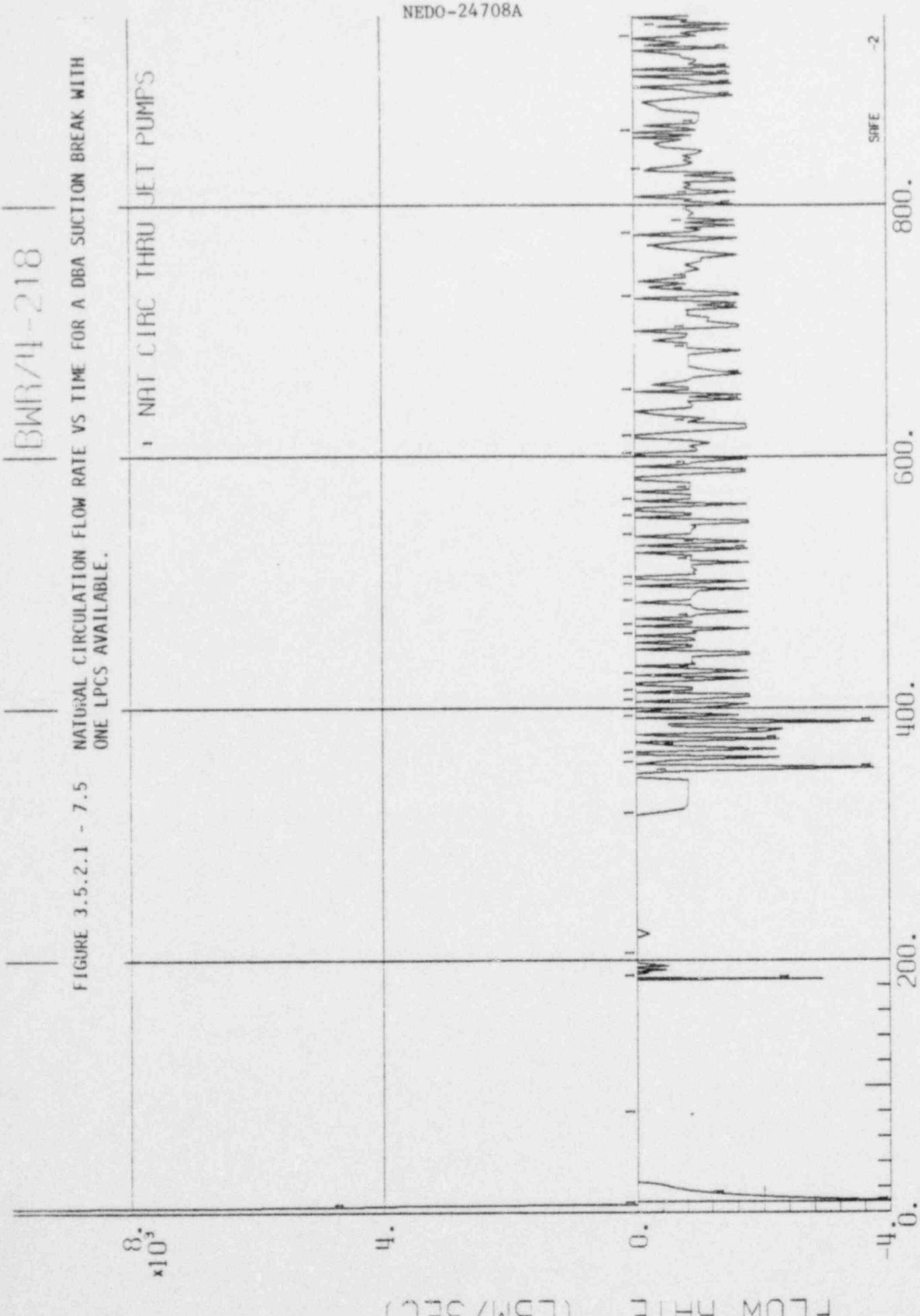


FIGURE 3.5.2.1 - 7.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 7.6 TEMPERATURE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

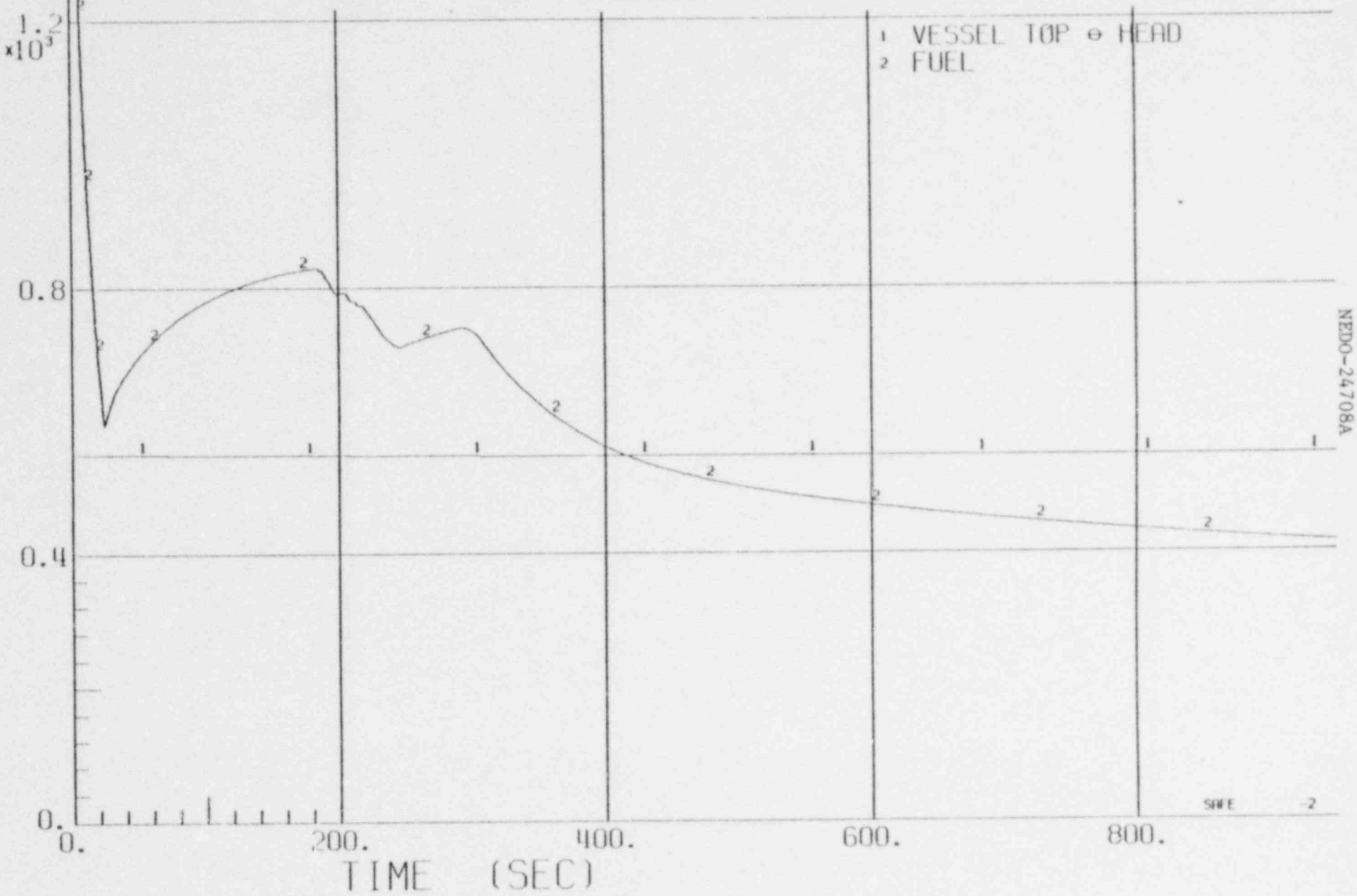

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FIGURE 3.5.2.1 - 7.7 ENTHALPY VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

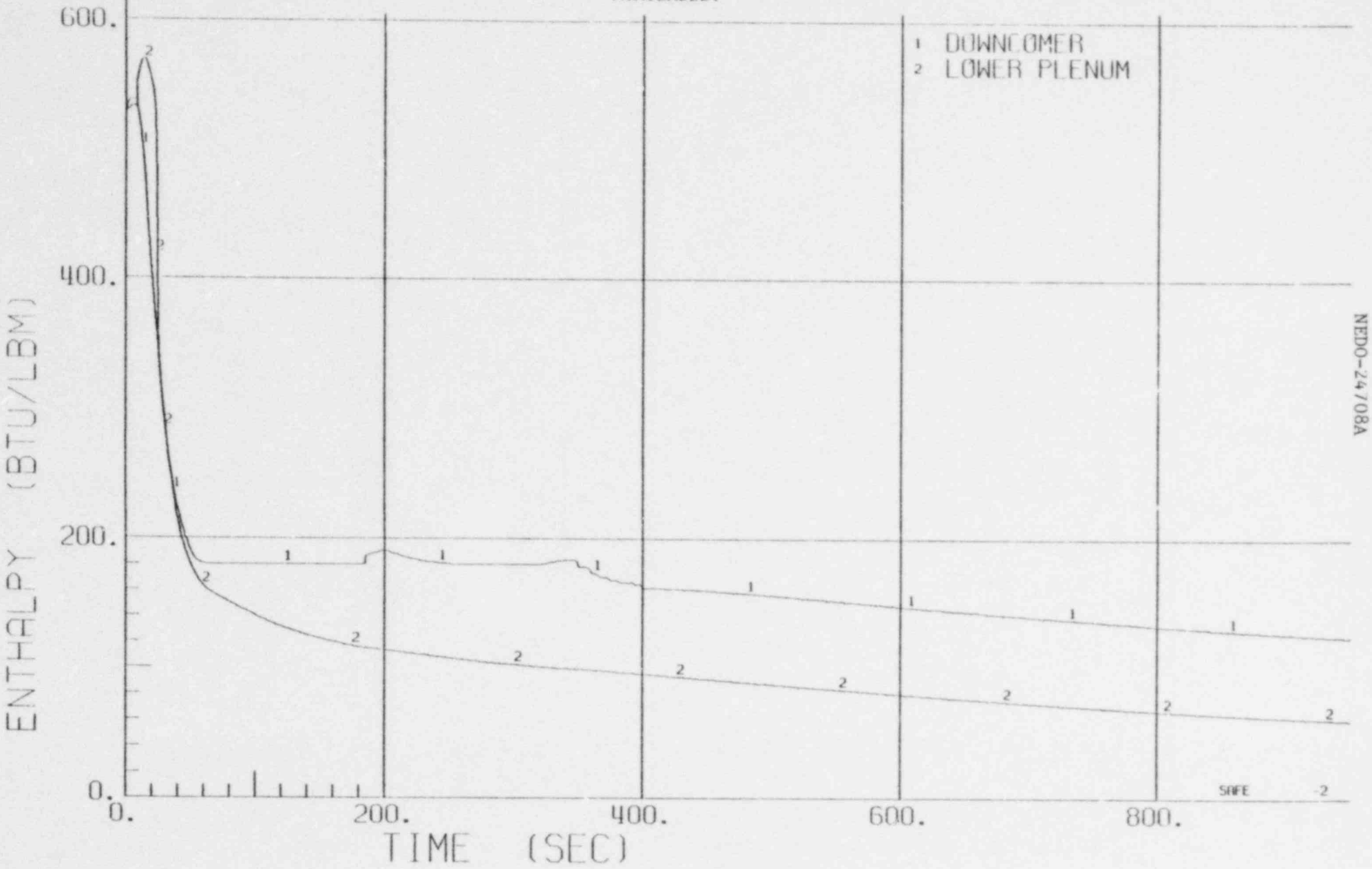

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FIGURE 3.5.2.1 - 7.8 QUALITY VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCS AVAILABLE.

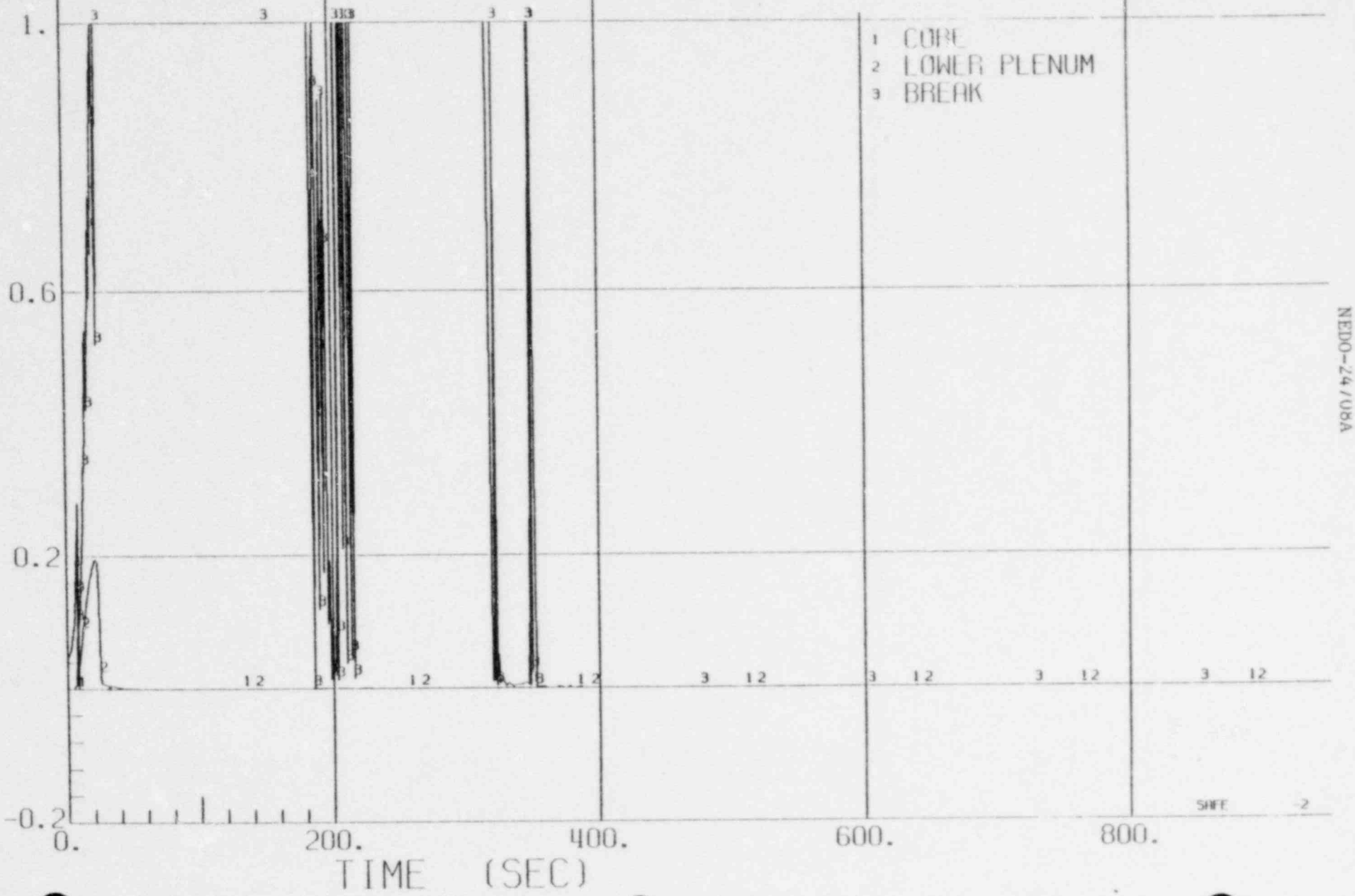

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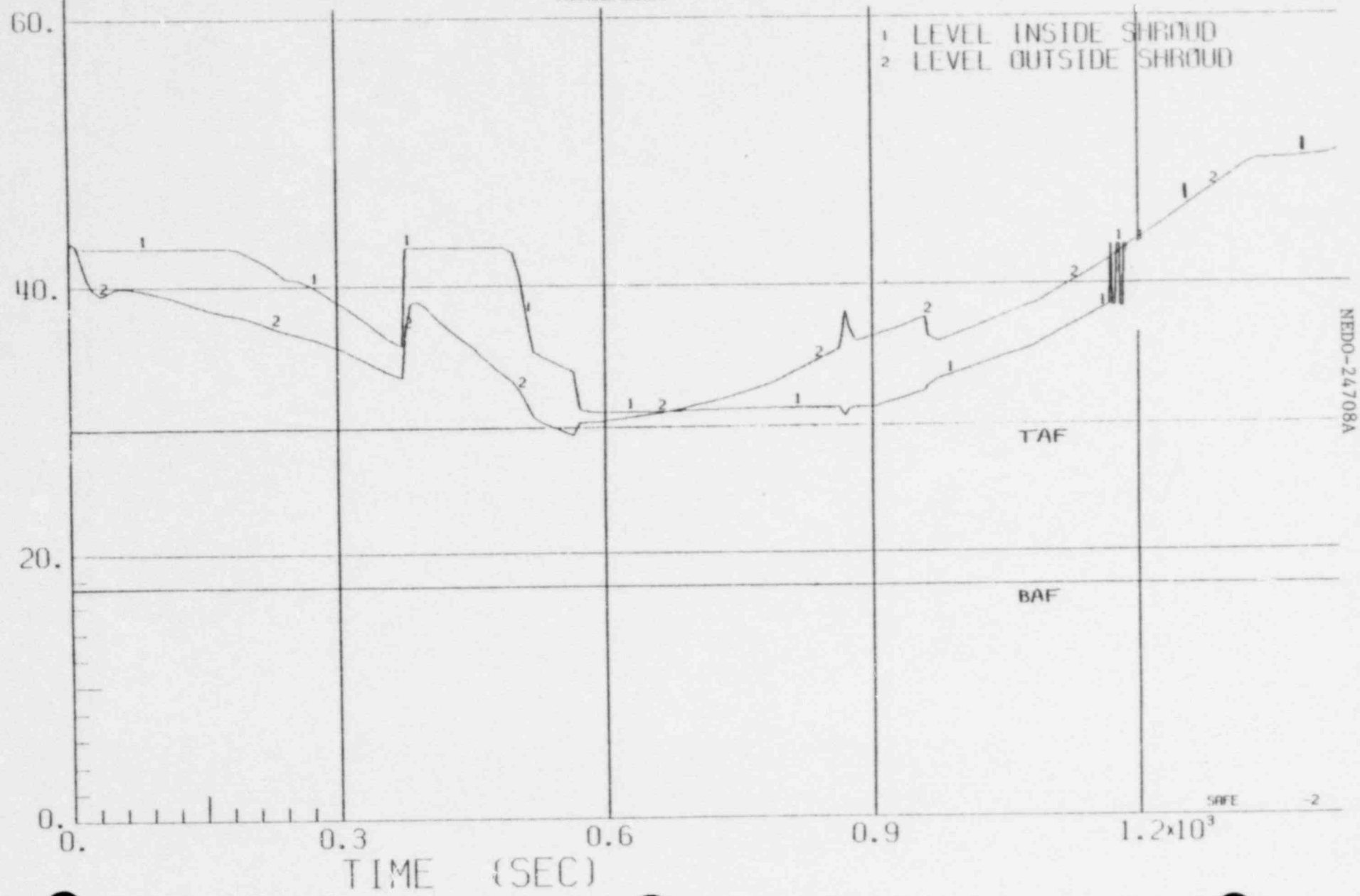
FIGURE 3.5.2.1 - 8.1 SYSTEM PRESSURE VS TIME FOR A 0.10 FT^2 STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

FIGURE 3.5.2.1 - 8.2 WATER LEVEL VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



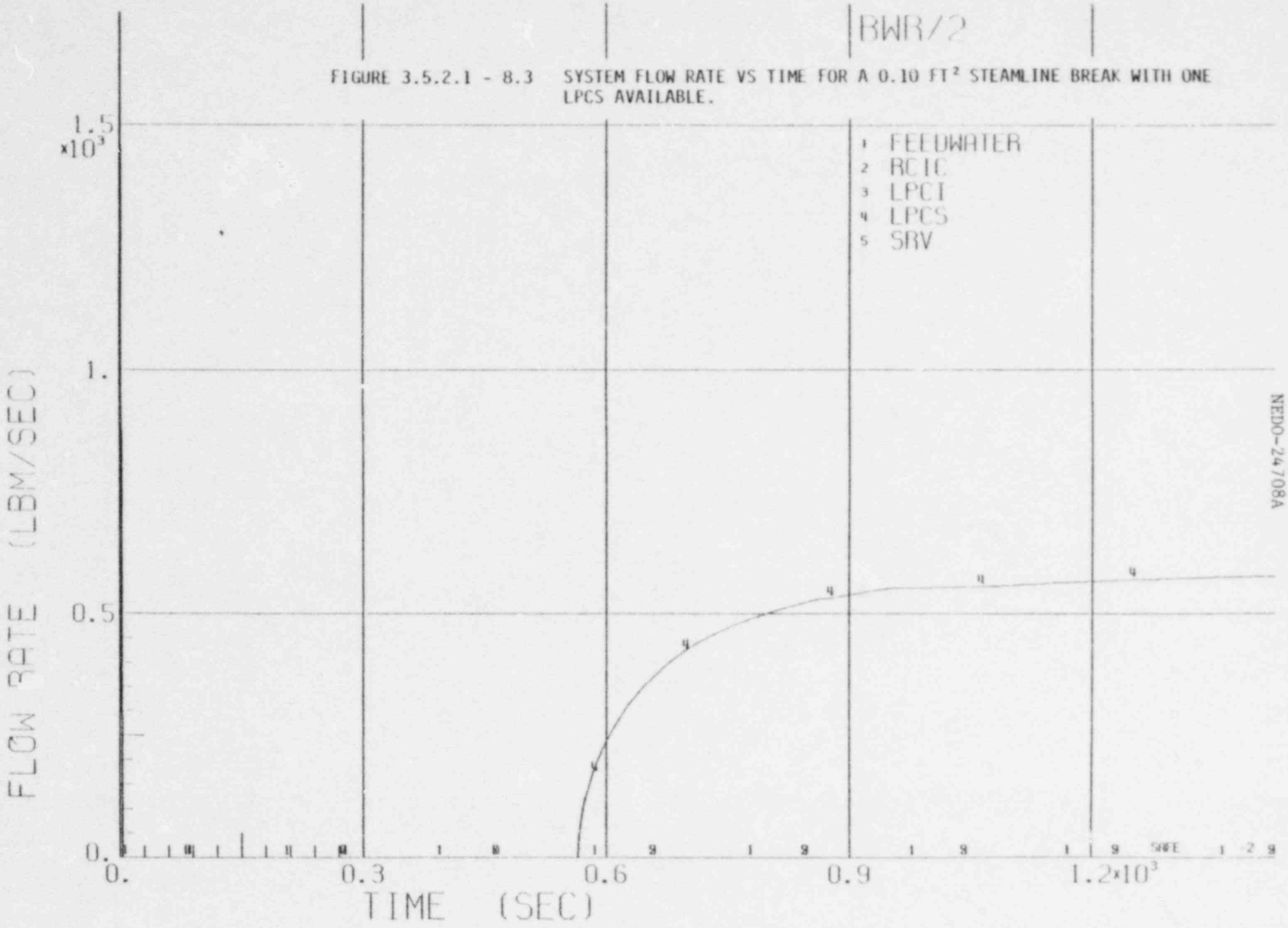
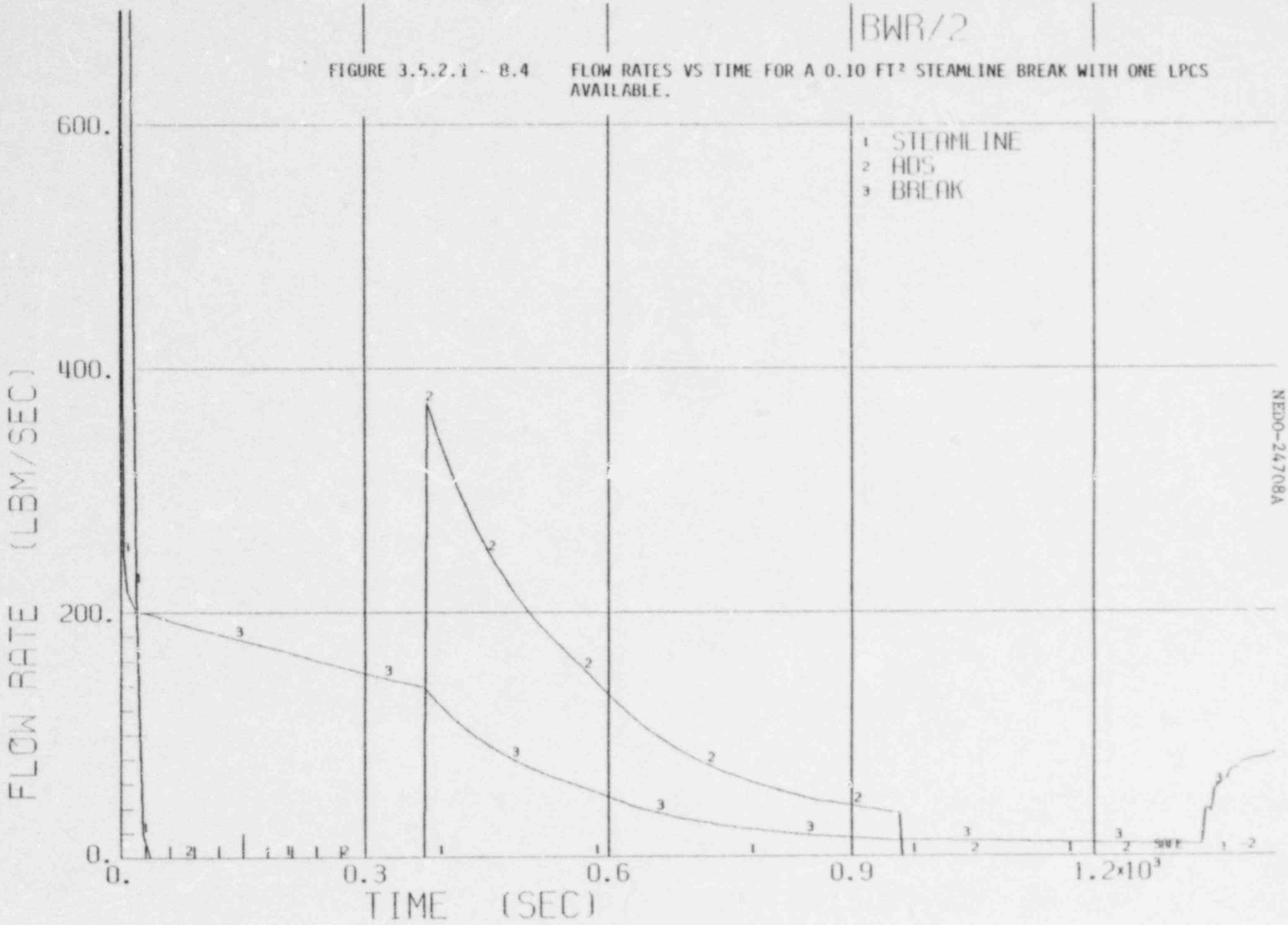


FIGURE 3.5.2.1 - 8.3 SYSTEM FLOW RATE VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

BWR/2

FIGURE 3.5.2.1 - 8.4 FLOW RATES VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

FIGURE 3.5.2.1 - 8.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

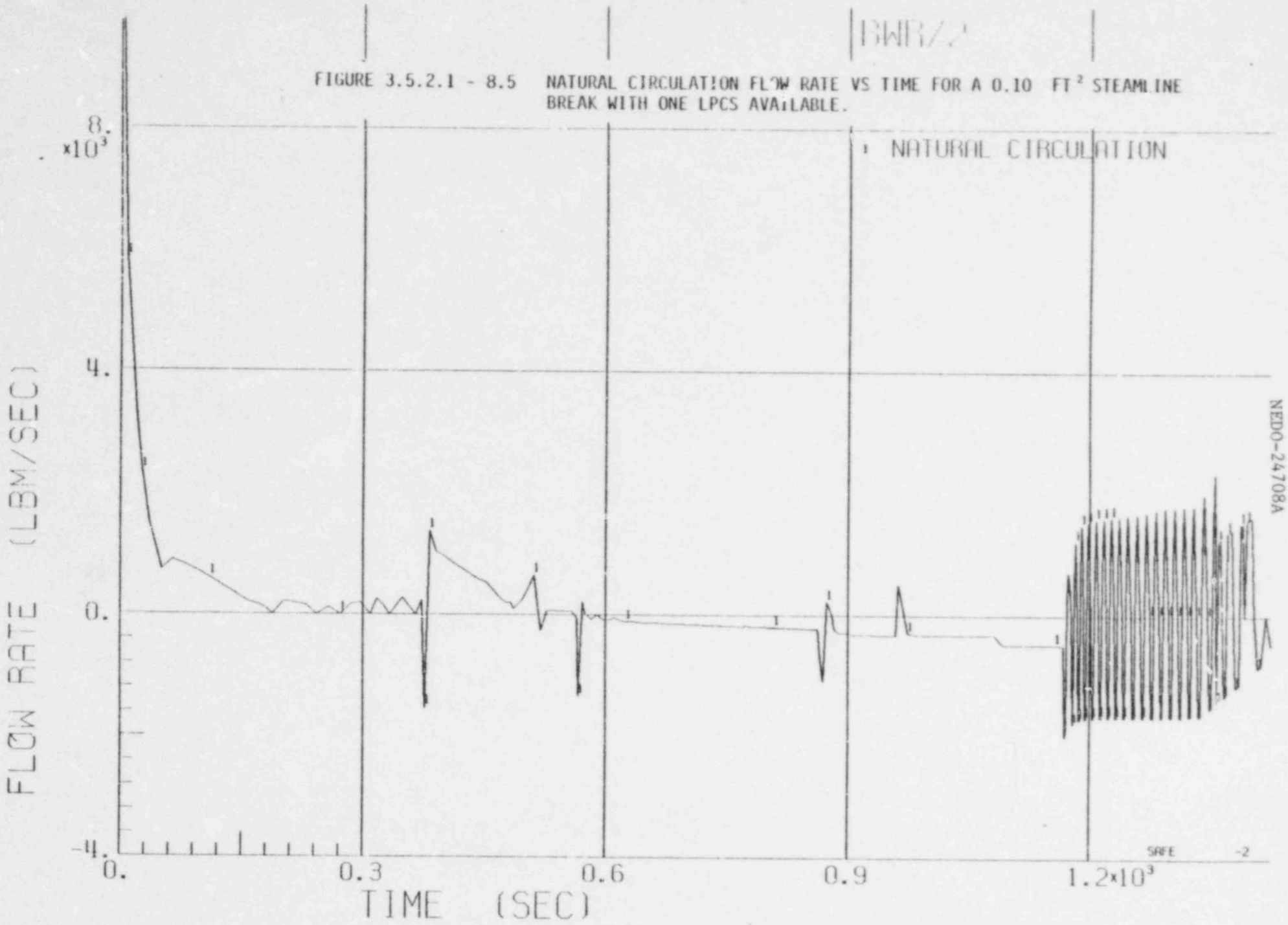
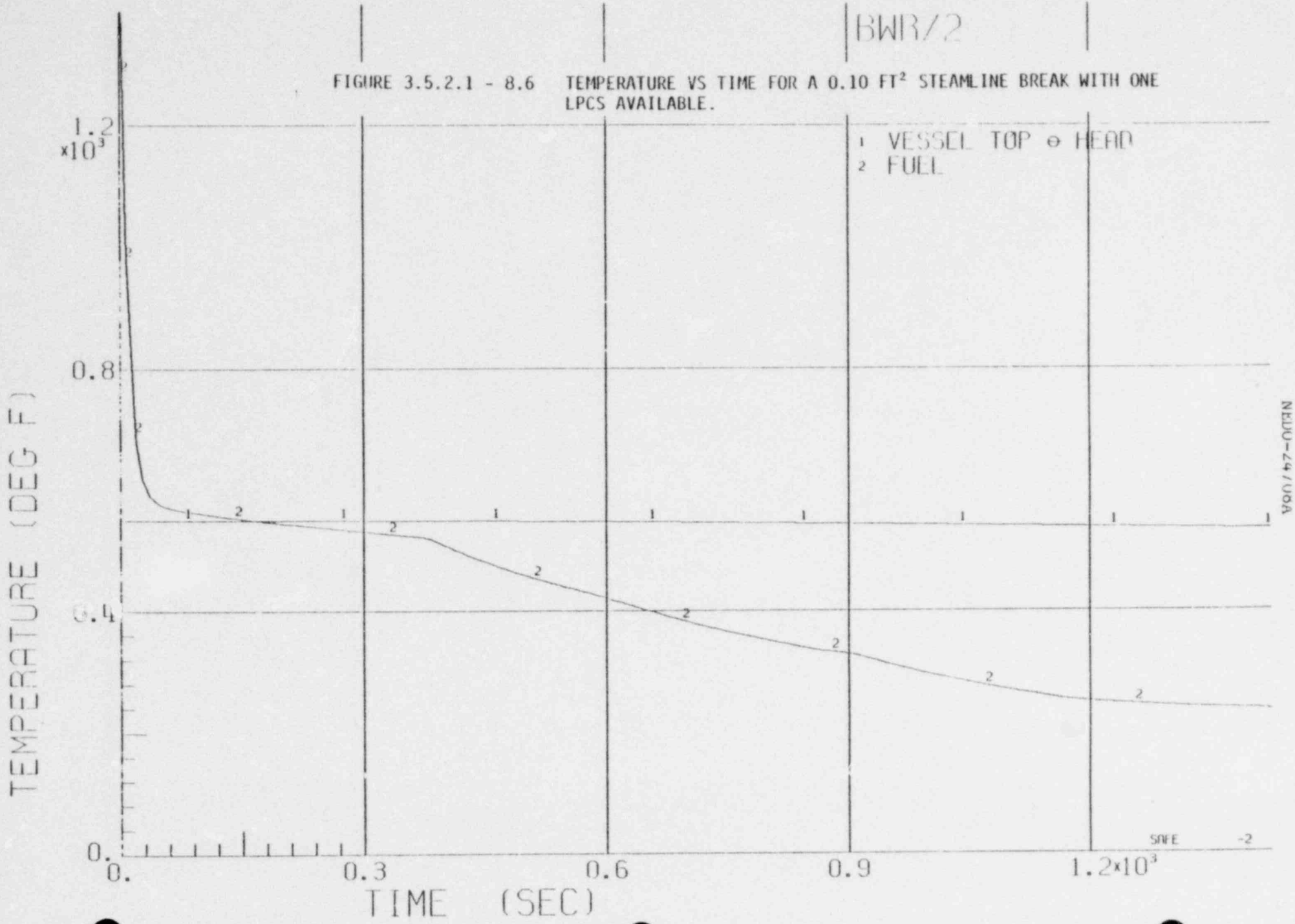
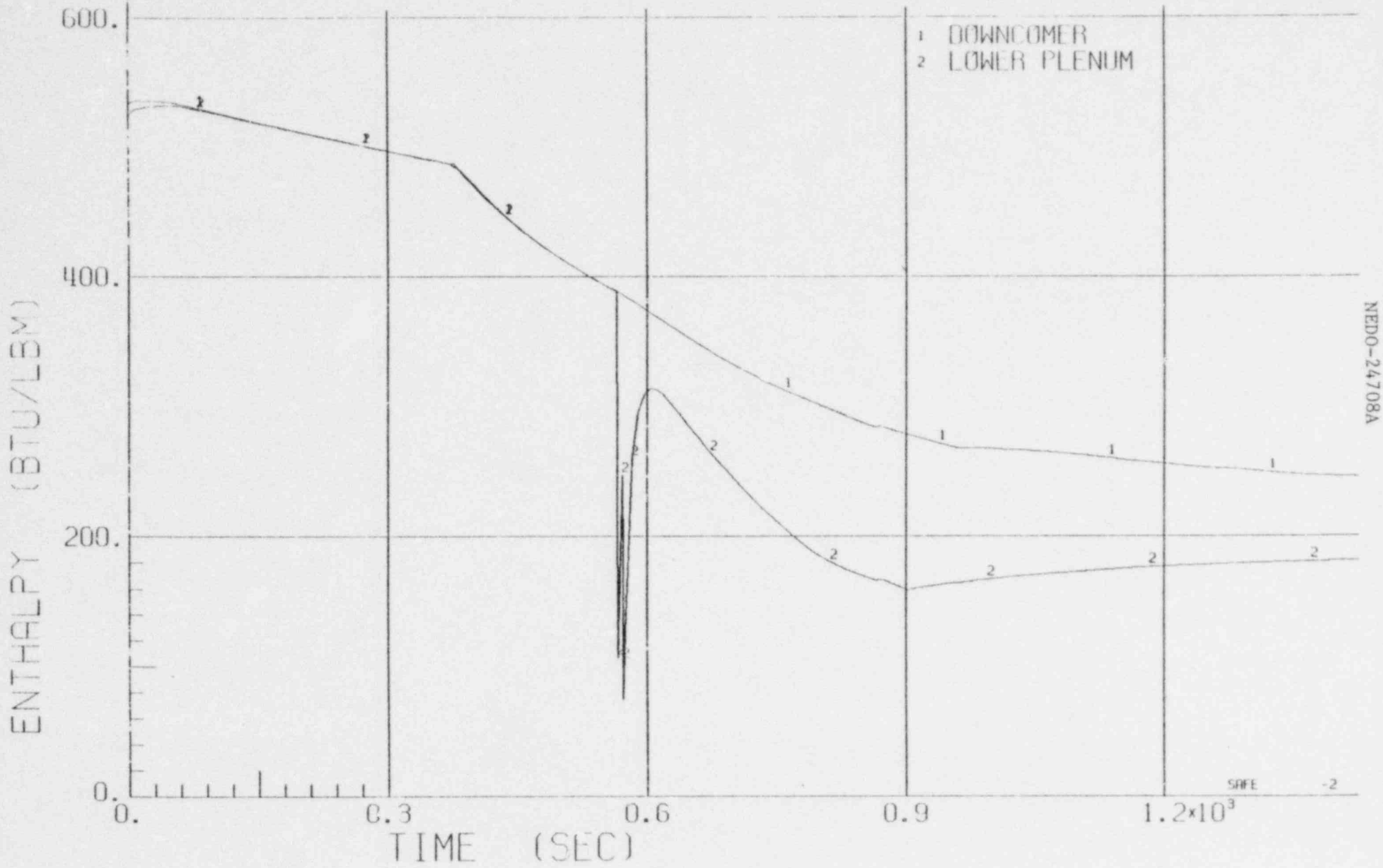


FIGURE 3.5.2.1 - 8.6 TEMPERATURE VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



BWR/2

FIGURE 3.5.2.1 - 8.7 ENTHALPY VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

BWR/2

FIGURE 3.5.2.1 - 8.8 QUALITY VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

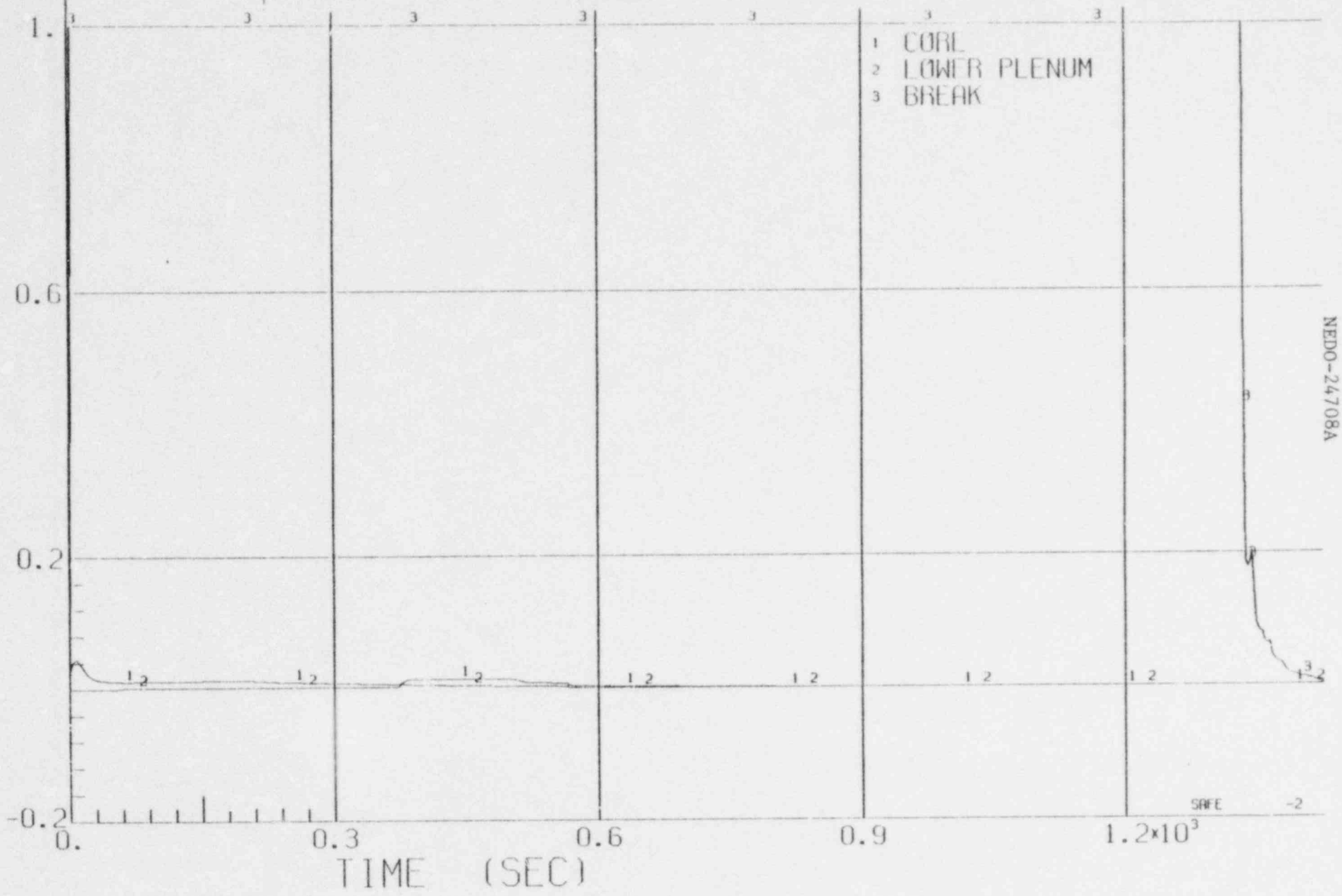


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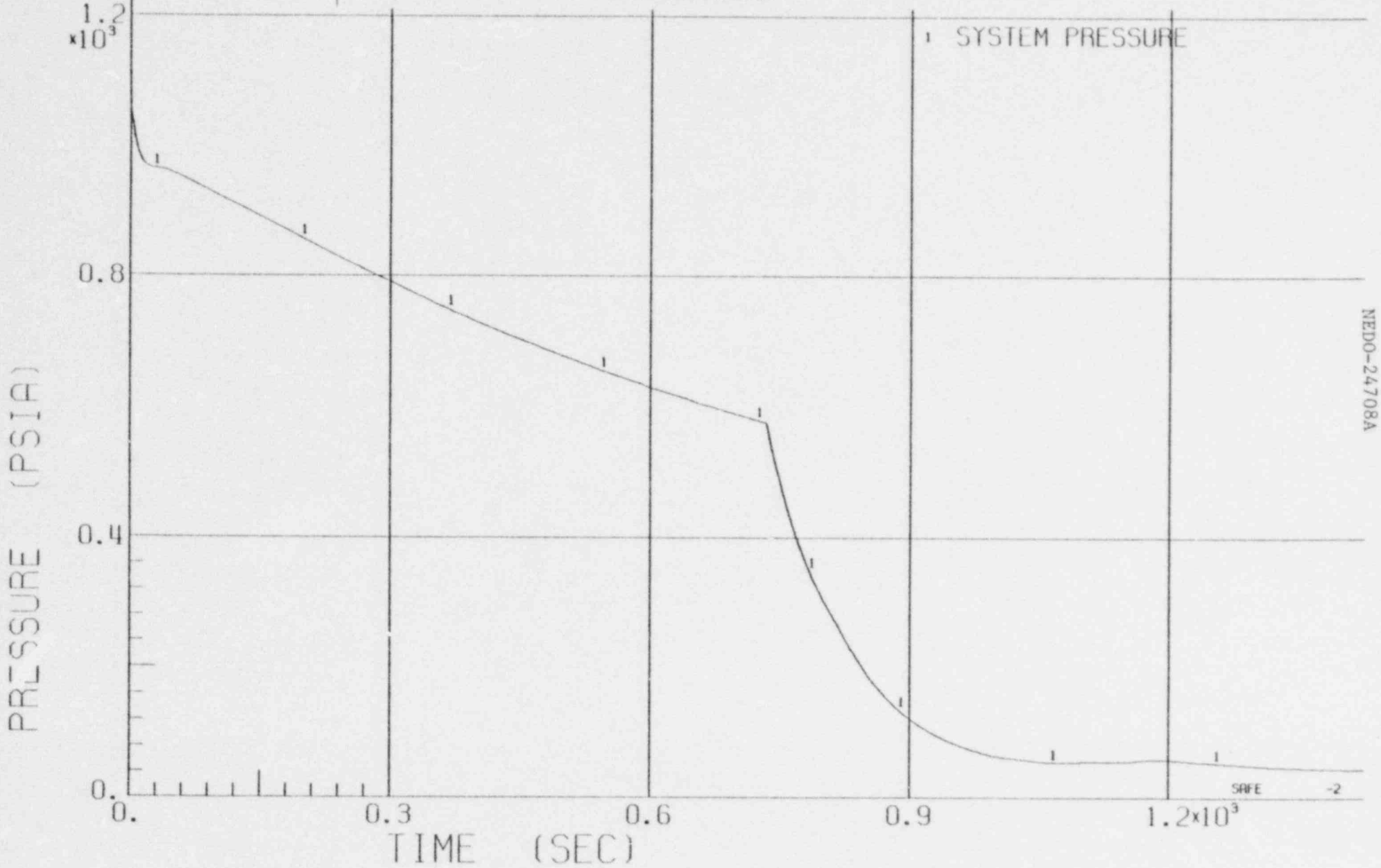
FIGURE 3.5.2.1 - 9.1 SYSTEM PRESSURE VS TIME FOR A 0.10 FT^2 STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



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4-949

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FIGURE 3.5.2.1 - 9.2 WATER LEVEL VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

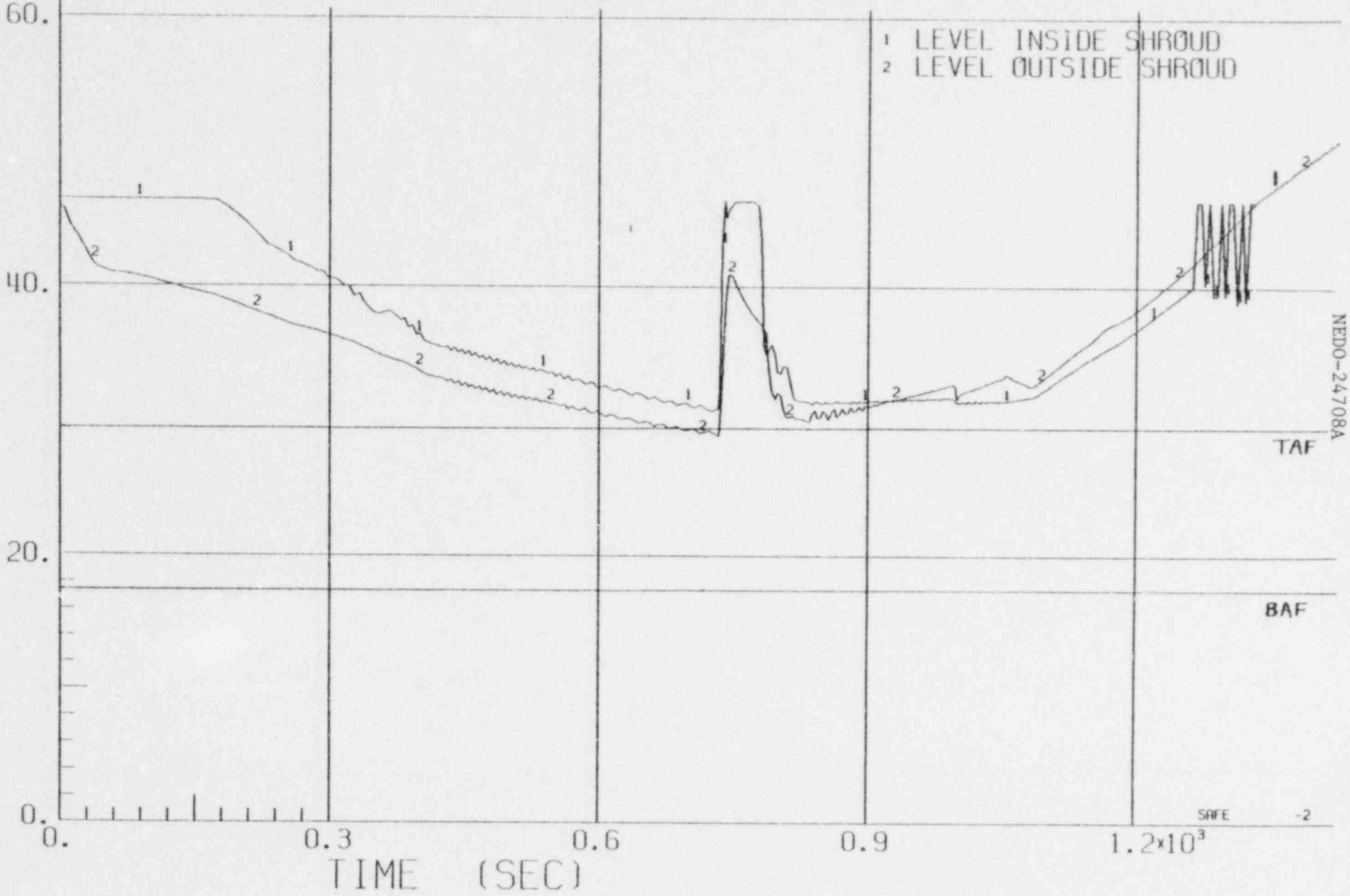

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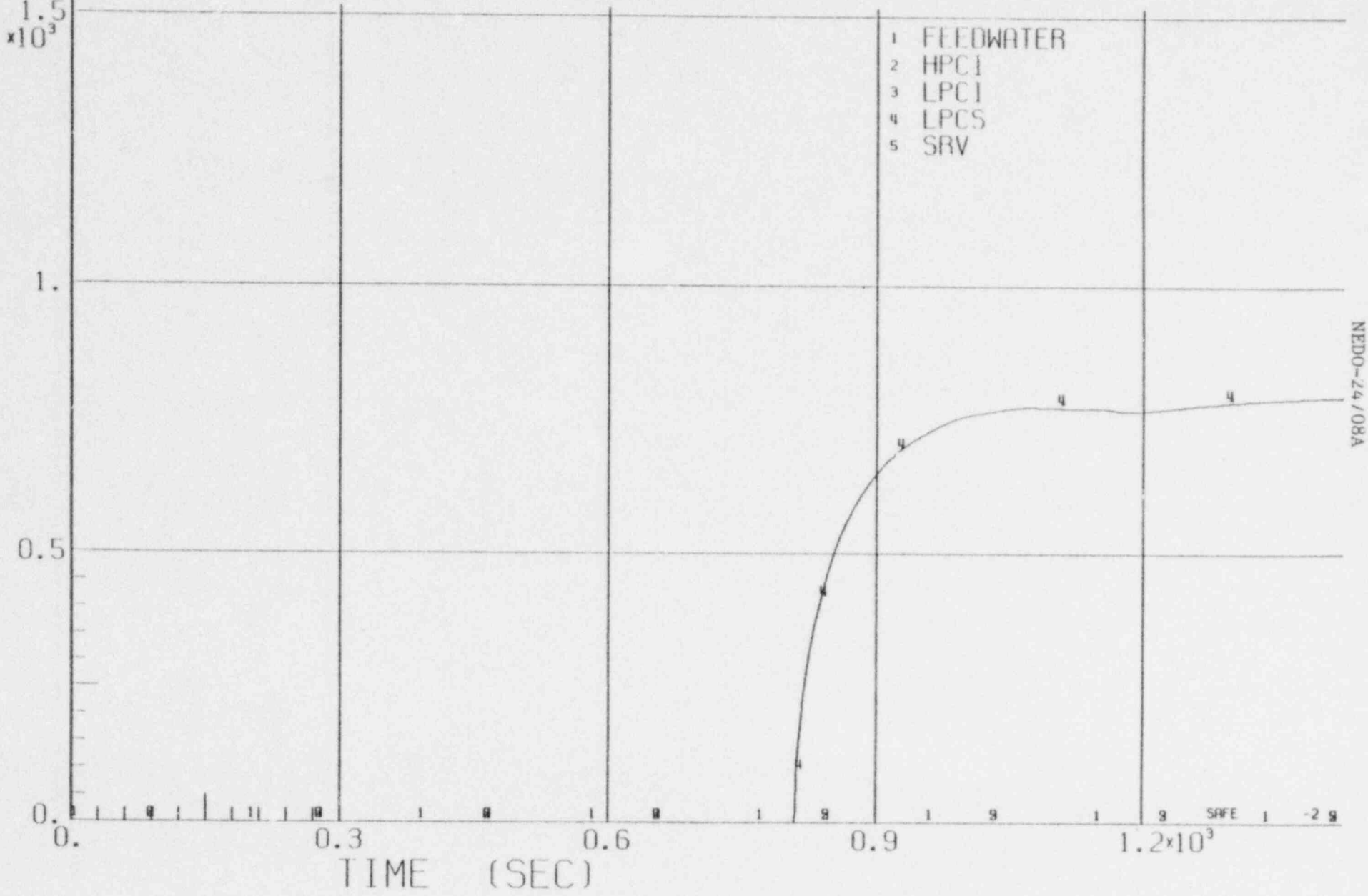
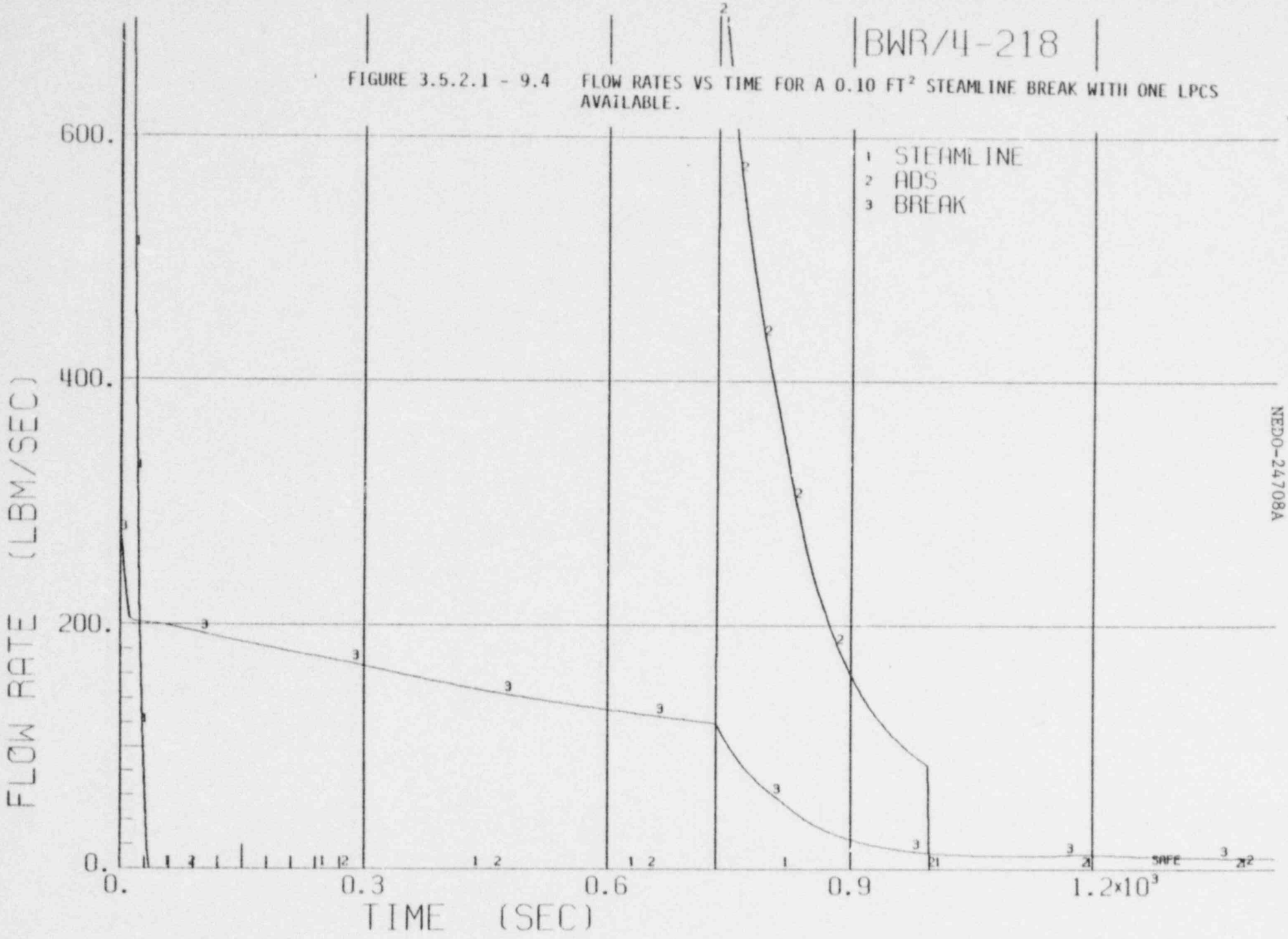
FIGURE 3.5.2.1 - 9.3 SYSTEM FLOW RATES VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



BWR/4-218

FIGURE 3.5.2.1 - 9.4 FLOW RATES VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



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4-952

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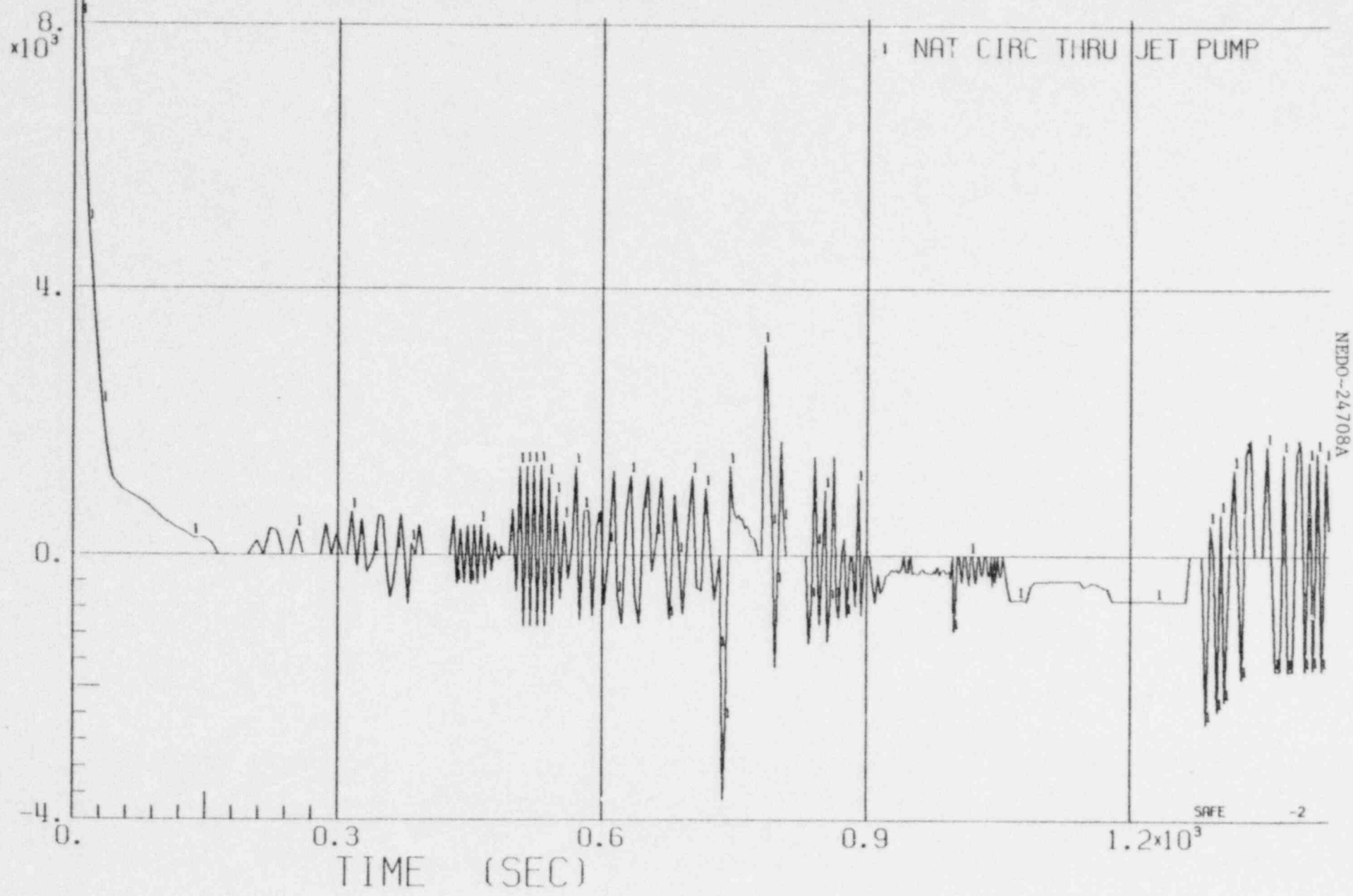
FIGURE 3.5.2.1 - 9.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

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FIGURE 3.5.2.1 - 9.6 TEMPERATURE VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

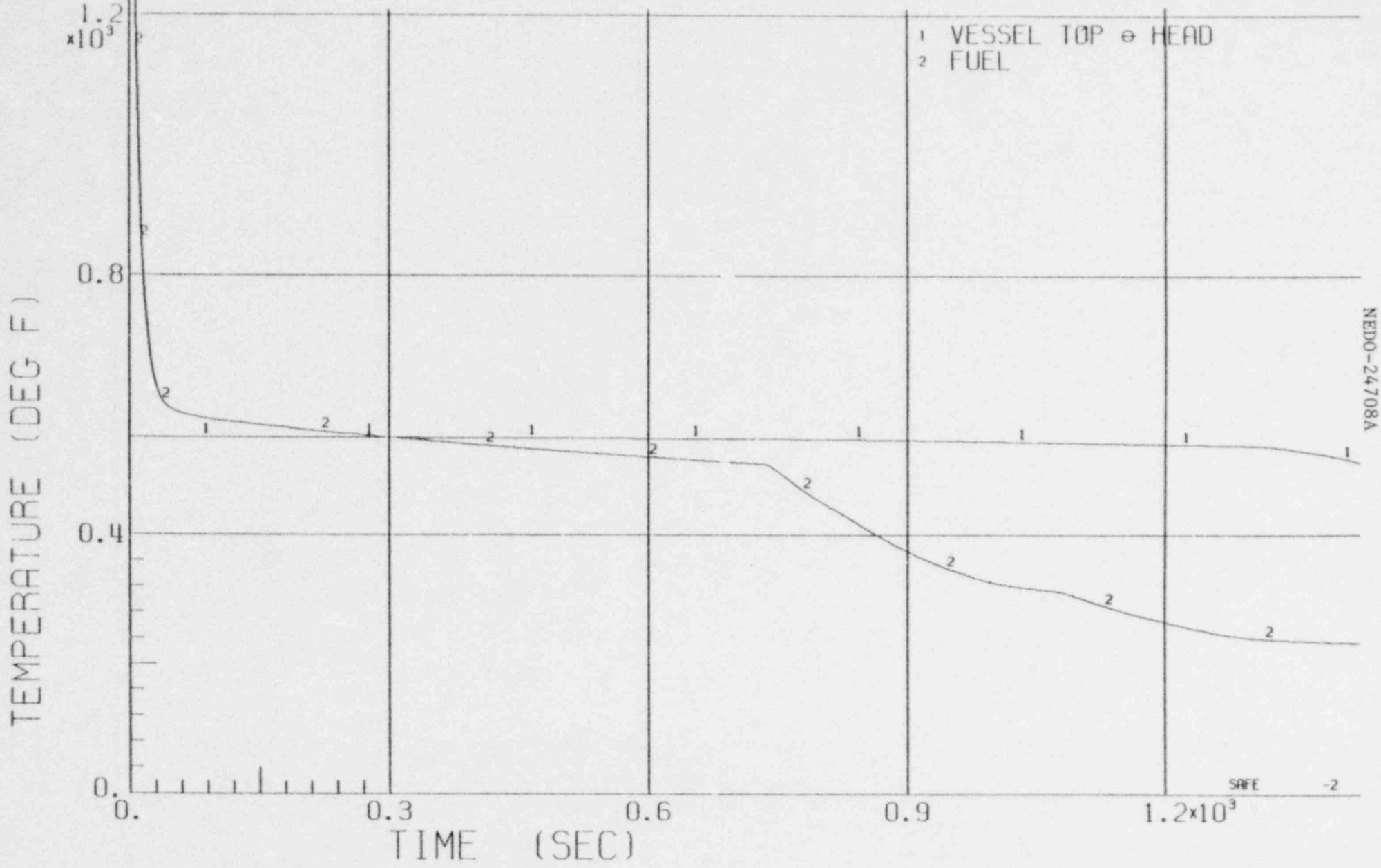

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FIGURE 3.5.2.1 - 9.7 ENTHALPY VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

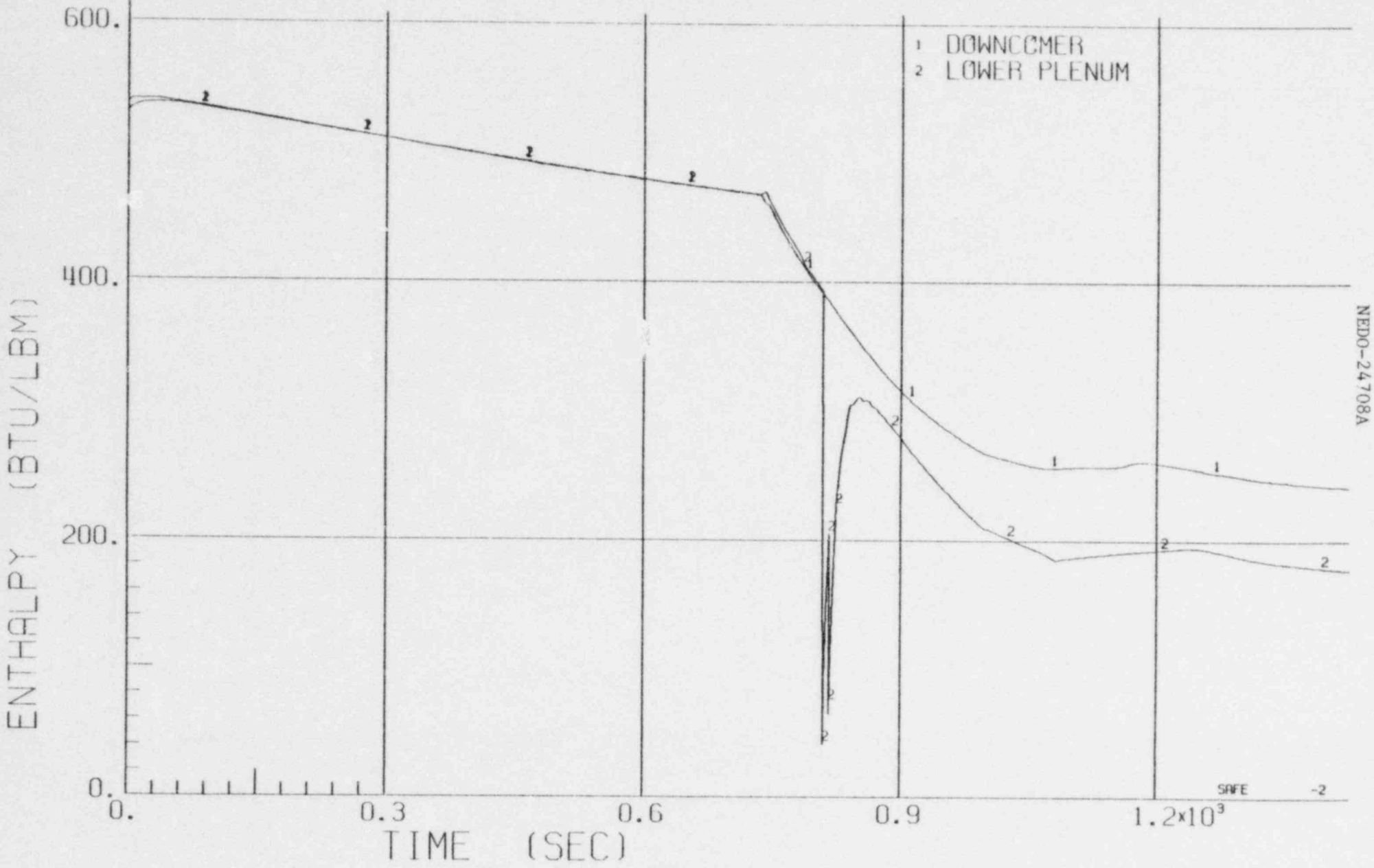

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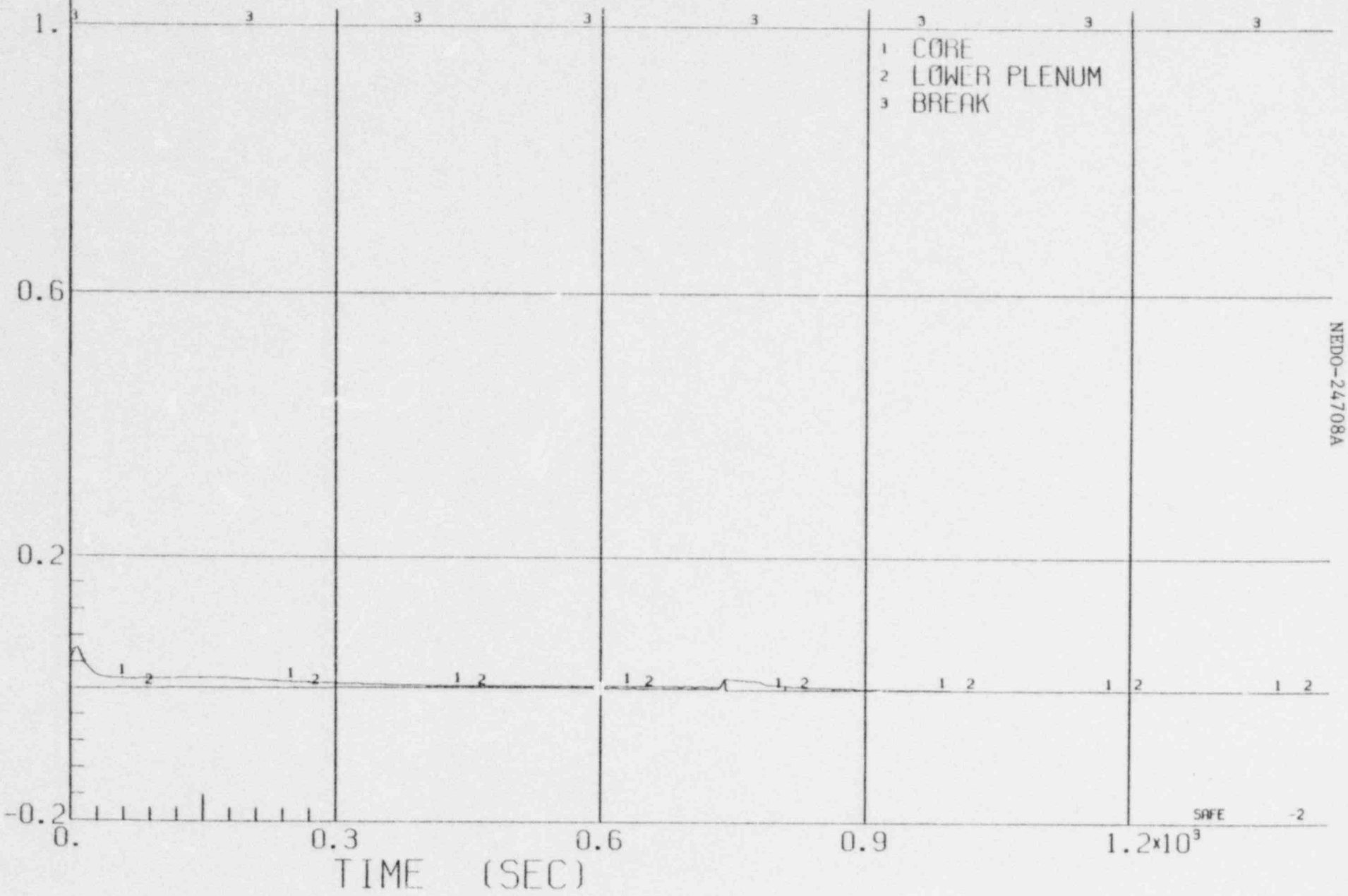
FIGURE 3.5.2.1 - 9.8 QUALITY VS TIME FOR A 0.10 FT² STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



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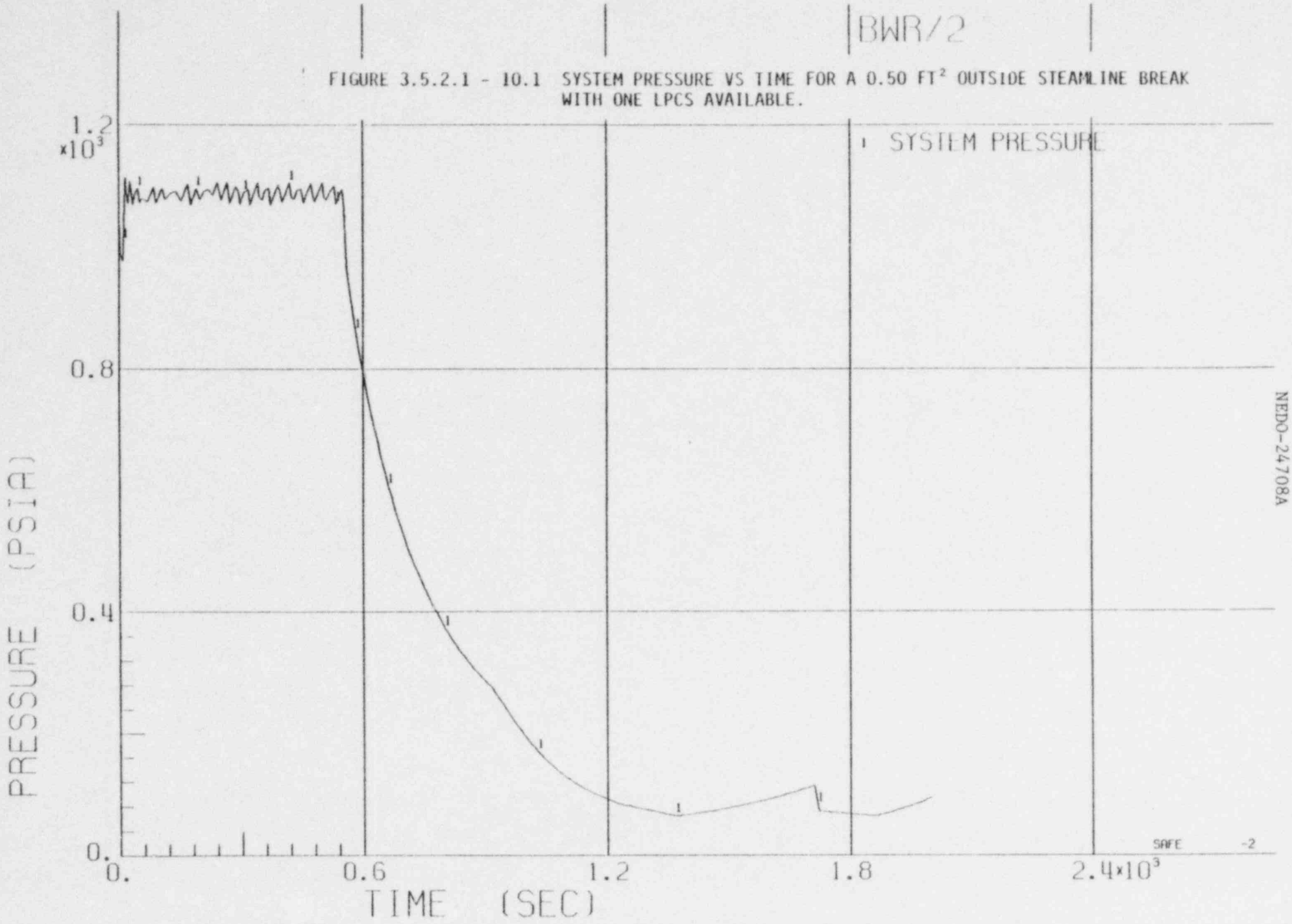
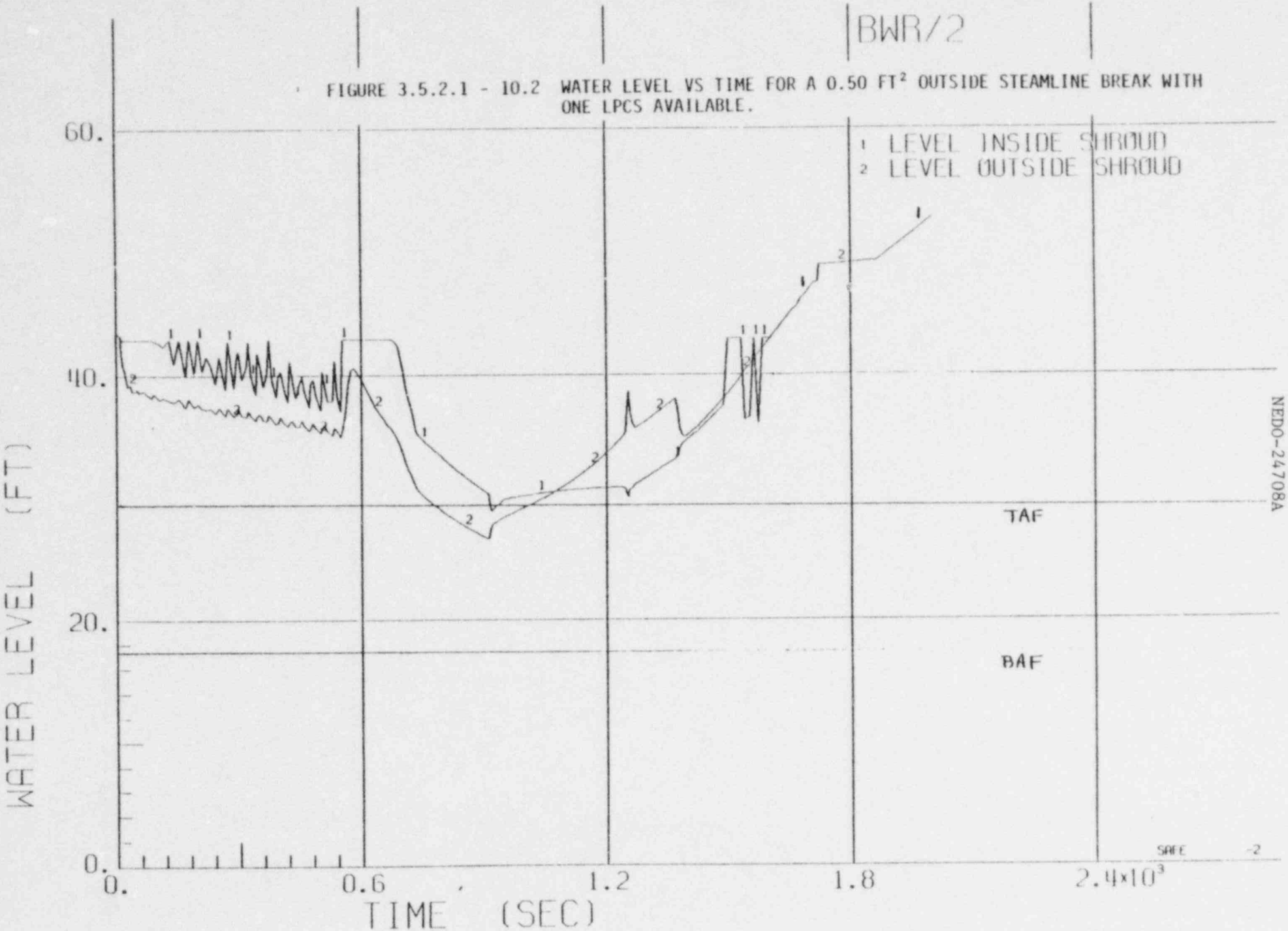
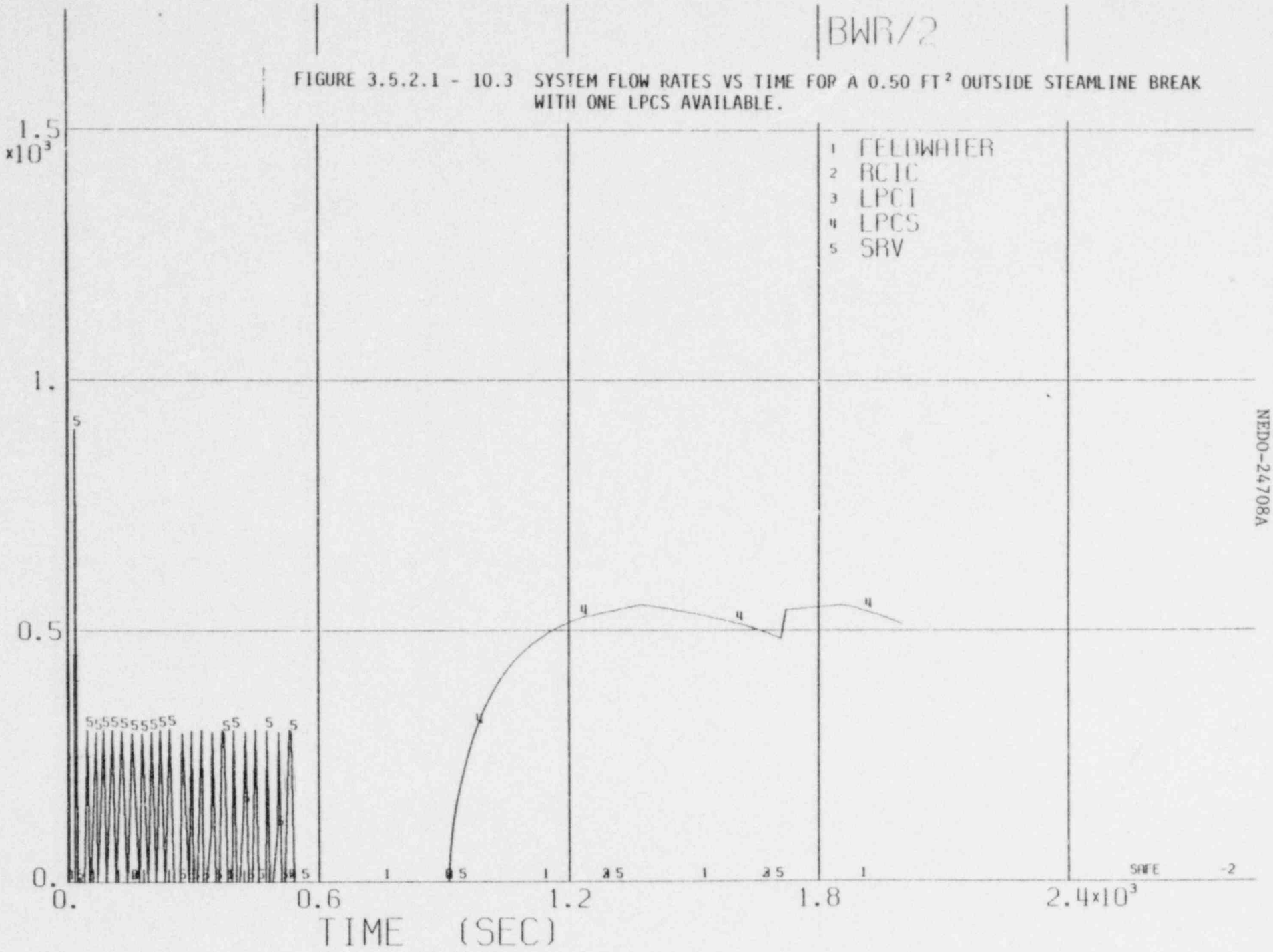


FIGURE 3.5.2.1 - 10.1 SYSTEM PRESSURE VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

FIGURE 3.5.2.1 - 10.2 WATER LEVEL VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.




BWR/2
FIGURE 3.5.2.1 - 10.3 SYSTEM FLOW RATES VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.
1 FEEDWATER
2 RCIC
3 LPCI
4 LPCS
5 SRV
1.5 ×10³
1.
0.5
0.
FLOW RATE (LBM/SEC)
0.
0.6
1.2
1.8
2.4×10³
TIME (SEC)
SAFE -2
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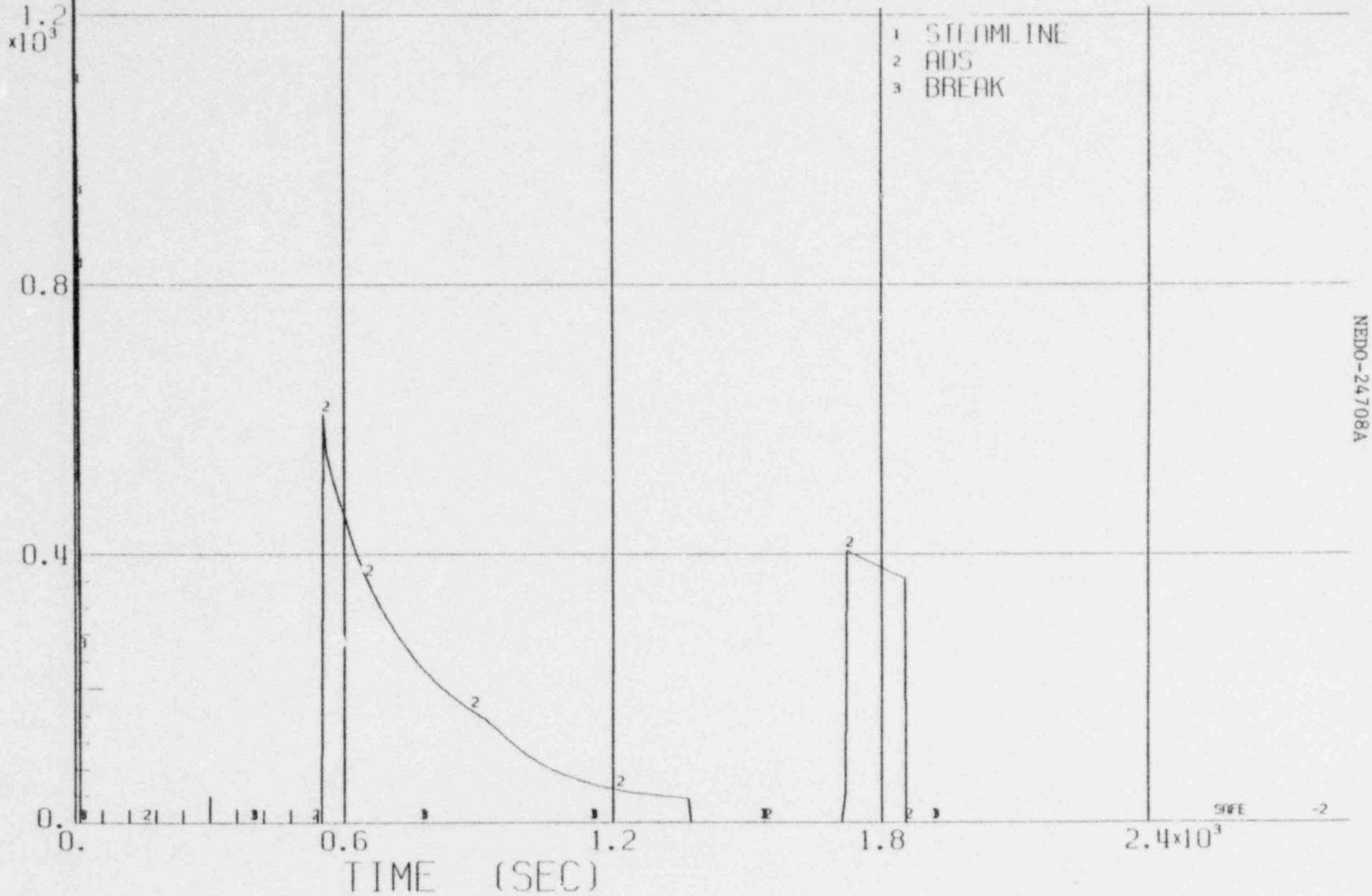
4-959

BWR/2

FIGURE 3.5.2.1 - 10.4 FLOW RATES VS TIME FOR A 0.50 FT^2 OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



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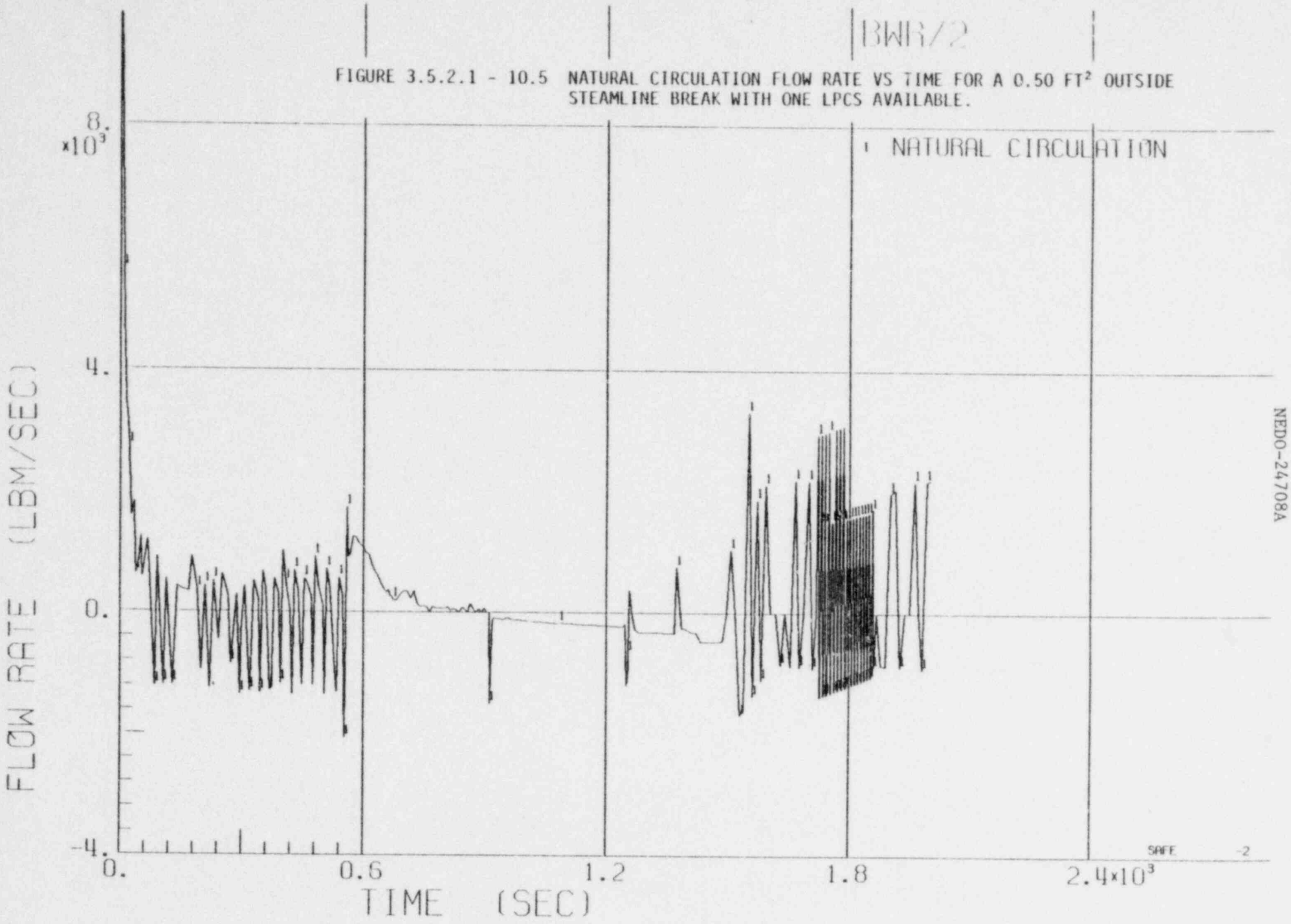
4-960

FIGURE 3.5.2.1 - 10.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

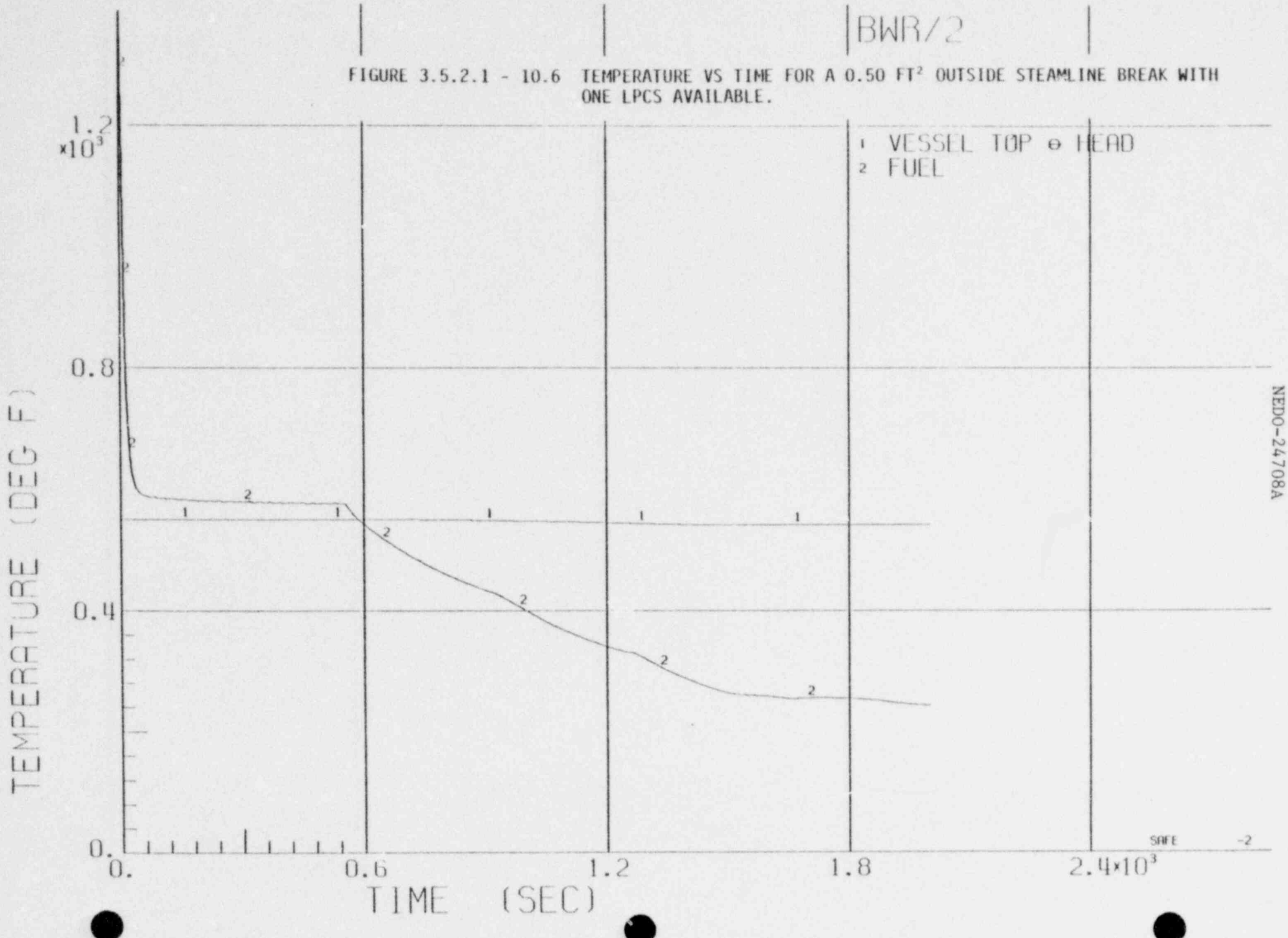


FIGURE 3.5.2.1 - 10.6 TEMPERATURE VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

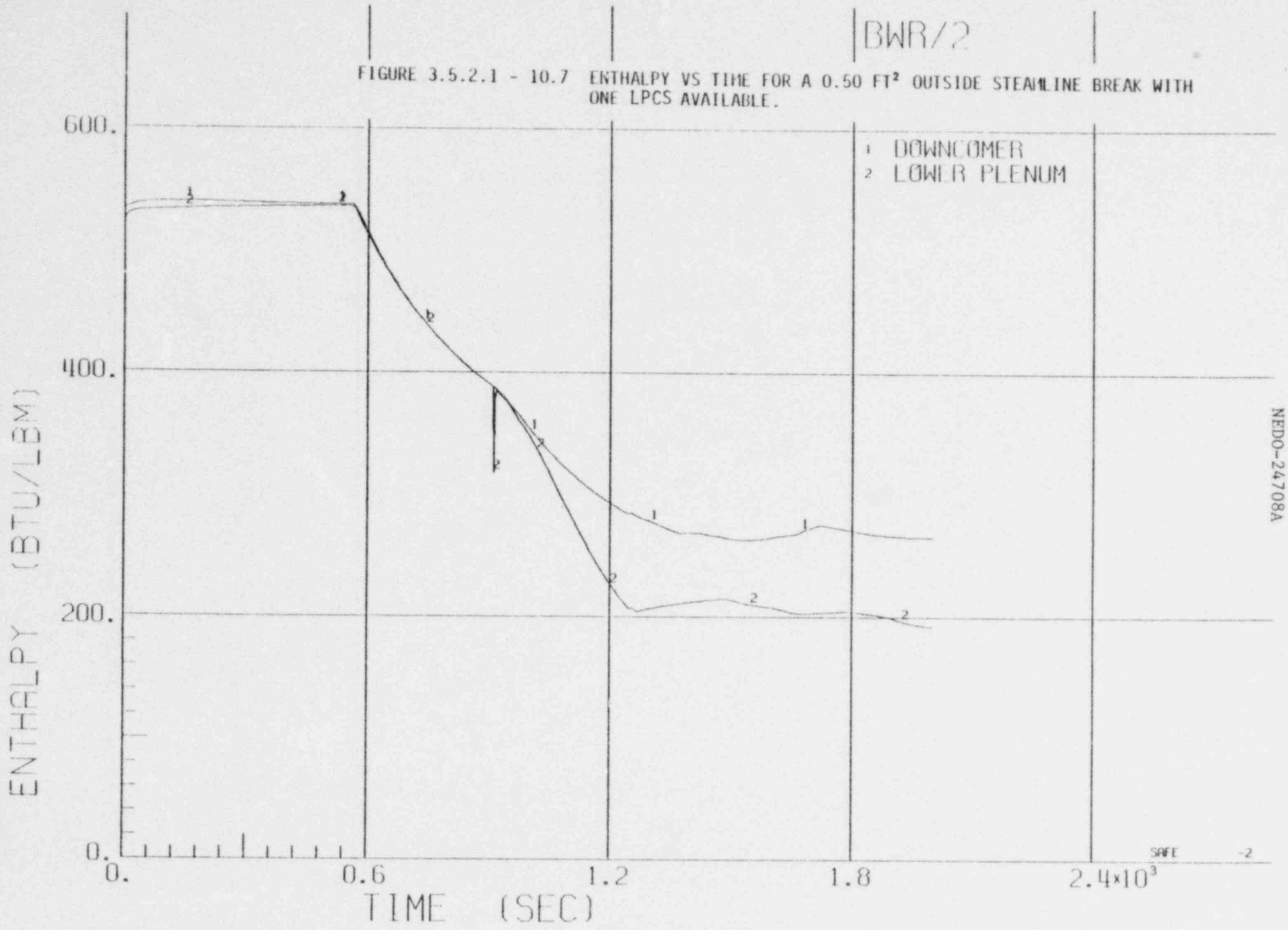


FIGURE 3.5.2.1 - 10.7 ENTHALPY VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

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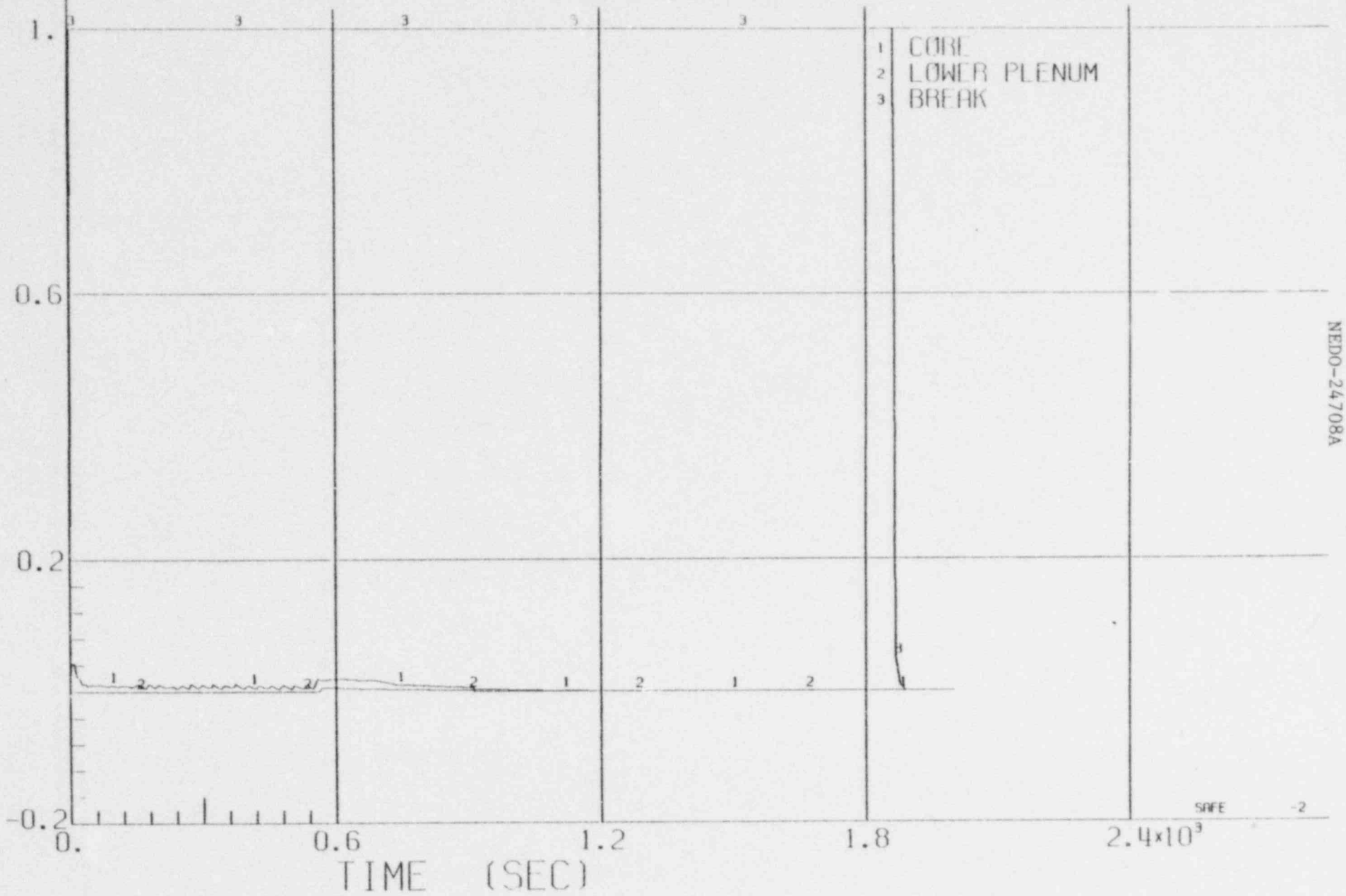
FIGURE 3.5.2.1 - 10.8 QUALITY VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



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4-964

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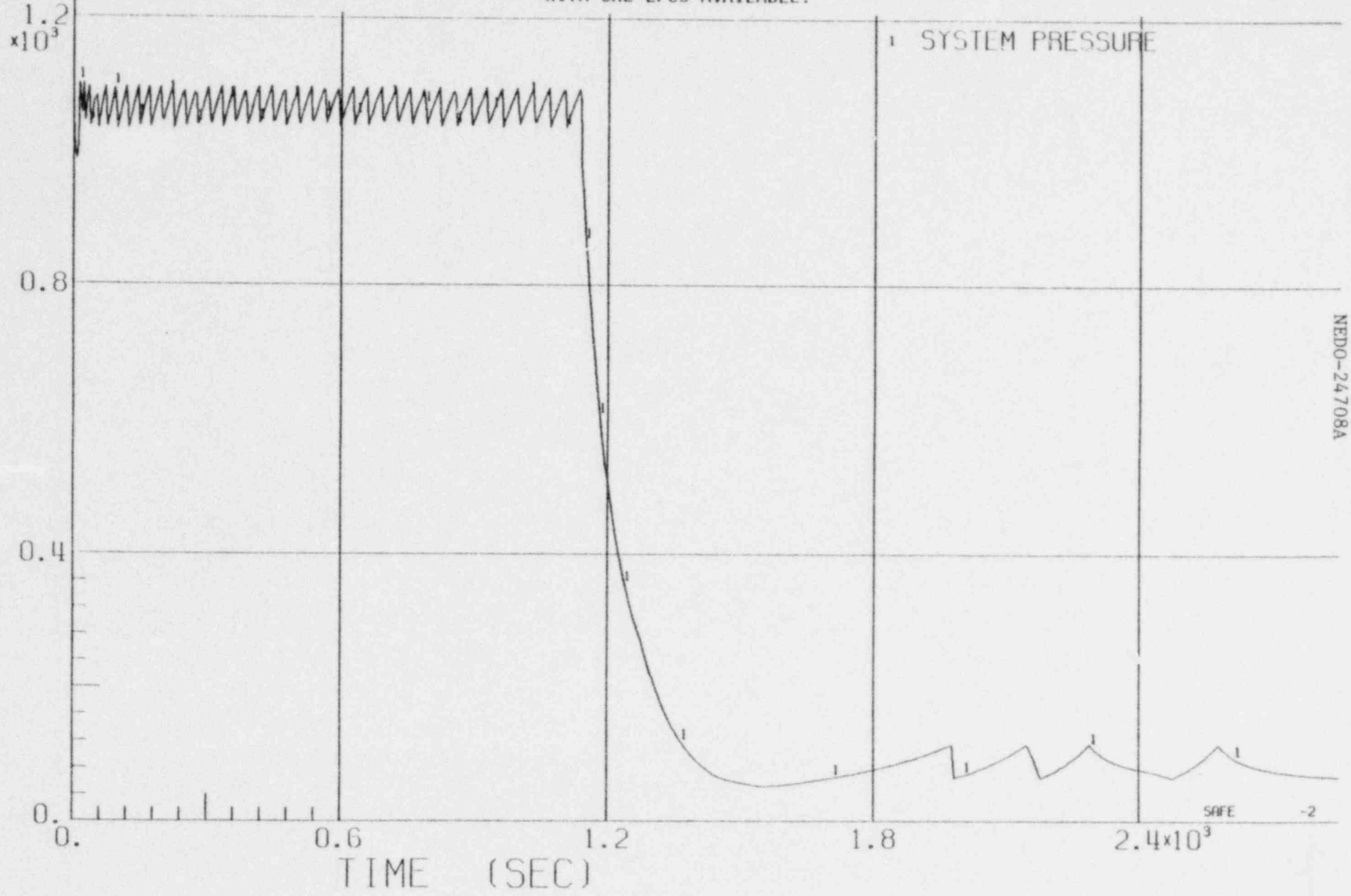
FIGURE 3.5.2.1 - 11.1 SYSTEM PRESSURE VS TIME FOR A 0.50 FT^2 OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

FIGURE 3.5.2.1 - 11.2 WATER LEVEL VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.

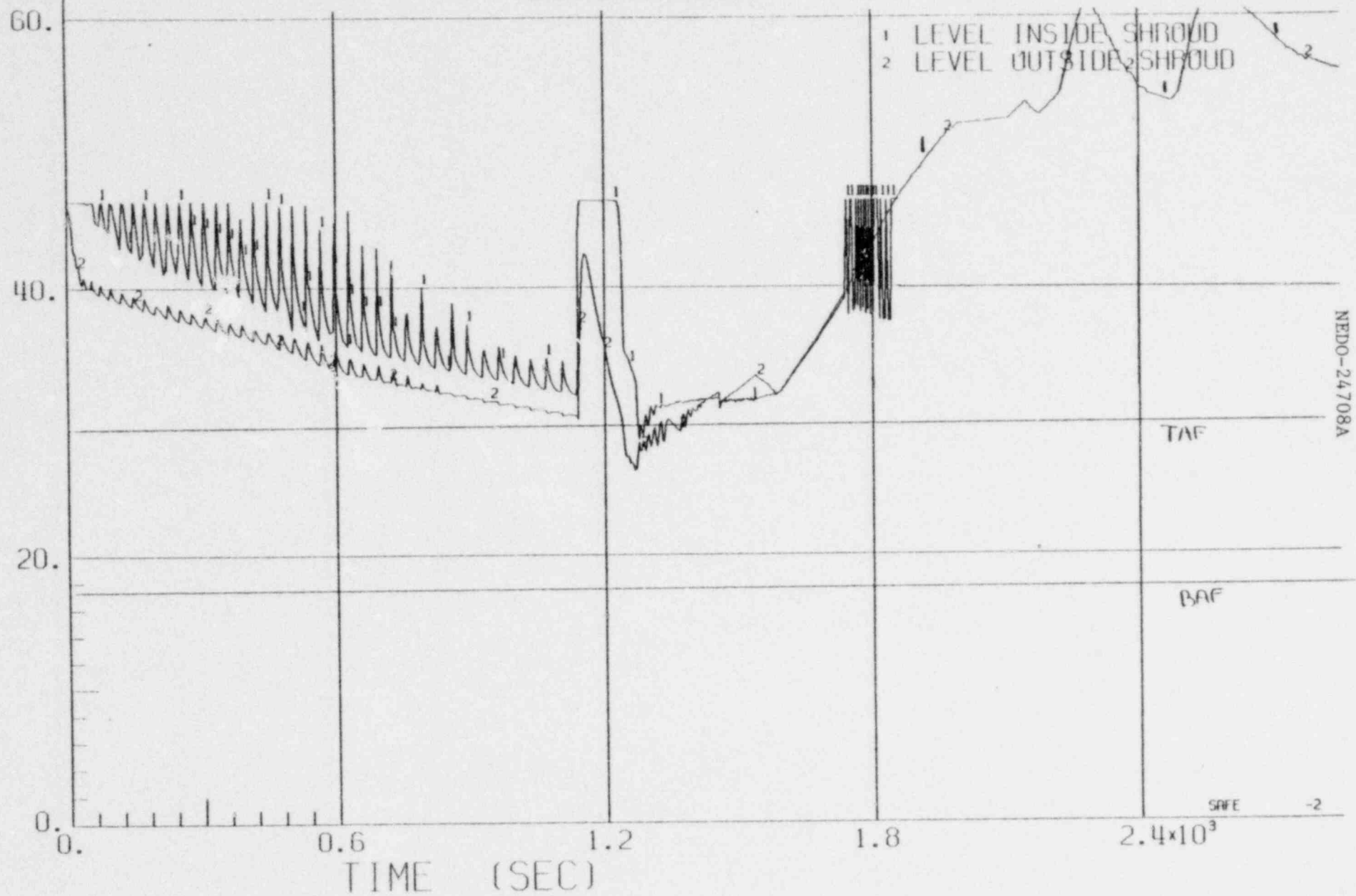


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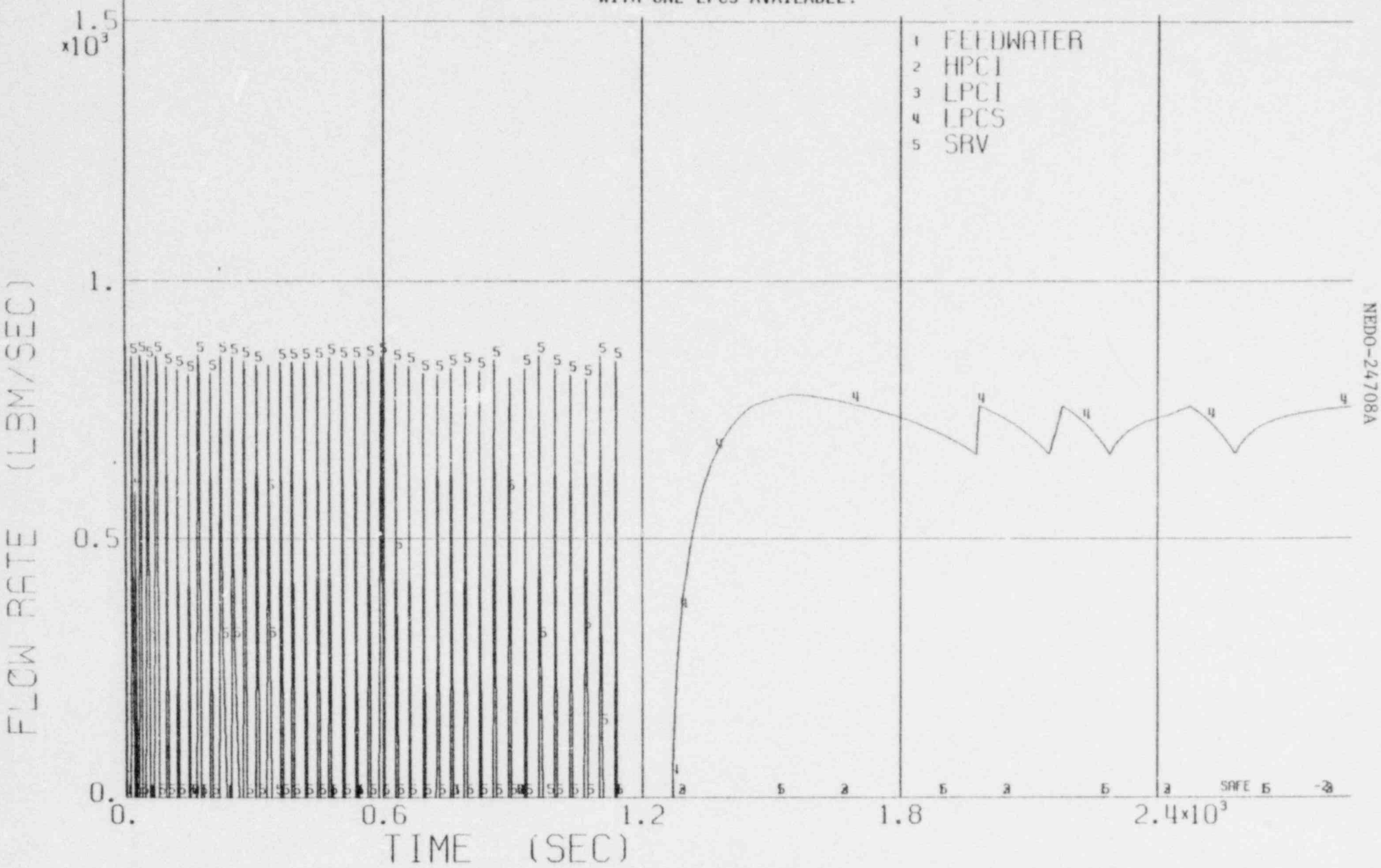
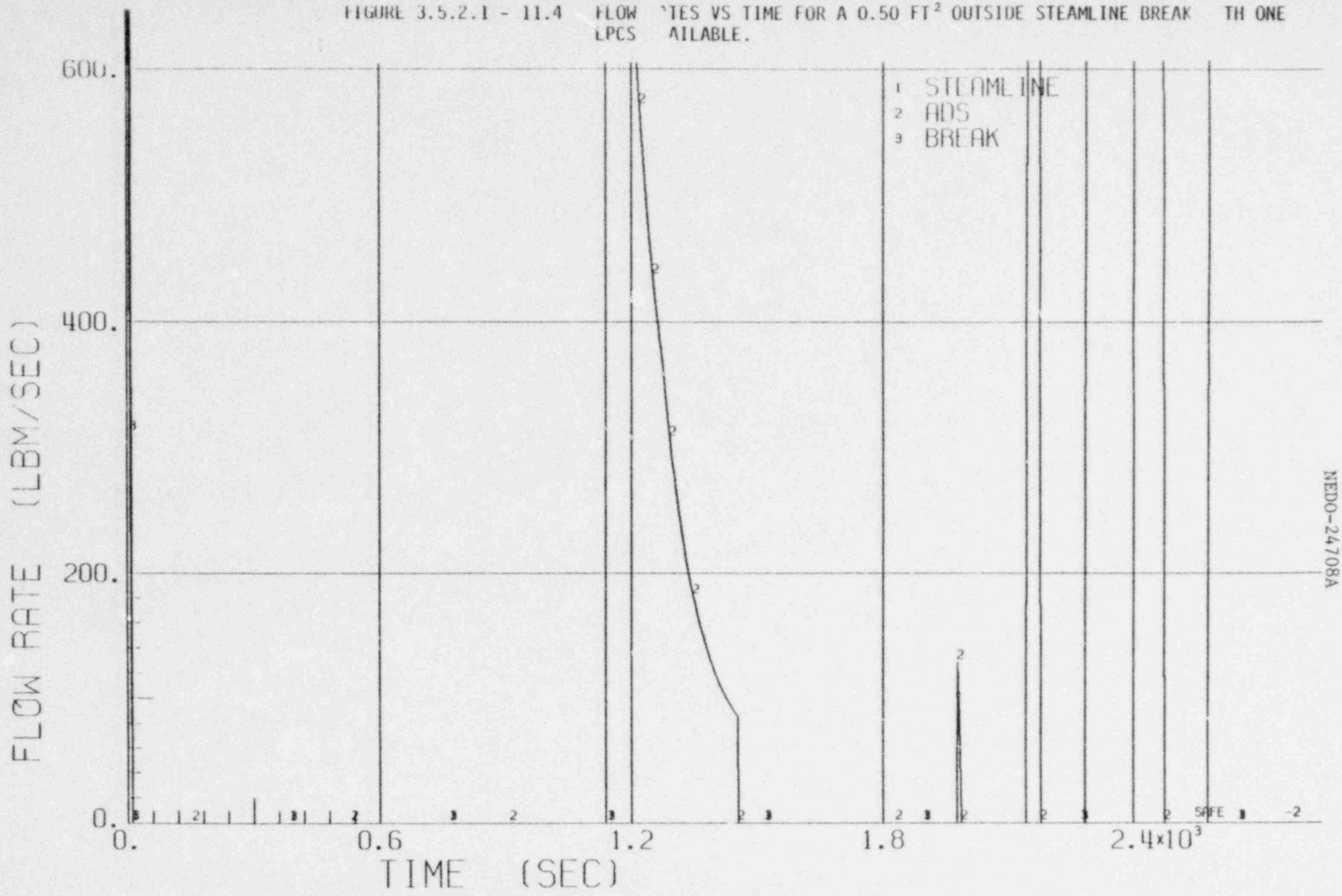
FIGURE 3.5.2.1 - 11.3 SYSTEM FLOW RATES VS TIME FOR A 0.50 FT^2 OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

FIGURE 3.5.2.1 - 11.4 FLOW `TES VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK TH ONE LPCS AILABLE.



NEDO-24708A

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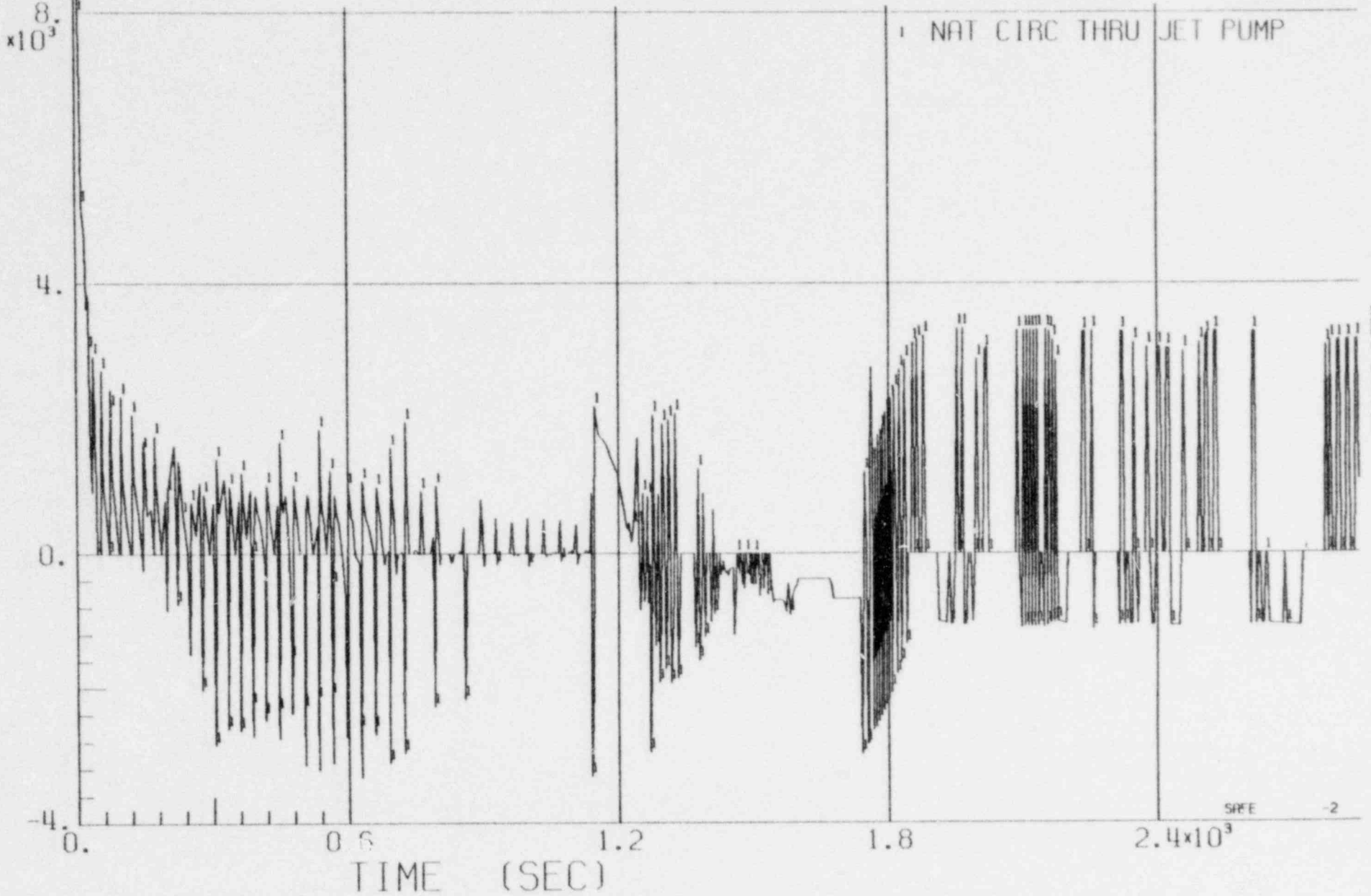
FIGURE 3.5.2.1 - 11.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



4-969

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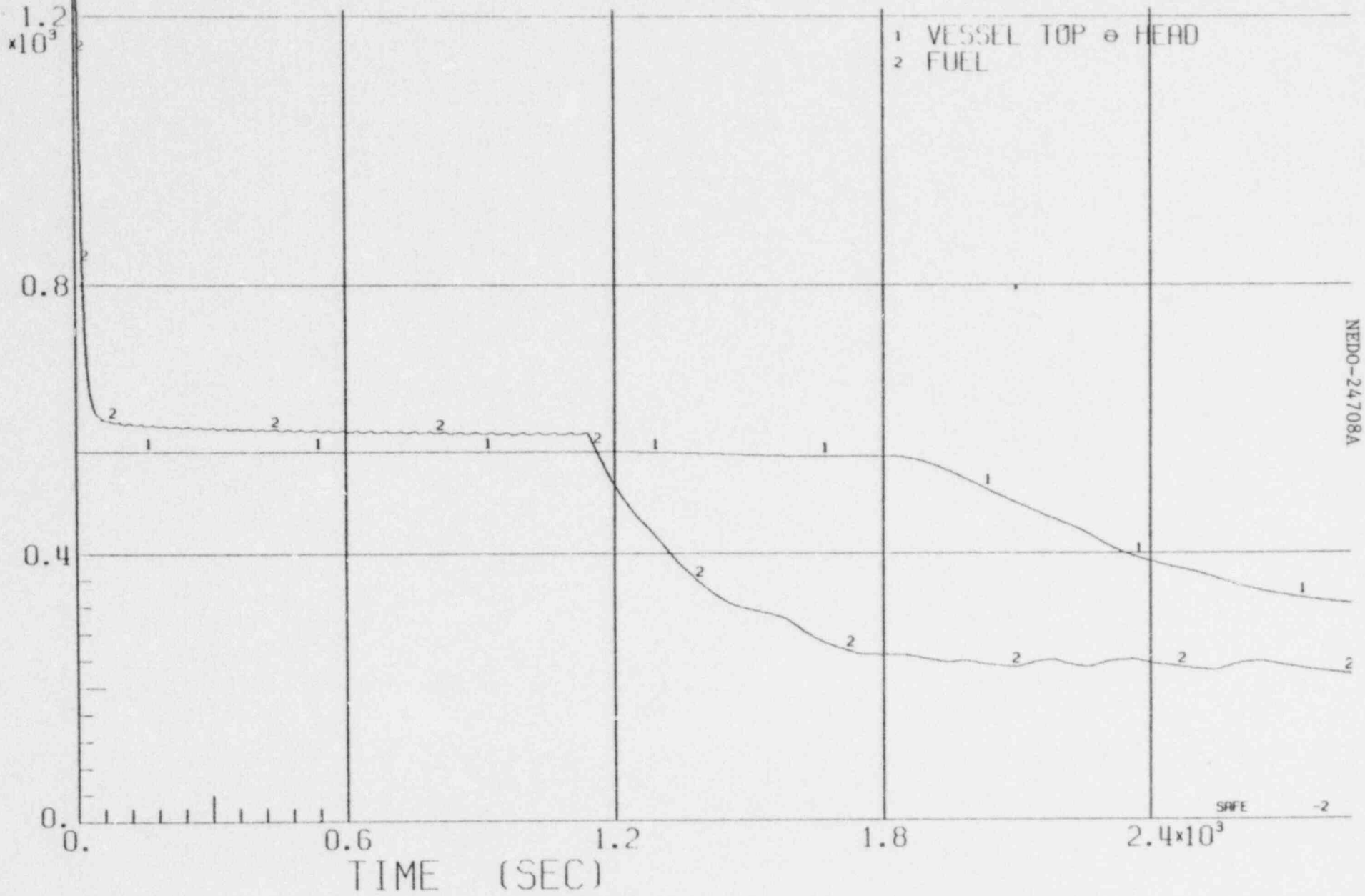
FIGURE 3.5.2.1 - 11.6 TEMPERATURE VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



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4-970

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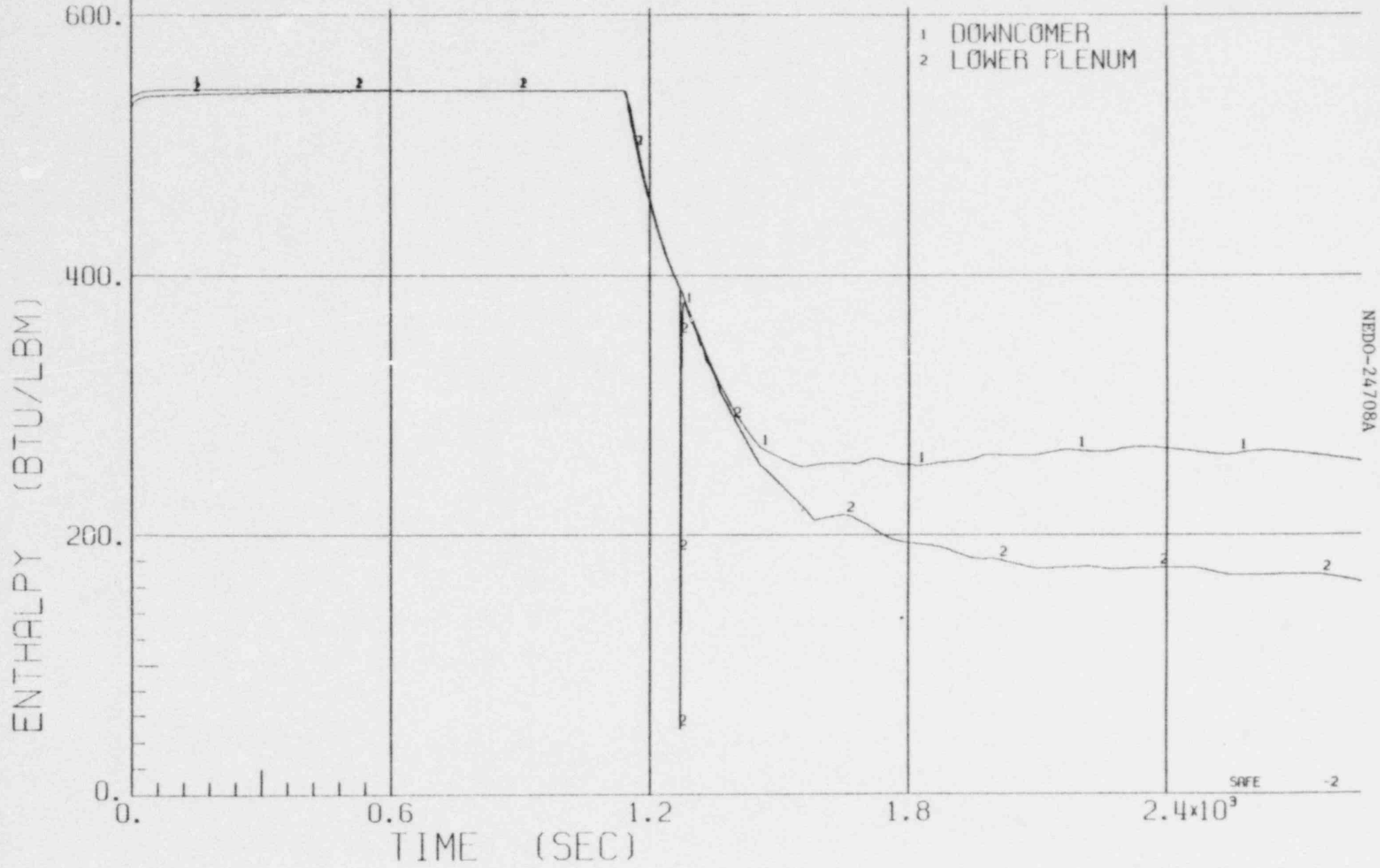
FIGURE 3.5.2.1 - 11.7 ENTHALPY VS TIME FOR A 0.10 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



NEDO-24708A

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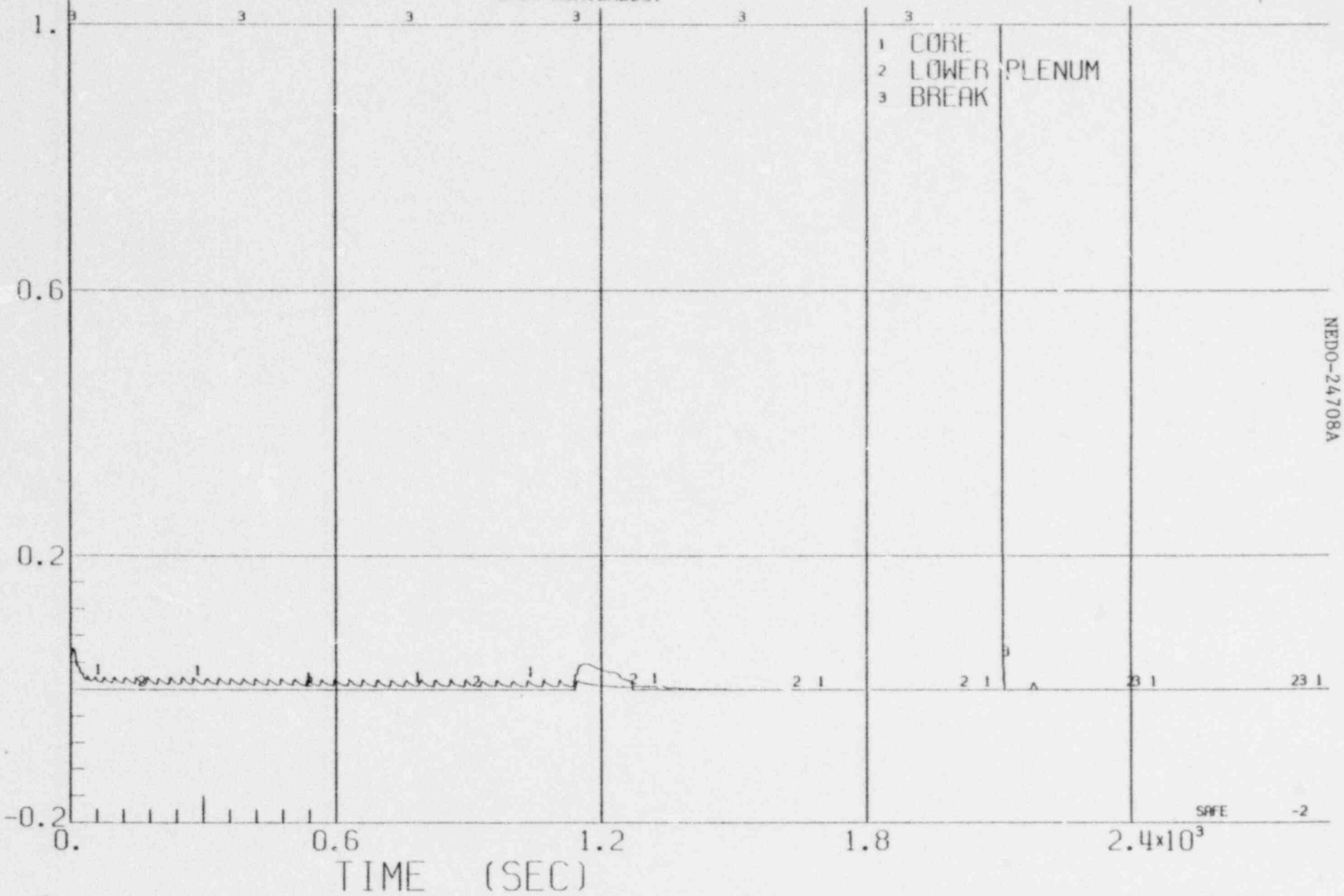
FIGURE 3.5.2.1 - 11.8 QUALITY VS TIME FOR A 0.50 FT² OUTSIDE STEAMLINE BREAK WITH ONE LPCS AVAILABLE.



4-972

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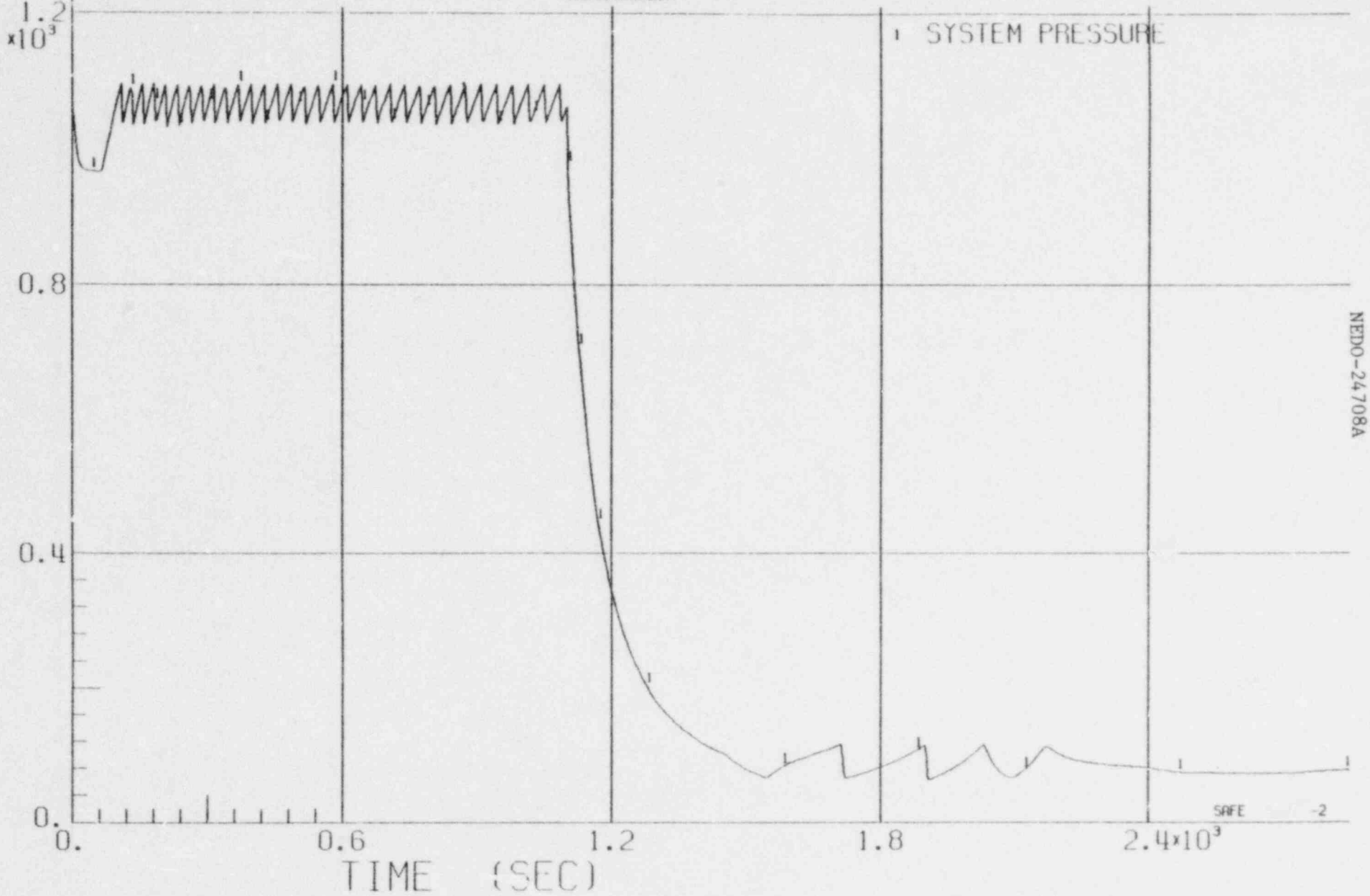
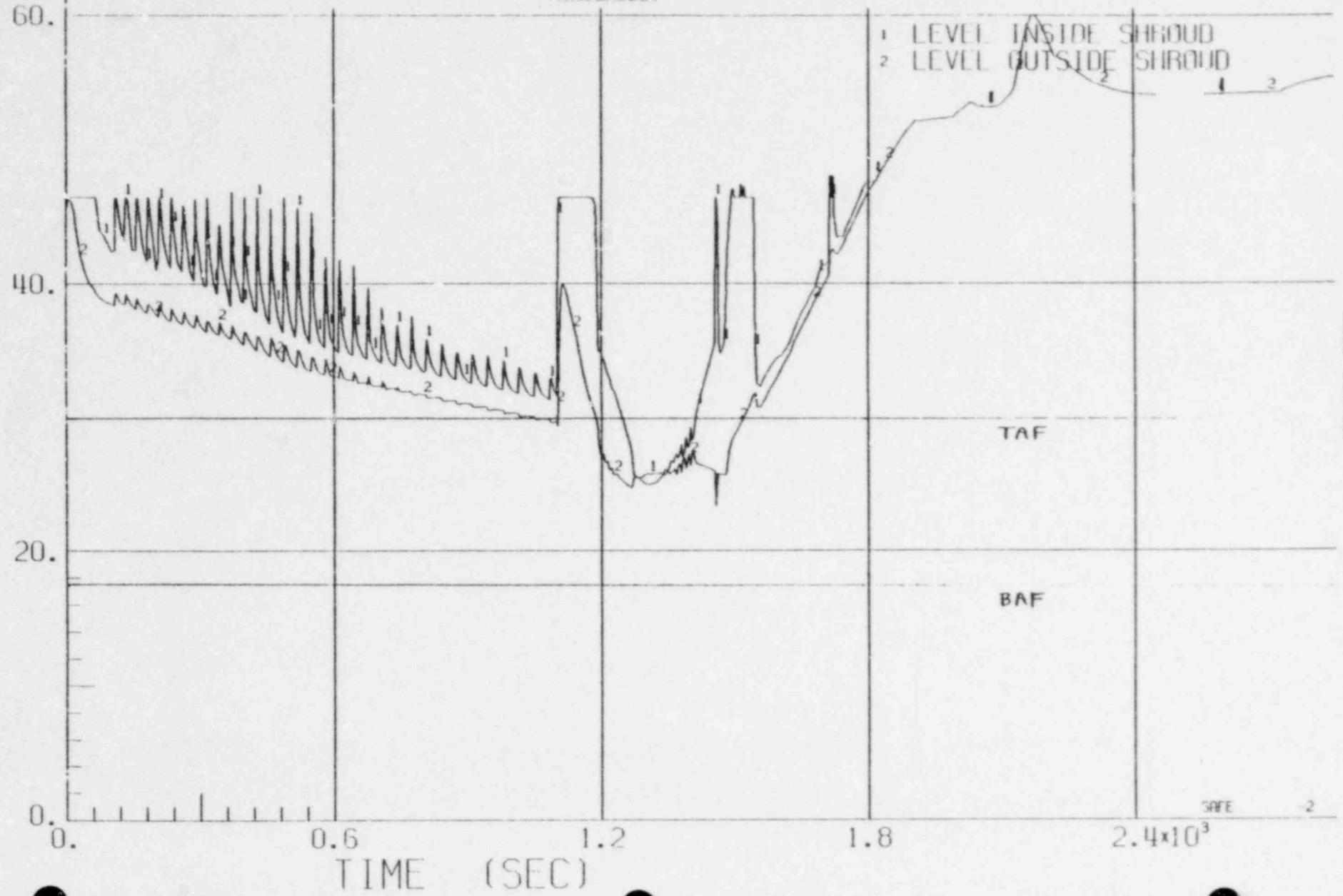
FIGURE 3.5.2.1 - 12.1 SYSTEM PRESSURE VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.



NEDO-24708A

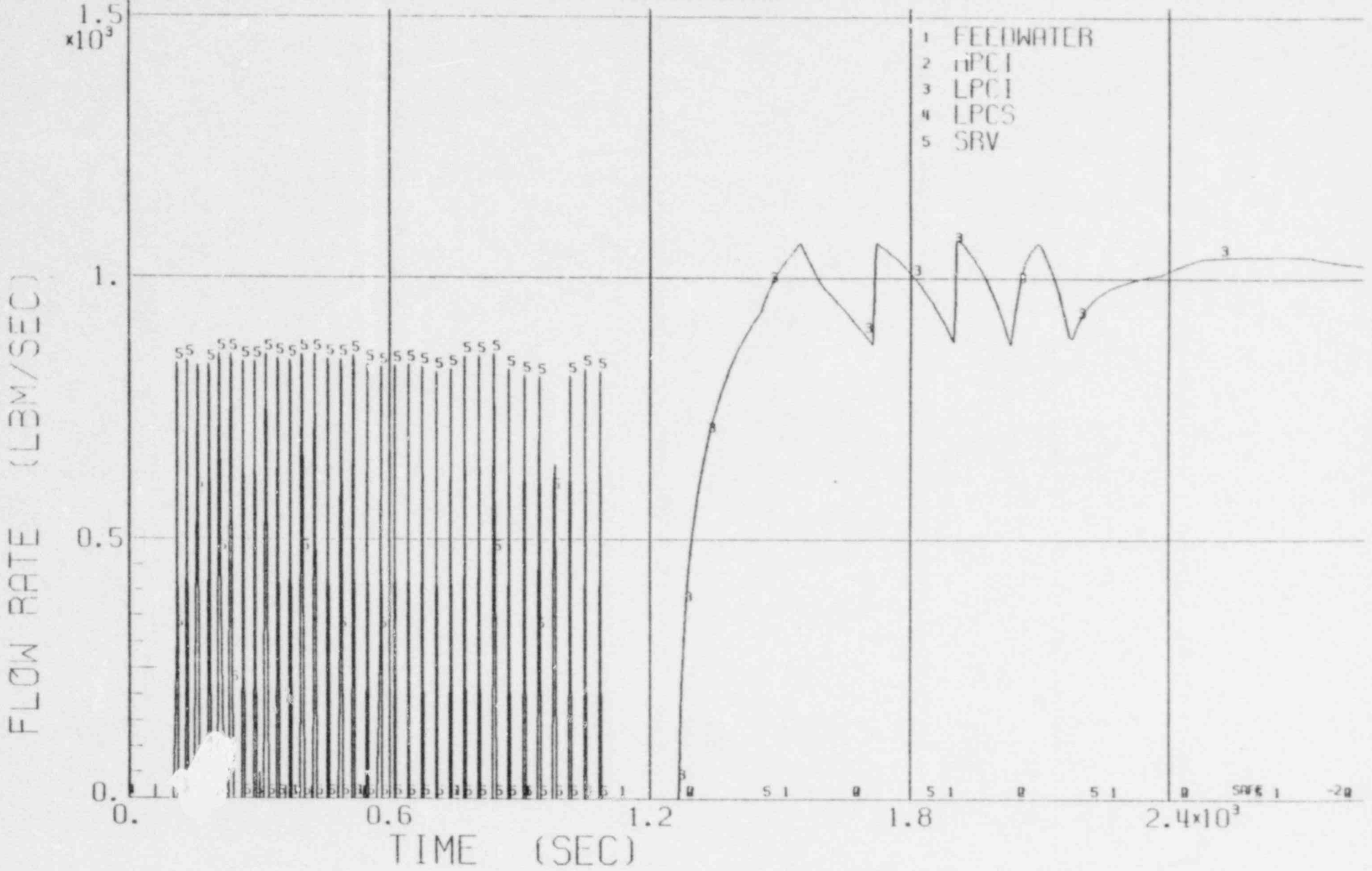
BWR/4-218

FIGURE 3.5.2.1 - 12.2 WATER LEVEL VS TIME FOR A 0.001 FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE.



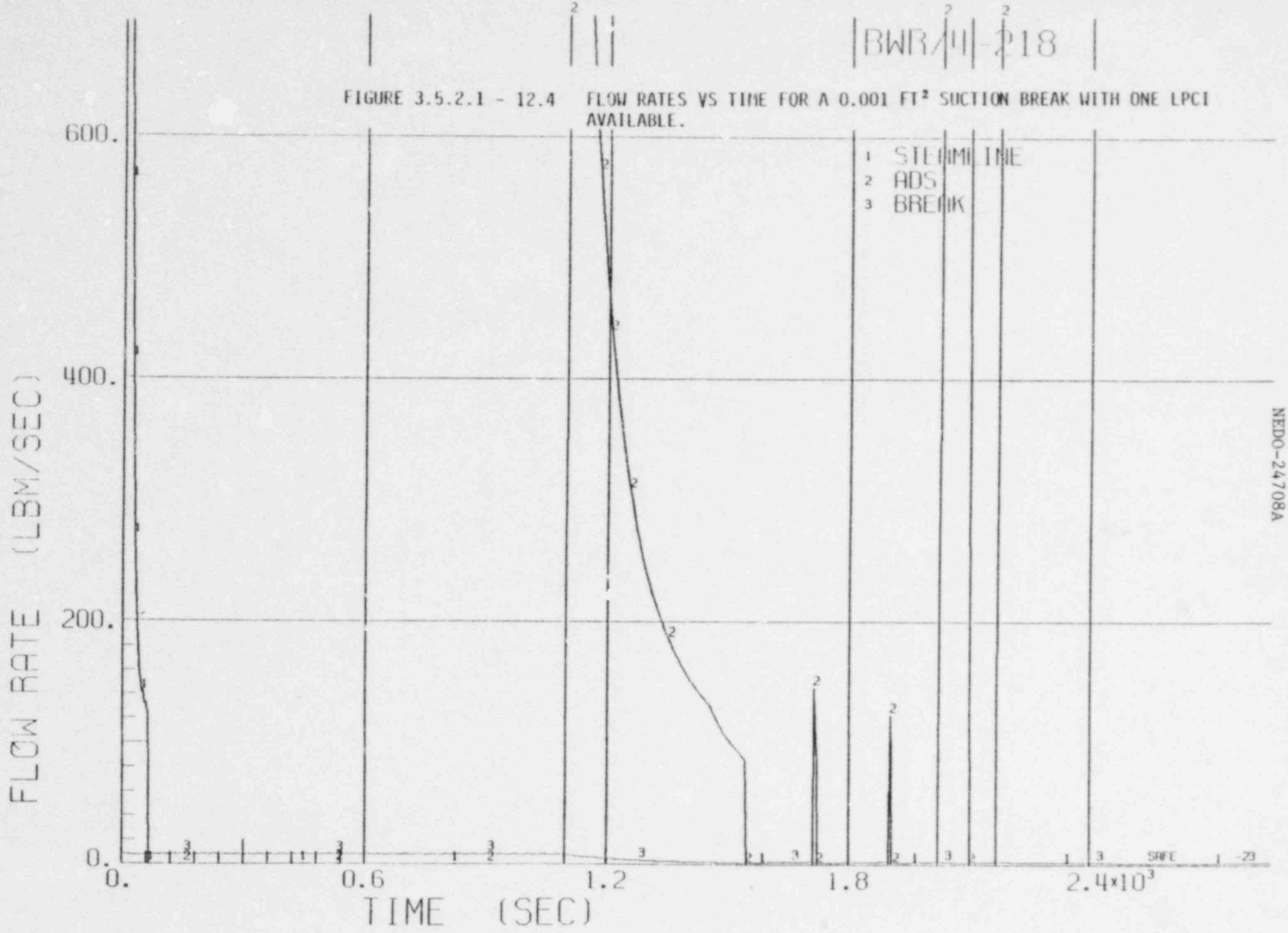
BWR/4-218

FIGURE 3.5.2.1 - 12.3 SYSTEM FLOW RATES VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.



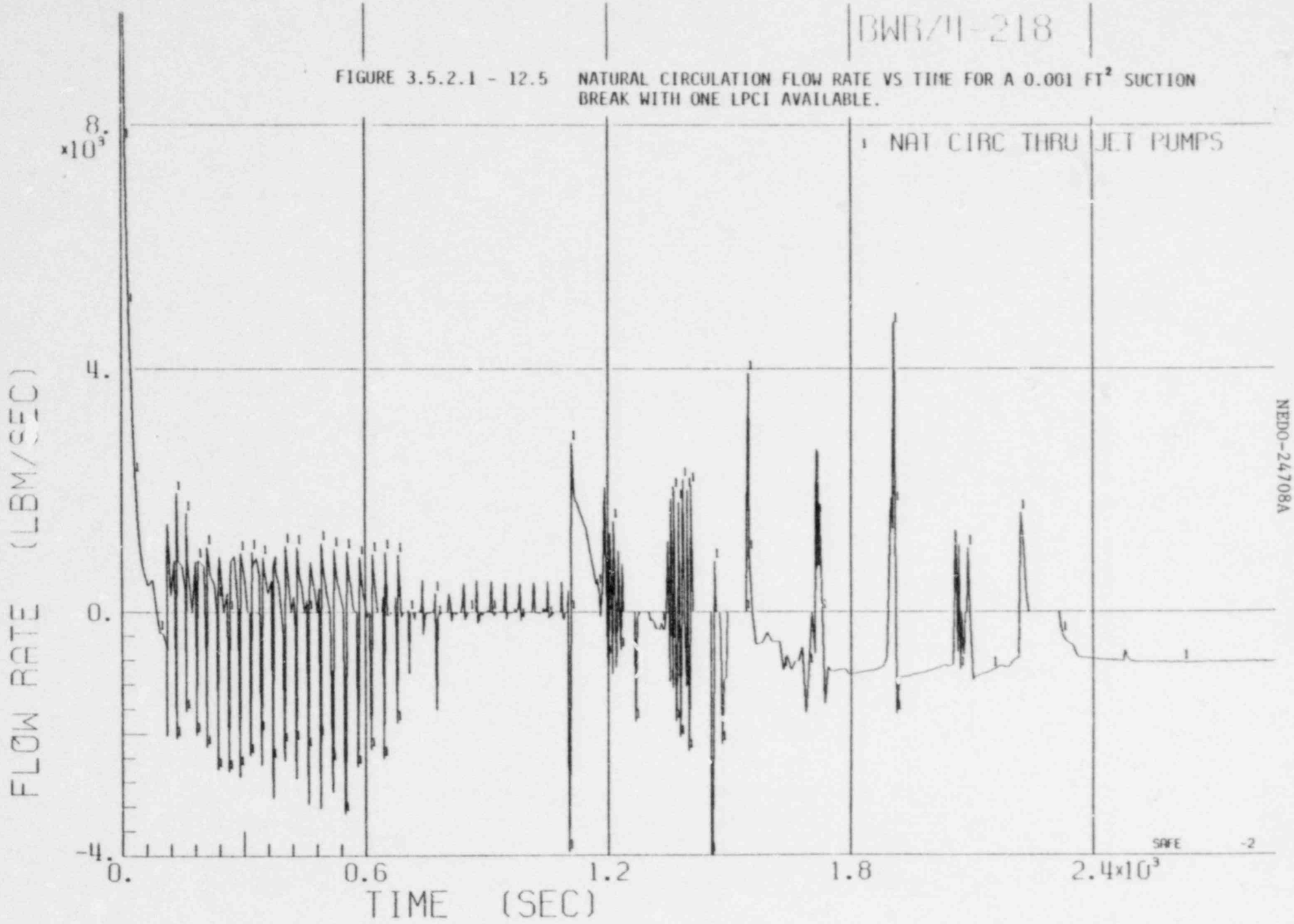
NEDO-24708A

FIGURE 3.5.2.1 - 12.4 FLOW RATES VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.



BWR/4-218

FIGURE 3.5.2.1 - 12.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.001 FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE.



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4-977

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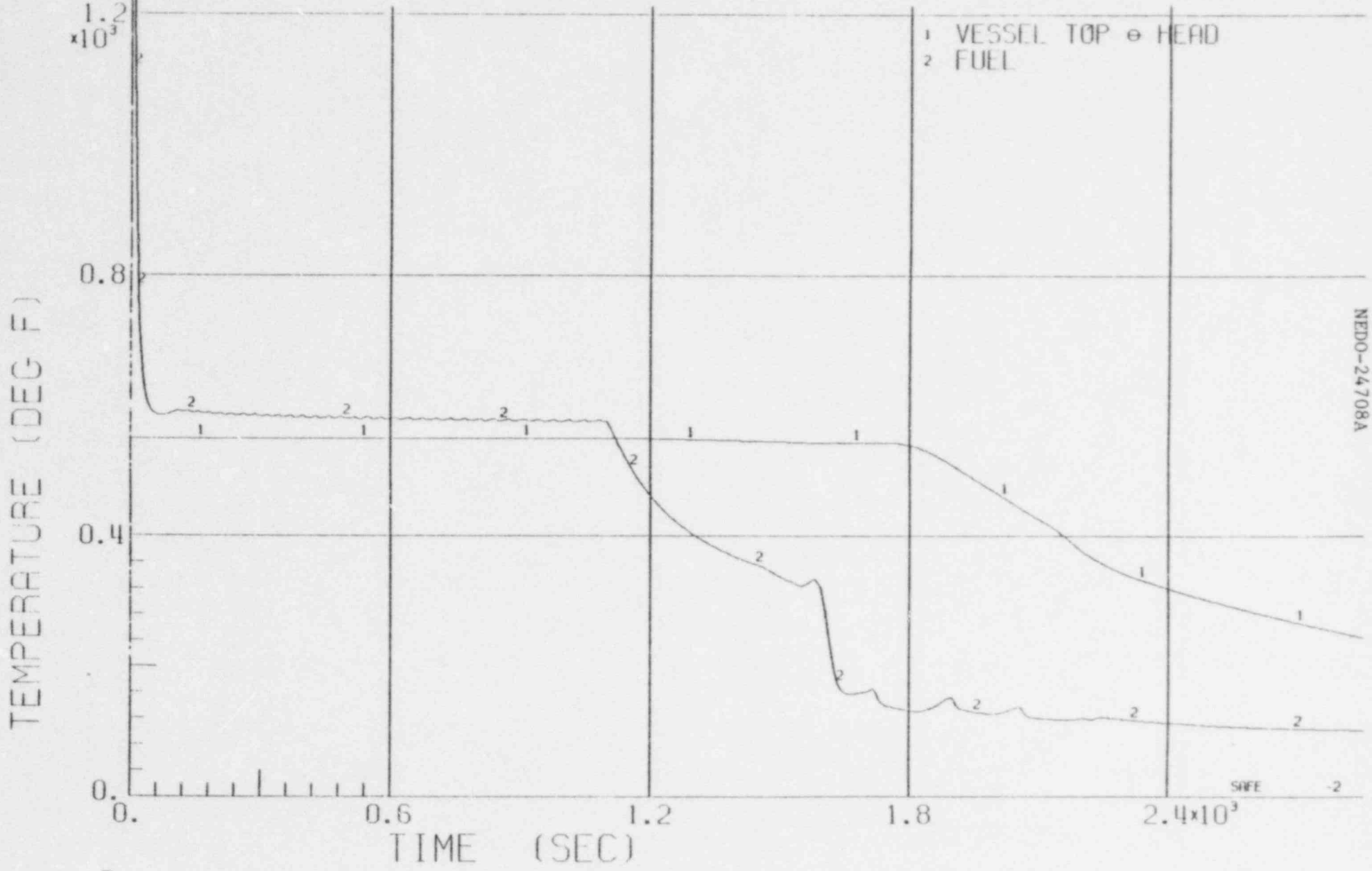
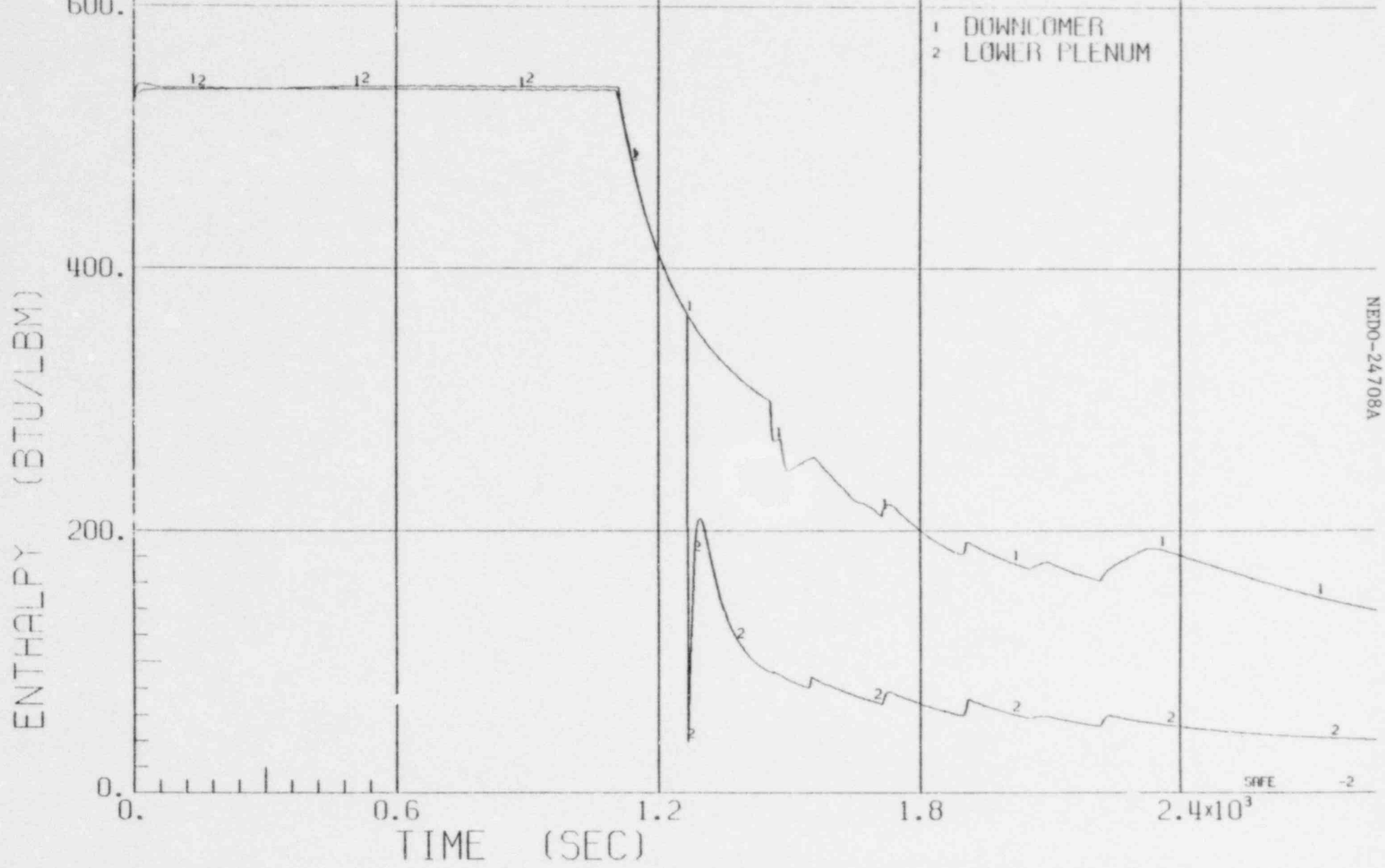
FIGURE 3.5.2.1 - 12.6 TEMPERATURE VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.



BWR/4-218

FIGURE 3.5.2.1 - 12.7 ENTHALPY VS TIME FOR A 0.001 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.



NEDO-24708A

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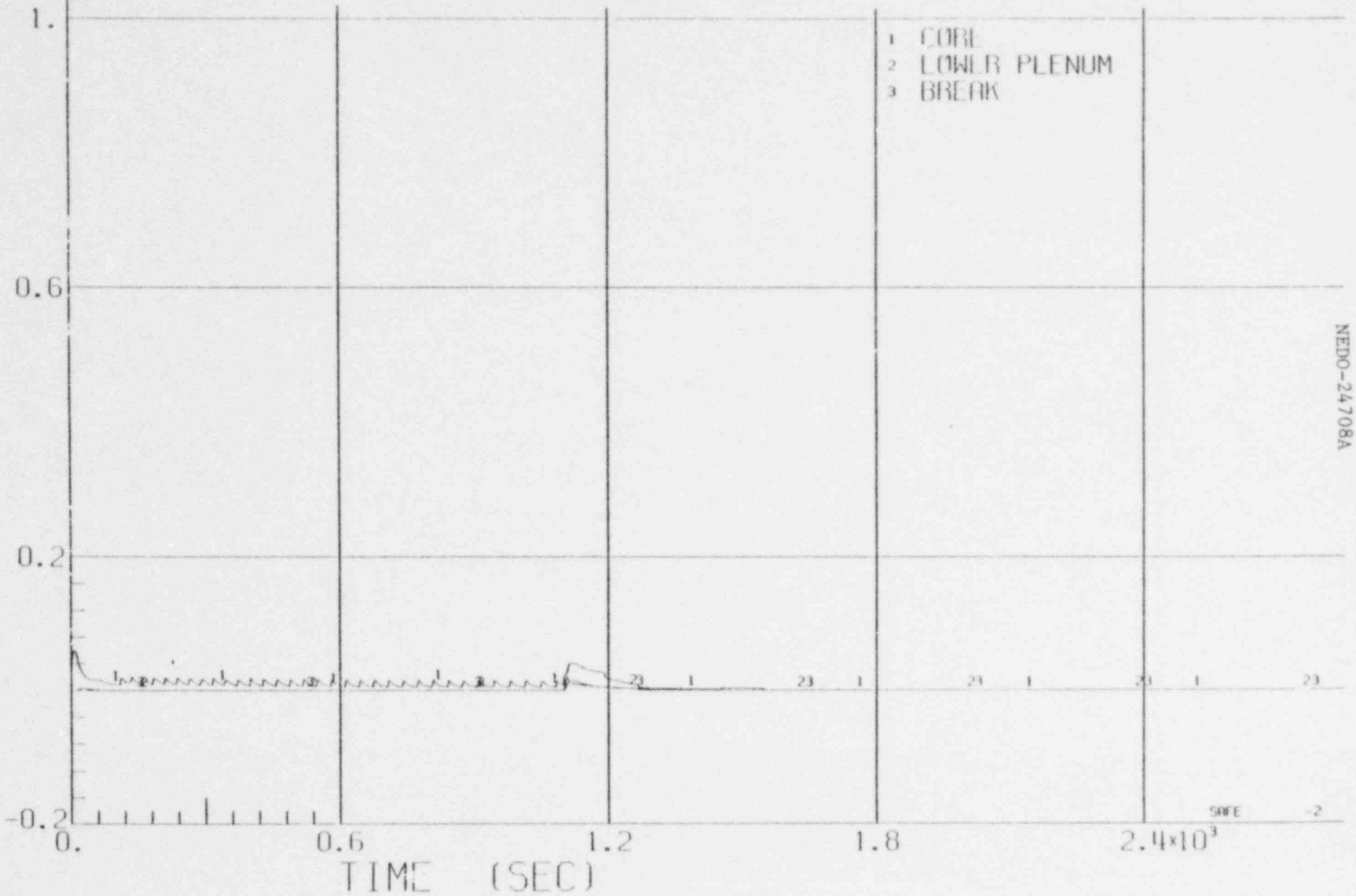
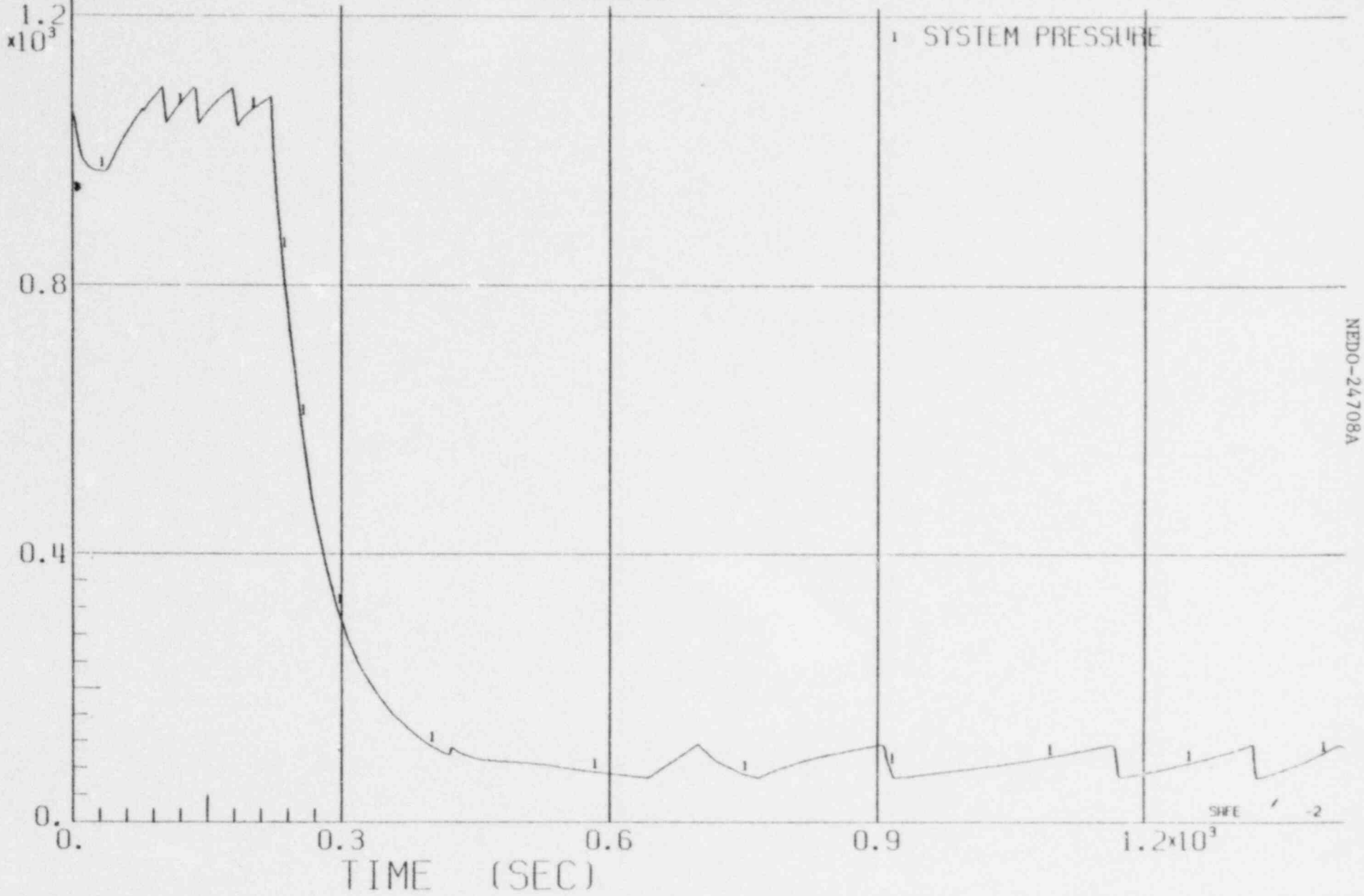
FIGURE 3.5.2.1 - 12.8 QUALITY VS TIME FOR A 0.001 FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE.



BWR/4-218

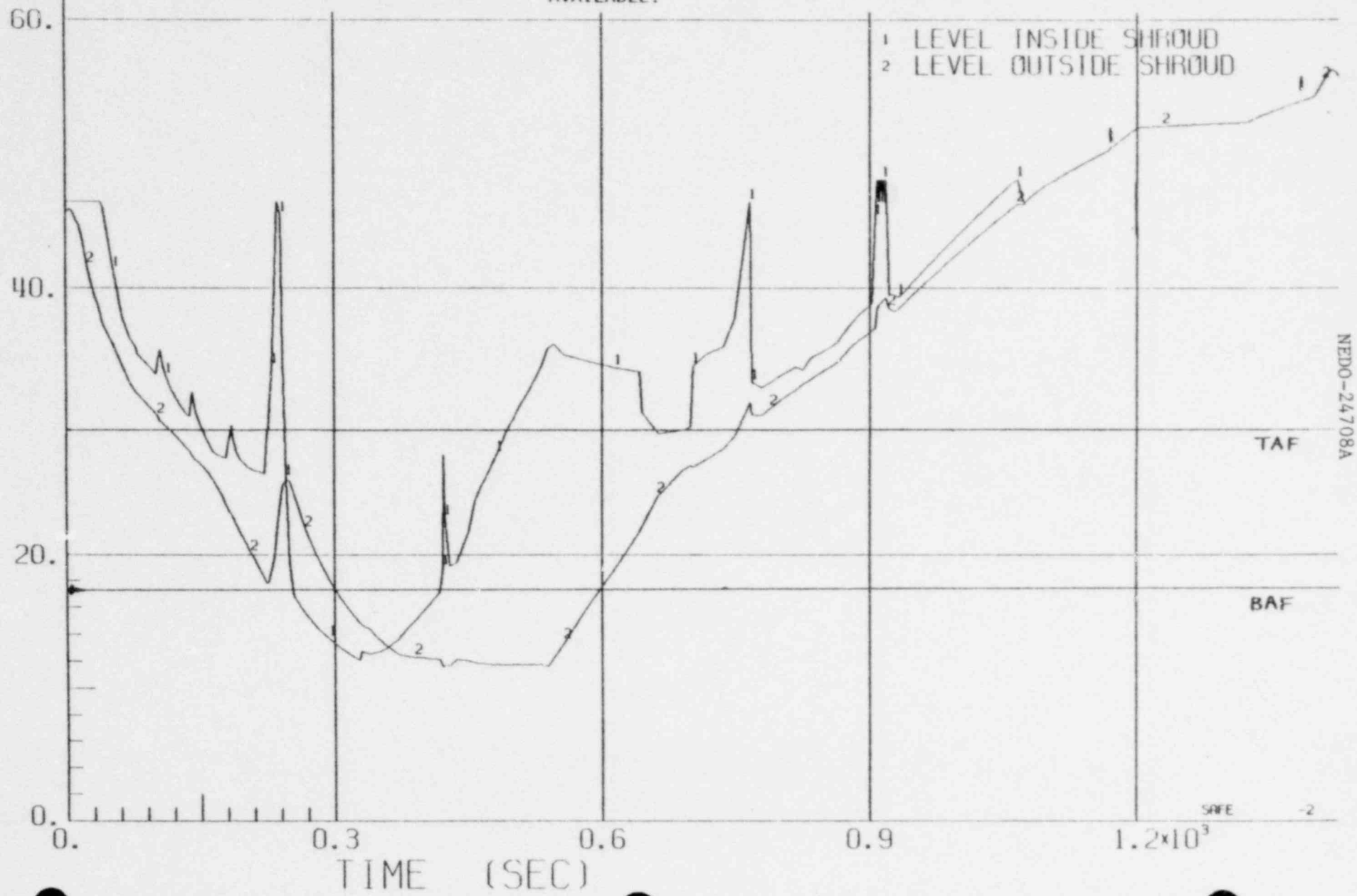
FIGURE 3.5.2.1 - 13.1 SYSTEM PRESSURE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.



NEDO-24708A

BWR/4-218

FIGURE 3.5.2.1 - 13.2 WATER LEVEL VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.



NEDO-24708A

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FIGURE 3.5.2.1 - 13.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

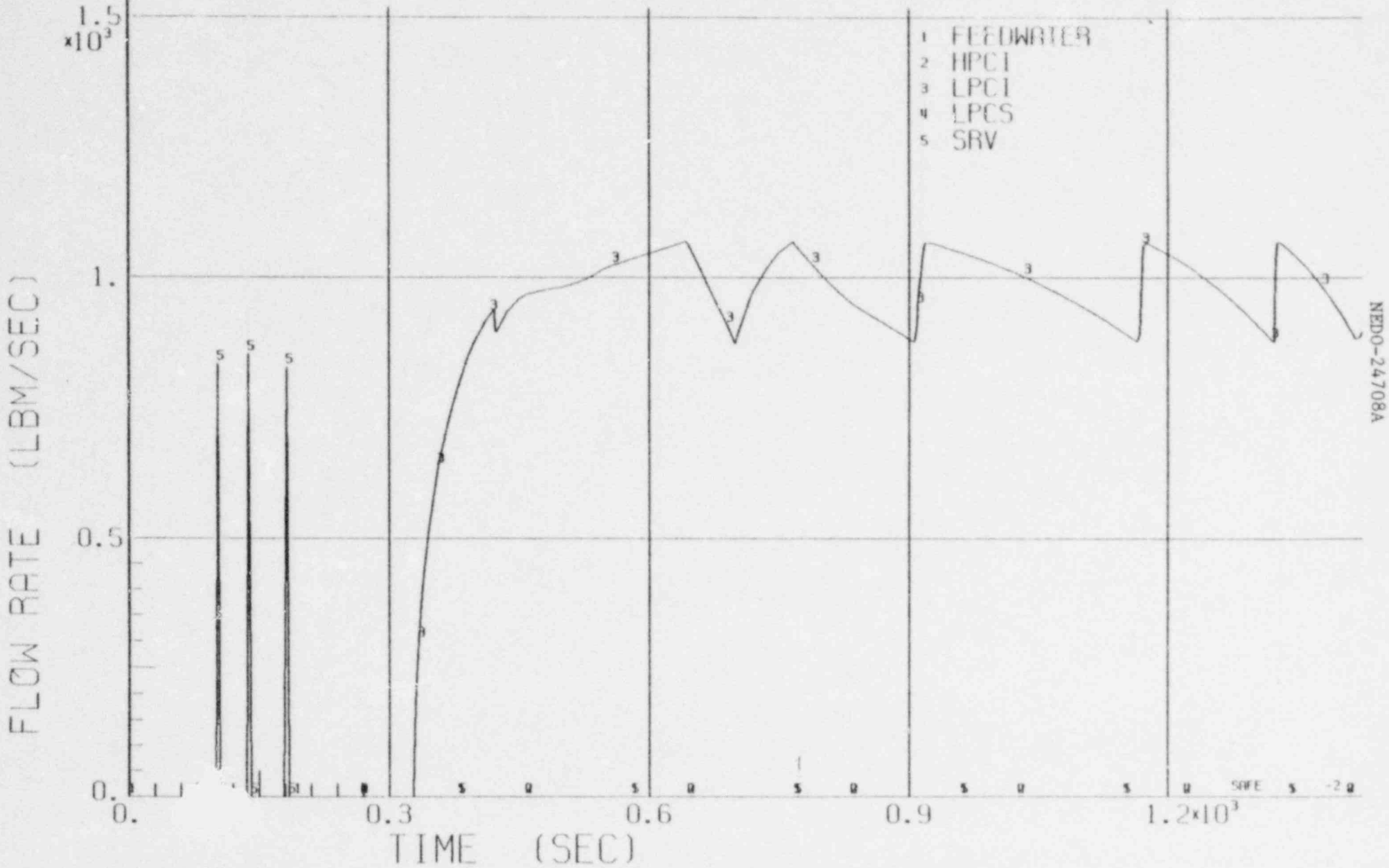

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FIGURE 3.5.2.1 - 13.4 FLOW RATES VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

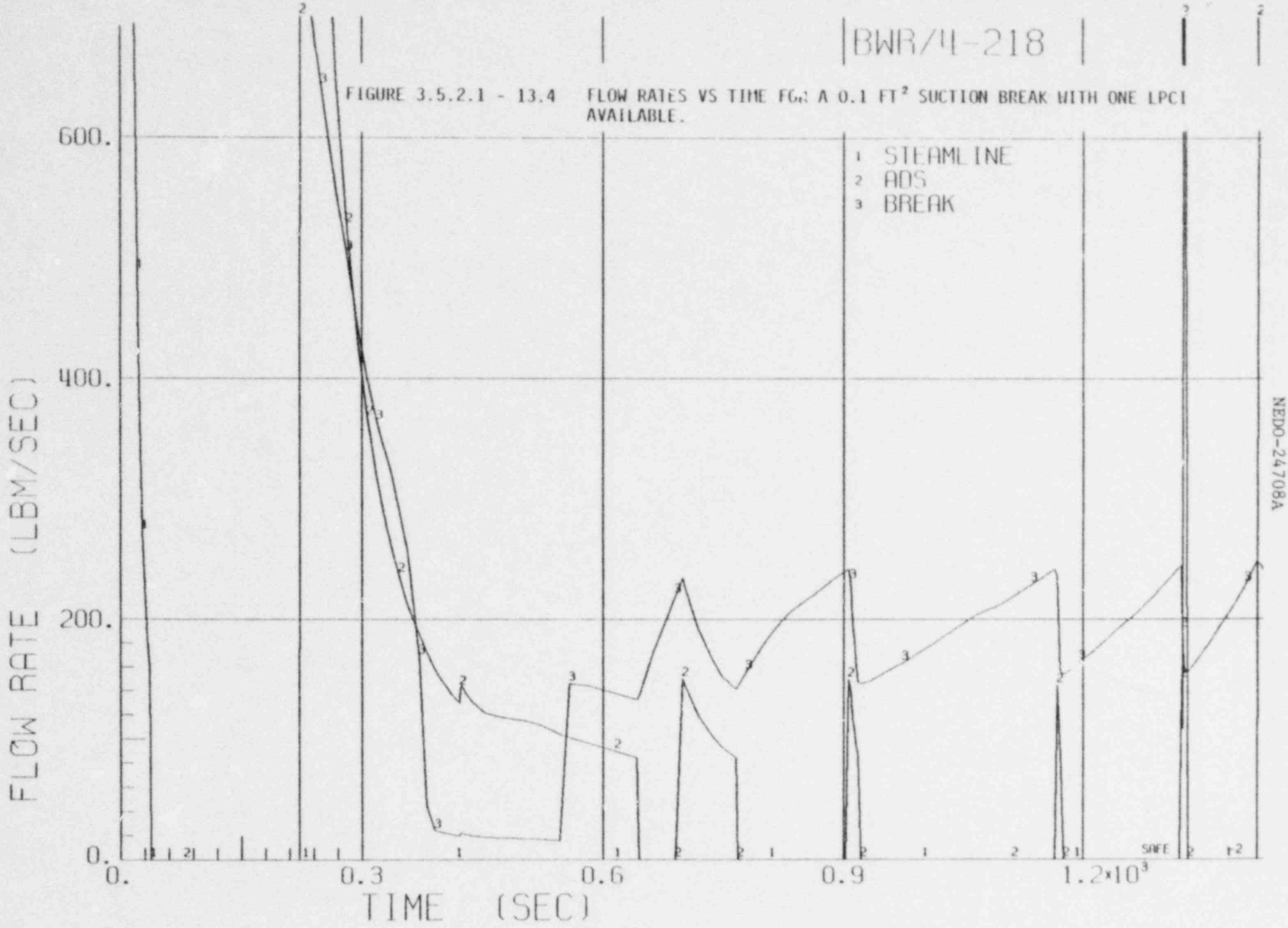

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FIGURE 3.5.2.1 - 13.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE.

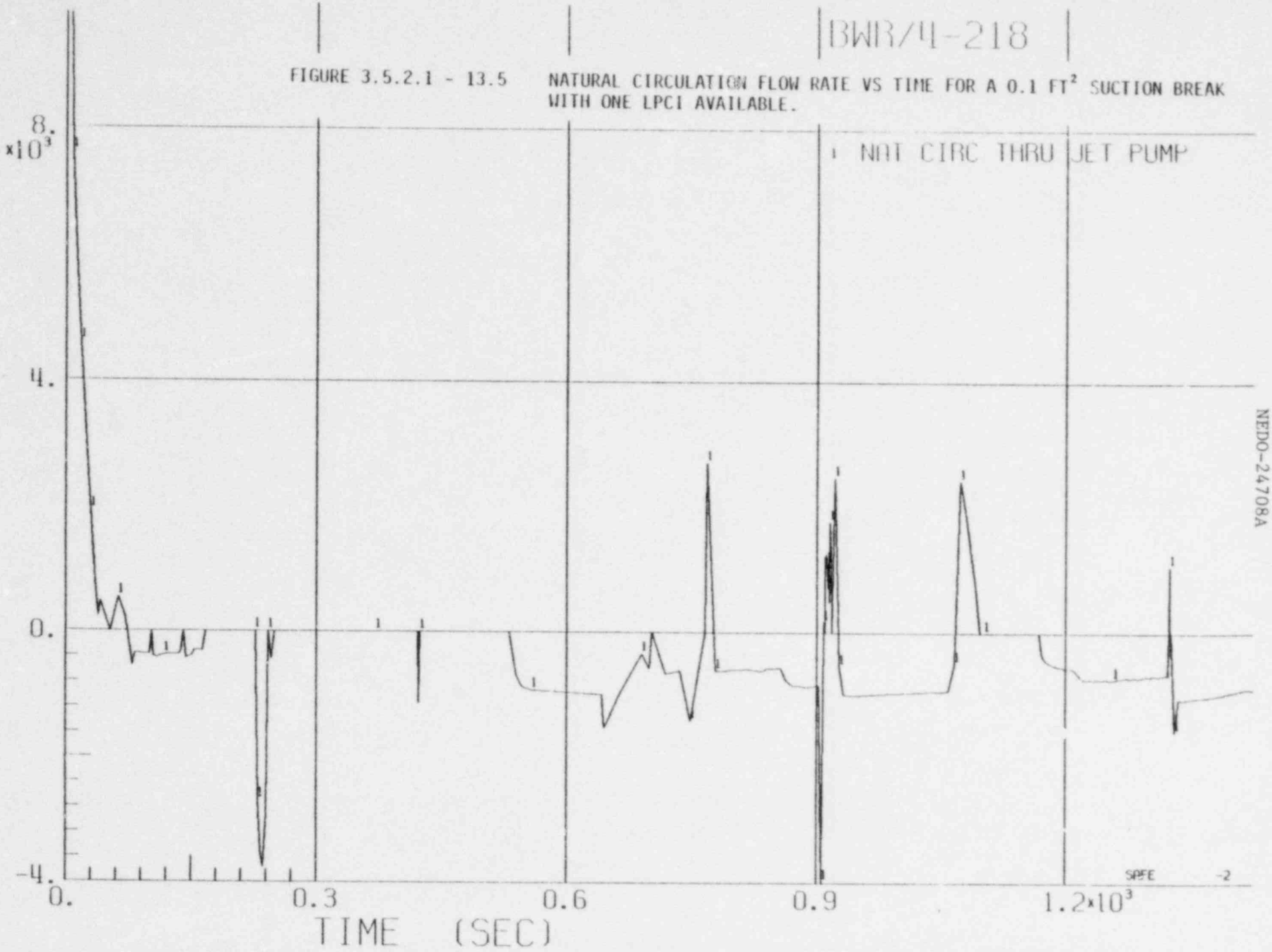

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FIGURE 3.5.2.1 - 13.6 TEMPERATURE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

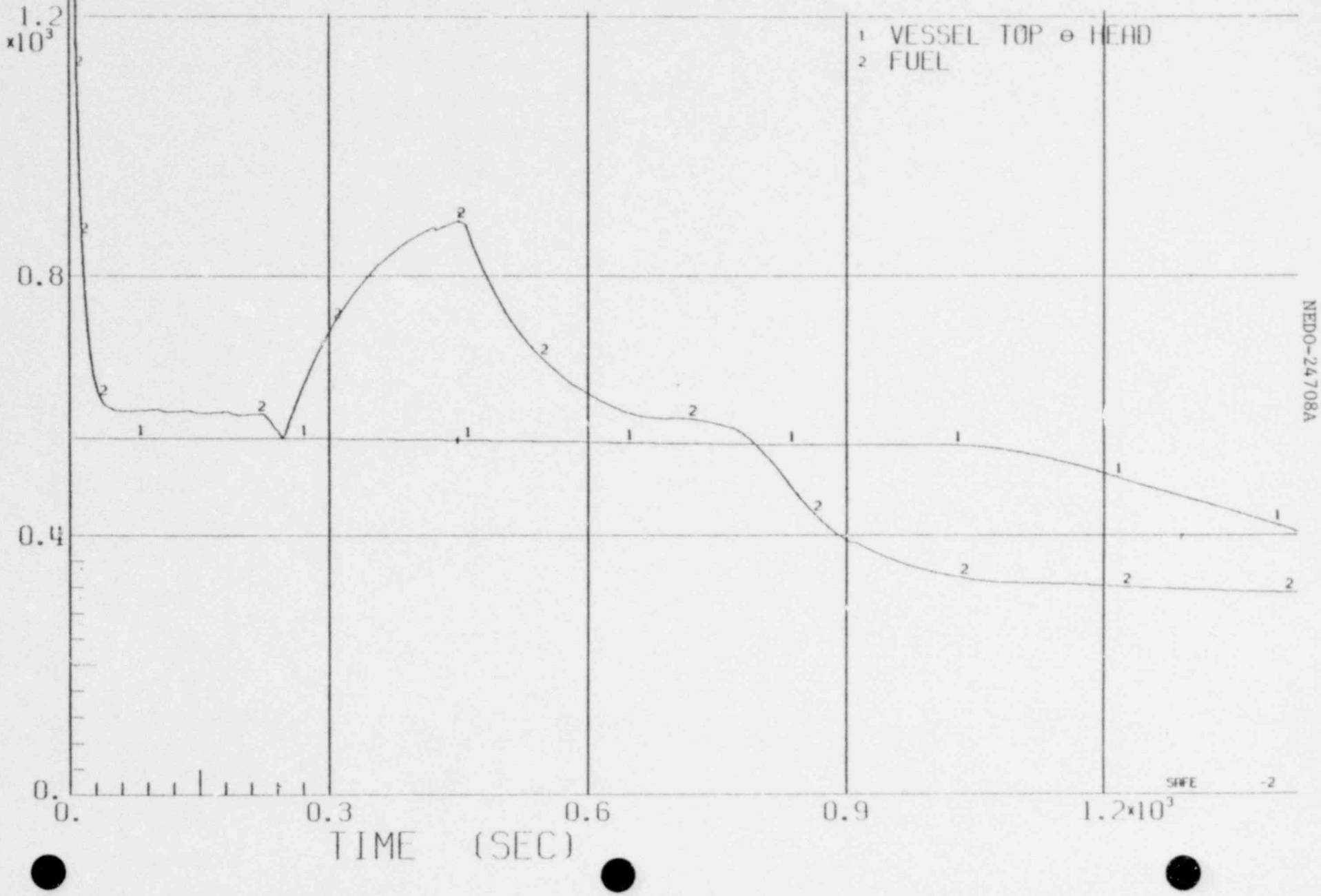

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FIGURE 3.5.2.1 - 13.7 ENTHALPY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

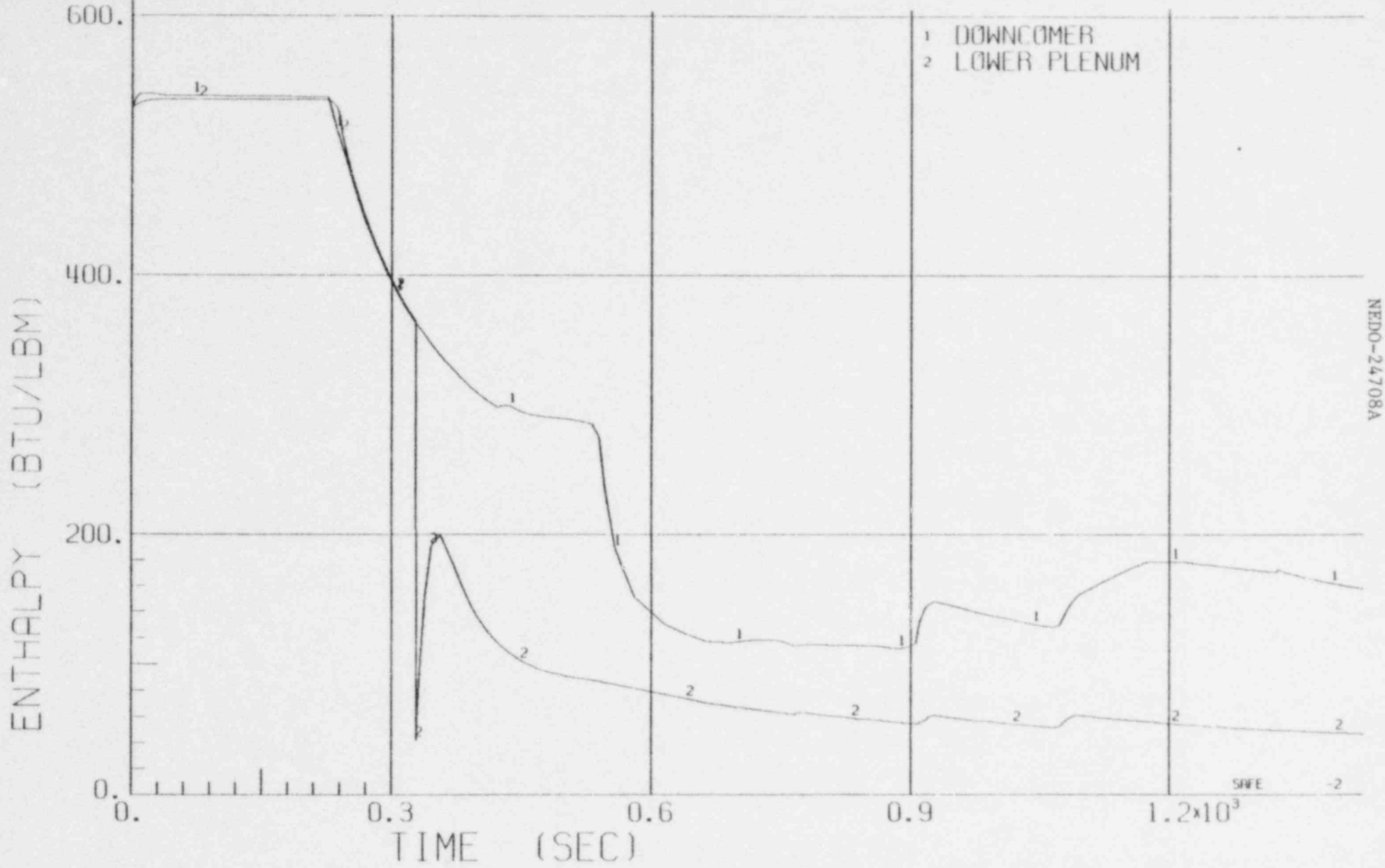

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FIGURE 3.5.2.1 - 13.8 QUALITY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

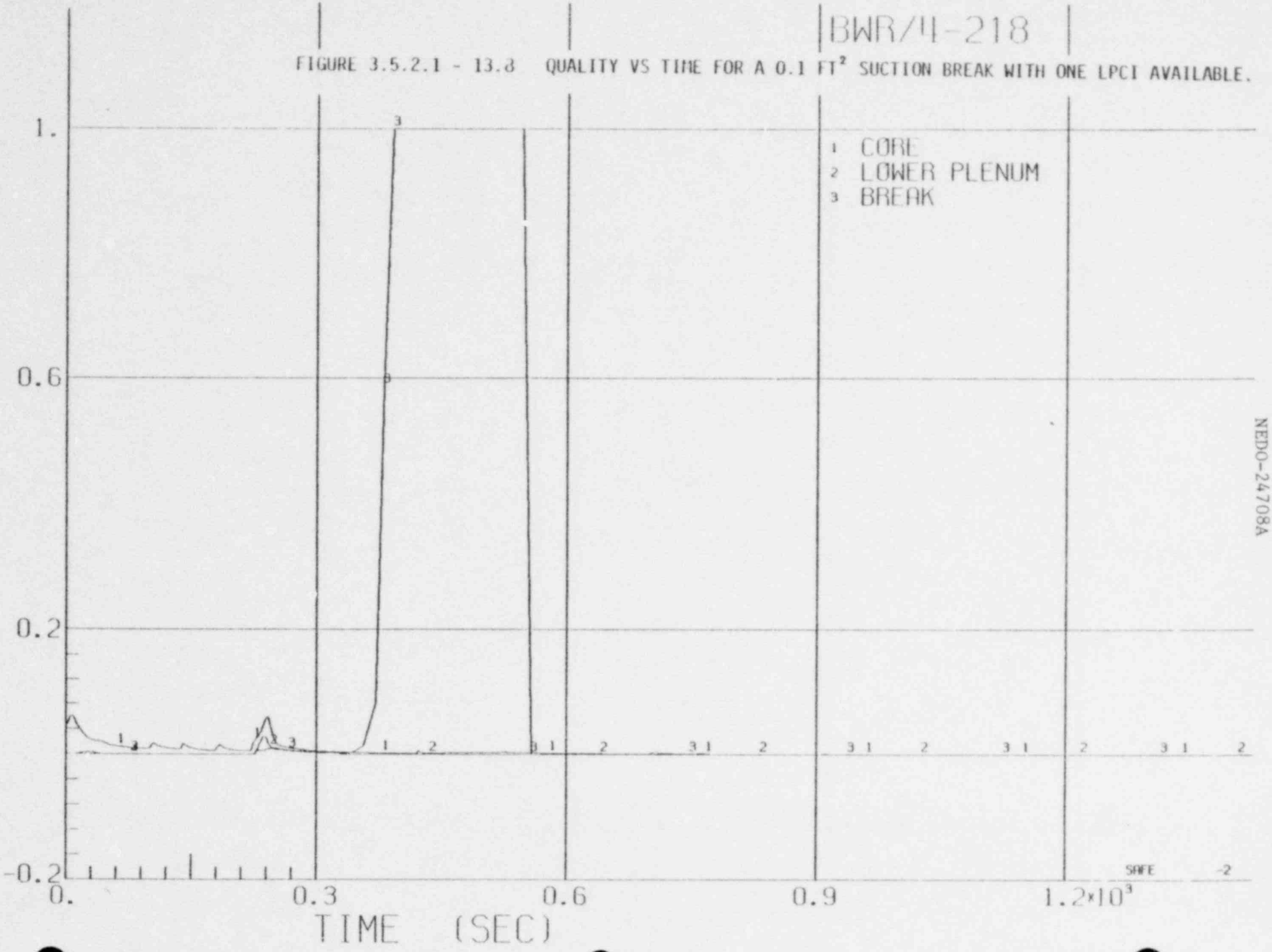

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FIGURE 3.5.2.1 - 14.1 SYSTEM PRESSURE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

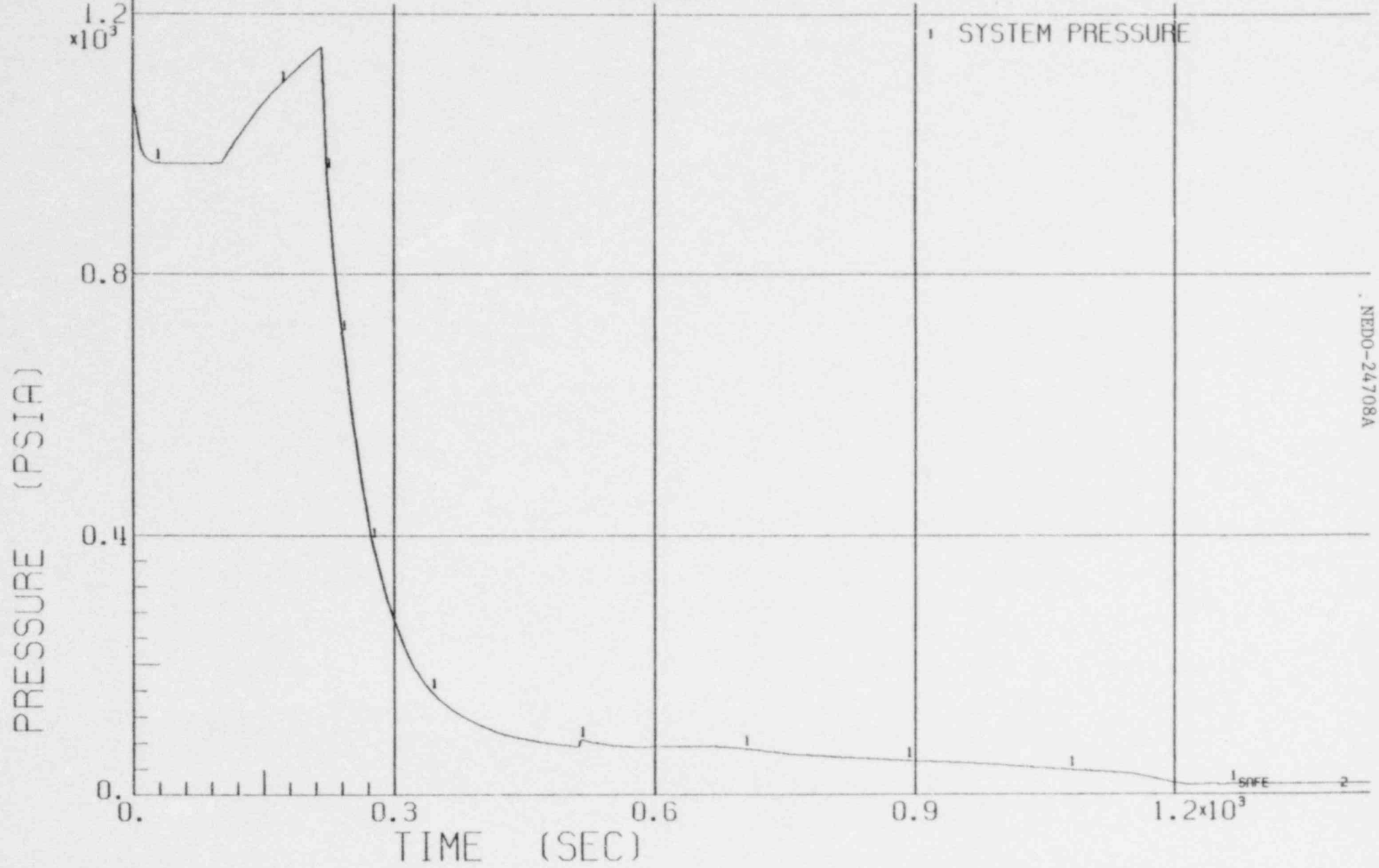

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FIGURE 3.5.2.1 - 14.2 WATER LEVEL VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

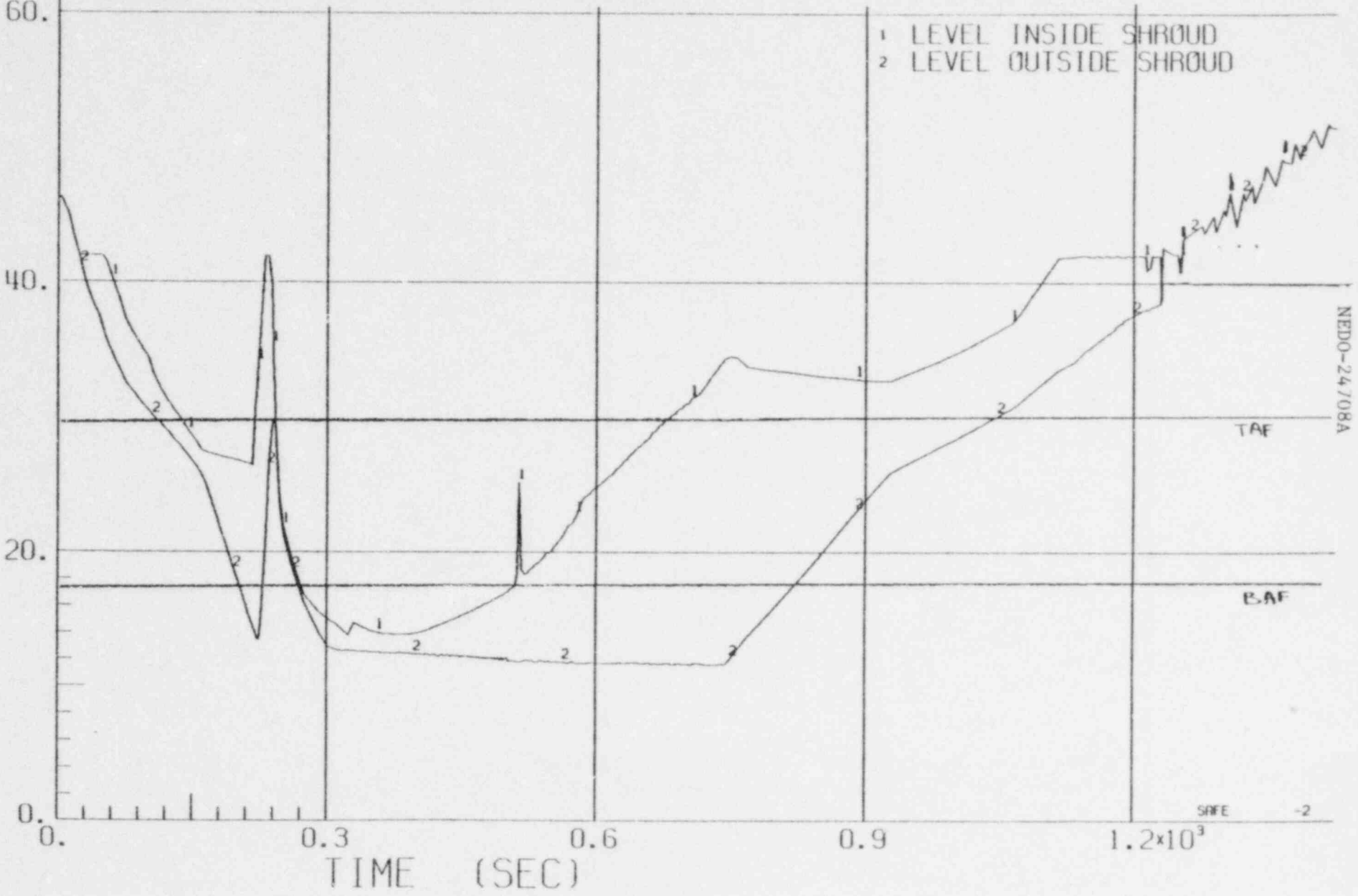

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FIGURE 3.5.2.1 - 14.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

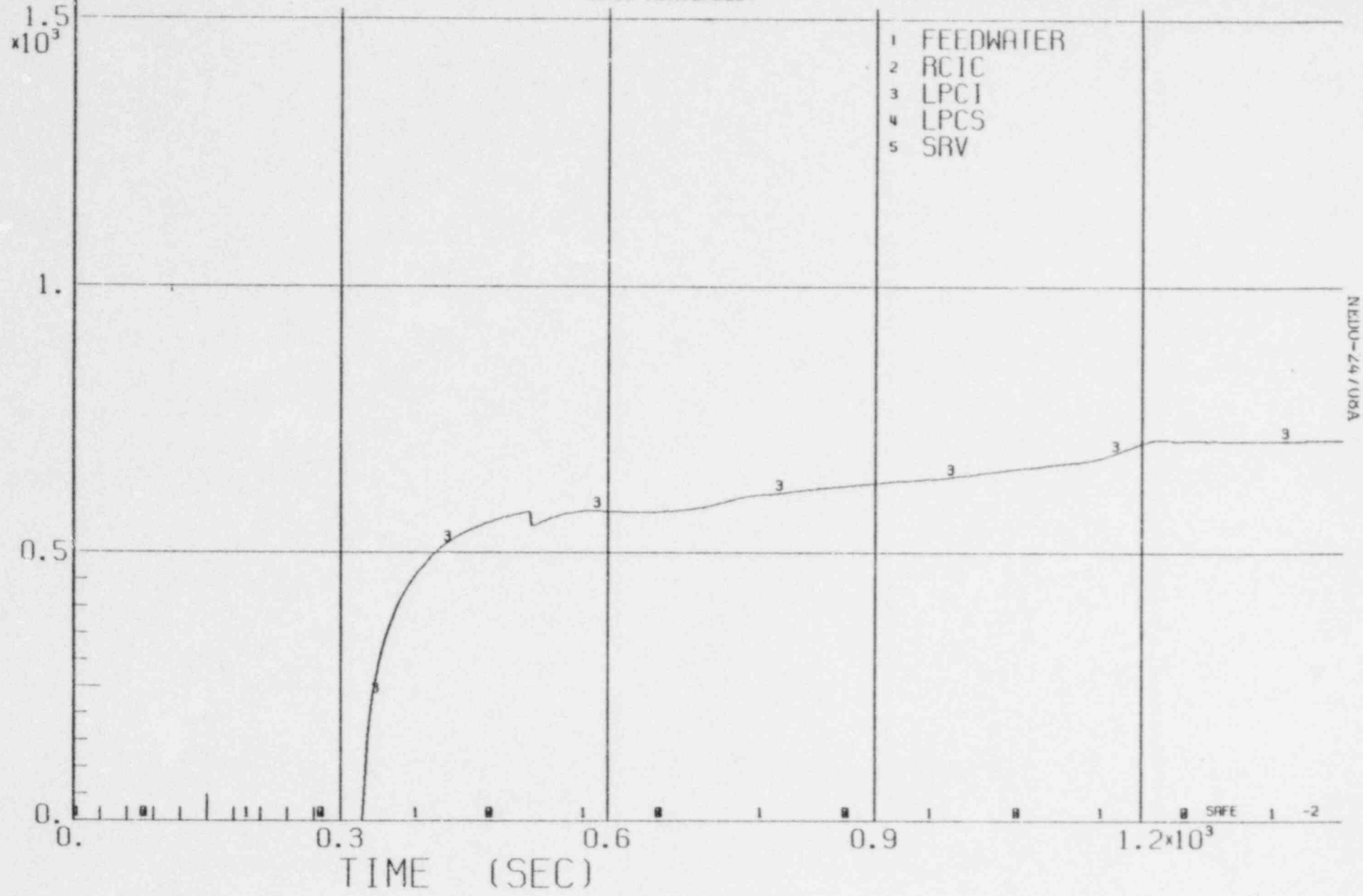

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FIGURE 3.5.2.1 - 14.4 FLOW RATES VS TIME FOR A 3.1 FT² SECTION BREAK WITH ONE LPCI AVAILABLE.

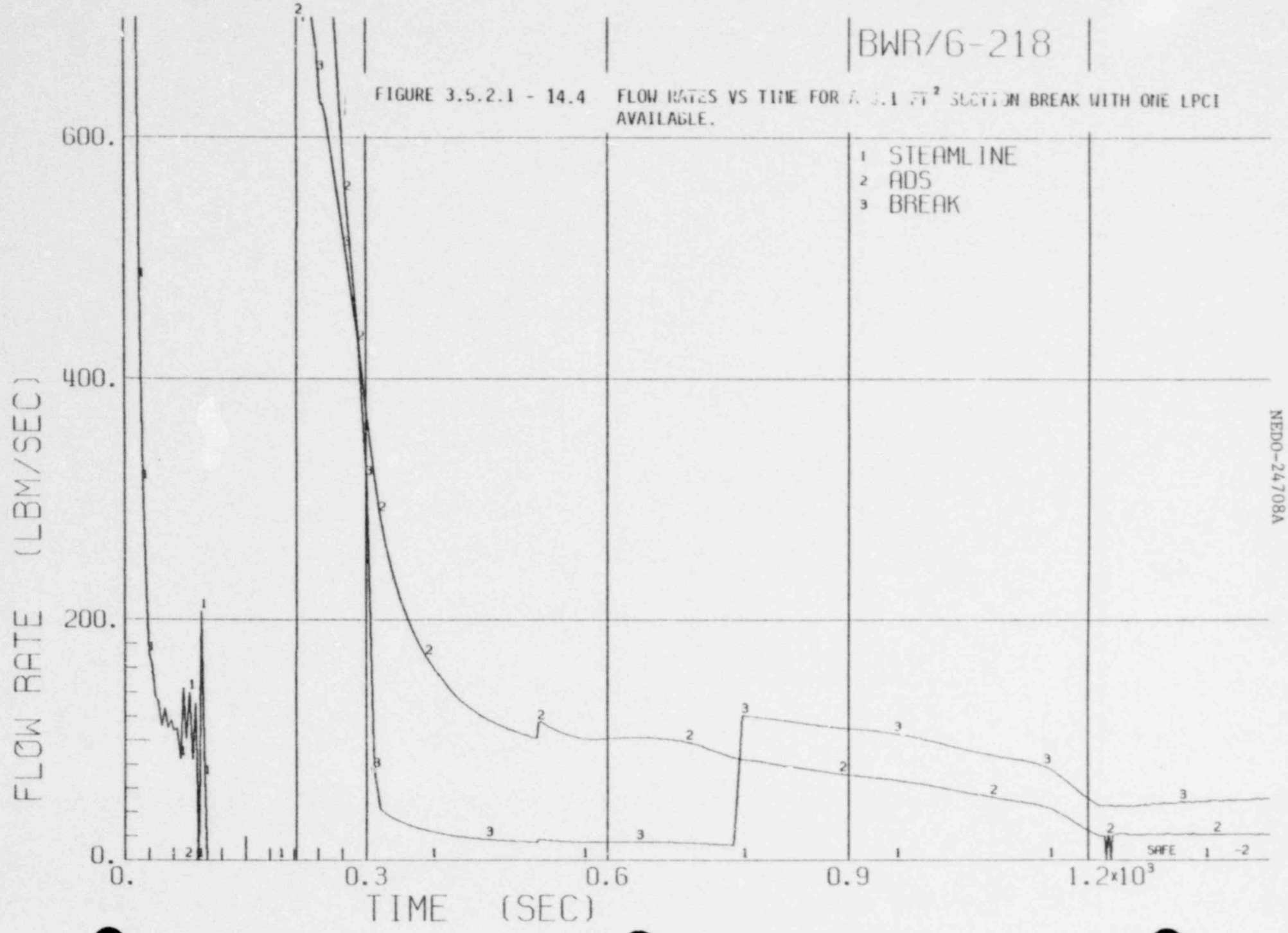

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FIGURE 3.5.2.1 - 14.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE.

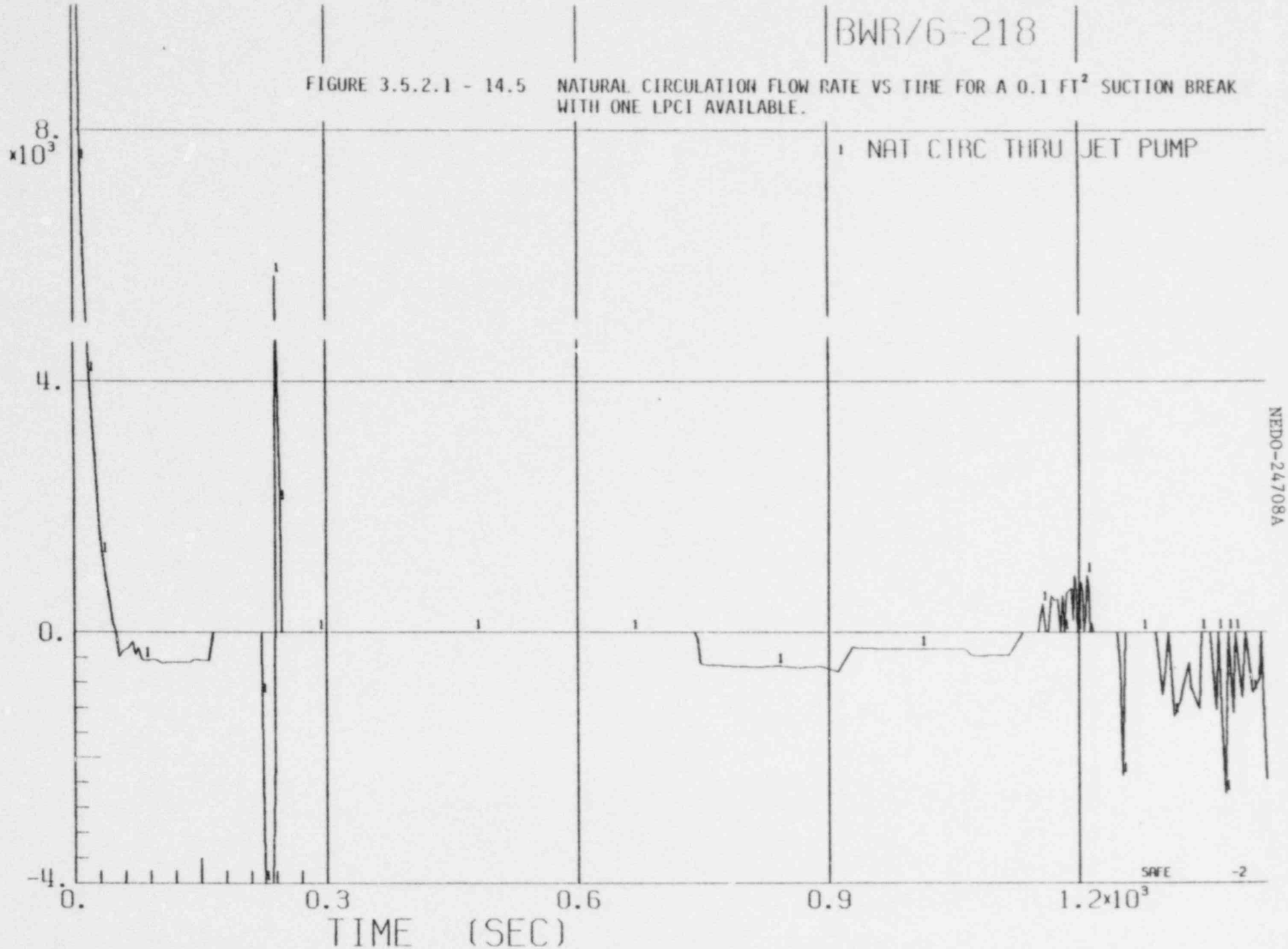

FIGURE 3.5.2.1 - 14.6 TEMPERATURE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE.

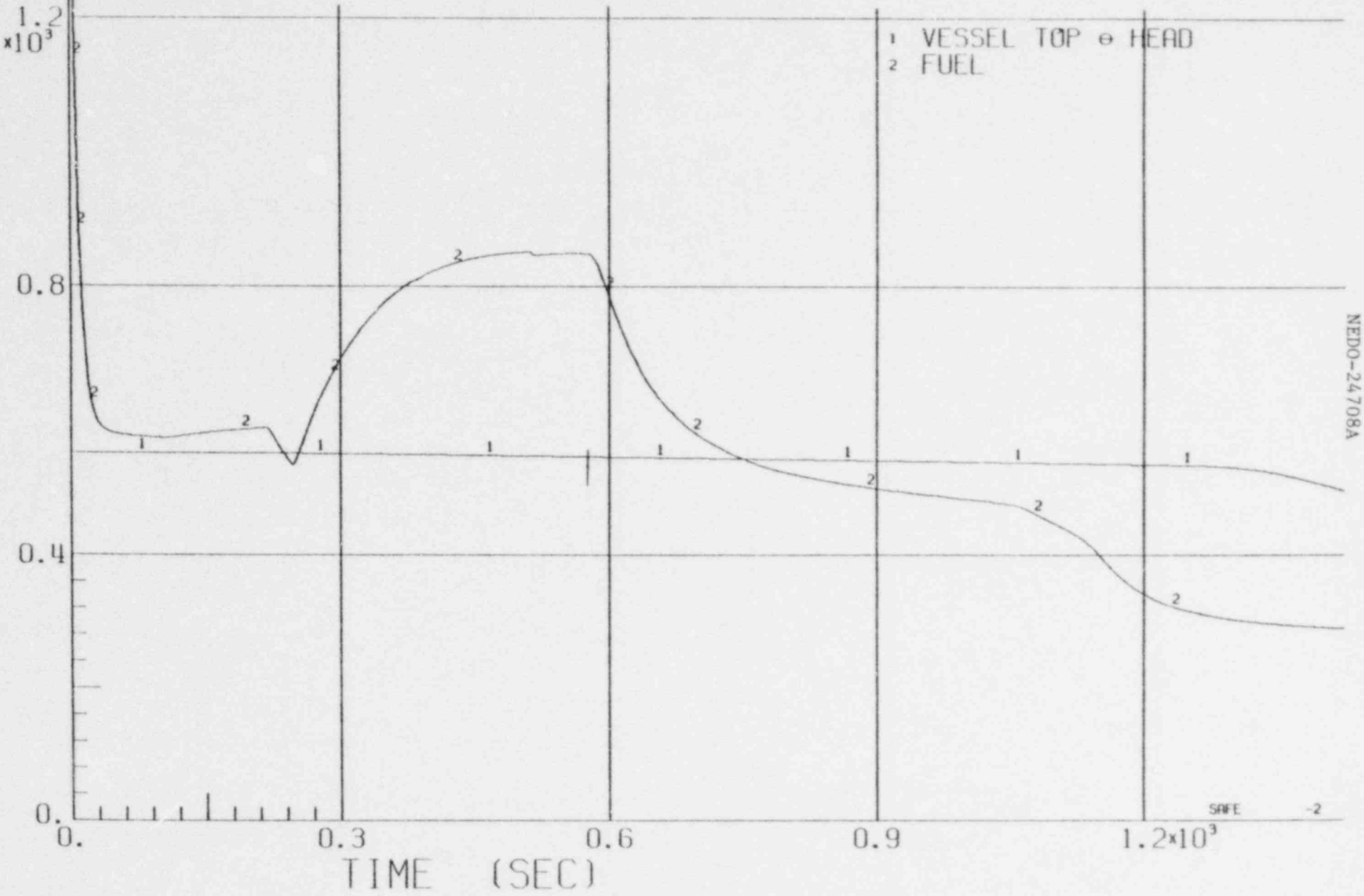

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FIGURE 3.5.2.1 - 14.7 ENTHALPY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE

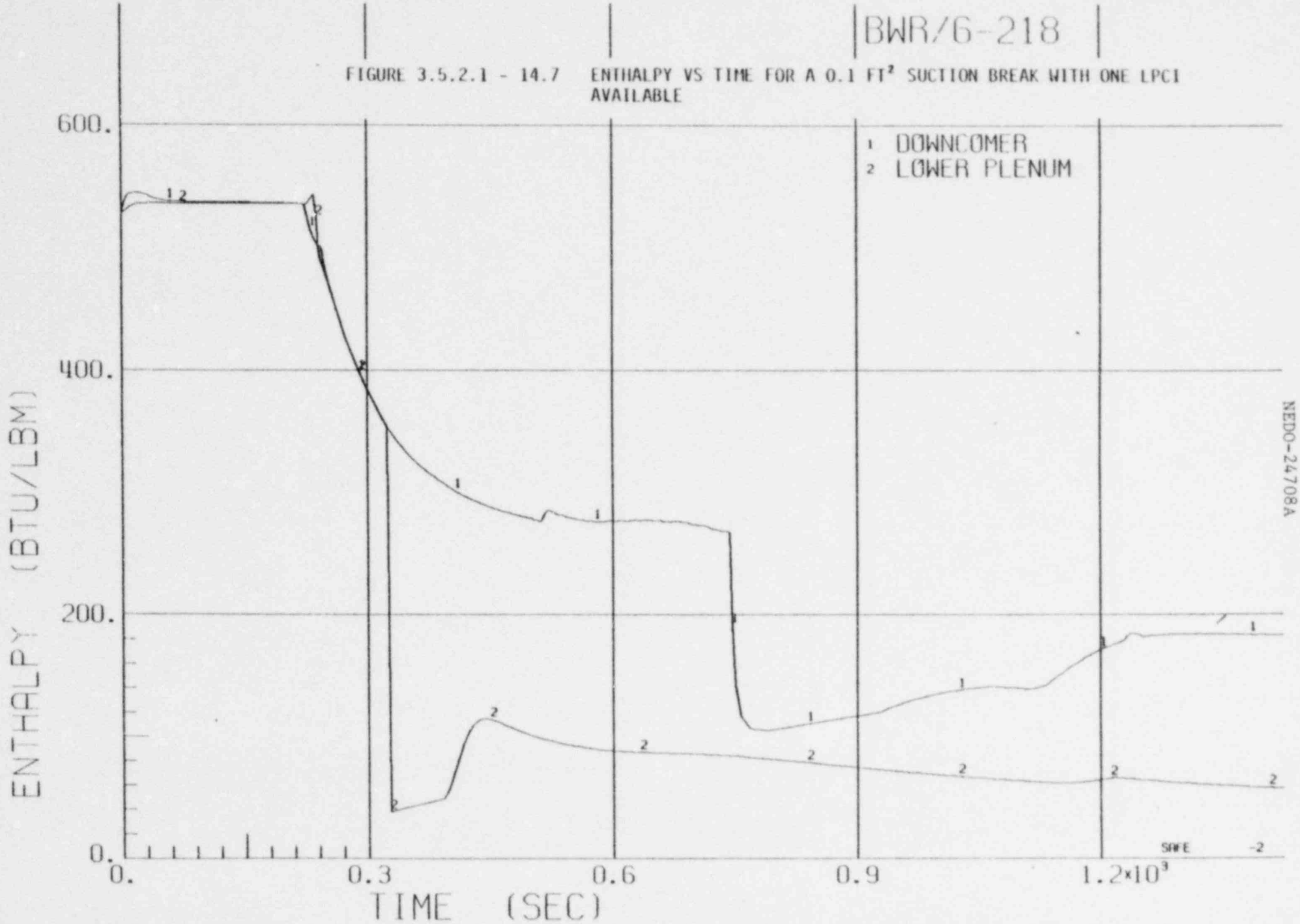

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FIGURE 3.5.2.1 - 14.8 QUALITY VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE.

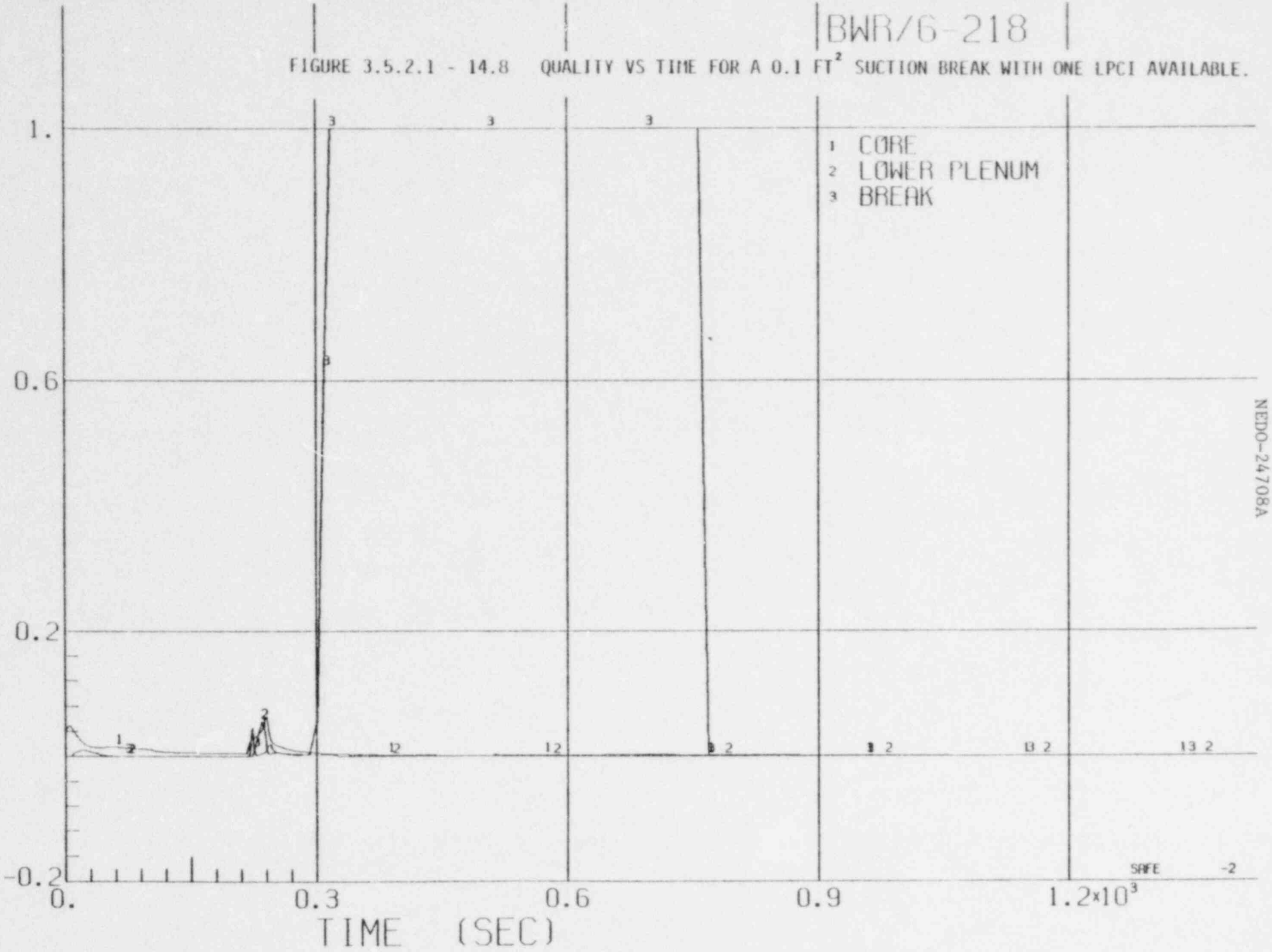

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FIGURE 3.5.2.1 - 15.1 SYSTEM PRESSURE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.

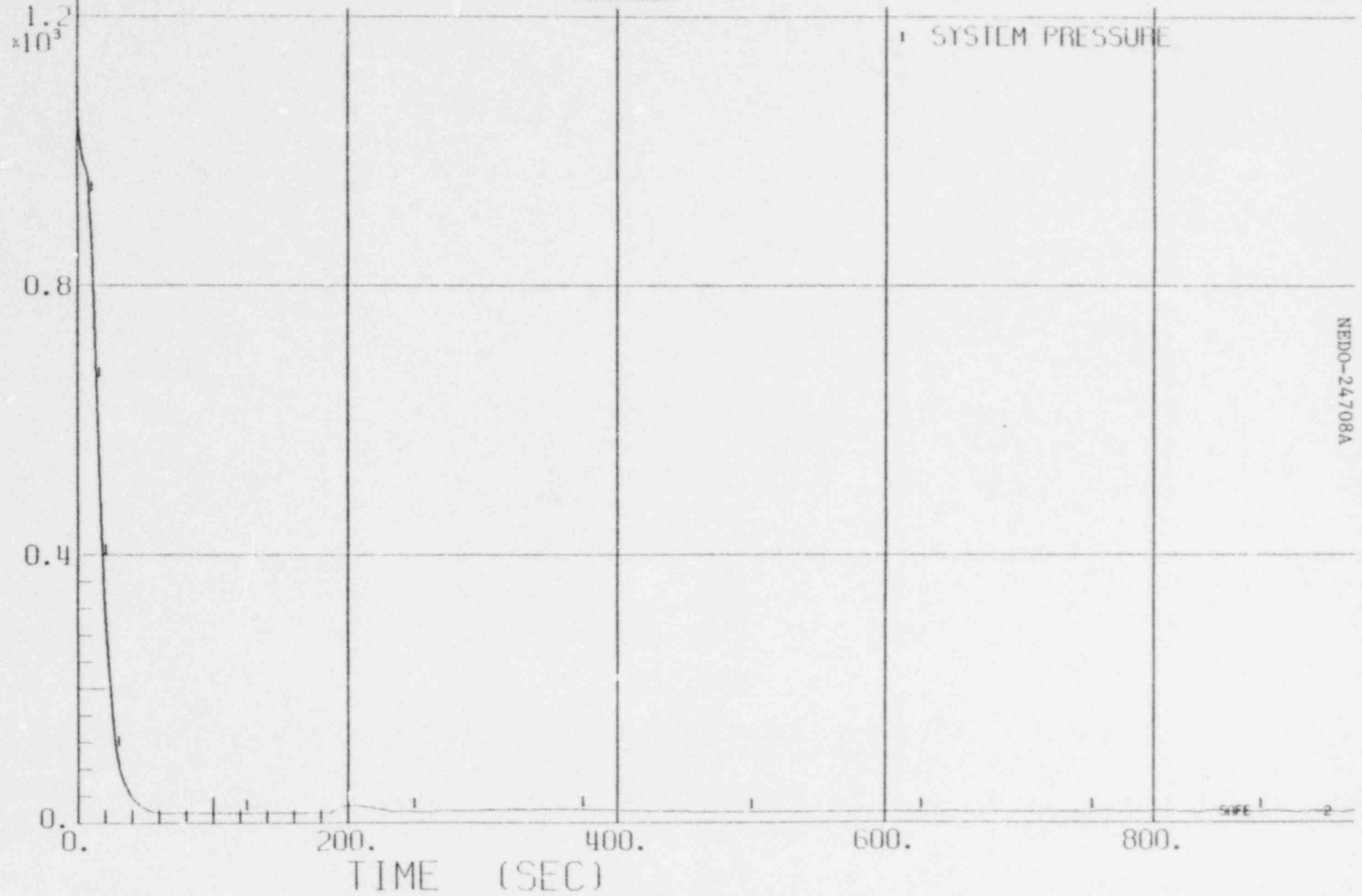

FIGURE 3.5.2.1 - 15.2 WATER LEVEL VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.

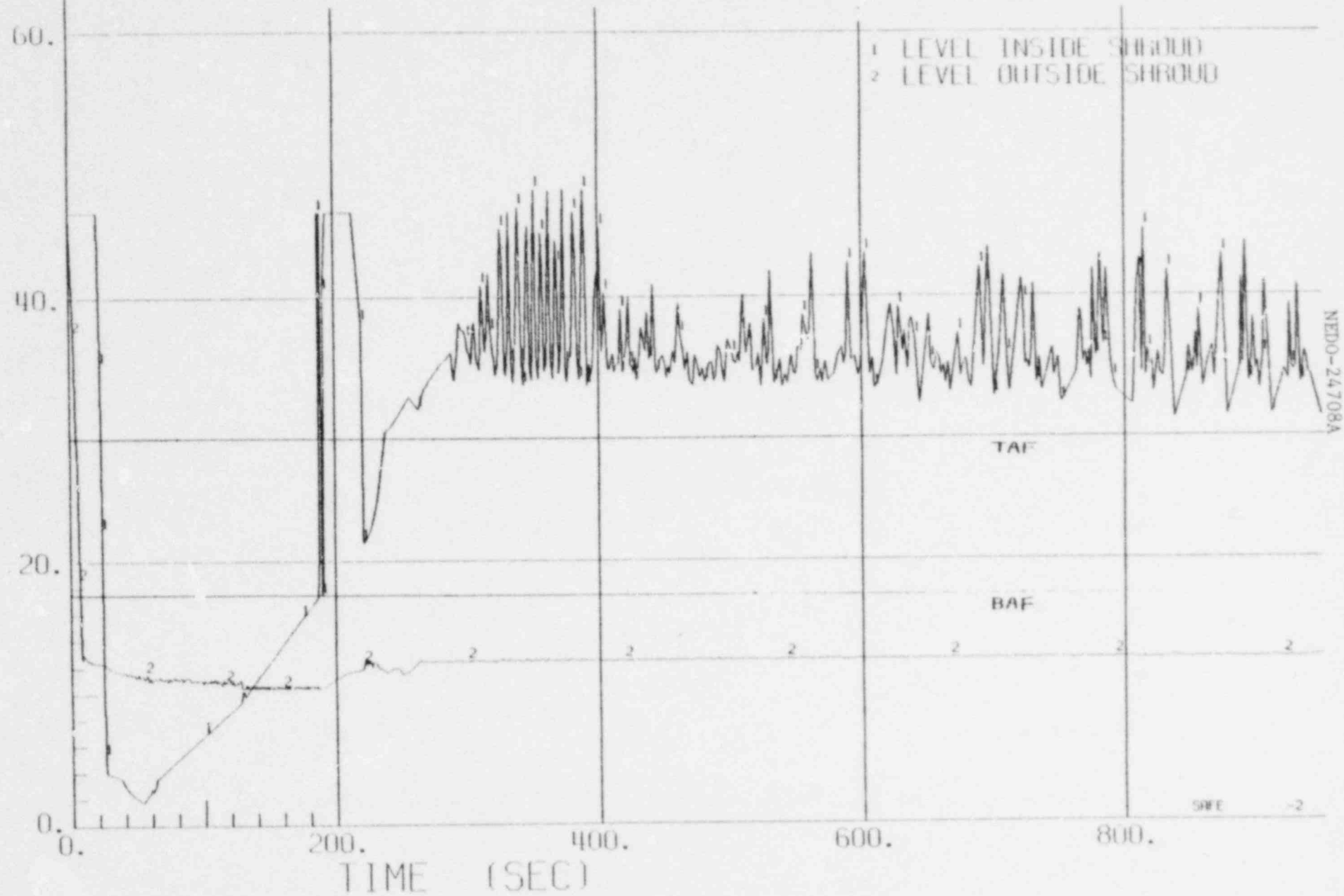

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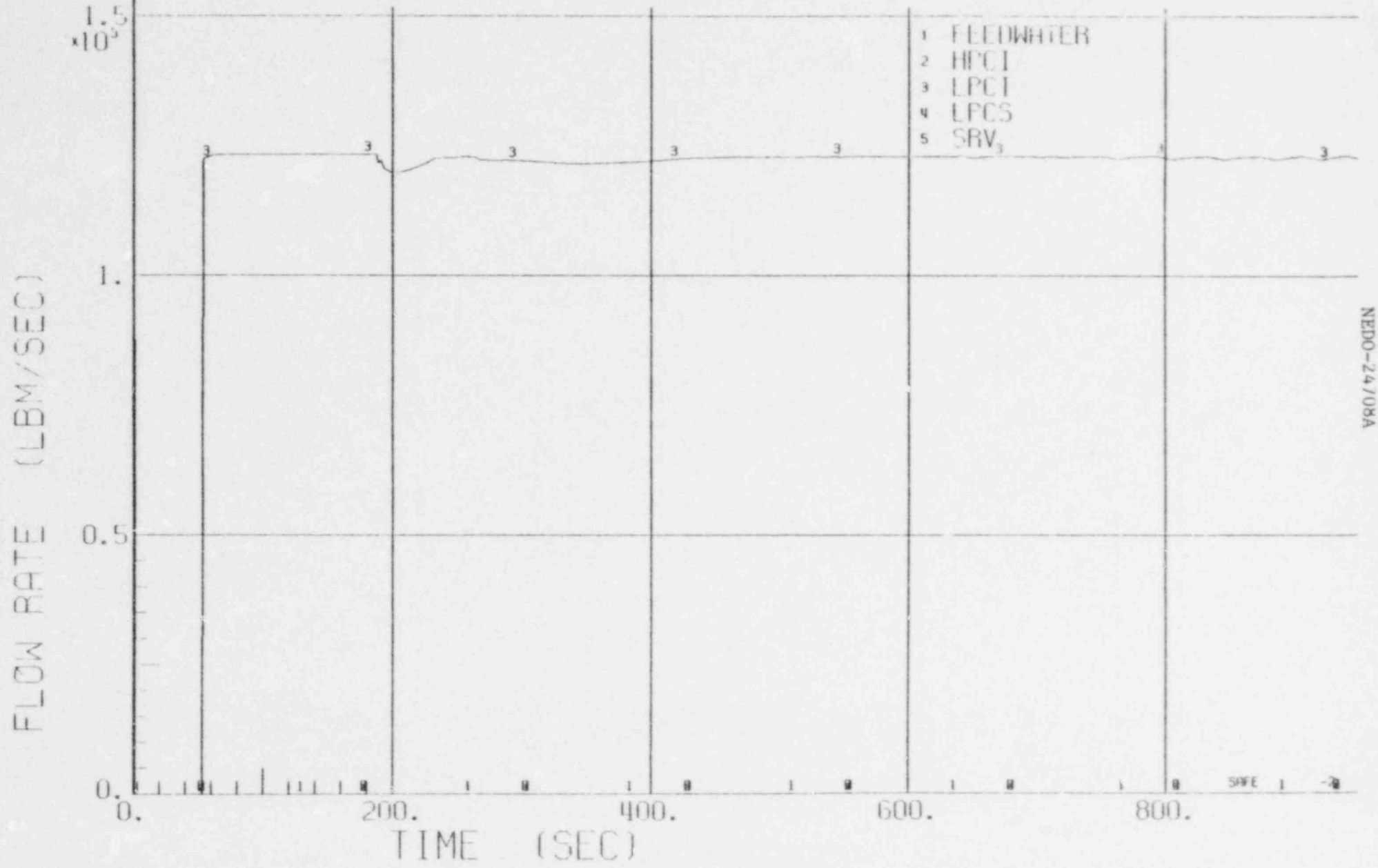
FIGURE 3.5.2.1 - 15.3 SYSTEM FLOW RATES VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.



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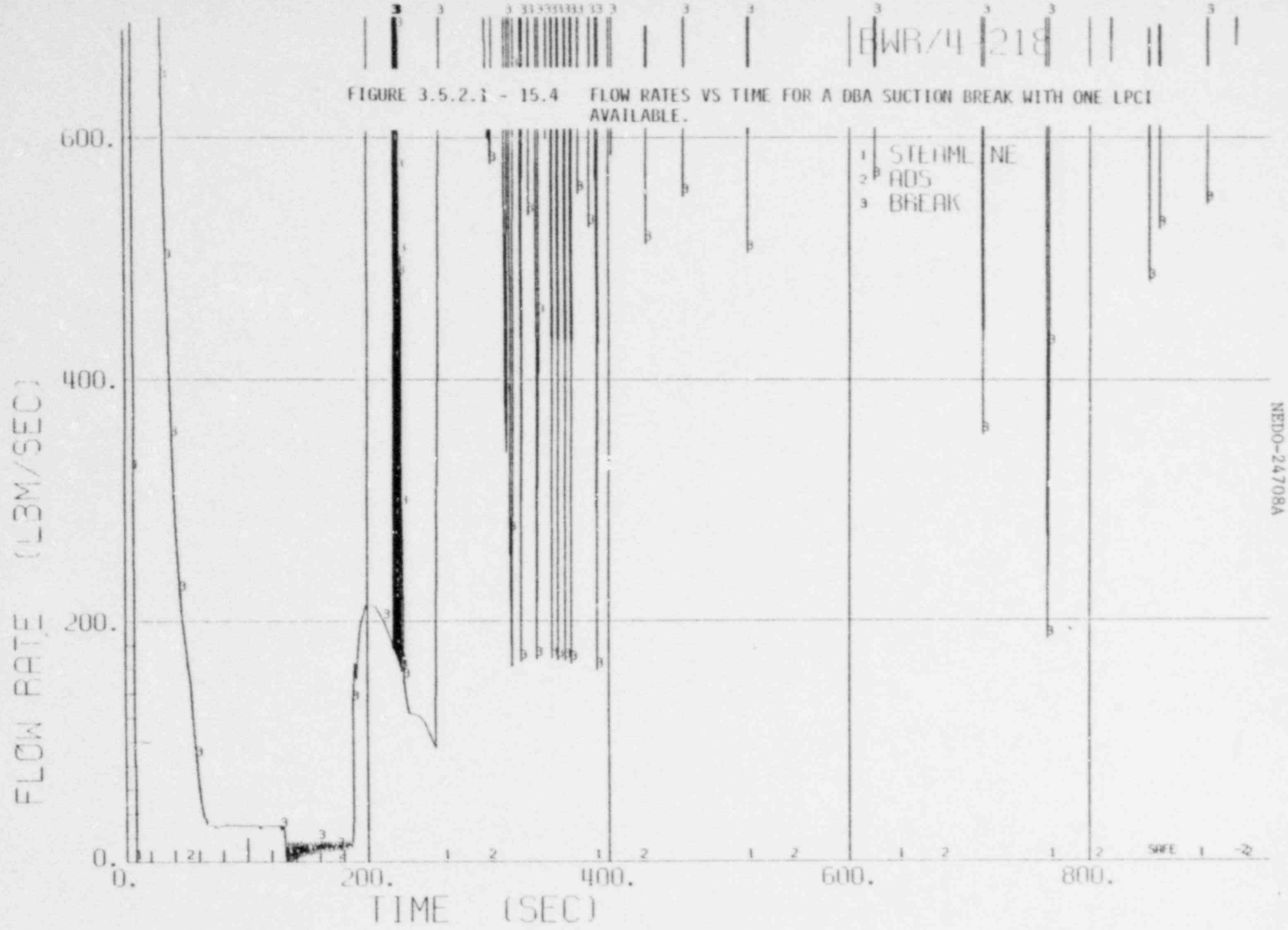

FIGURE 3.5.2.1 - 15.4 FLOW RATES VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.

FIGURE 3.5.2.1 - 15.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.

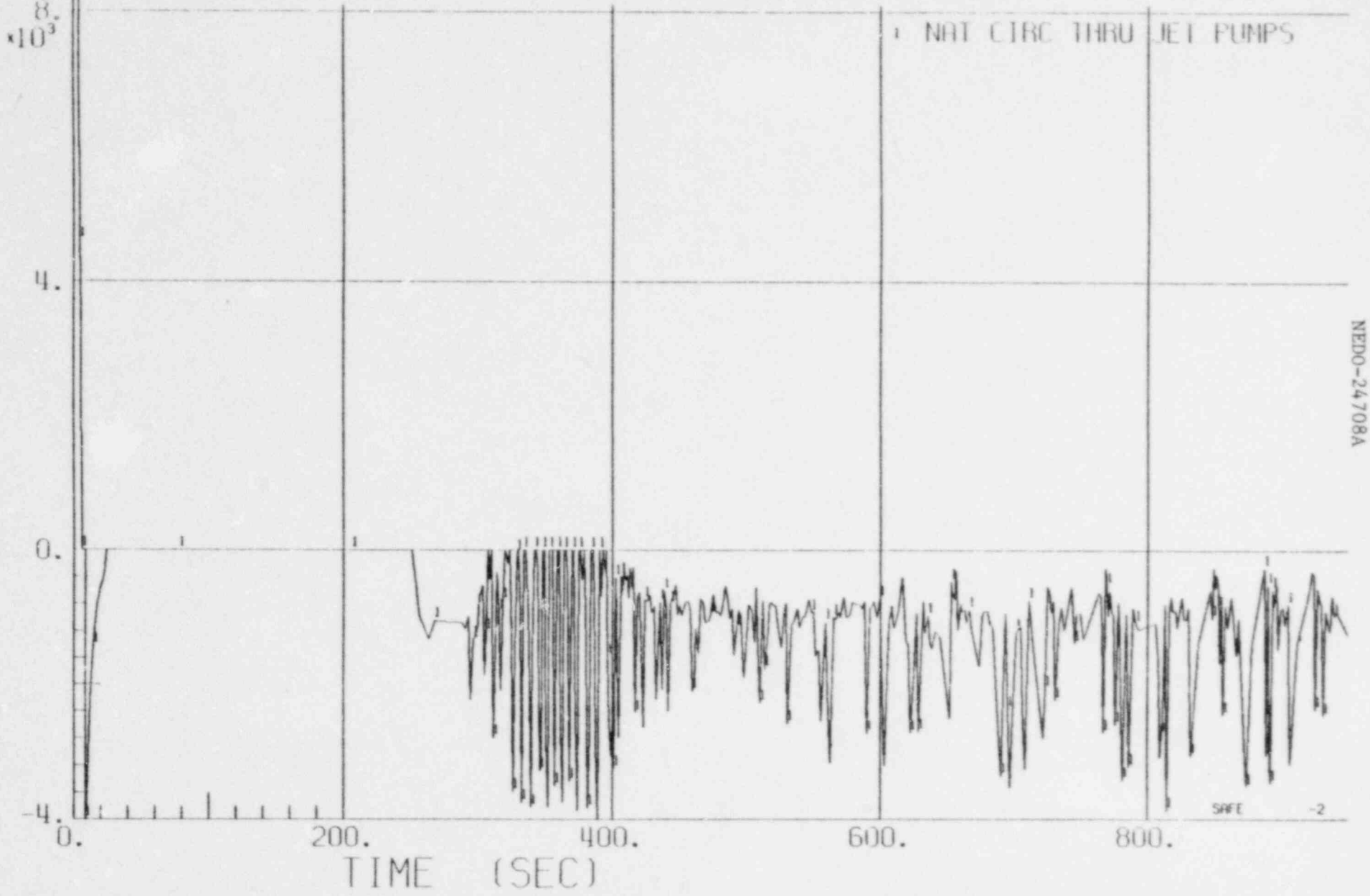

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FIGURE 3.5.2.1 - 15.6 TEMPERATURE VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.

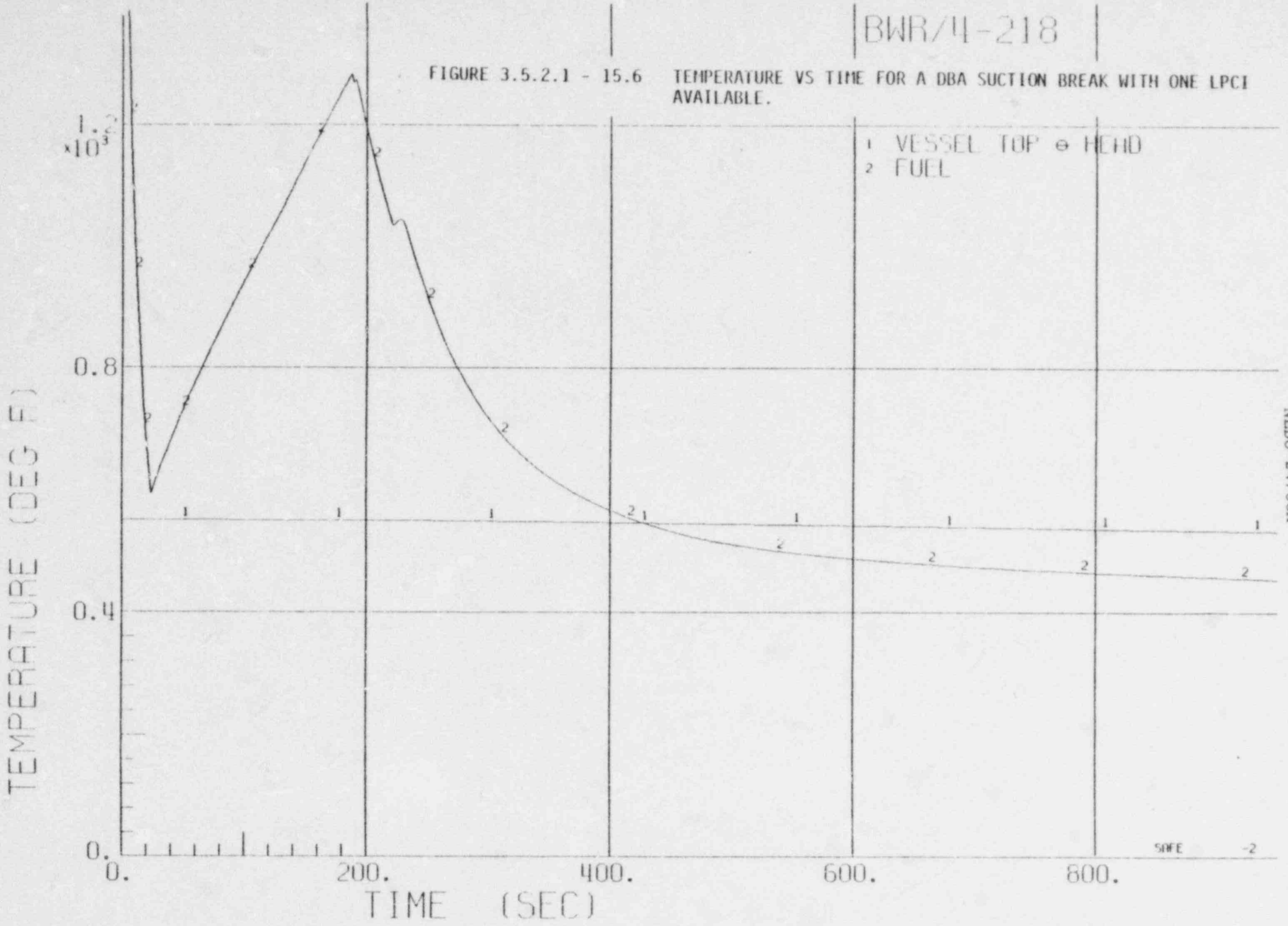

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FIGURE 3.5.2.1 - 15.7 ENTHALPY VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.

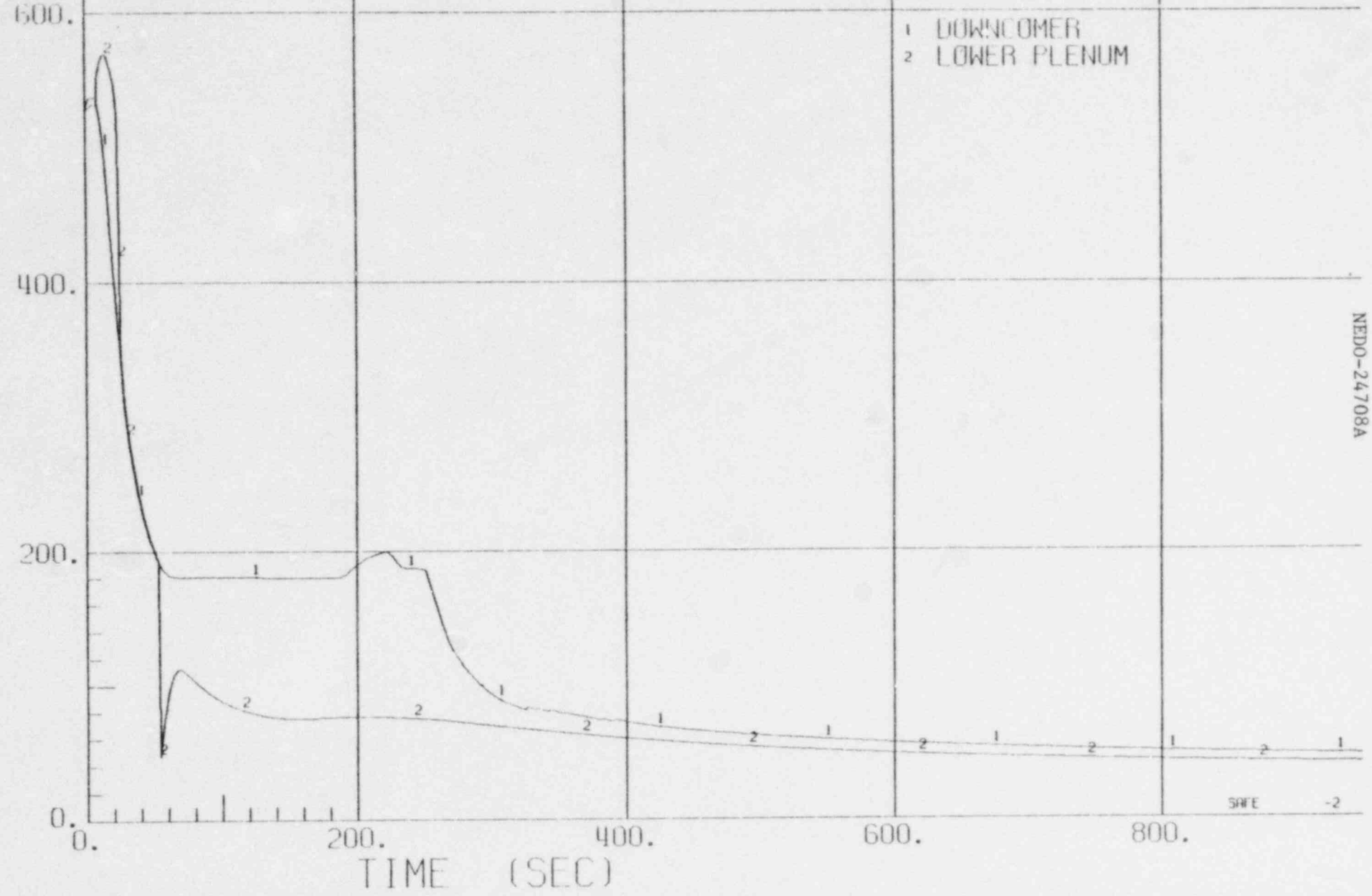

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FIGURE 3.5.2.1 - 15.8 QUALITY VS TIME FOR A DBA SUCTION BREAK WITH ONE LPCI AVAILABLE.

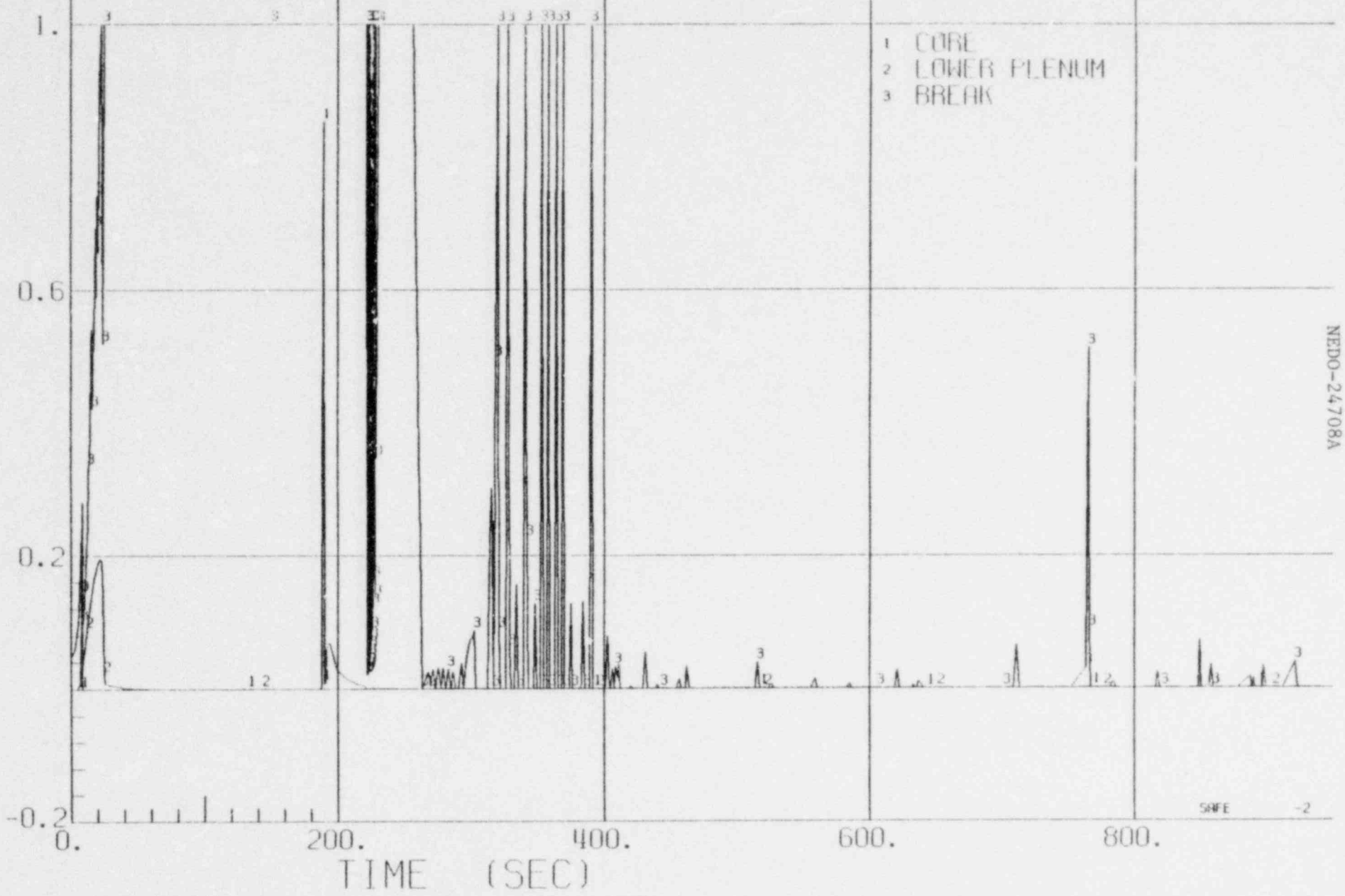

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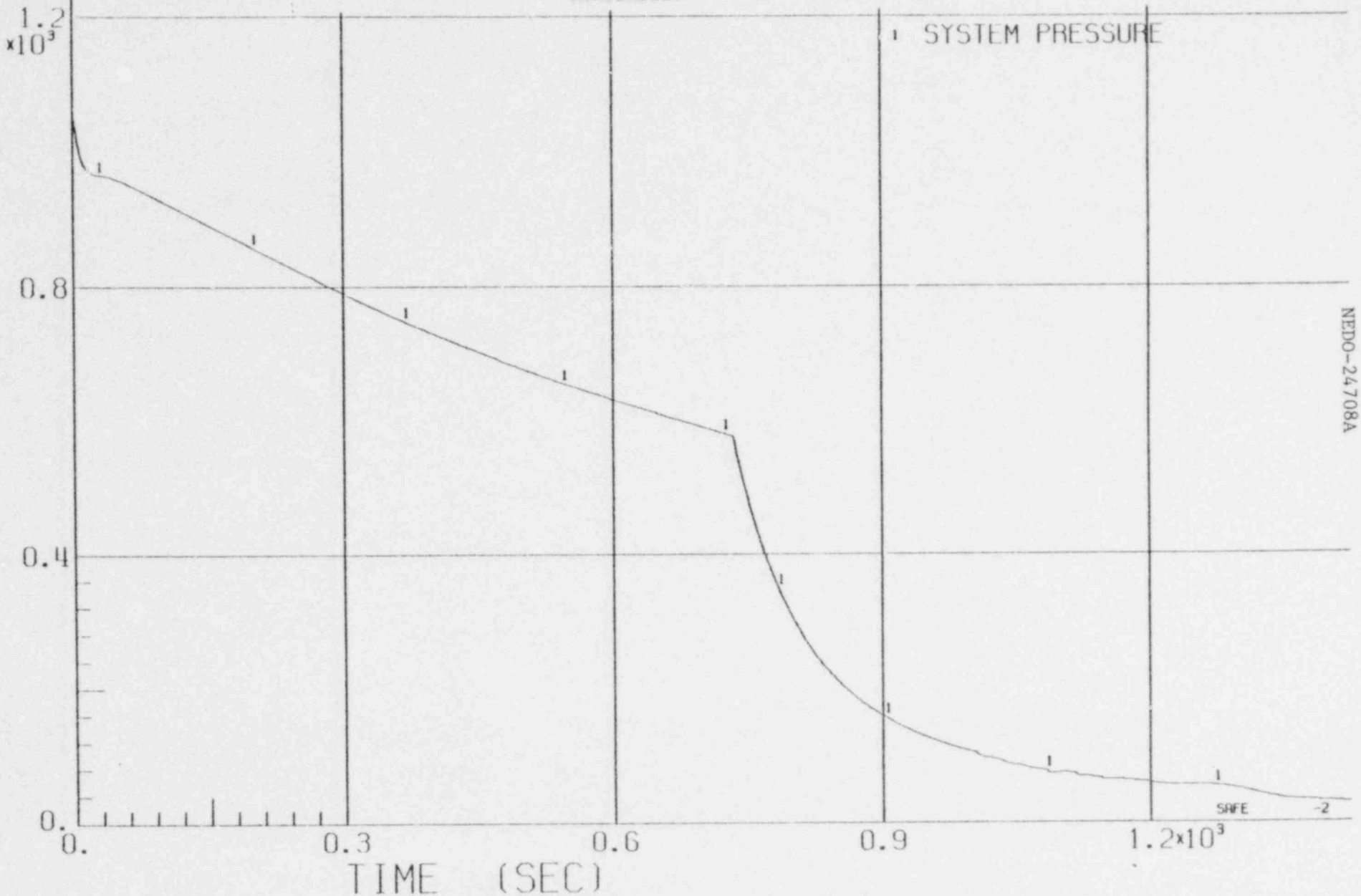
FIGURE 3.5.2.1 - 16.1 SYSTEM PRESSURE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AVAILABLE.



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4-1005

FIGURE 3.5.2.1 - 16.2 WATER LEVEL VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE.

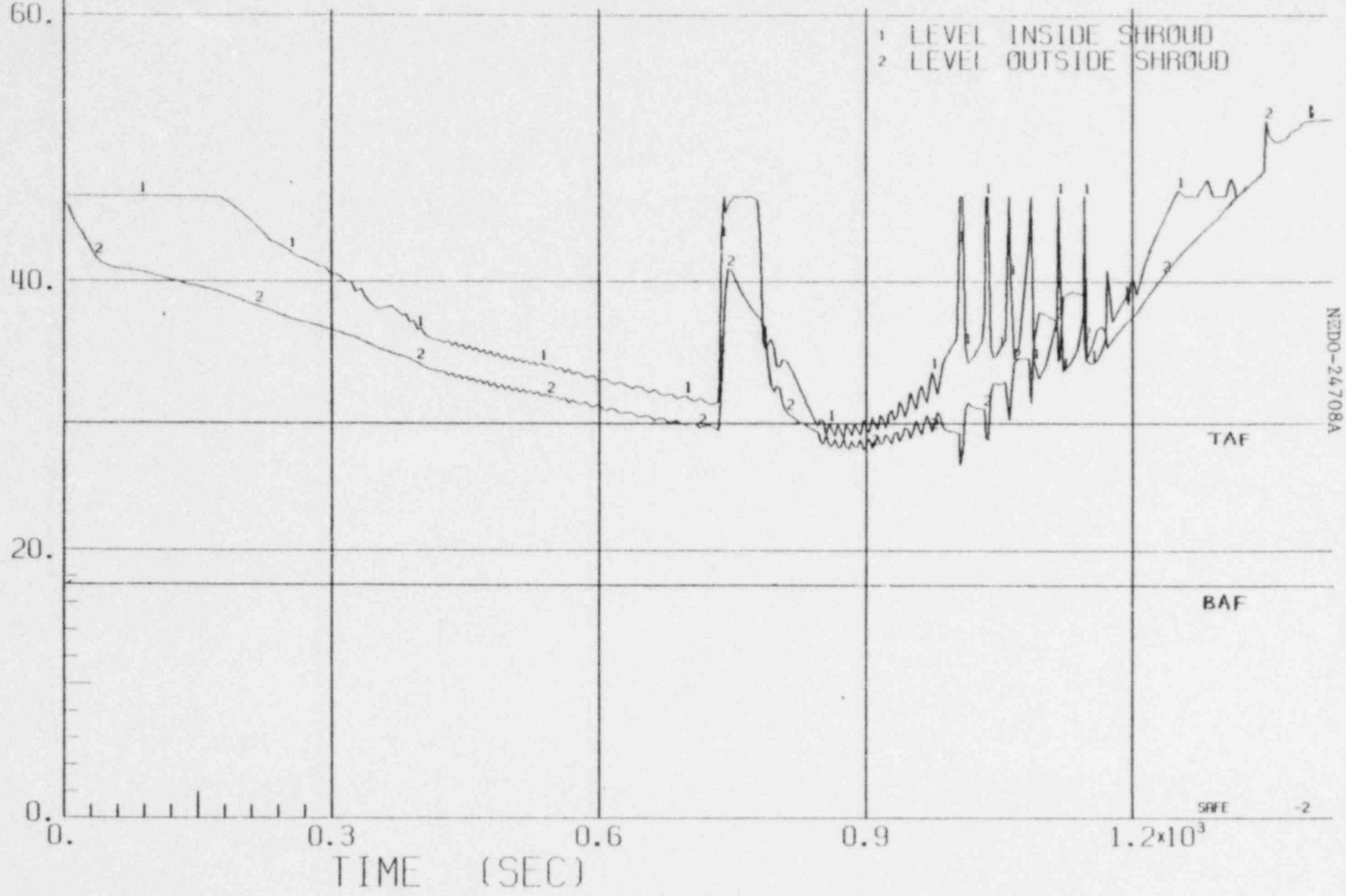

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FIGURE 3.5.2.1 - 16.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AVAILABLE.

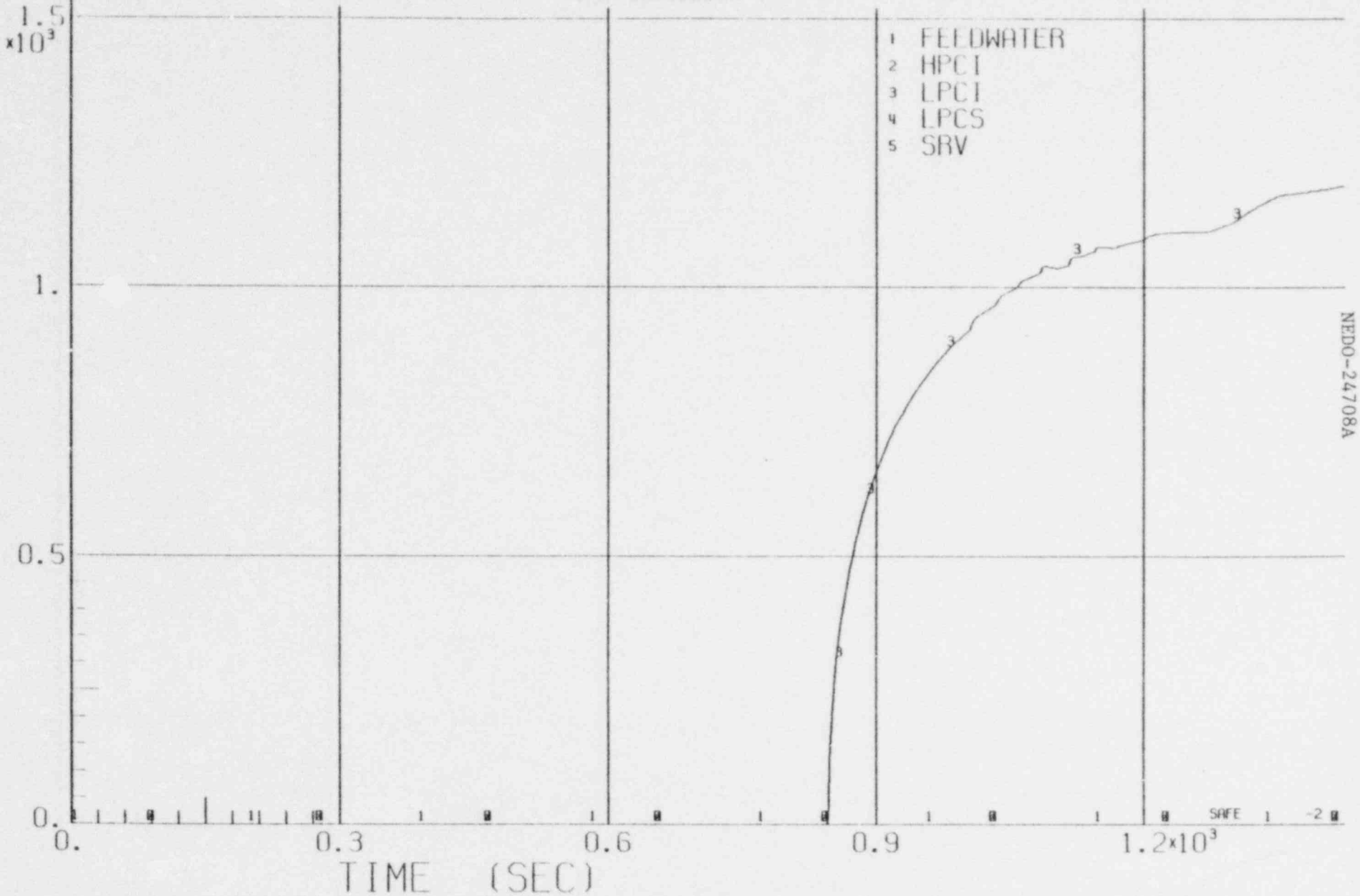

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FIGURE 3.5.2.1 - 16.4 FLOW RATES VS TIME FOR A 0.1 Ft^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE.

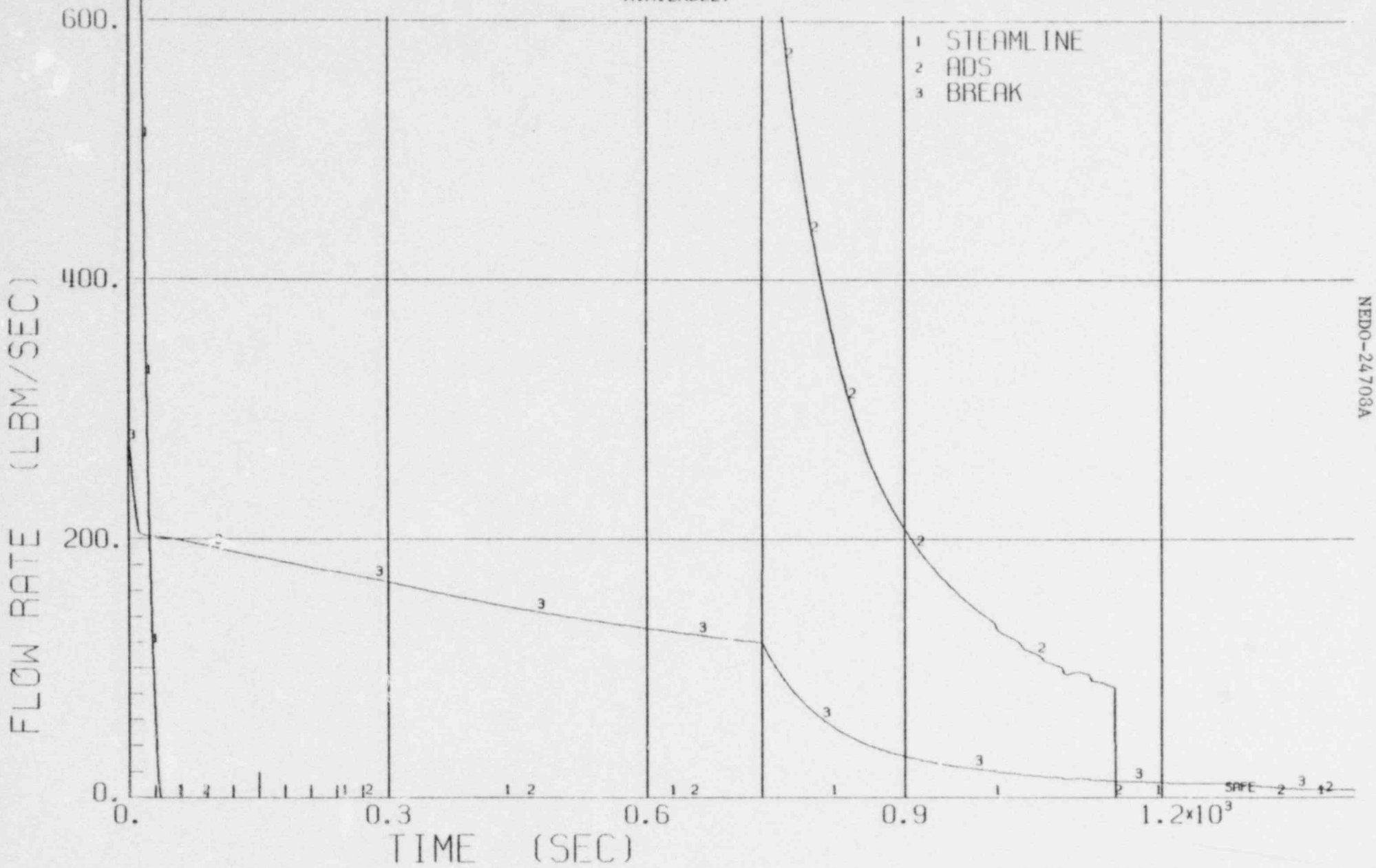

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FIGURE 3.5.2.1 - 16.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE.

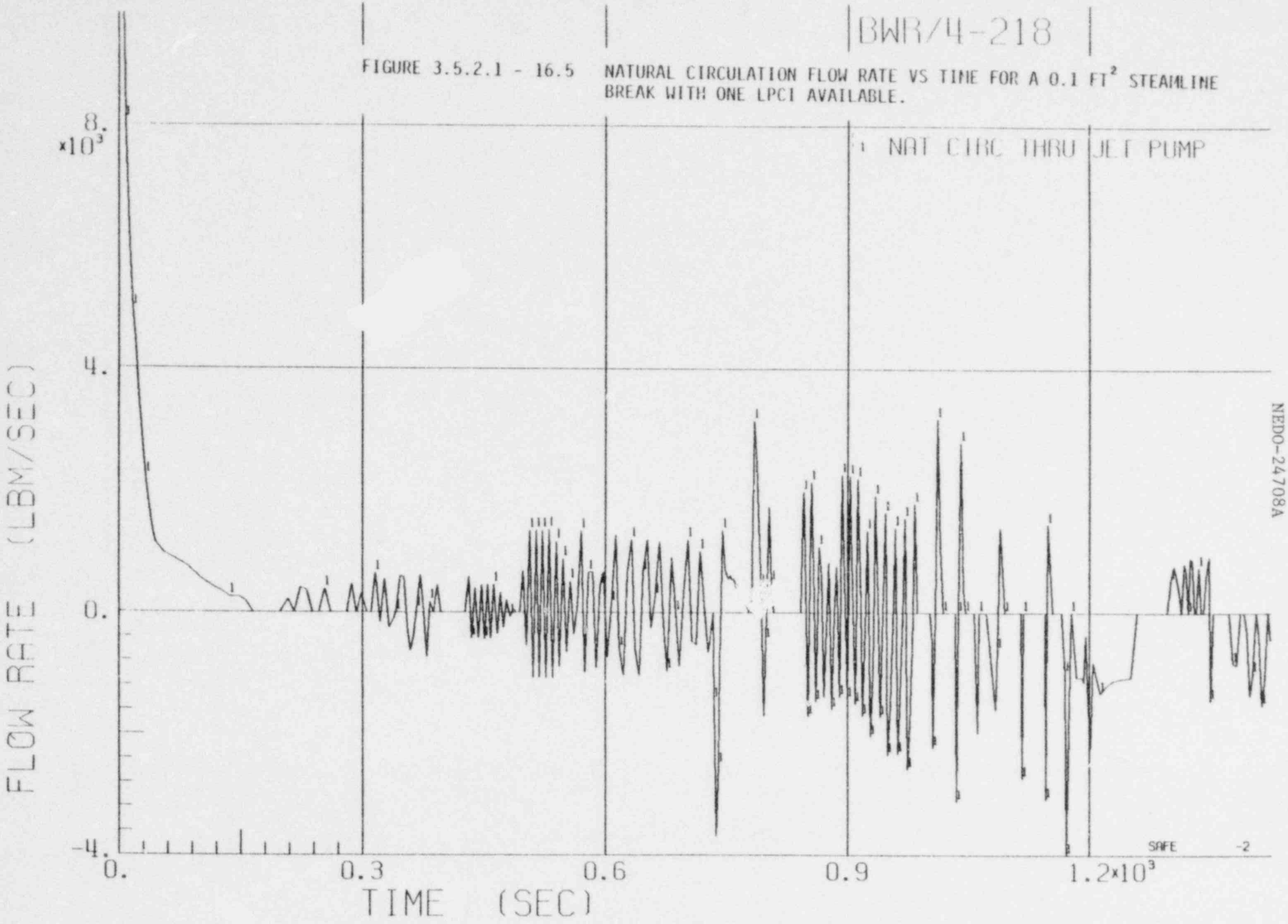

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FIGURE 3.5.2.1 - 16.6 TEMPERATURE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AVAILABLE.

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FIGURE 3.5.2.1 - 16.7 ENTHALPY VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE.

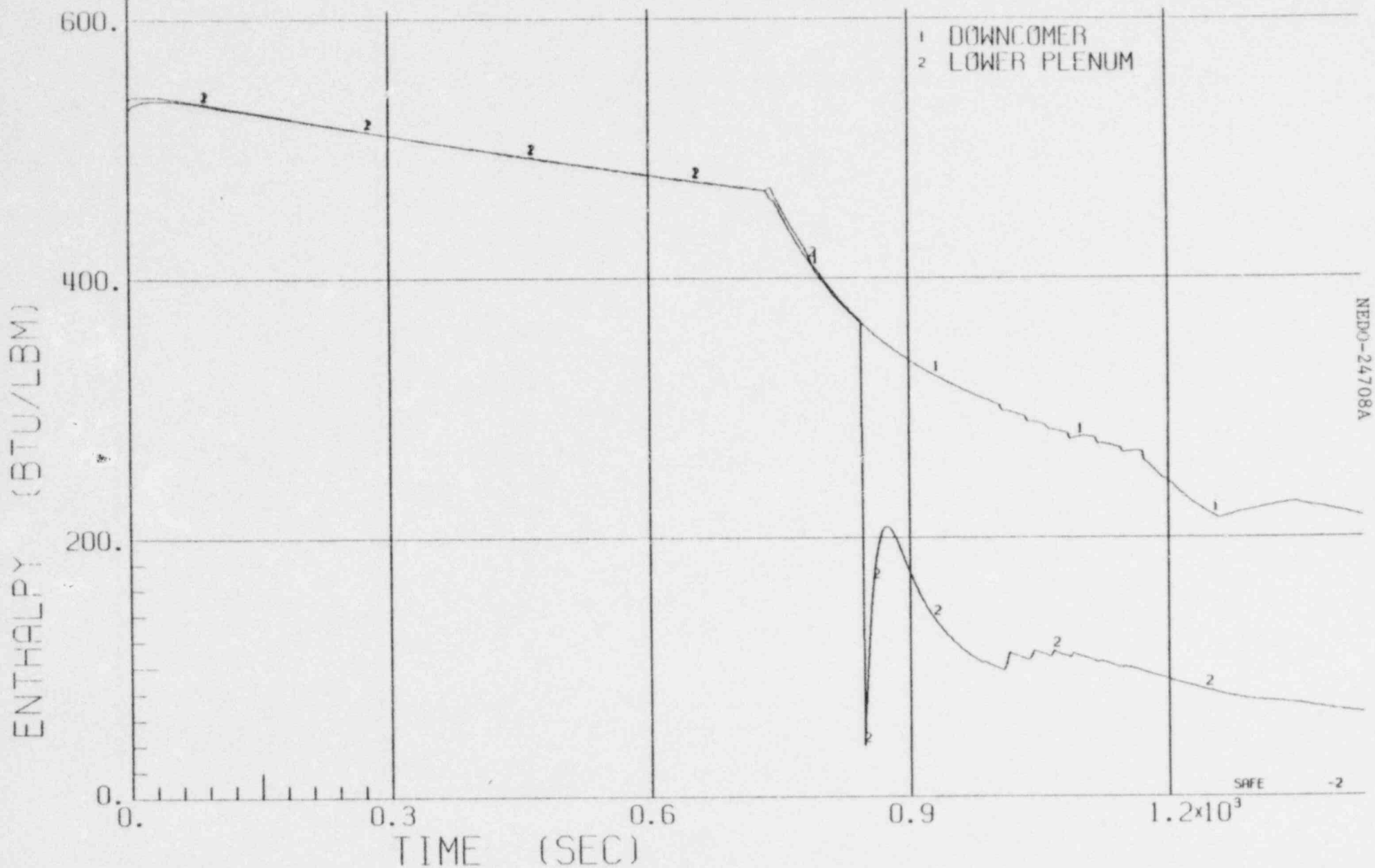

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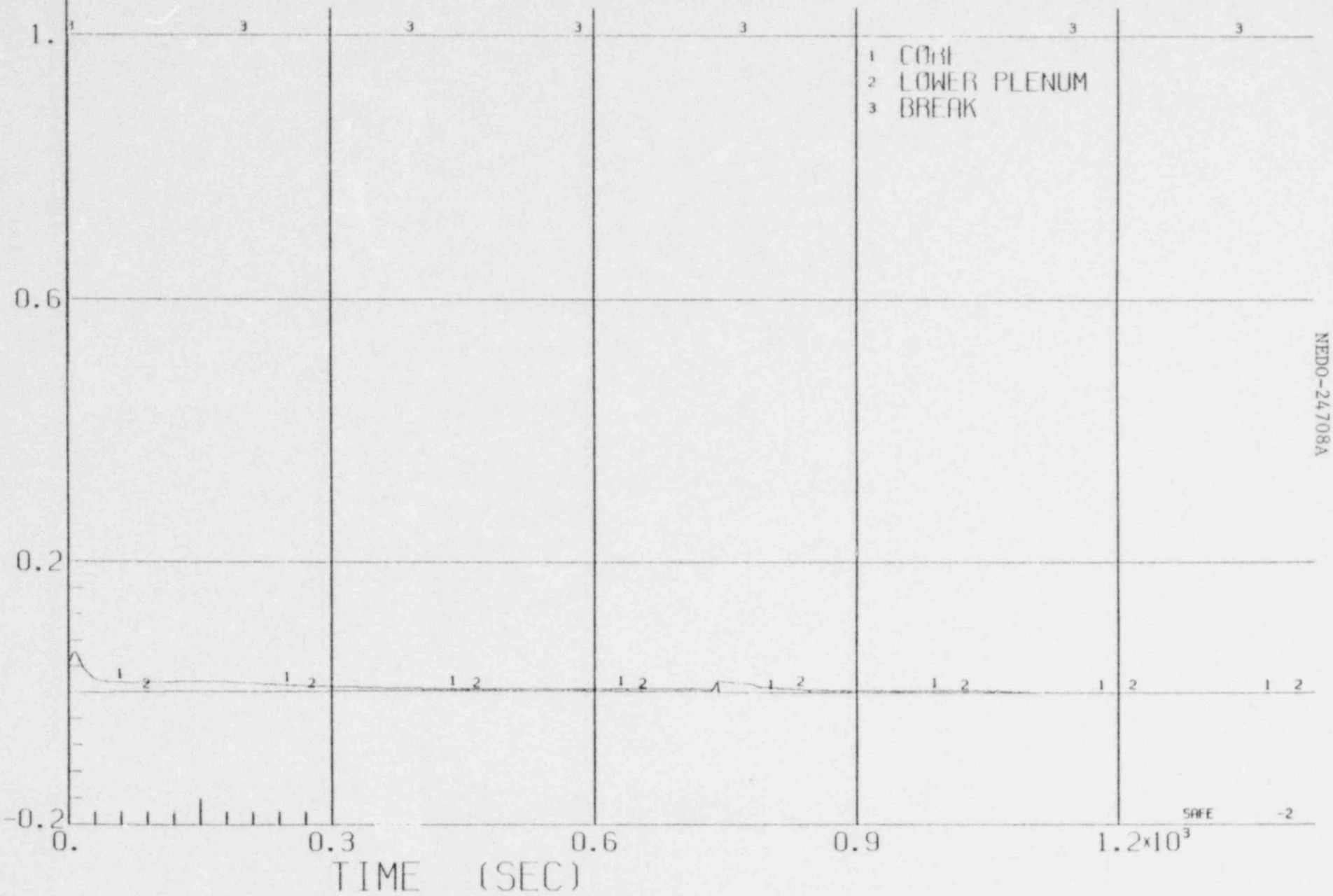
FIGURE 3.5.2.1 - 16.8 QUALITY VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AVAILABLE.



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4-1012

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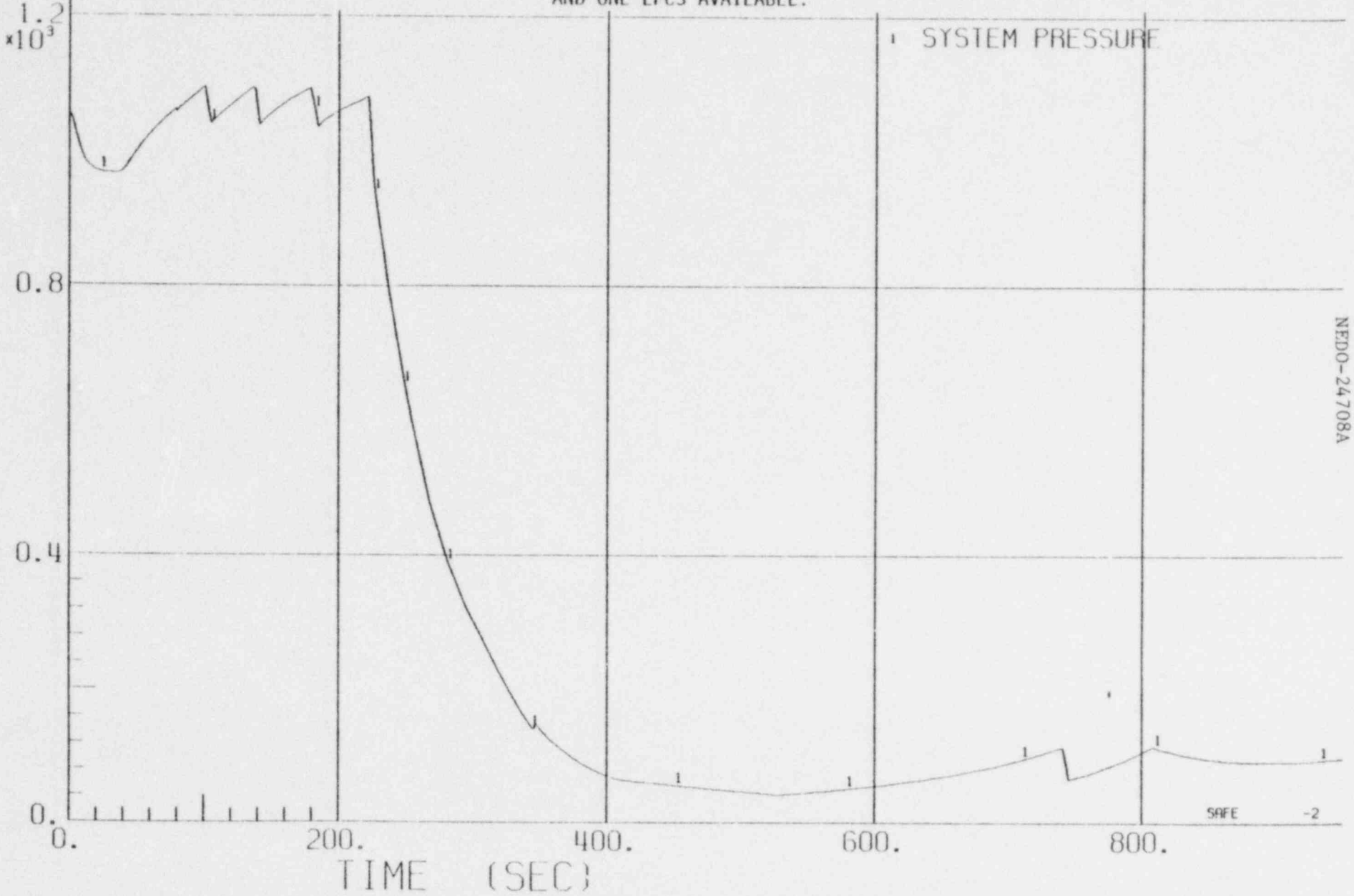
FIGURE 3.5.2.1 - 17.1 SYSTEM PRESSURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.



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4-1013

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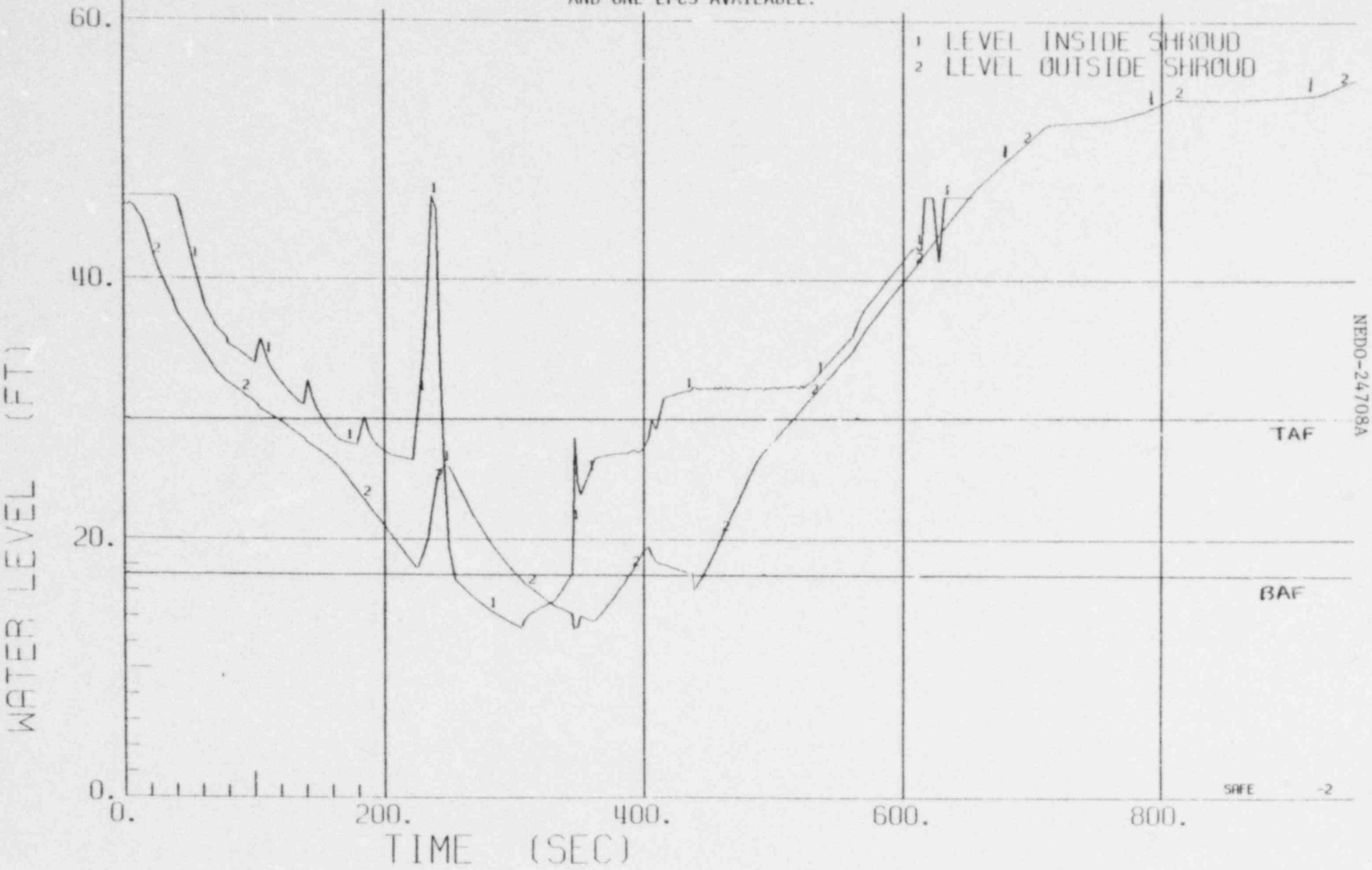
FIGURE 3.5.2.1 - 17.2 WATER LEVEL VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.



NEDO-24708A

4-1014

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FIGURE 3.5.2.1 - 17.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

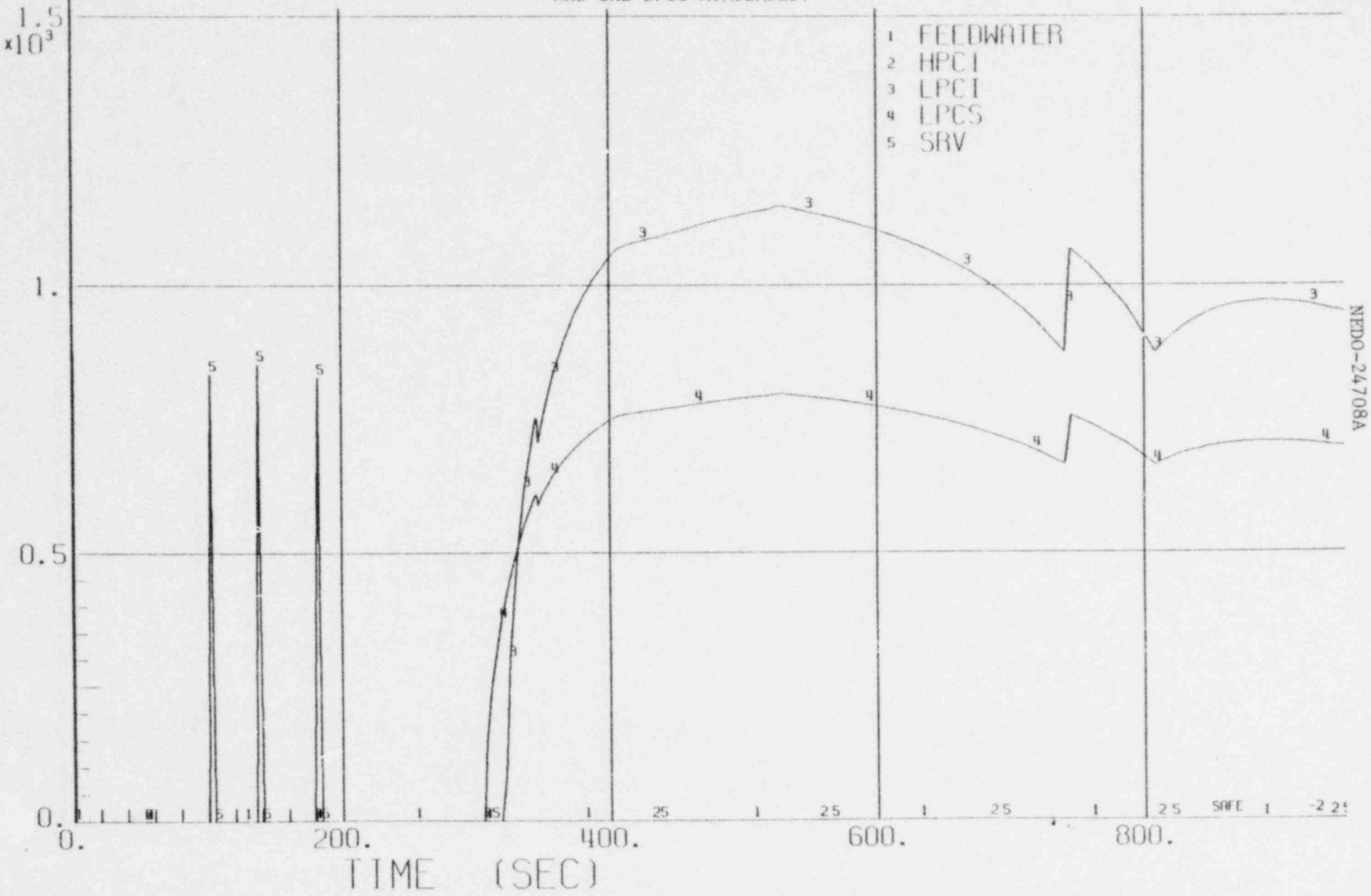

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FIGURE 3.5.2.1 - 17.4 FLOW RATES VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

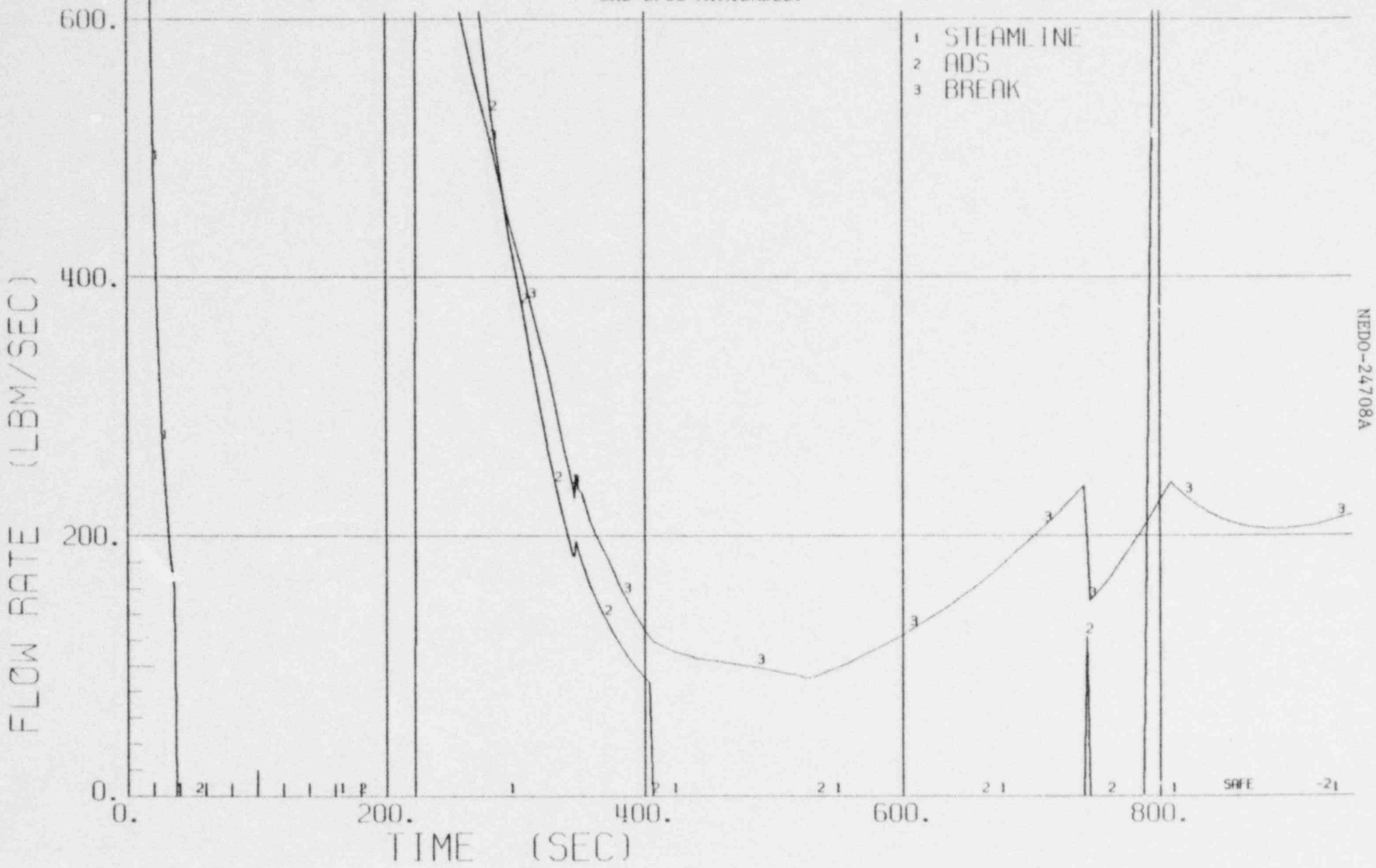

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FIGURE 3.5.2.1 - 17.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

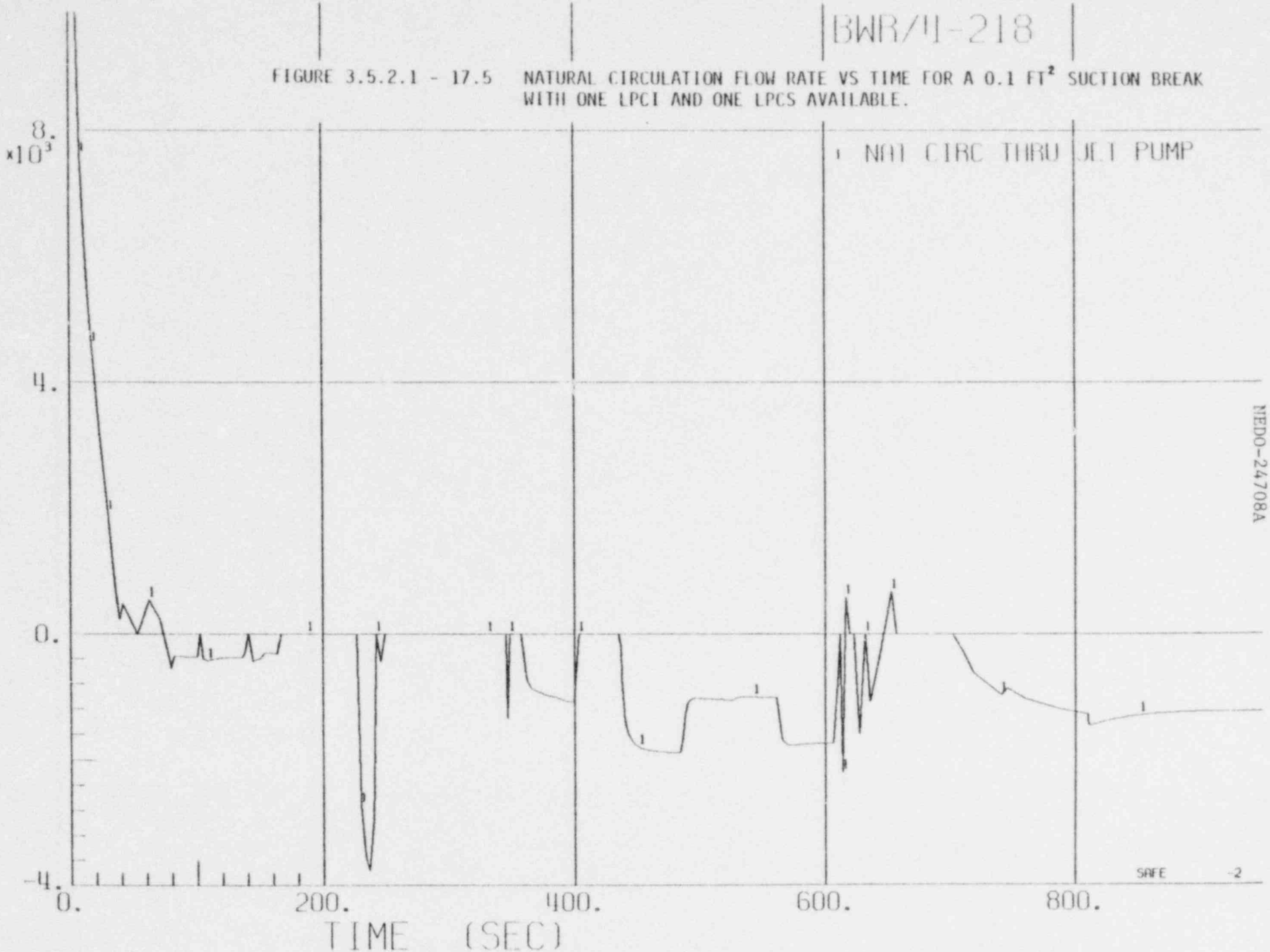

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FIGURE 3.5.2.1 - 17.6 TEMPERATURE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

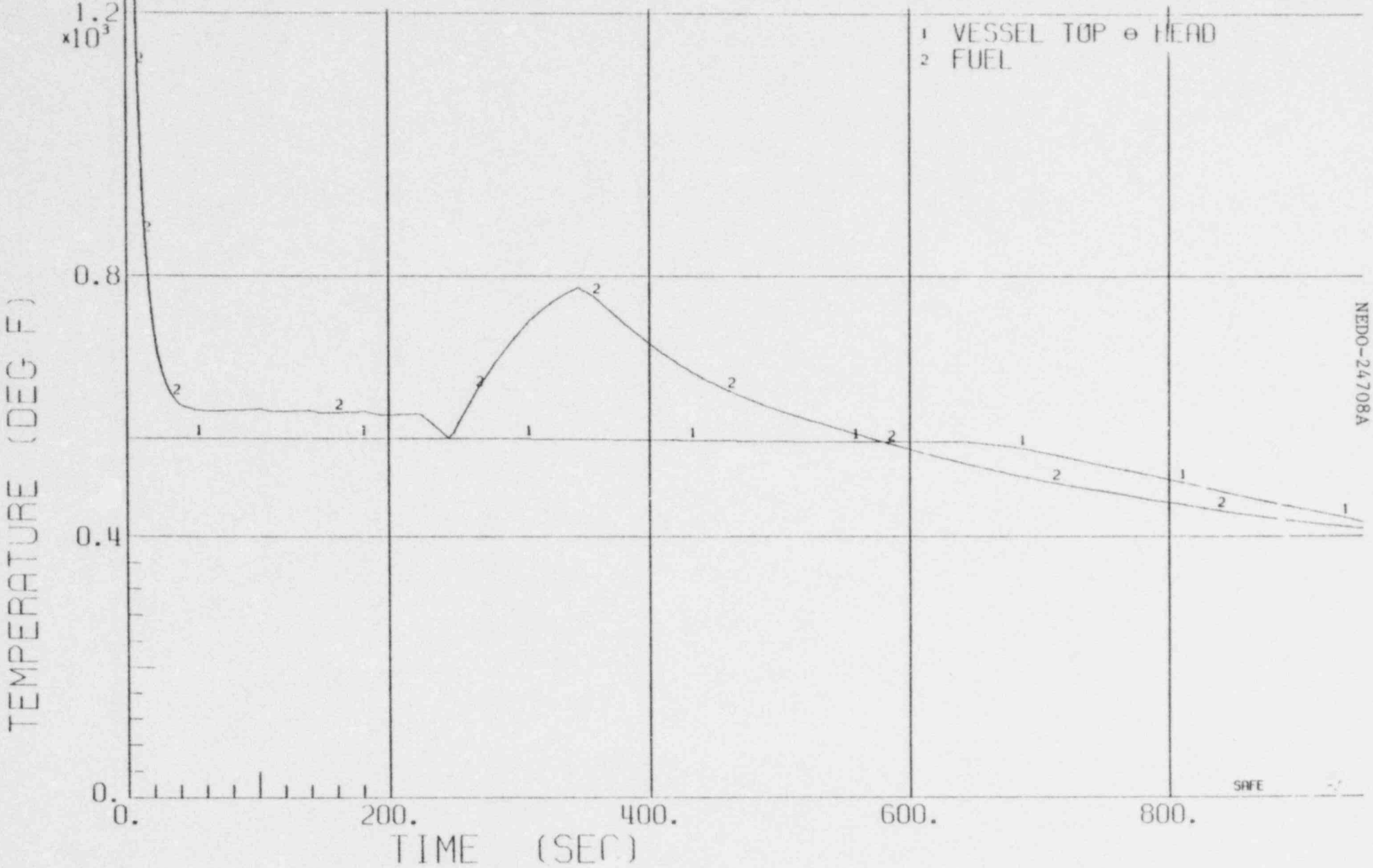

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FIGURE 3.5.2.1 - 17.7 ENTHALPY VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

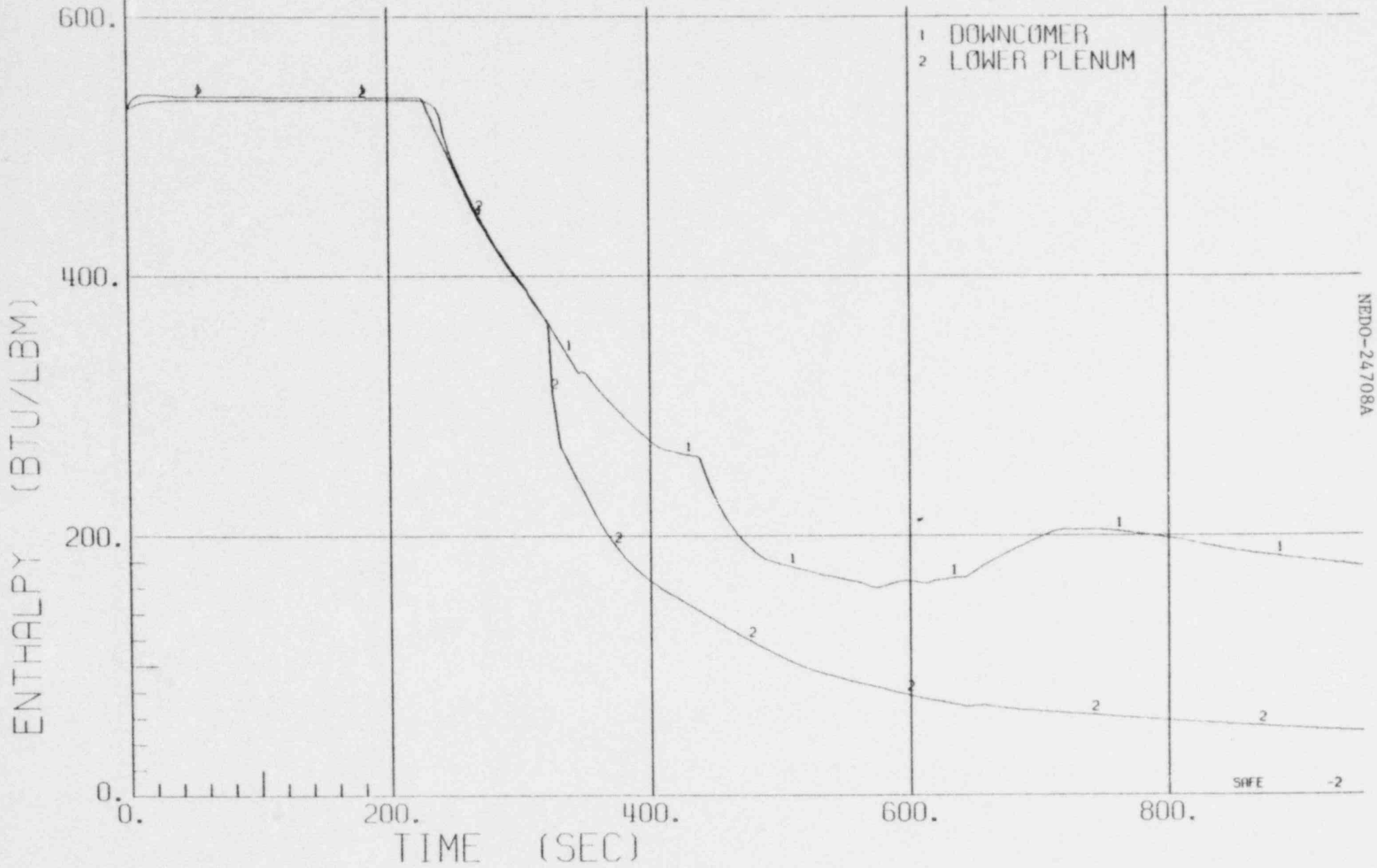

FIGURE 3.5.2.1 - 17.8 QUALITY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND LPCS AVAILABLE.

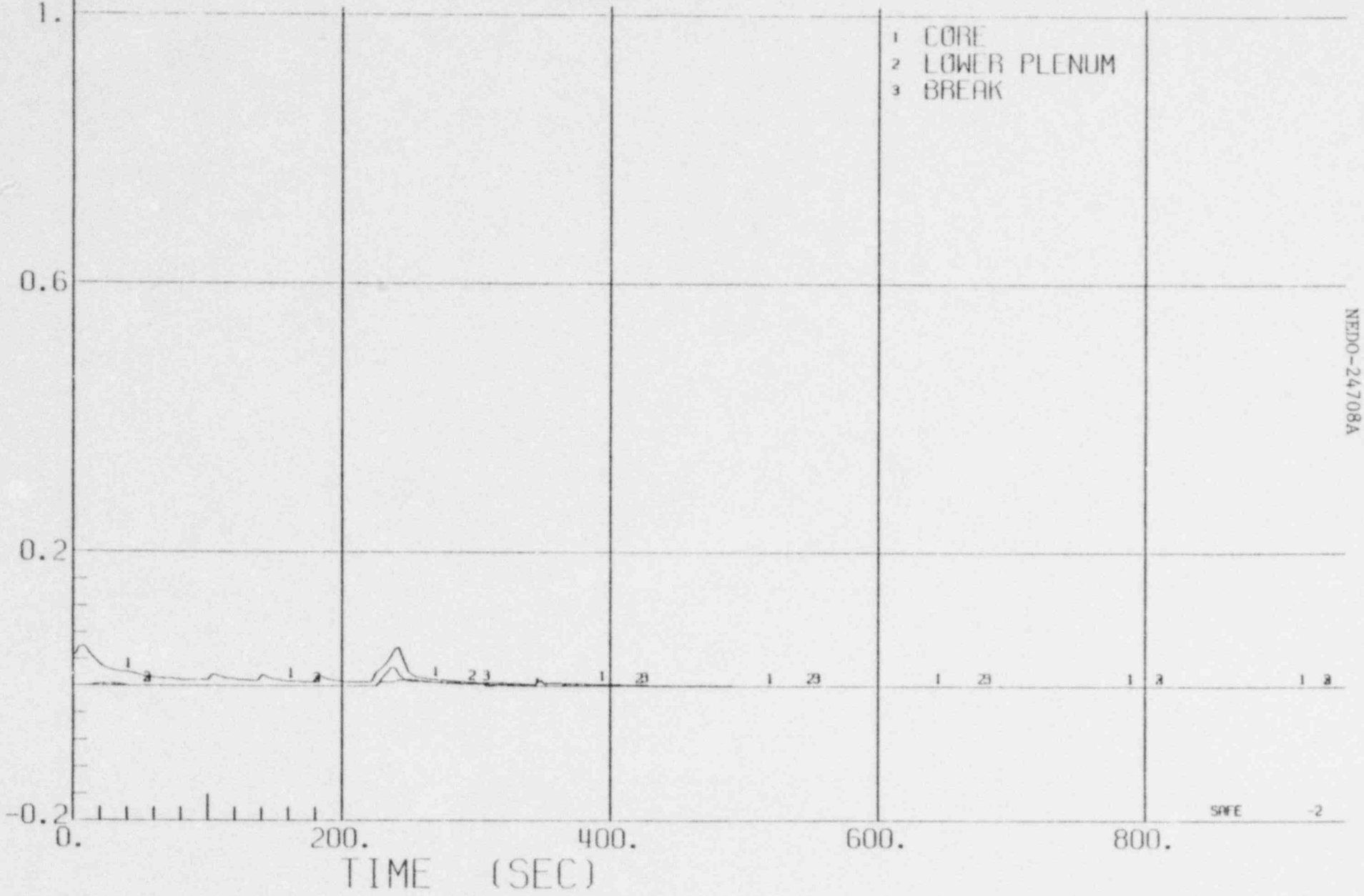

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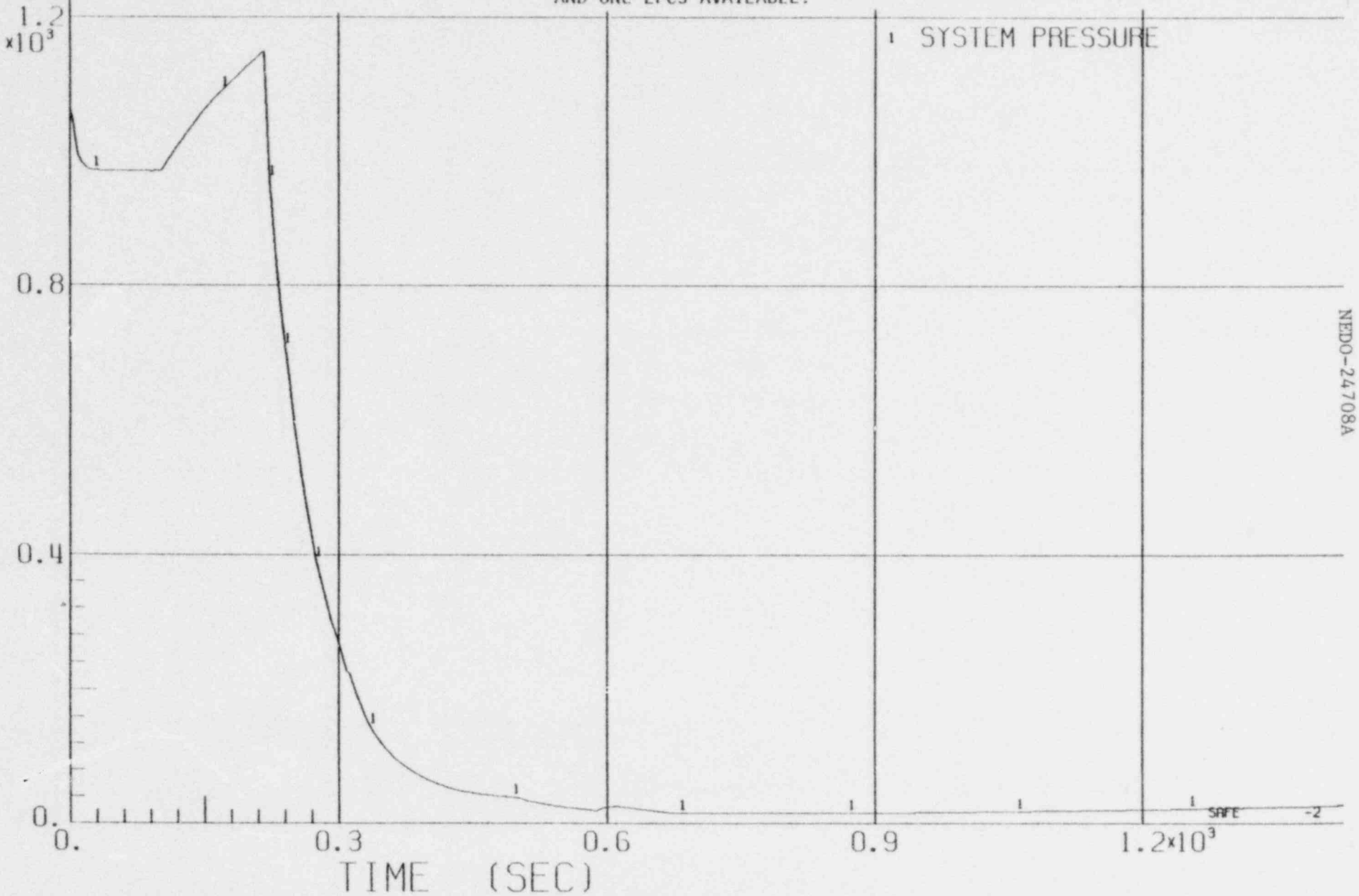
FIGURE 3.5.2.1 - 18.1 SYSTEM PRESSURE VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.



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4-1021

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FIGURE 3.5.2.1 - 18.2 WATER LEVEL VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

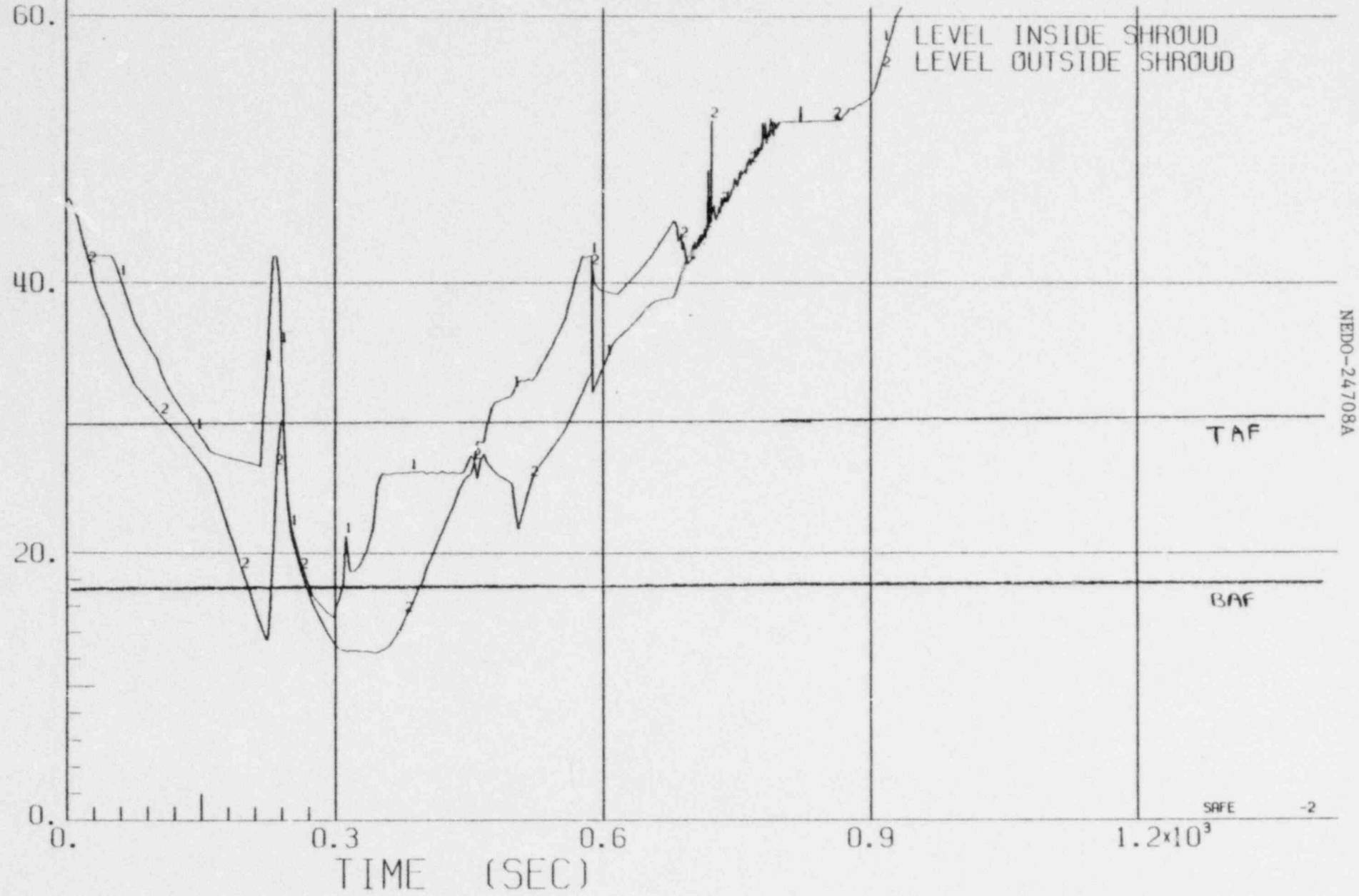

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FIGURE 3.5.2.1 - 18.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

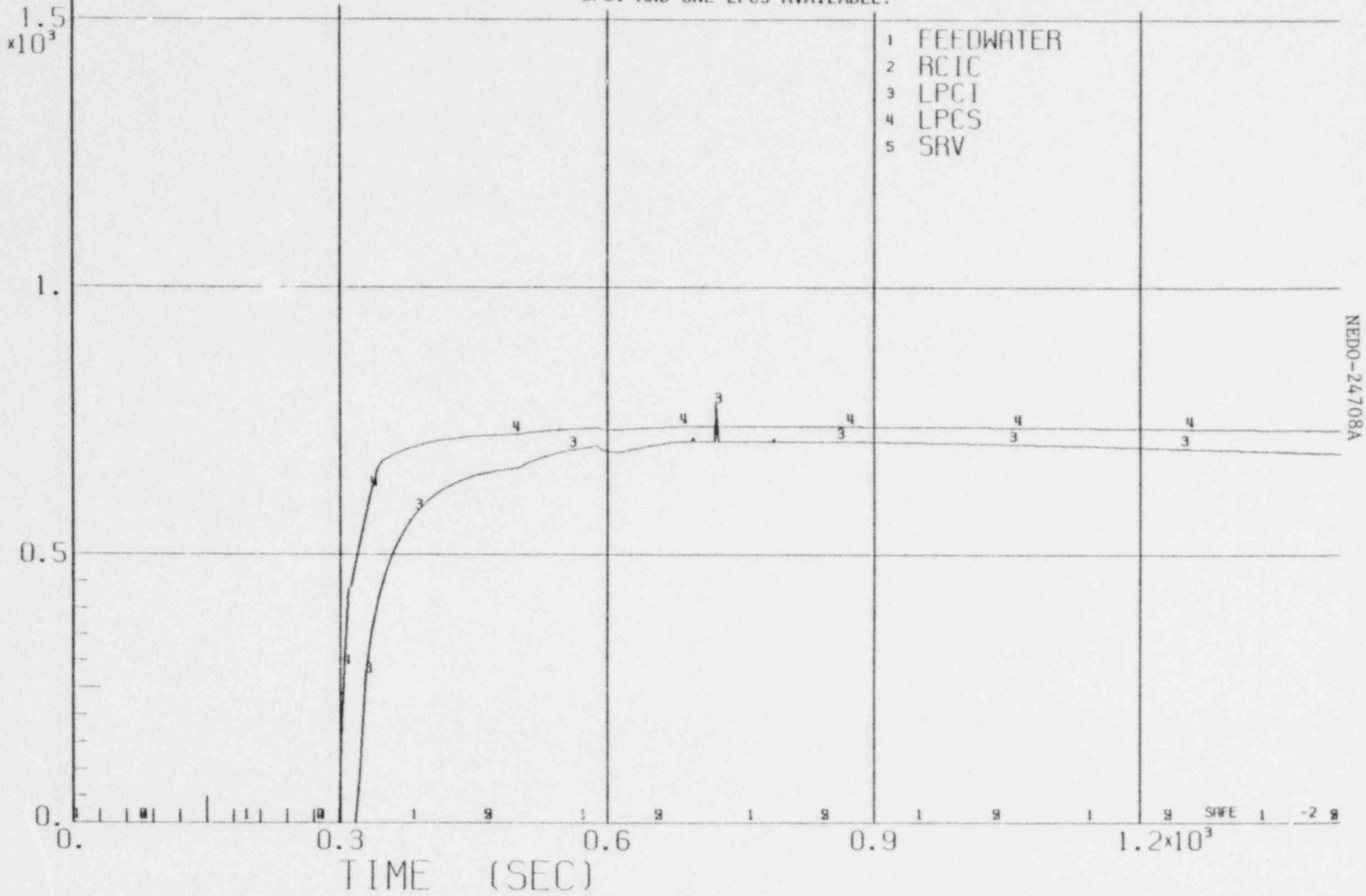

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FIGURE 3.5.2.1 - 18.4 FLOW RATES VS TIME FOR A 0.1 FT^2 SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

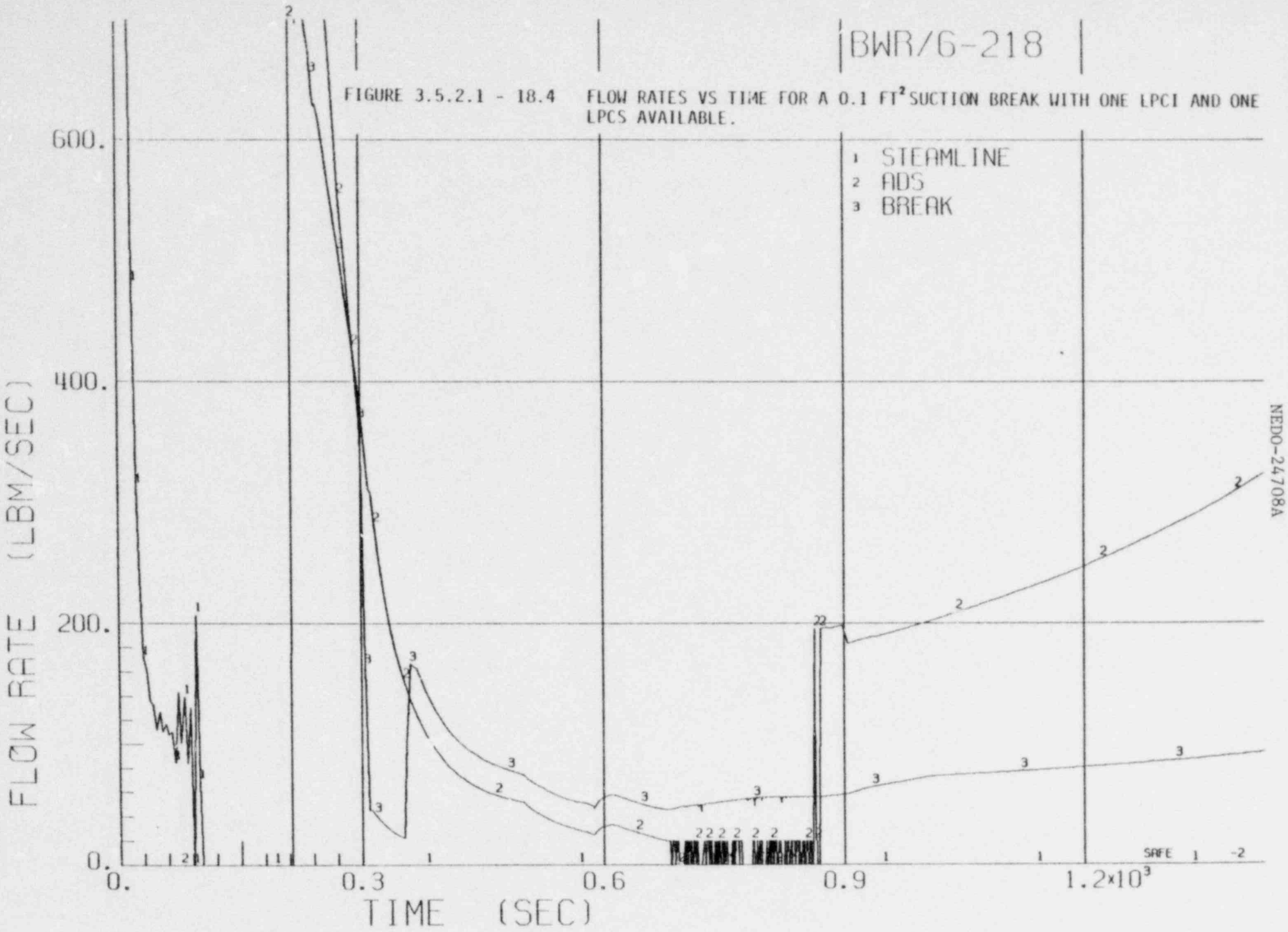

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FIGURE 3.5.2.1 - 18.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE HPCI AND ONE LPCS AVAILABLE.

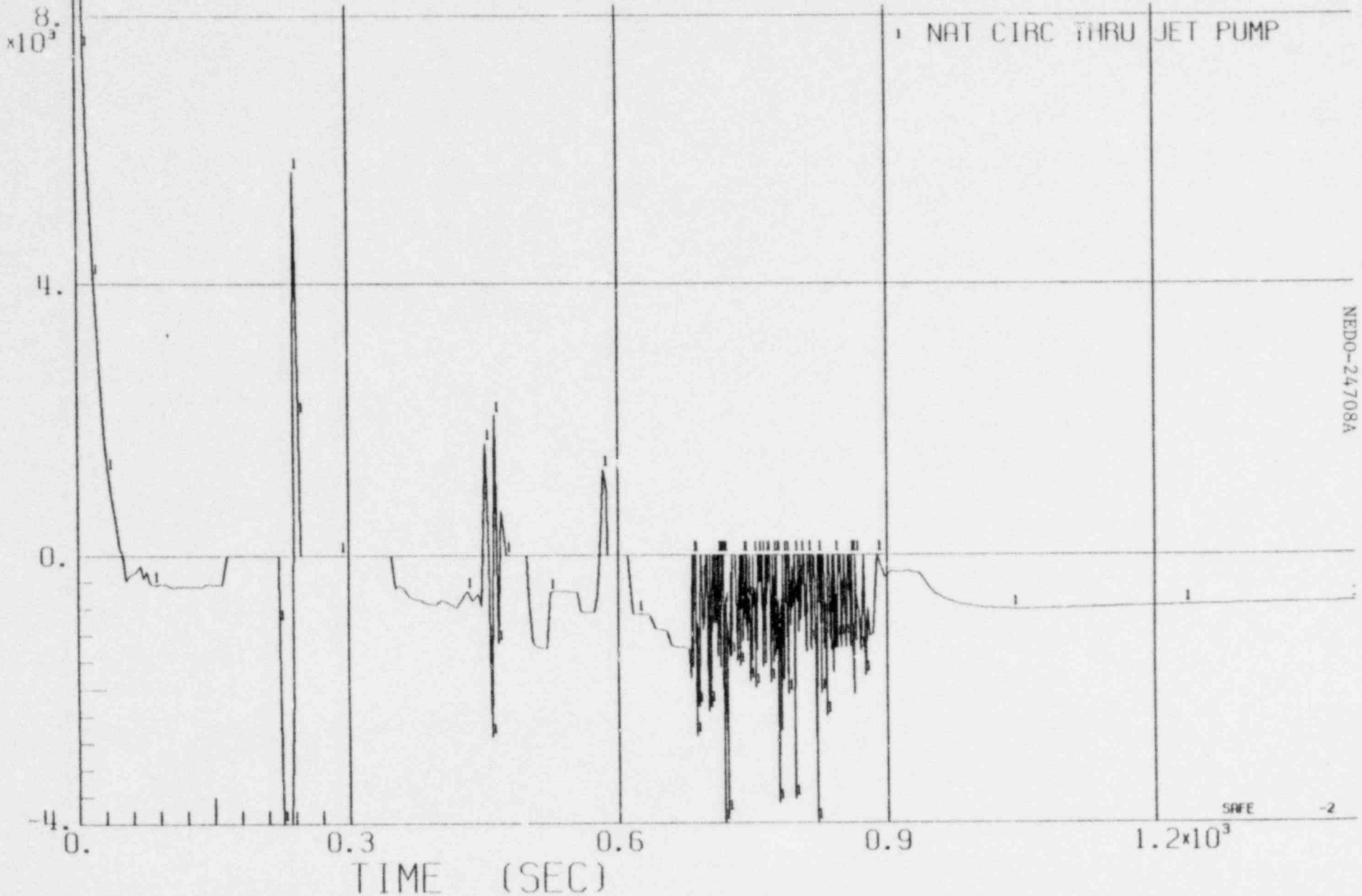

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FIGURE 3.5.2.1 - 18.6 TEMPERATURE VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

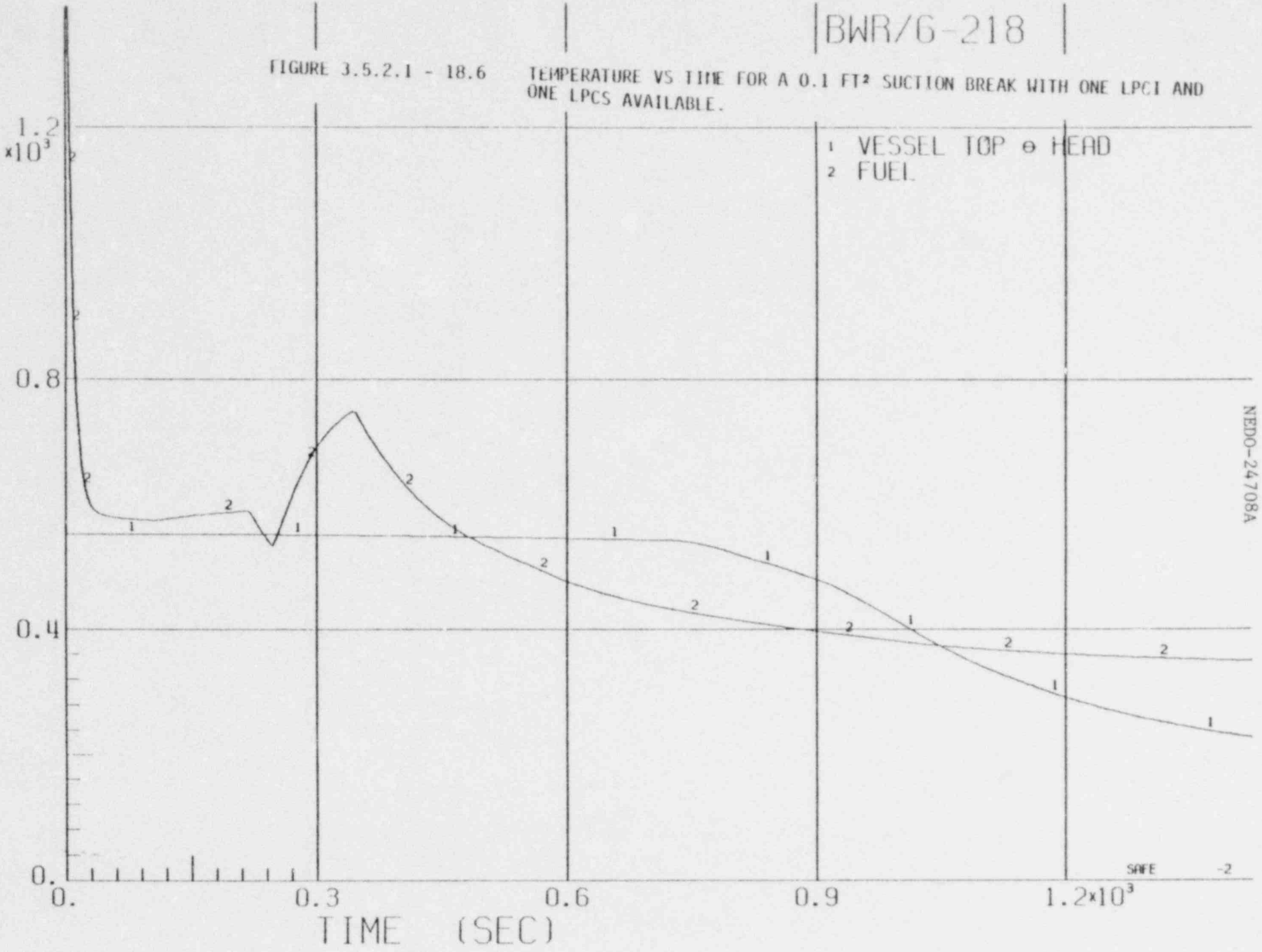

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FIGURE 3.5.2.1 - 18.7 ENTHALPY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

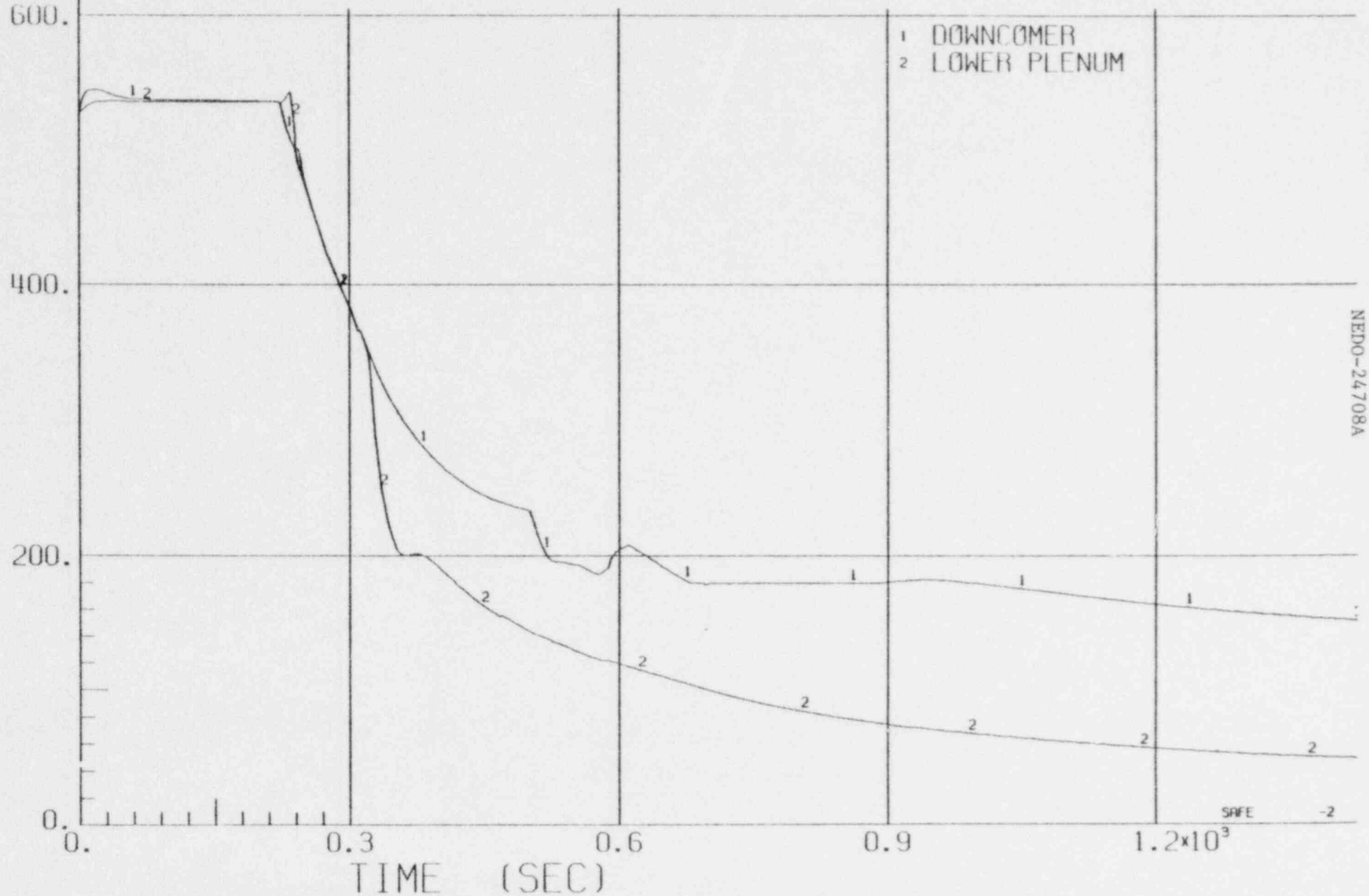

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FIGURE 3.5.2.1 - 18.8 QUALITY VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

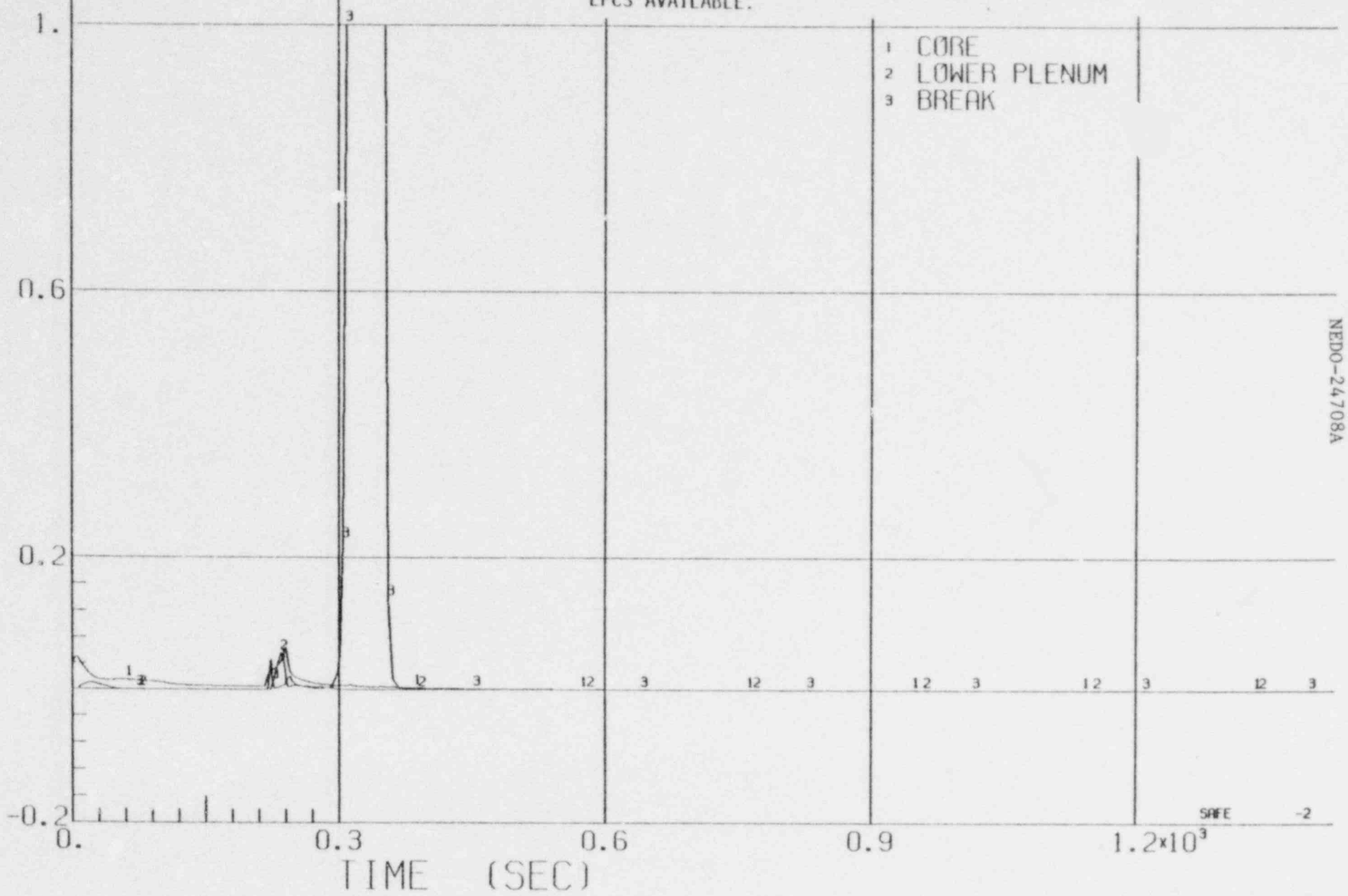

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FIGURE 3.5.2.1 - 19.1 SYSTEM PRESSURE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

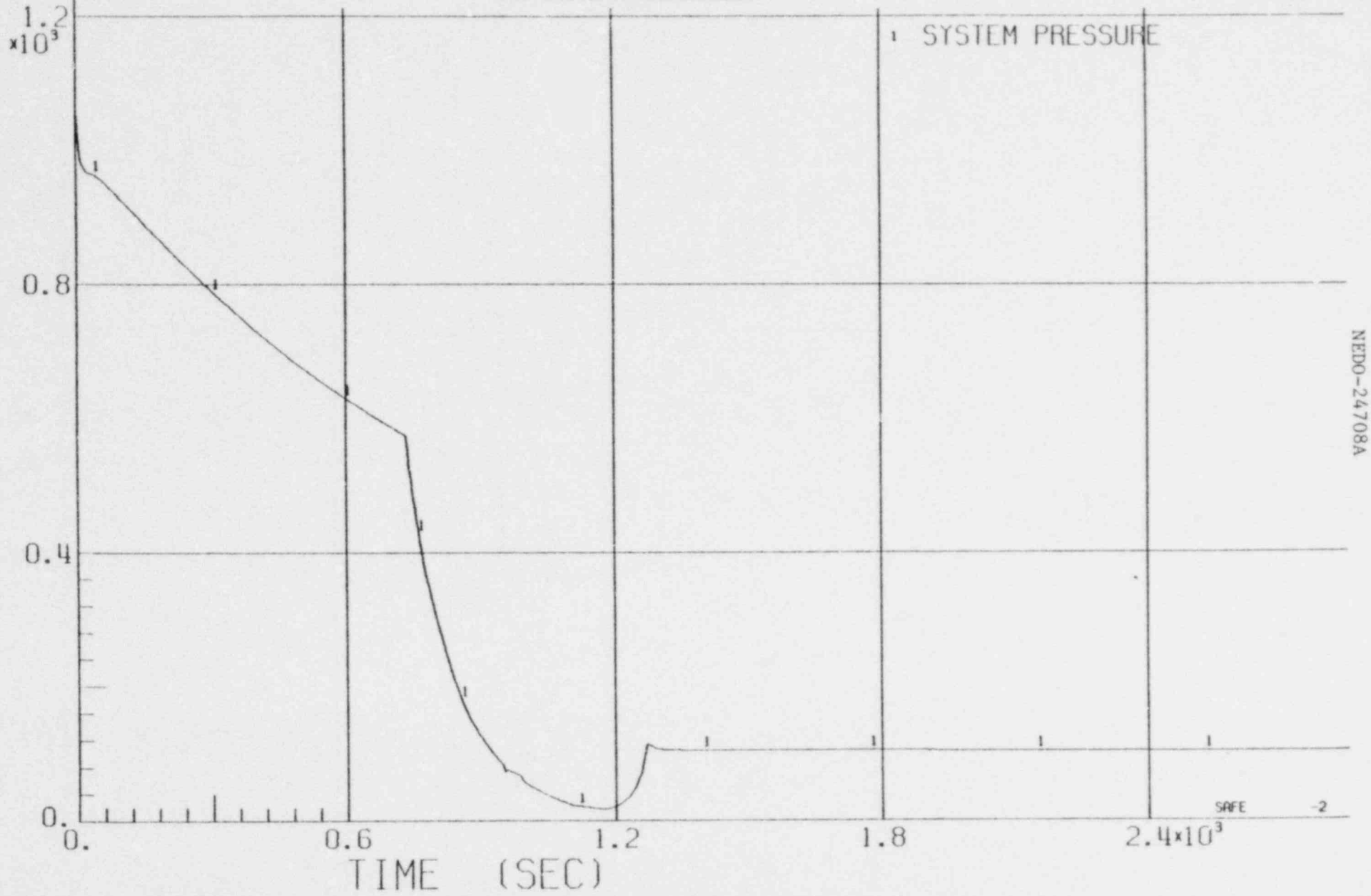

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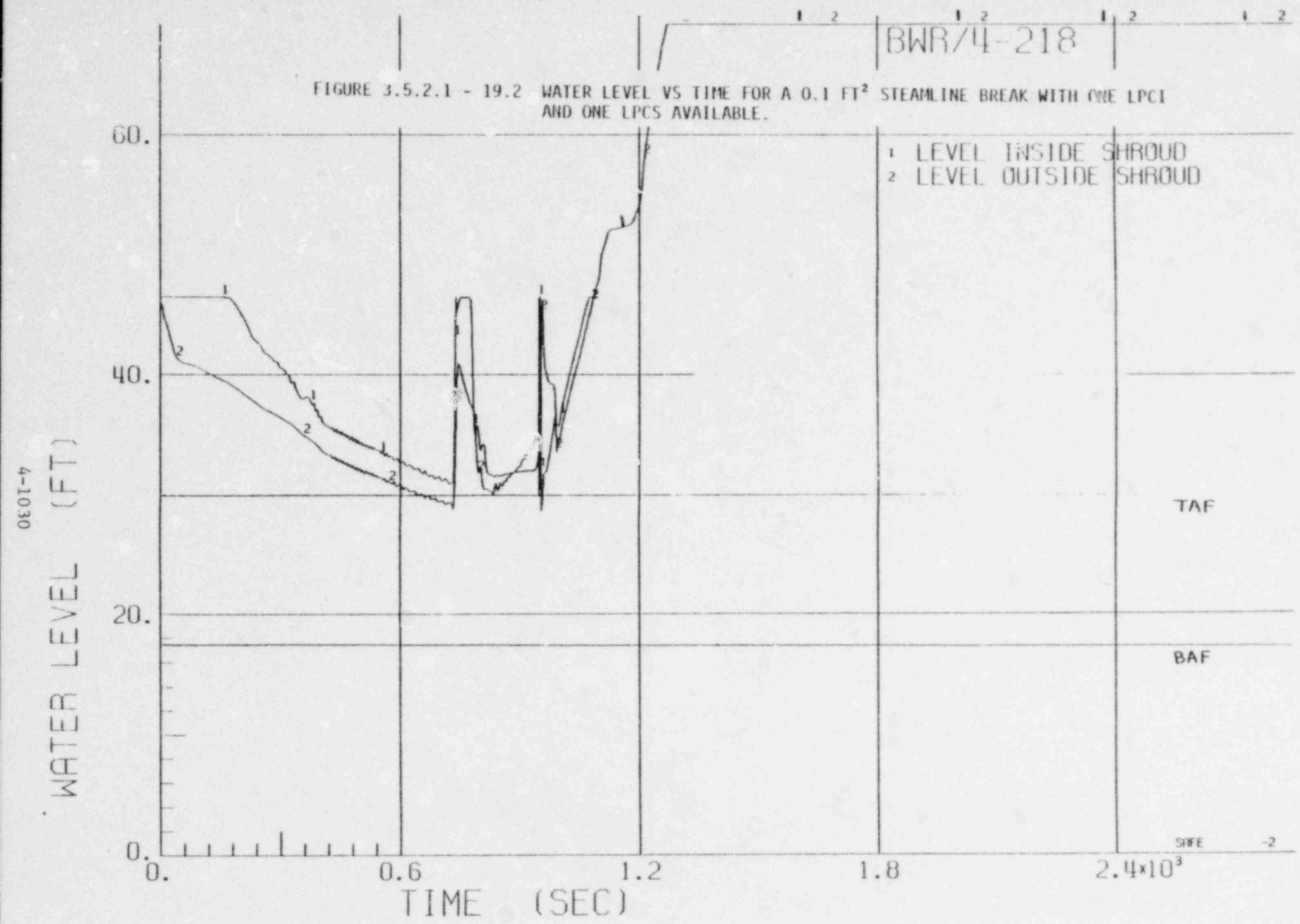
FIGURE 3.5.2.1 - 19.2 WATER LEVEL VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.



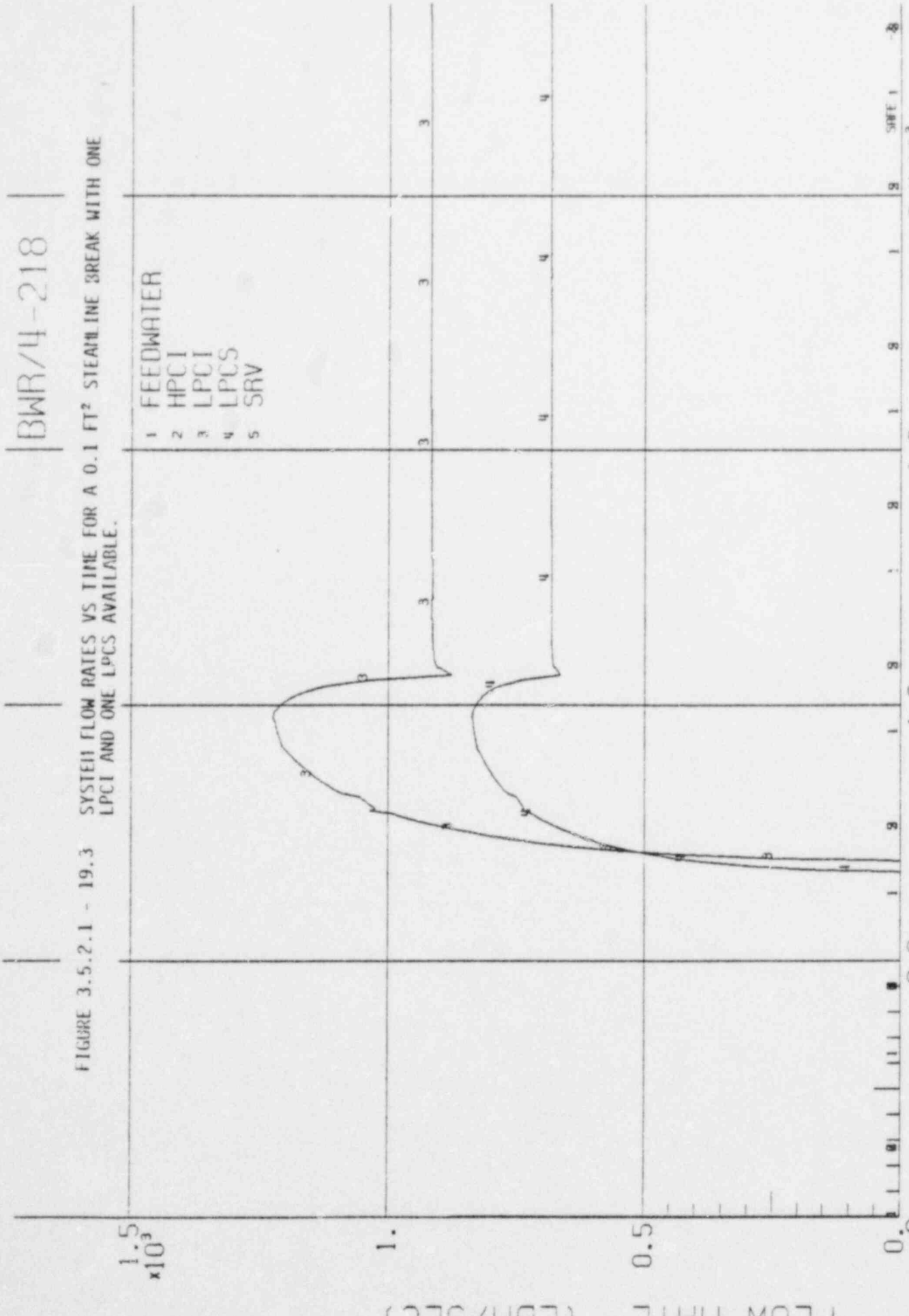


FIGURE 3.5.2.1 - 19.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 19.4 FLOW RATES VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

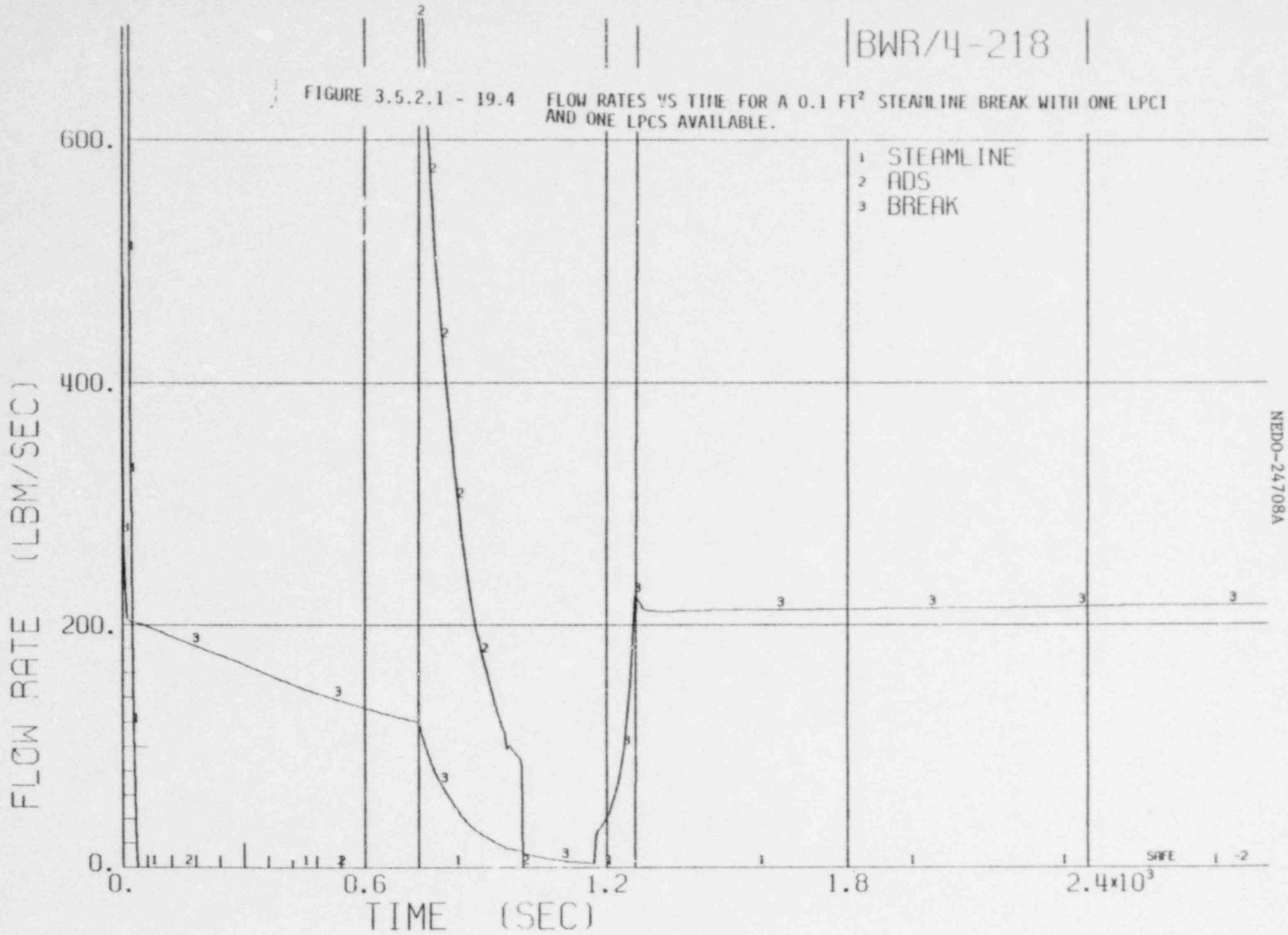

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FIGURE 3.5.2.1 - 19.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

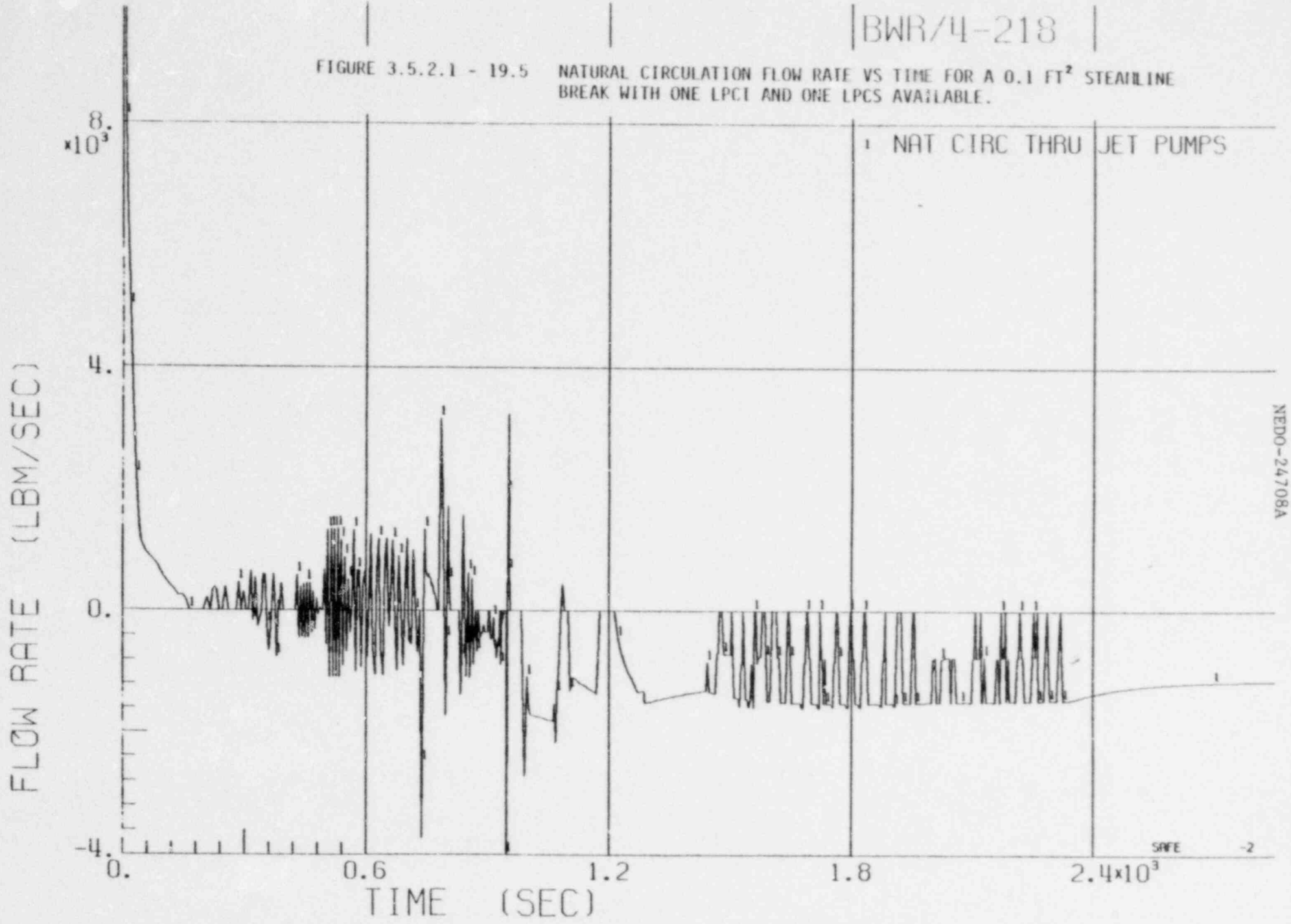

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FIGURE 3.5.2.1 - 19.6 TEMPERATURE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

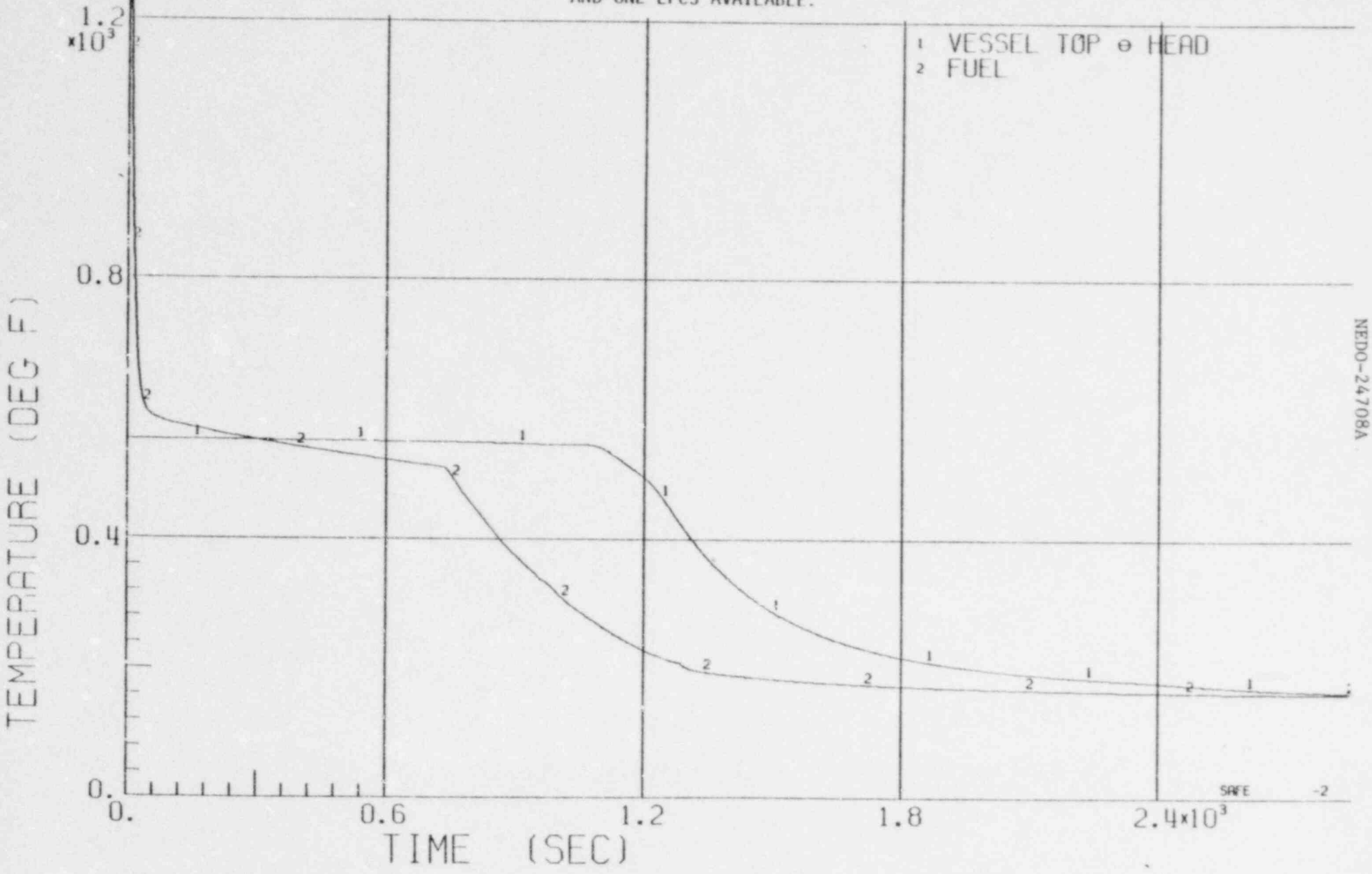

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FIGURE 3.5.2.1 - 19.7 ENTHALPY VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

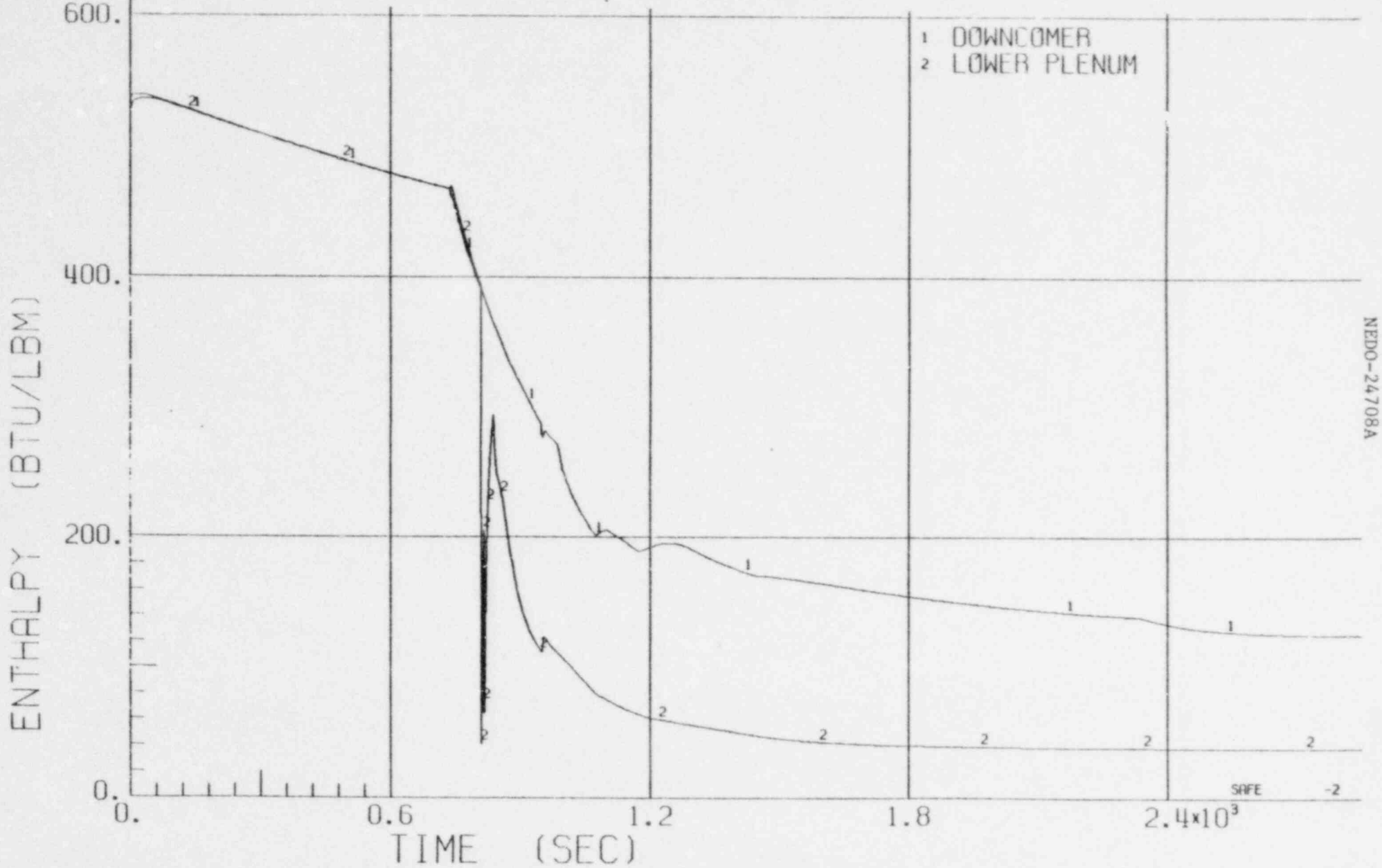

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FIGURE 3.5.2.1 - 19.3 QUALITY VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

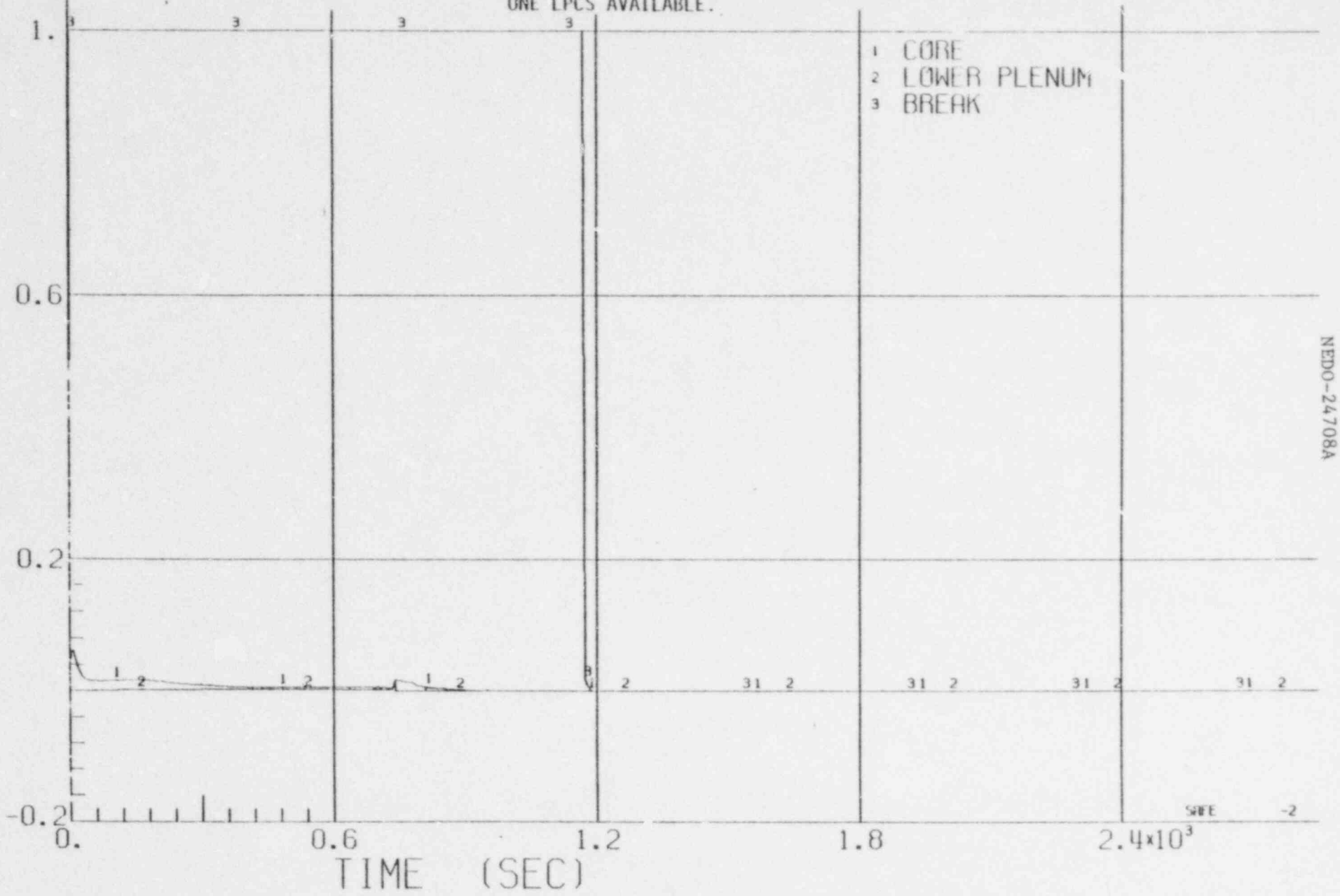

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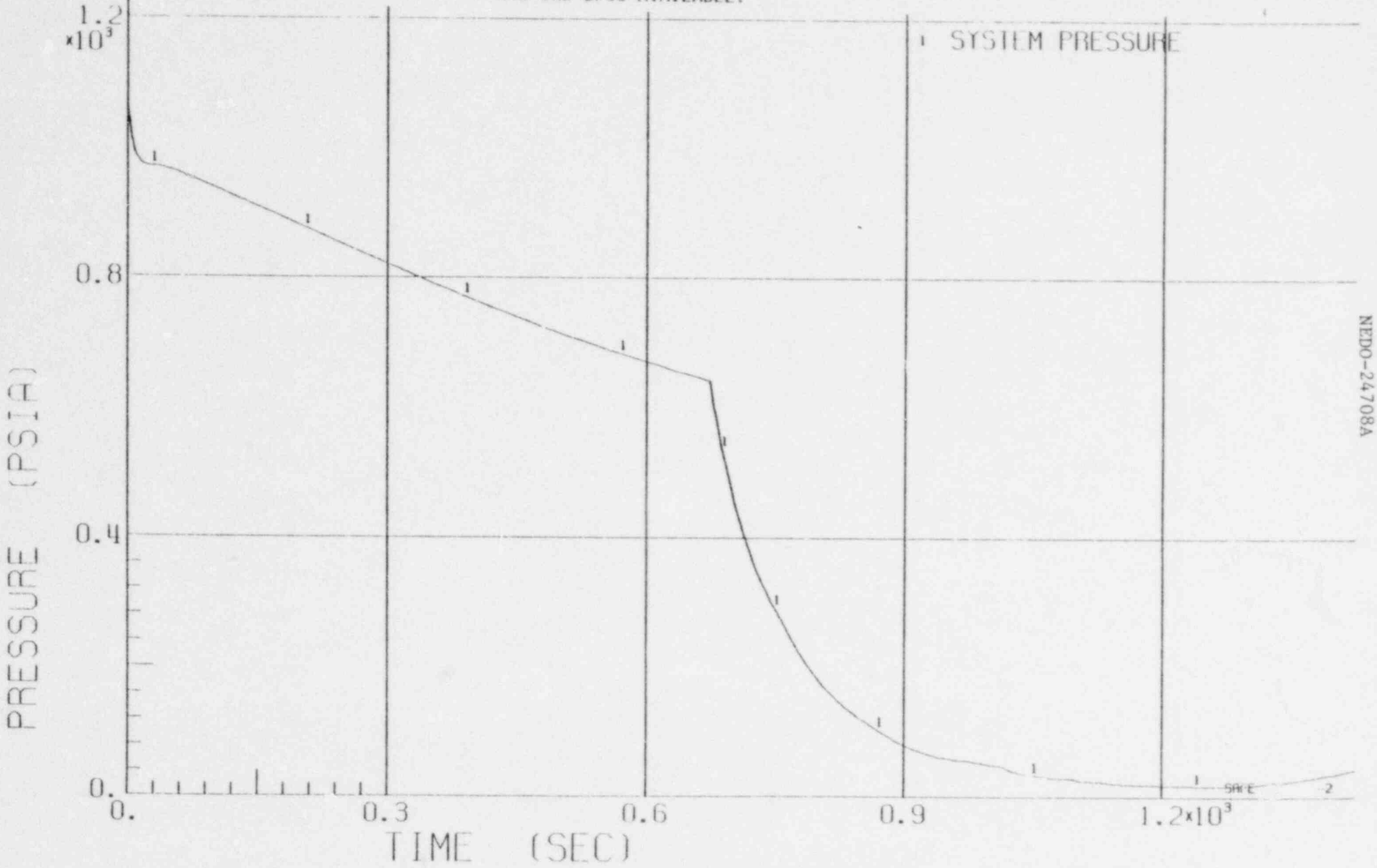
FIGURE 3.5.2.1 - 20.1 SYSTEM PRESSURE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.



4-1037

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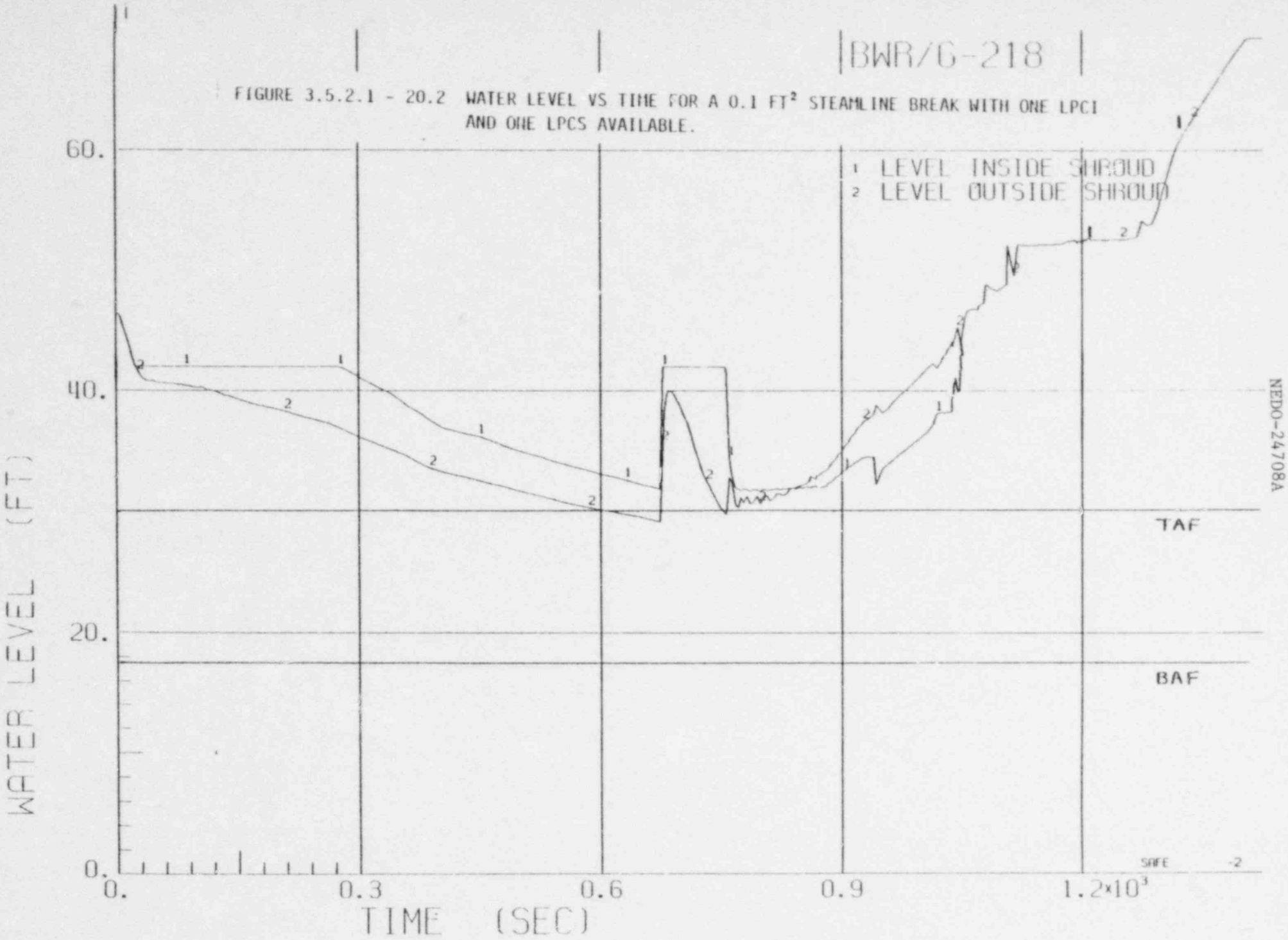

FIGURE 3.5.2.1 - 20.2 WATER LEVEL VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

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FIGURE 3.5.2.1 - 20.3 SYSTEM FLOW RATES VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

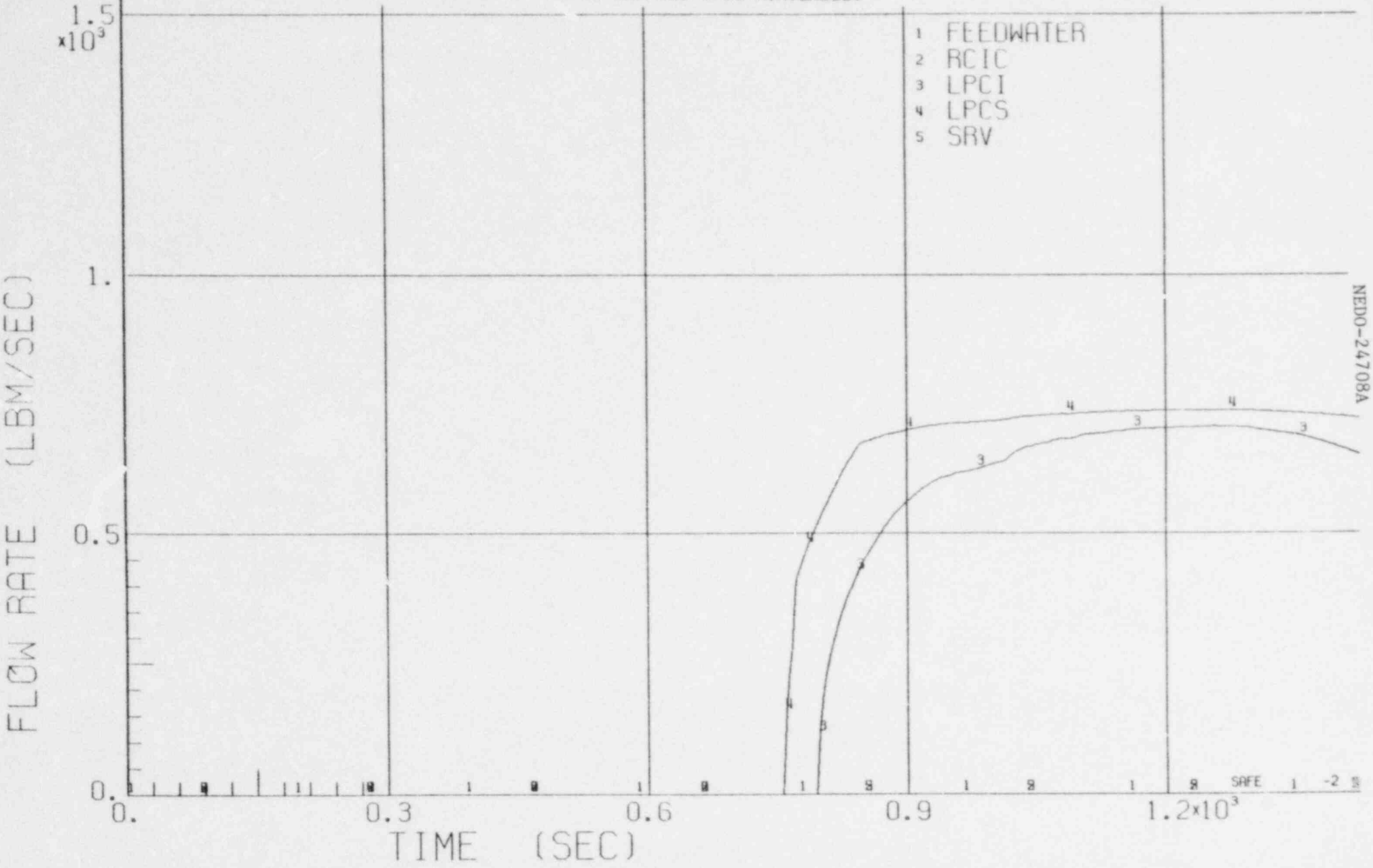

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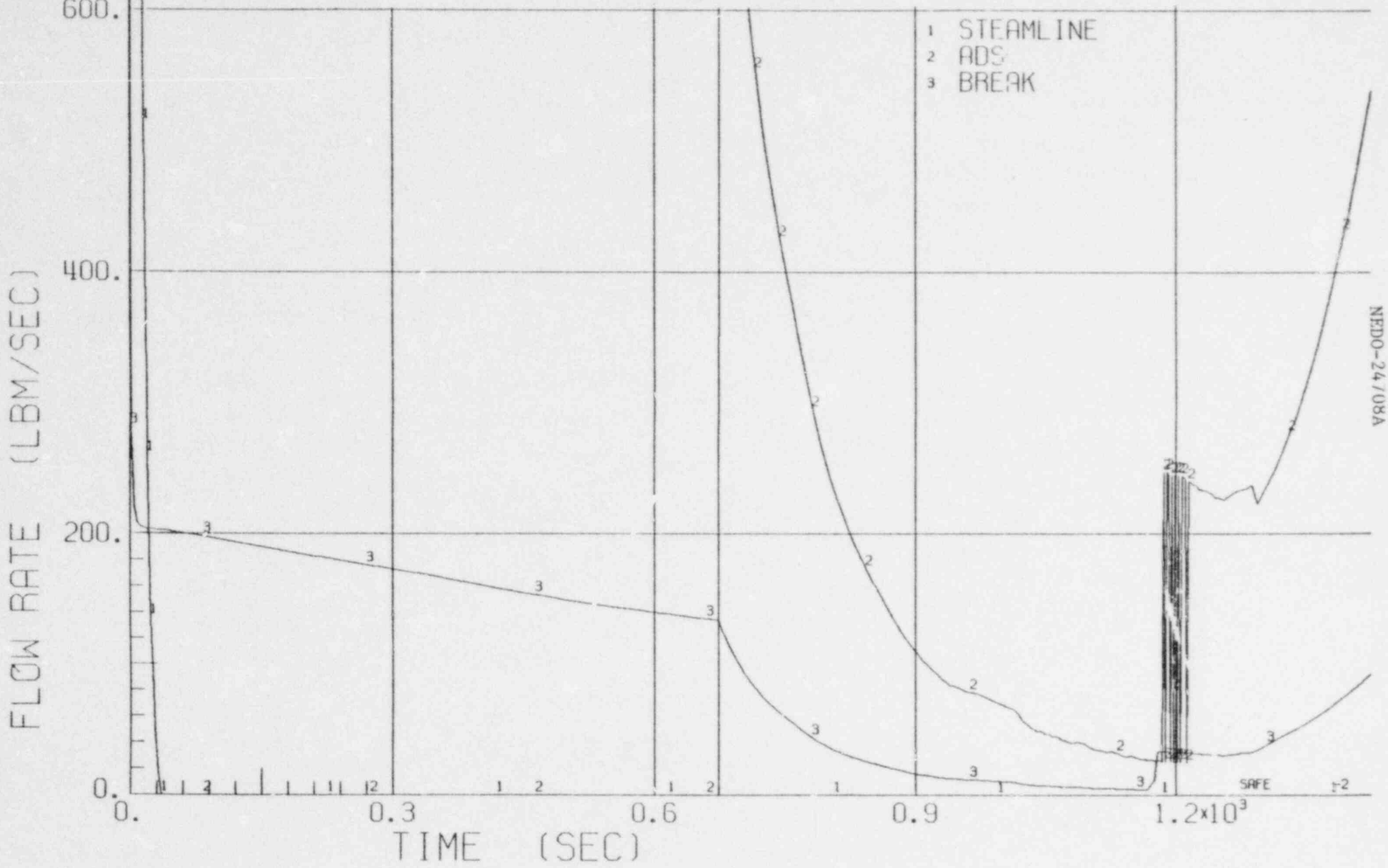
FIGURE 3.5.2.1 - 20.4 FLOW RATES VS TIME FOR A 0.1 FT^2 STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.



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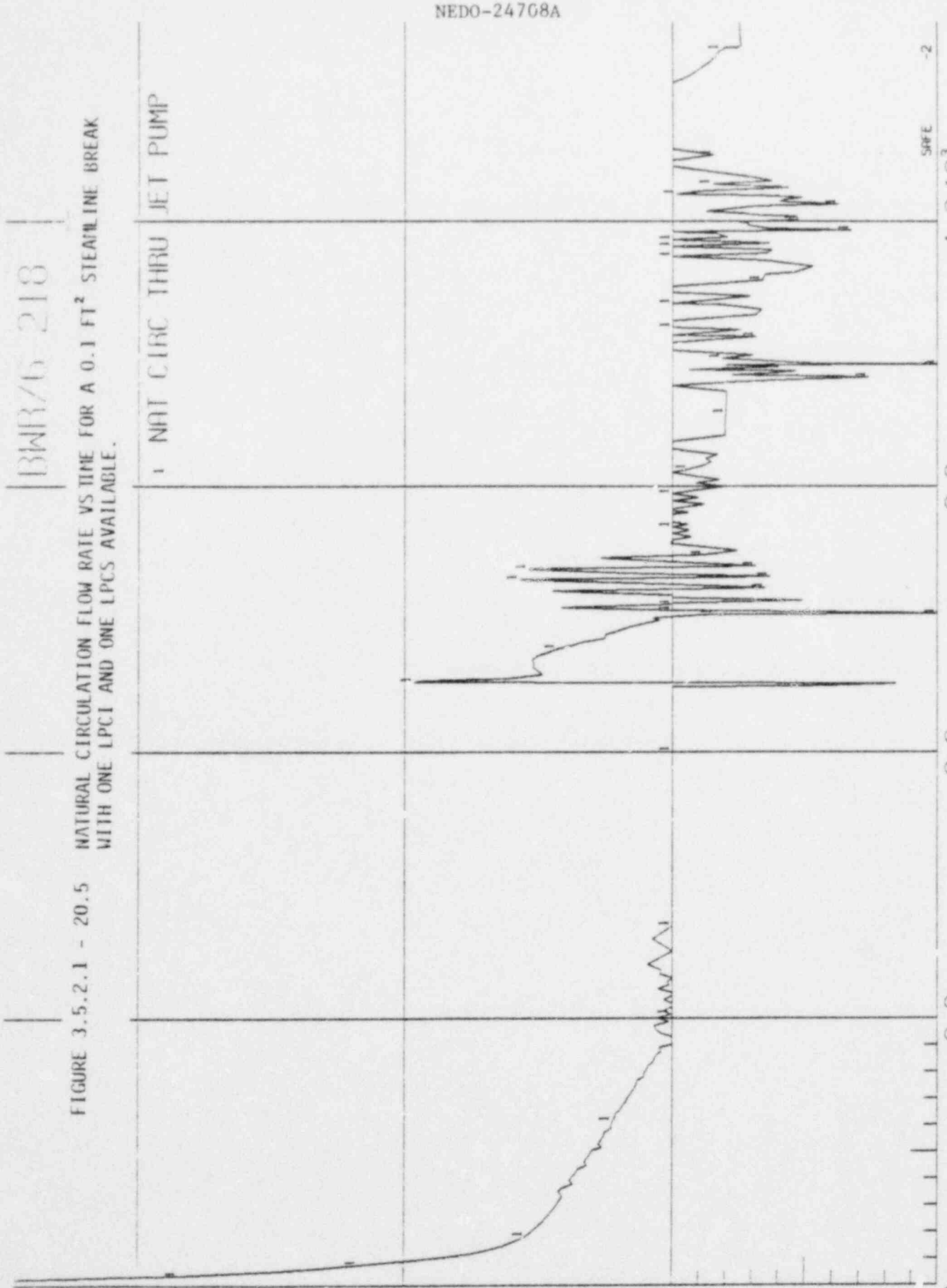

FIGURE 3.5.2.1 - 20.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

FIGURE 3.5.2.1 - 20.6 TEMPERATURE VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

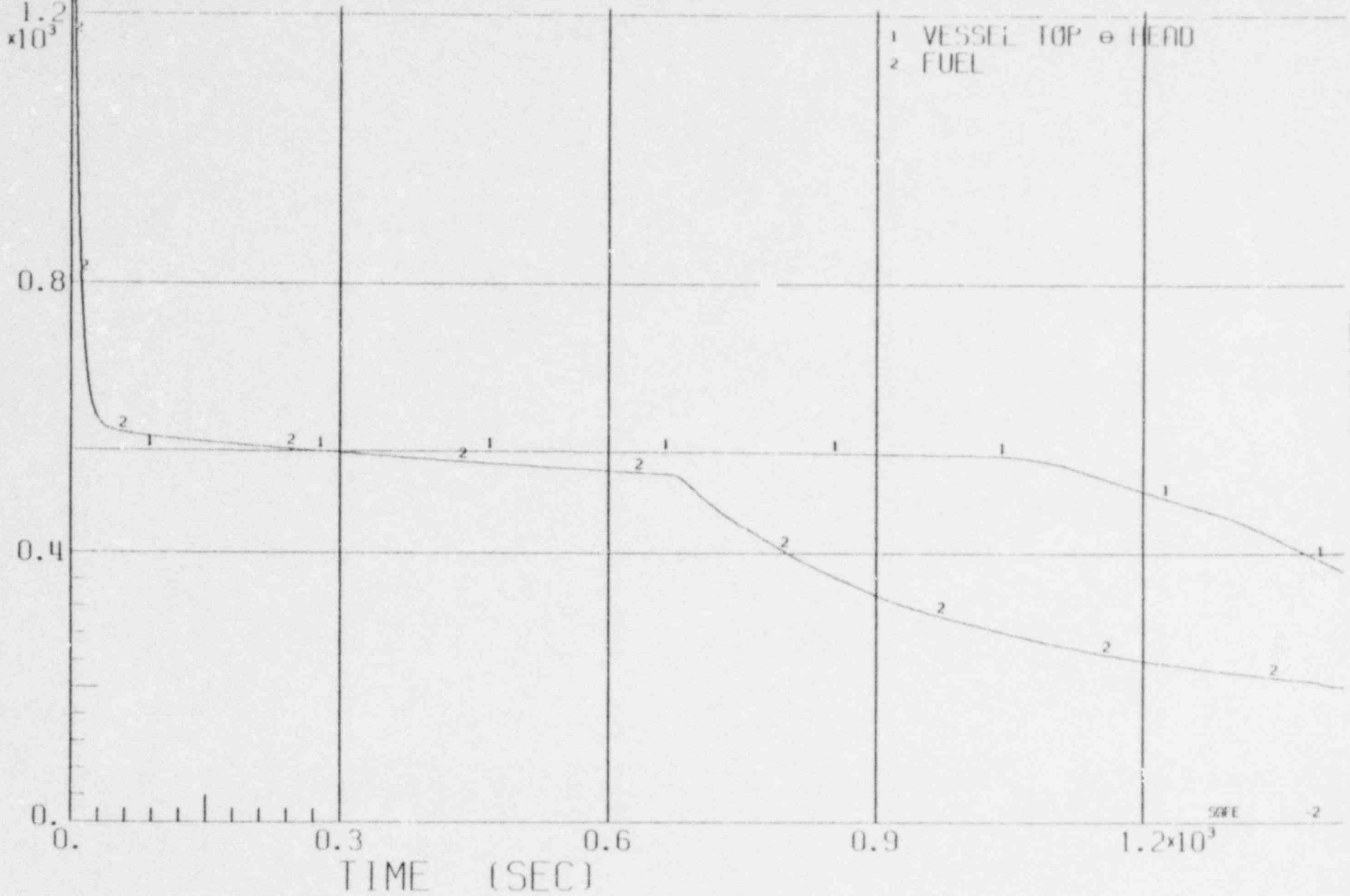

FIGURE 3.5.2.1 - 20.7 ENTHALPY VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

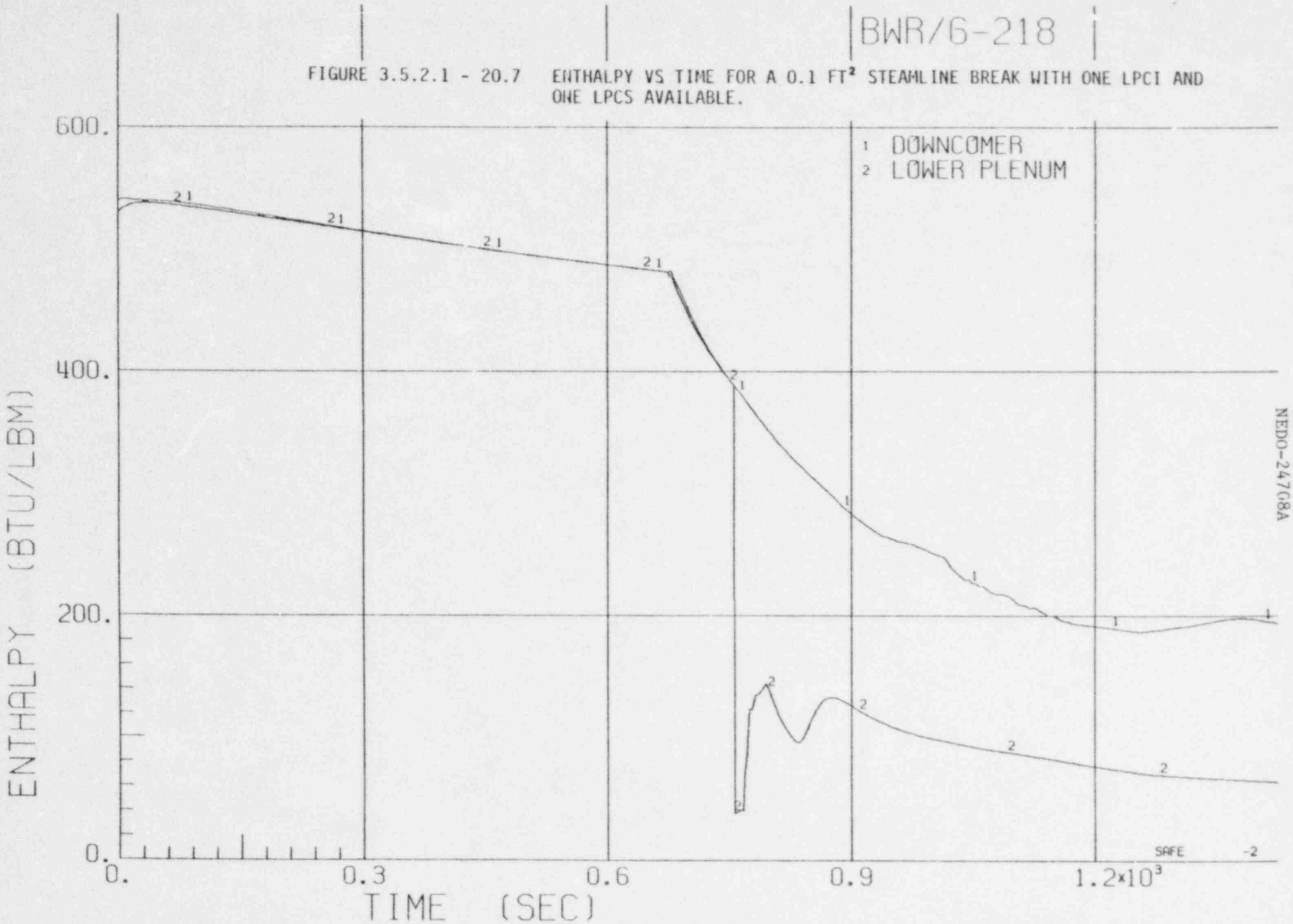

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FIGURE 3.5.2.1 - 20.8 QUALITY VS TIME FOR A 0.1 FT² STEAMLINE BREAK WITH ONE LPCI AND ONE LPCS AVAILABLE.

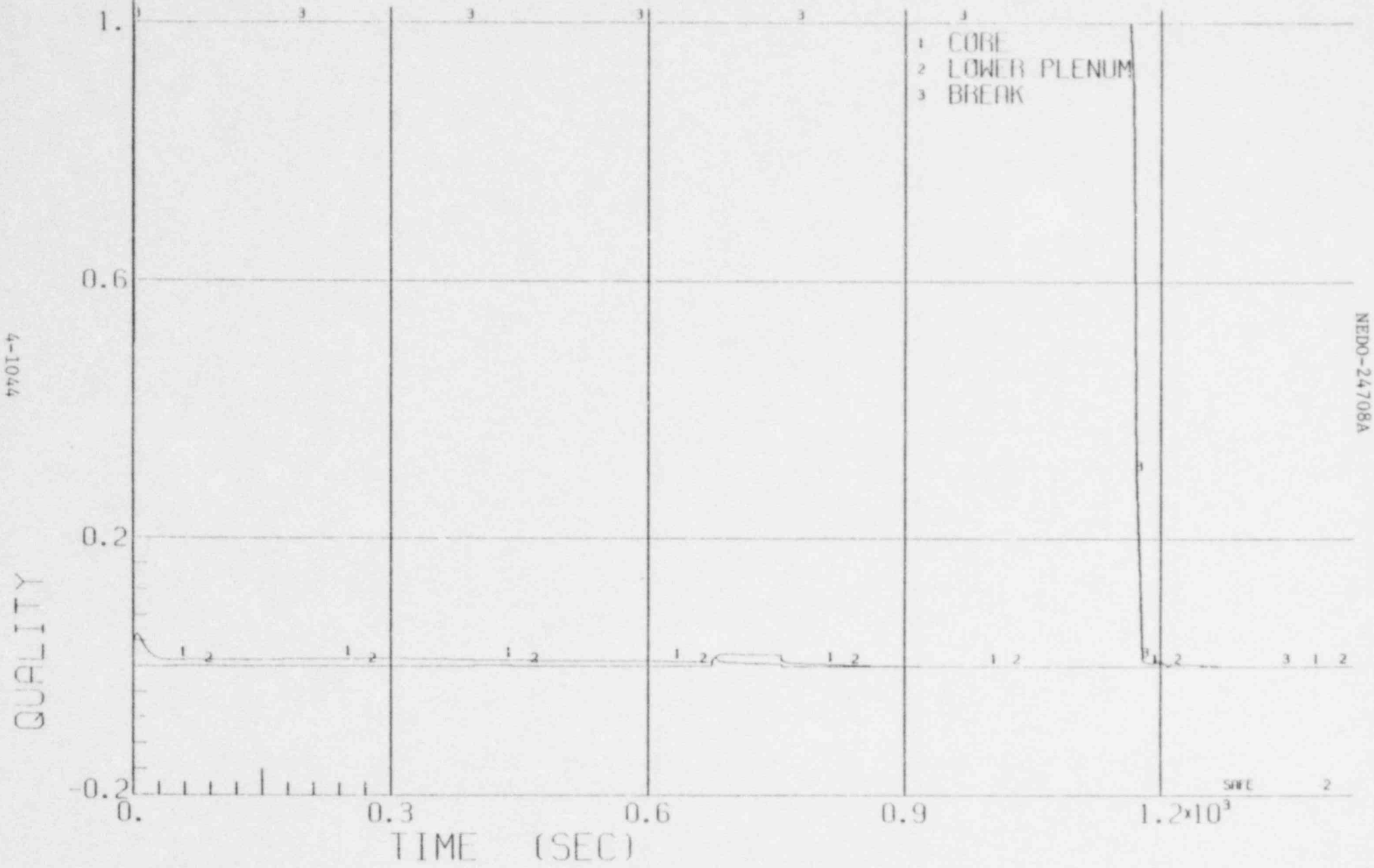

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FIGURE 3.5.2.1 - 21.1 SYSTEM PRESSURE VS TIME FOR A 0.022 FT^2 CORE SPRAY LINE BREAK WITH ONE LPCI AVAILABLE.

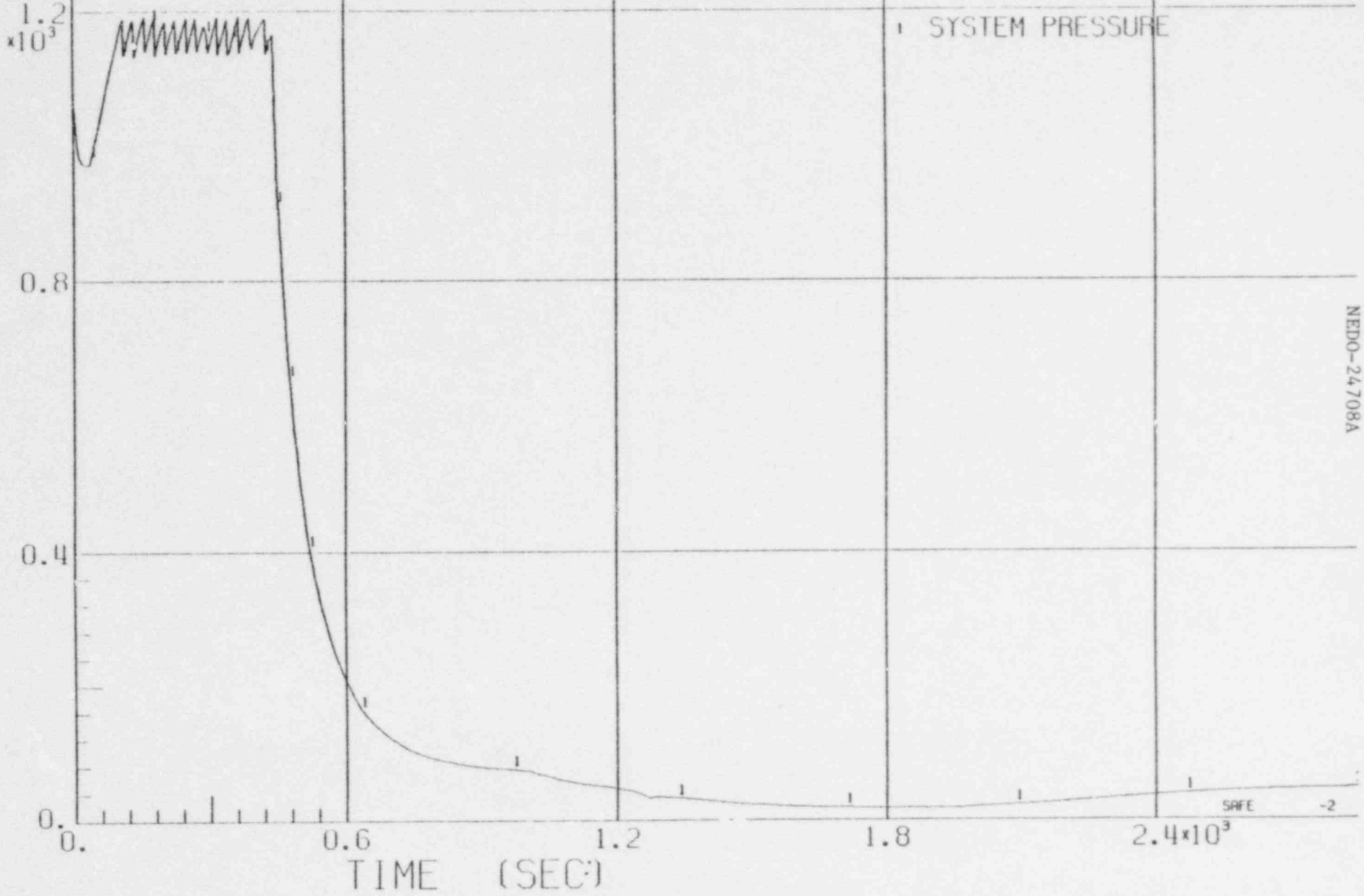

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FIGURE 3.5.2.1 - 21.2 WATER LEVEL VS TIME FOR A 0.022 FT^2 CORE SPRAY LINE BREAK WITH ONE LPCI AVAILABLE.

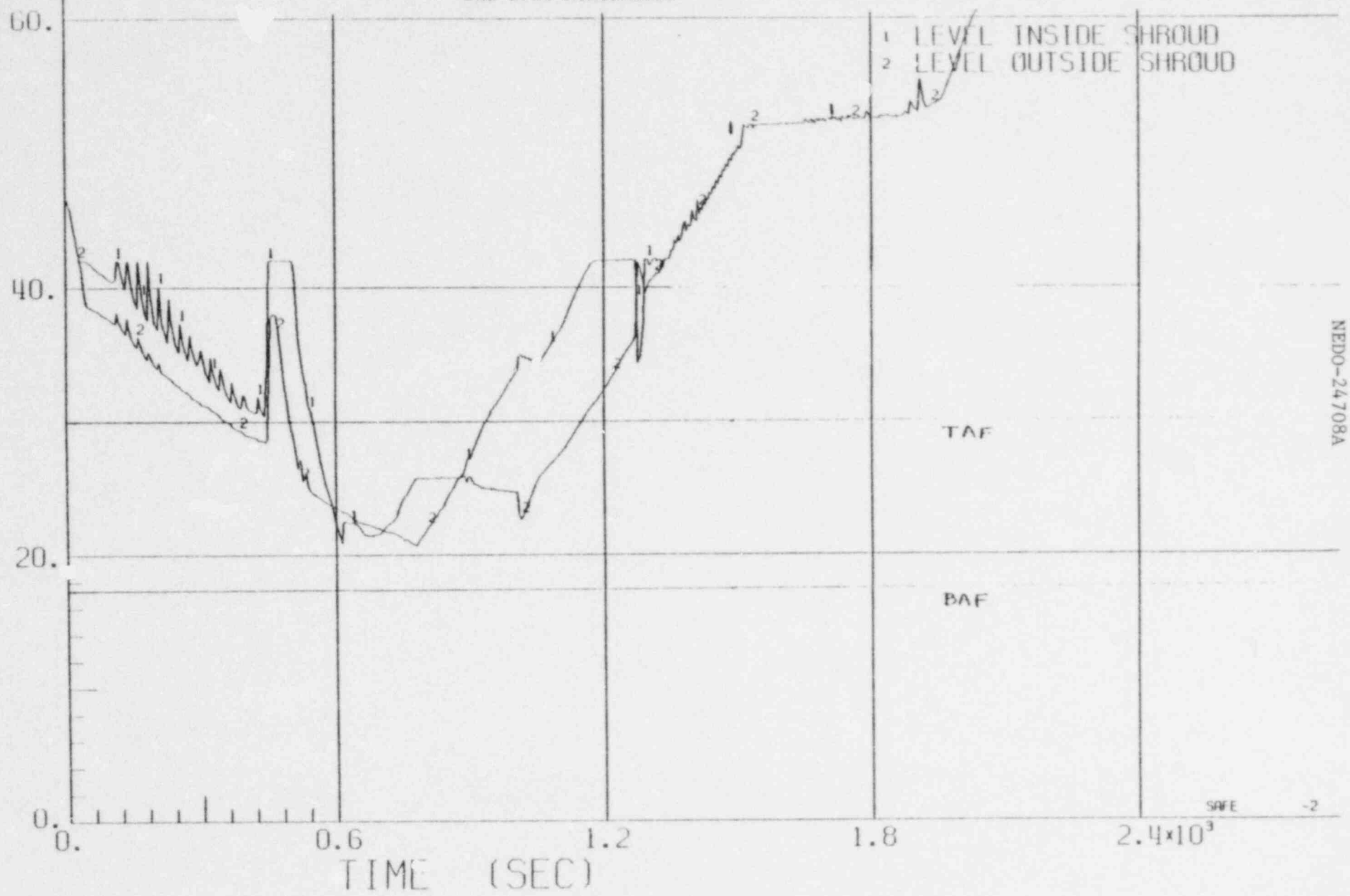

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FIGURE 3.5.2.1 - 21.3 SYSTEM FLOW RATES VS TIME FOR A 0.022 FT^2 CORE SPRAY LINE BREAK WITH ONE LPCI AVAILABLE.

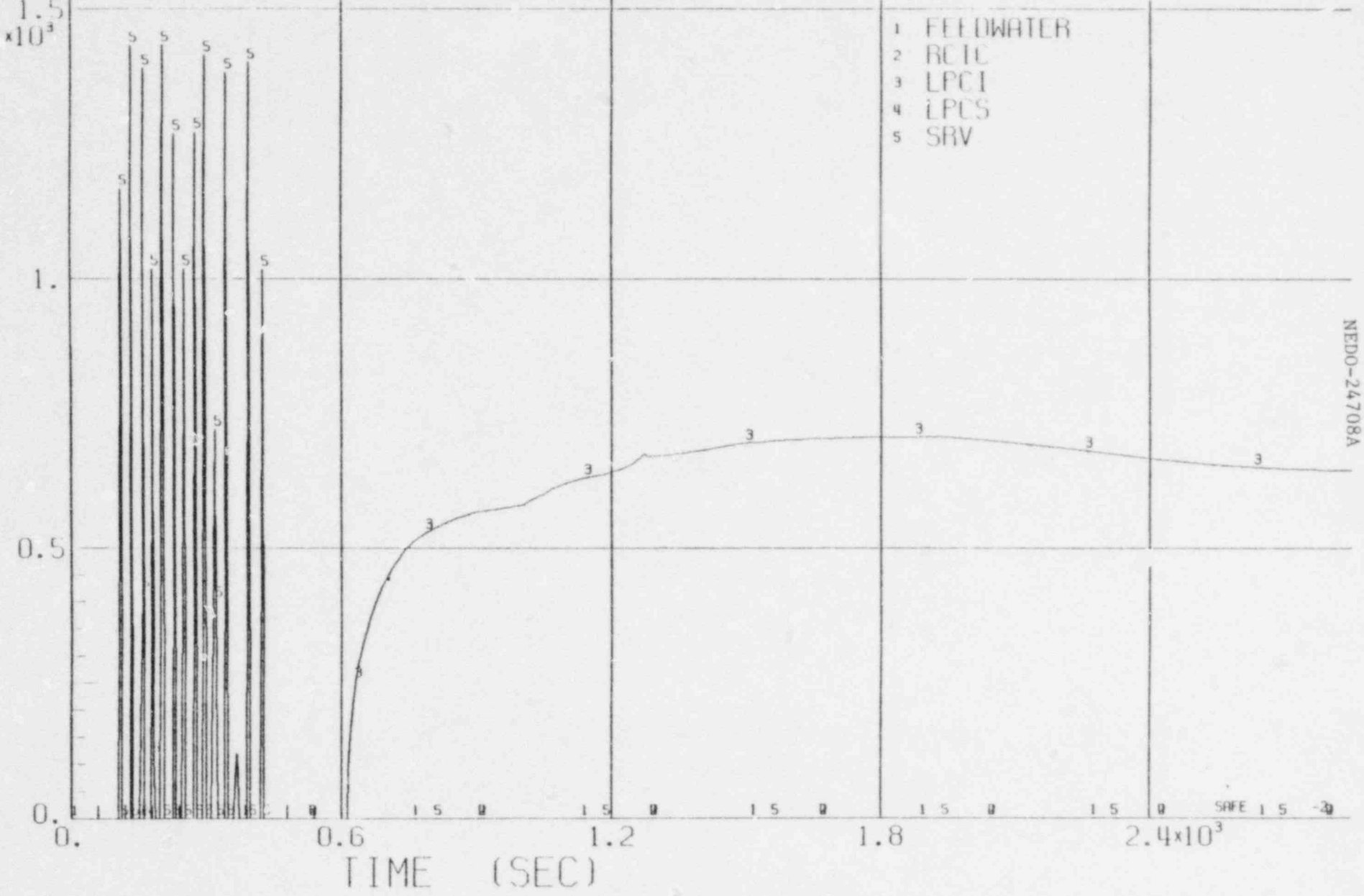

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FIGURE 3.5.2.1 - 21.4 FLOW RATES VS TIME FOR A 0.022 FT^2 CORE SPRAY LINE BREAK WITH ONE LPCI AVAILABLE.

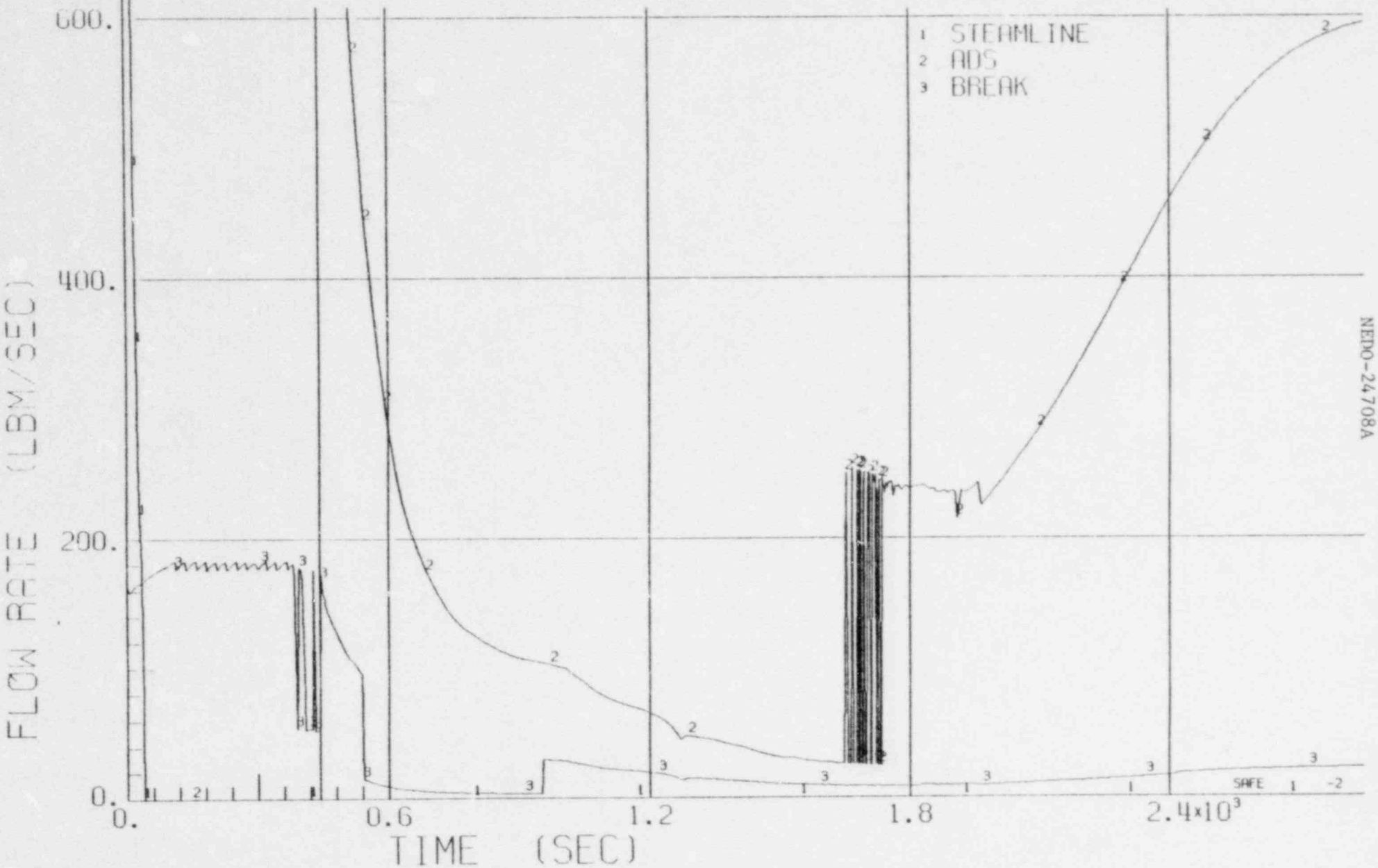

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FIGURE 3.5.2.1 - 21.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.022 FT^2 CORE SPRAY LINE BREAK WITH ONE LPCI AVAILABLE.

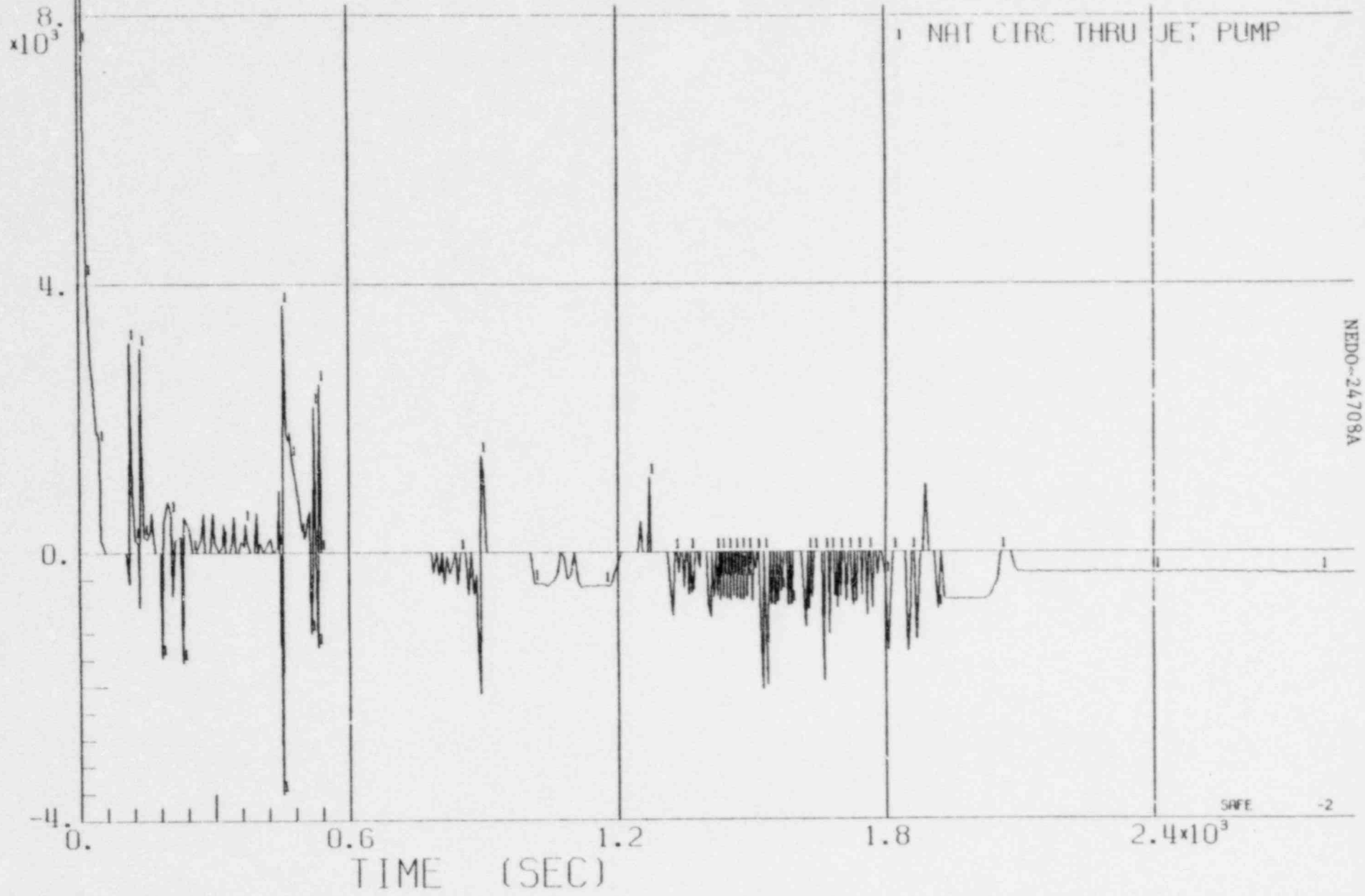

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FIGURE 3.5.2.1 - 21.6 TEMPERATURE VS TIME FOR A 0.022 FT² CORE SPRAY LINE BREAK WITH ONE LPCI AVAILABLE.

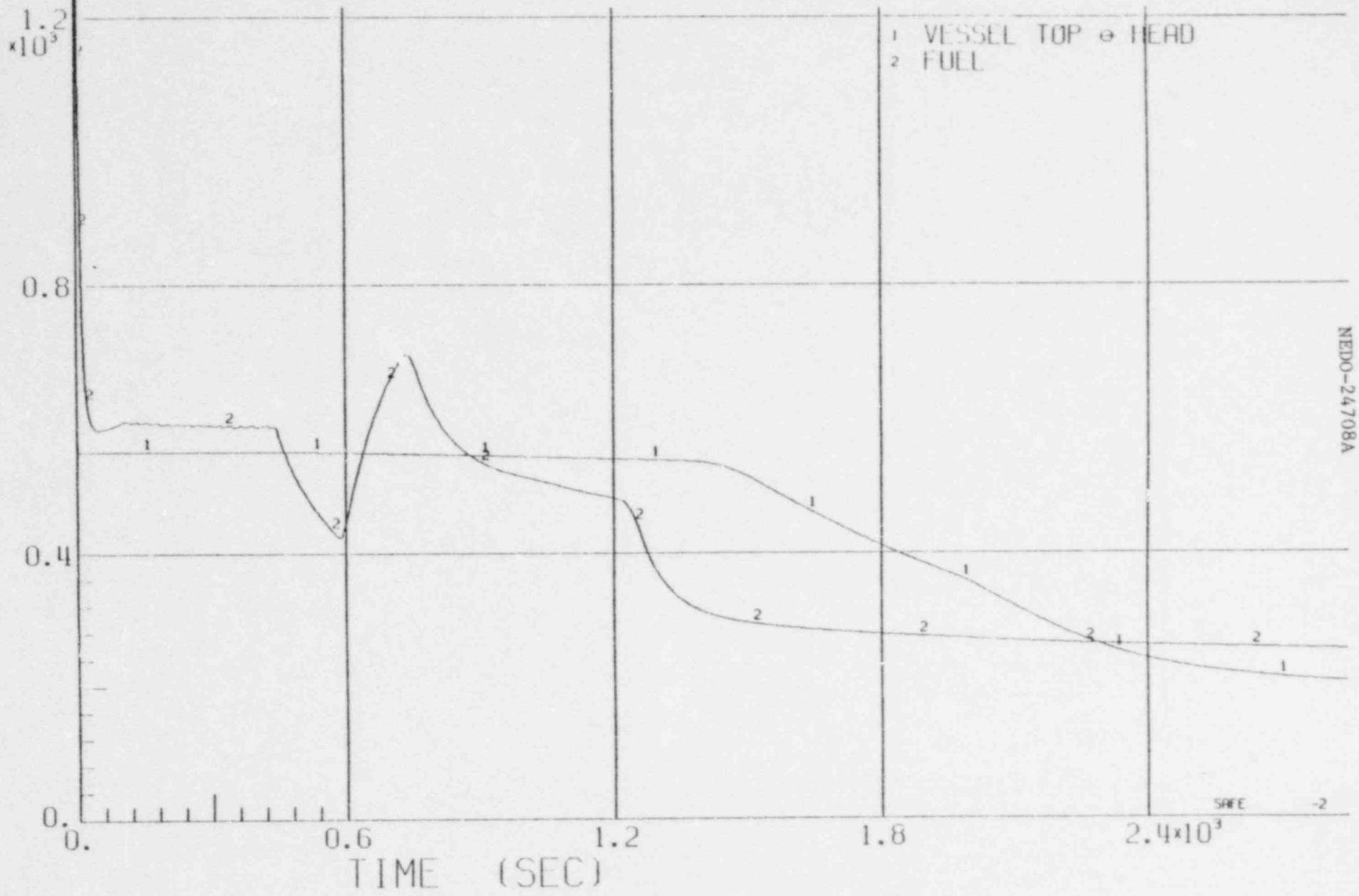

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FIGURE 3.5.2.1 - 21.7 ENTHALPY VS TIME FOR A 0.022 FT² CORE SPRAY LINE BREAK WITH ONE LPCI AVAILABLE.

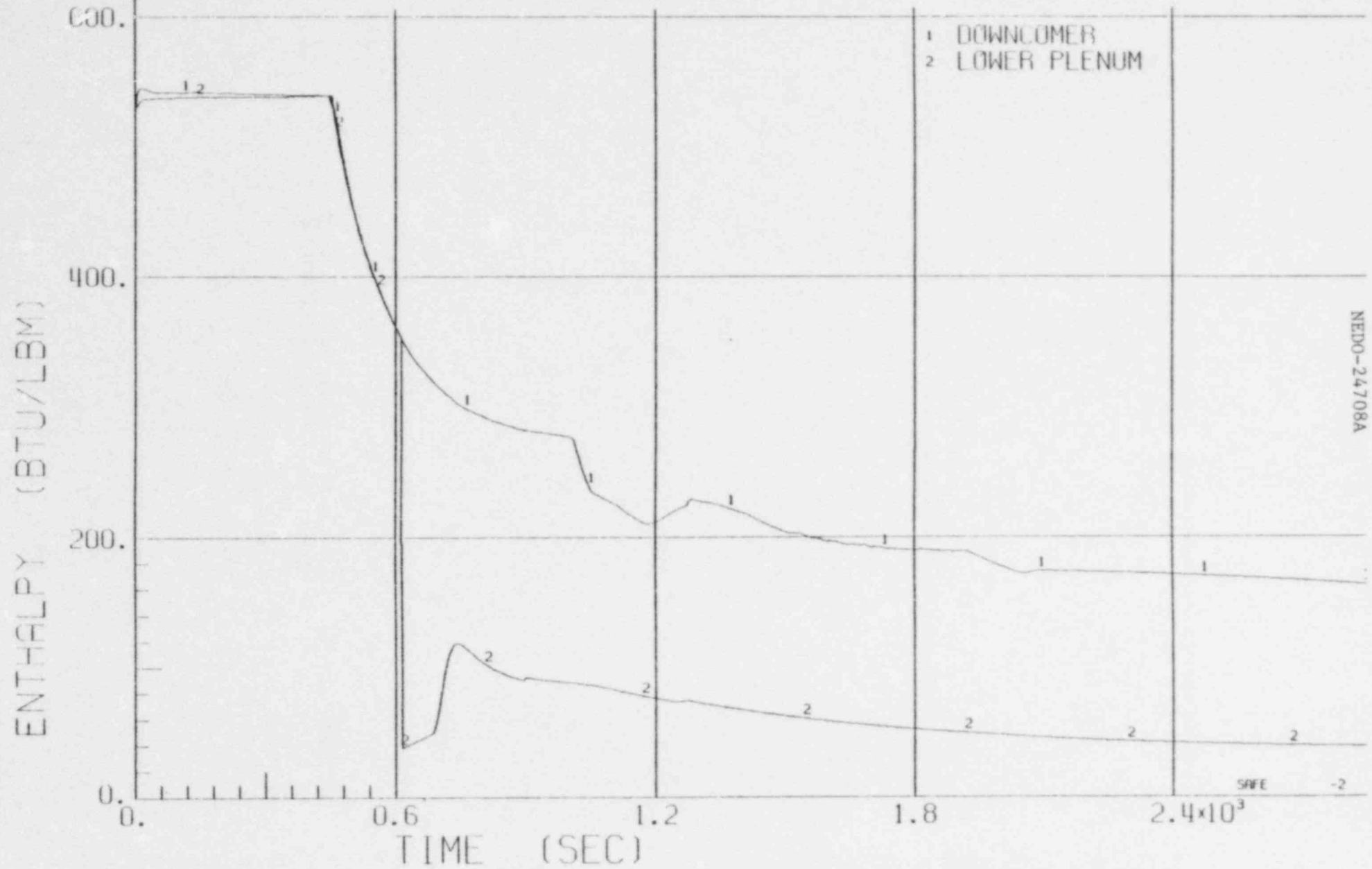

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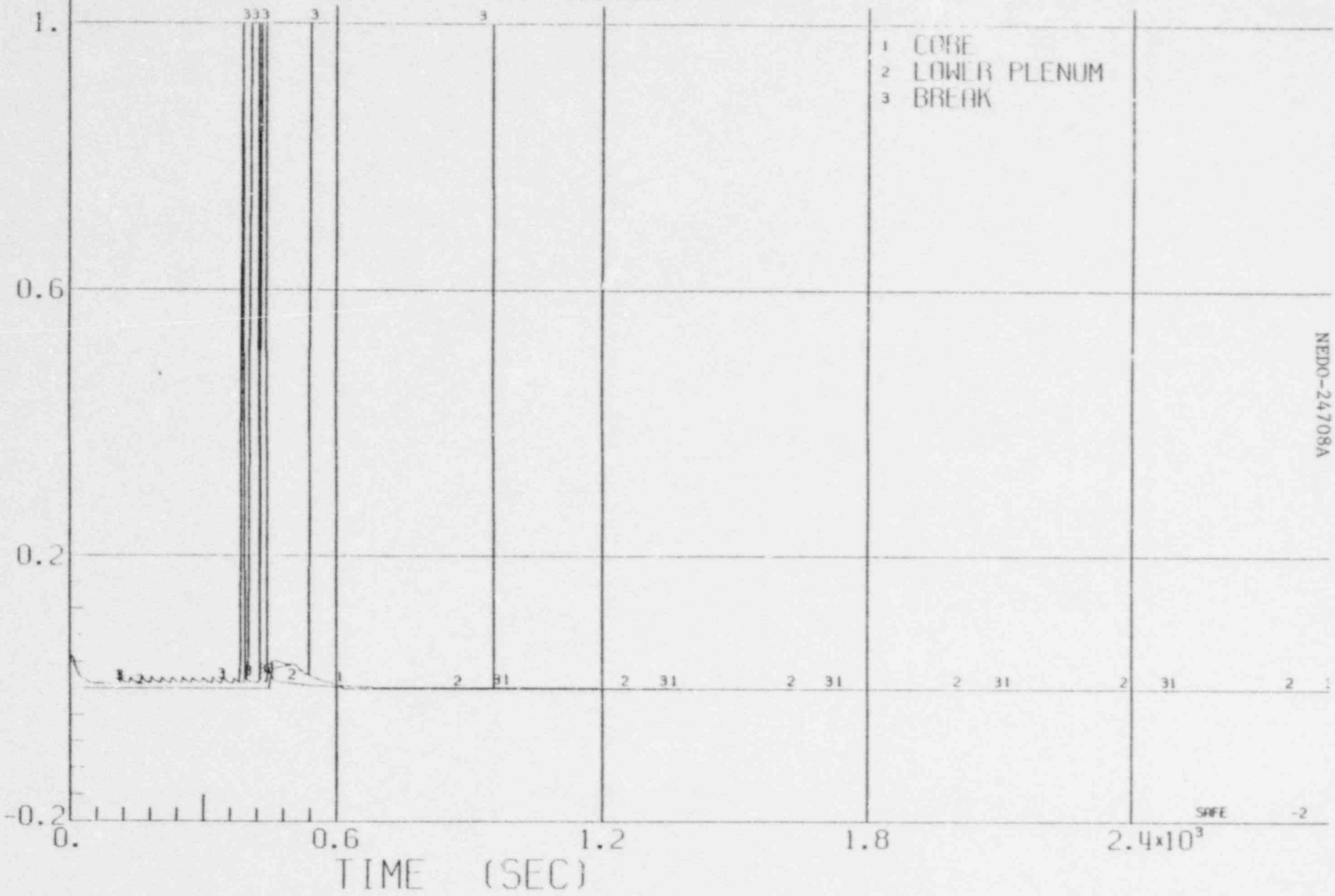
FIGURE 3.5.2.1 - 21.8 QUALITY VS TIME FOR A 0.022 FT² CORE SPRAY LINE BREAK WITH ONE LPCS AVAILABLE.



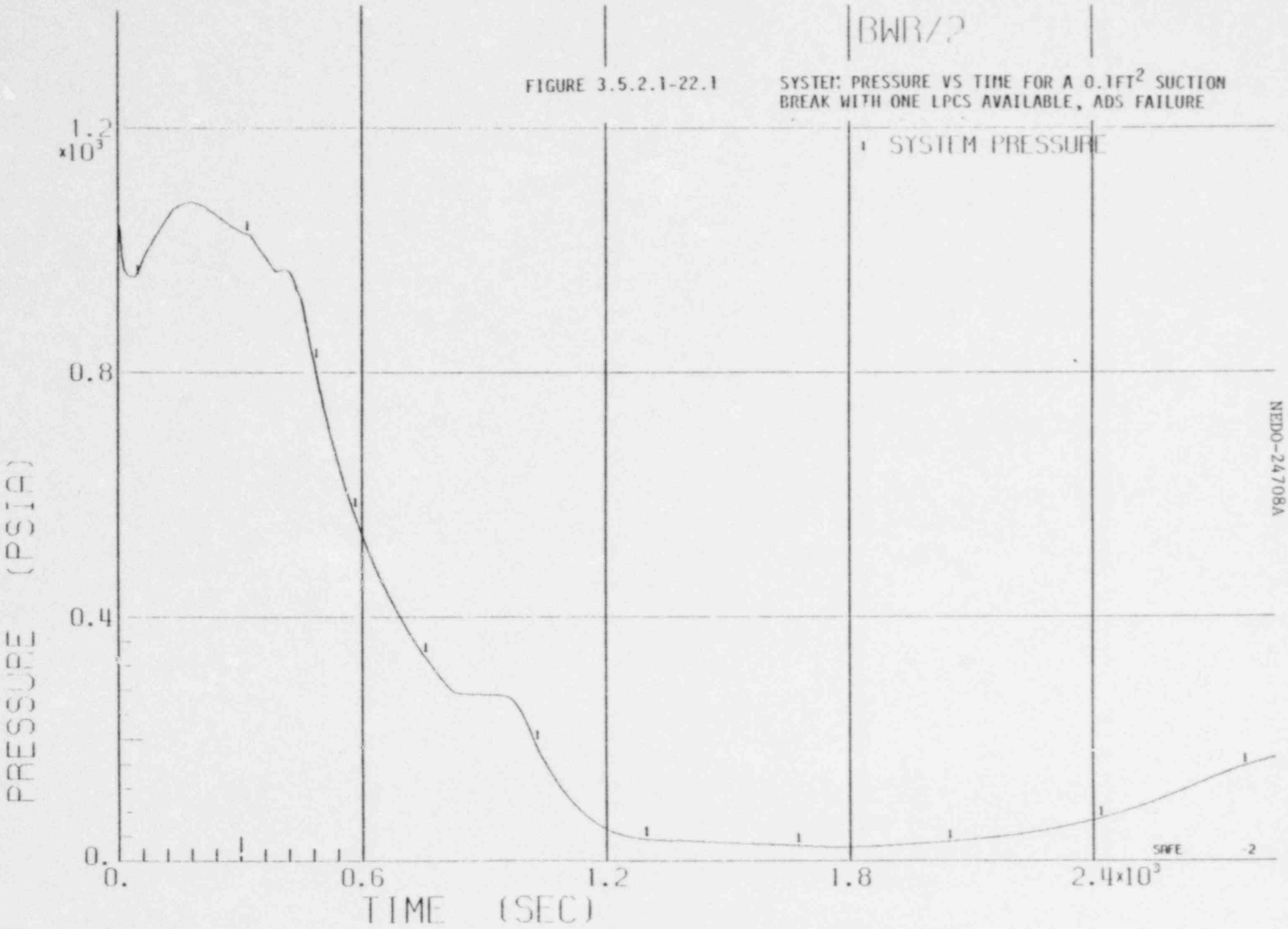


FIGURE 3.5.2.1-22.1 SYSTEM PRESSURE VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE, ADS FAILURE

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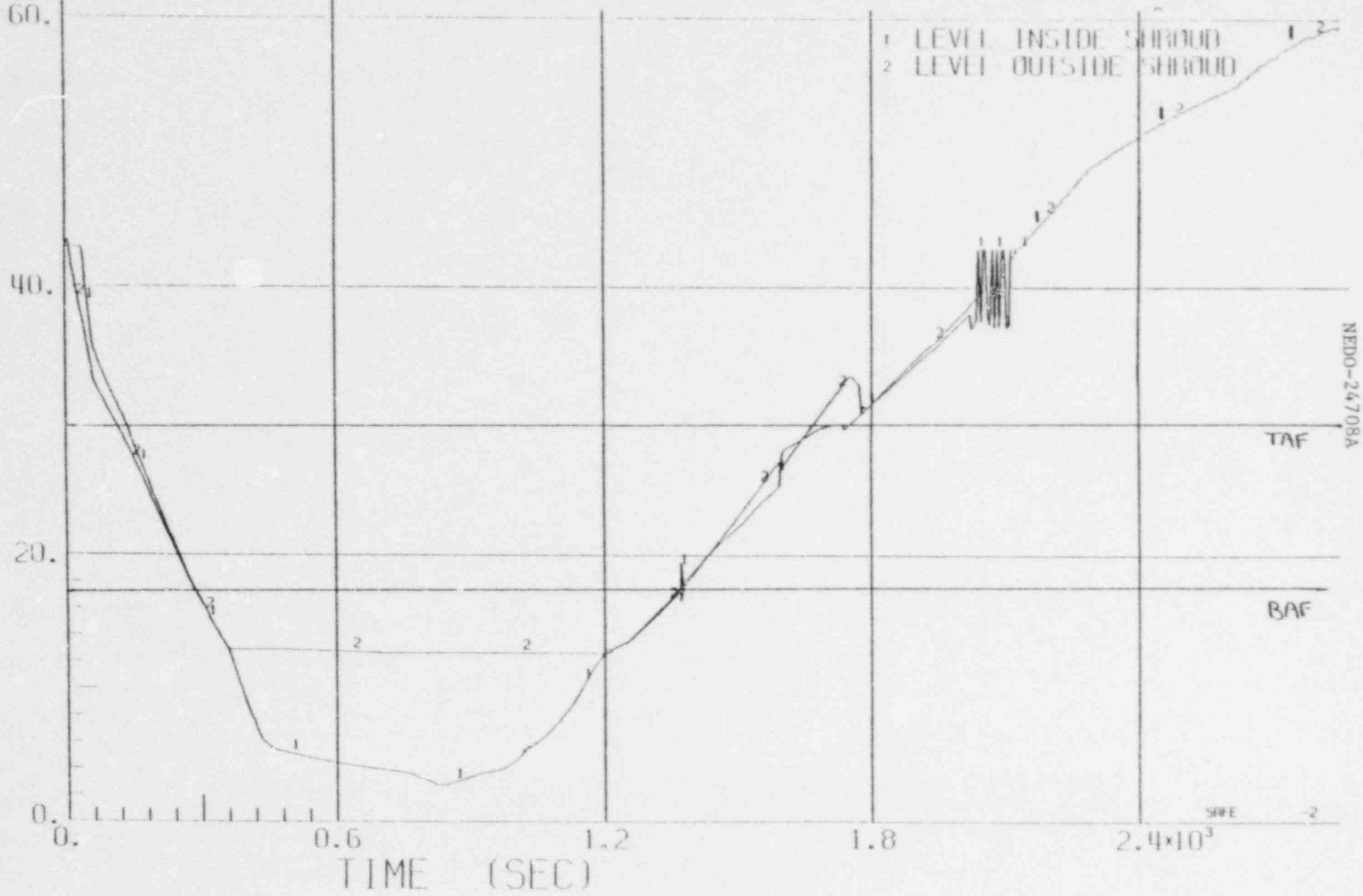
BWR/2

FIGURE 3.5.2.1-22.2 WATER LEVEL VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE, ADS FAILURE



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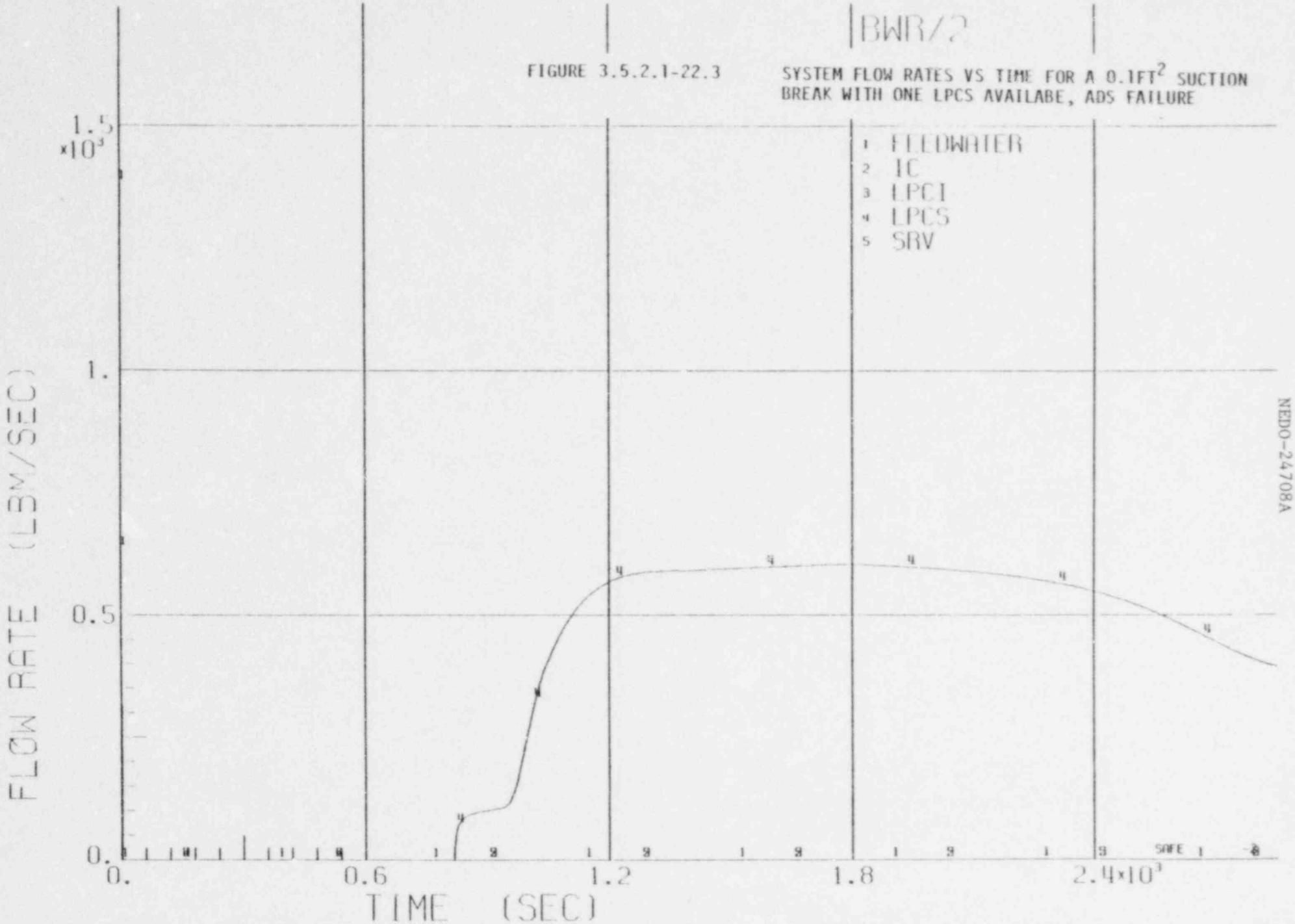
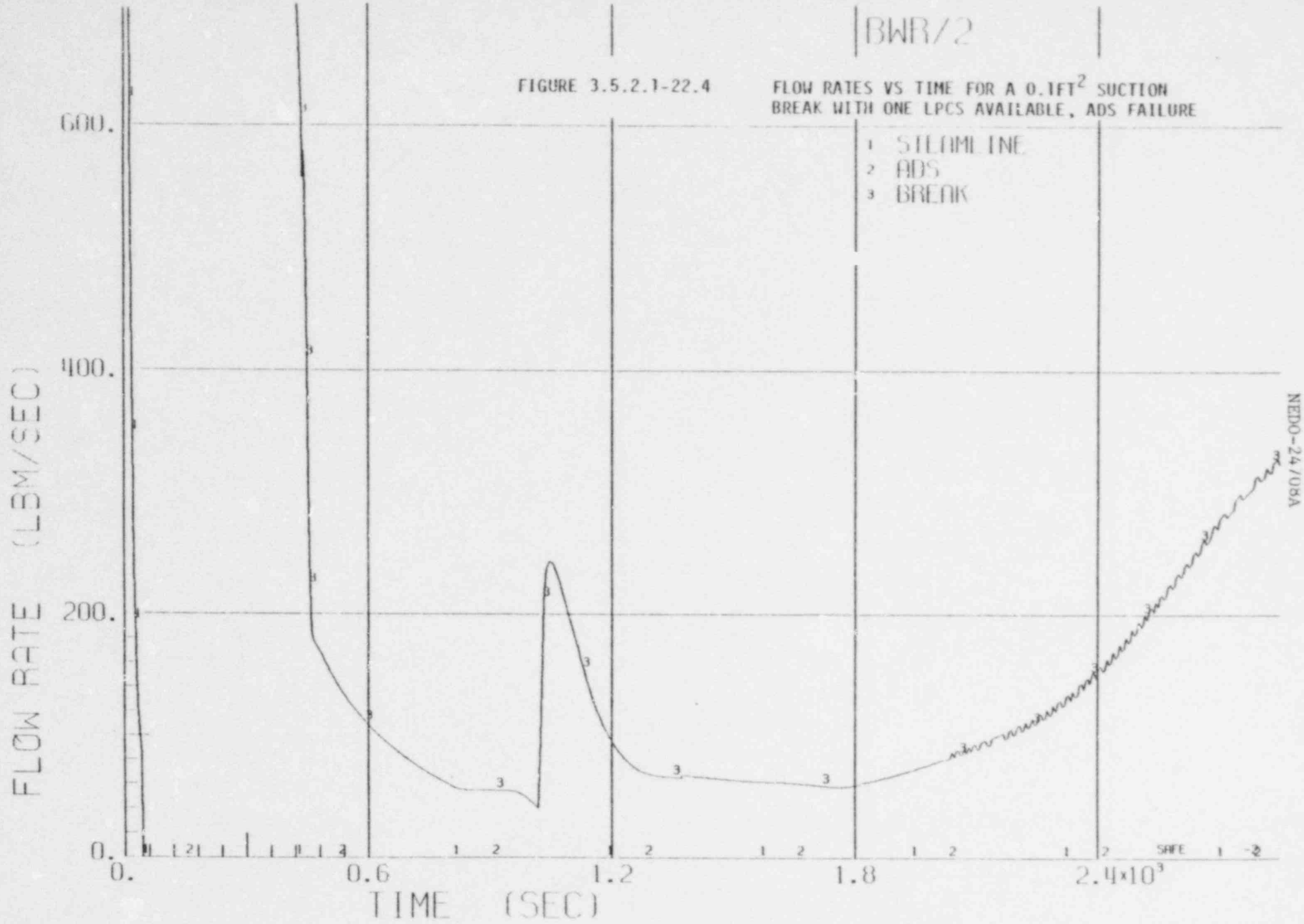


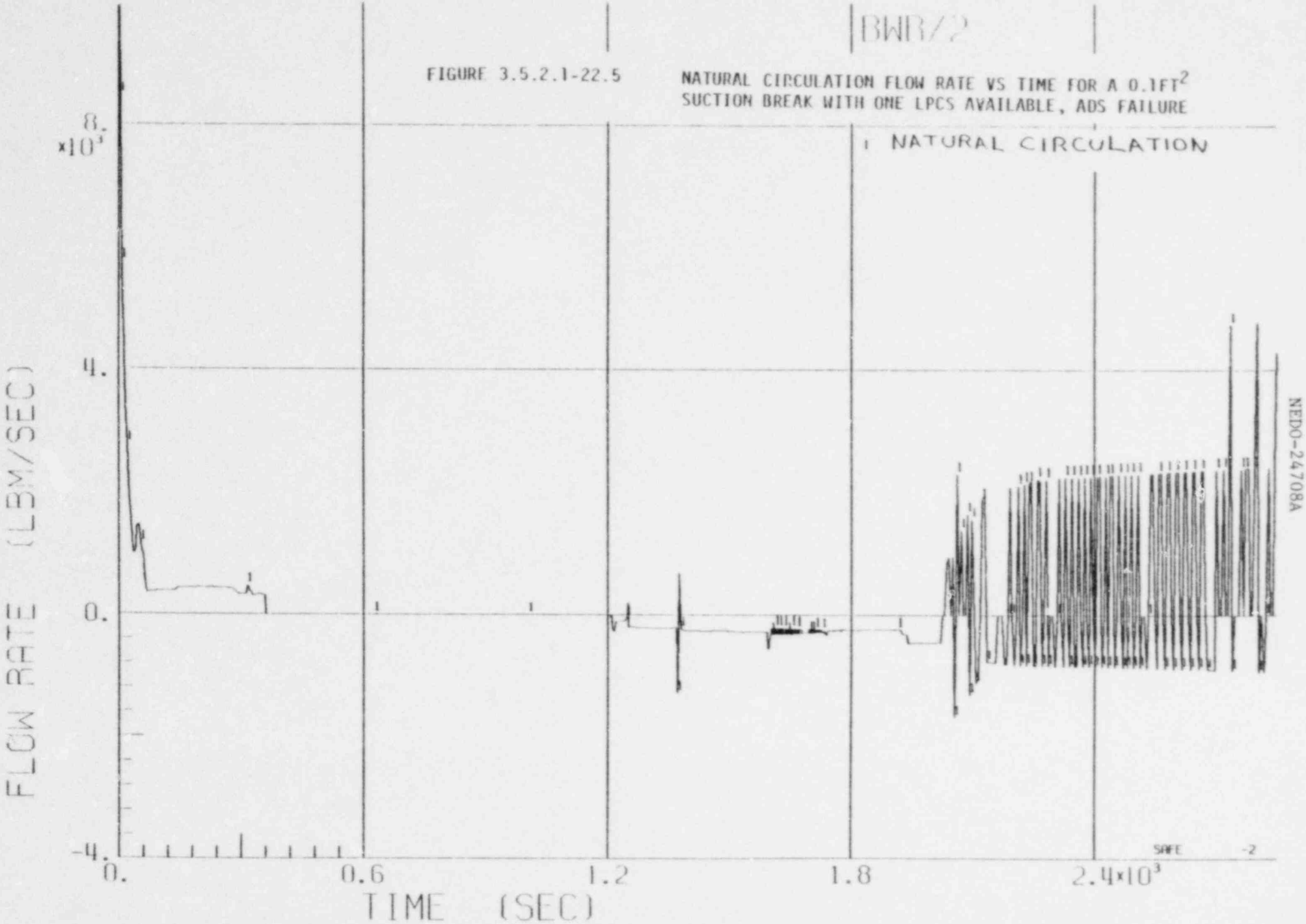
FIGURE 3.5.2.1-22.3 SYSTEM FLOW RATES VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABE, ADS FAILURE


BWR/2
FIGURE 3.5.2.1-22.4
FLOW RATES VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE, ADS FAILURE
1 STEAMLINE
2 ADS
3 BREAK
600.
400.
200.
0.
FLOW RATE (LBM/SEC)
0.
0.6
1.2
1.8
2.4×10^3
TIME (SEC)
SAFE
NEDO-24708A
4-1056

BWR/2

FIGURE 3.5.2.1-22.5

NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE, ADS FAILURE



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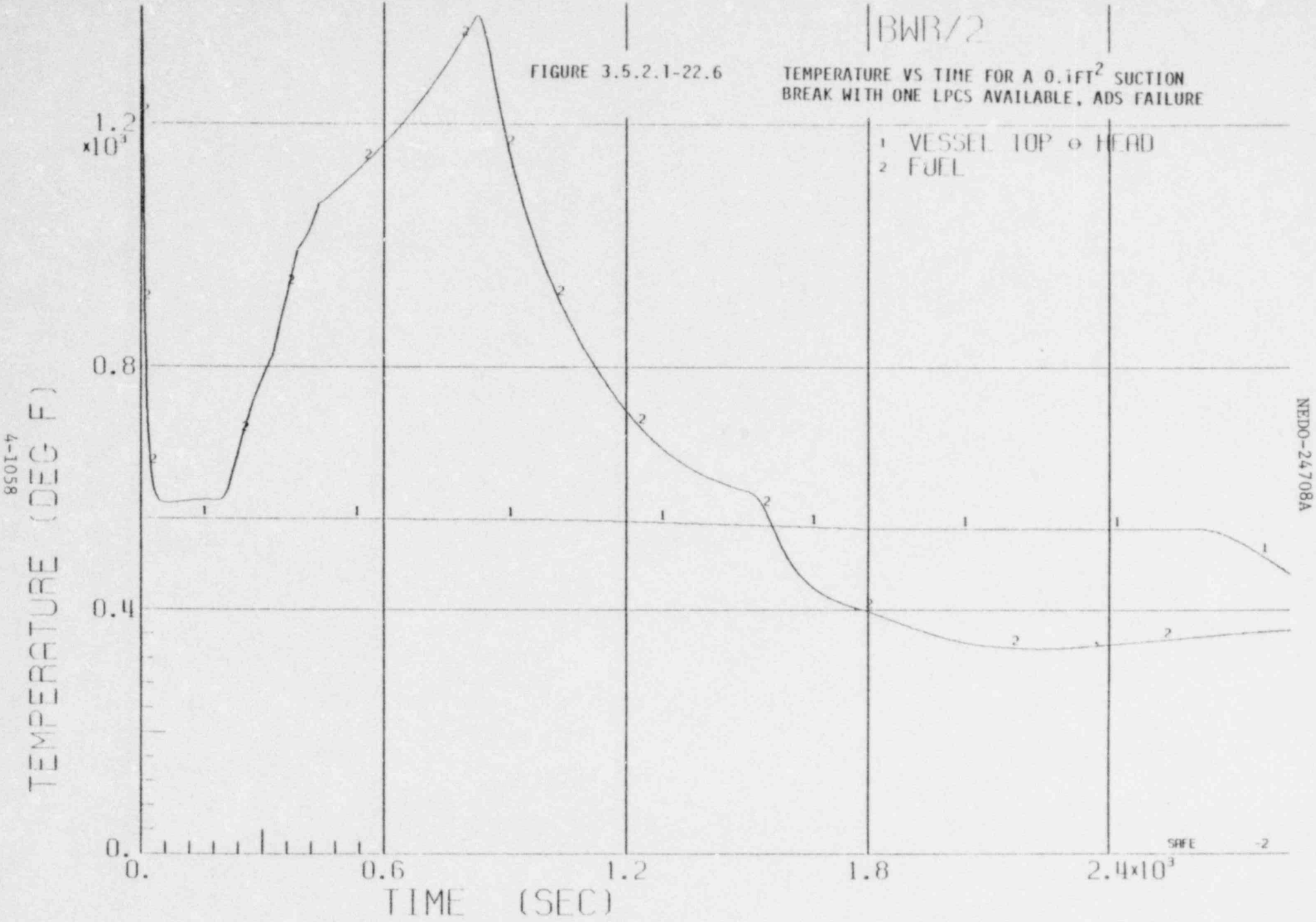
BWR/2
FIGURE 3.5.2.1-22.6
TEMPERATURE VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE, ADS FAILURE
1 VESSEL TOP & HEAD
2 FUEL
TEMPERATURE (DEG F)
1.2 x10^3
0.8
0.4
0.
0.
0.6
1.2
1.8
2.4x10^3
TIME (SEC)
SAFE -2
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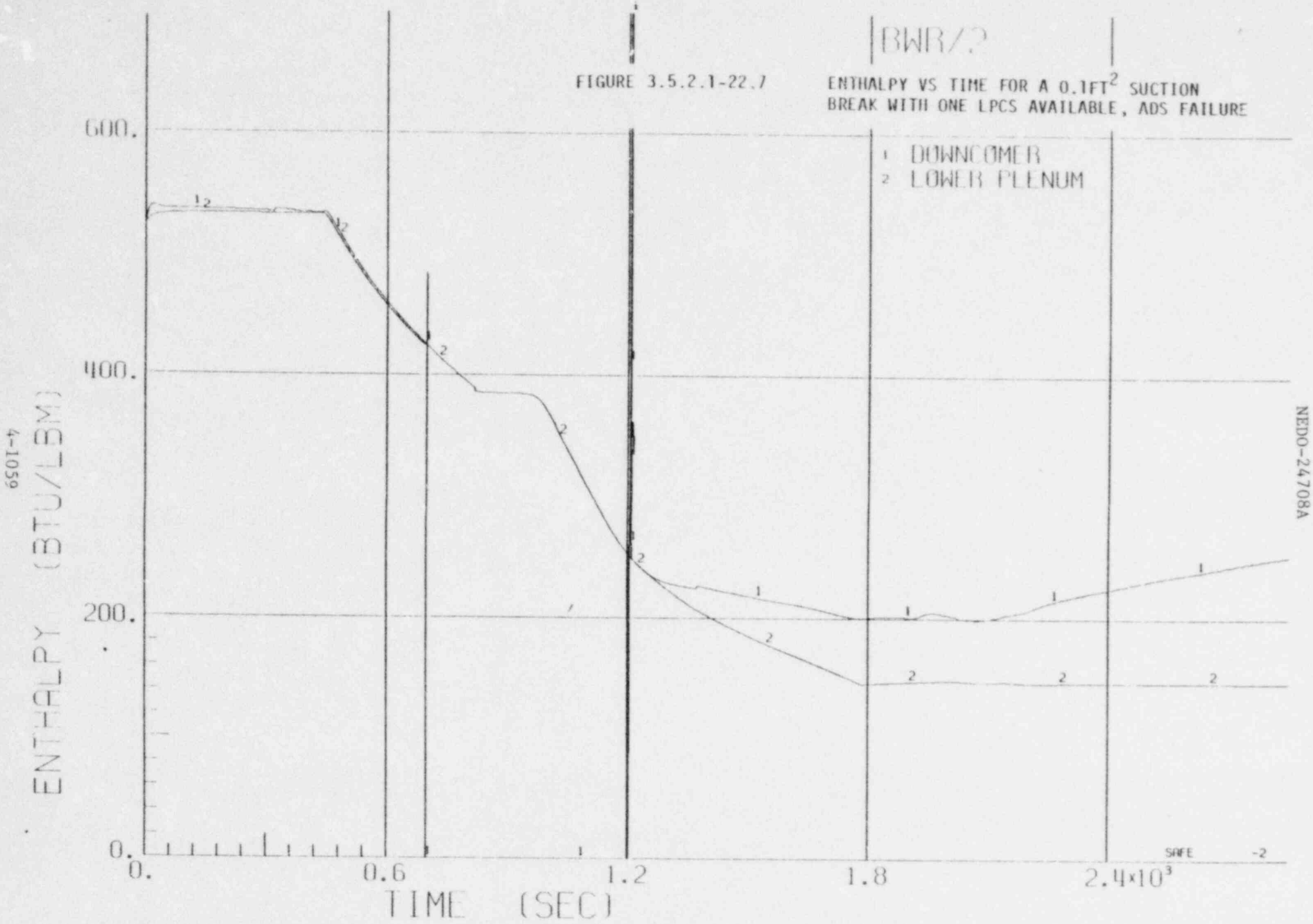
BWR/?
FIGURE 3.5.2.1-22.7
ENTHALPY VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE, ADS FAILURE
1 DOWNCOMER
2 LOWER PLENUM
600.
400.
200.
0.
ENTHALPY (BTU/LBM)
0.
0.6
1.2
1.8
2.4x10^3
TIME (SEC)
SAFE -2
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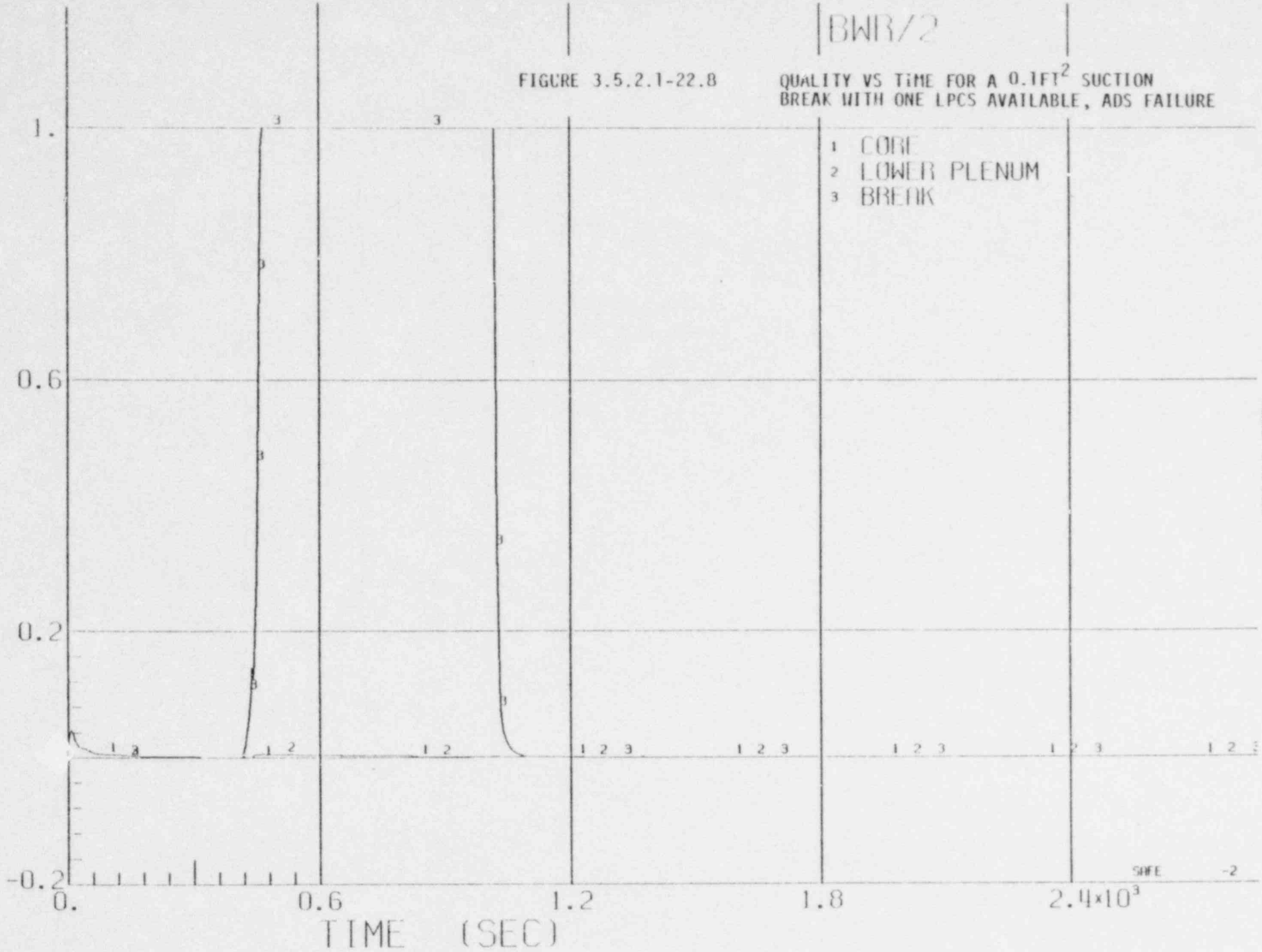

FIGURE 3.5.2.1-22.8 QUALITY VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCS AVAILABLE, ADS FAILURE

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FIGURE 3.5.2.1-23.1 SYSTEM PRESSURE VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

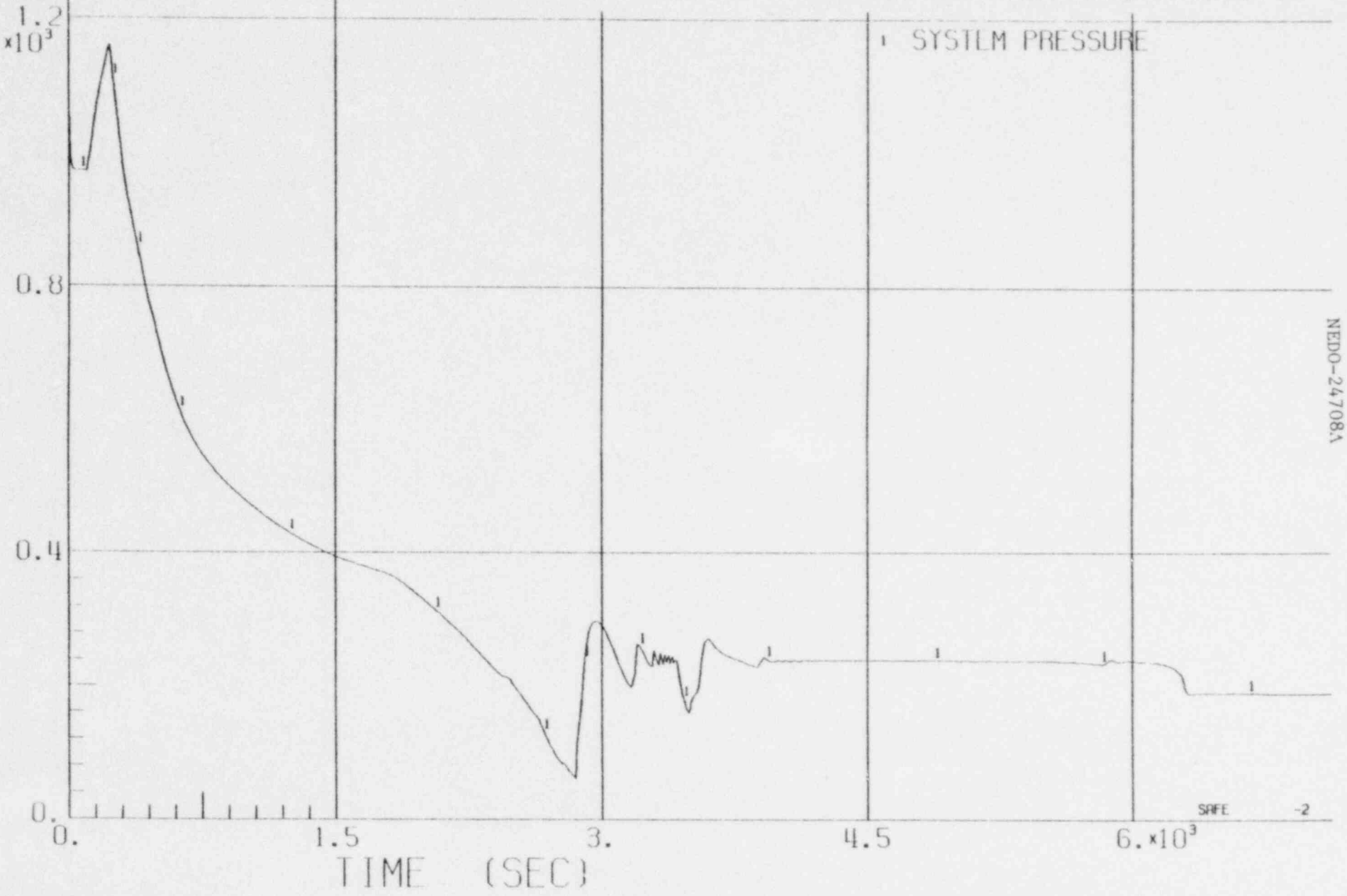

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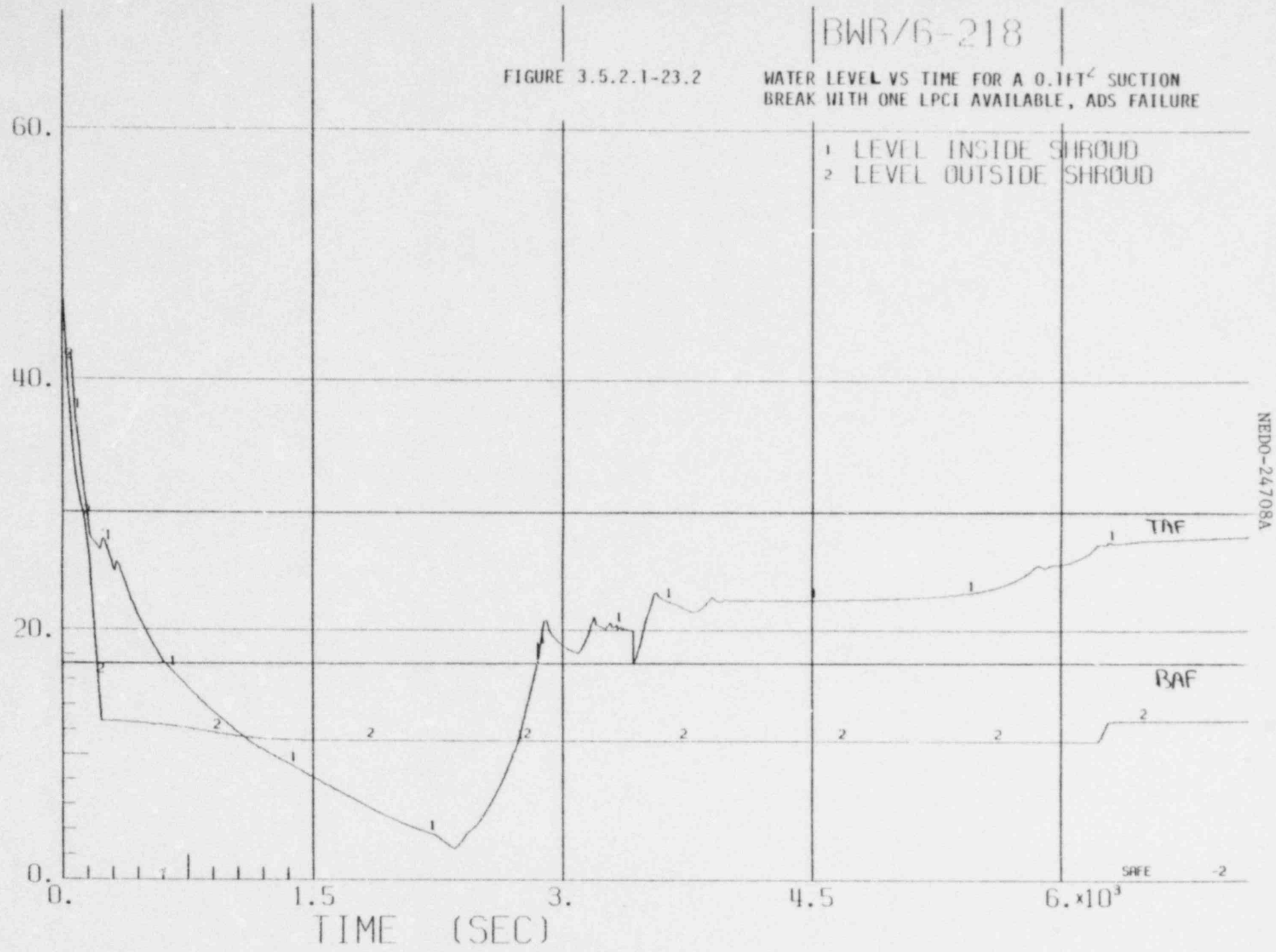
FIGURE 3.5.2.1-23.2 WATER LEVEL VS TIME FOR A 0.1FT² SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE



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4-1062

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FIGURE 3.5.2.1-23.3 SYSTEM FLOW RATES VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

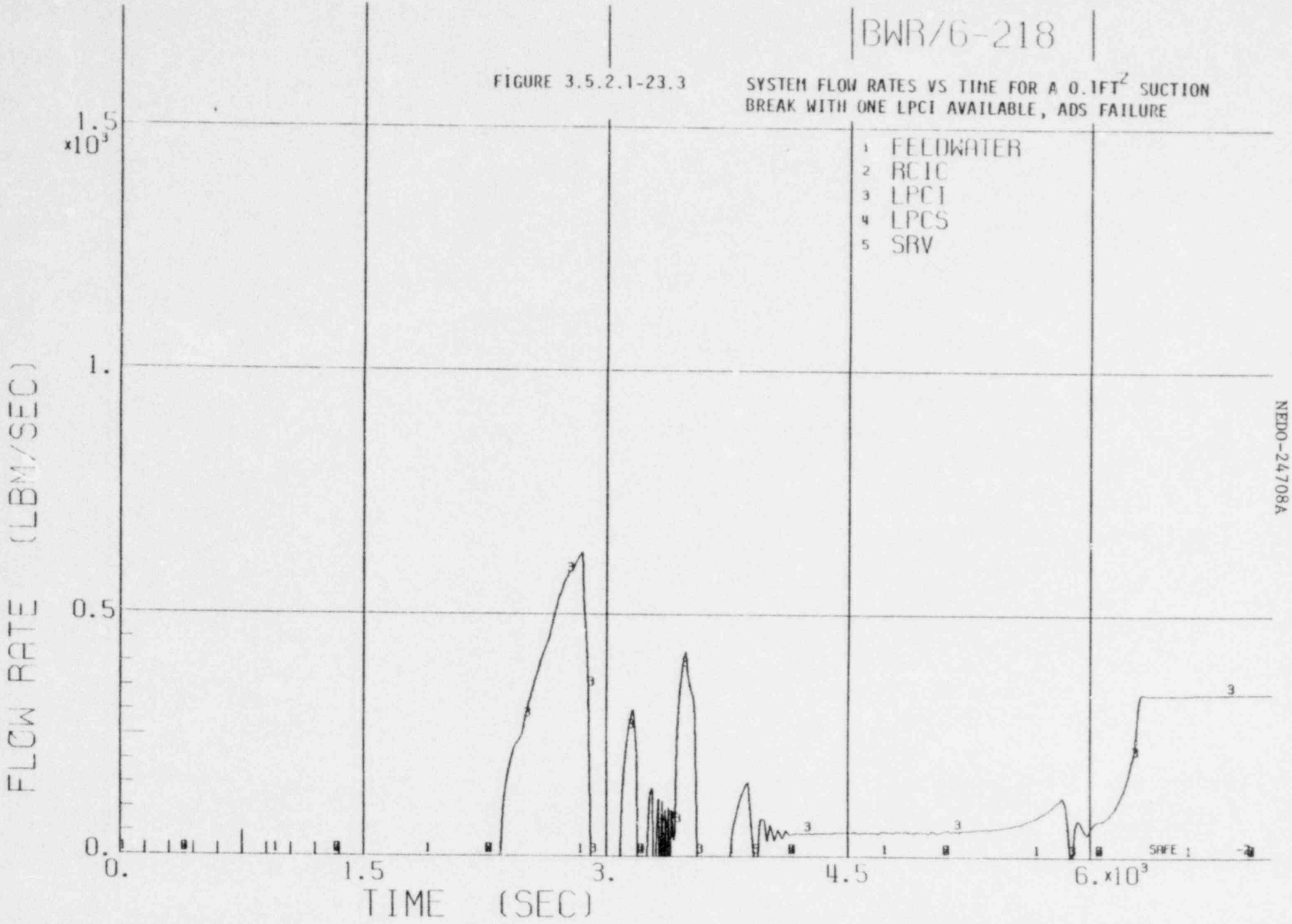

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FIGURE 3.5.2.1-23.4 FLOW RATES VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

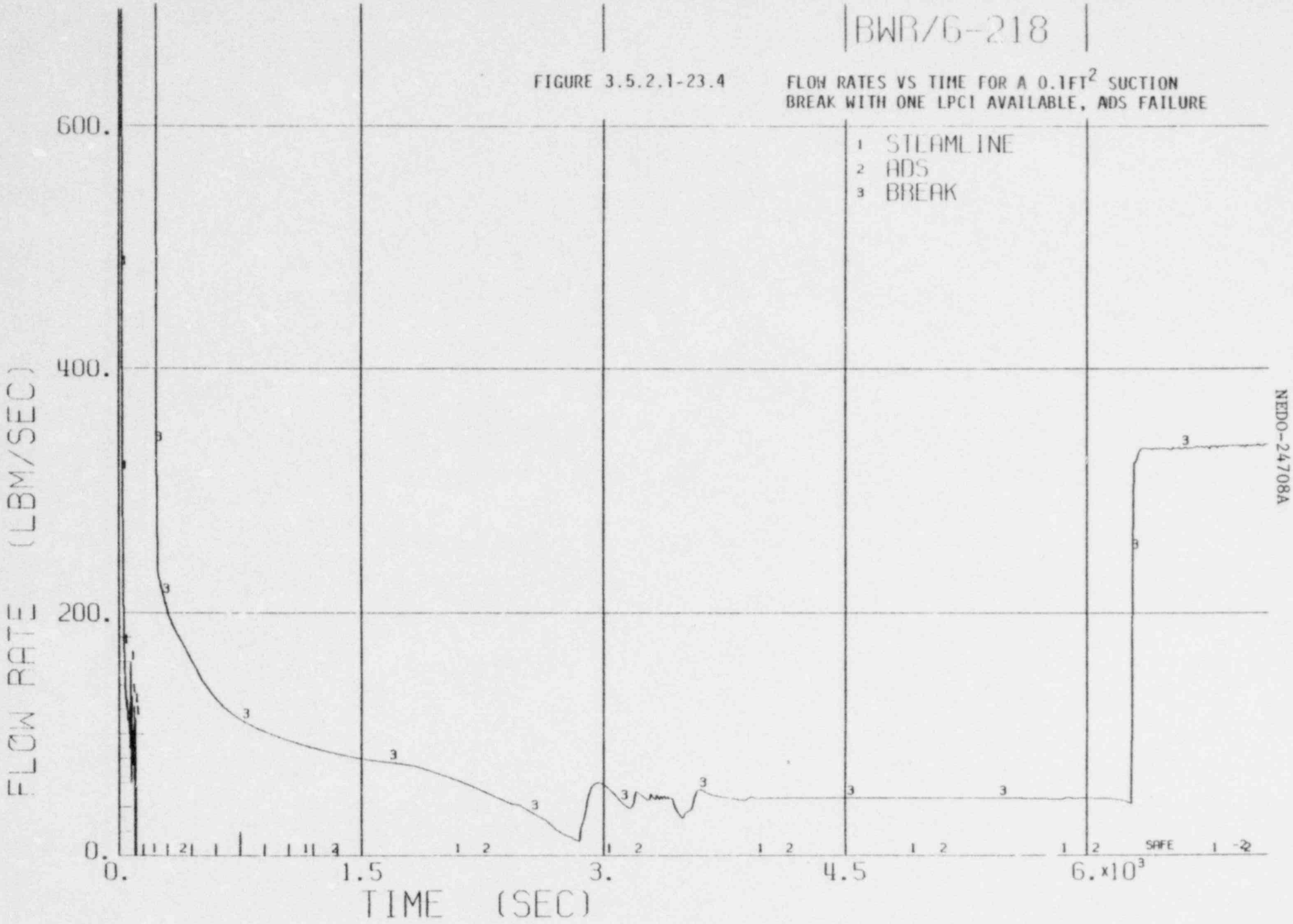

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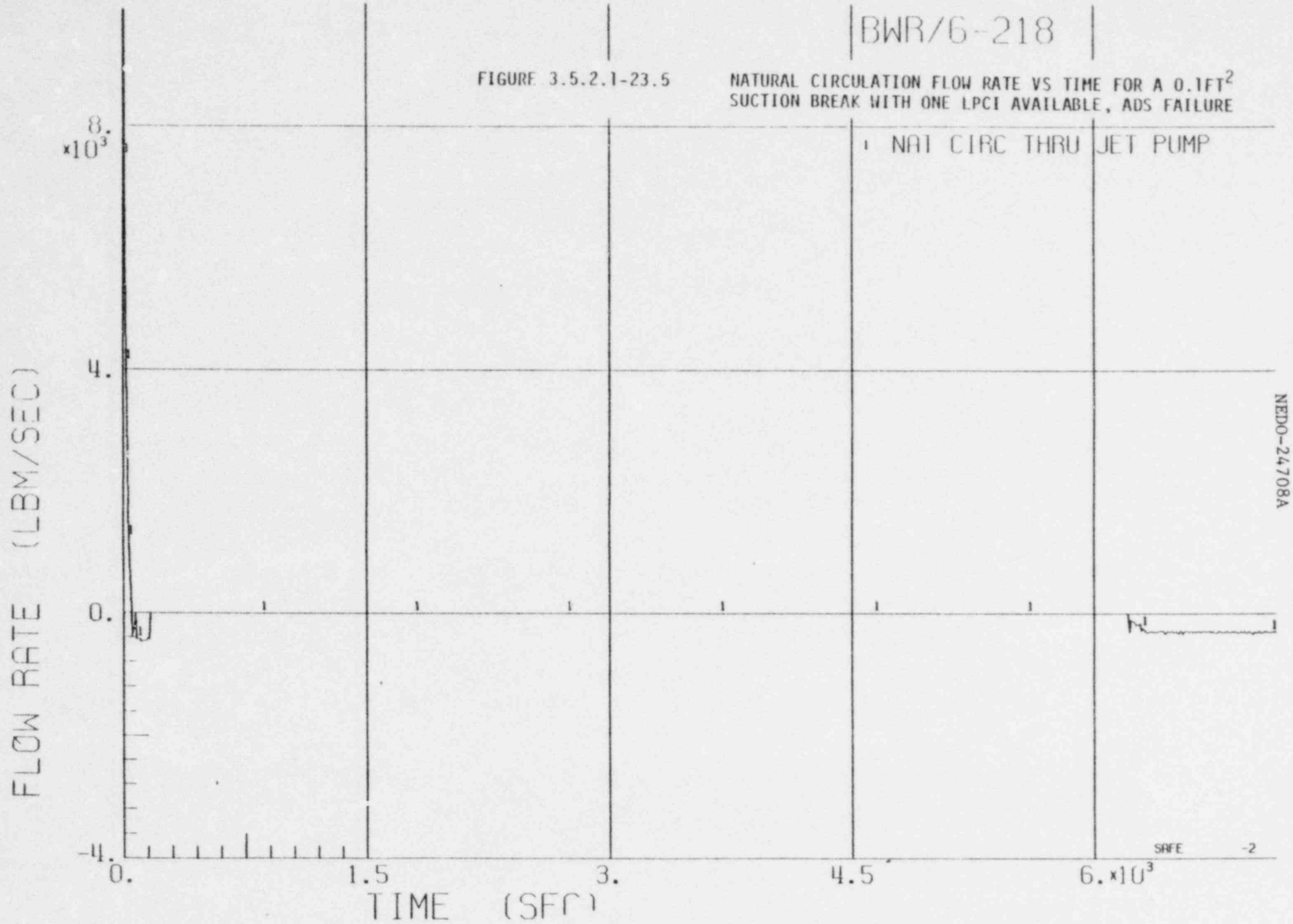
FIGURE 3.5.2.1-23.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE



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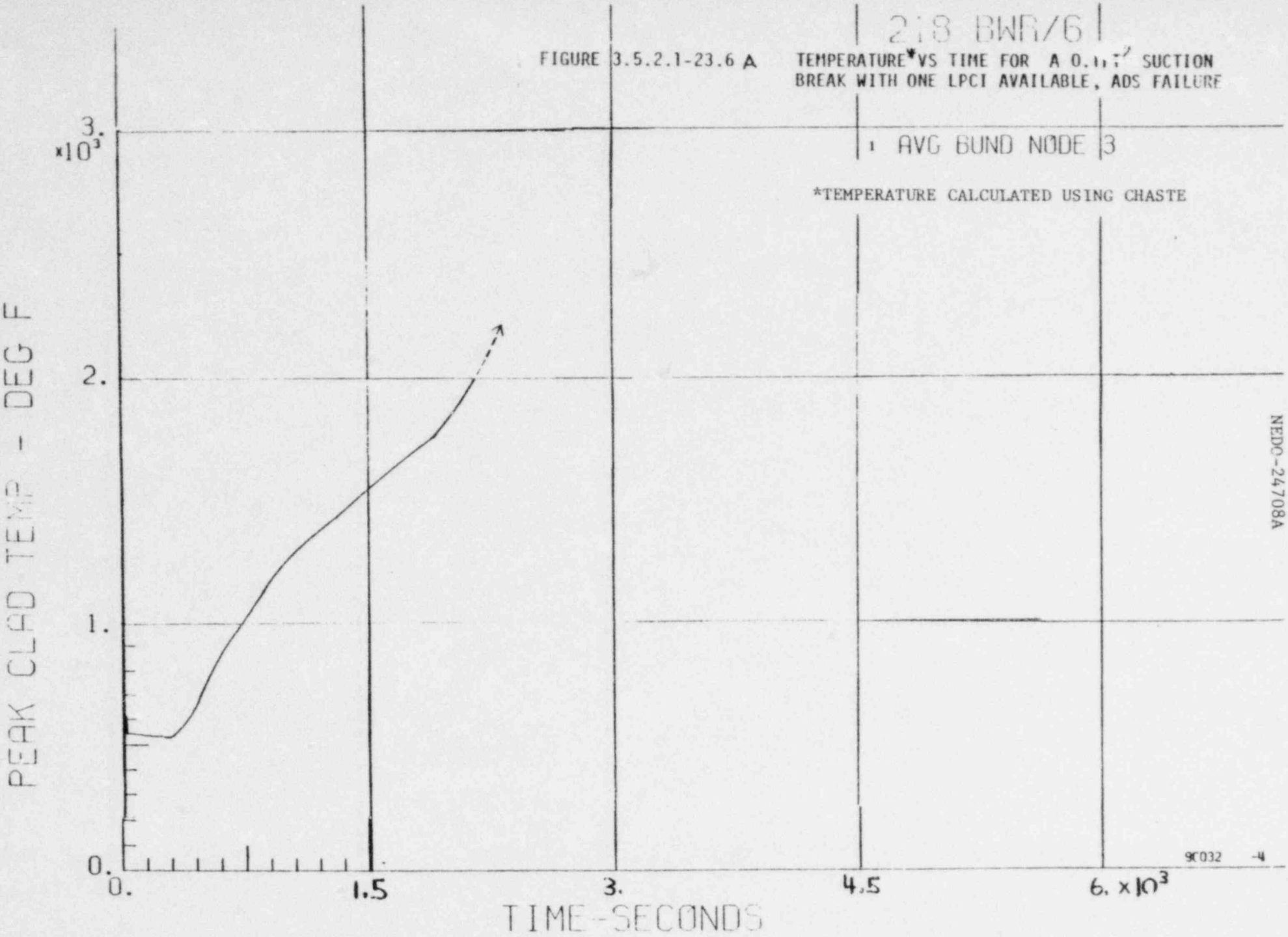

FIGURE 3.5.2.1-23.6 A TEMPERATURE* VS TIME FOR A 0.1 FT² SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

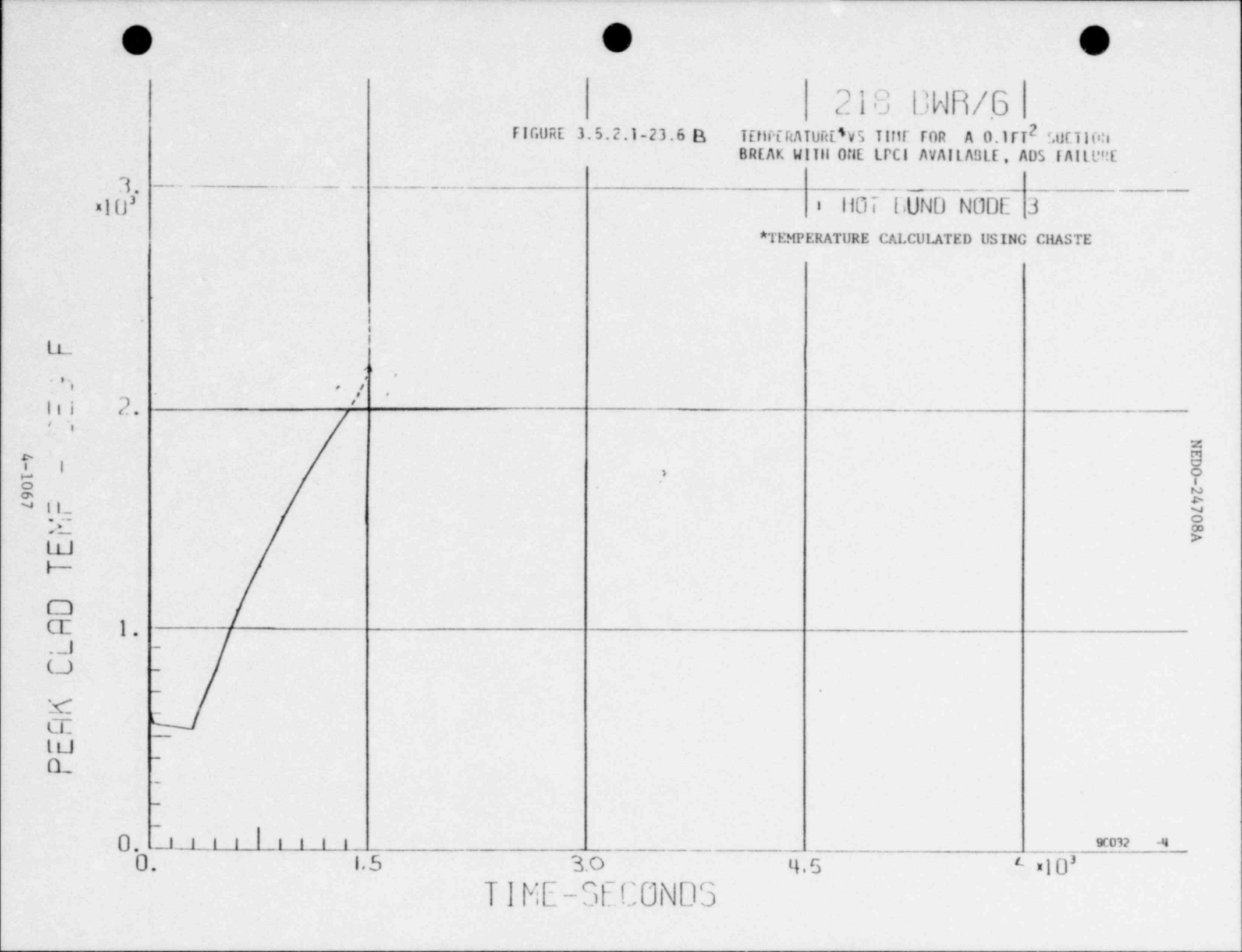
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FIGURE 3.5.2.1-23.6 B
TEMPERATURE* VS TIME FOR A 0.1FT2 SUCTION
BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE
HOT BUND NODE 3
*TEMPERATURE CALCULATED USING CHASTE
PEAK CLAD TEMP - DEG F
3.
x10³
2.
1.
0.
0.
1.5
3.0
4.5
x10³
TIME-SECONDS
NEDO-24708A
4-1067
9C032 -4

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FIGURE 3.5.2.1-23.7 ENTHALPY VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

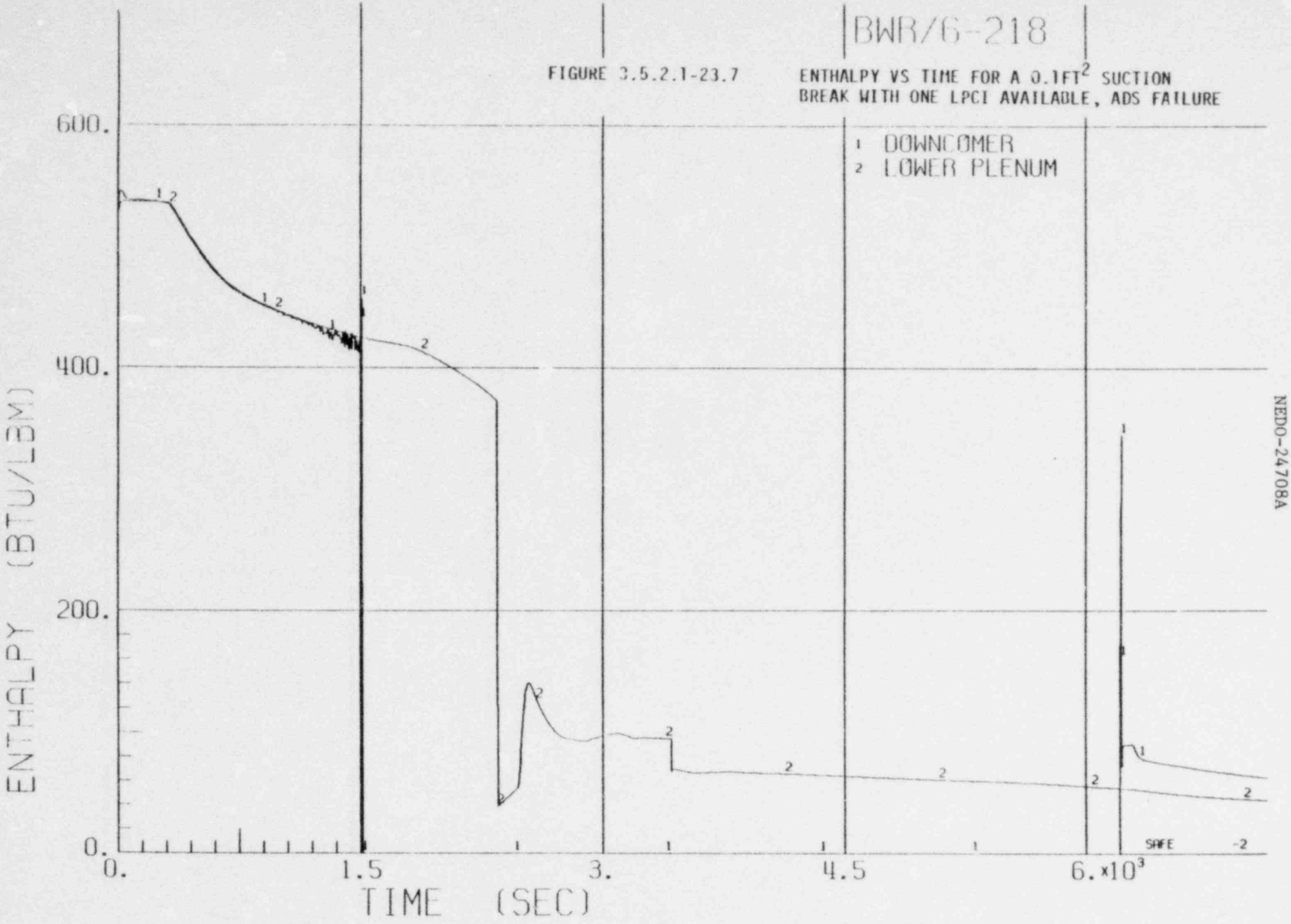

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FIGURE 3.5.2.1-23.8 QUALITY VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

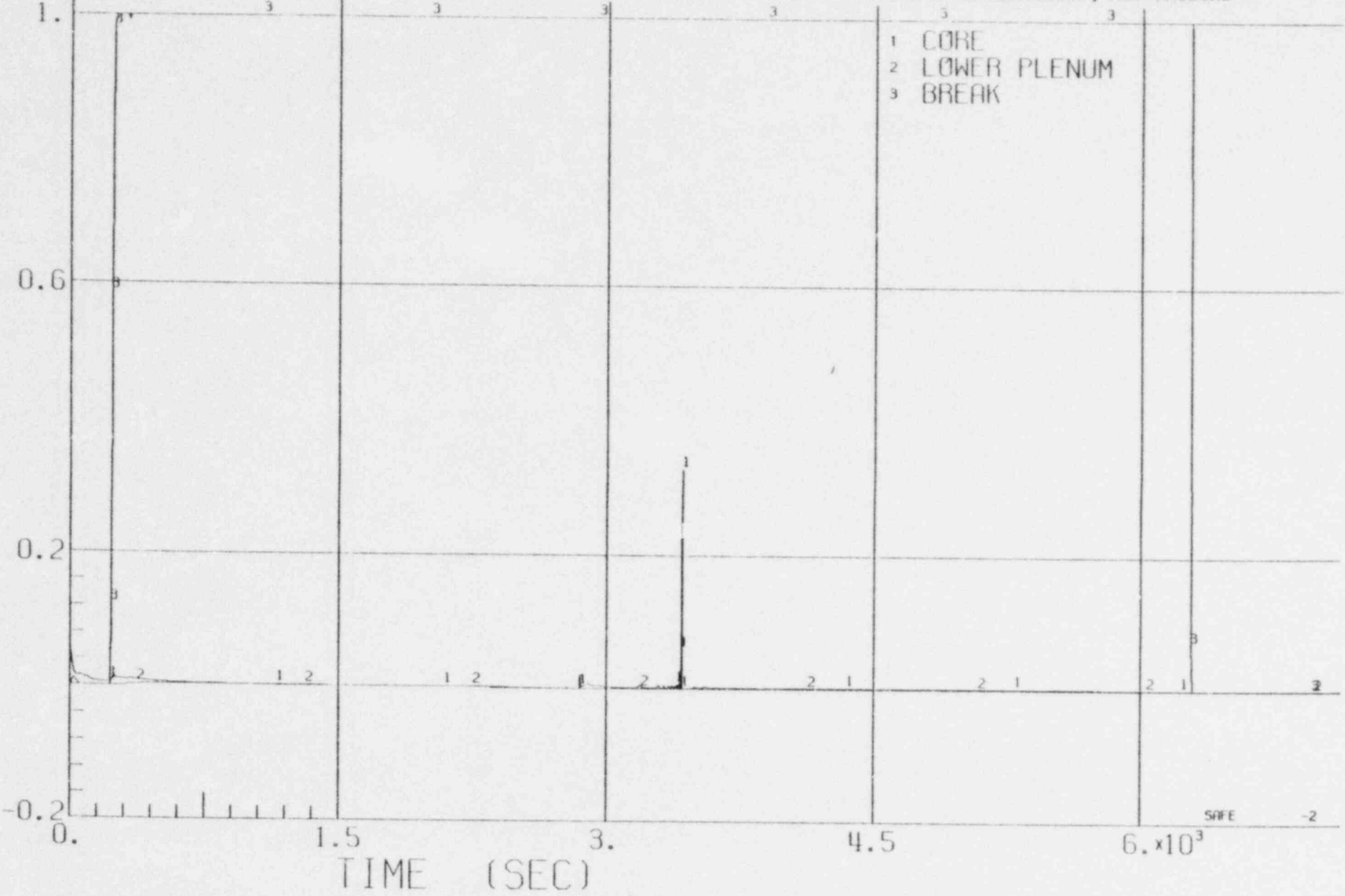

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FIGURE 3.5.2.1-24.1 SYSTEM PRESSURE VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

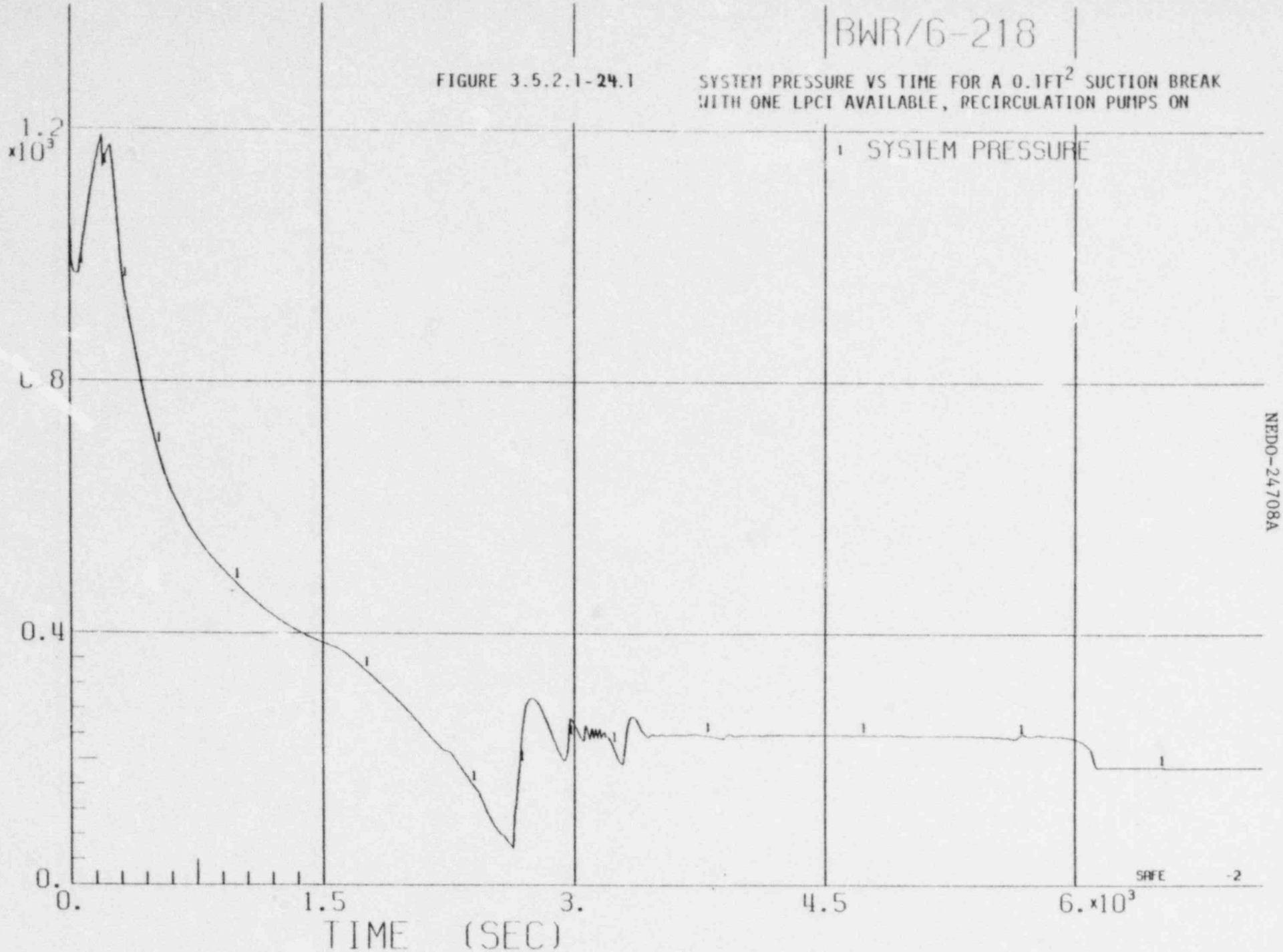

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FIGURE 3.5.2.1-24.2 WATER LEVEL VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

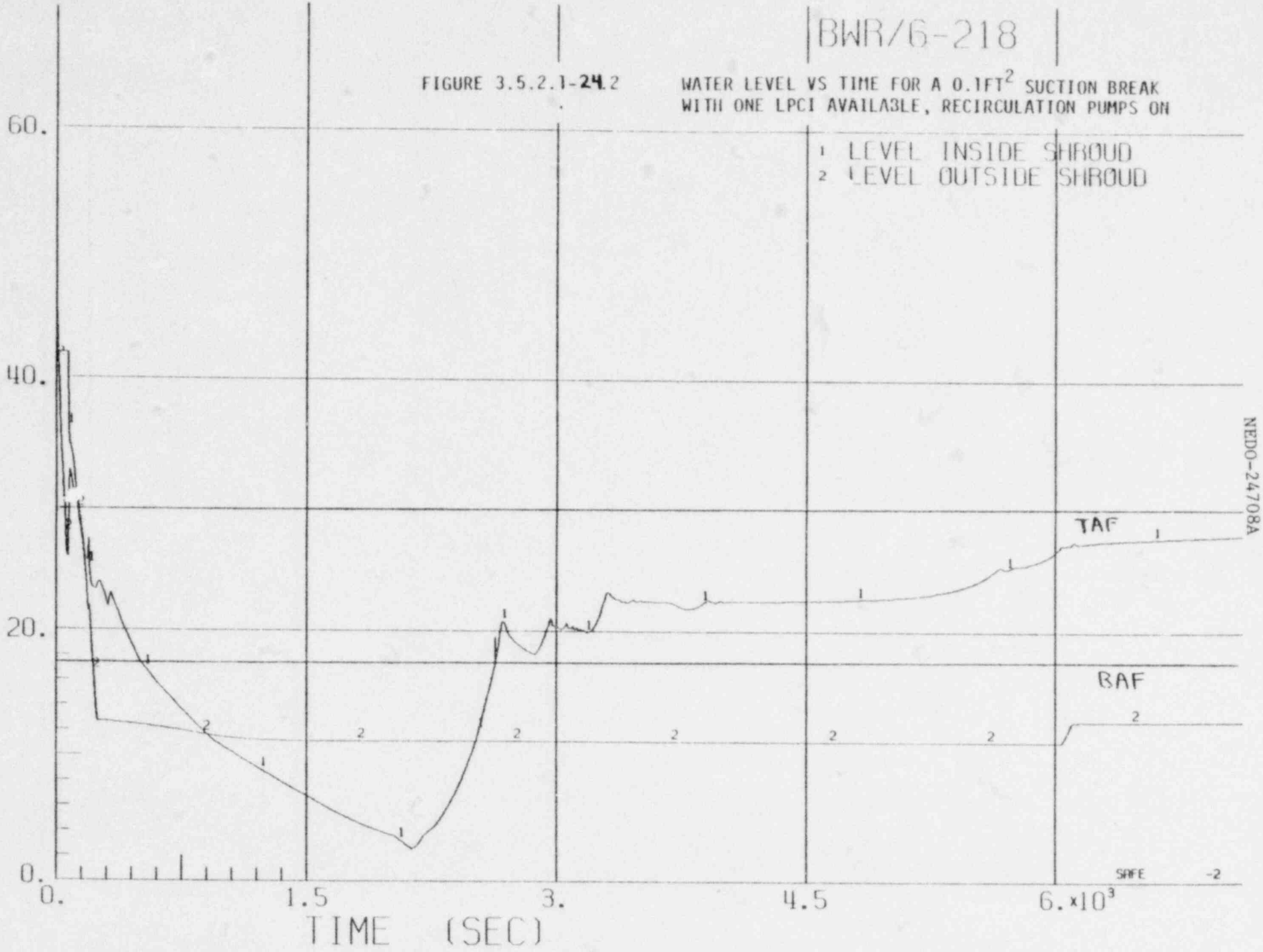

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FIGURE 2.5.2.1-24.3 SYSTEM FLOW RATES VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

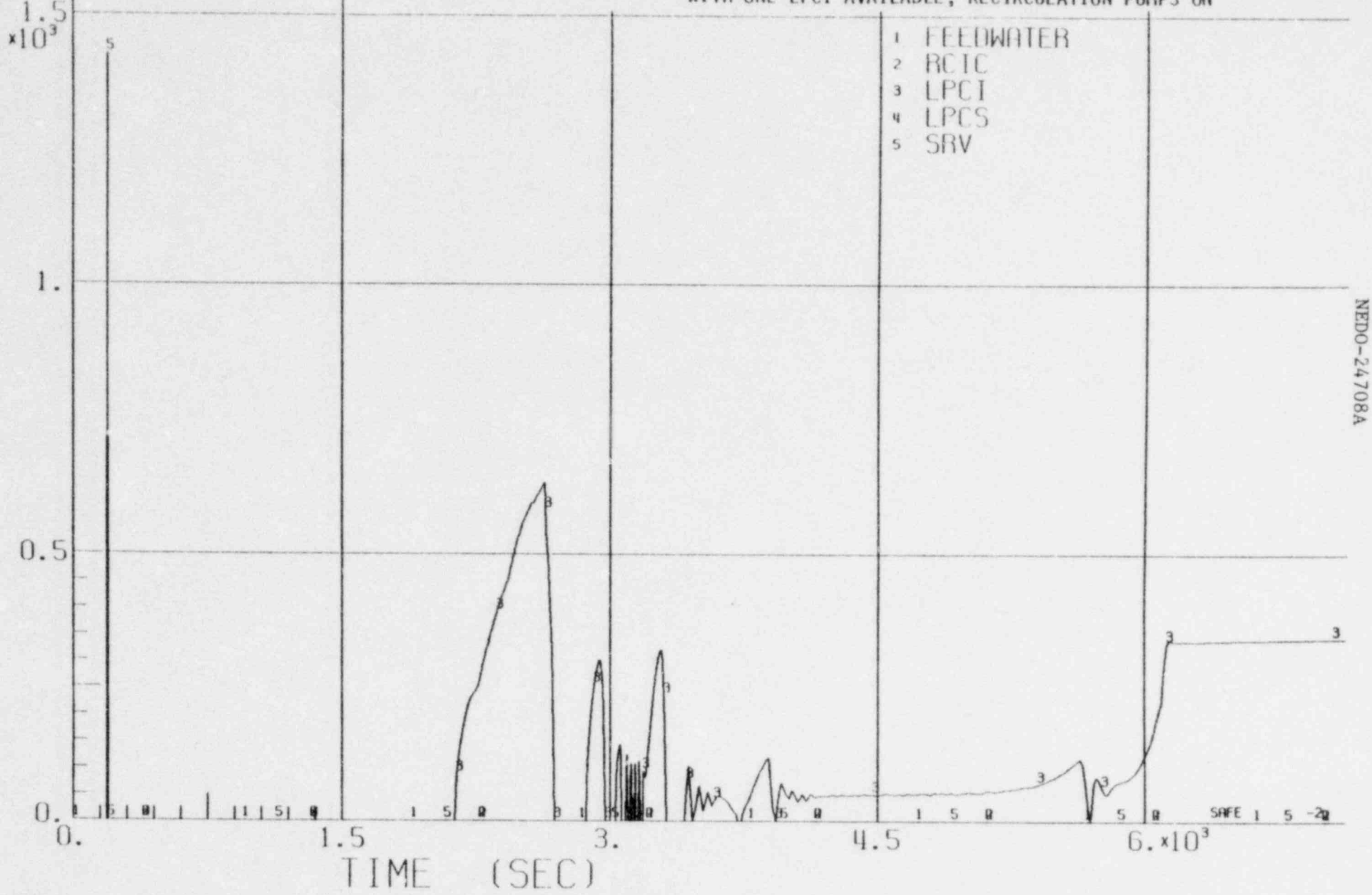

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FIGURE 3.5.2.1-24.4 FLOW RATES VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

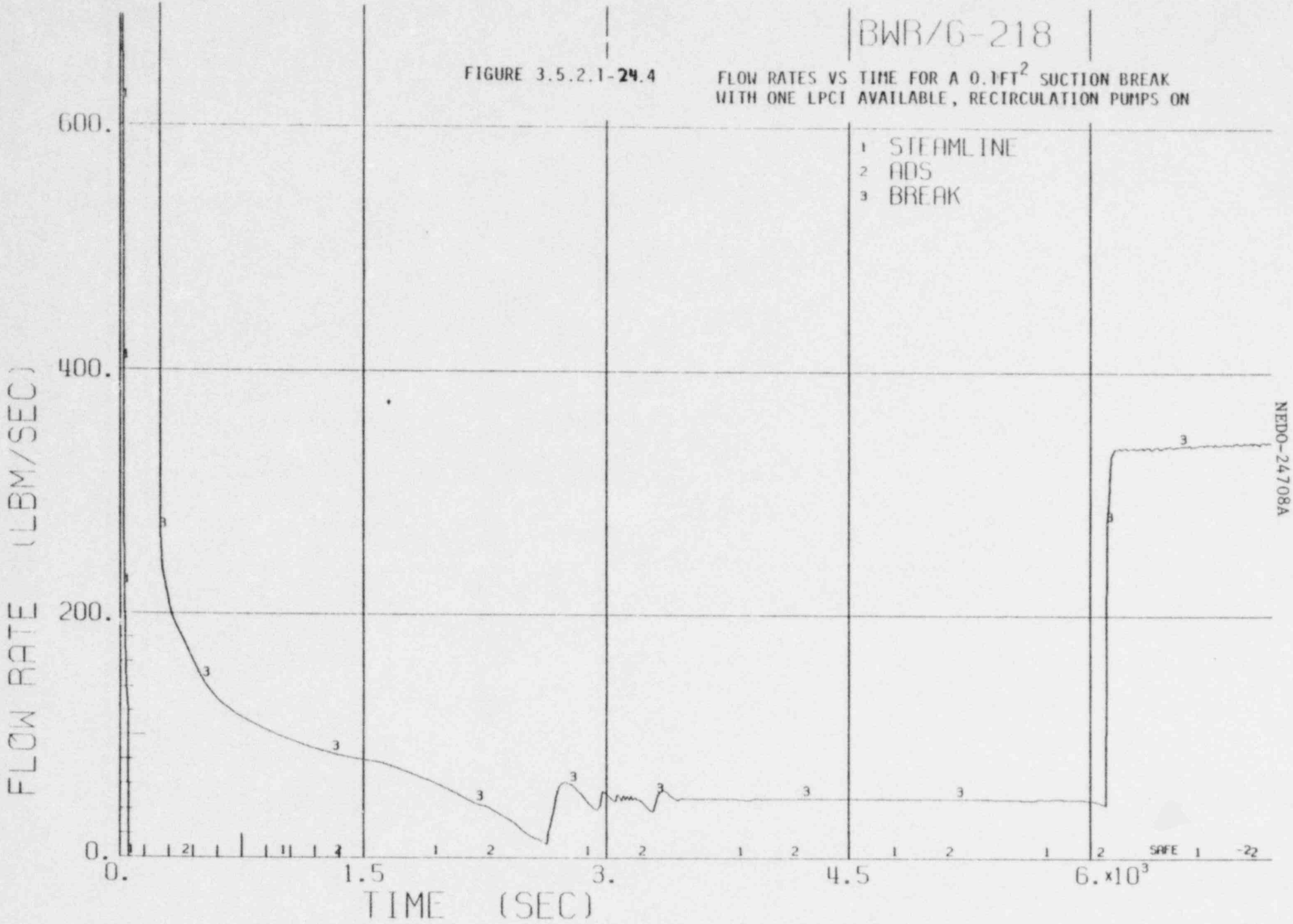

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FIGURE 3.5.2.1-24.5

NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

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FIGURE 3.5.2.1-24.6A TEMPERATURE* VS TIME FOR A 0.1FT^2 SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

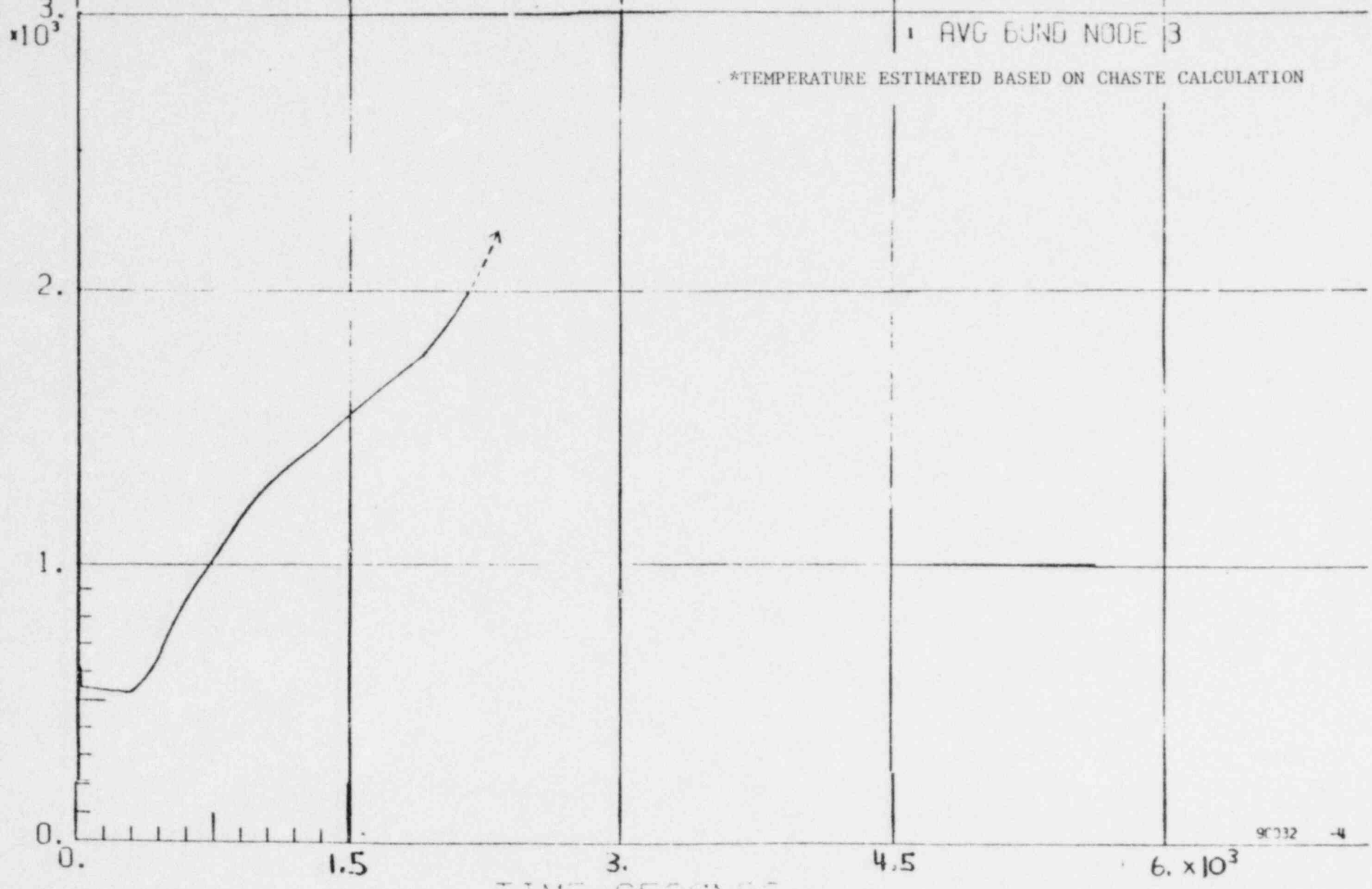

FIGURE 3.5.2.1-24.6B TEMPERATURE* VS TIME FOR A 0.1FT^2 SUCTION-BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

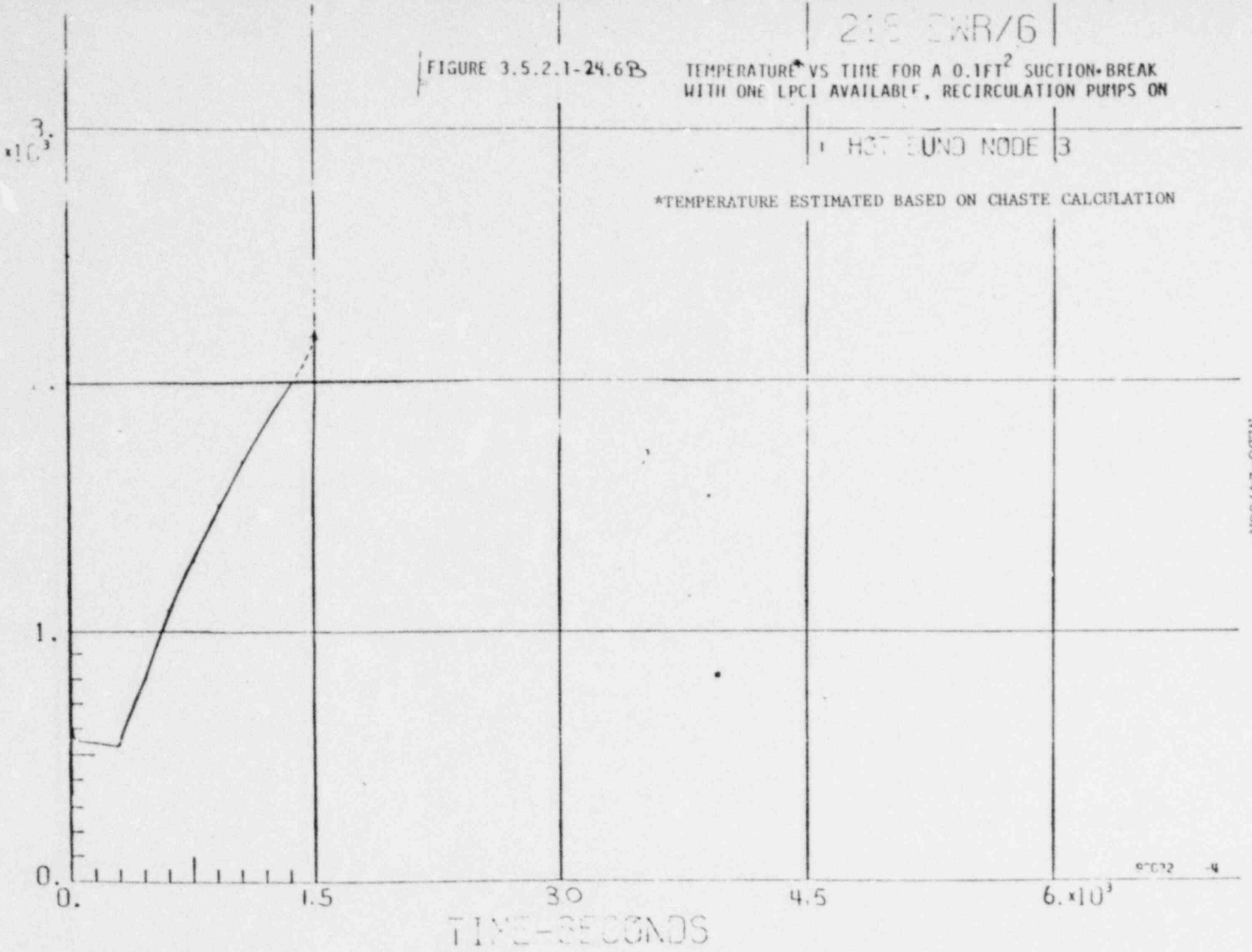

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FIGURE 3.5.2.1-24.7 ENTHALPY VS TIME FOR A SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

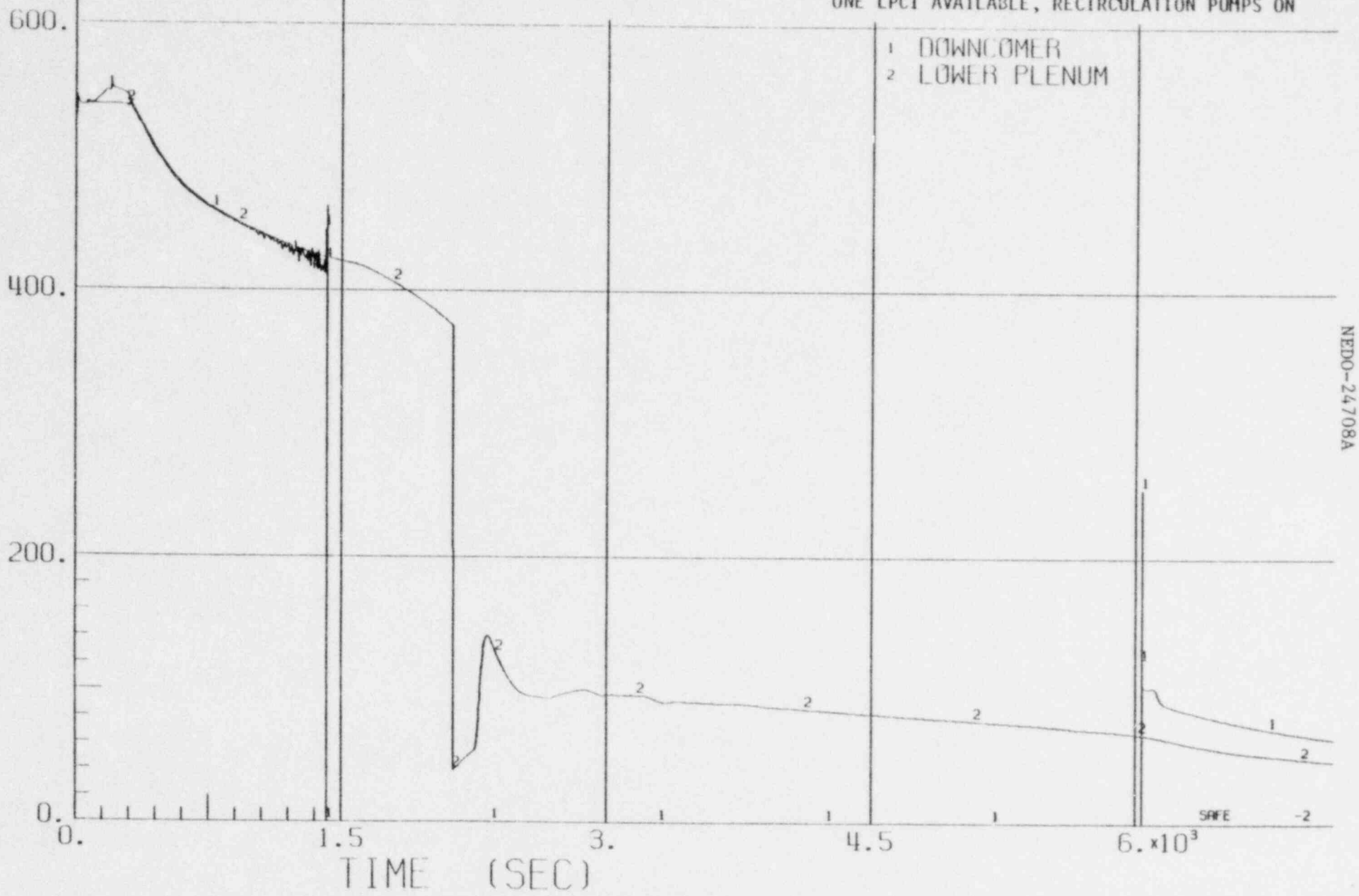

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FIGURE 3.5.2.1-24.8 QUALITY VS TIME FOR A SUCTION BREAK WITH ONE LPCI AVAILABLE, RECIRCULATION PUMPS ON

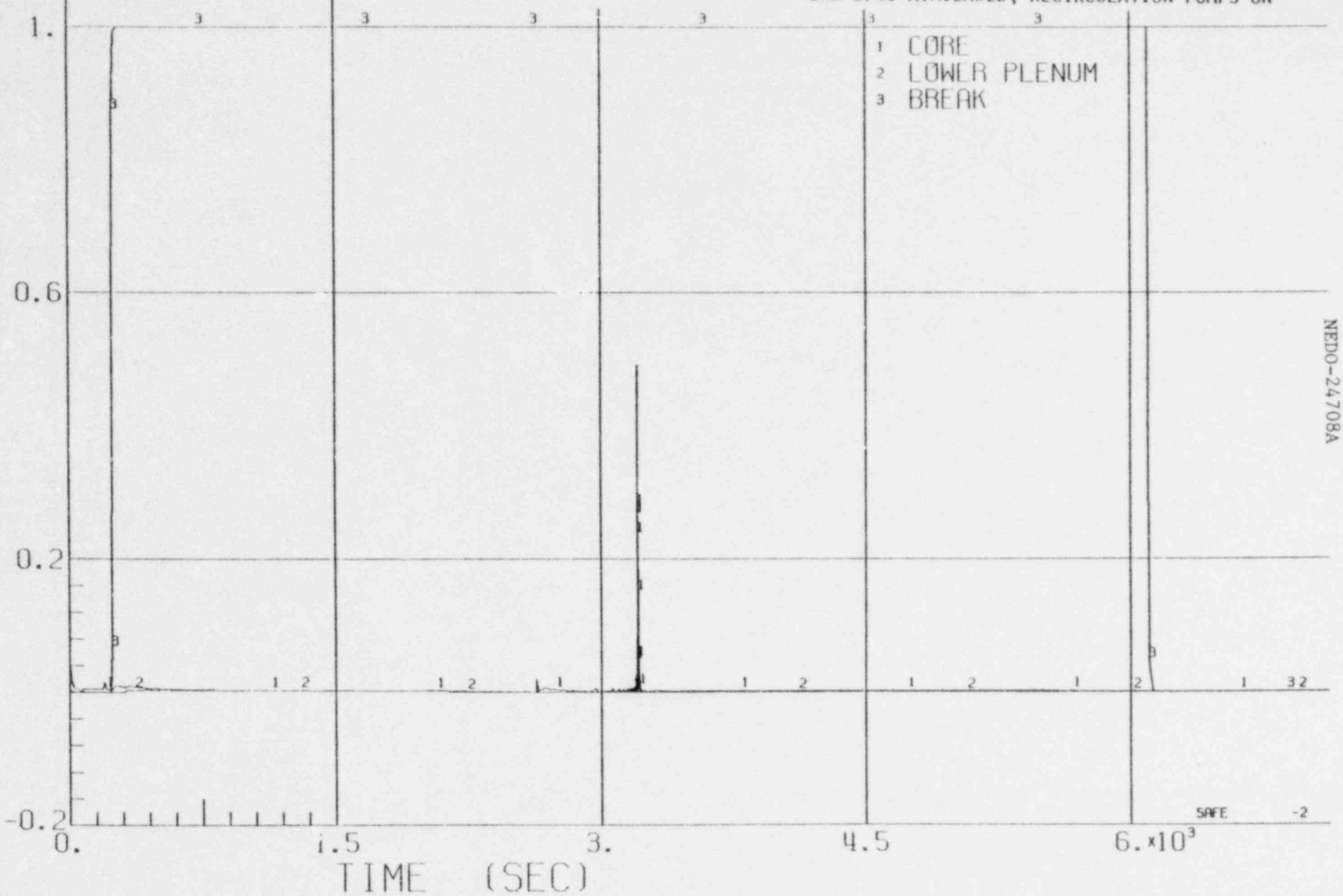

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FIGURE 3.5.2.1-25.1 SYSTEM PRESSURE VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

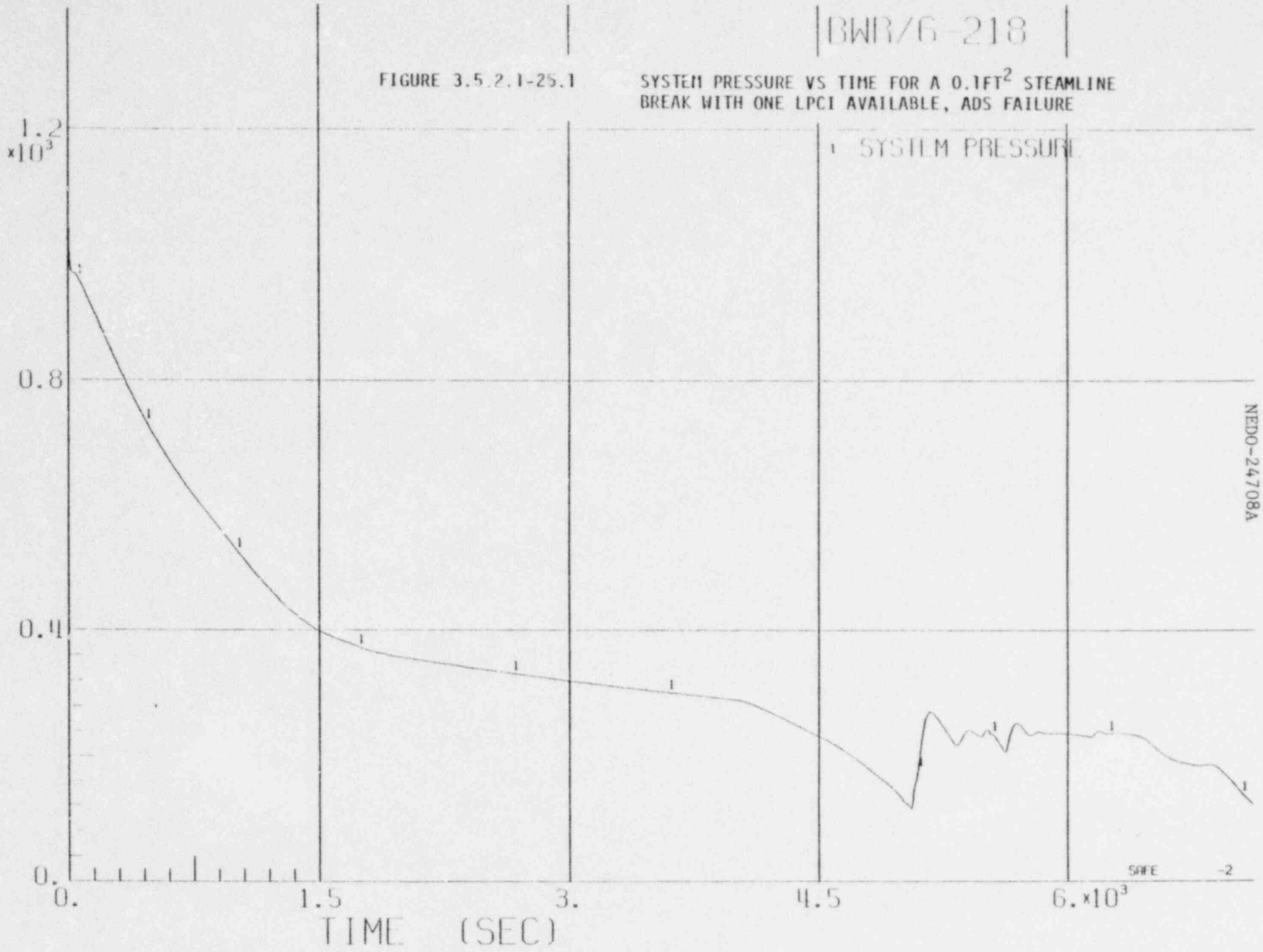

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FIGURE 3.5.2.1-25.2 WATER LEVEL VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

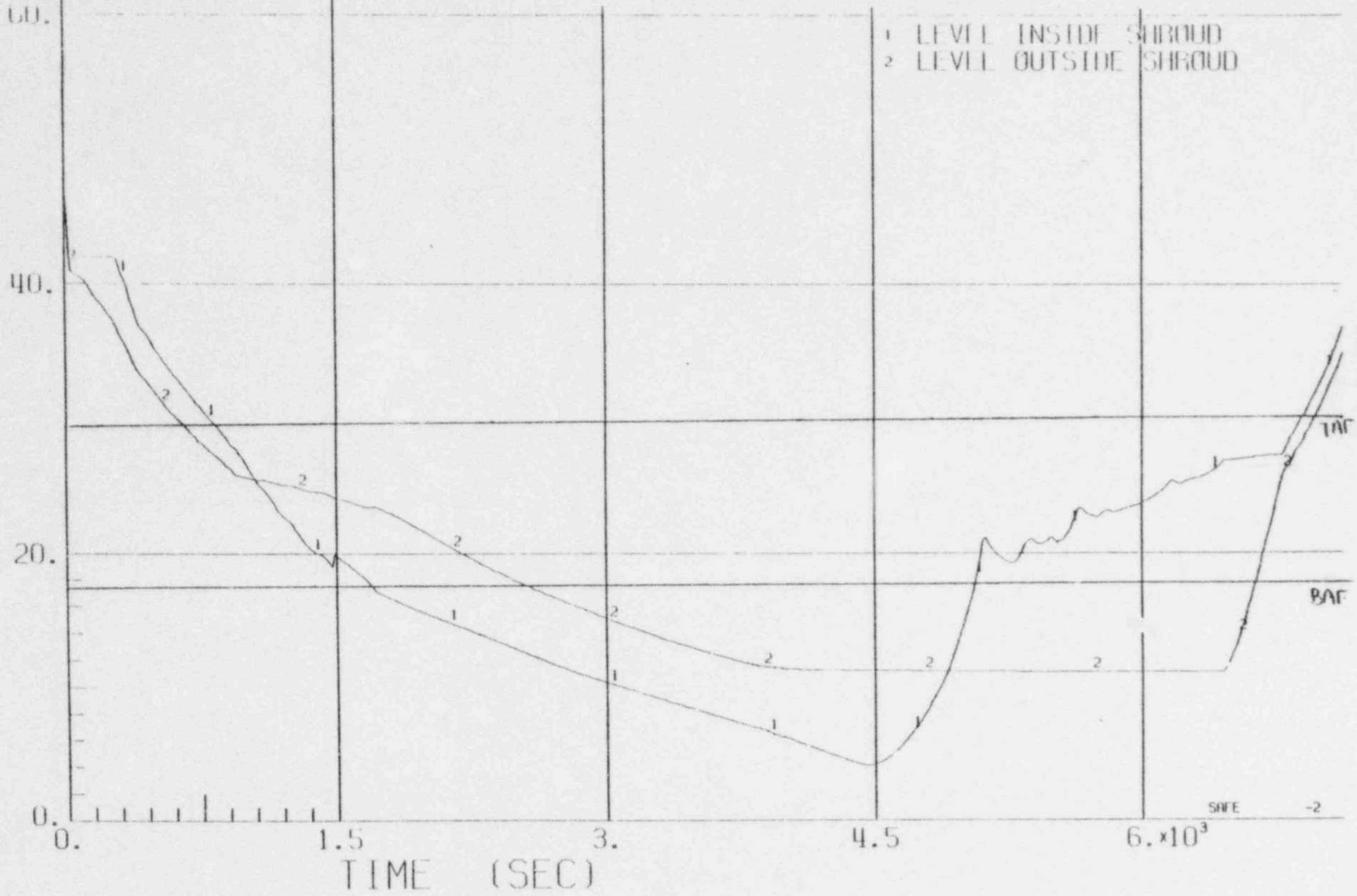

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FIGURE 3.5.2.1-25.3 SYSTEM FLOW RATES VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

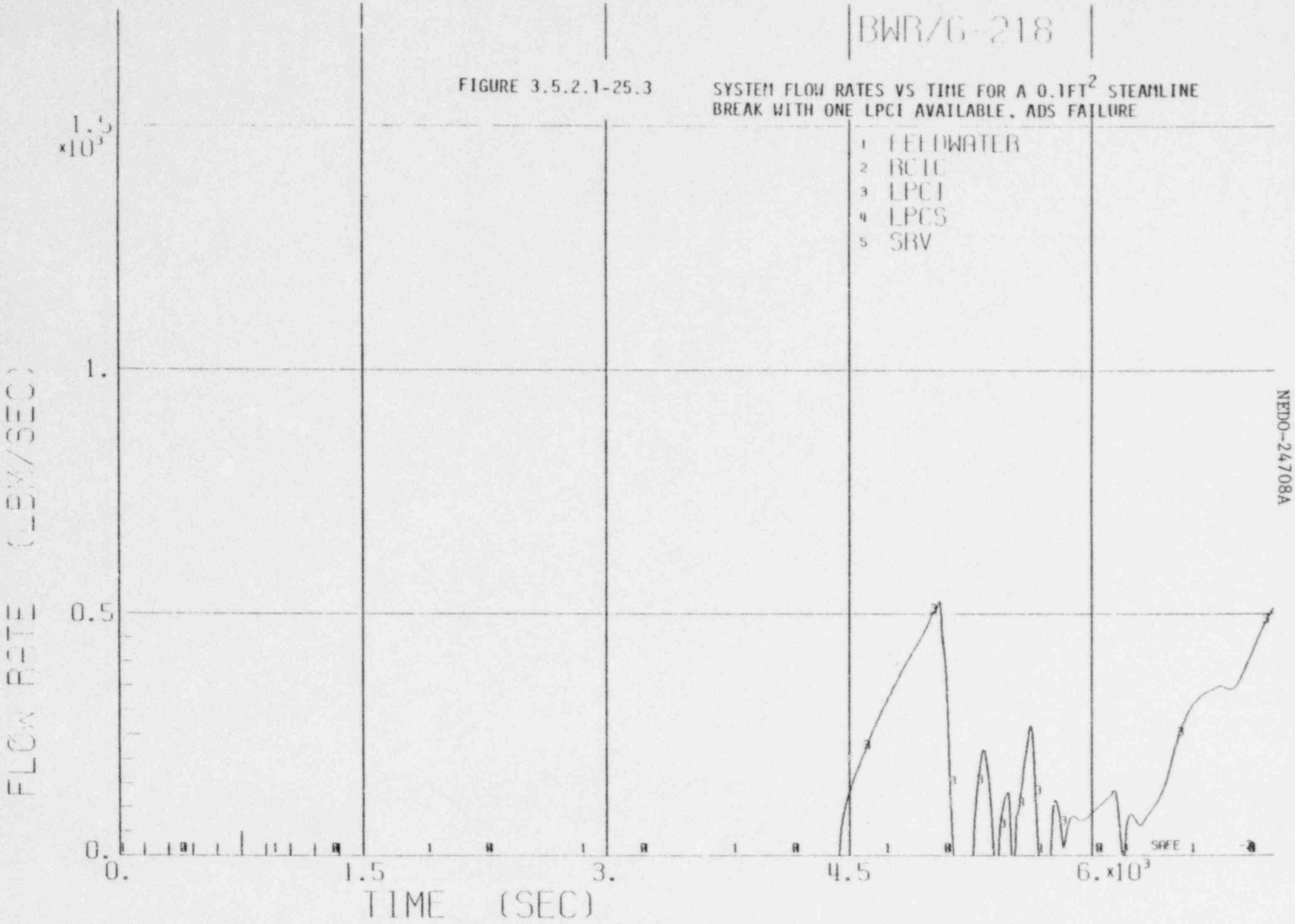

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FIGURE 3.5.2.1-25.4

FLOW RATES VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

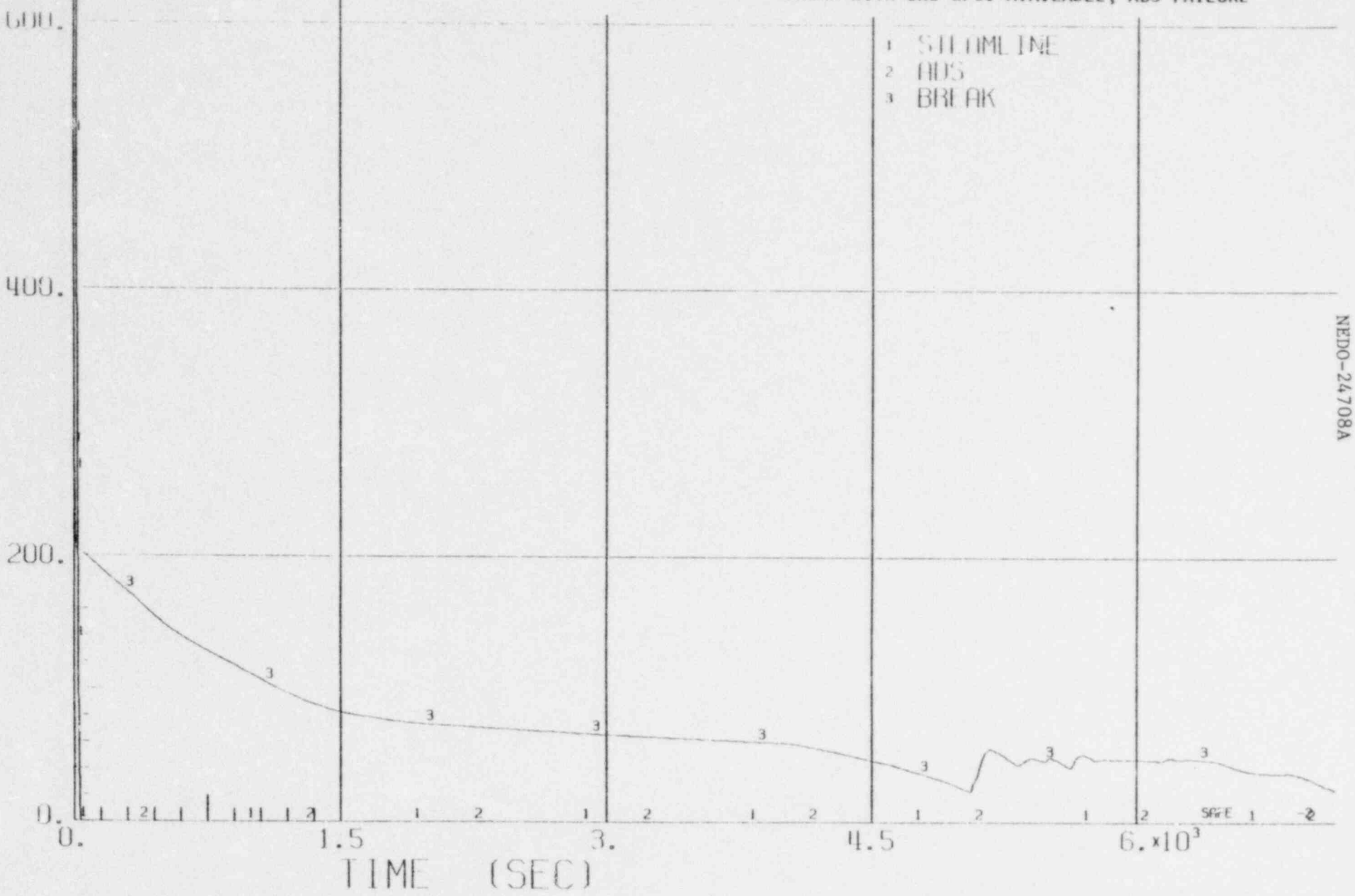

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FIGURE 3.5.2.1-25.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

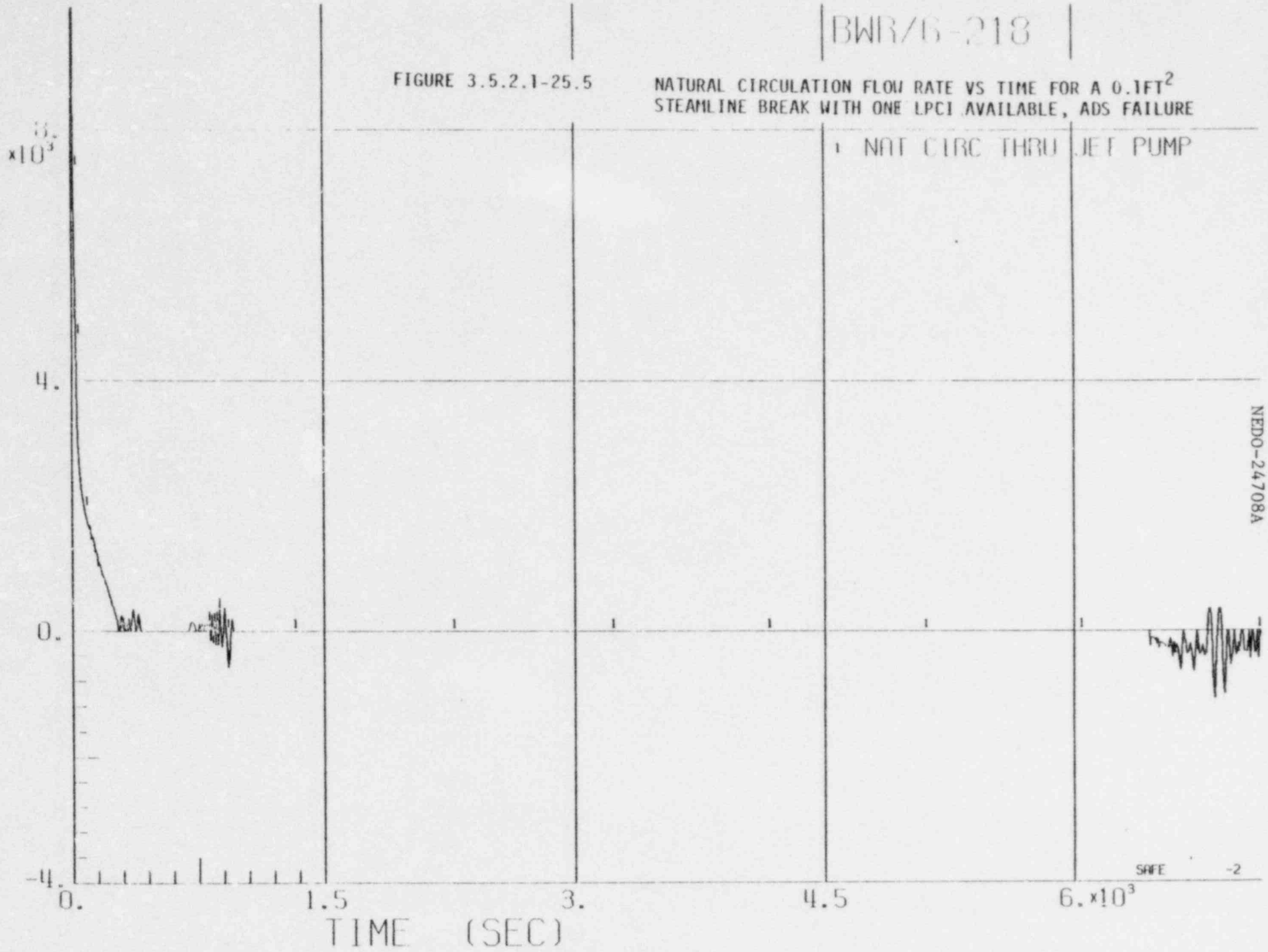

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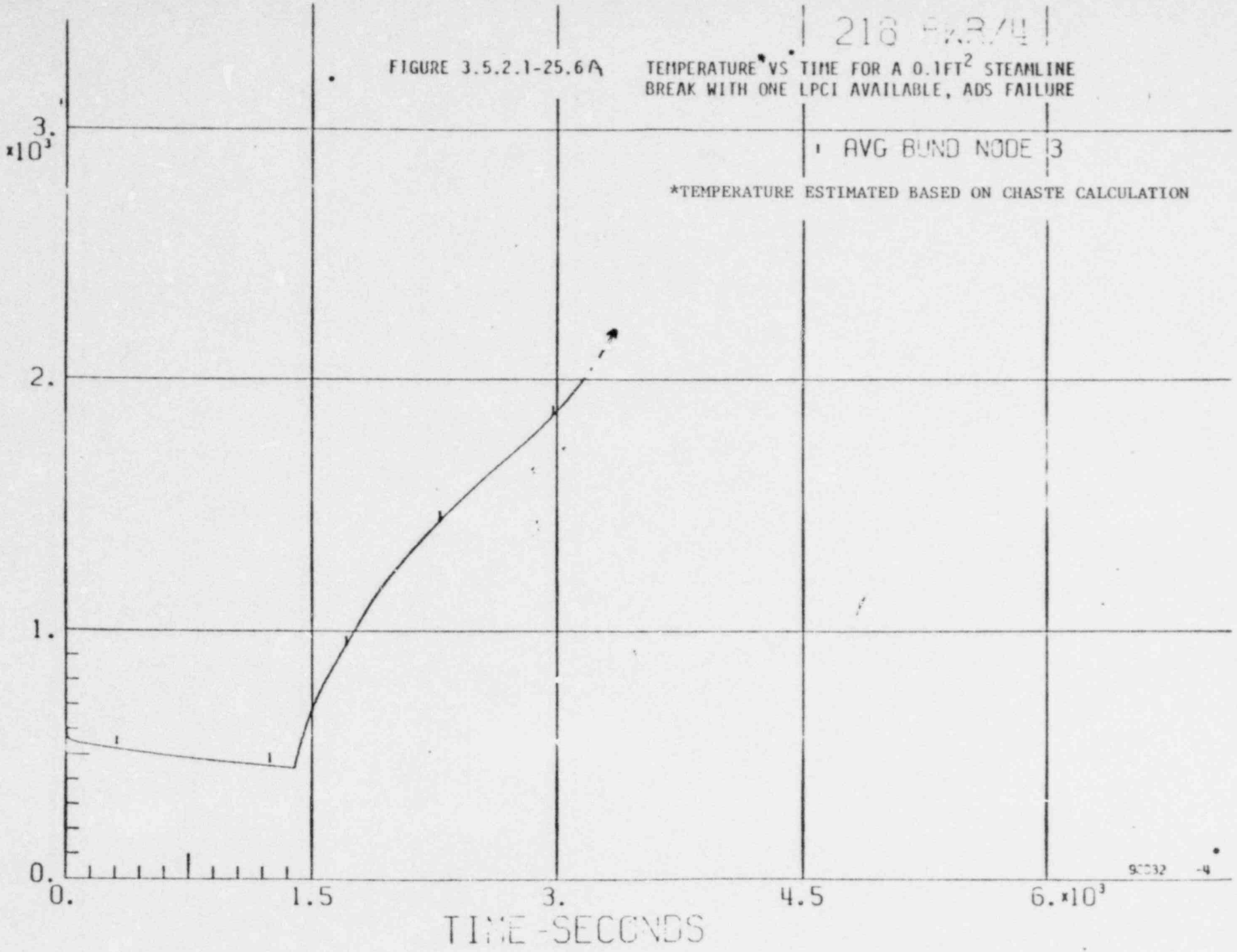
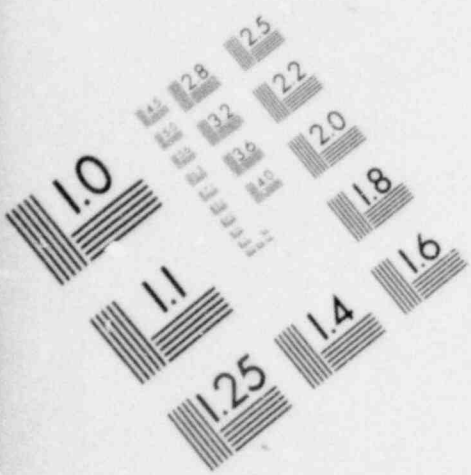
FIGURE 3.5.2.1-25.6A TEMPERATURE VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE





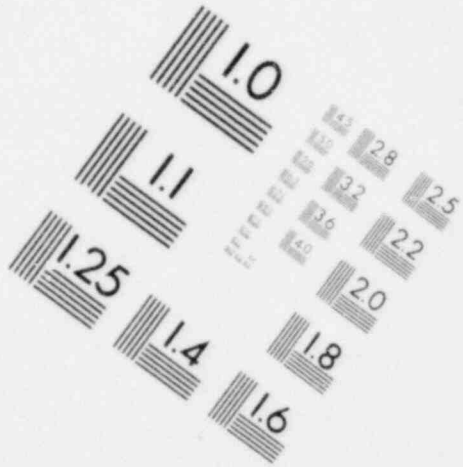
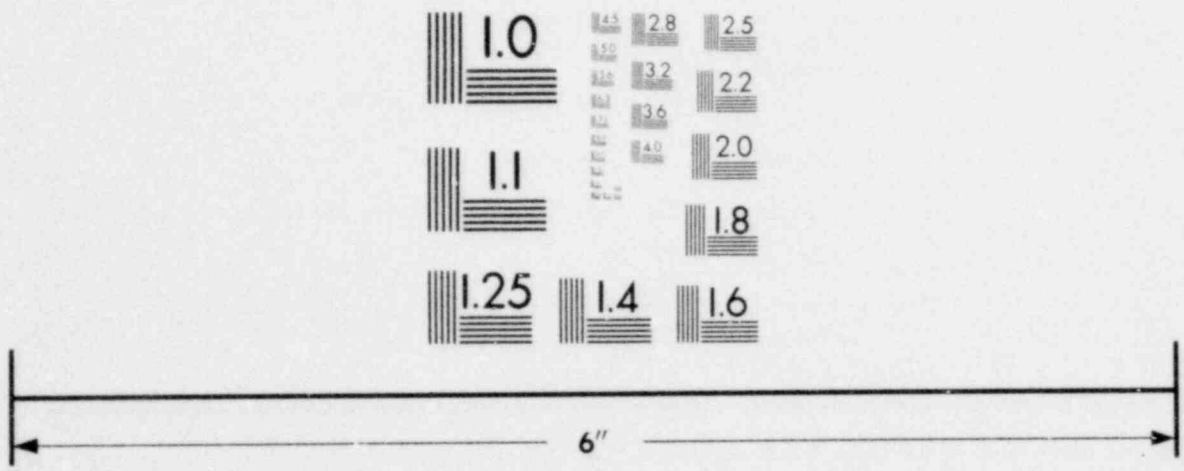
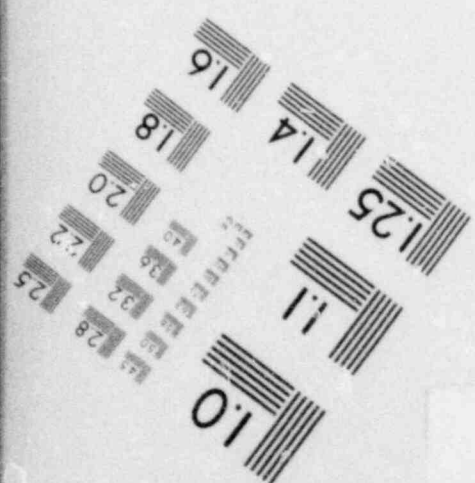
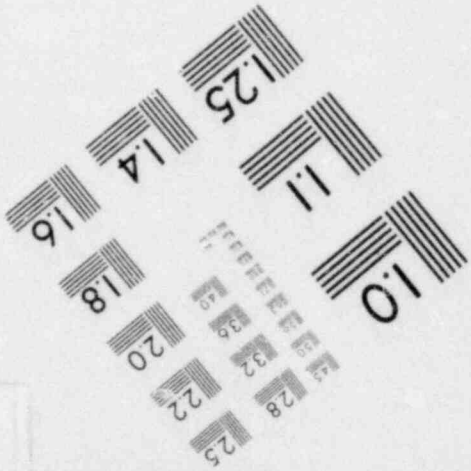


IMAGE EVALUATION TEST TARGET (MT-3)







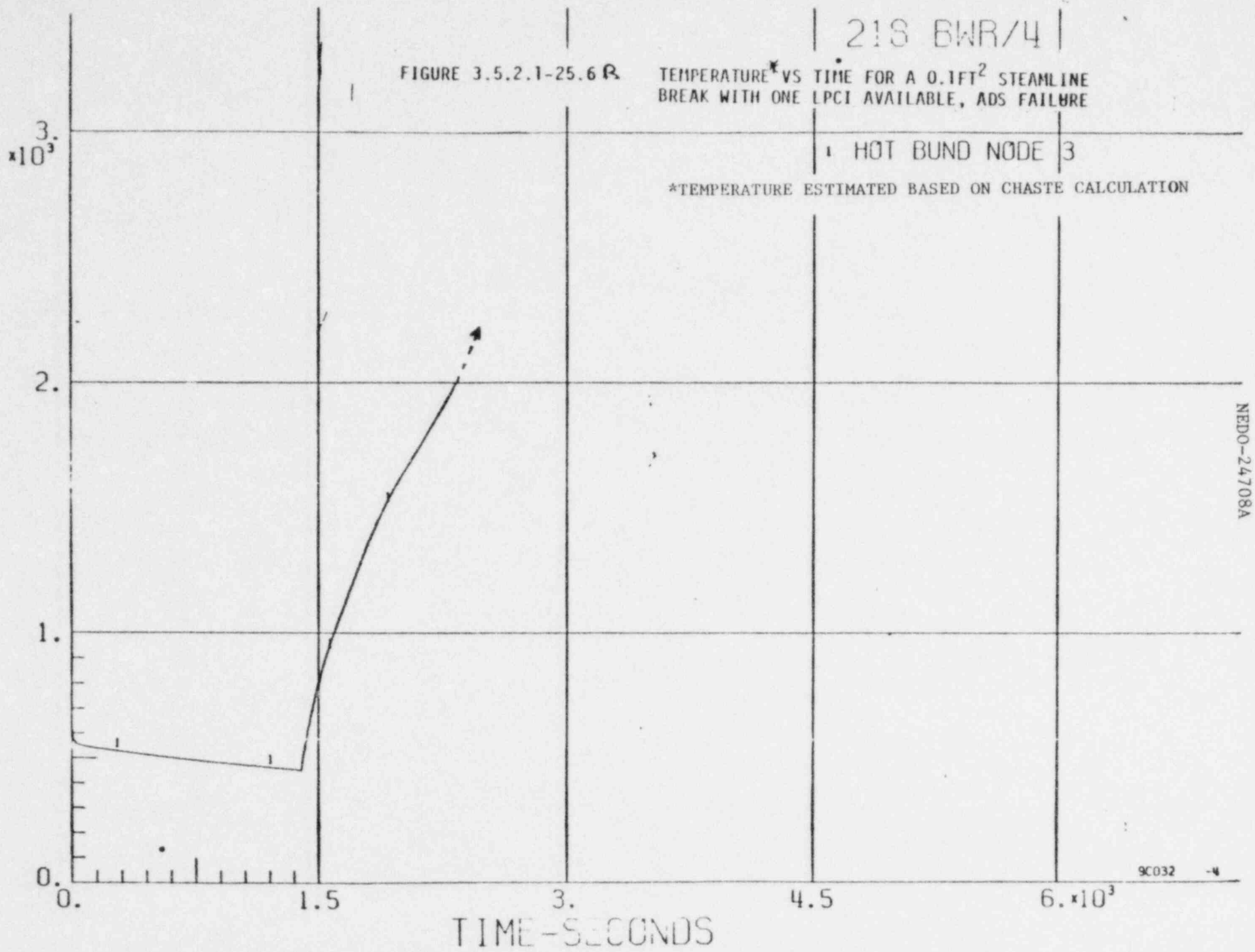


FIGURE 3.5.2.1-25.6R TEMPERATURE* VS TIME FOR A 0.1FT² STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

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FIGURE 3.5.2.1-25.7 ENTHALPY VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

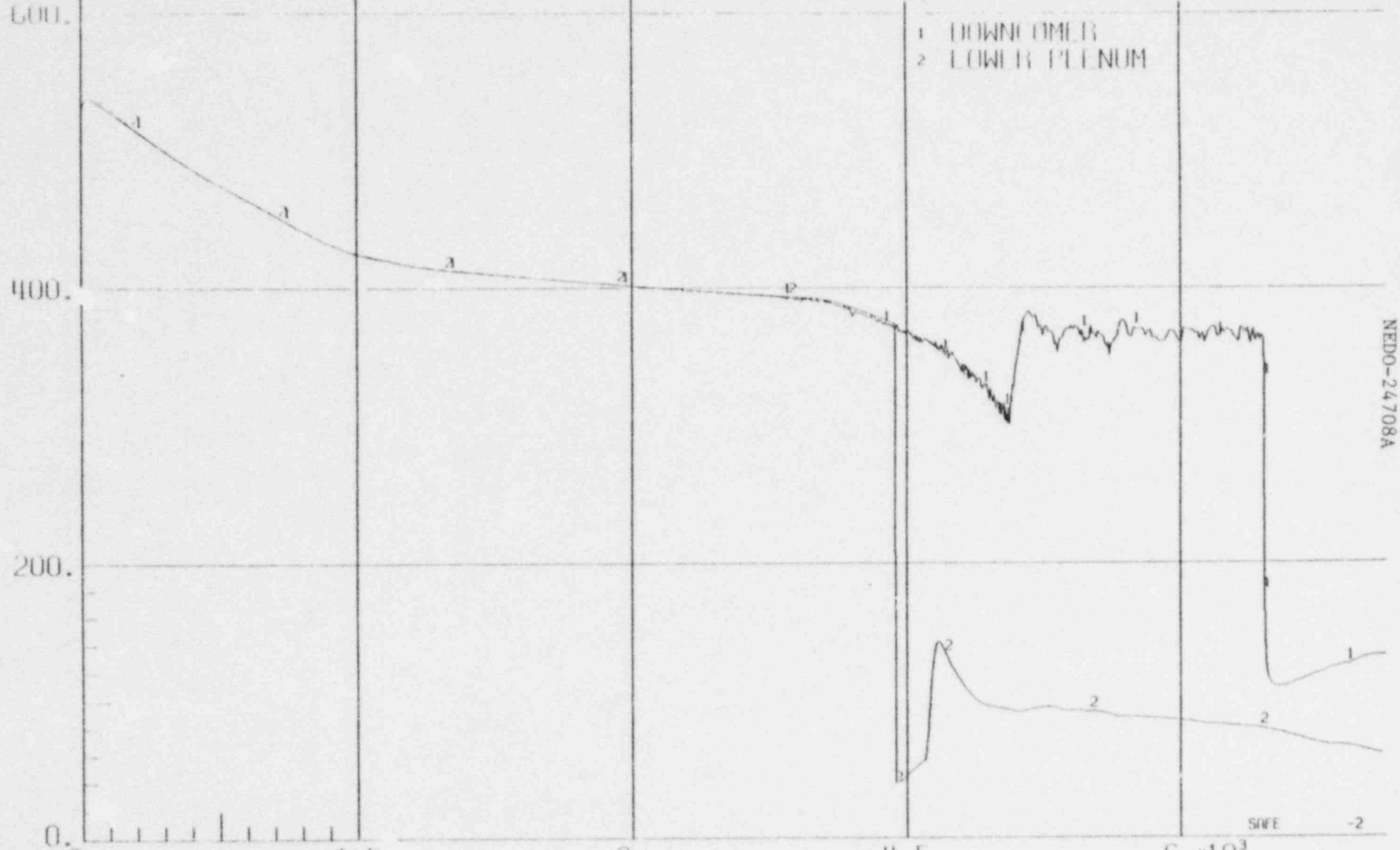

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FIGURE 3.5.2.1-25.8 QUALITY VS TIME FOR A 0.1FT^2 STEAMLINE BREAK WITH ONE LPCI AVAILABLE, ADS FAILURE

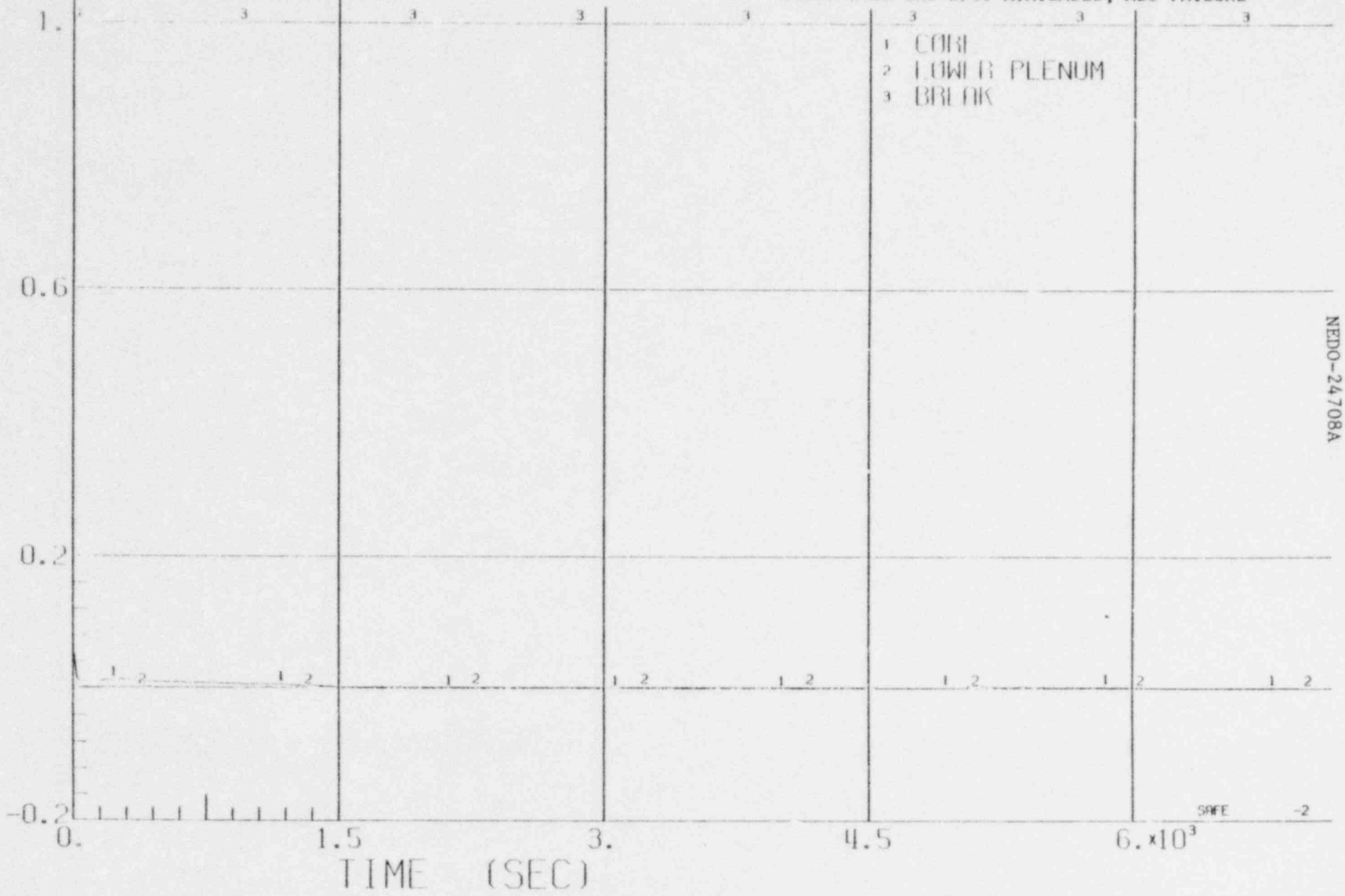

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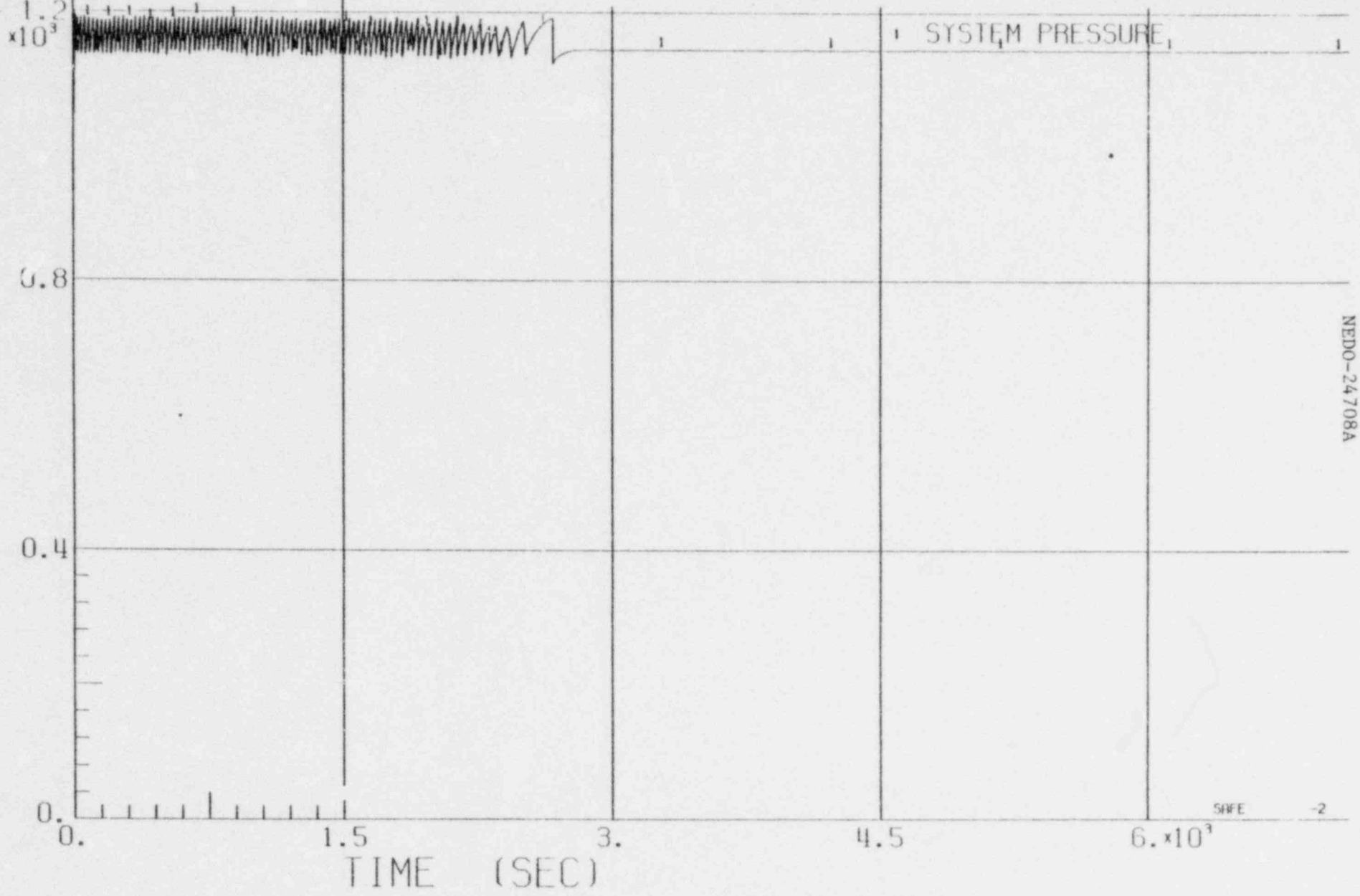
FIGURE 3.5.2.1-26.1 SYSTEM PRESSURE VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS OFF



NEDO-24708A

4-1088

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FIGURE 3.5.2.1-26.2 WATER LEVEL VS TIME FOR ANISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS OFF

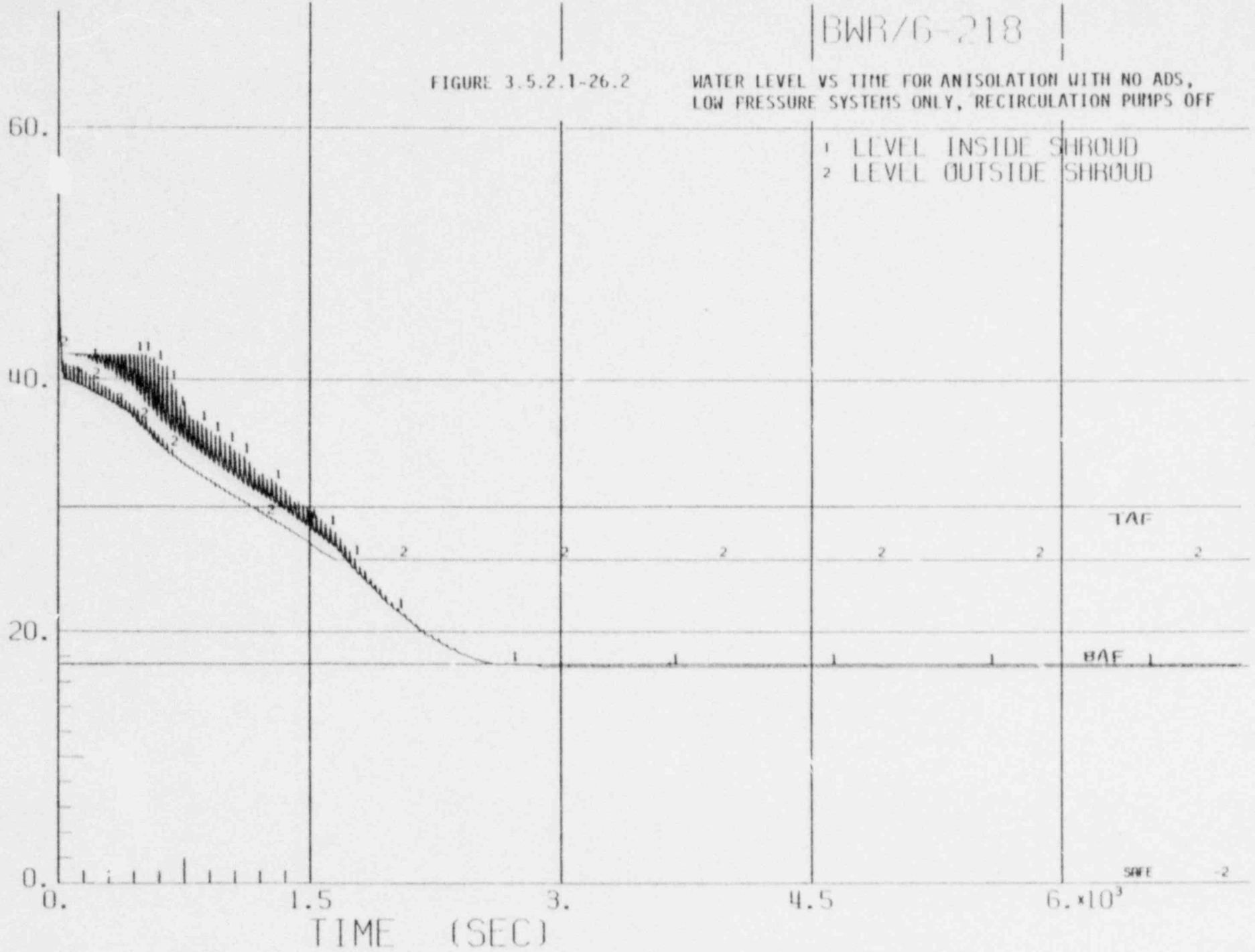

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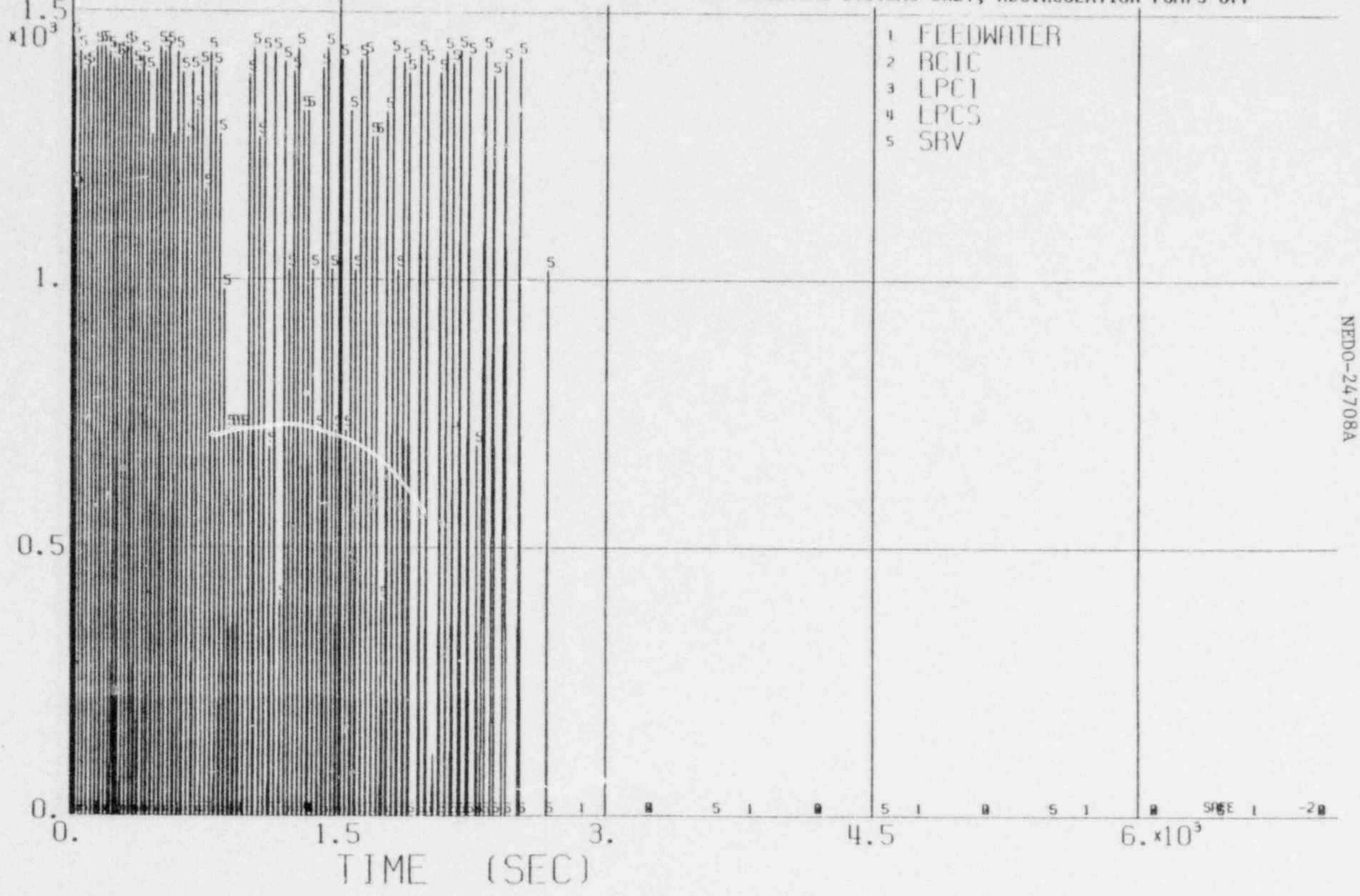
FIGURE 3.5.2.1-26.3 SYSTEM FLOW RATES VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS OFF



4-1090

NEDO-24708A

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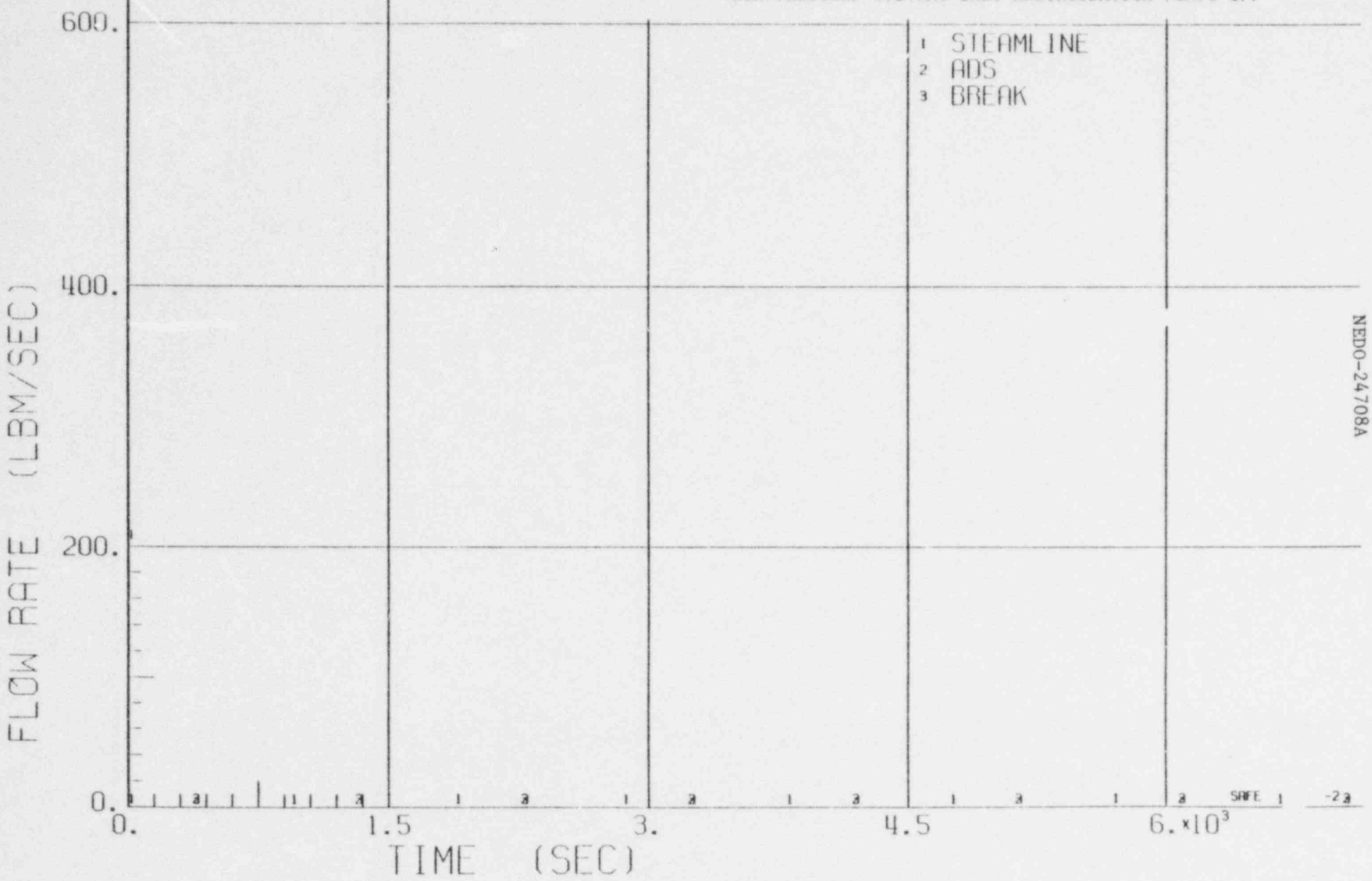
FIGURE 3.5.2.1-26.4 FLOW RATES VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY RECIRCULATION PUMPS OFF



4-1091

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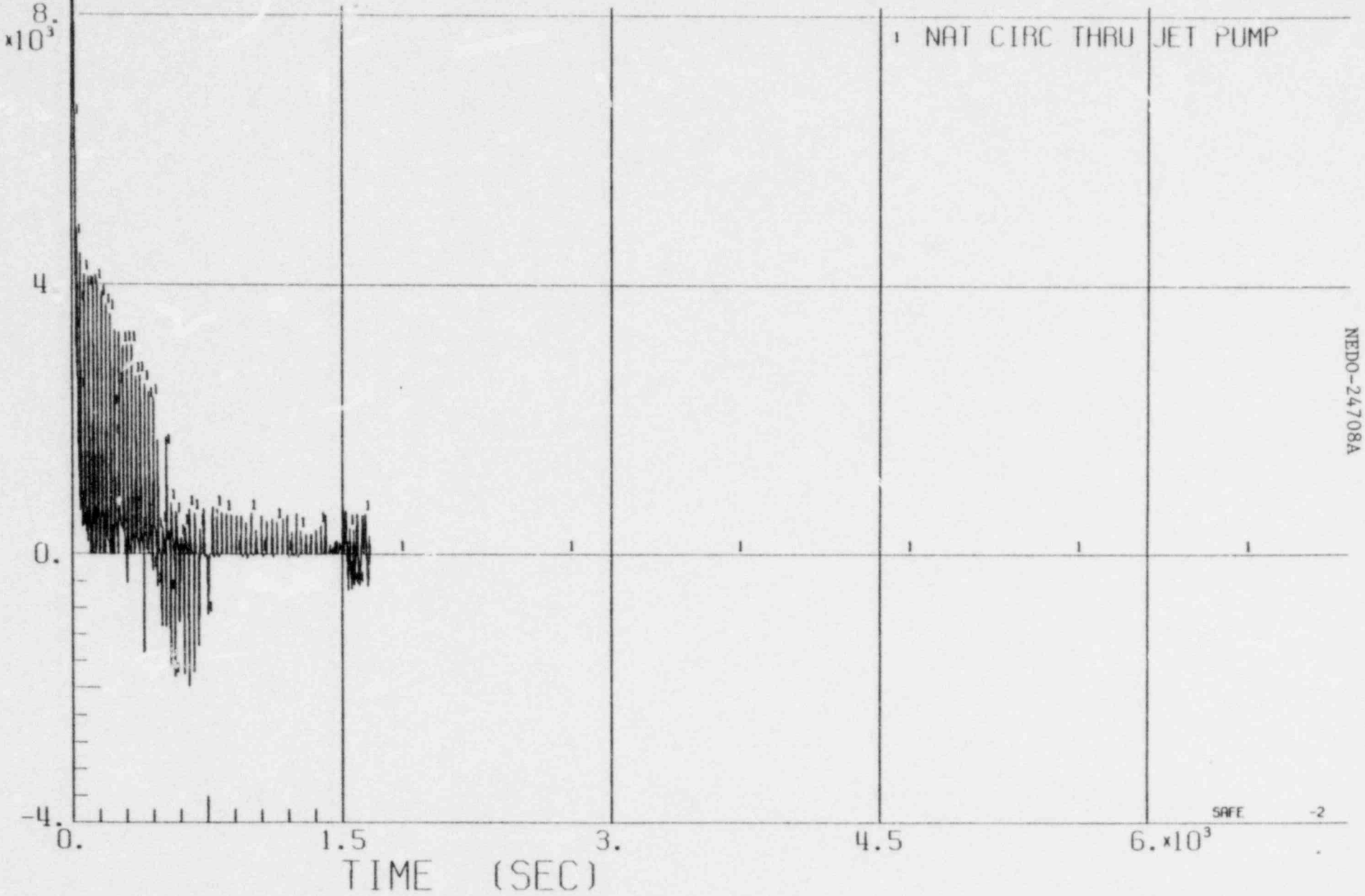
FIGURE 3.5.2.1-26.5

NATURAL CIRCULATION FLOW RATE VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS OFF



4-1092

NEDO-24708A

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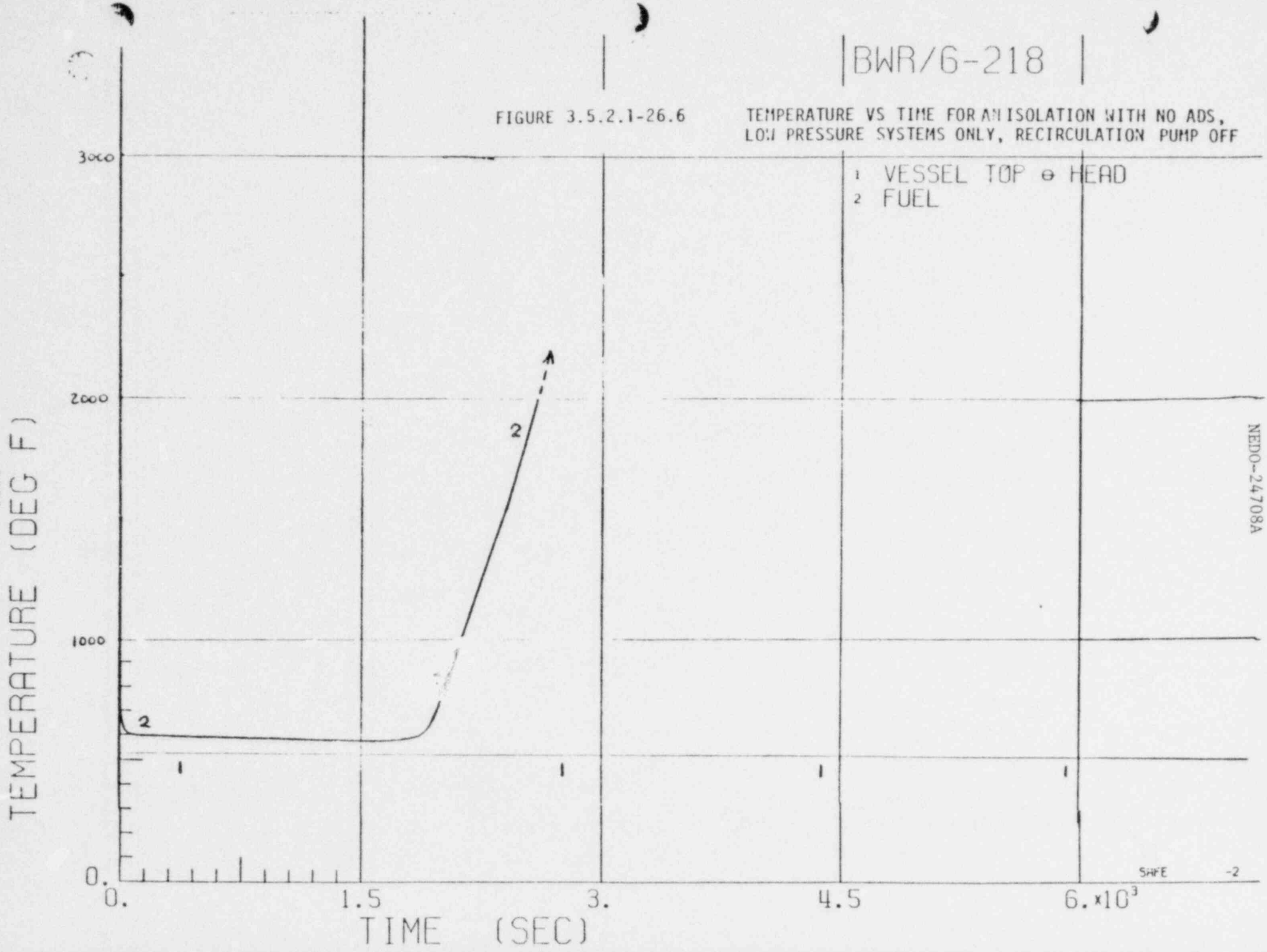
FIGURE 3.5.2.1-26.6 TEMPERATURE VS TIME FOR ANTICIPATED ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMP OFF



4-1093

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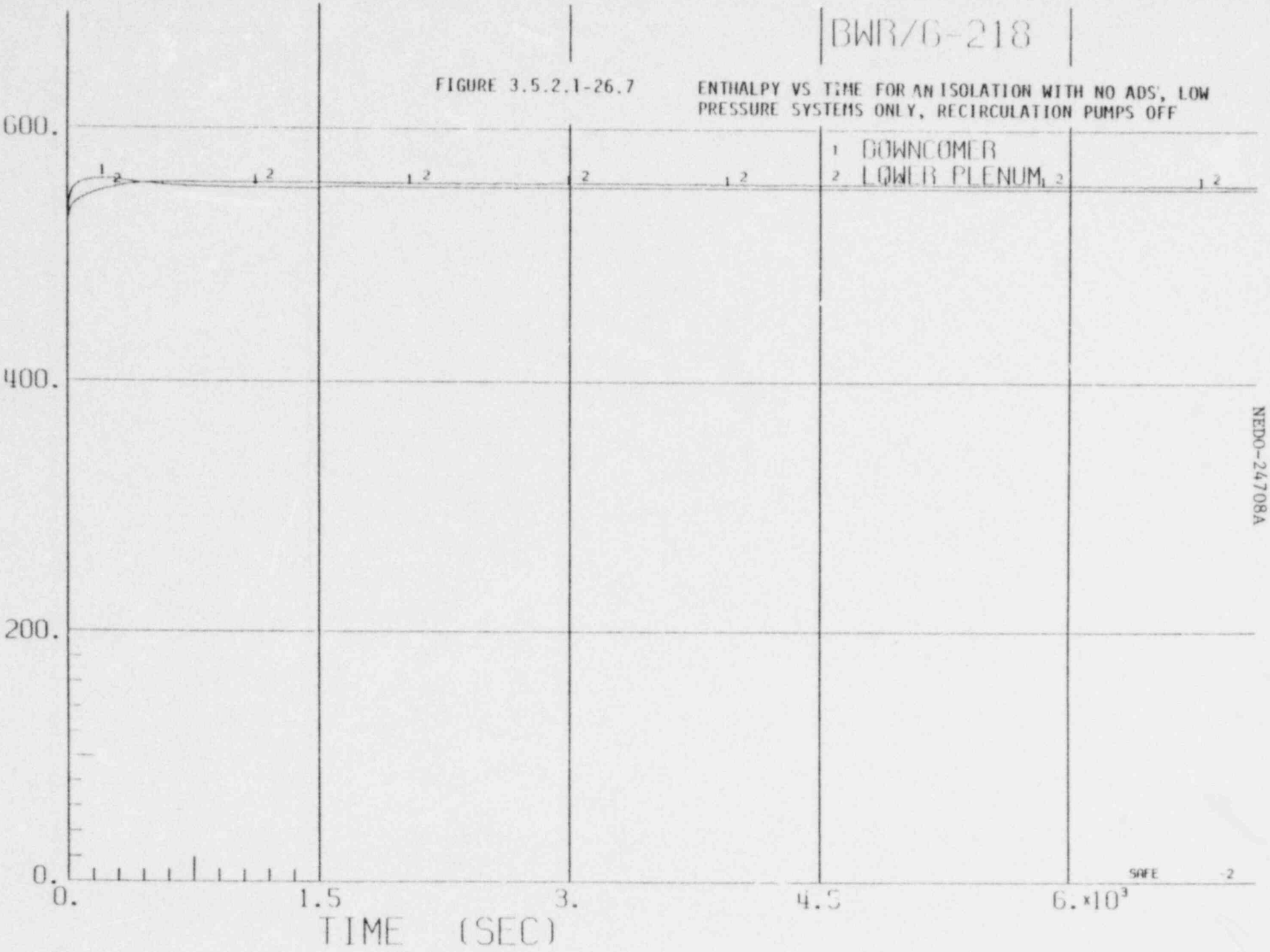
FIGURE 3.5.2.1-26.7 ENTHALPY VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS OFF



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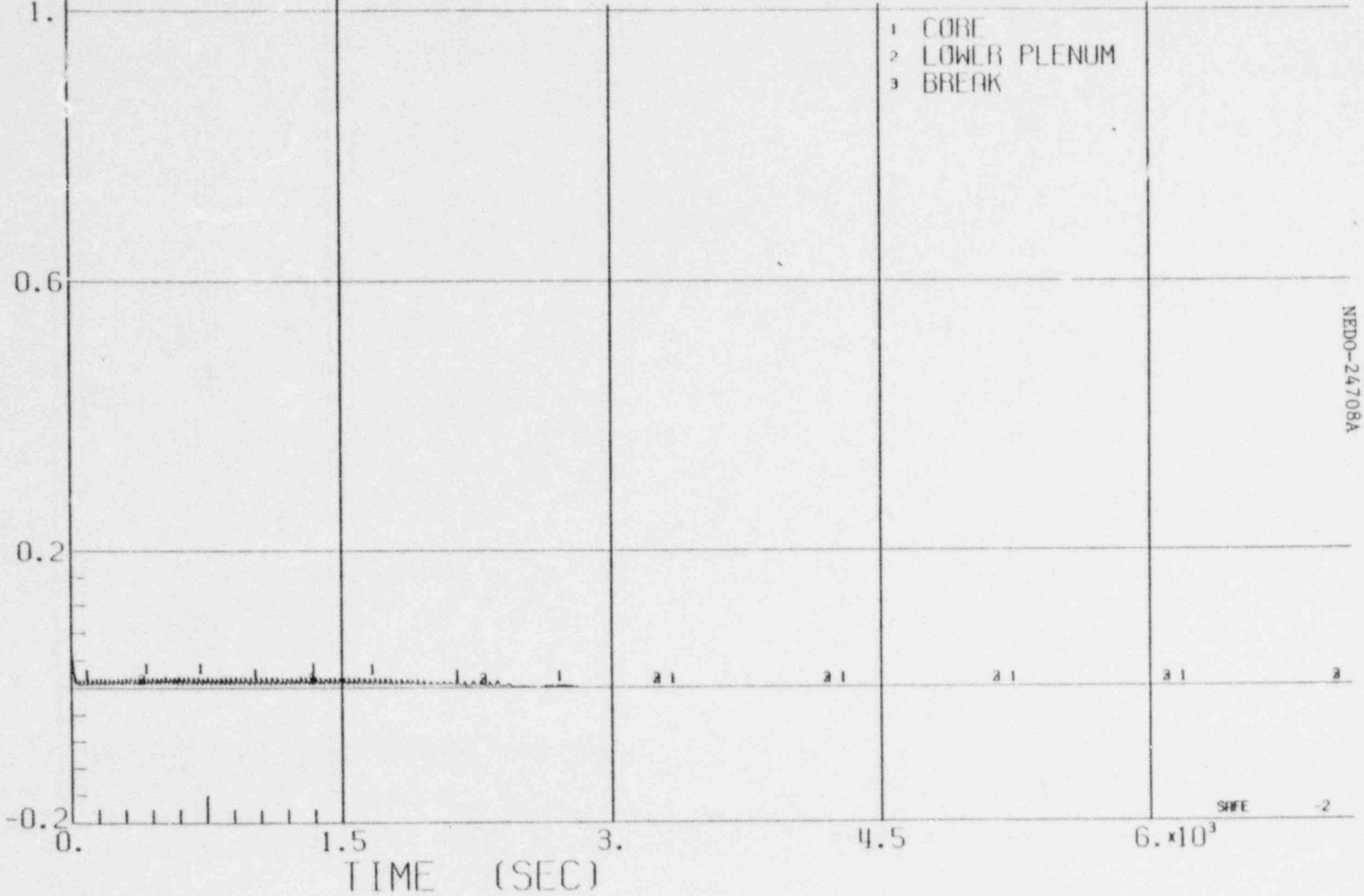
4-1094

BWR/6-218

FIGURE 3.5.2.1-26.8 QUALITY VS TIME FOR ANISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS OFF



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4-1095

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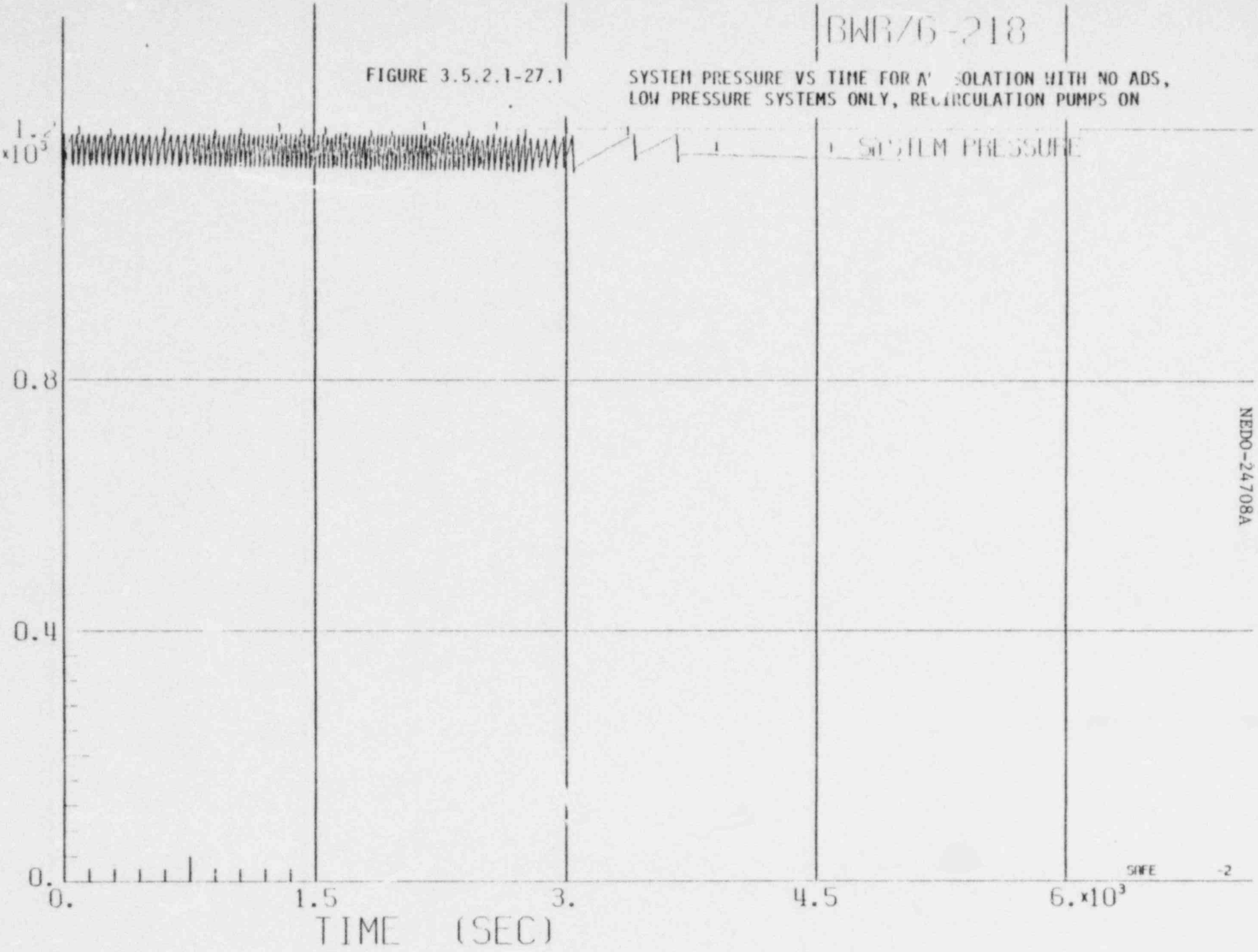
FIGURE 3.5.2.1-27.1 SYSTEM PRESSURE VS TIME FOR A' SOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON



NEDO-24708A

4-1096

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FIGURE 3.5.2.1-27.2 WATER LEVEL VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON

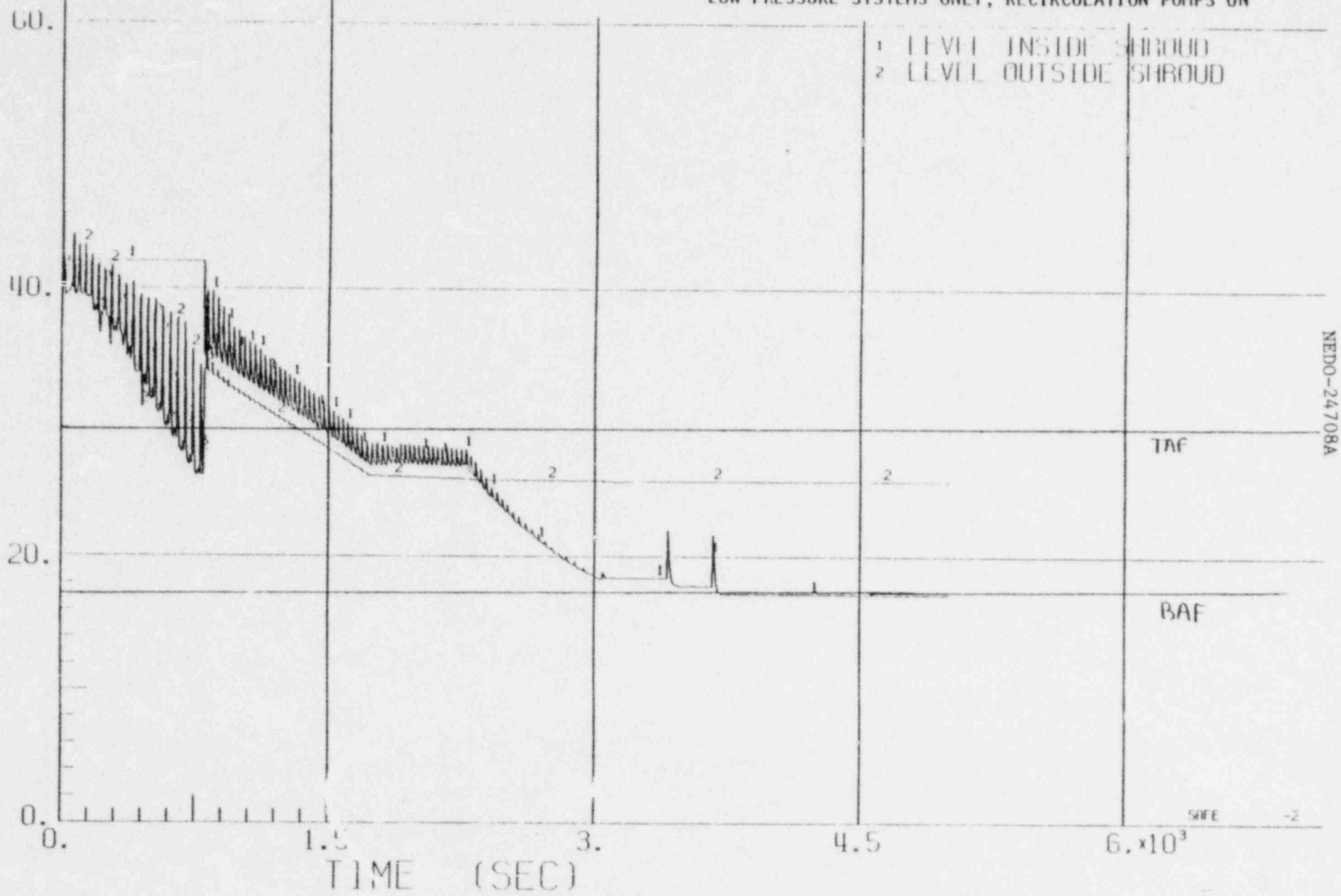

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FIGURE 3.5.2.1-27.3 SYSTEM FLOW RATES VS TIME FOR ANISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON

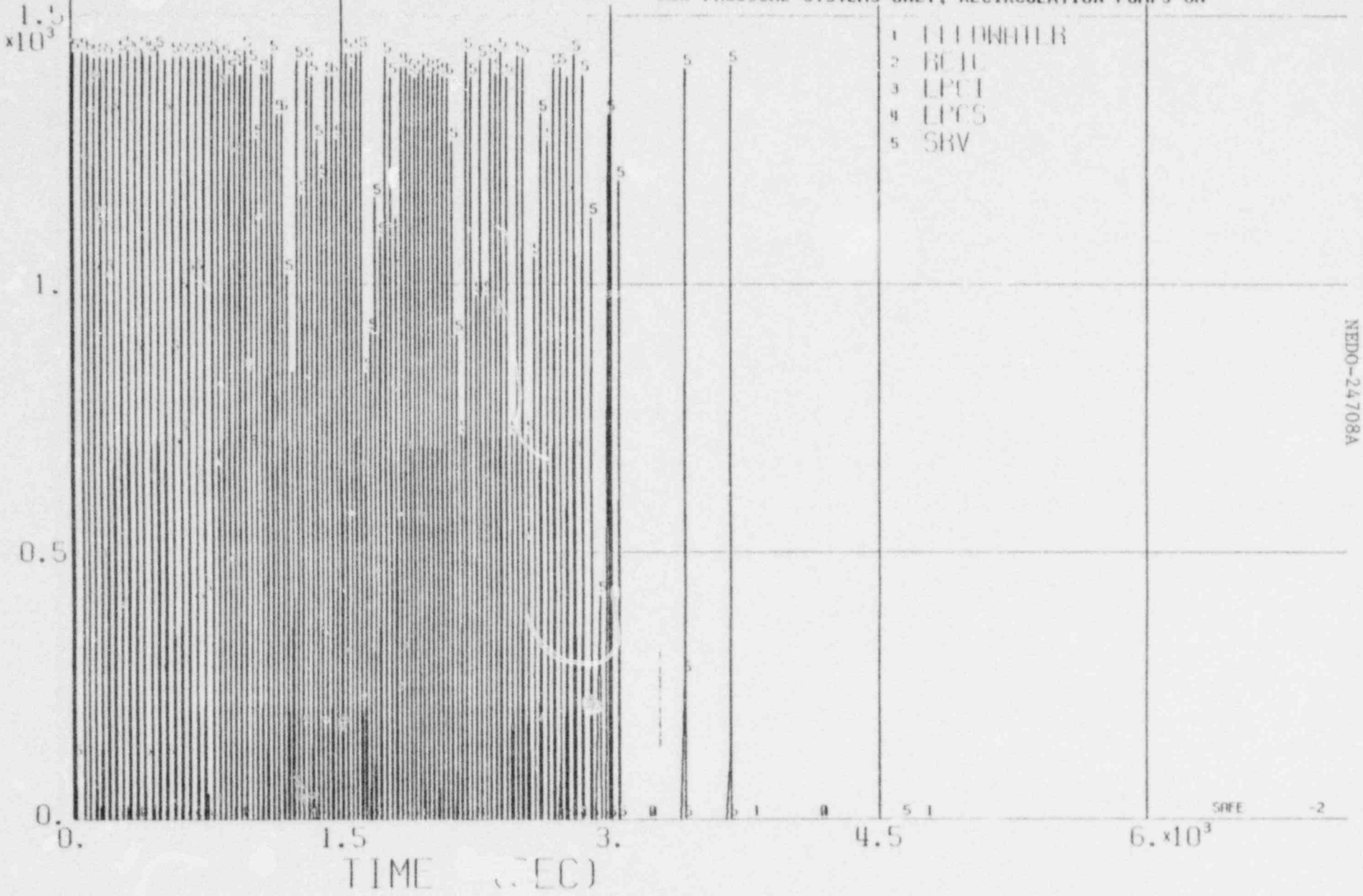

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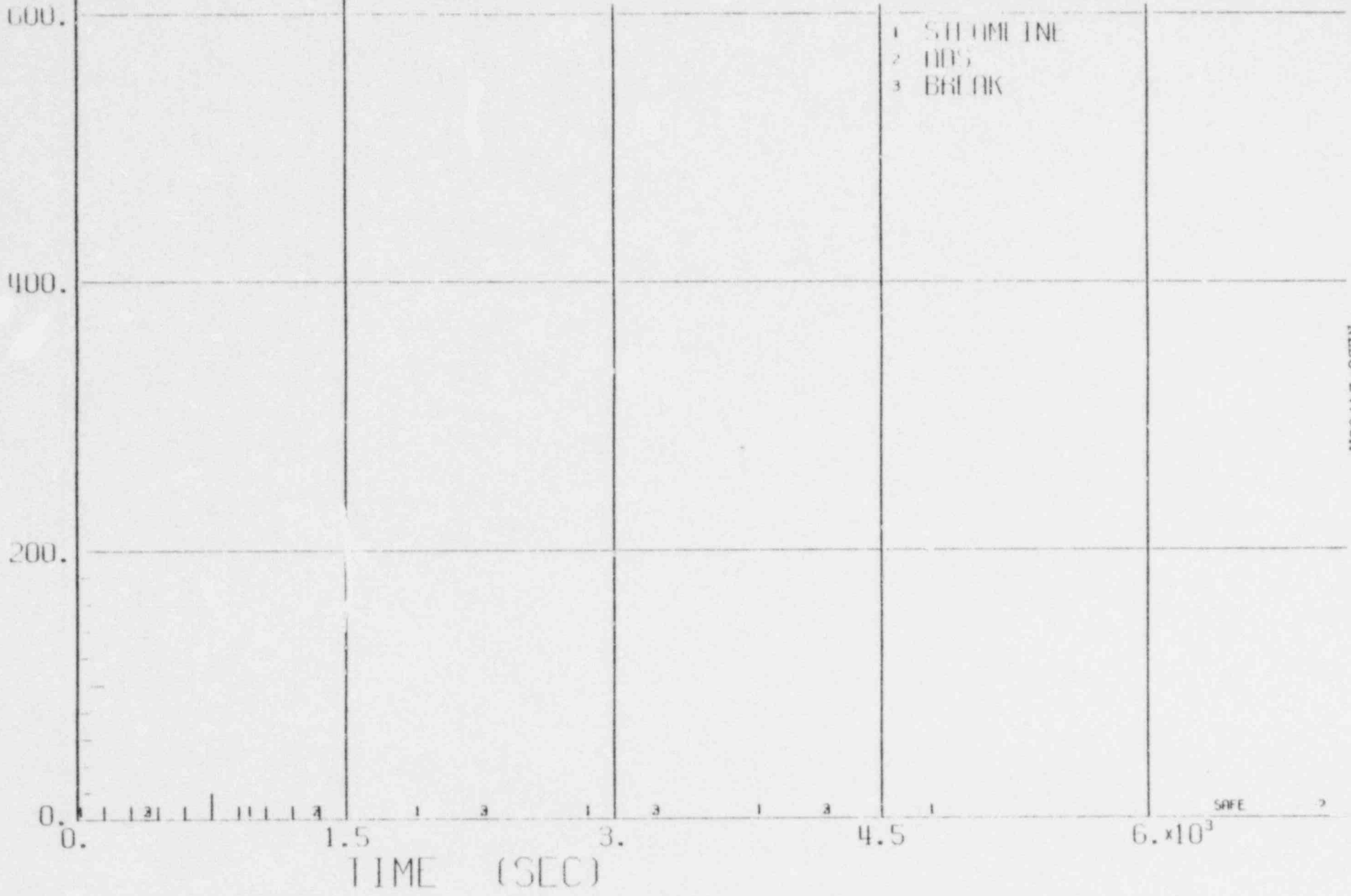
FIGURE 3.5.2.1-27.4 FLOW RATES VS TIME FOR ANISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON



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4-1099

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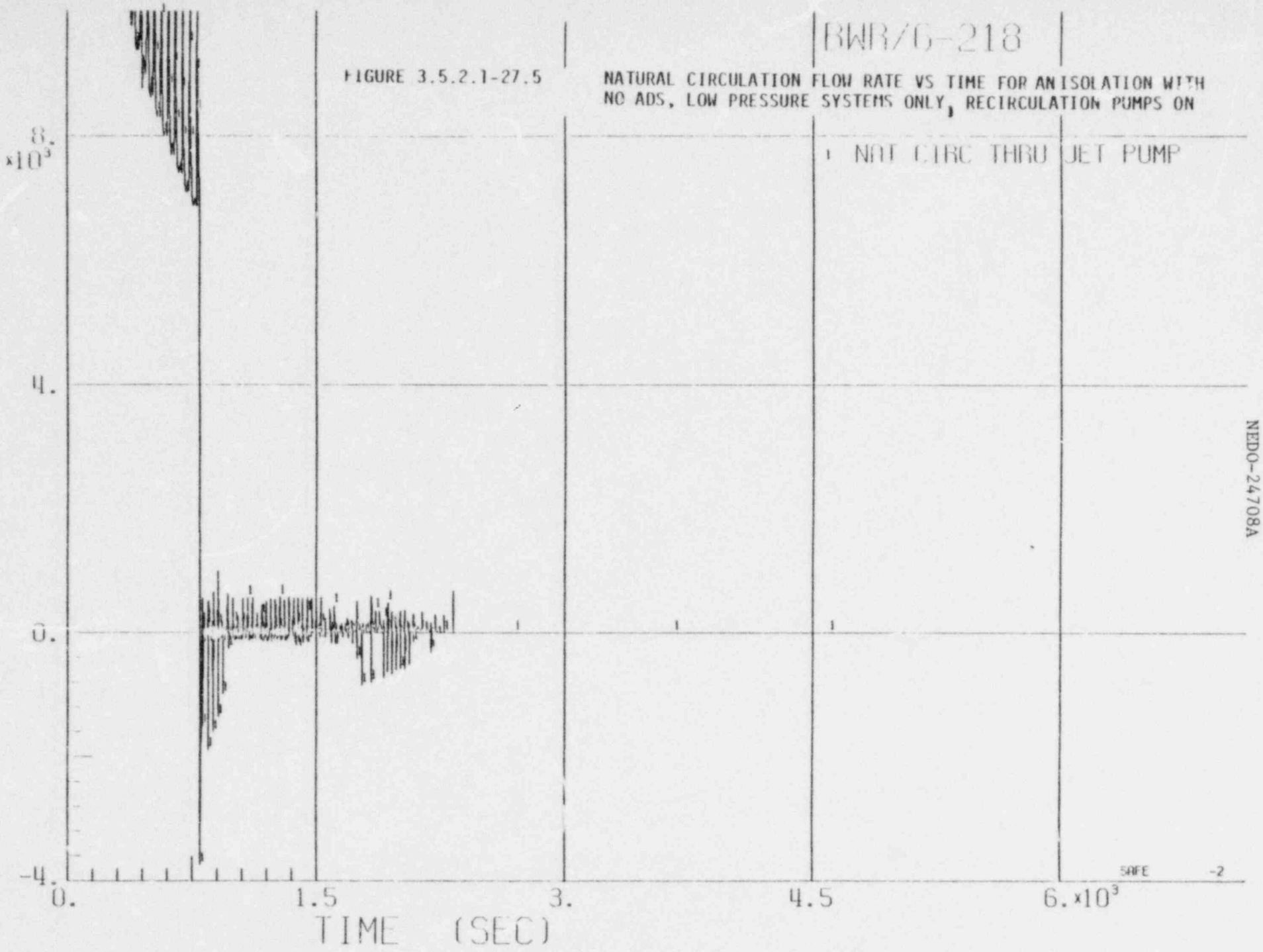
FIGURE 3.5.2.1-27.5

NATURAL CIRCULATION FLOW RATE VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON



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4-1100

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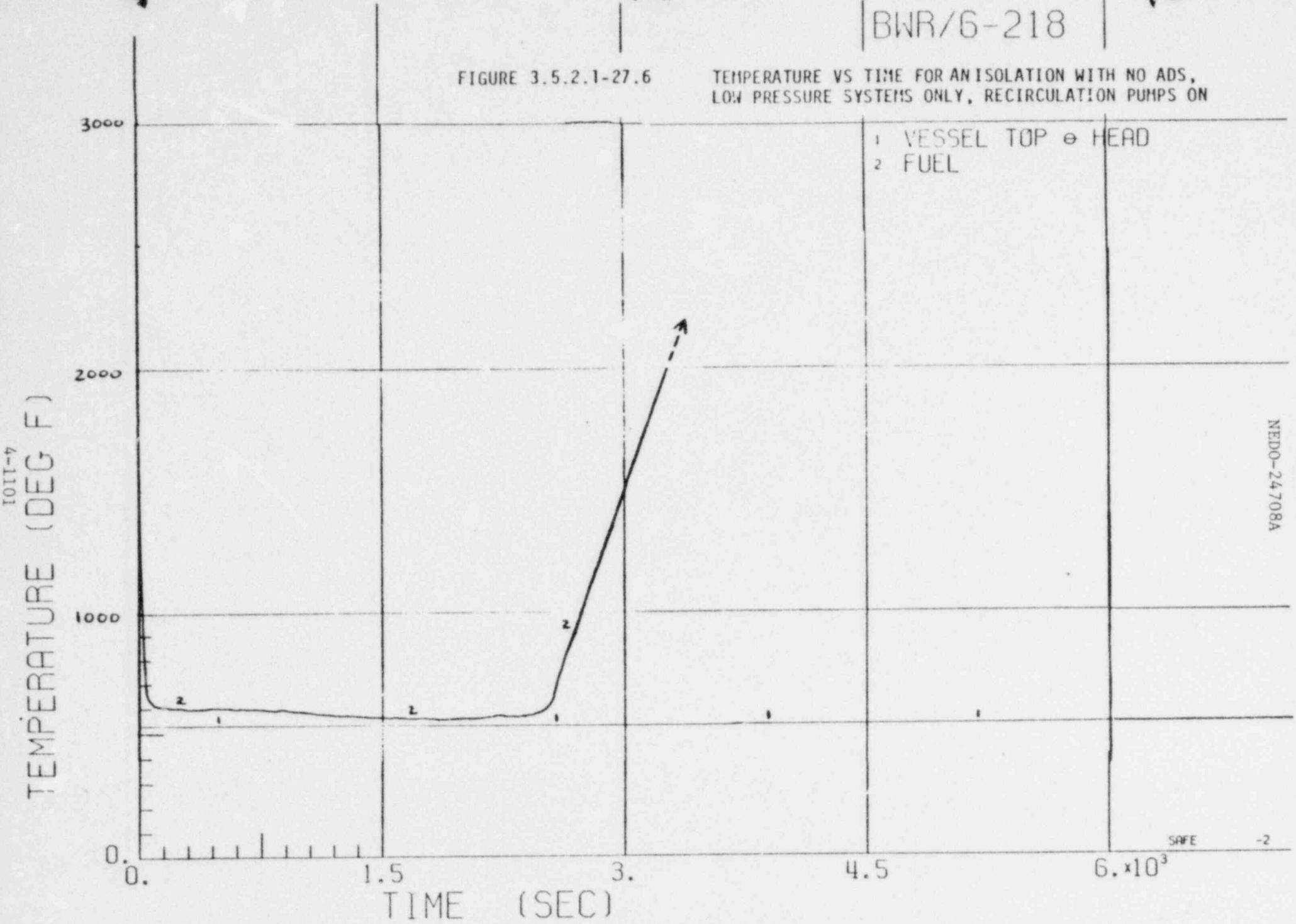
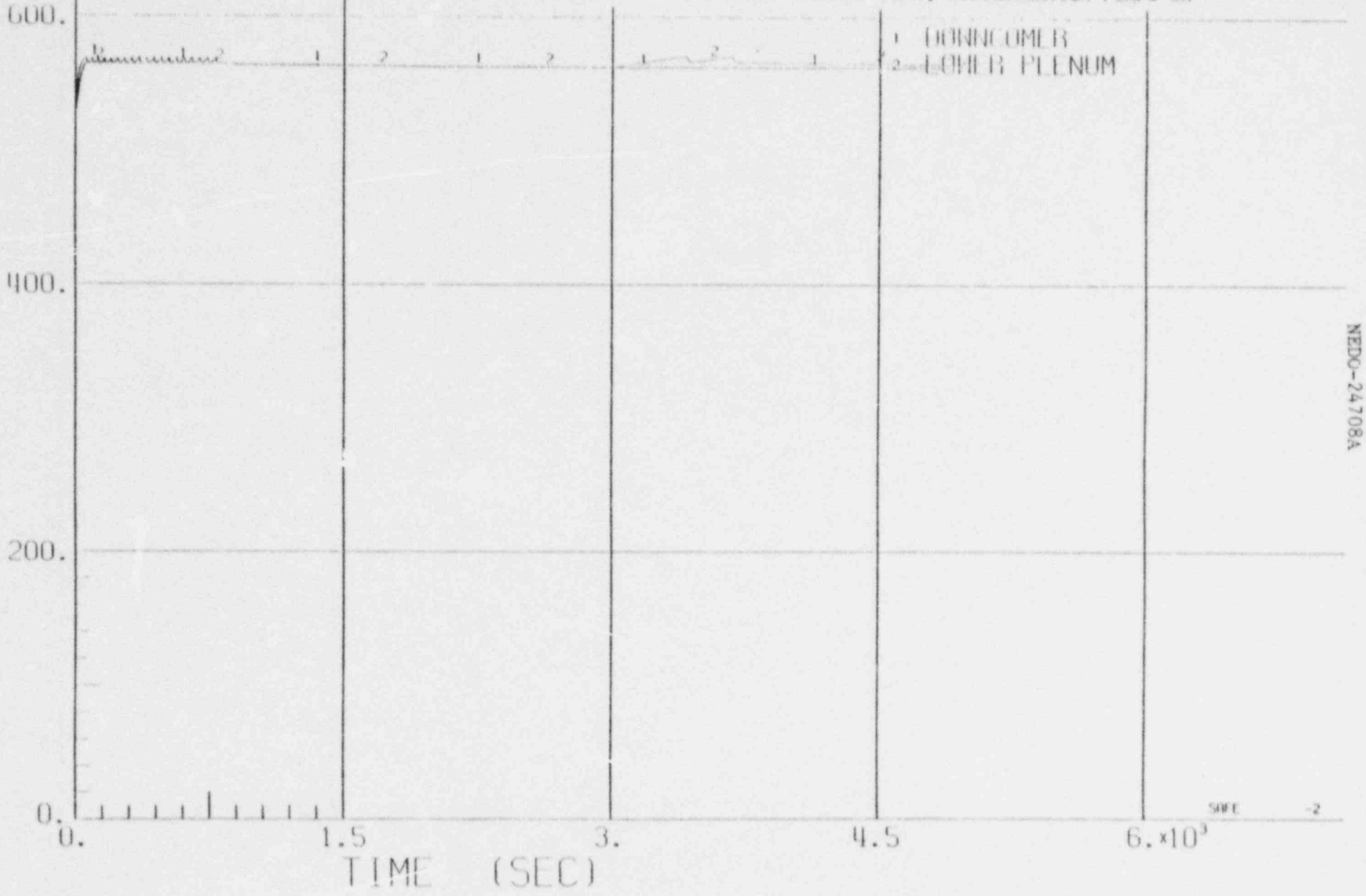
FIGURE 3.5.2.1-27.6 TEMPERATURE VS TIME FOR AN ISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON



4-1101

FIGURE 3.5.2.1-27.7 ENTHALPY VS TIME FOR ANTISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON

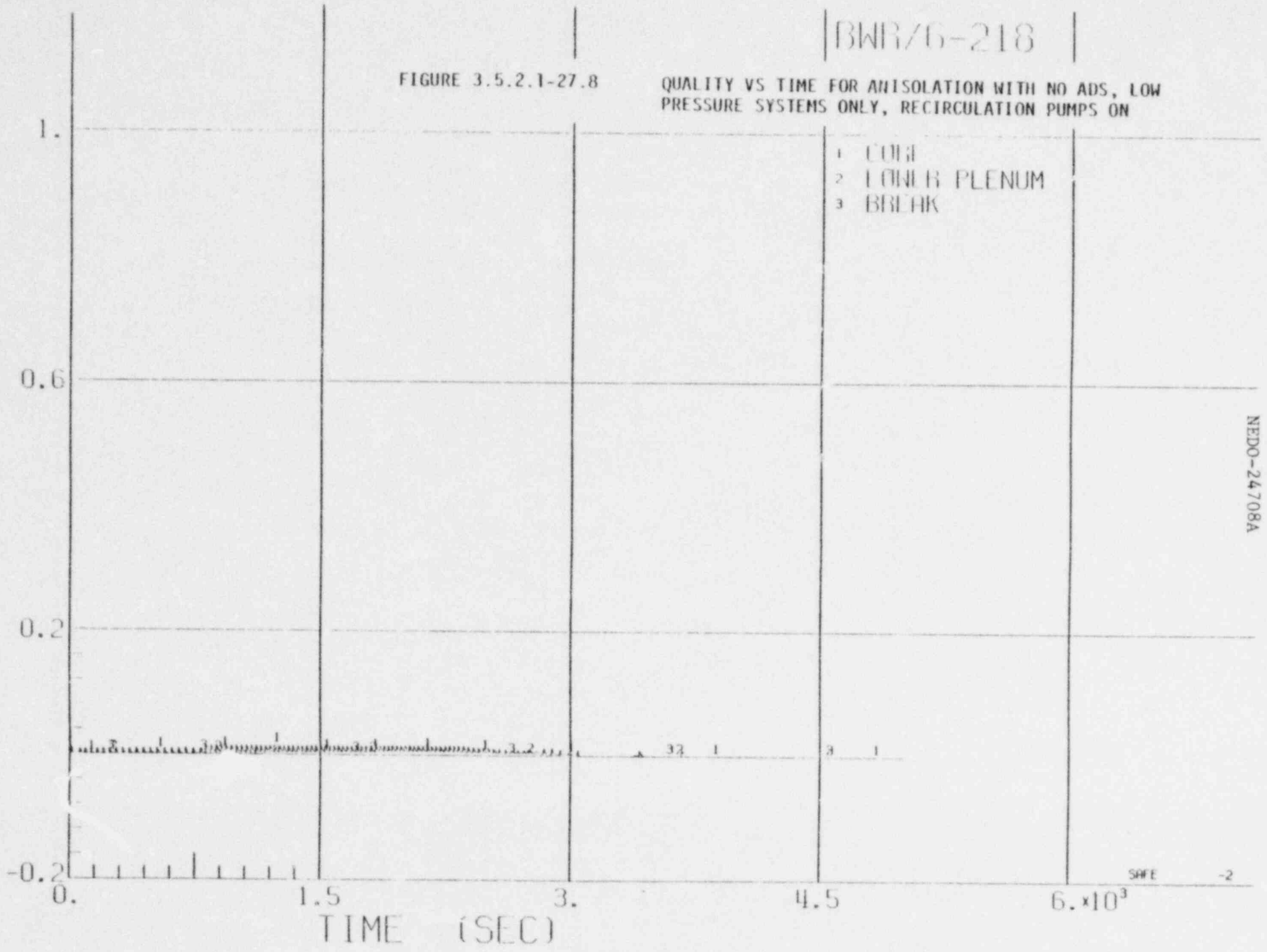


4-1102

NEDO-24708A

BWR/6-218

FIGURE 3.5.2.1-27.8 QUALITY VS TIME FOR ANTISOLATION WITH NO ADS, LOW PRESSURE SYSTEMS ONLY, RECIRCULATION PUMPS ON



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4-1103

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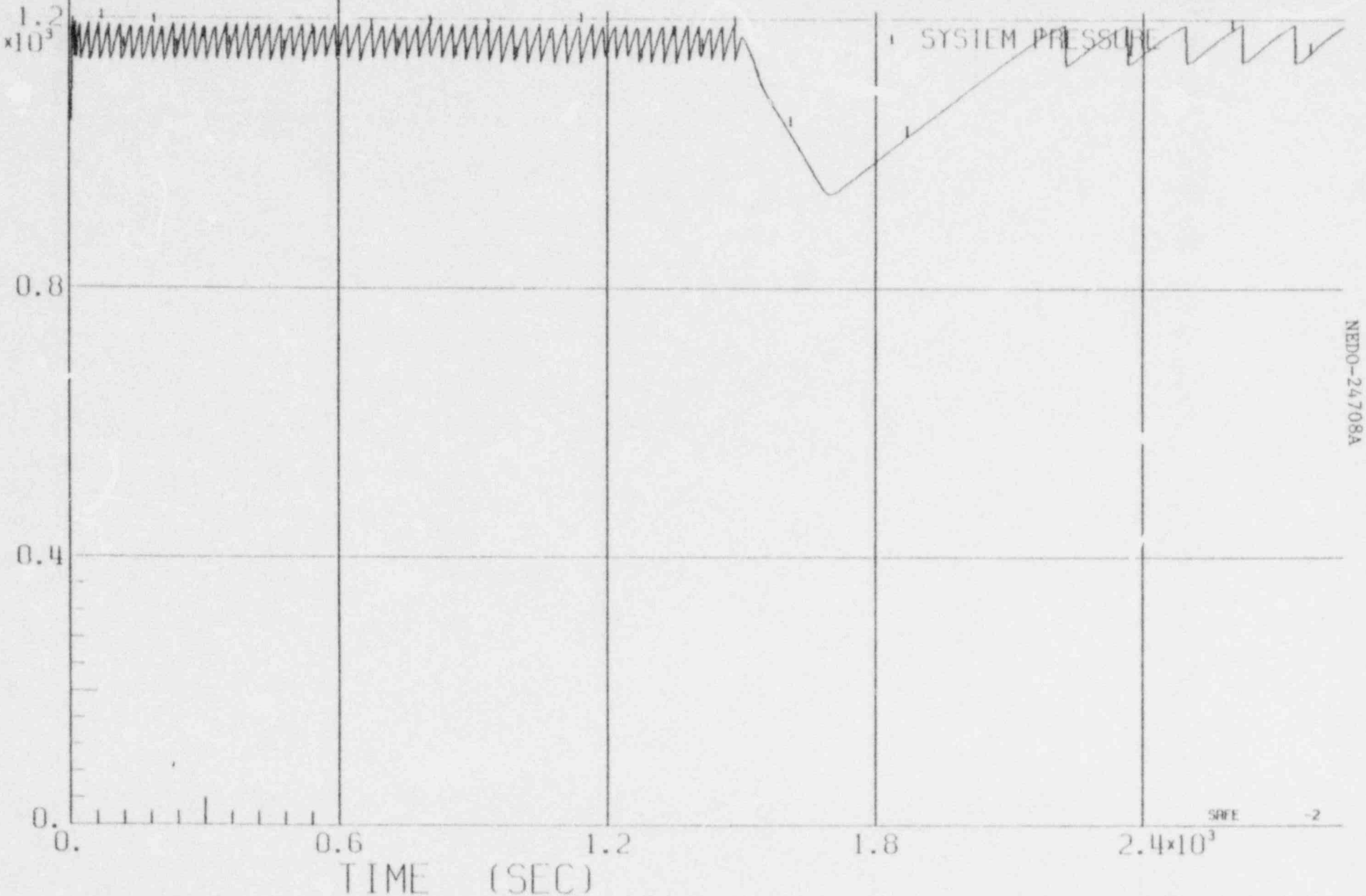
FIGURE 3.5.2.1-28.1 SYSTEM PRESSURE VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS



4-1104

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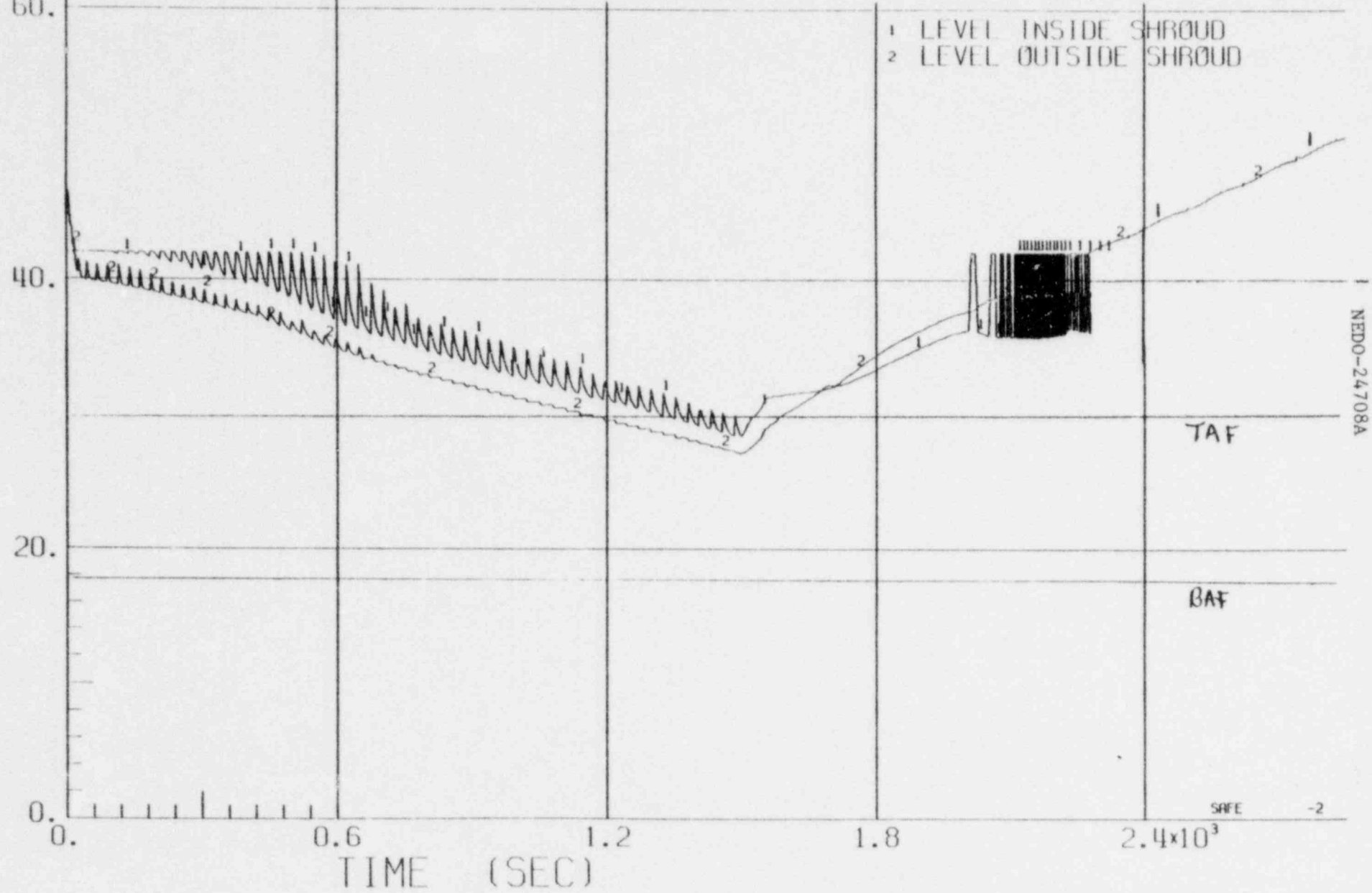
FIGURE 3.5.2.1-2B.2 WATER LEVEL VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS



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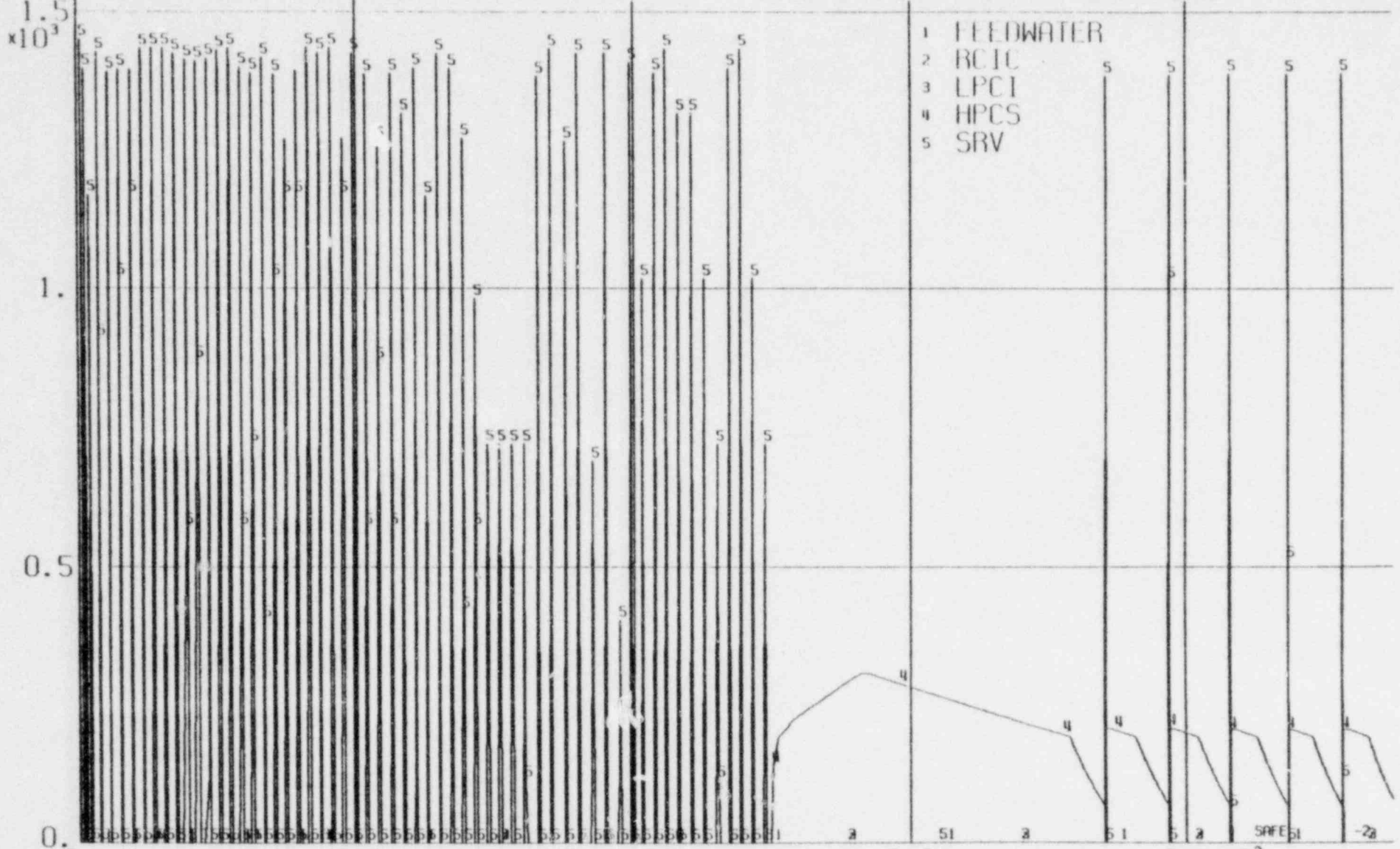
4-1105

SAFE -2

BWR/6-218

FIGURE 3.5.2 1-28.3

SYSTEM FLOW RATES VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS



4-11106

NEDO-24708A

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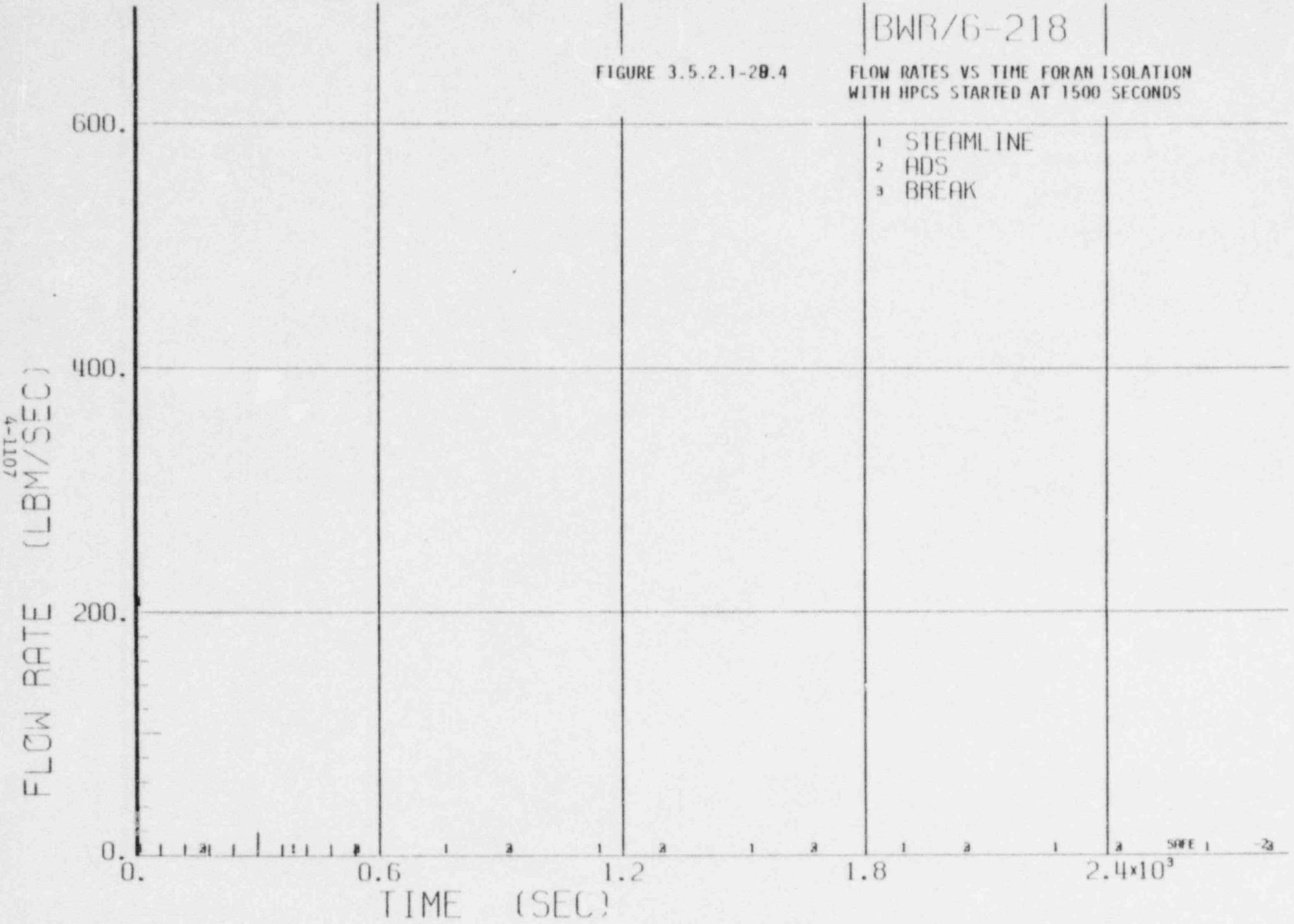
FIGURE 3.5.2.1-2B.4 FLOW RATES VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS

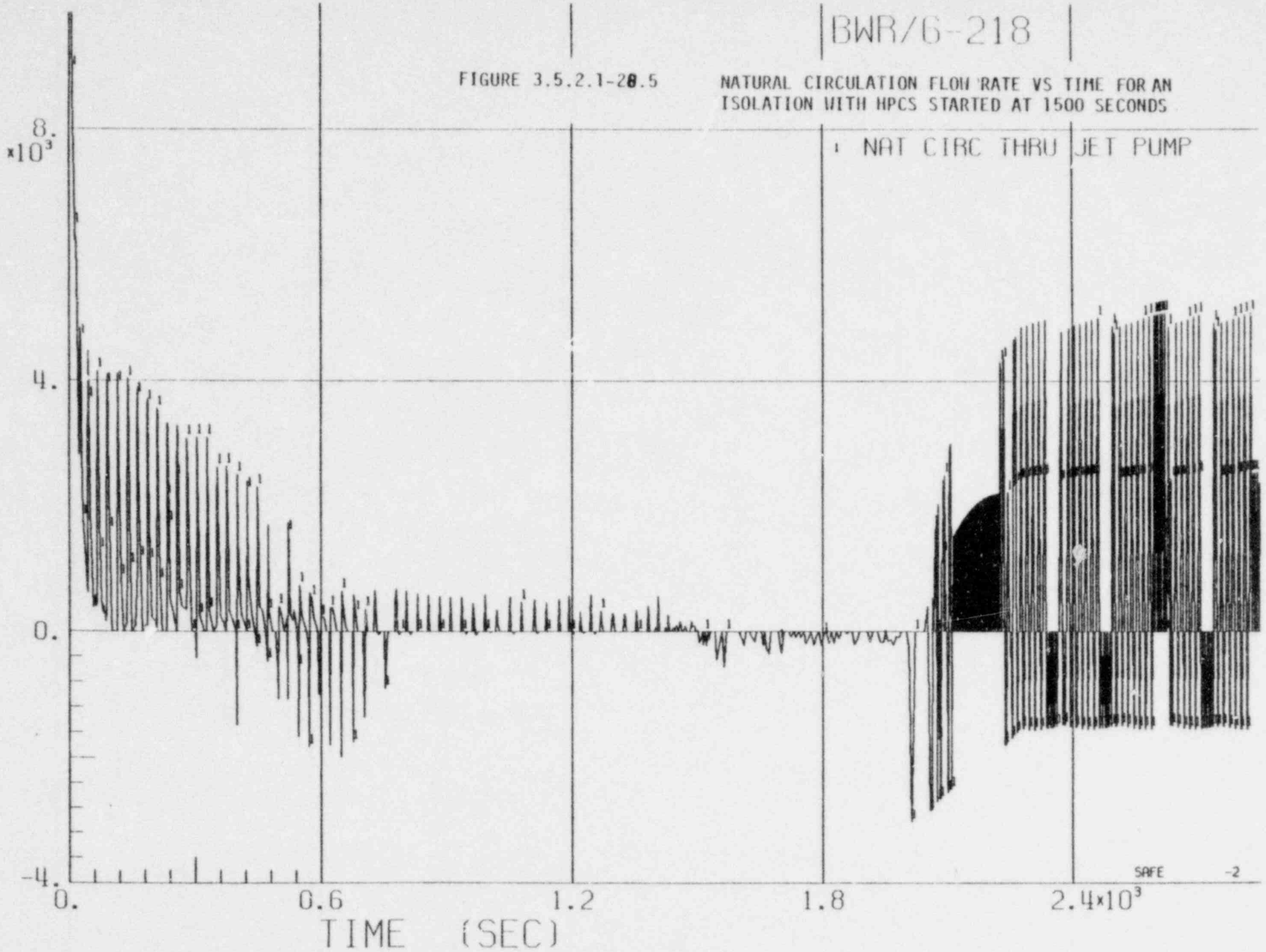


NEDO-24708A

4-1107

BWR/6-218

FIGURE 3.5.2.1-28.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS

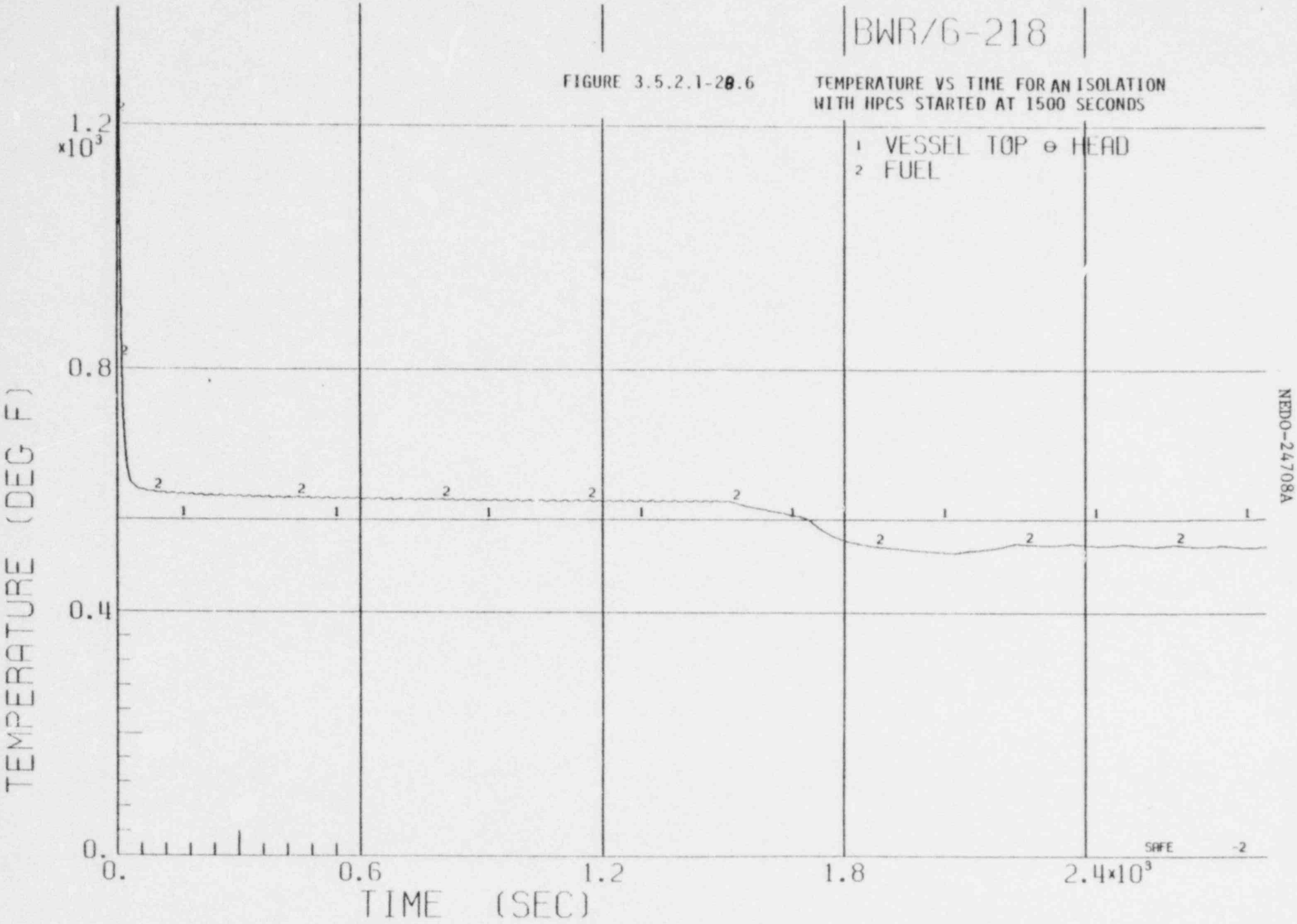


4-1108

NEDO-24708A

BWR/6-218

FIGURE 3.5.2.1-28.6 TEMPERATURE VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS



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4-1109

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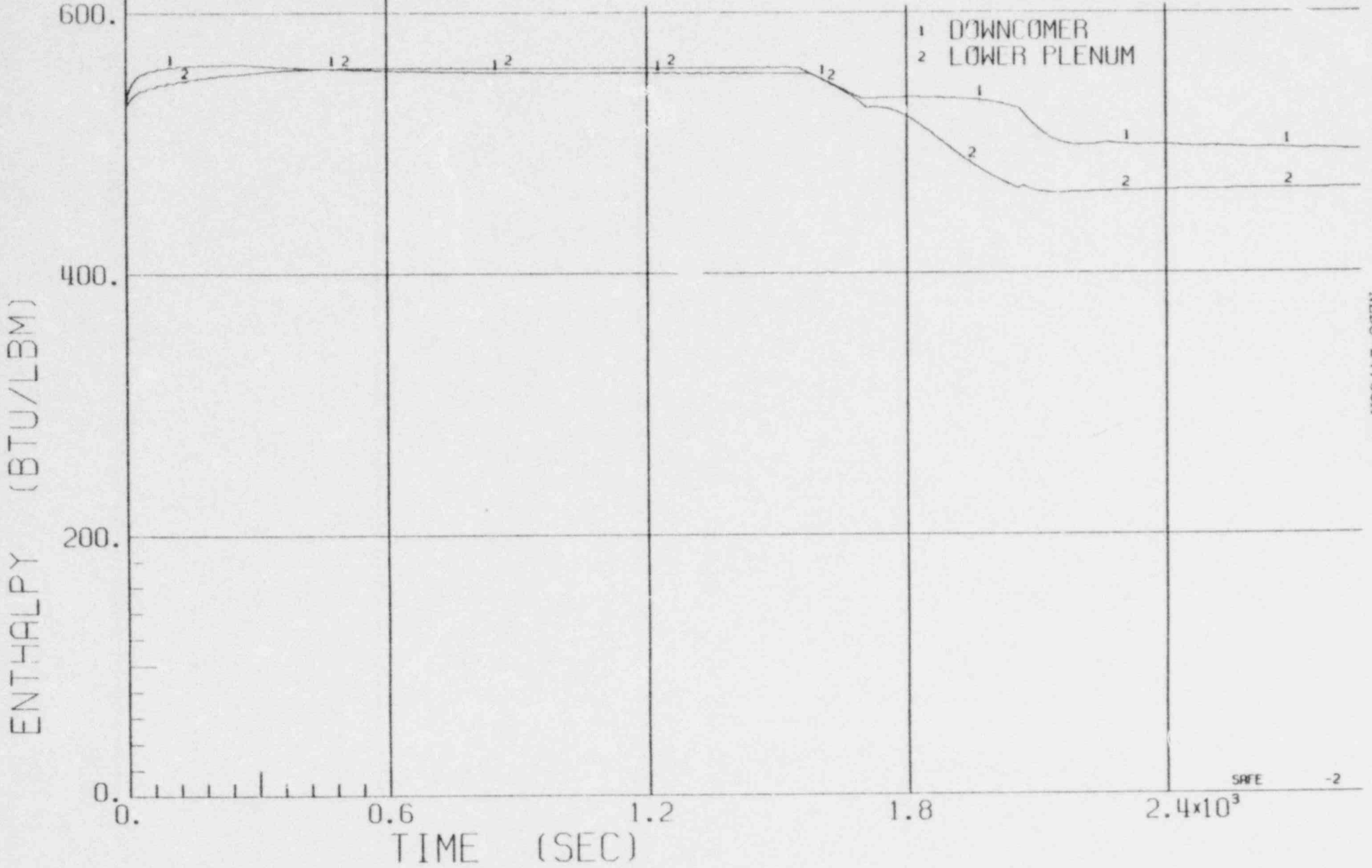
FIGURE 3.5.2.1-28.7 ENTHALPY VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS



4-1110

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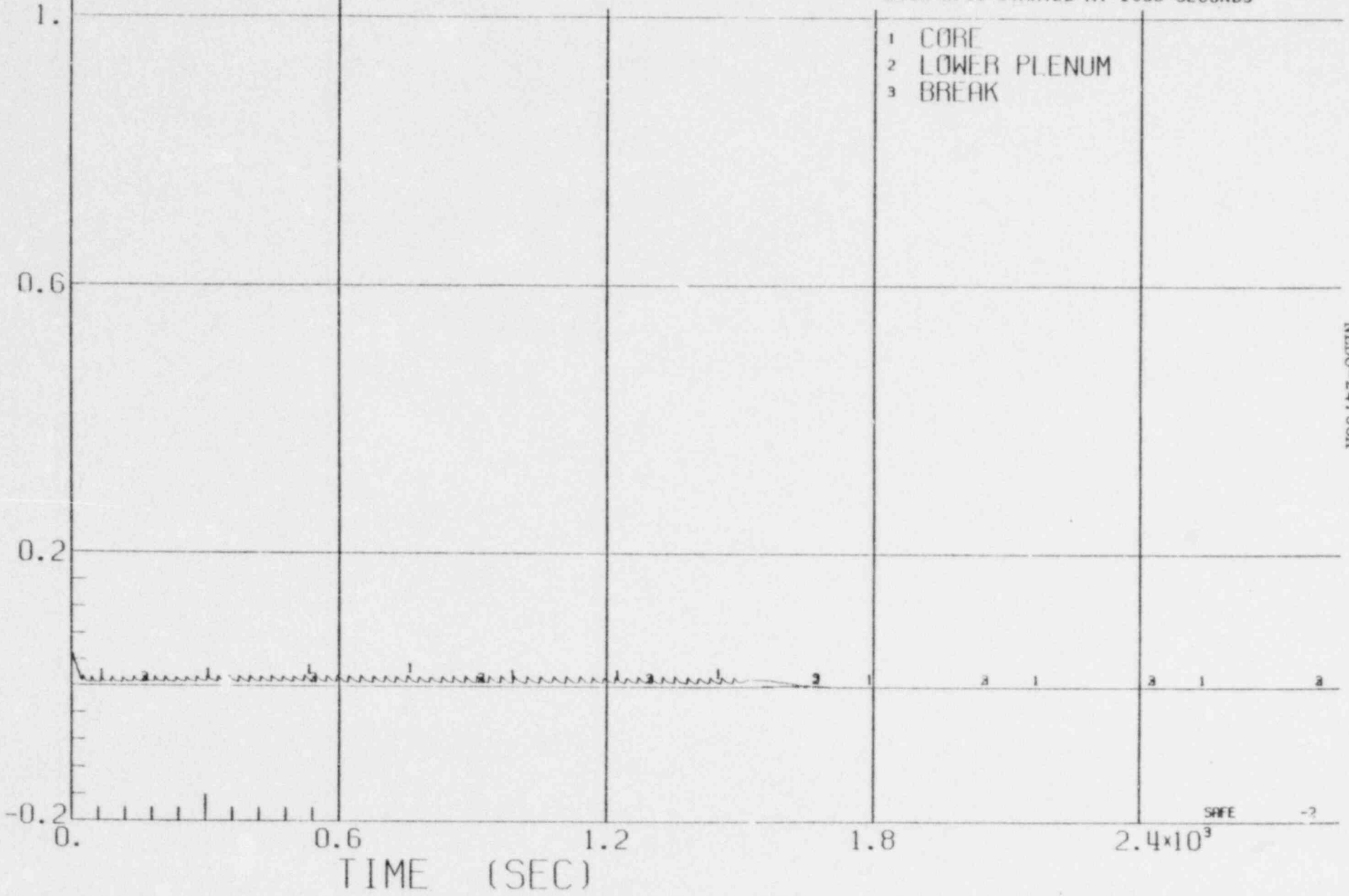
FIGURE 3.5.2.1-28.8 QUALITY VS TIME FOR AN ISOLATION WITH HPCS STARTED AT 1500 SECONDS



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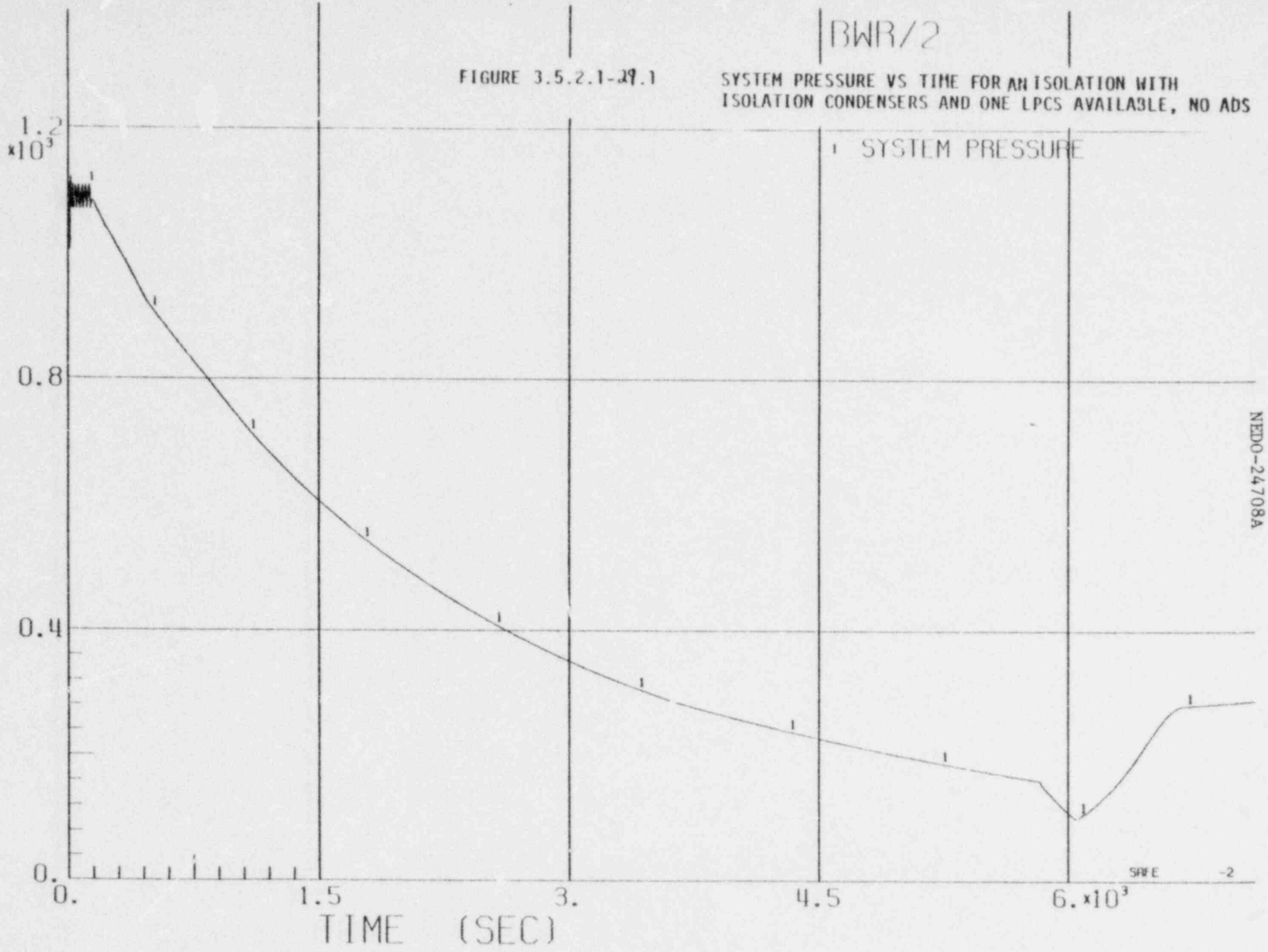
BWR/2

FIGURE 3.5.2.1-29.1 SYSTEM PRESSURE VS TIME FOR AN ISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS



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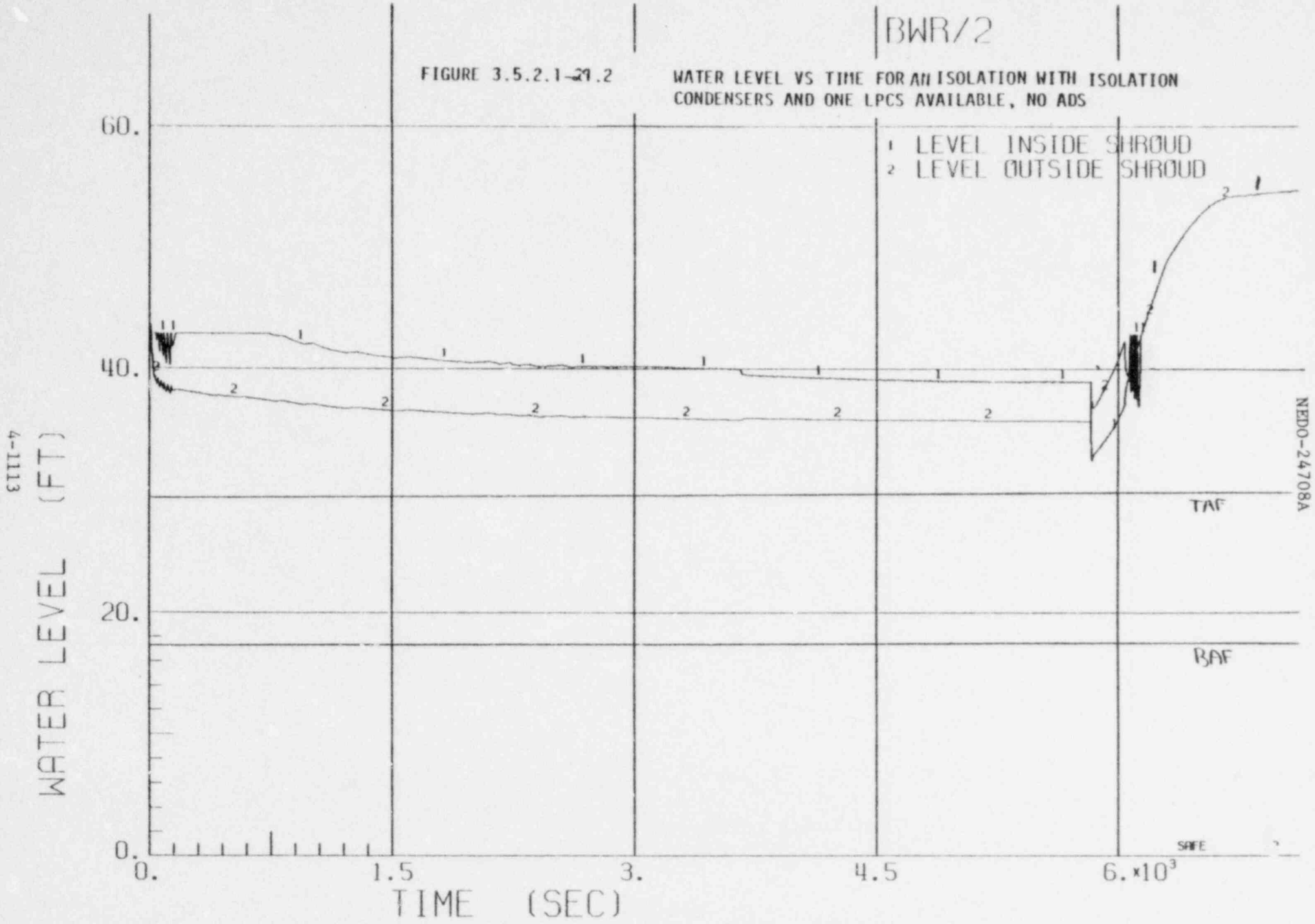
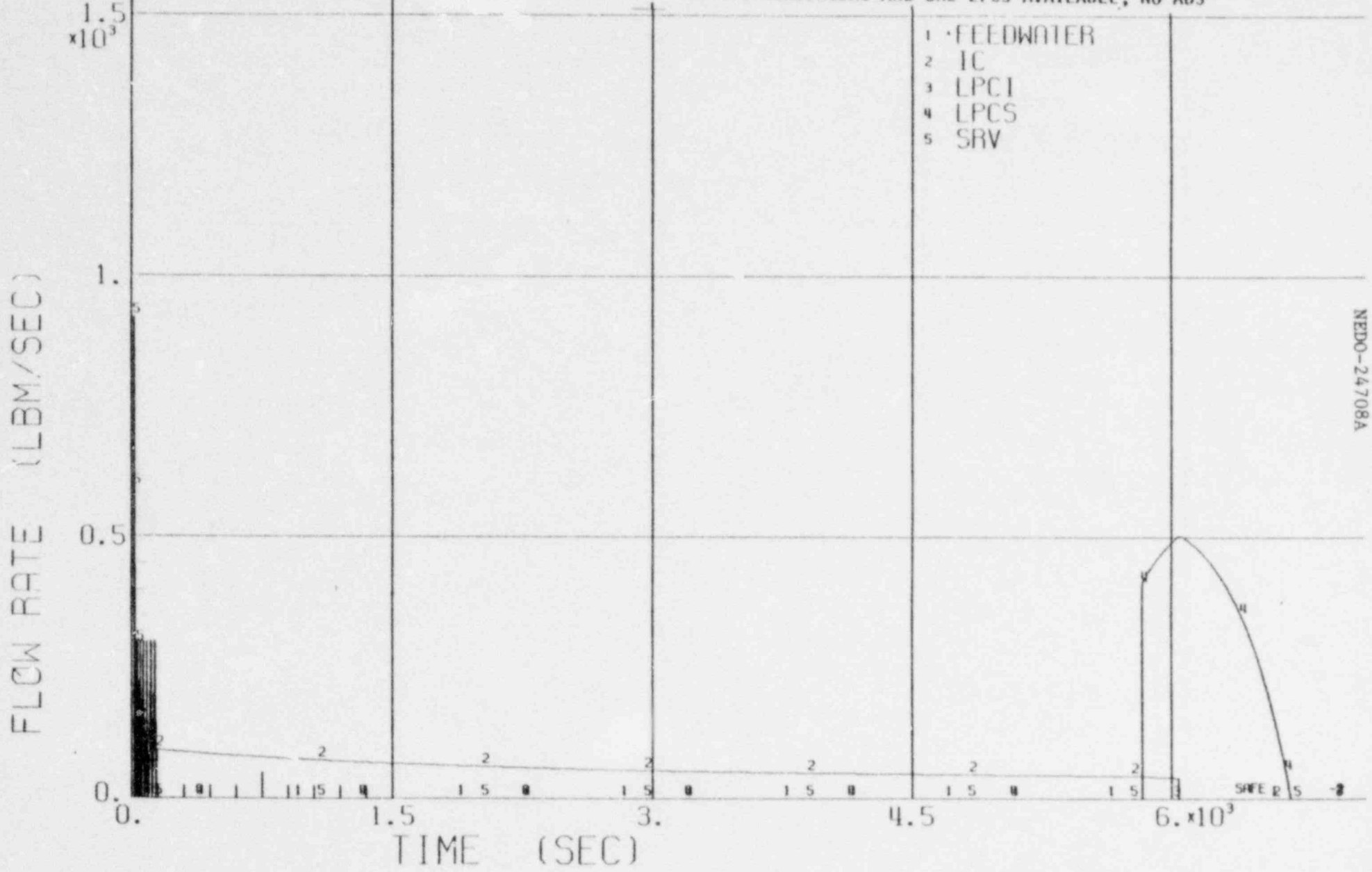

BWR/2
FIGURE 3.5.2.1-29.2
WATER LEVEL VS TIME FOR AN ISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS
1 LEVEL INSIDE SHROUD
2 LEVEL OUTSIDE SHROUD
60.
40.
20.
0.
TAF
BAF
0.
1.5
3.
4.5
6.×10³
TIME (SEC)
WATER LEVEL (FT)
NEDO-24708A
4-1113
SAFE

BWR/2

FIGURE 3.5.2.1-29.3 SYSTEM FLOW RATES VS TIME FOR ANISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS



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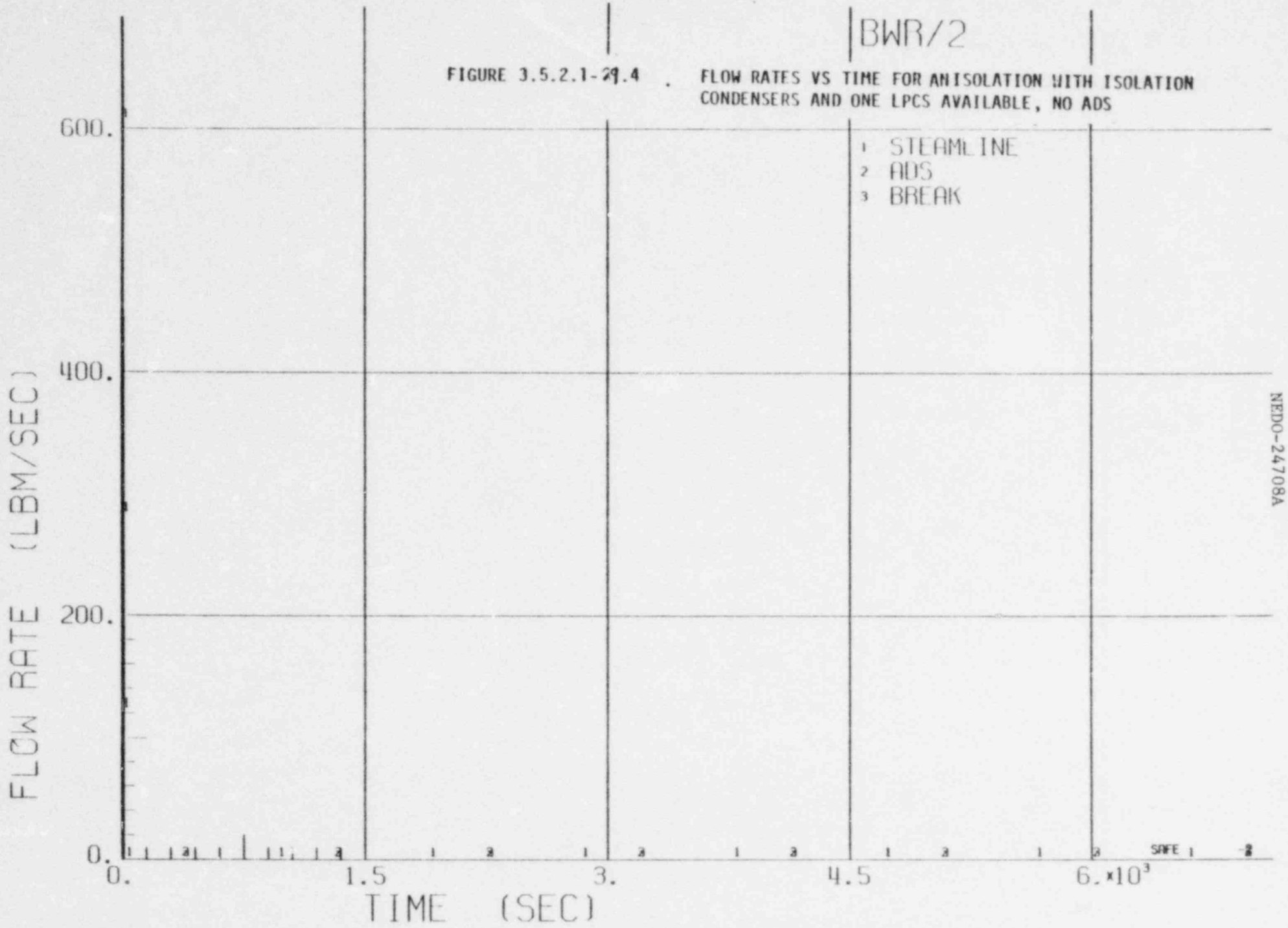
4-1114

BWR/2

FIGURE 3.5.2.1-29.4 . FLOW RATES VS TIME FOR ANISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS



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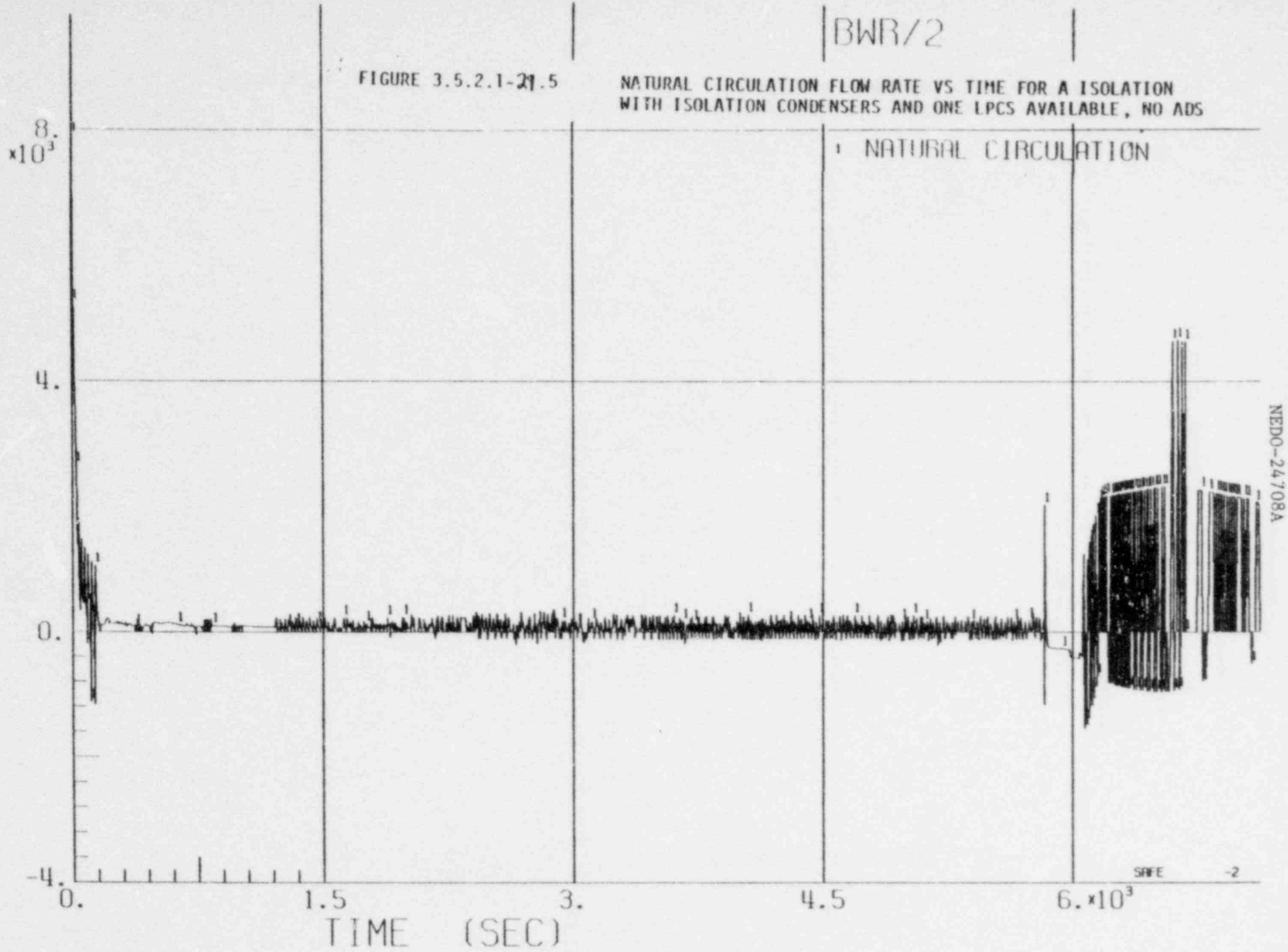
BWR/2

FIGURE 3.5.2.1-21.5

NATURAL CIRCULATION FLOW RATE VS TIME FOR A ISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS



4-1116

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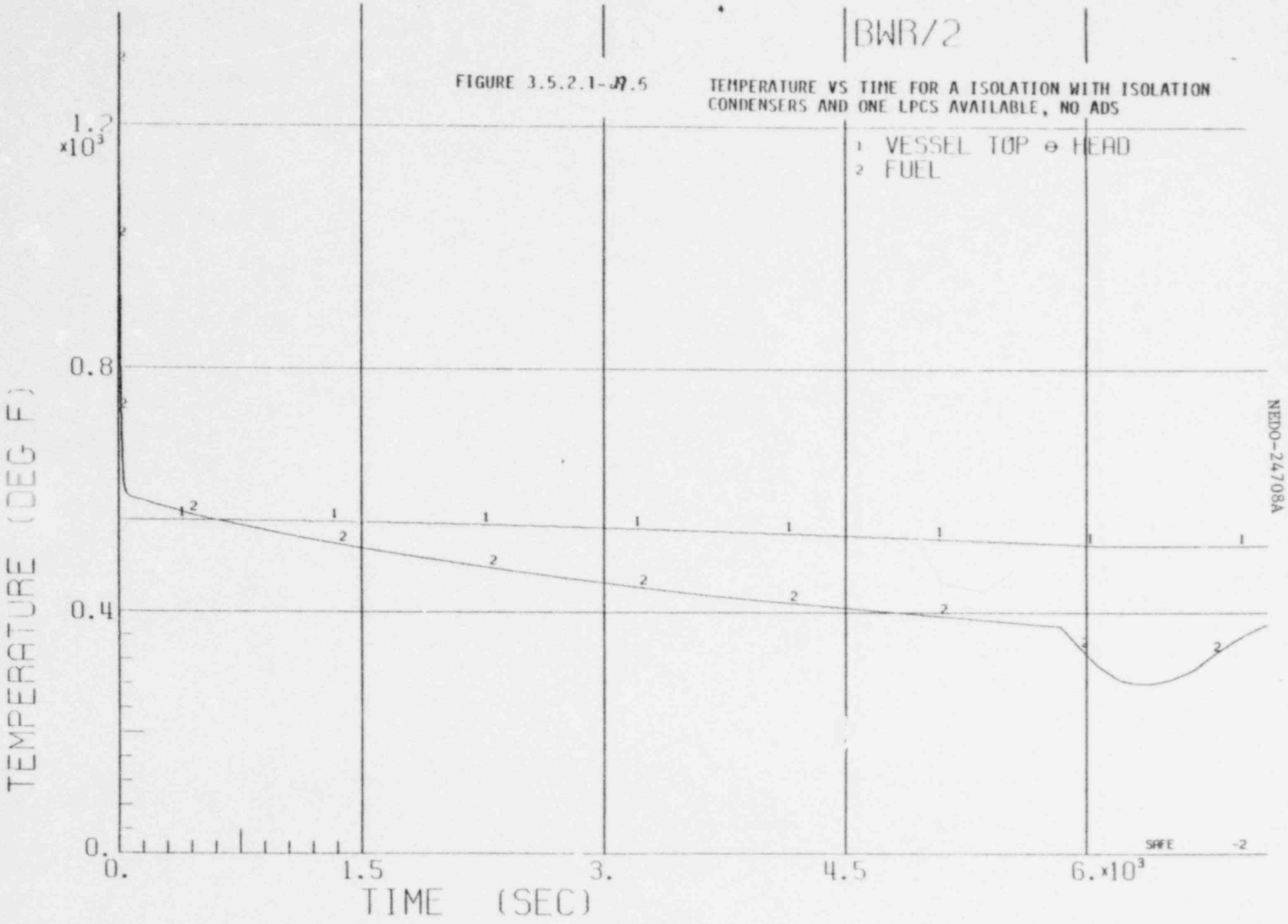
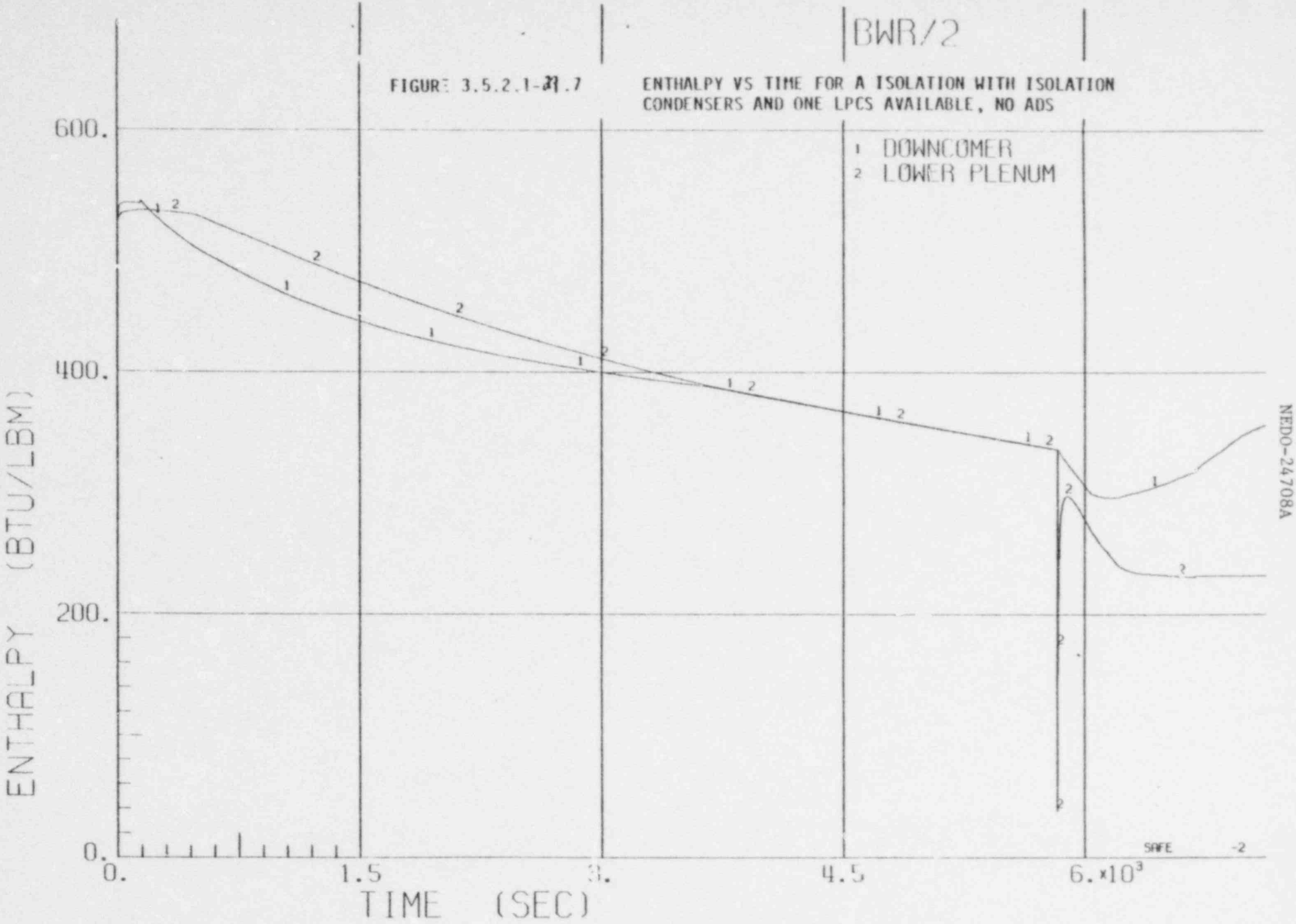

BWR/2
FIGURE 3.5.2.1-A7.5
TEMPERATURE VS TIME FOR A ISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS
1 VESSEL TOP ⊖ HEAD
2 FUEL
1.2 ×10³
0.8
0.4
0.
TEMPERATURE (DEG F)
0.
1.5
3.
4.5
6. ×10³
TIME (SEC)
NEDO-24708A
SAFE -2

BWR/2

FIGURE 3.5.2.1-37.7 ENTHALPY VS TIME FOR A ISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS



4-11118

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BWR/2
FIGURE 3.5.2.1-37.8
QUALITY VS TIME FOR A ISOLATION WITH ISOLATION CONDENSERS AND ONE LPCS AVAILABLE, NO ADS
1 CORE
2 LOWER PLENUM
3 BREAK
1.
0.6
0.2
-0.2
QUALITY
0.
1.5
3.
4.5
6.×10³
TIME (SEC)
NEDO-24708A
4-119
SAFE -2

BWR/6-218

FIGURE 3.5.2.1-30.1 SYSTEM PRESSURE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.

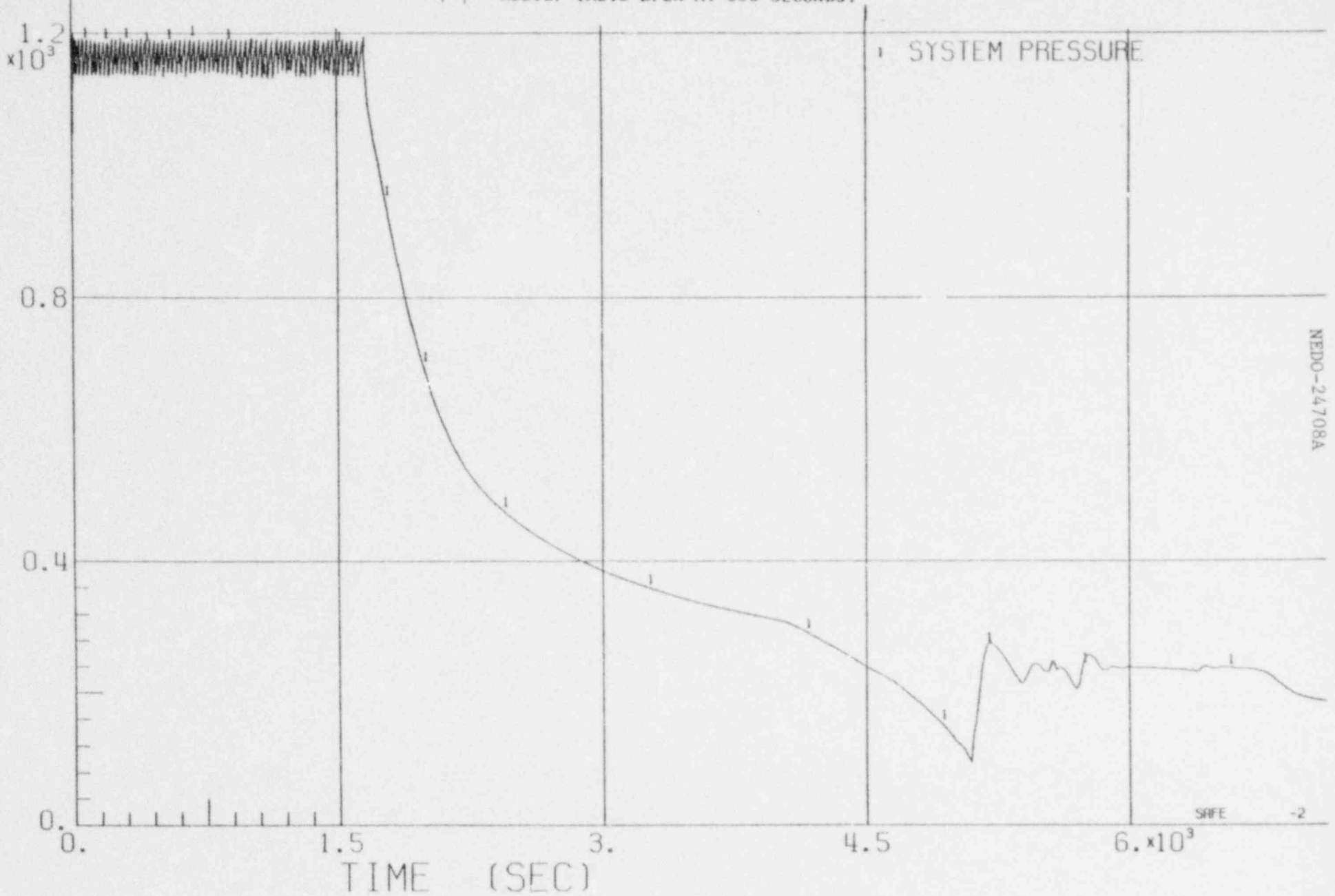

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FIGURE 3.5.2.1-30.2 WATER LEVEL VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.

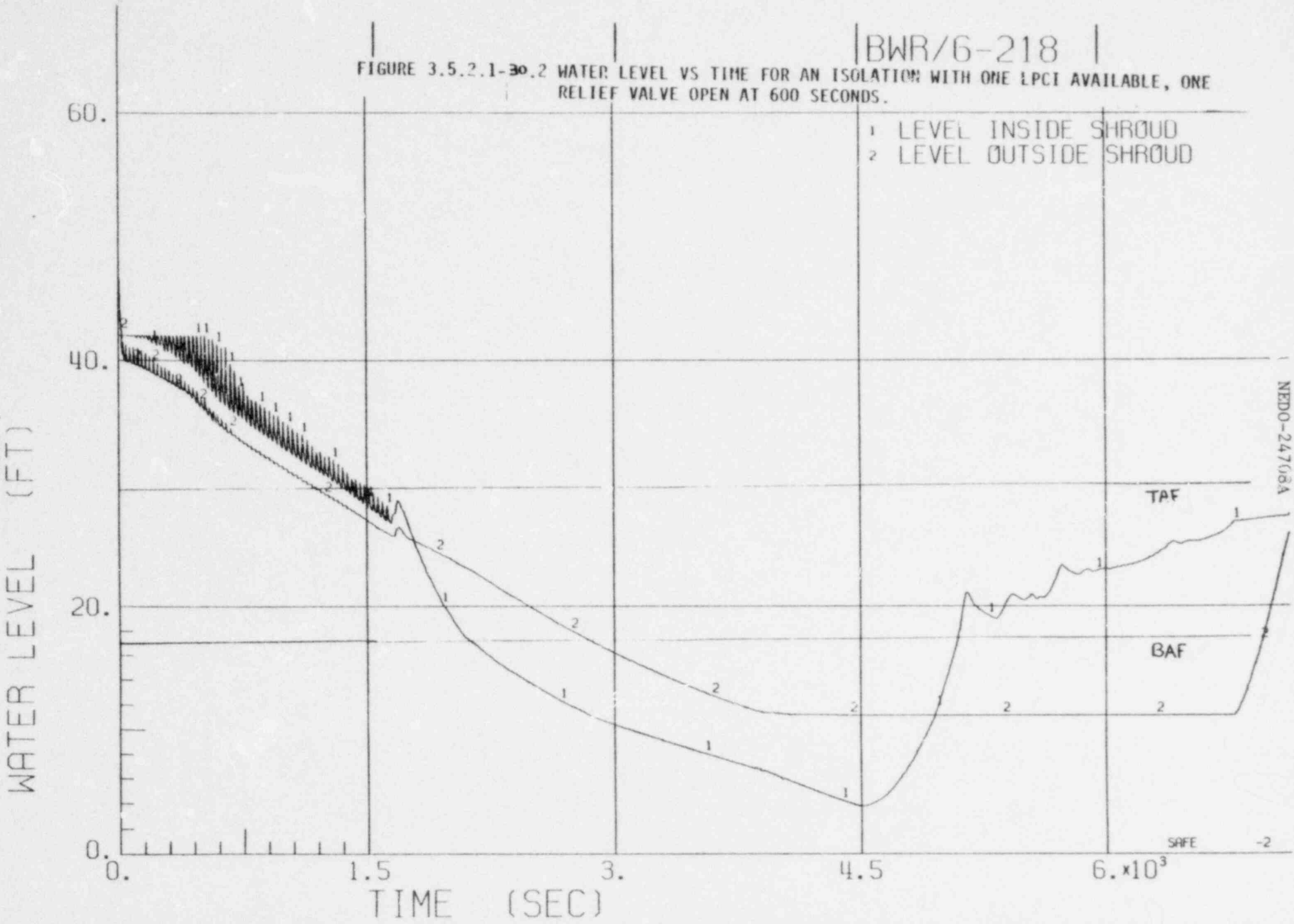

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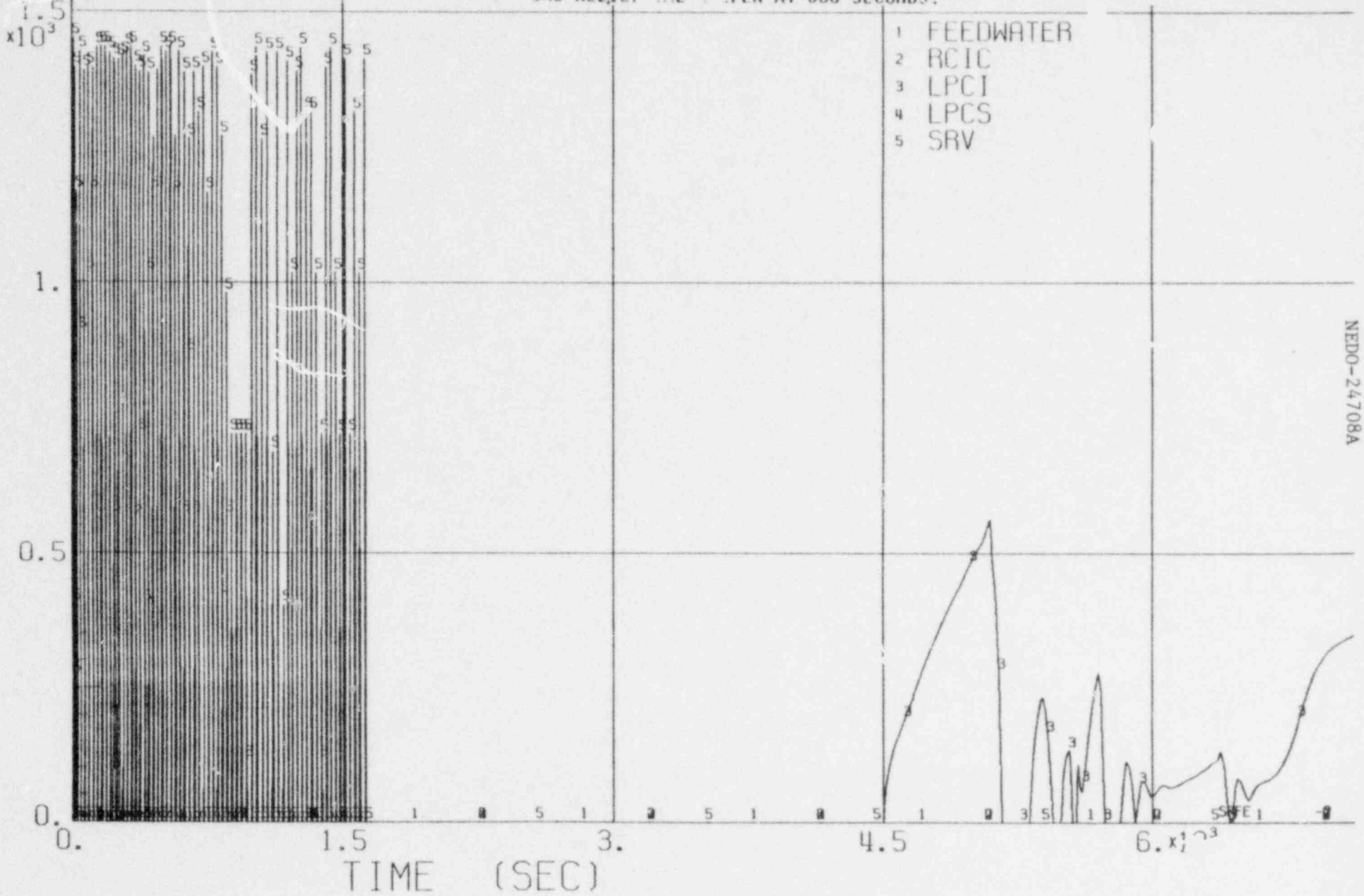
FIGURE 3.5.2.1-30.3 SYSTEM FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.



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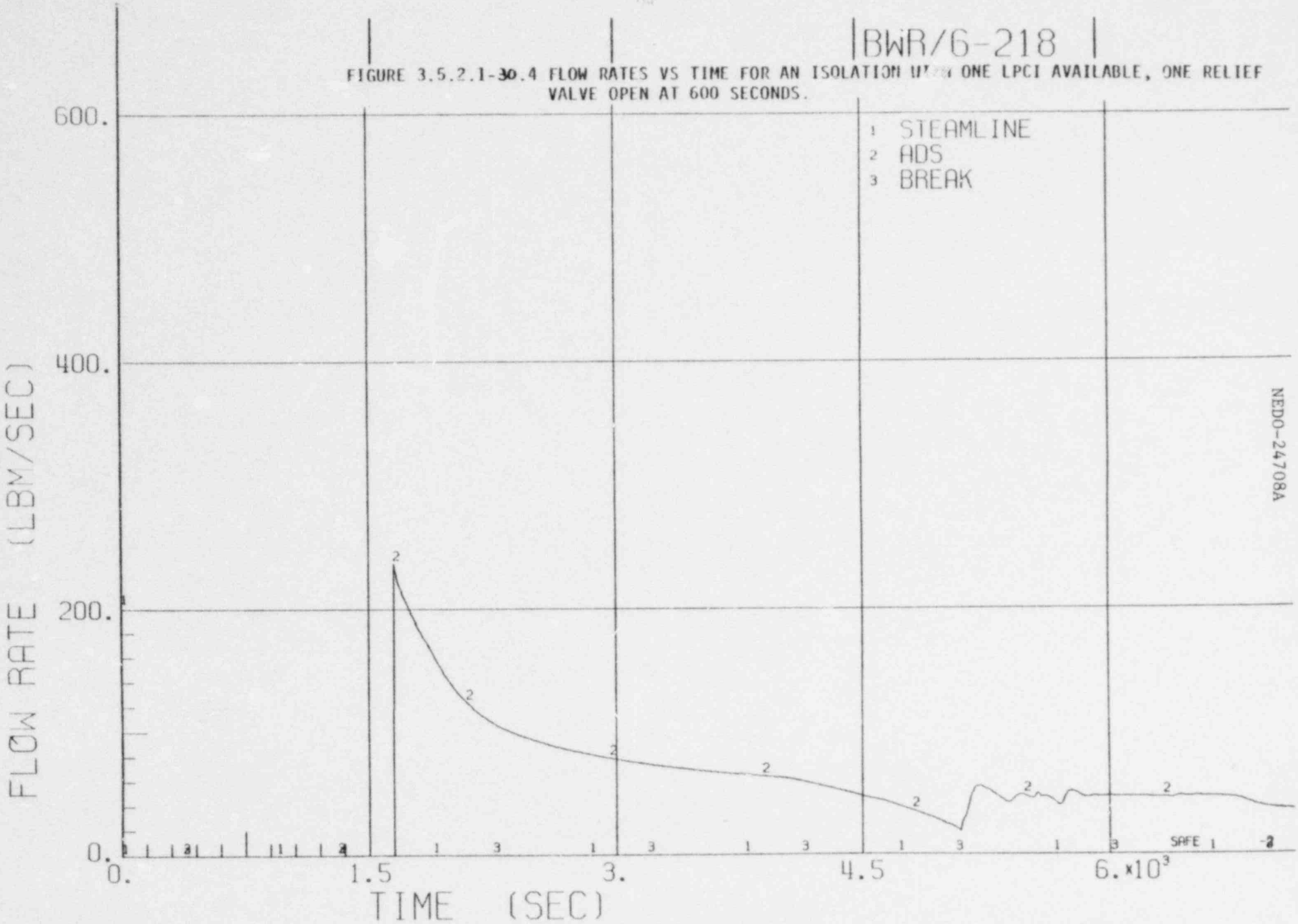
BWR/6-218

FIGURE 3.5.2.1-30.4 FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.



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4-1123

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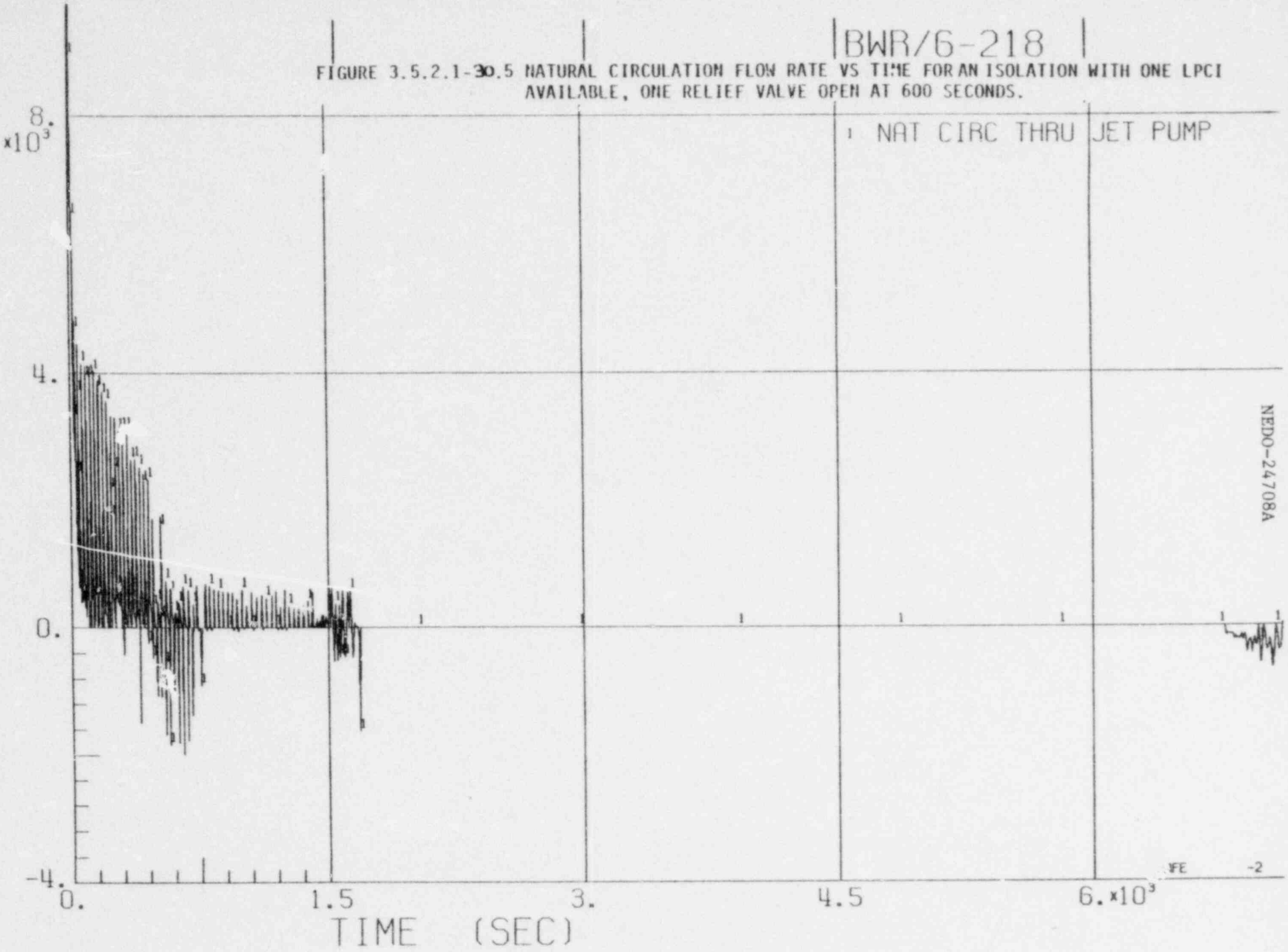
FIGURE 3.5.2.1-30.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.



BWR/6-218

FIGURE 3.5.2.1-30-6A TEMPERATURE* VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.

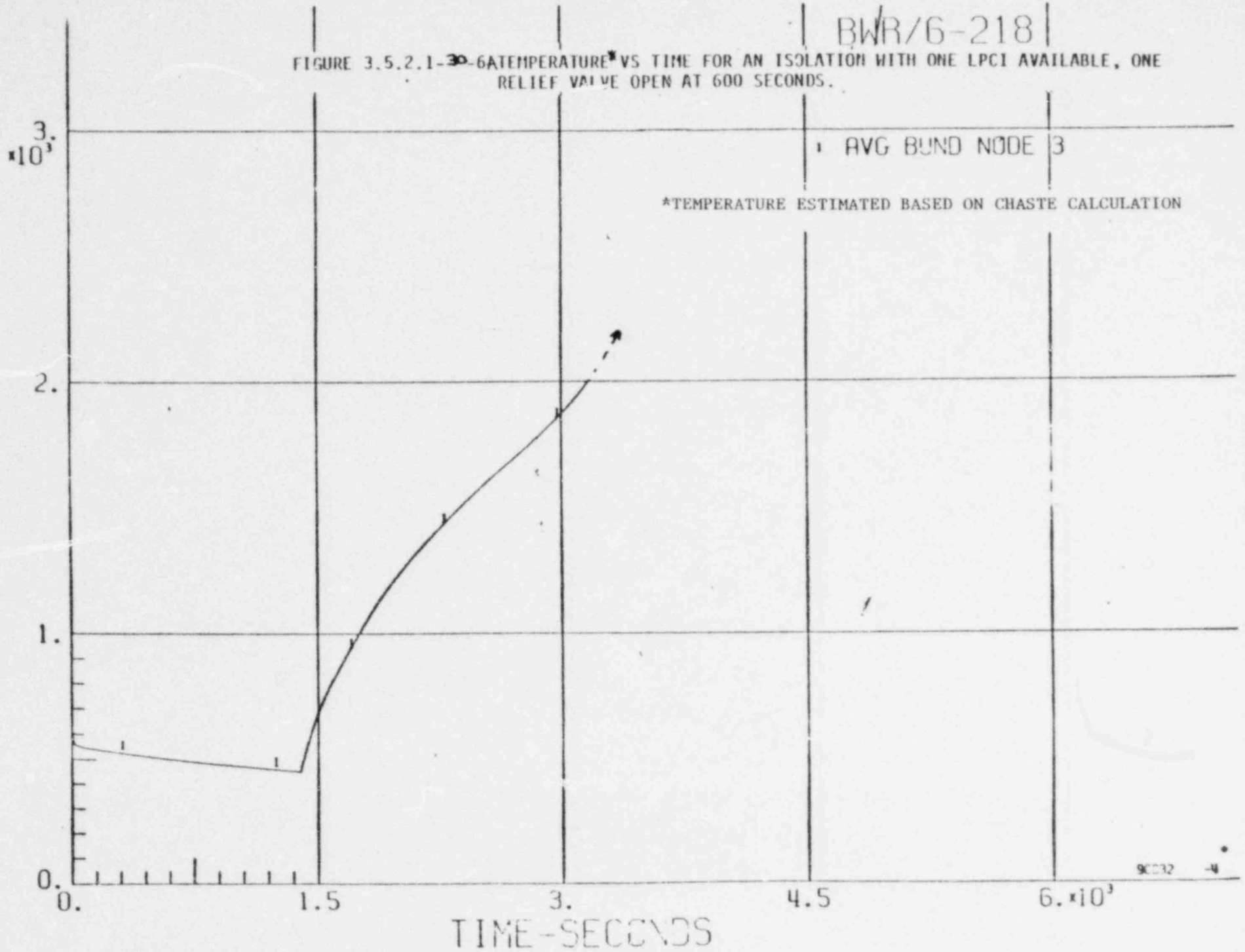


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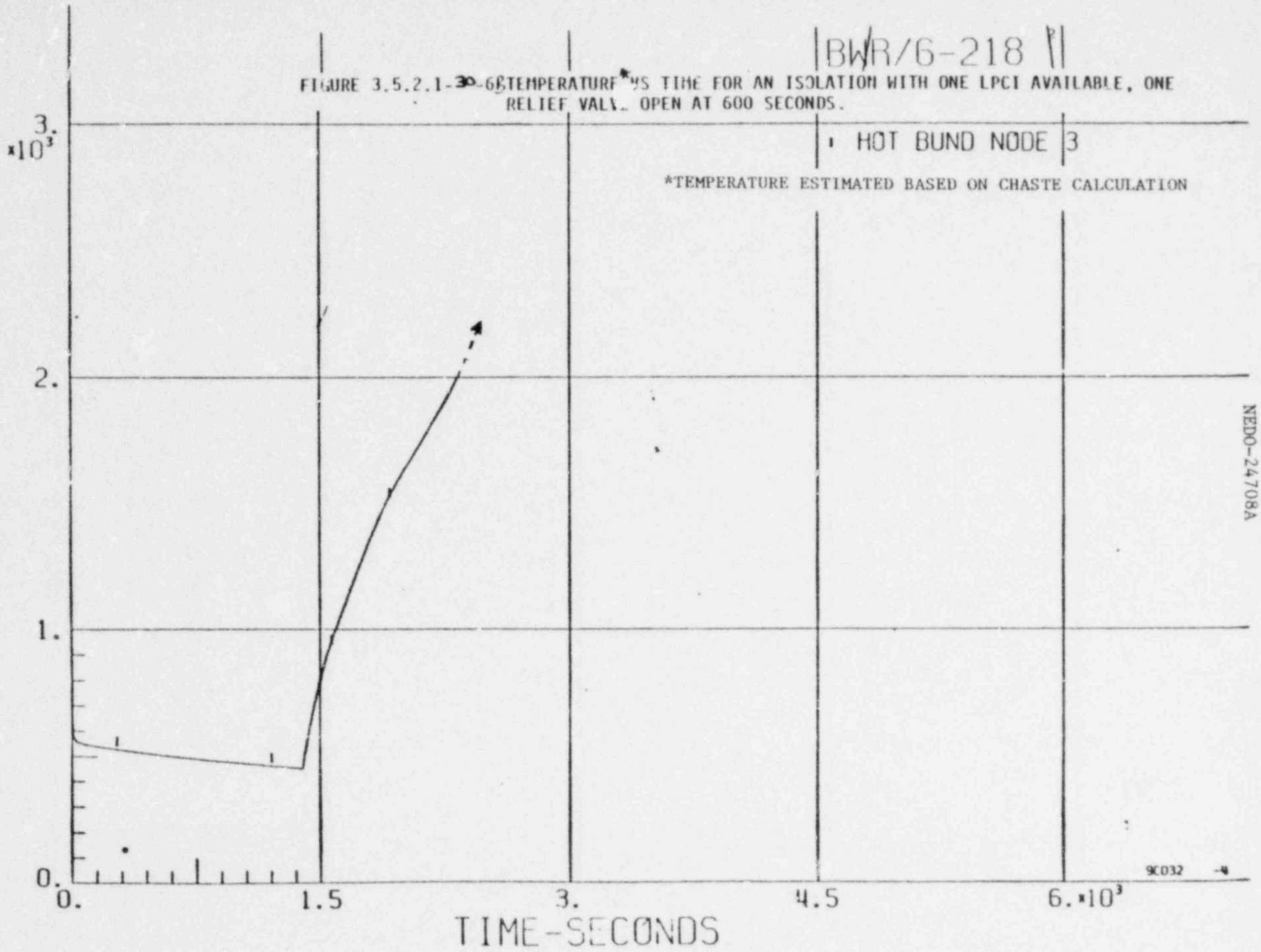
FIGURE 3.5.2.1-30-6 TEMPERATURE* VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.



4-1126

NEDO-24708A

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FIGURE 3.5.2.1-30.7 ENTHALPY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.

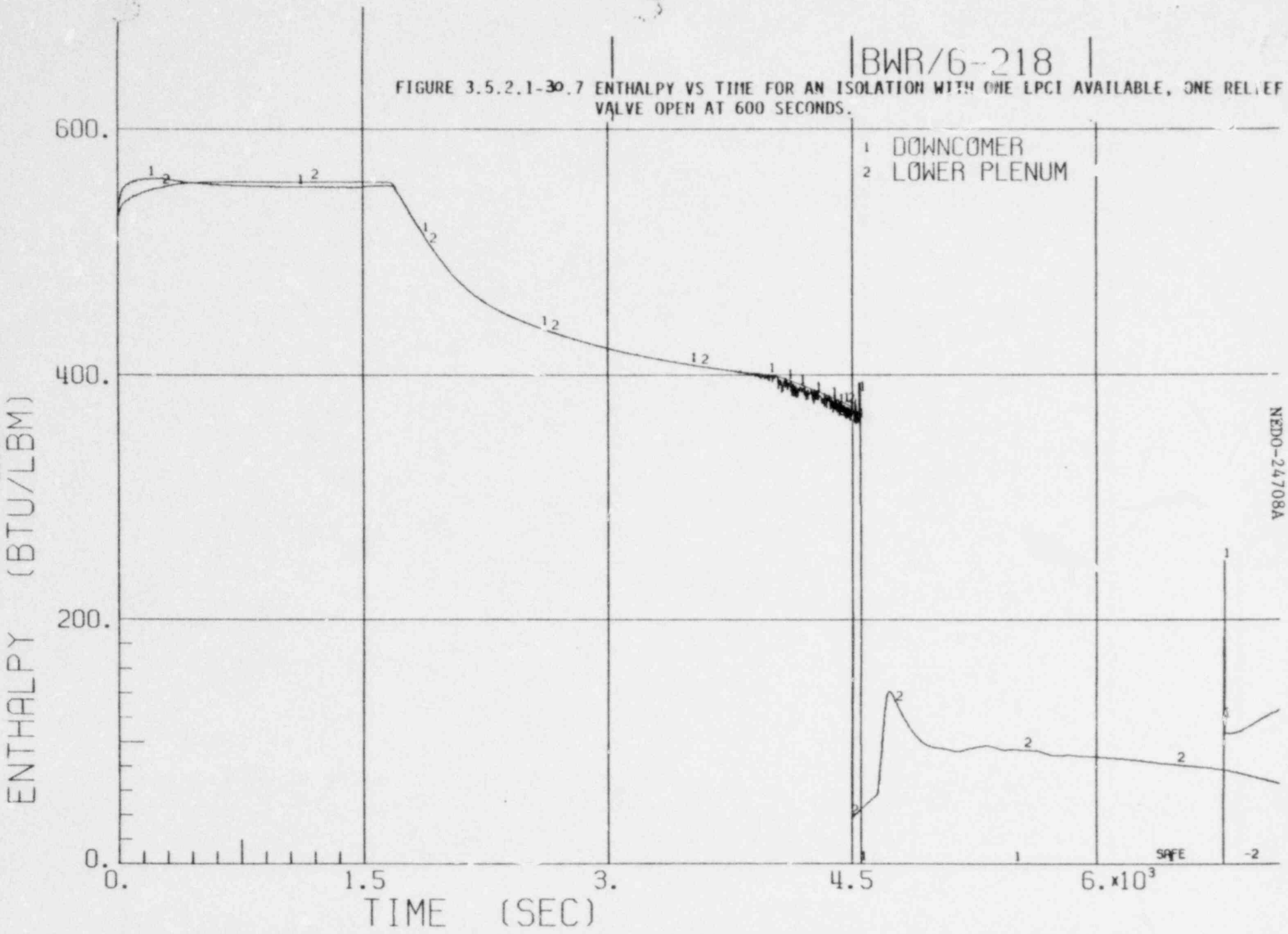

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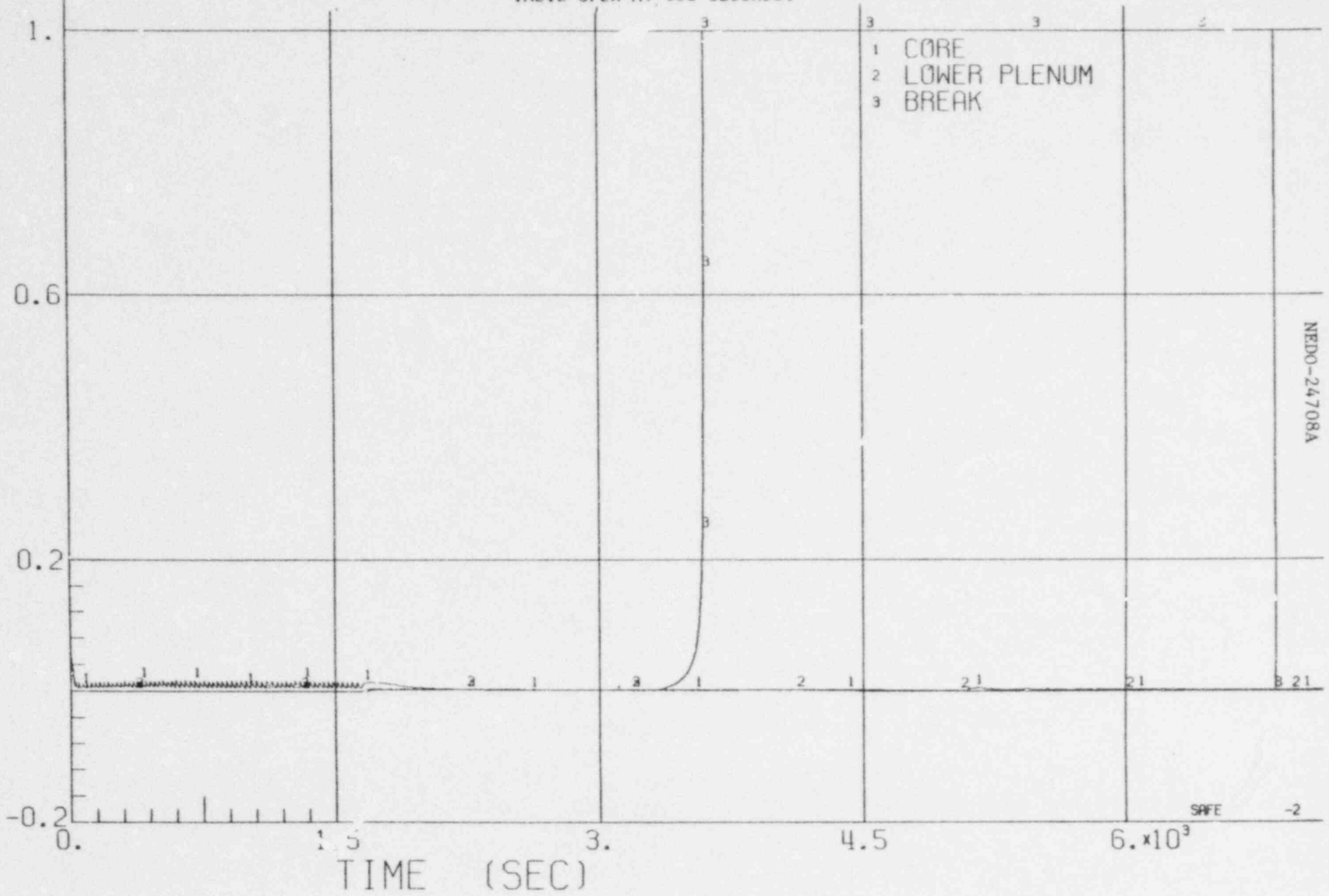
FIGURE 3.5.2.1-30.8 QUALITY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, ONE RELIEF VALVE OPEN AT 600 SECONDS.



4-1128

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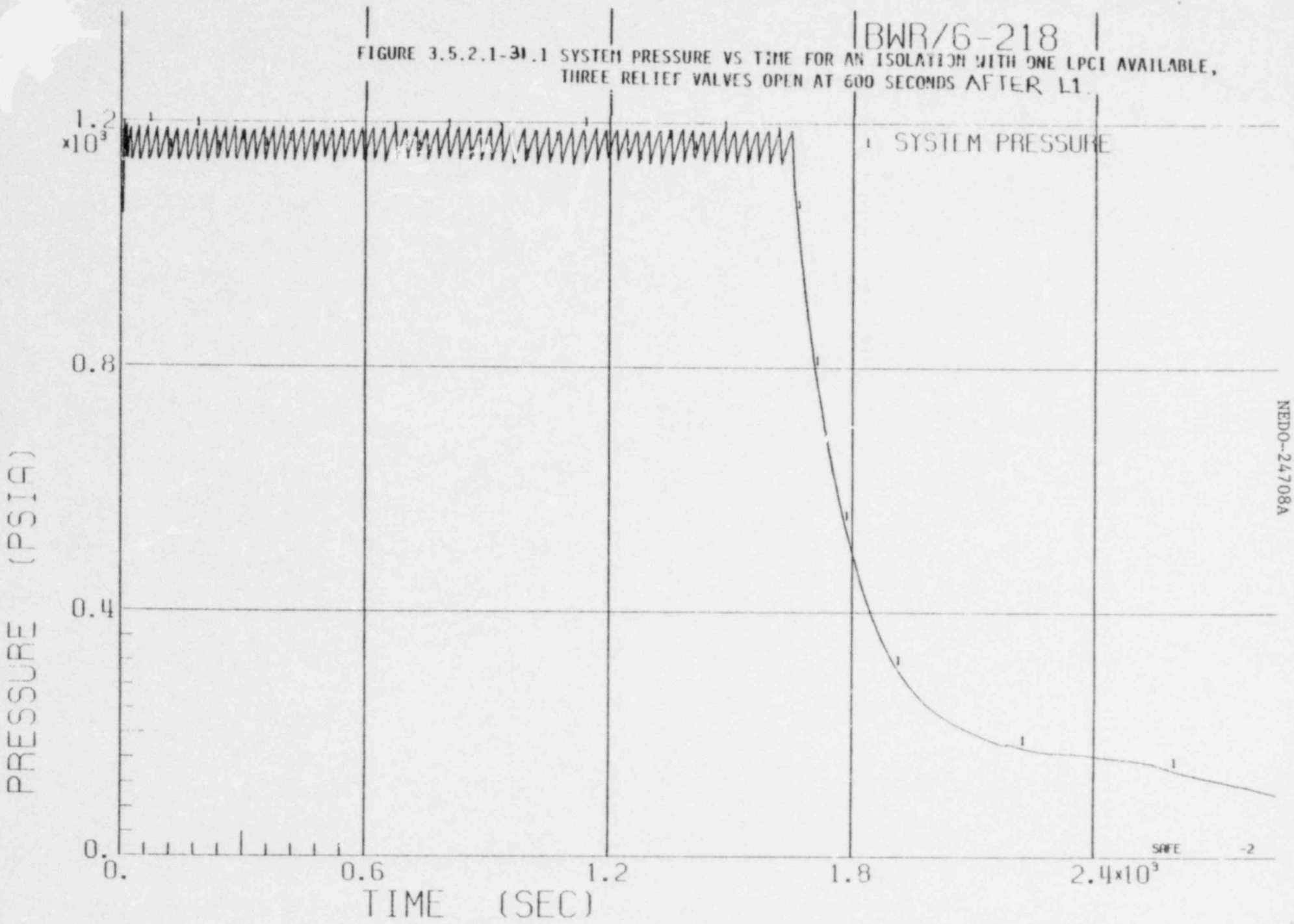
FIGURE 3.5.2.1-31.1 SYSTEM PRESSURE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.



NEDO-24708A

4-1129

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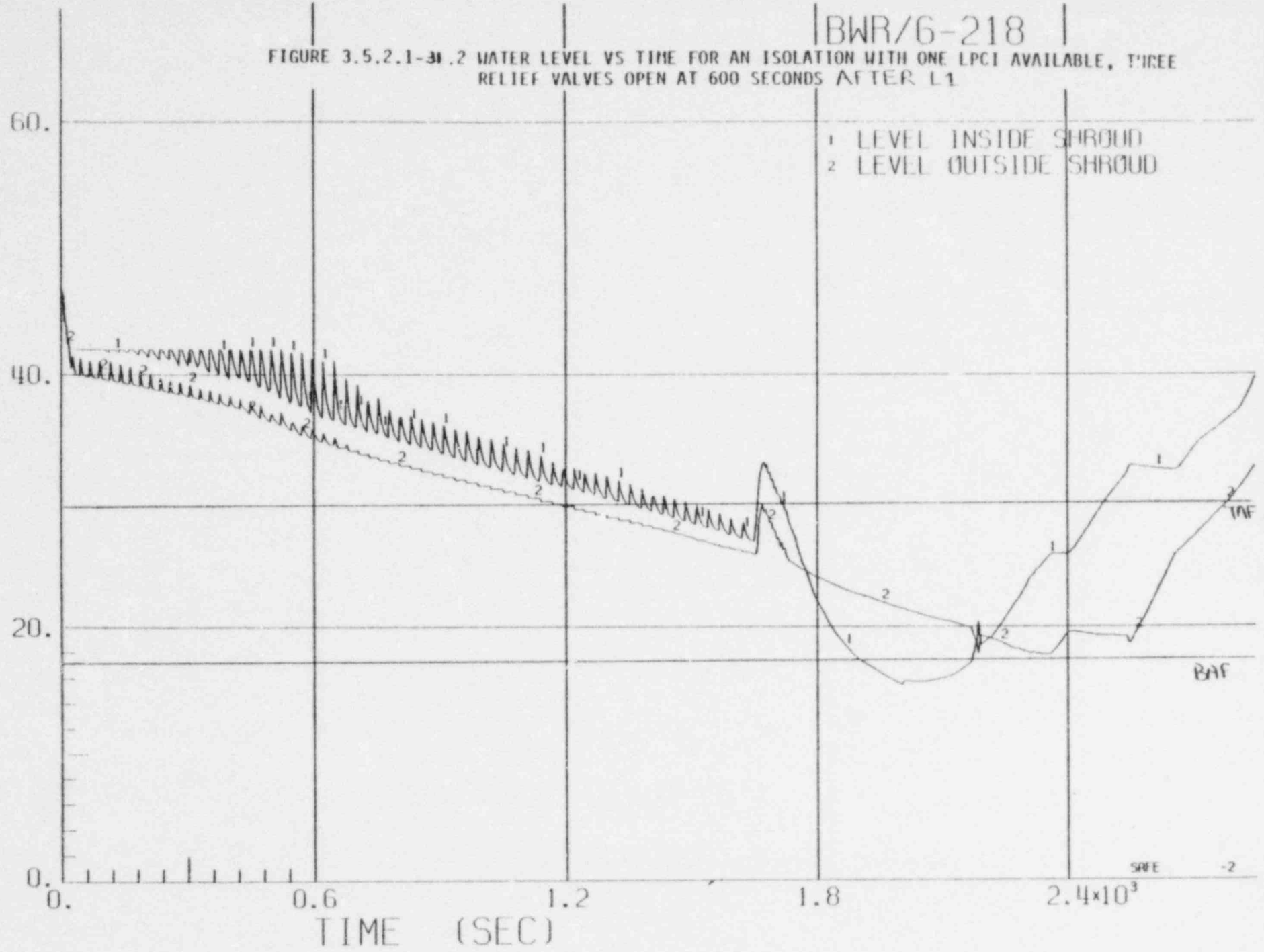
FIGURE 3.5.2.1-3 .2 WATER LEVEL VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1



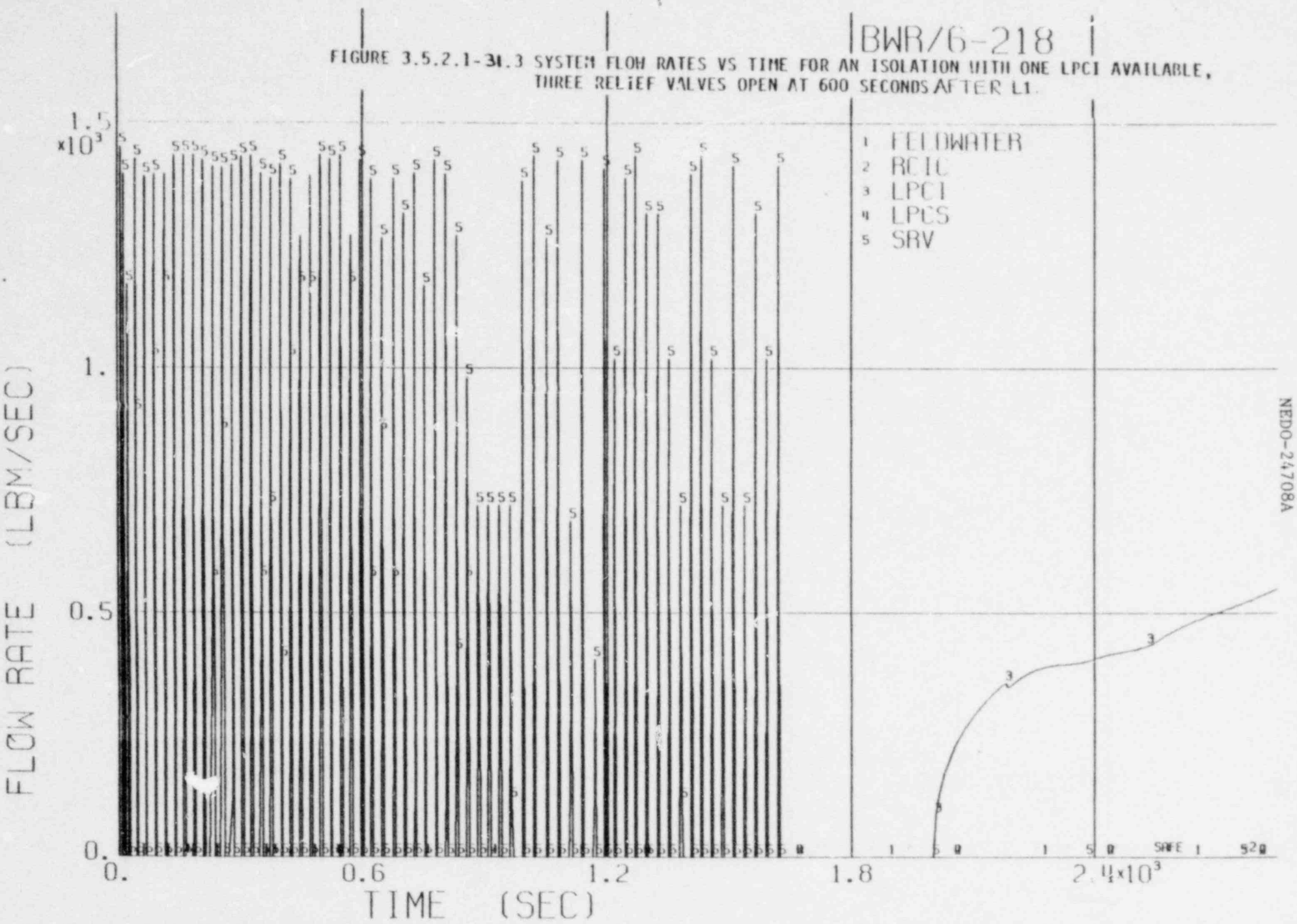


FIGURE 3.5.2.1-31.3 SYSTEM FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.

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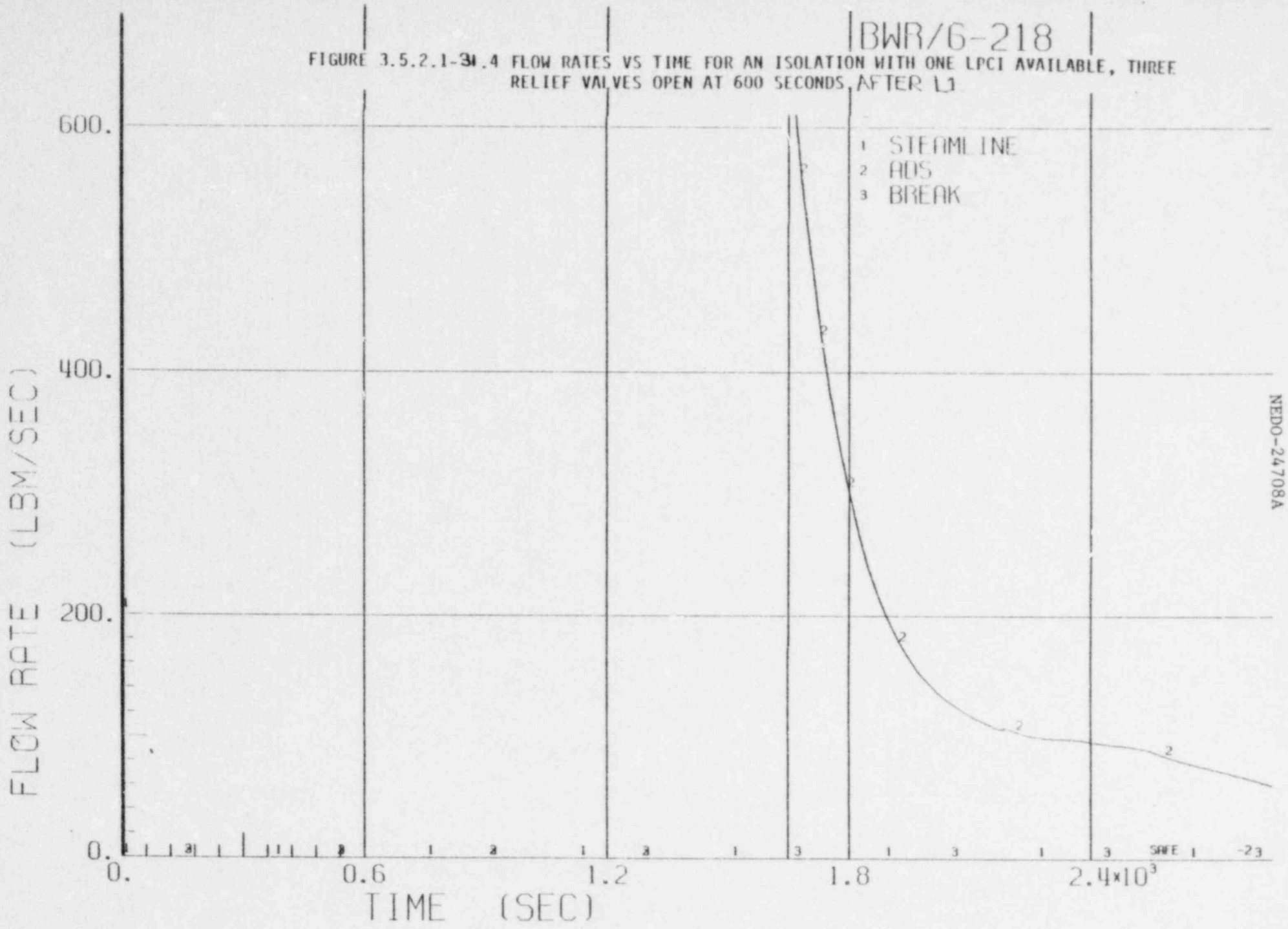
FIGURE 3.5.2.1-31.4 FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1



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BWR/6-218

FIGURE 3.5.2.1-31 .5 NATURAL CIRCULATION FLOW RATE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.

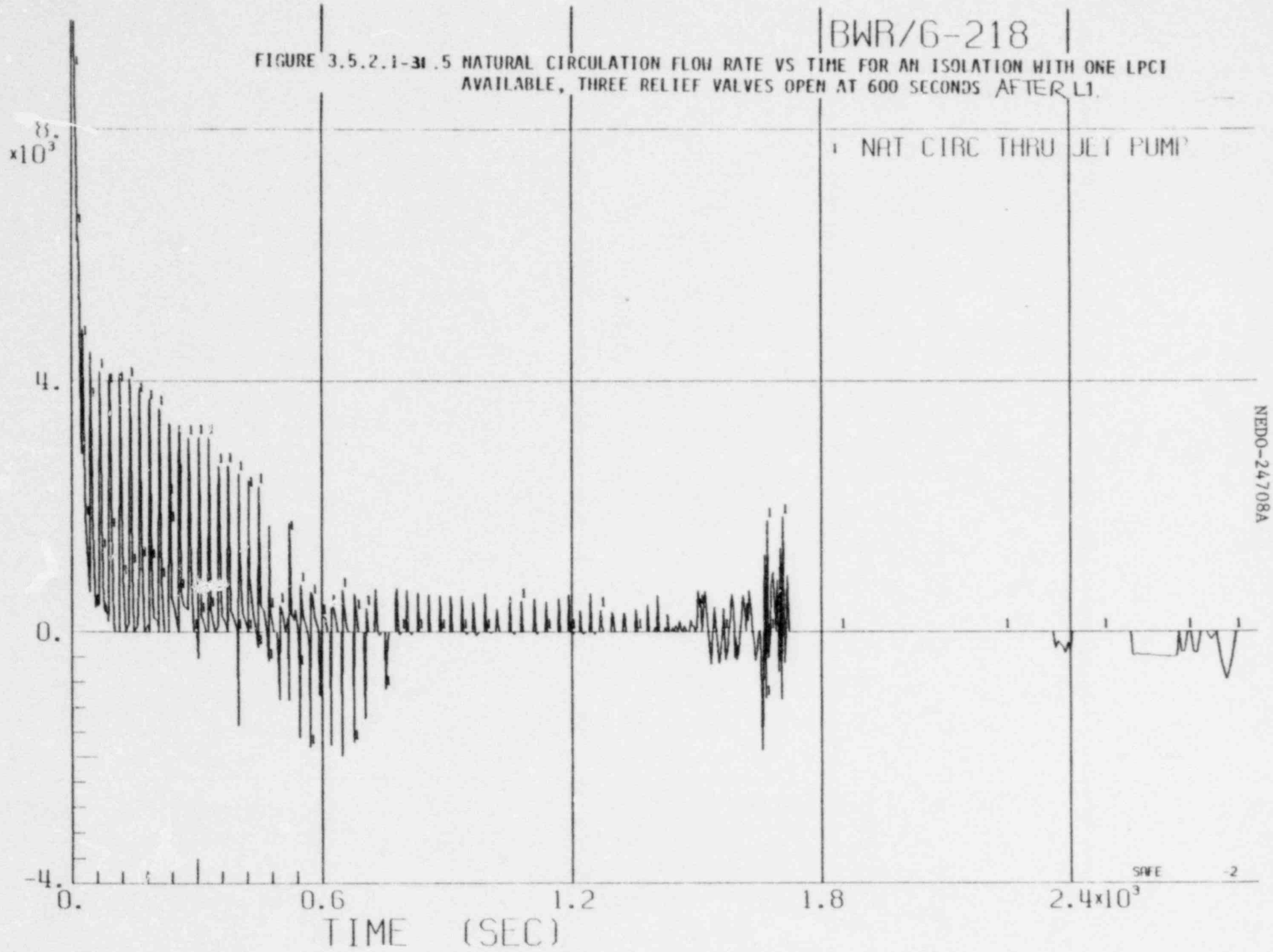

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FIGURE 3.5.2.1-3[illegible].6 TEMPERATURE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1

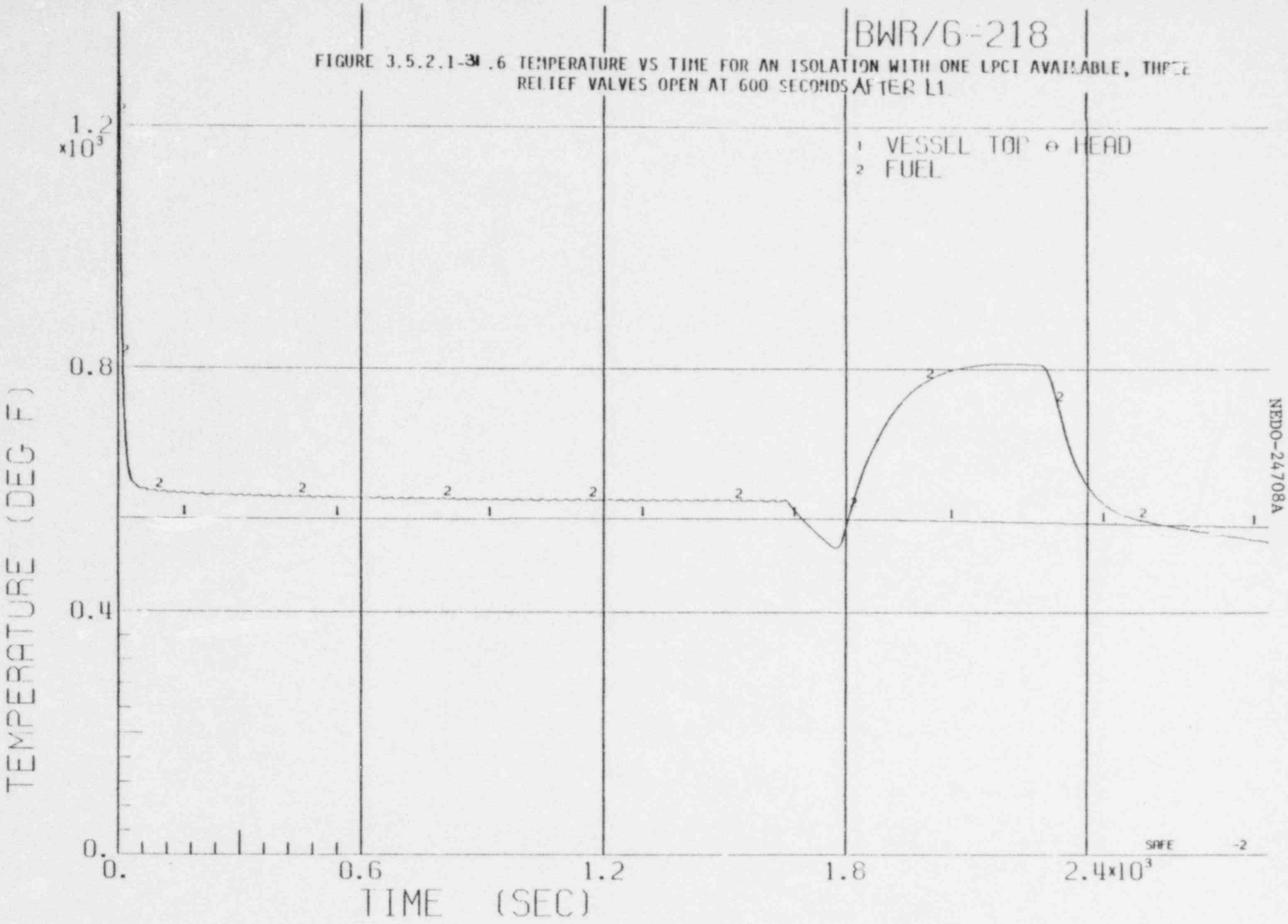

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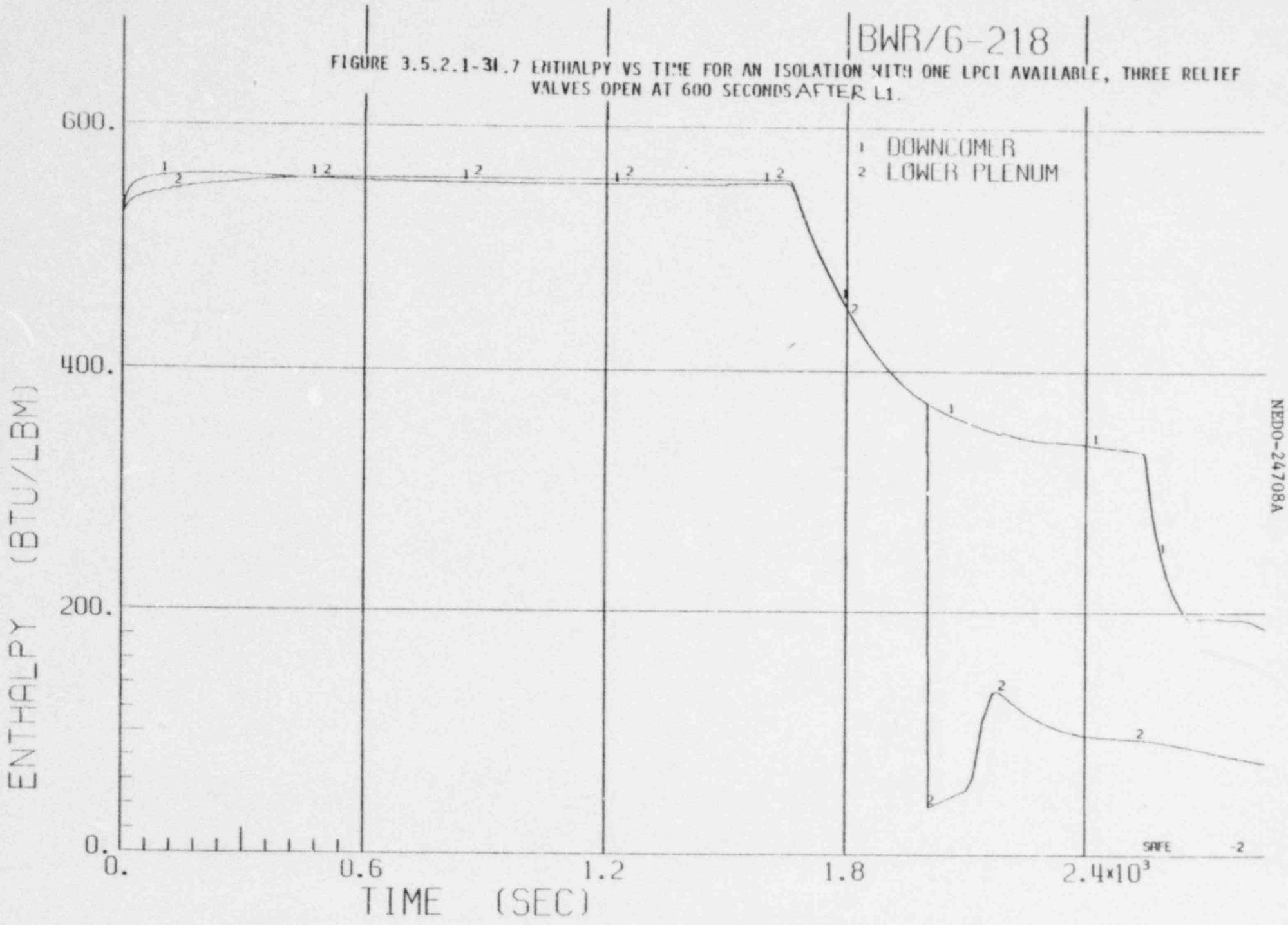
FIGURE 3.5.2.1-31.7 ENTHALPY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.



4-1135

NEDO-24708A

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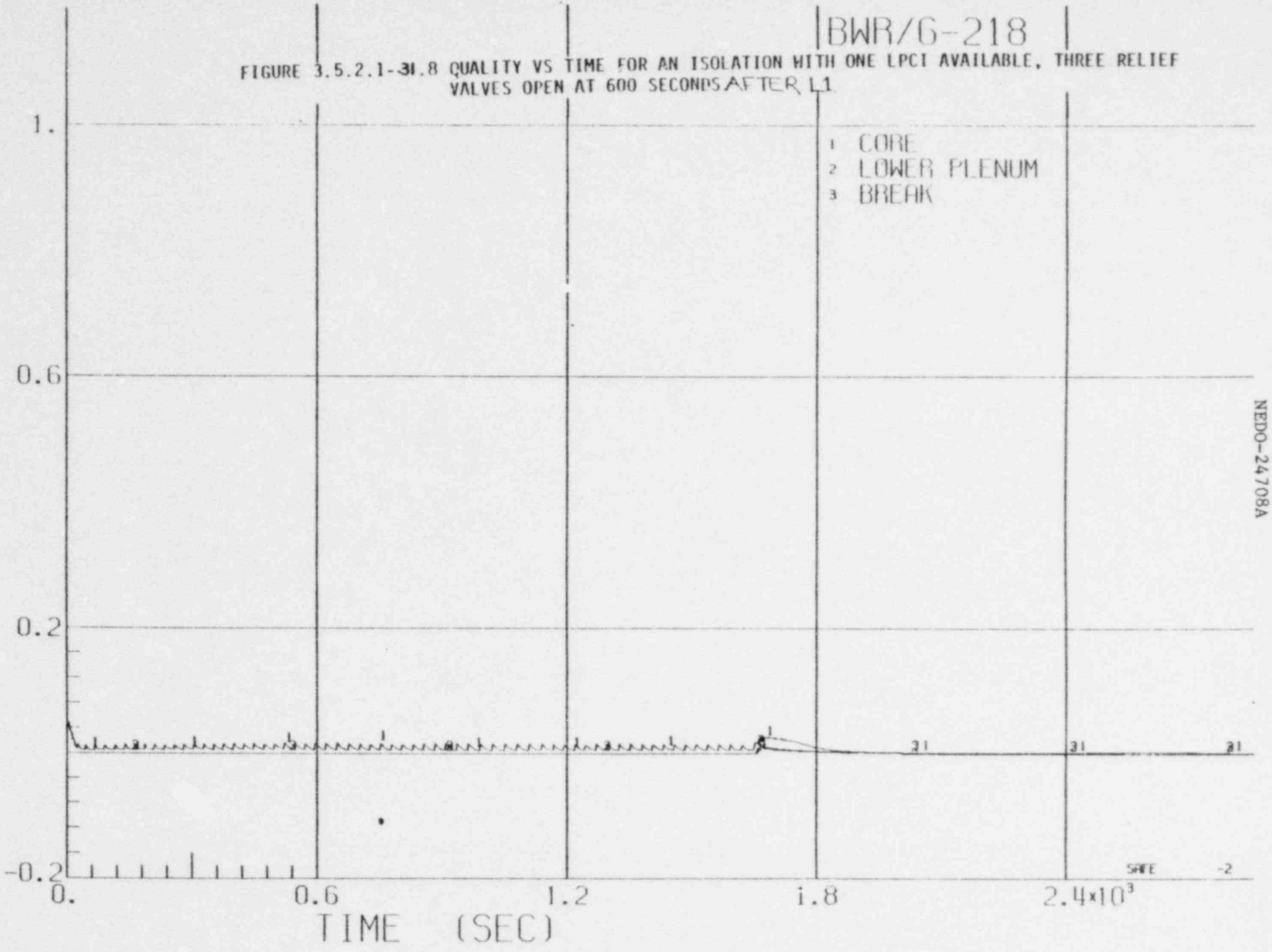
FIGURE 3.5.2.1-31.8 QUALITY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, THREE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1



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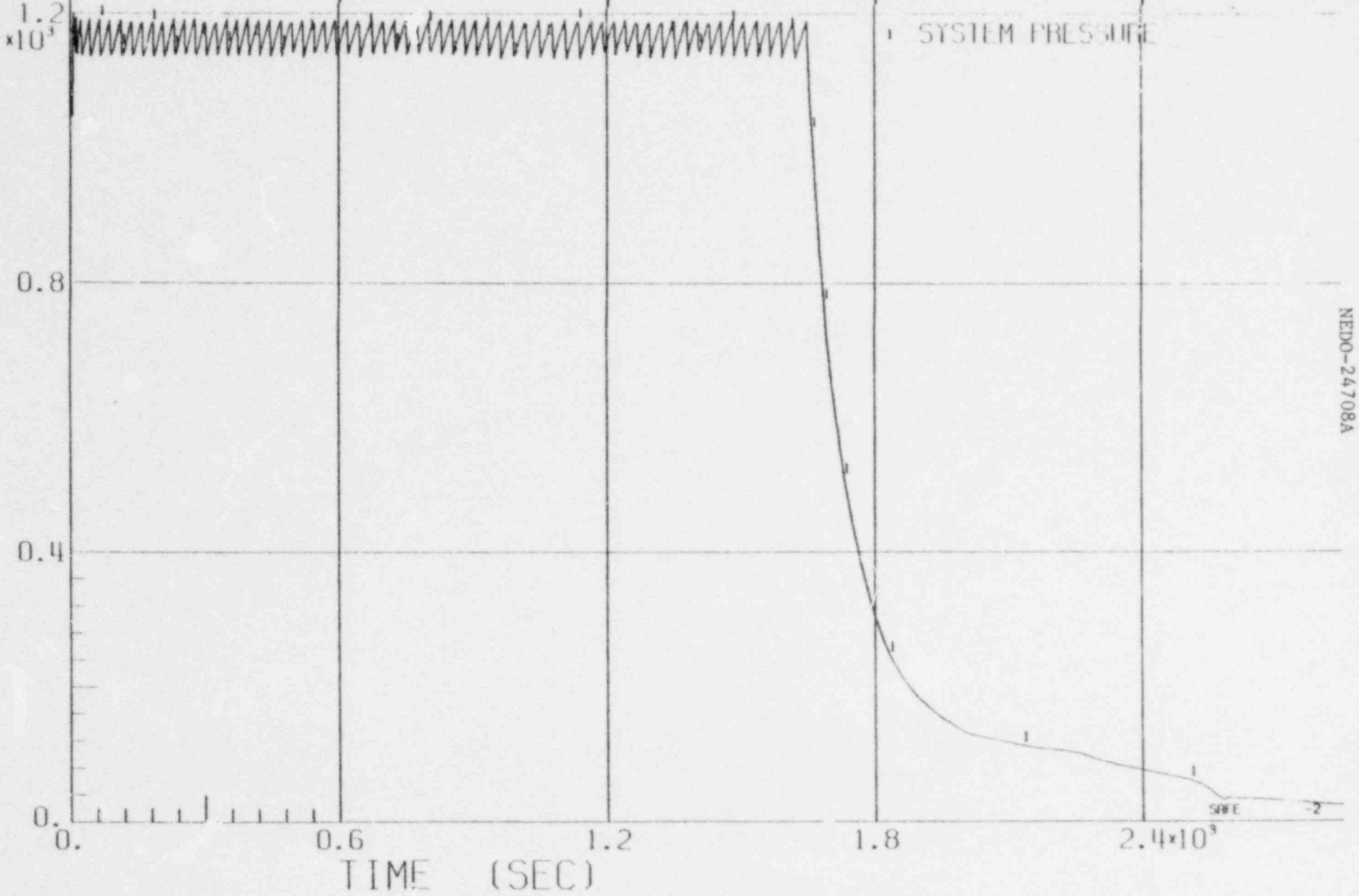
4-1136

BWR/6-218

FIGURE 3.5.2.1-32.1 SYSTEM PRESSURE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1



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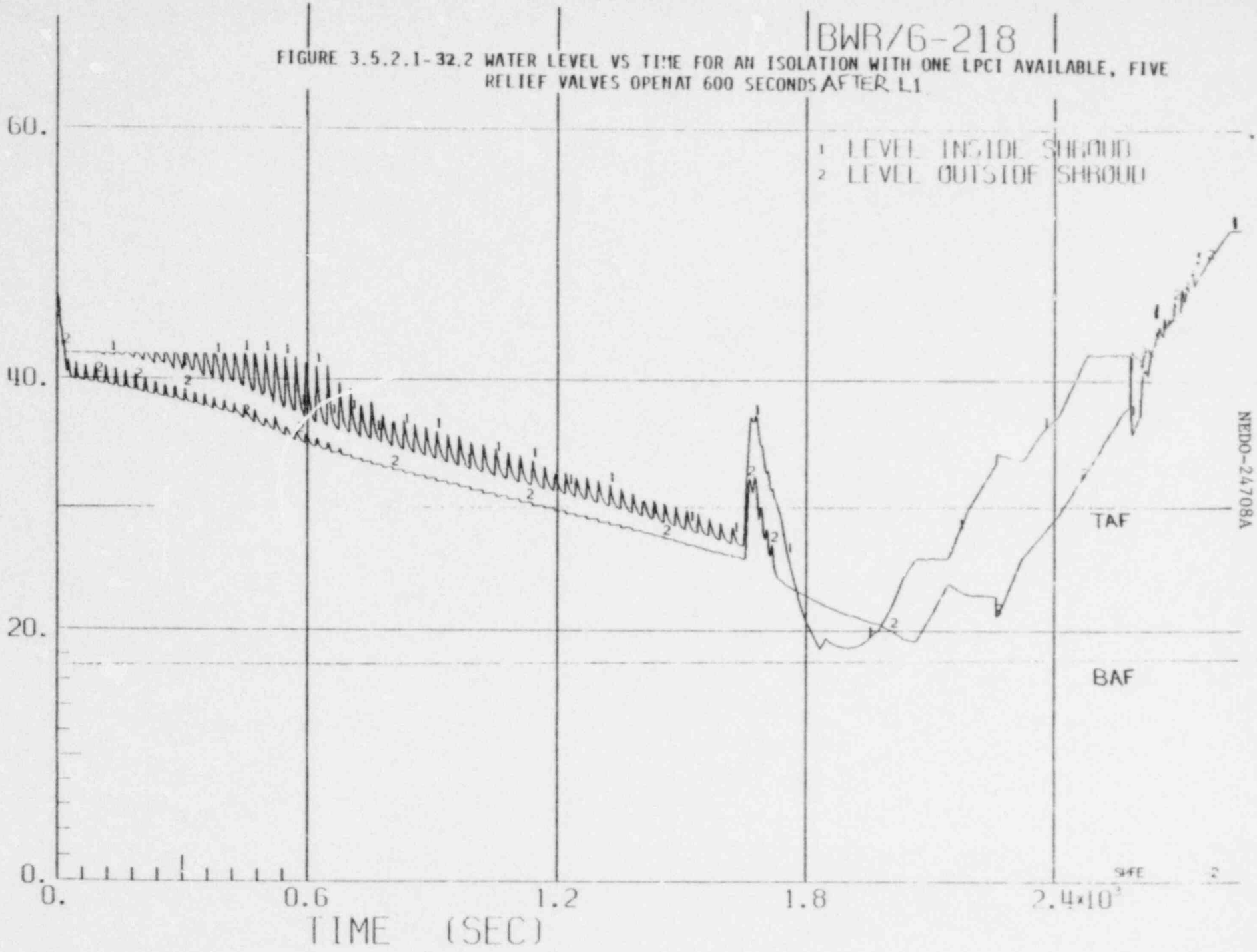
4-1137

BWR/6-218

FIGURE 3.5.2.1-32.2 WATER LEVEL VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPENAT 600 SECONDS AFTER L1



BWR/6-218

FIGURE 3.5.2.1-32.3 SYSTEM FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.

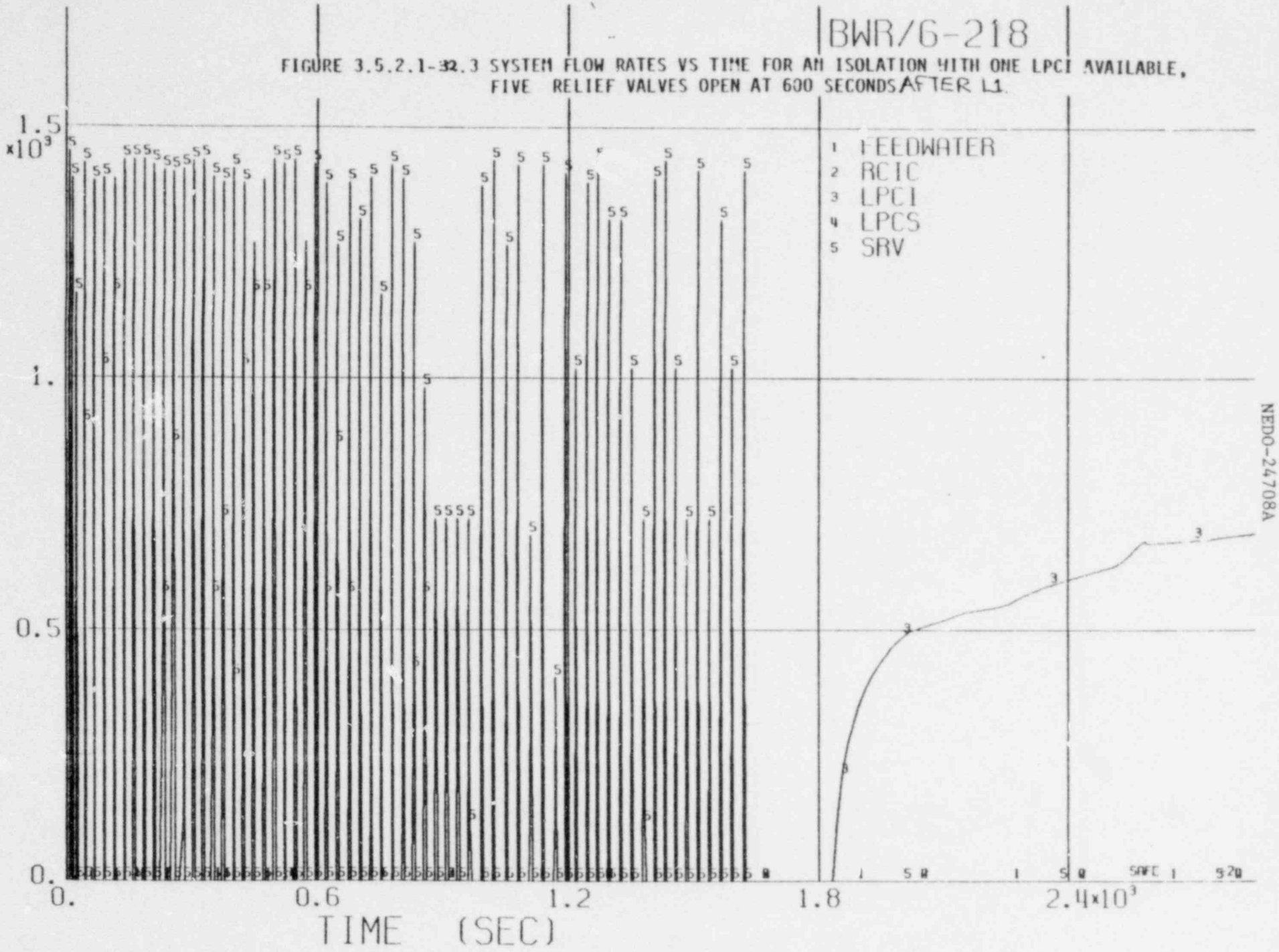


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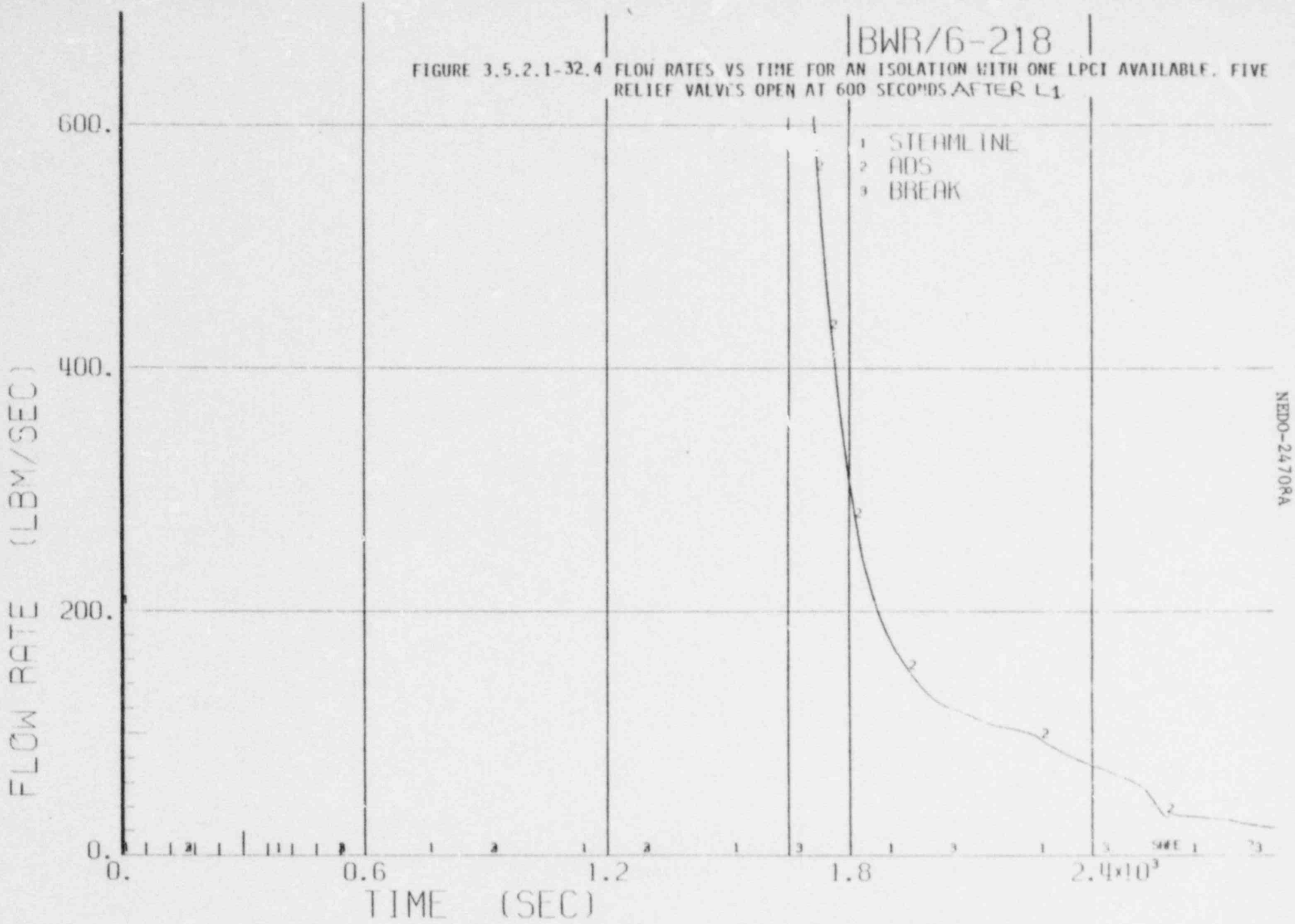
FIGURE 3.5.2.1-32.4 FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1



4-1140

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FIGURE 3.5.2.1-32.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1

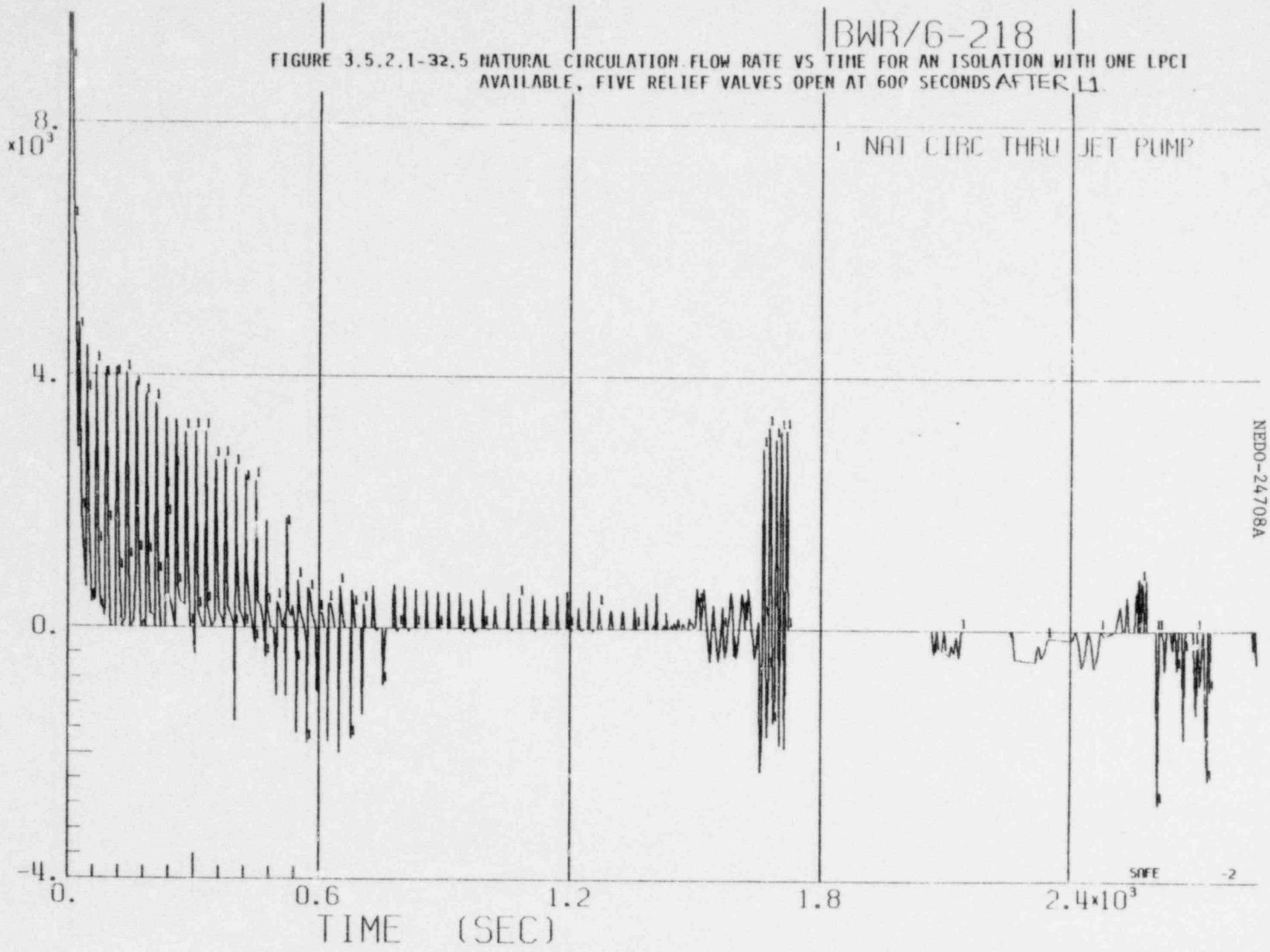

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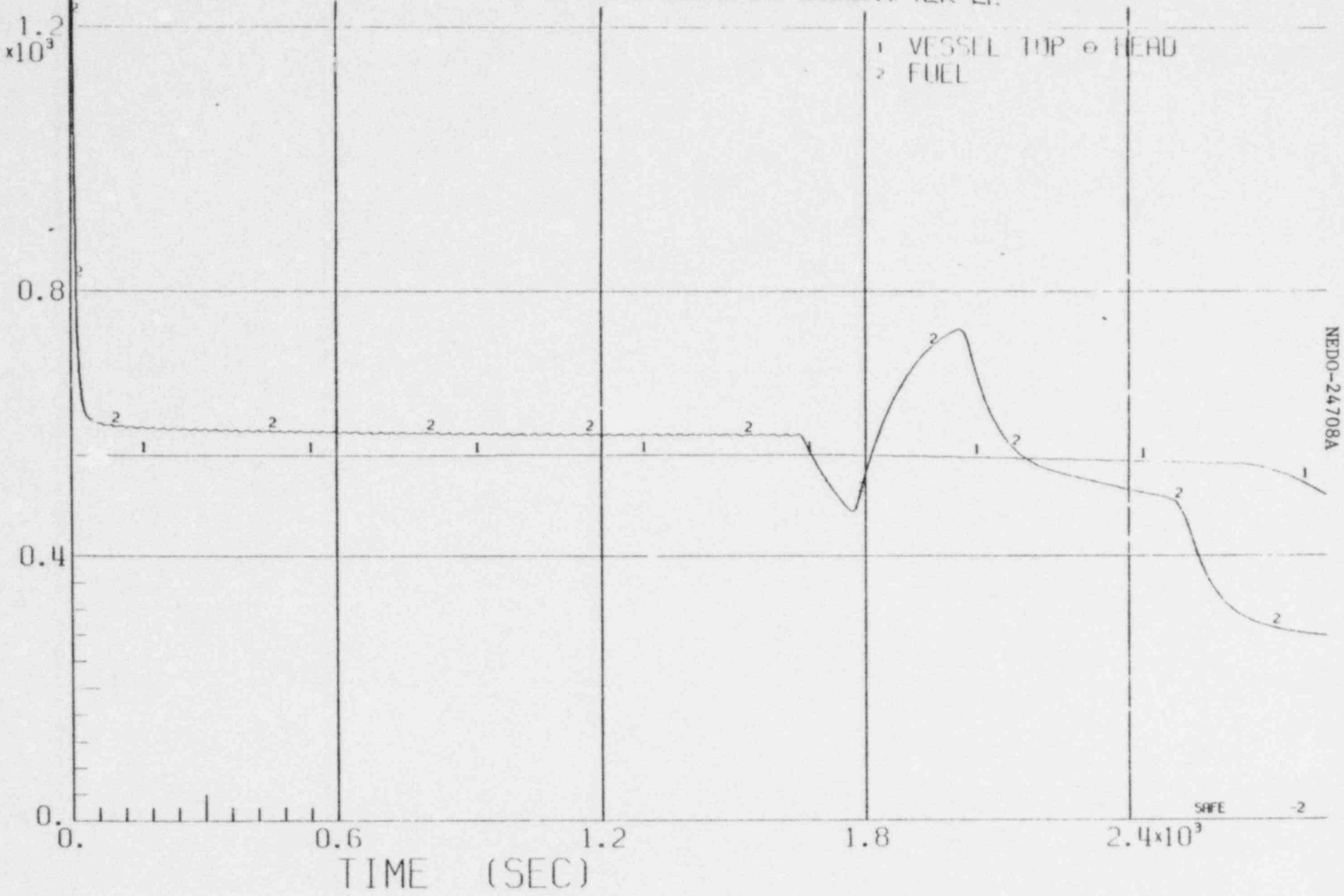
FIGURE 3.5.2.1-32.6 TEMPERATURE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.



4-1142

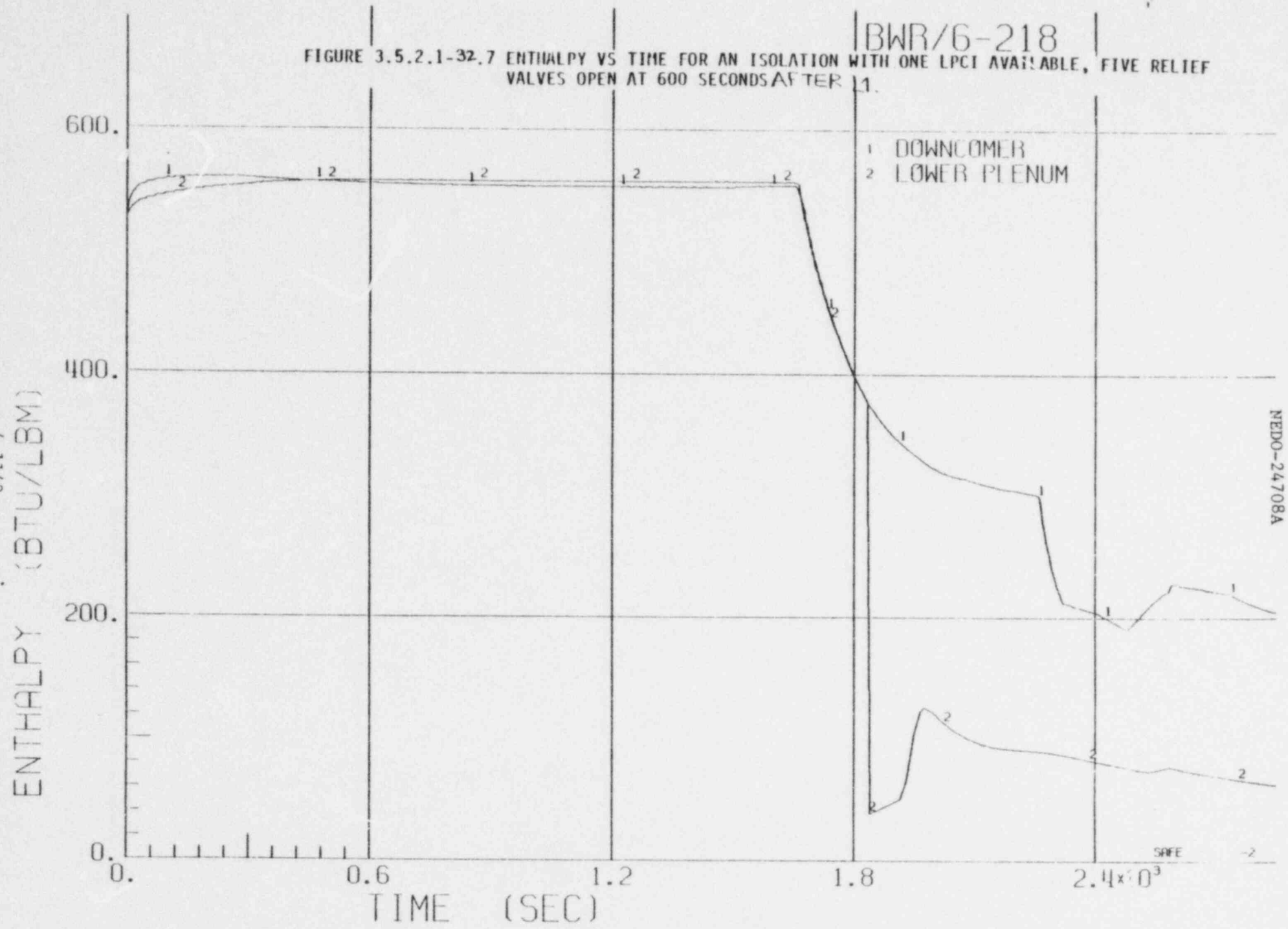


FIGURE 3.5.2.1-32.7 ENTHALPY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.

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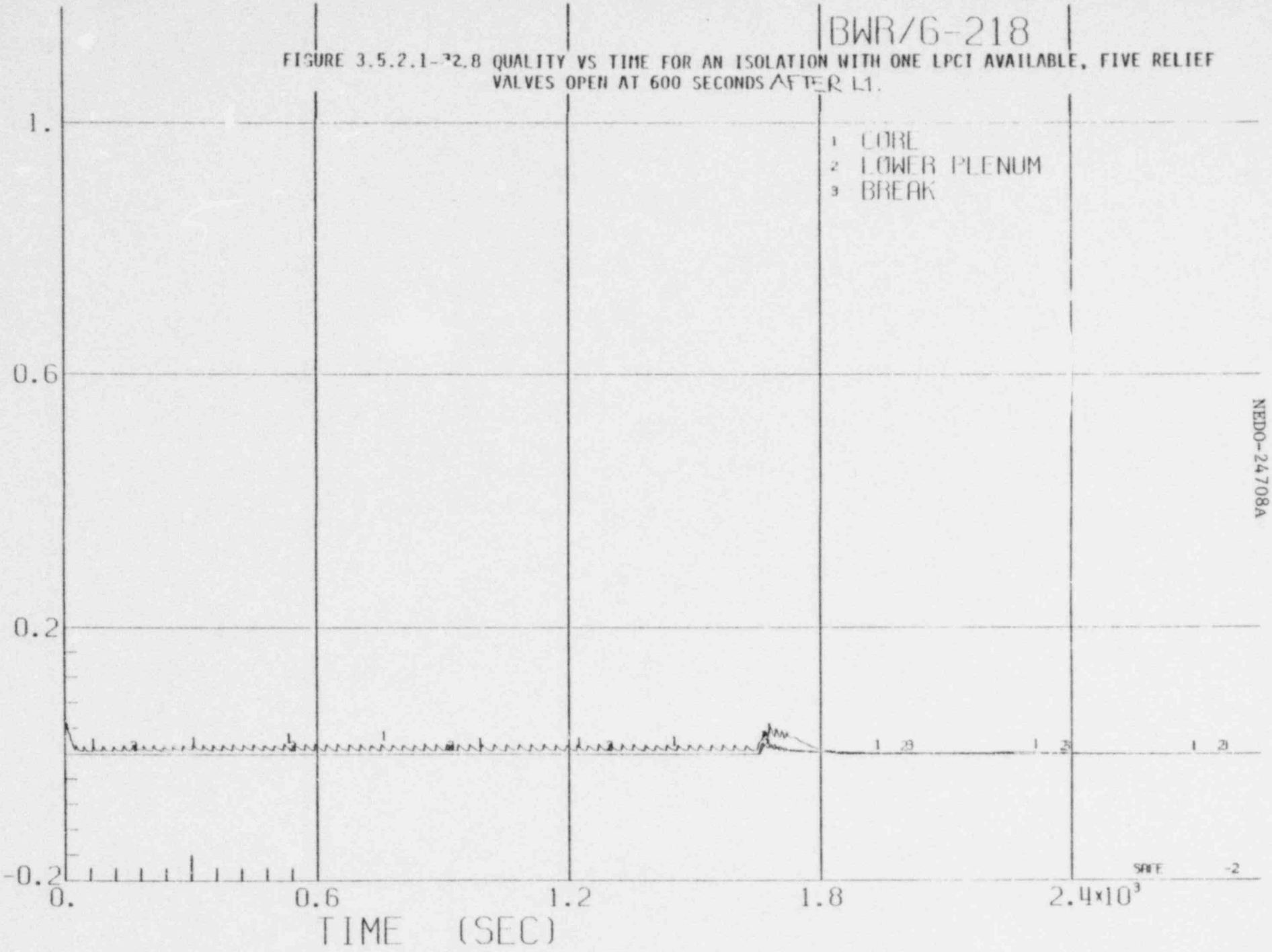
FIGURE 3.5.2.1-32.8 QUALITY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, FIVE RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.



4-1144

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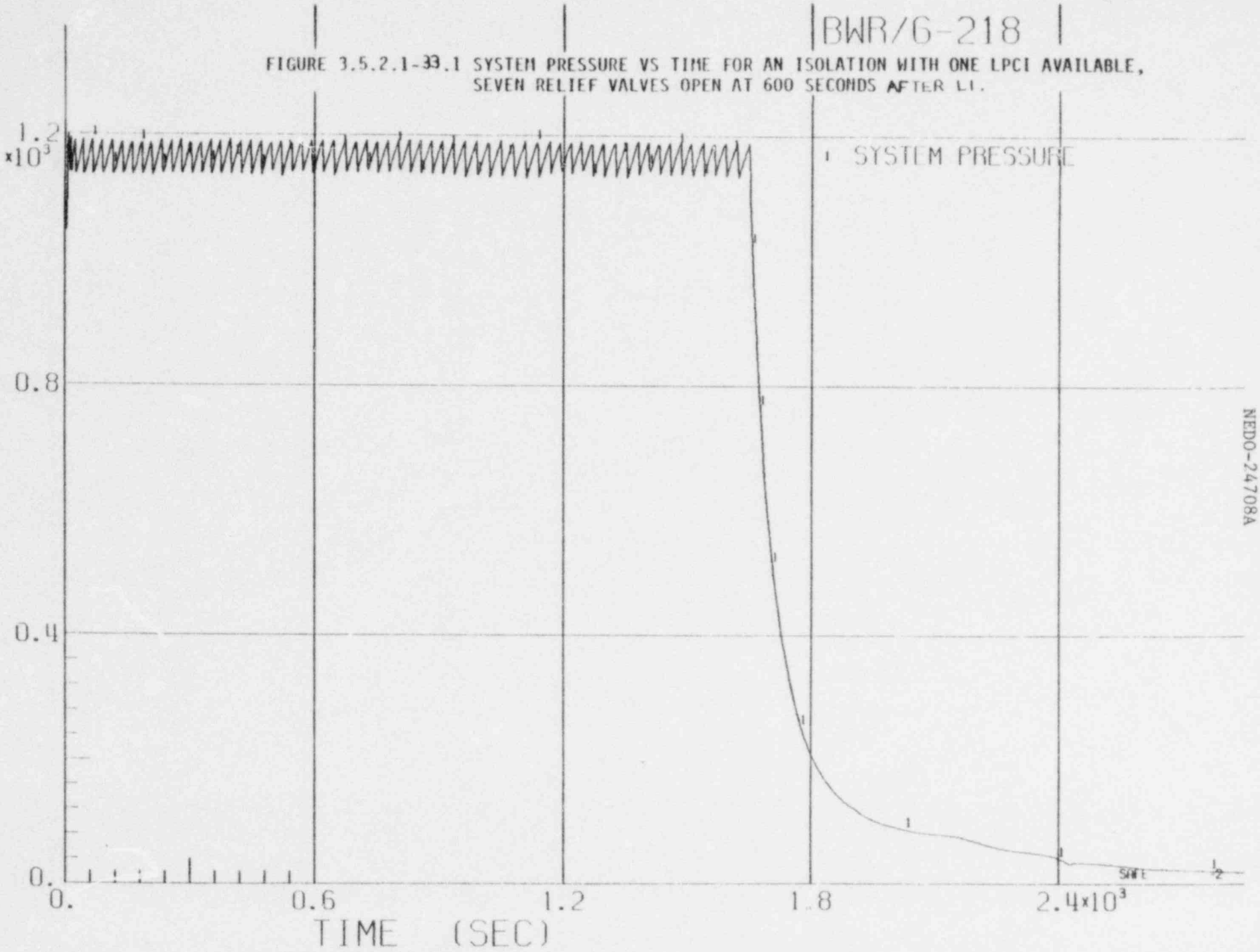
FIGURE 3.5.2.1-33.1 SYSTEM PRESSURE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER LI.



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4-1145

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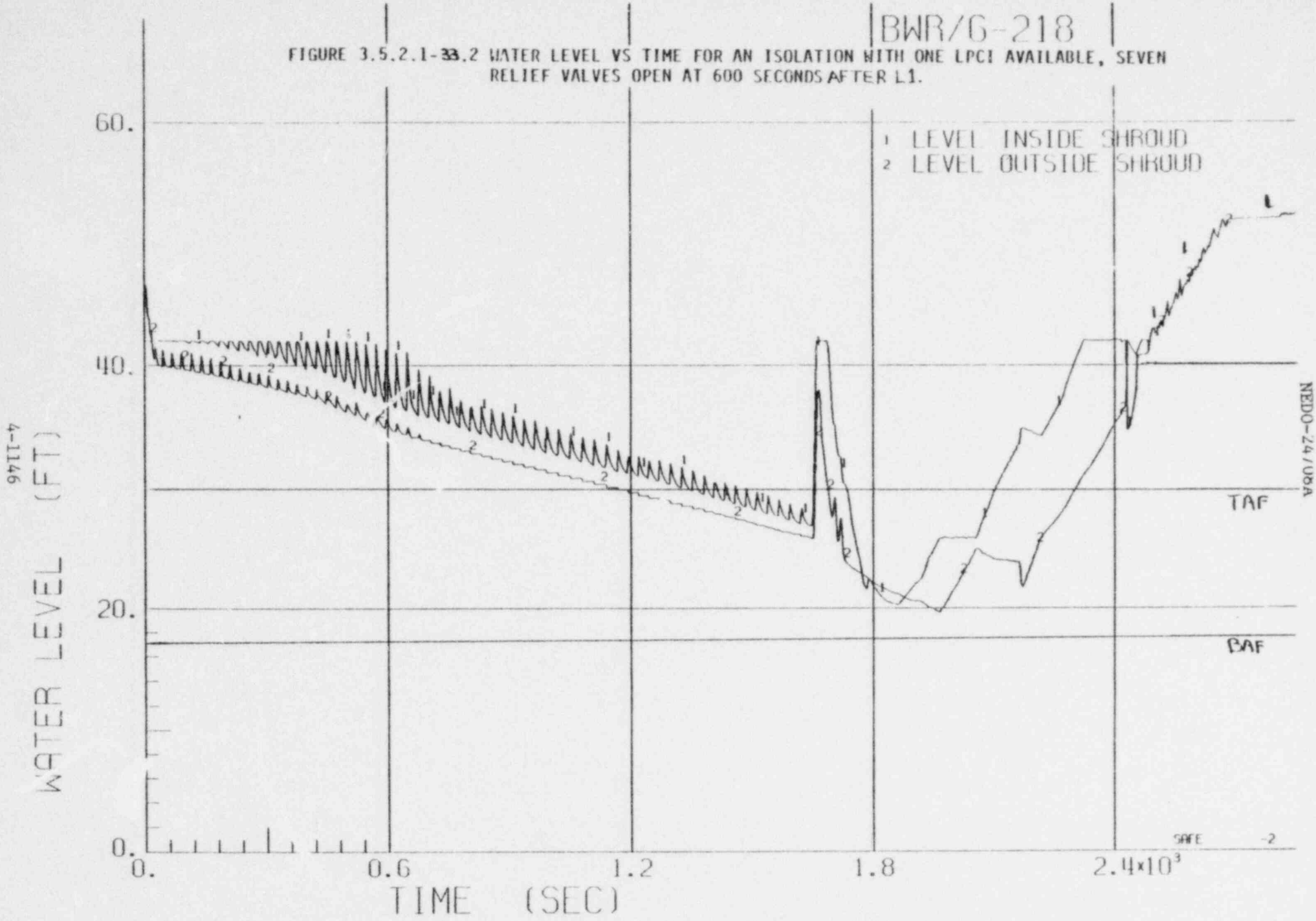
FIGURE 3.5.2.1-33.2 WATER LEVEL VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.



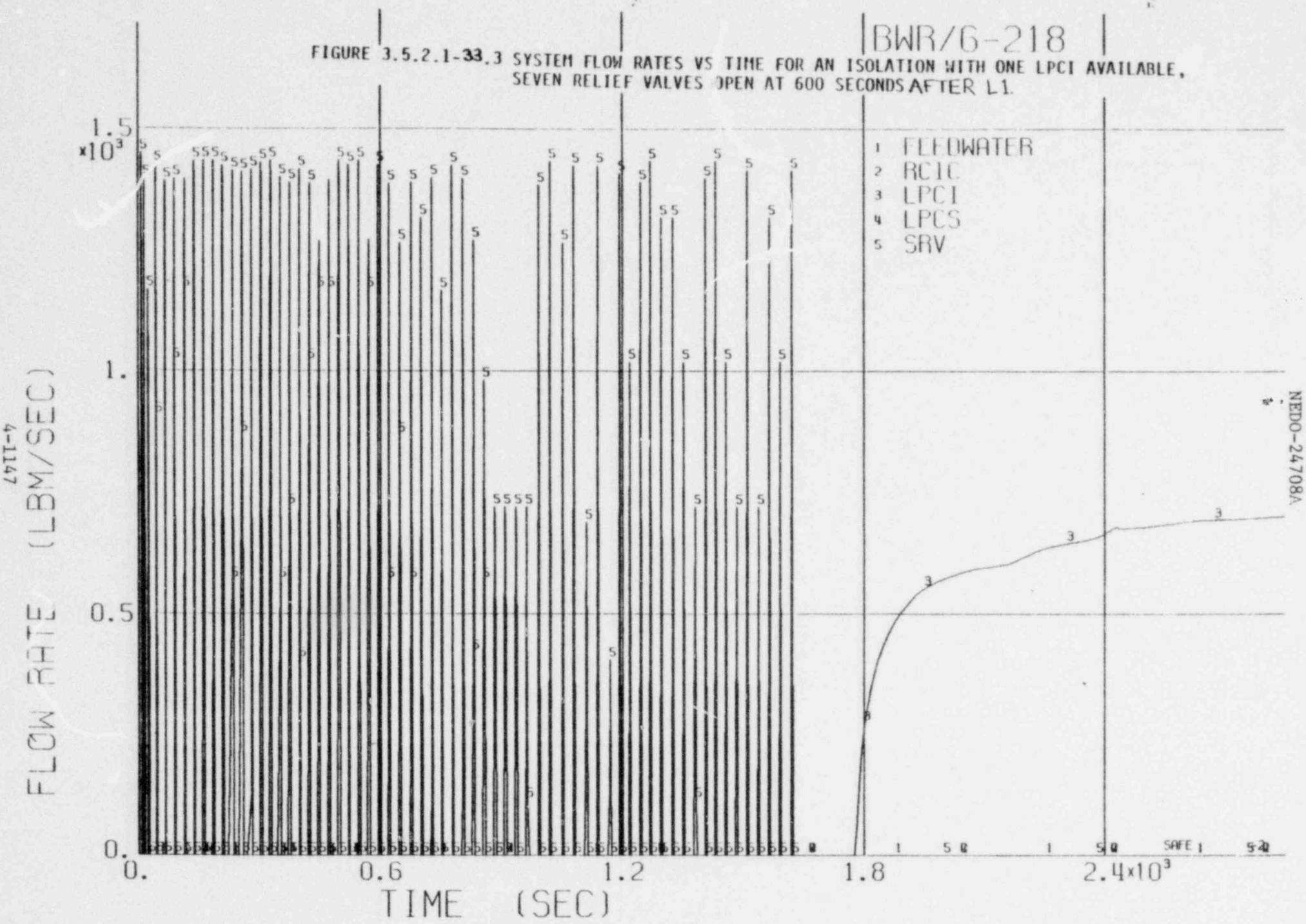


FIGURE 3.5.2.1-33.3 SYSTEM FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.

FIGURE 3.5.2.1-33.4 FLOW RATES VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.

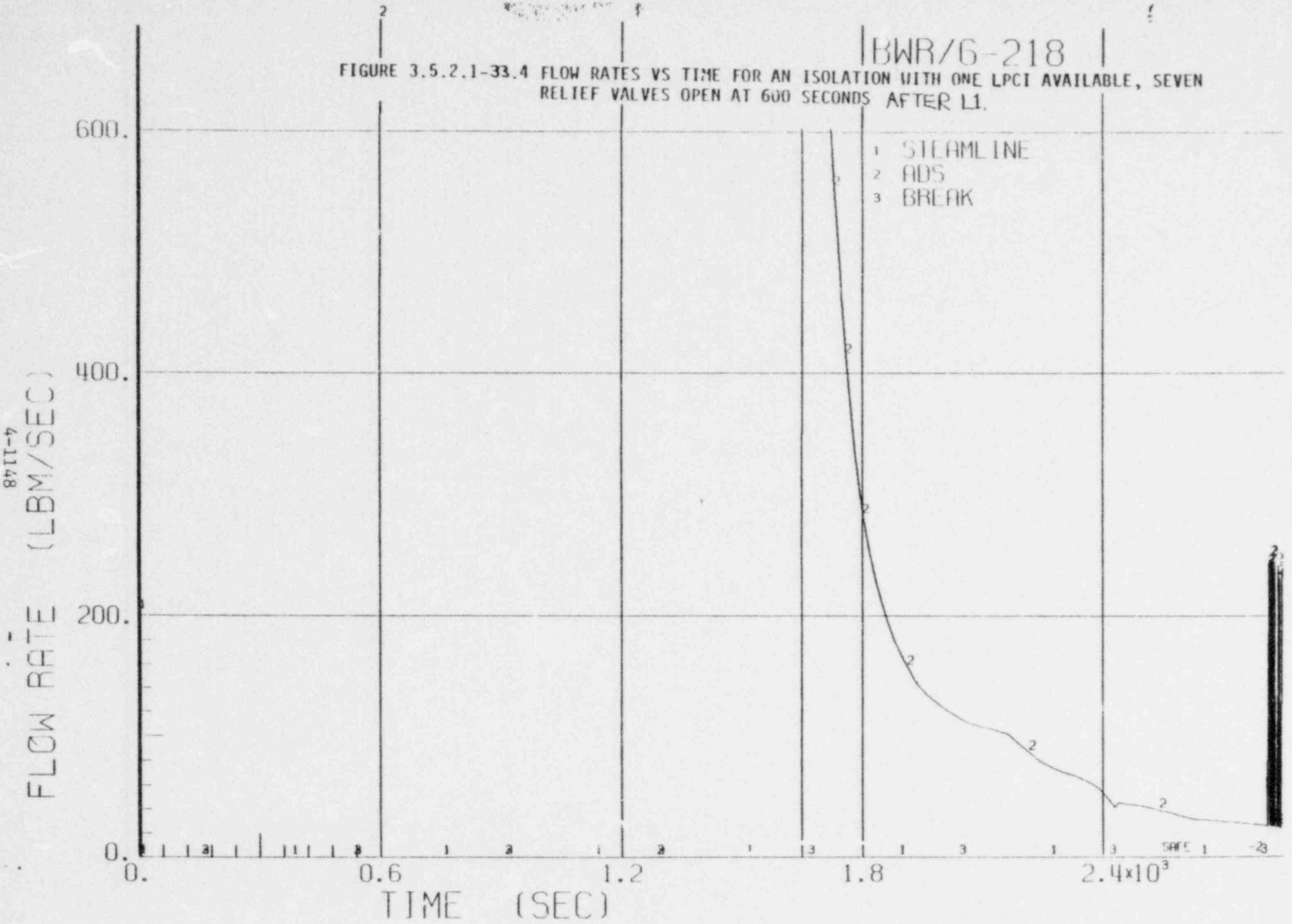


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FIGURE 3.5.2.1-33.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.

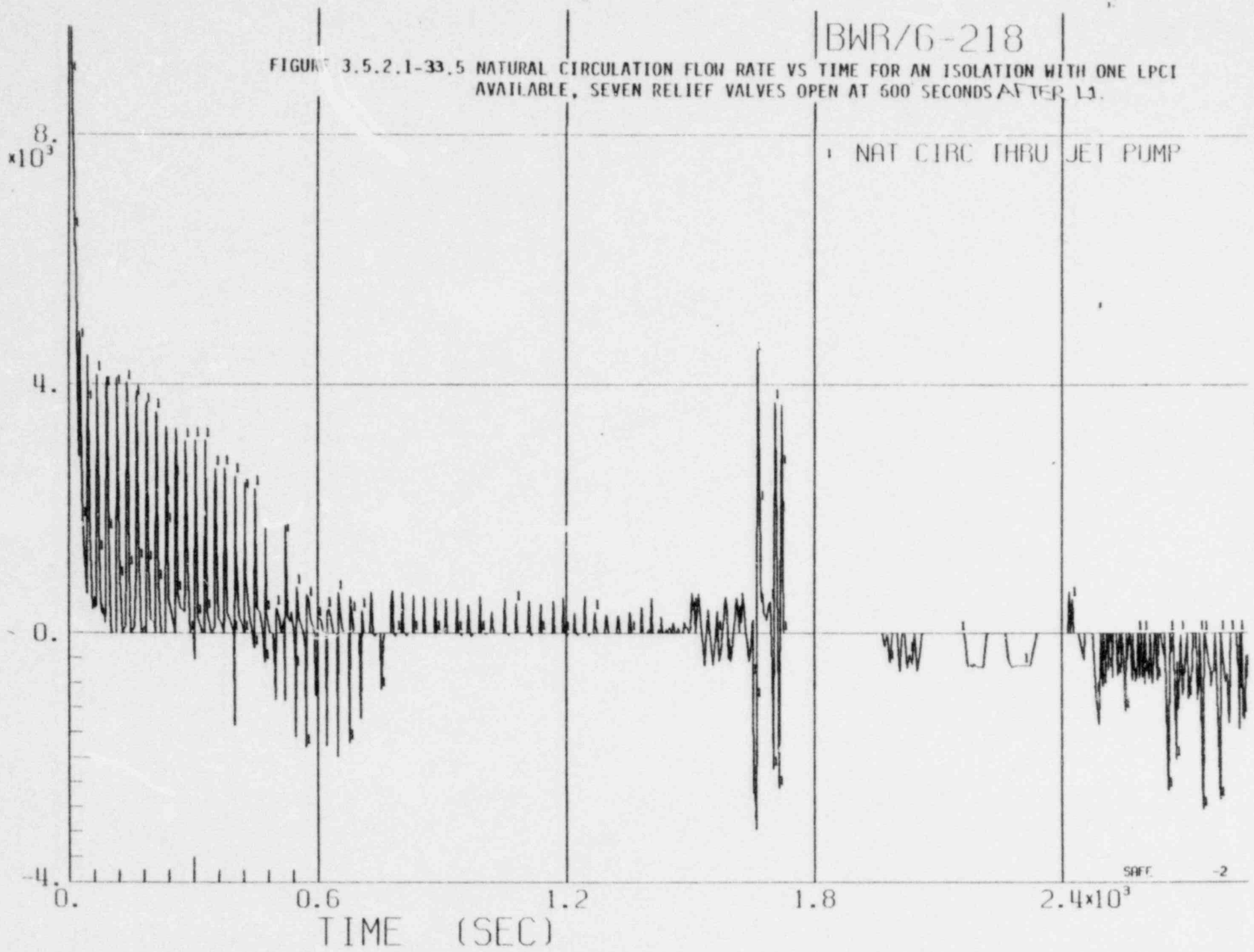

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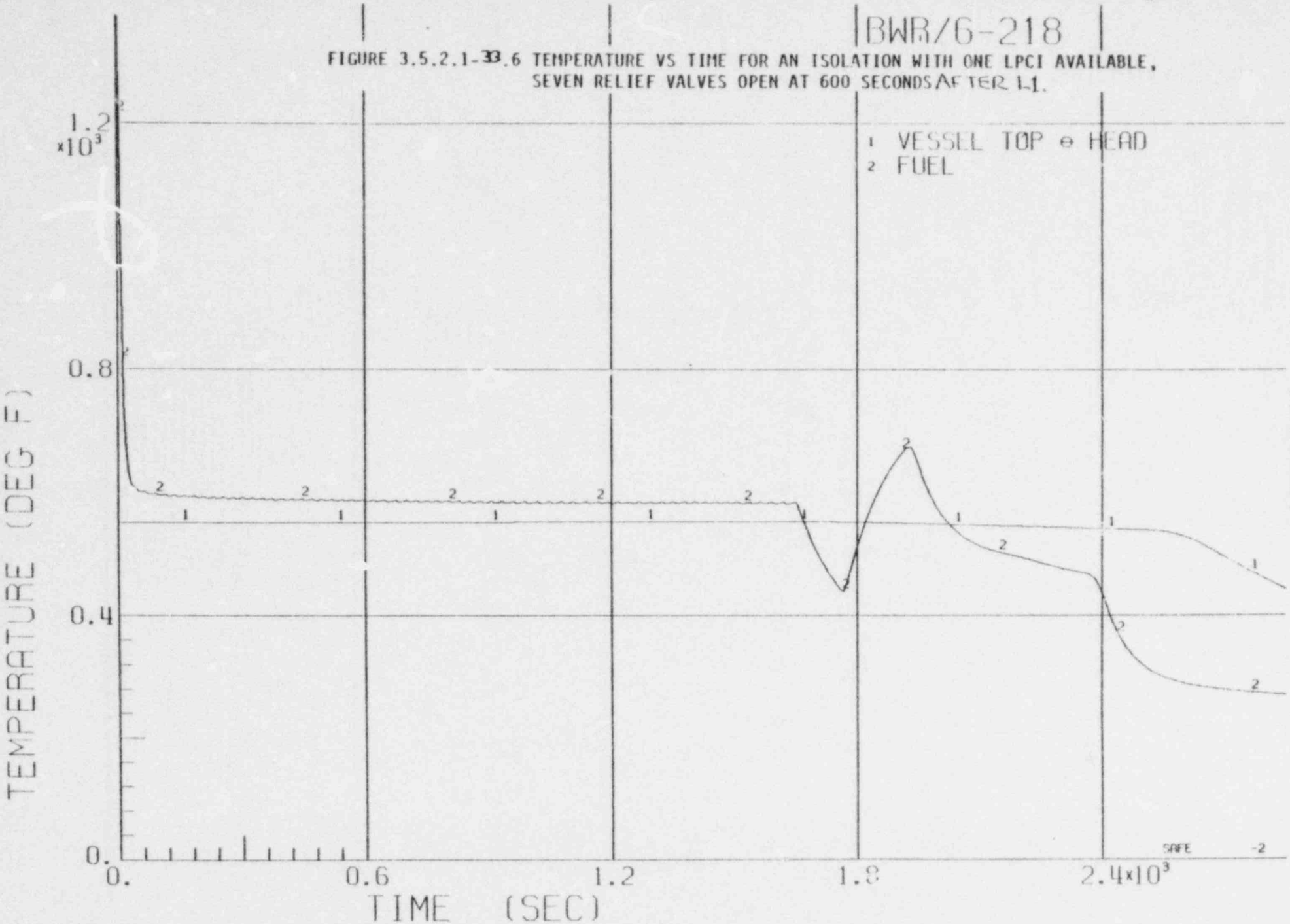
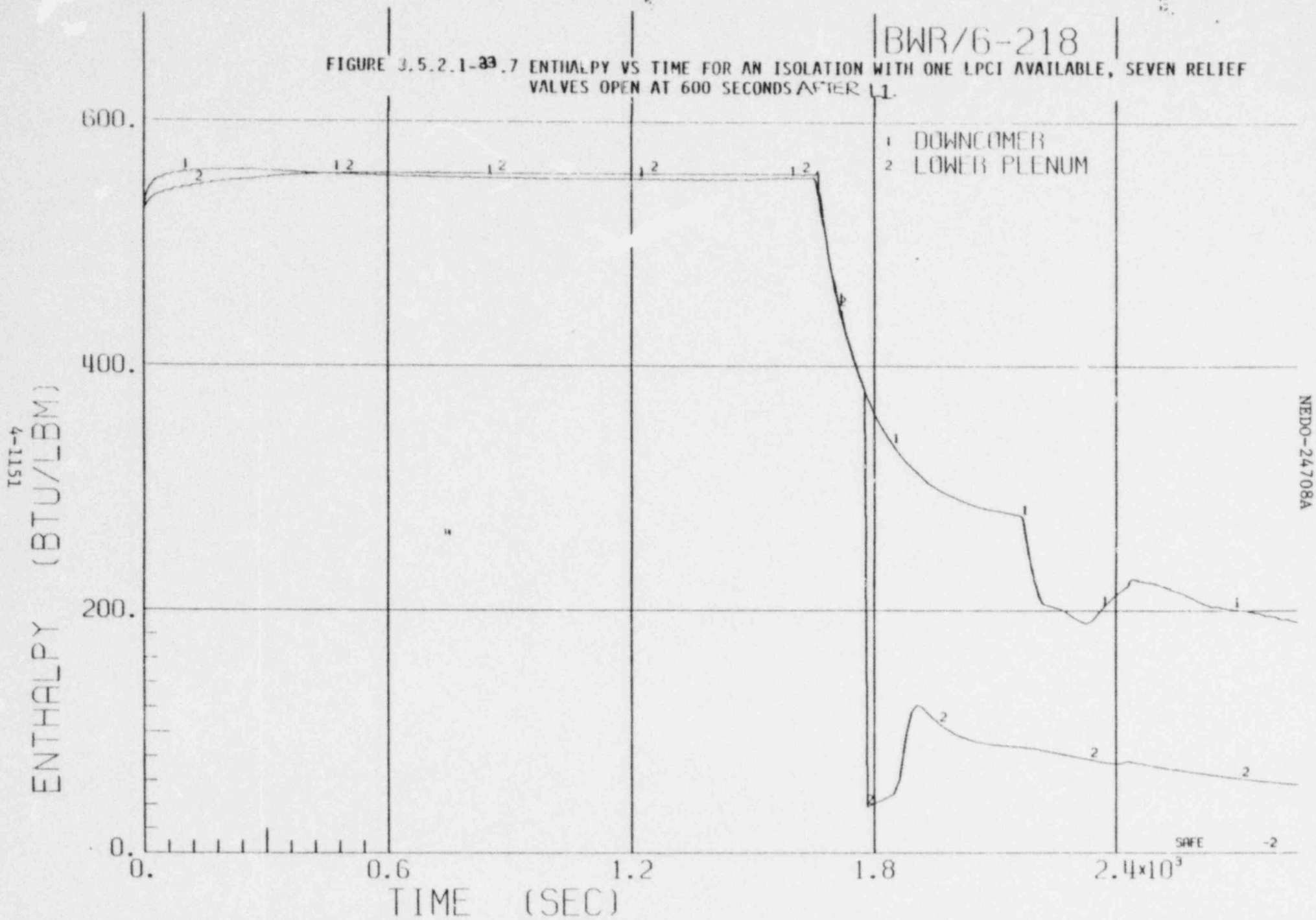
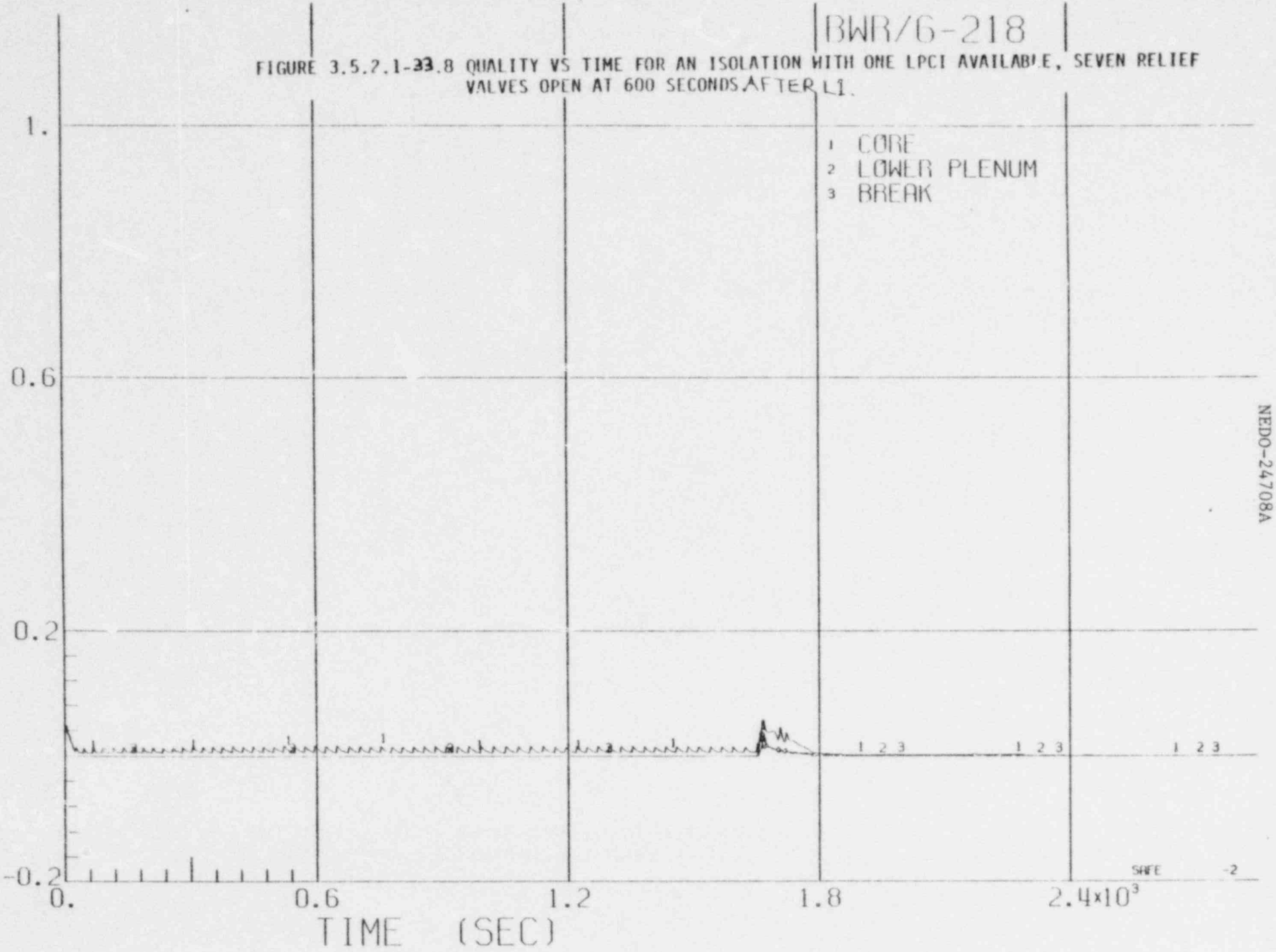
FIGURE 3.5.2.1-33.6 TEMPERATURE VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.




BWR/6-218
FIGURE 3.5.2.1-33.7 ENTHALPY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.
1 DOWNCOMER
2 LOWER PLENUM
600.
400.
200.
0.
ENTHALPY (BTU/LBM)
0.
0.6
1.2
1.8
2.4x10^3
TIME (SEC)
NEDO-24708A
4-1151
SAFE -2

BWR/6-218

FIGURE 3.5.2.1-33.8 QUALITY VS TIME FOR AN ISOLATION WITH ONE LPCI AVAILABLE, SEVEN RELIEF VALVES OPEN AT 600 SECONDS AFTER L1.



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4-1152

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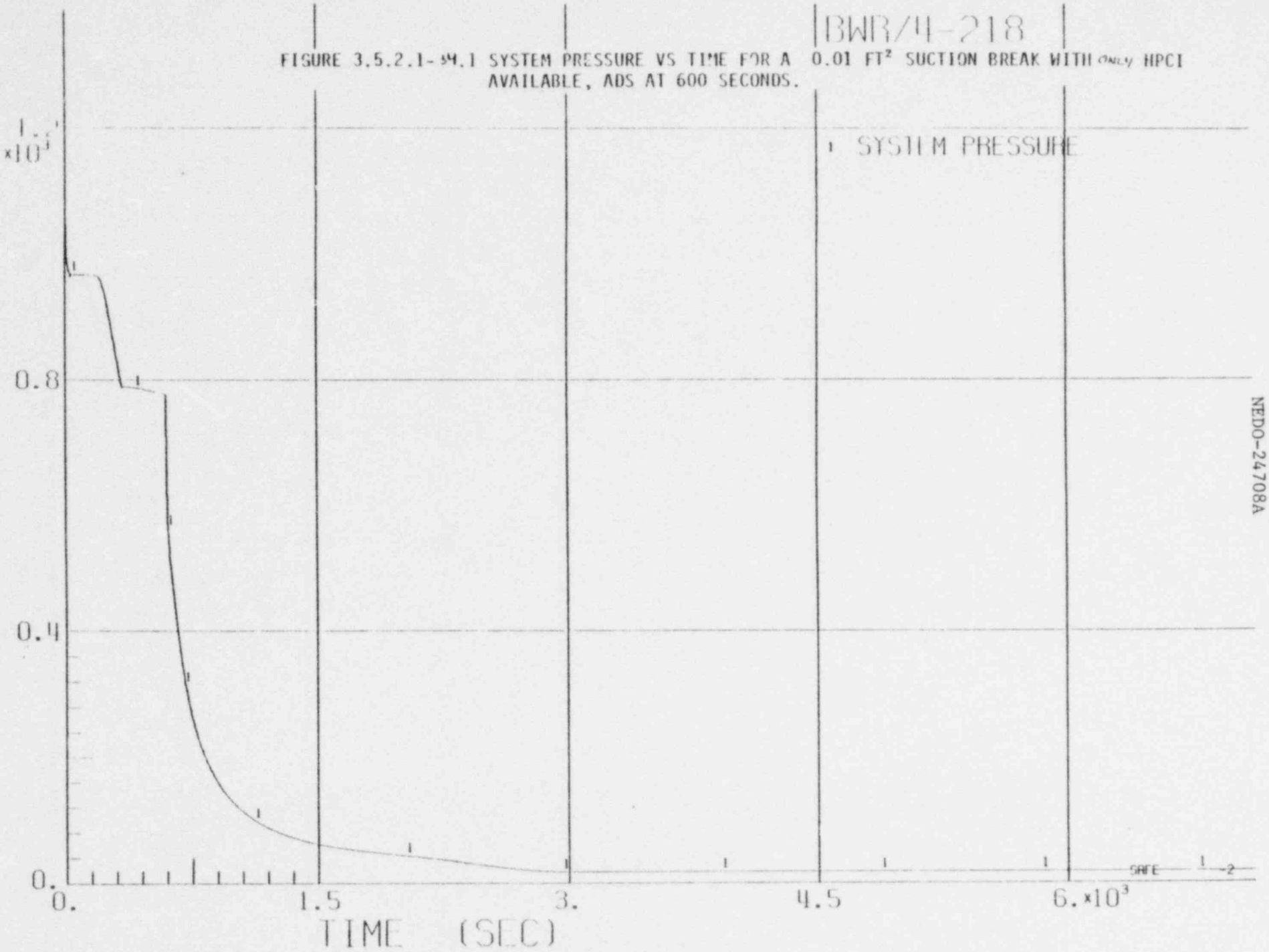
FIGURE 3.5.2.1-94.1 SYSTEM PRESSURE VS TIME FOR A 0.01 FT² SUCTION BREAK WITH ONLY HPCI AVAILABLE, ADS AT 600 SECONDS.

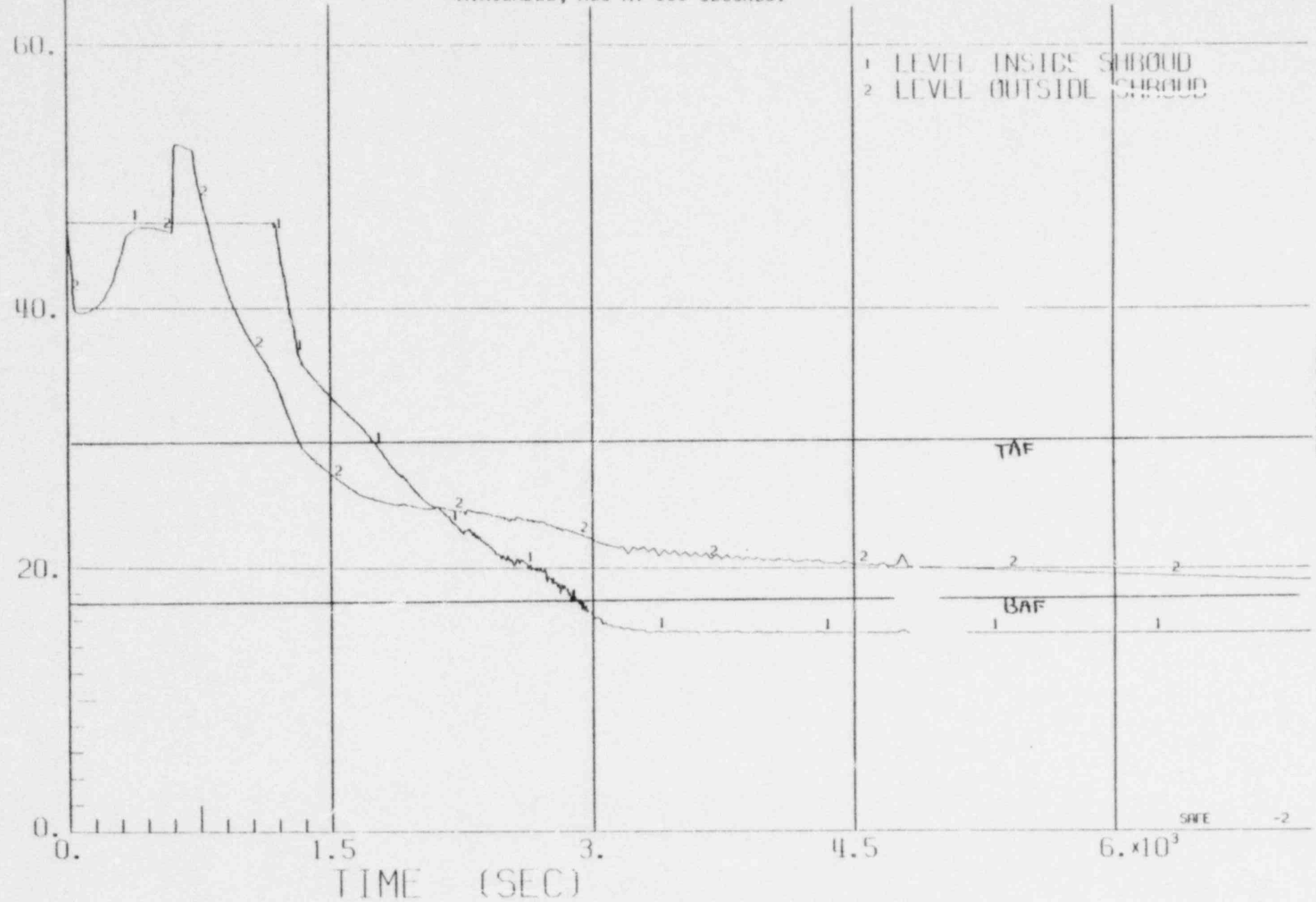


NEDO-24708A

4-1153

BWR/4-218

FIGURE 3.5.2.1-34.2 WATER LEVEL VS TIME FOR A 0.01 FT² SUCTION BREAK WITH ONLY HPCI AVAILABLE, ADS AT 600 SECONDS.



4-1154

NEDO-24708A

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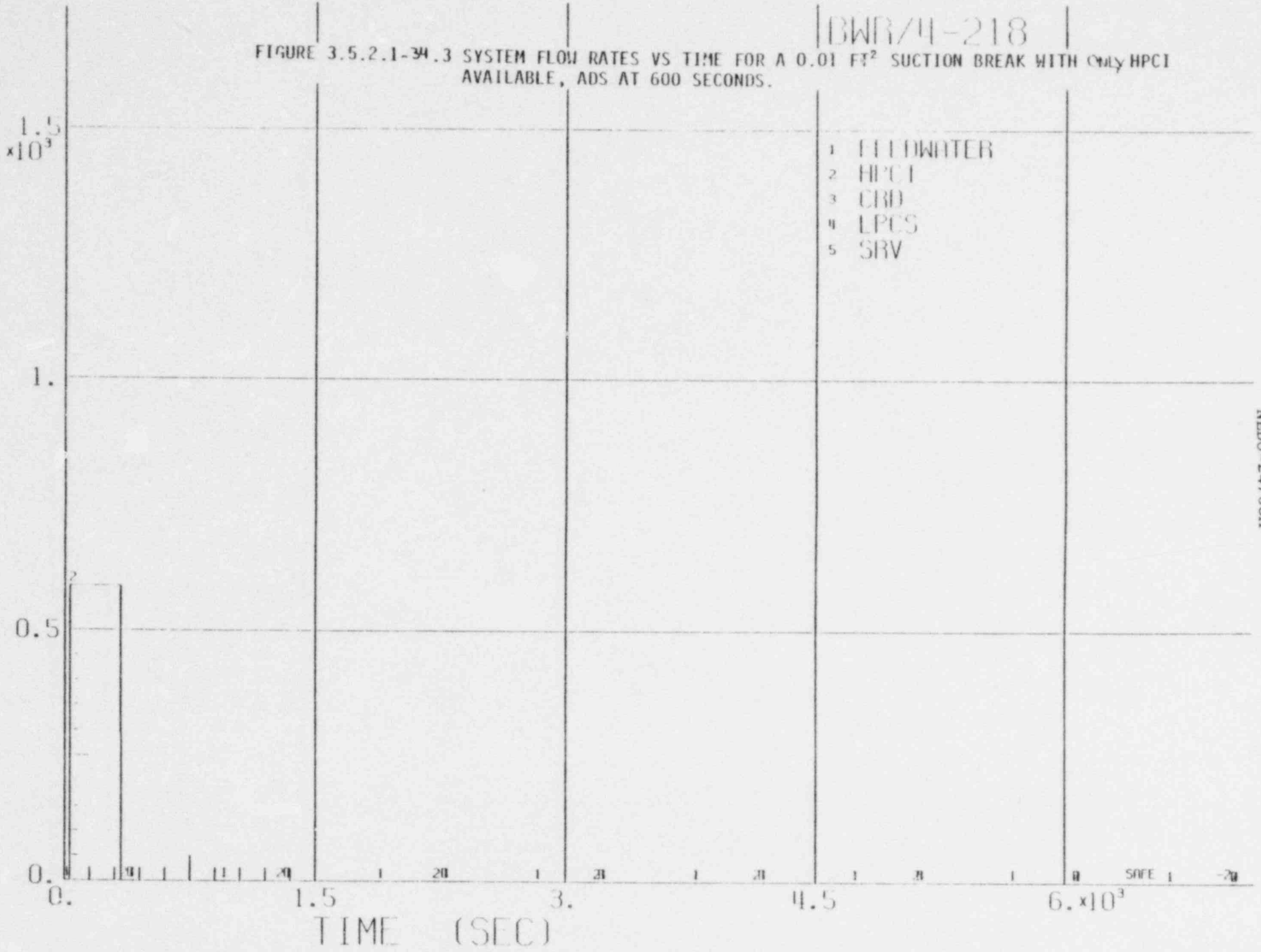
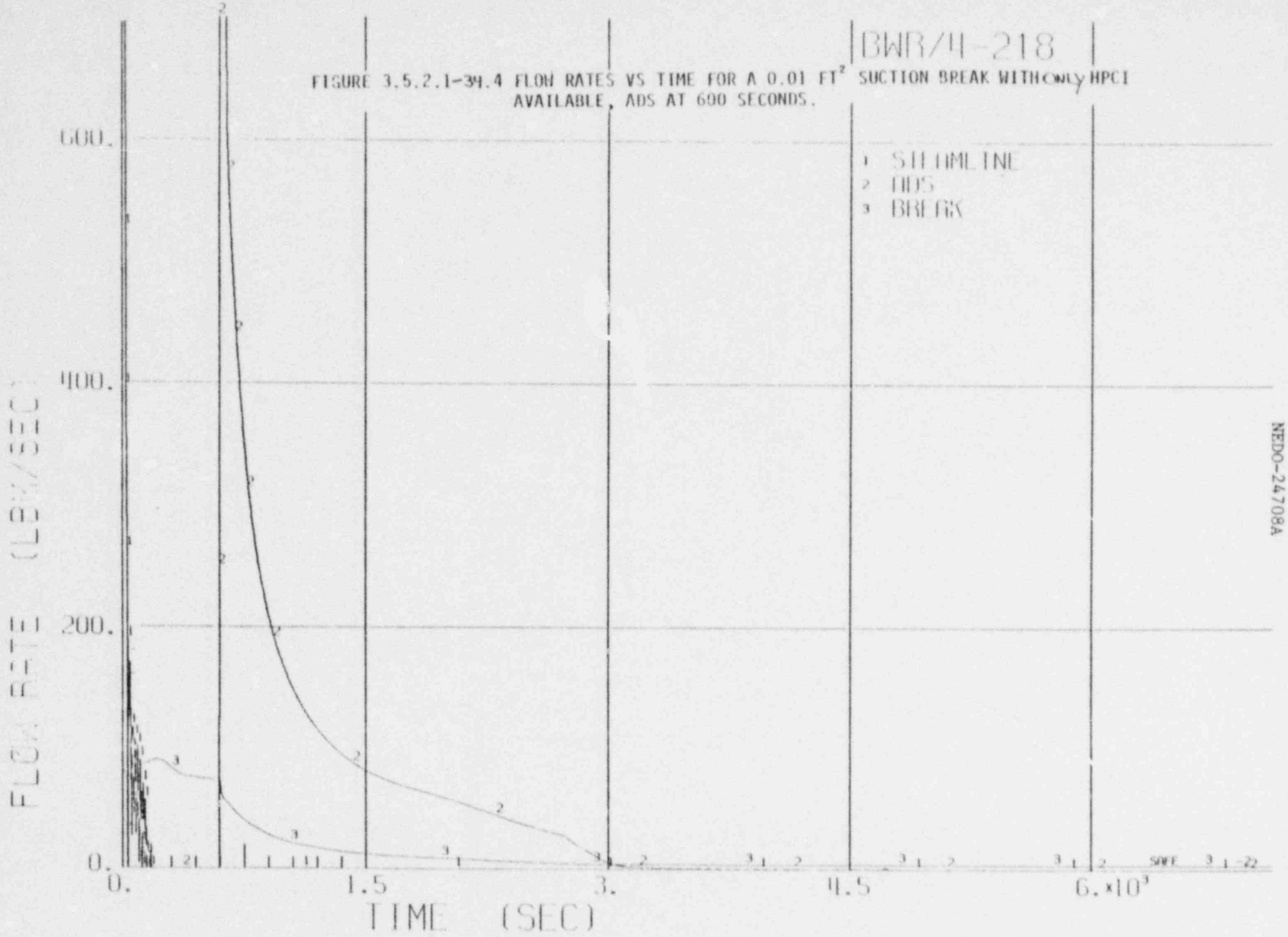
FIGURE 3.5.2.1-34.3 SYSTEM FLOW RATES VS TIME FOR A 0.01 FT² SUCTION BREAK WITH Only HPCI AVAILABLE, ADS AT 600 SECONDS.



BWR/4-218

FIGURE 3.5.2.1-34.4 FLOW RATES VS TIME FOR A 0.01 FT^2 SUCTION BREAK WITH ONLY HPCI AVAILABLE, ADS AT 600 SECONDS.



NEDO-24708A

4-1156

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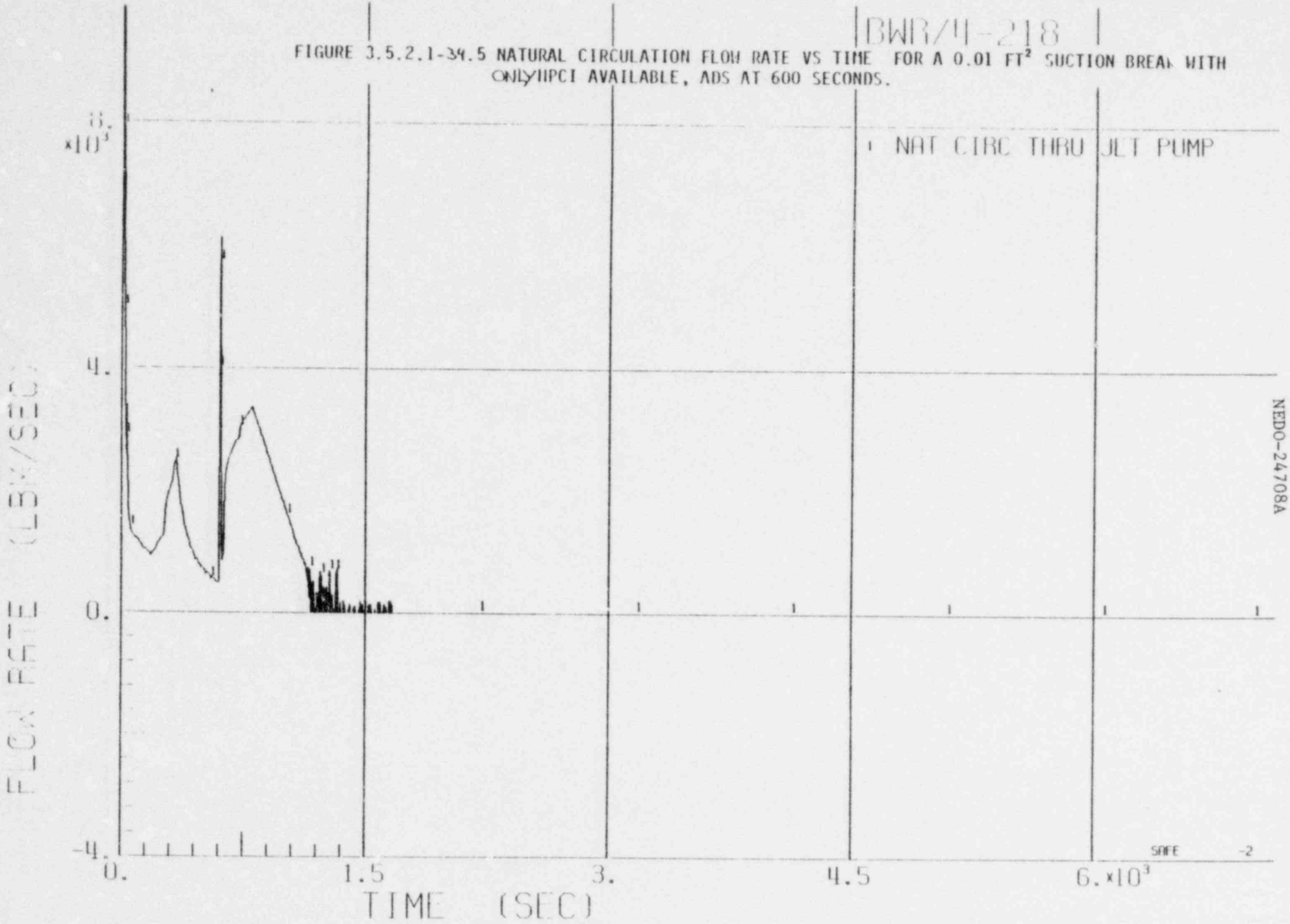
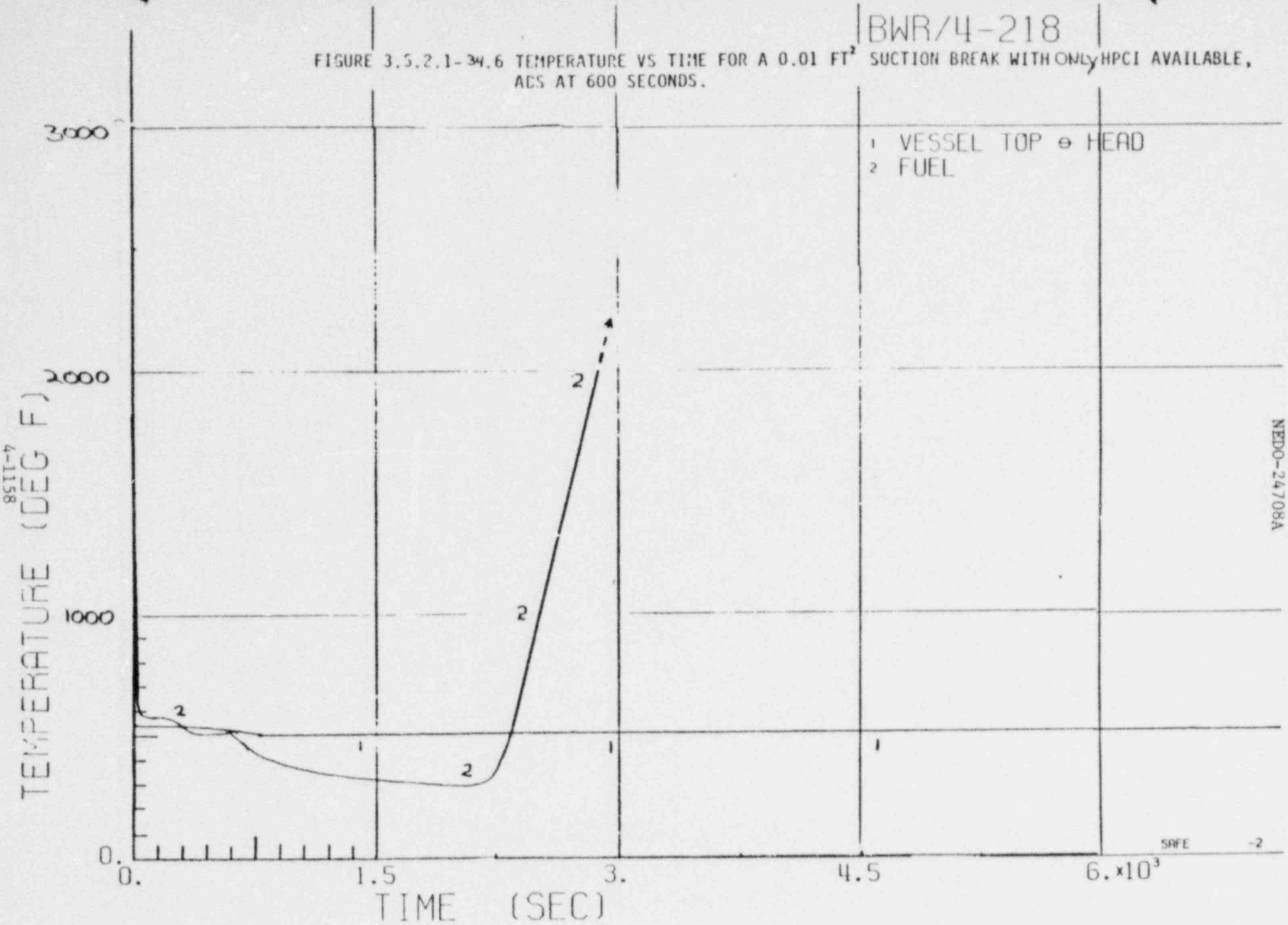
FIGURE 3.5.2.1-34.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.01 FT² SUCTION BREAK WITH ONLY HPCI AVAILABLE, ADS AT 600 SECONDS.



BWR/4-218

FIGURE 3.5.2.1-34.6 TEMPERATURE VS TIME FOR A 0.01 FT^2 SUCTION BREAK WITH ONLY HPCI AVAILABLE, ACS AT 600 SECONDS.



BWR/4-218

FIGURE 3.5.2.1-34.7 ENTHALPY VS TIME FOR A 0.01 FT² SUCTION BREAK WITH Only HPCI AVAILABLE, ADS AT 600 SECONDS.

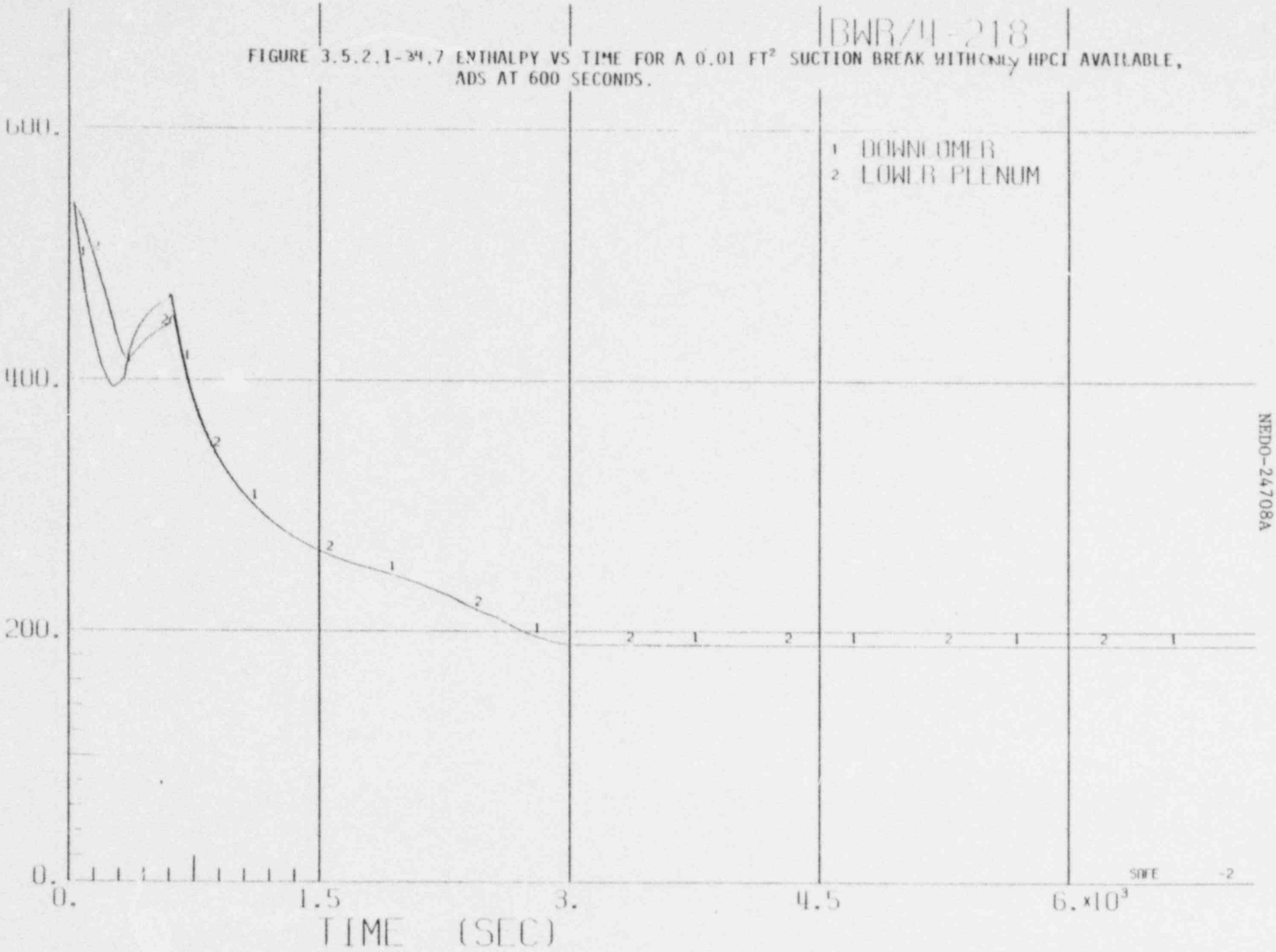


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FIGURE 3.5.2.1-34.8 QUALITY VS TIME FOR A 0.01 FT² SUCTION BREAK WITH ONLY HPCI AVAILABLE, ADS AT 600 SECONDS.

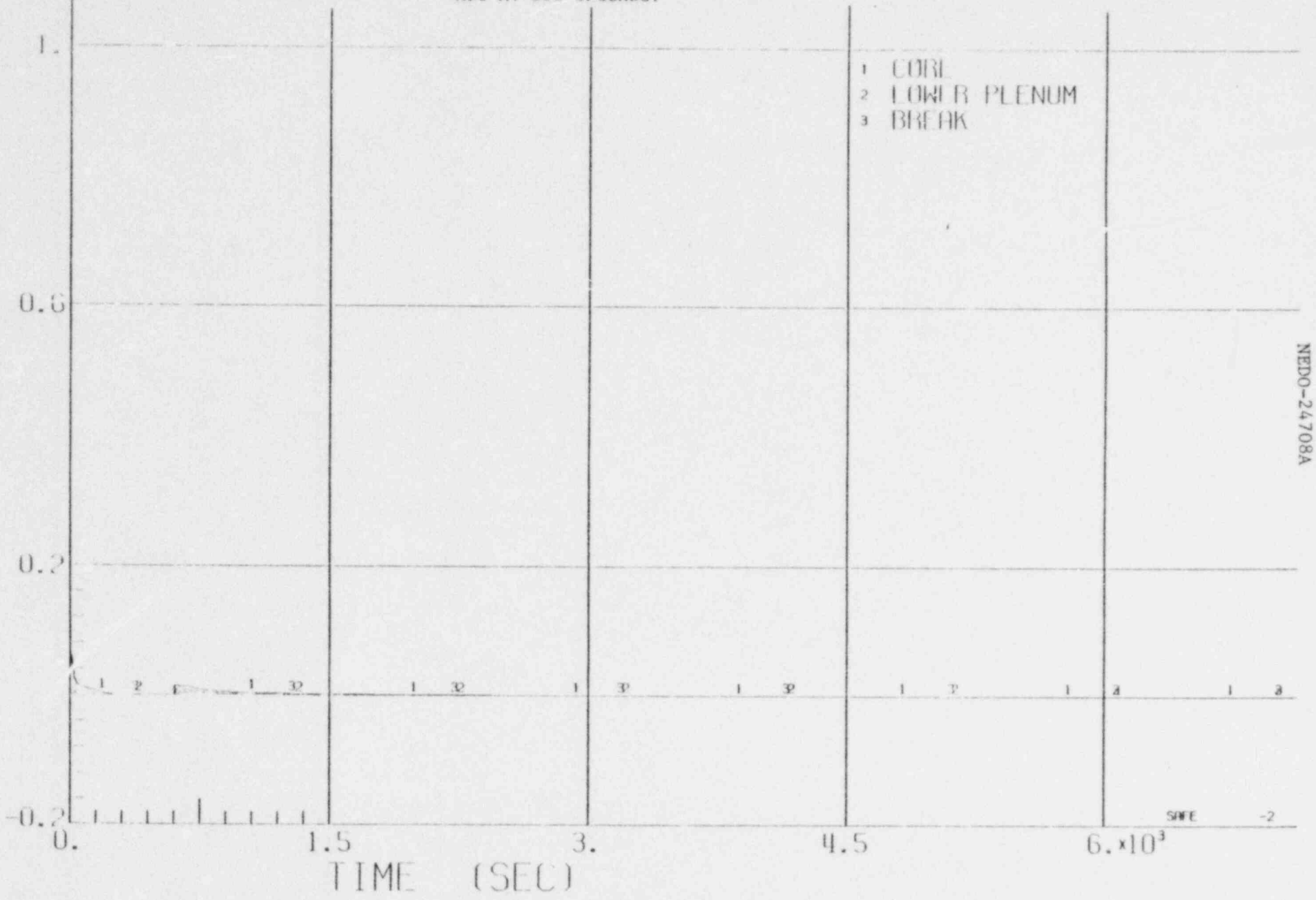

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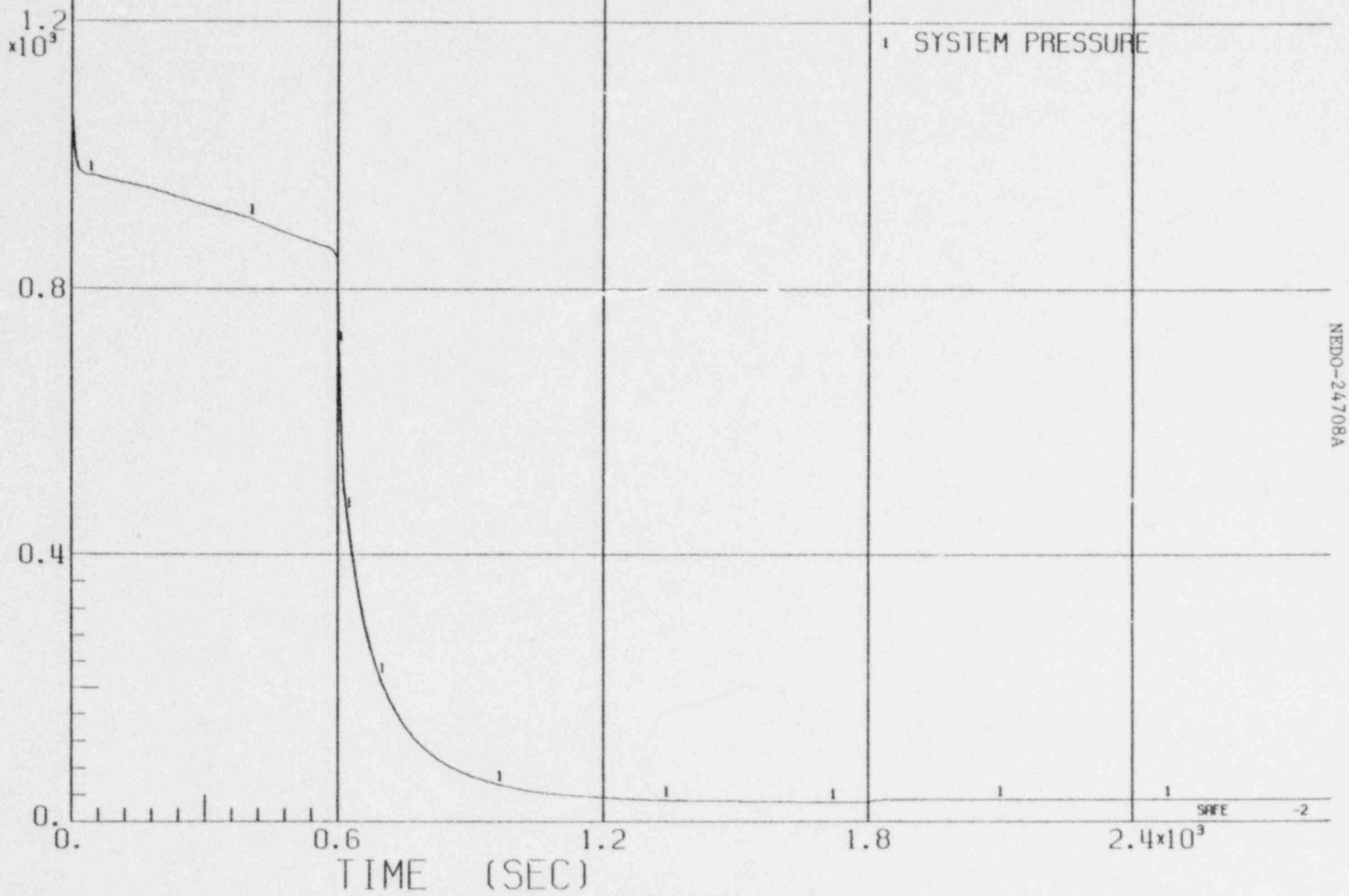
FIGURE 3.5.2.1-35.1 SYSTEM PRESSURE VS TIME FOR A 0.05 FT² SUCTION BREAK WITH ONLY HPCS AVAILABLE, ADS AT 600 SECONDS



4-1161

NEDO-24708A

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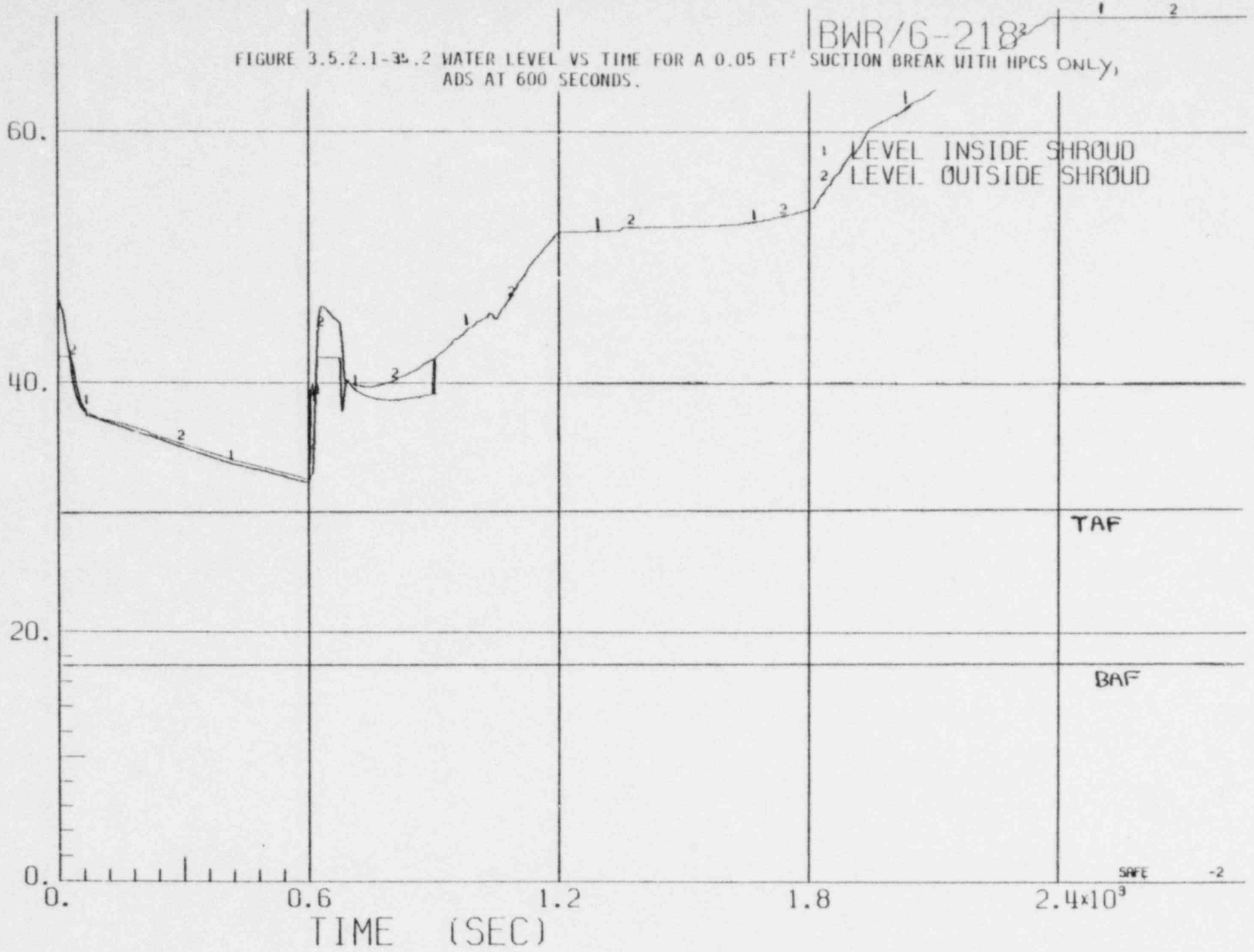
FIGURE 3.5.2.1-35.2 WATER LEVEL VS TIME FOR A 0.05 FT² SUCTION BREAK WITH HPCS ONLY, ADS AT 600 SECONDS.



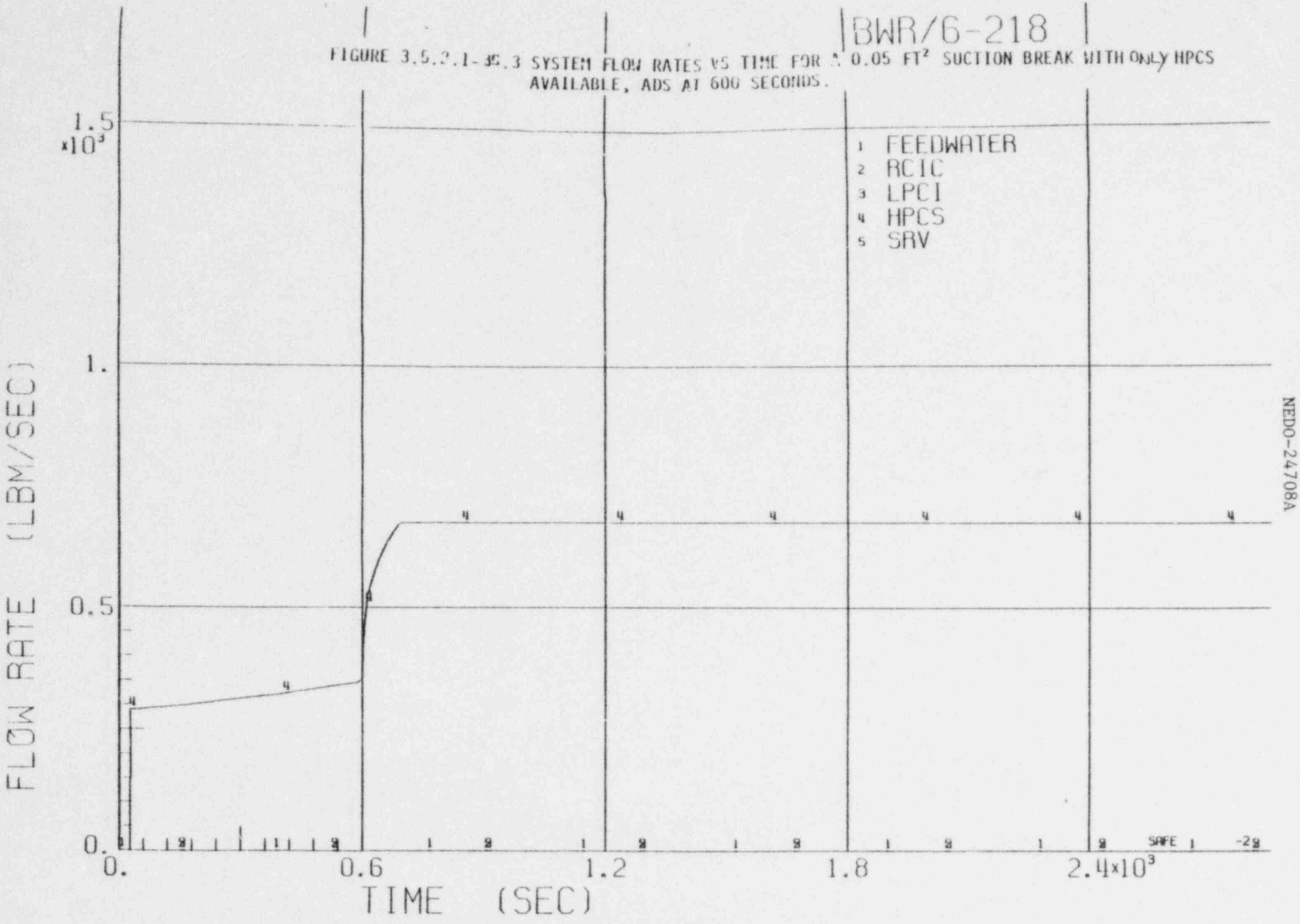
4-1162

NEDO-24708A

SAFE -2

BWR/6-218

FIGURE 3.5.2.1-35.3 SYSTEM FLOW RATES VS TIME FOR A 0.05 FT² SUCTION BREAK WITH ONLY HPCS AVAILABLE, ADS AT 600 SECONDS.



NEDO-24708A

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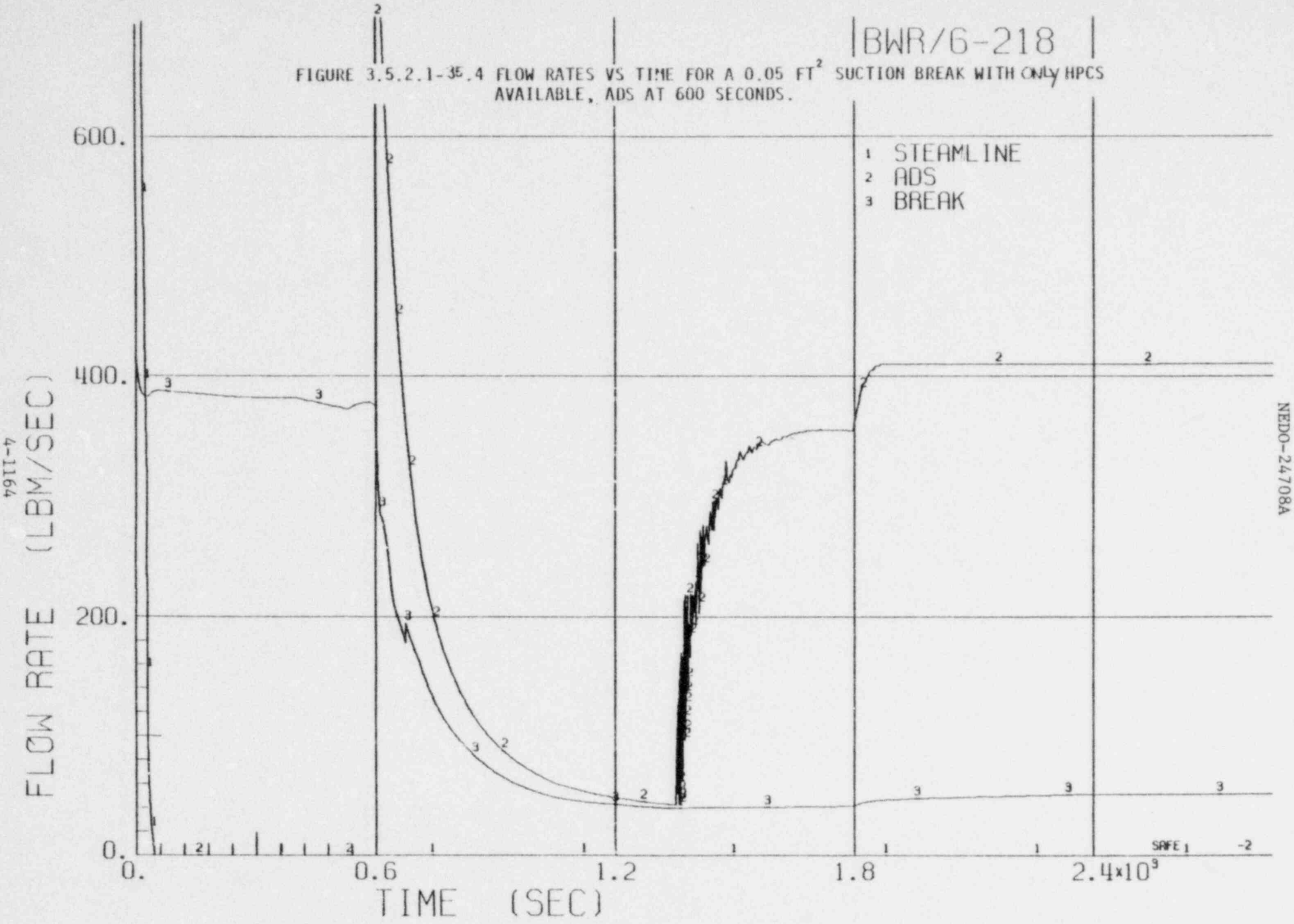
BWR/6-218
FIGURE 3.5.2.1-35.4 FLOW RATES VS TIME FOR A 0.05 FT² SUCTION BREAK WITH ONLY HPCS AVAILABLE, ADS AT 600 SECONDS.
1 STEAMLINE
2 ADS
3 BREAK
FLOW RATE (LBM/SEC)
600.
400.
200.
0.
0.
0.6
1.2
1.8
2.4x10³
TIME (SEC)
SAFE 1 -2
NEDO-24708A
4-1164

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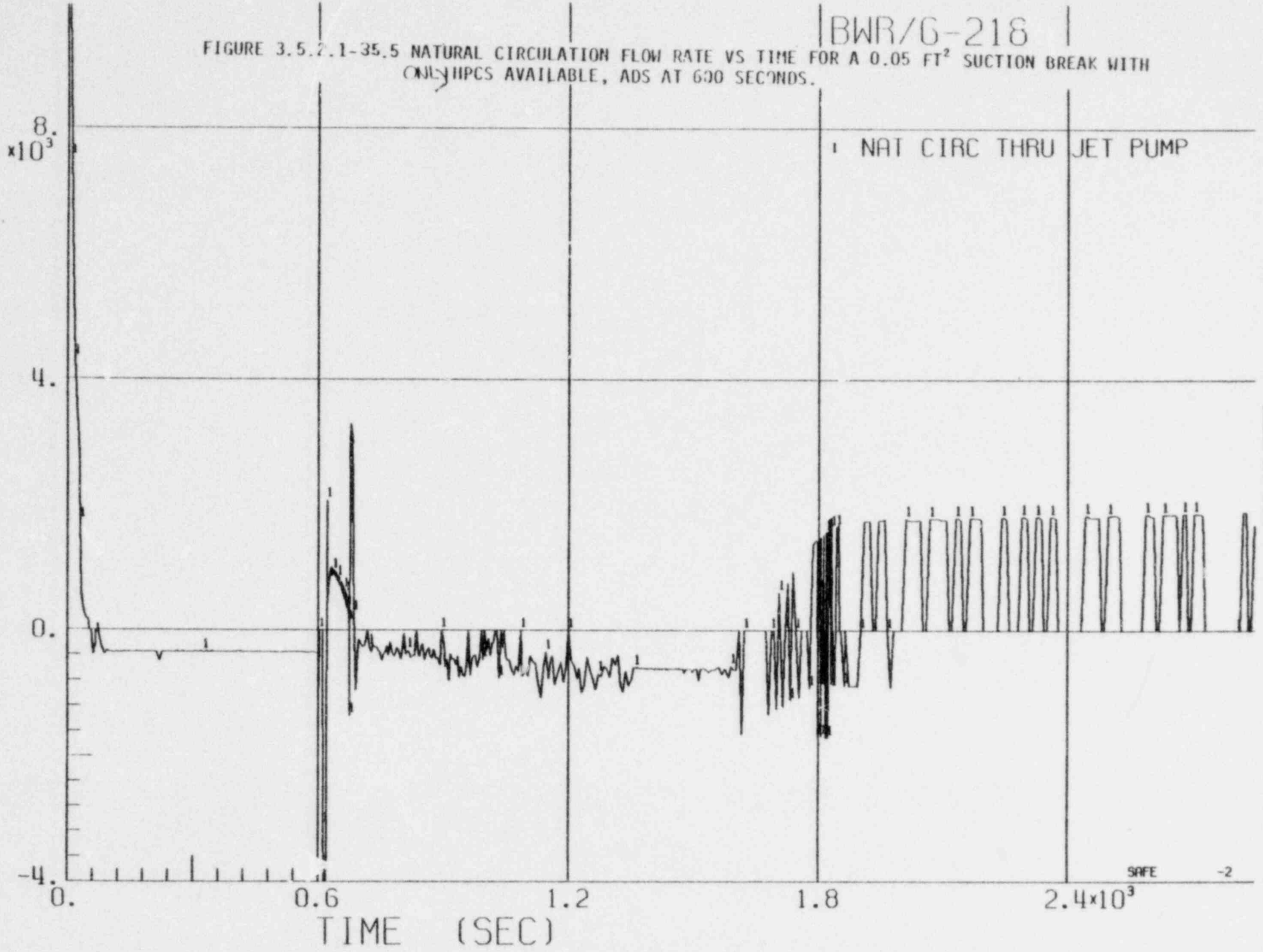
FIGURE 3.5.2.1-35.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A 0.05 FT² SUCTION BREAK WITH ONLY HPCS AVAILABLE, ADS AT 600 SECONDS.



4-1165

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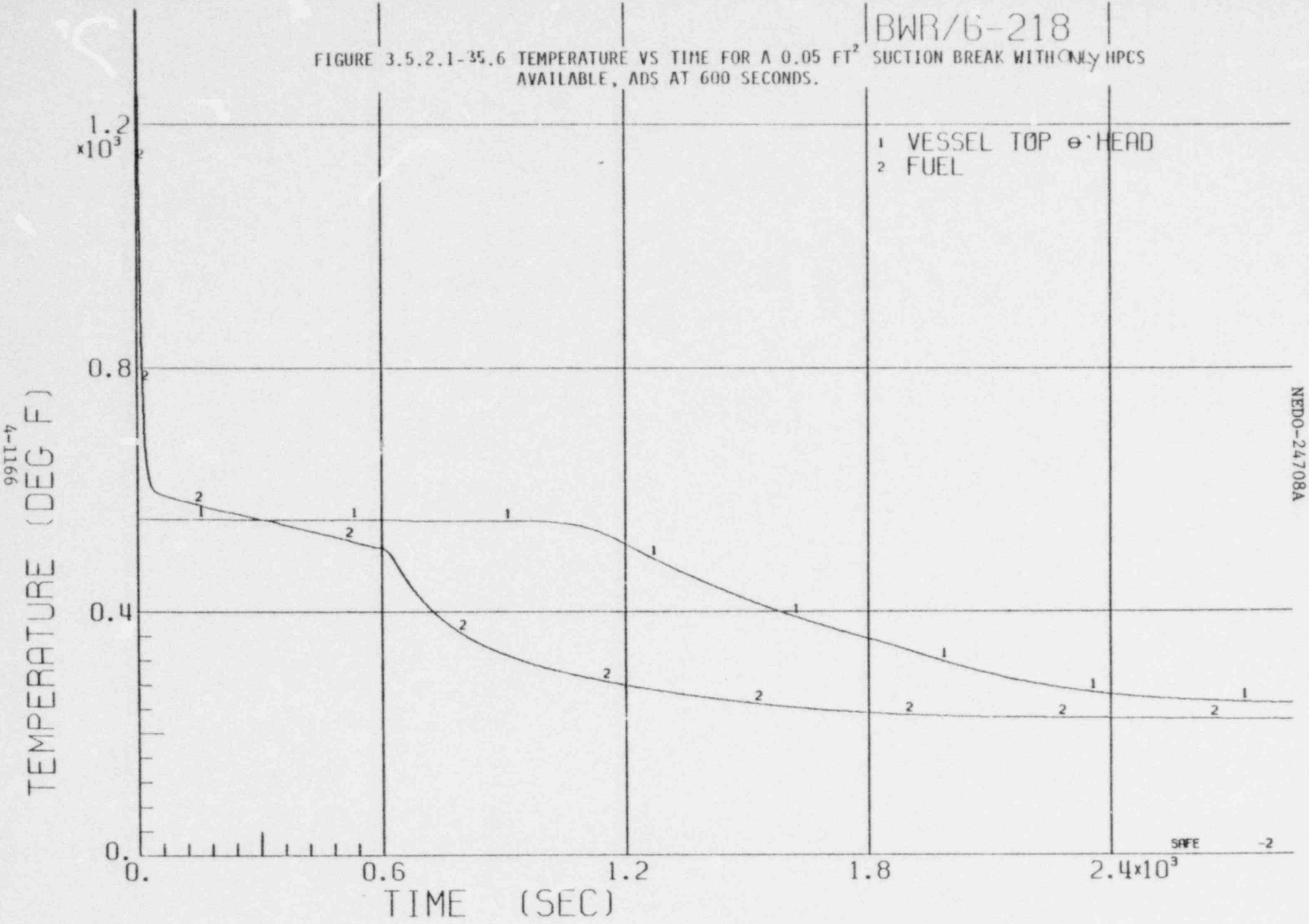
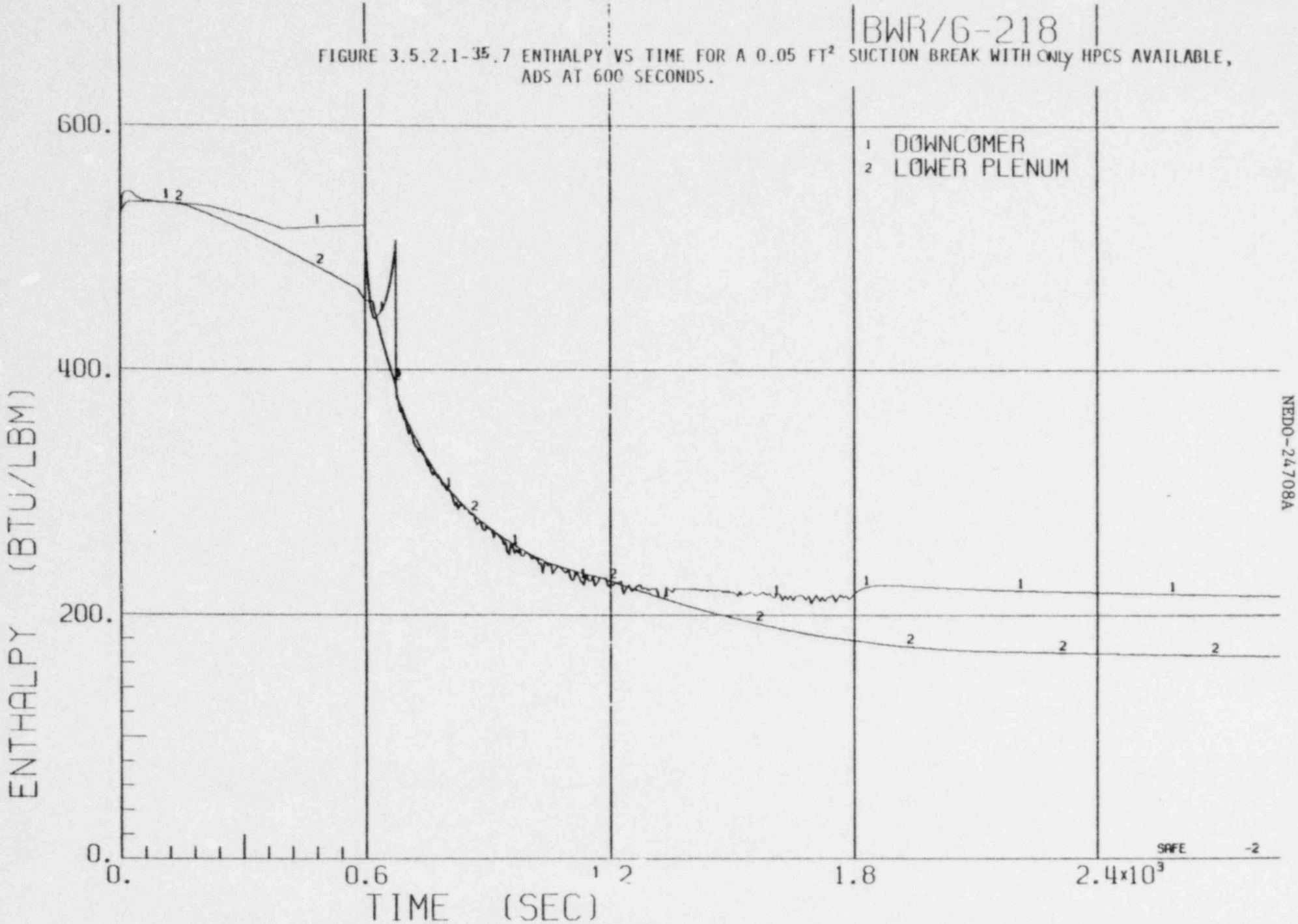
FIGURE 3.5.2.1-35.6 TEMPERATURE VS TIME FOR A 0.05 FT^2 SUCTION BREAK WITH ONLY HPCS AVAILABLE, ADS AT 600 SECONDS.



BWR/6-218

FIGURE 3.5.2.1-35.7 ENTHALPY VS TIME FOR A 0.05 FT² SUCTION BREAK WITH ONLY HPCS AVAILABLE, ADS AT 600 SECONDS.

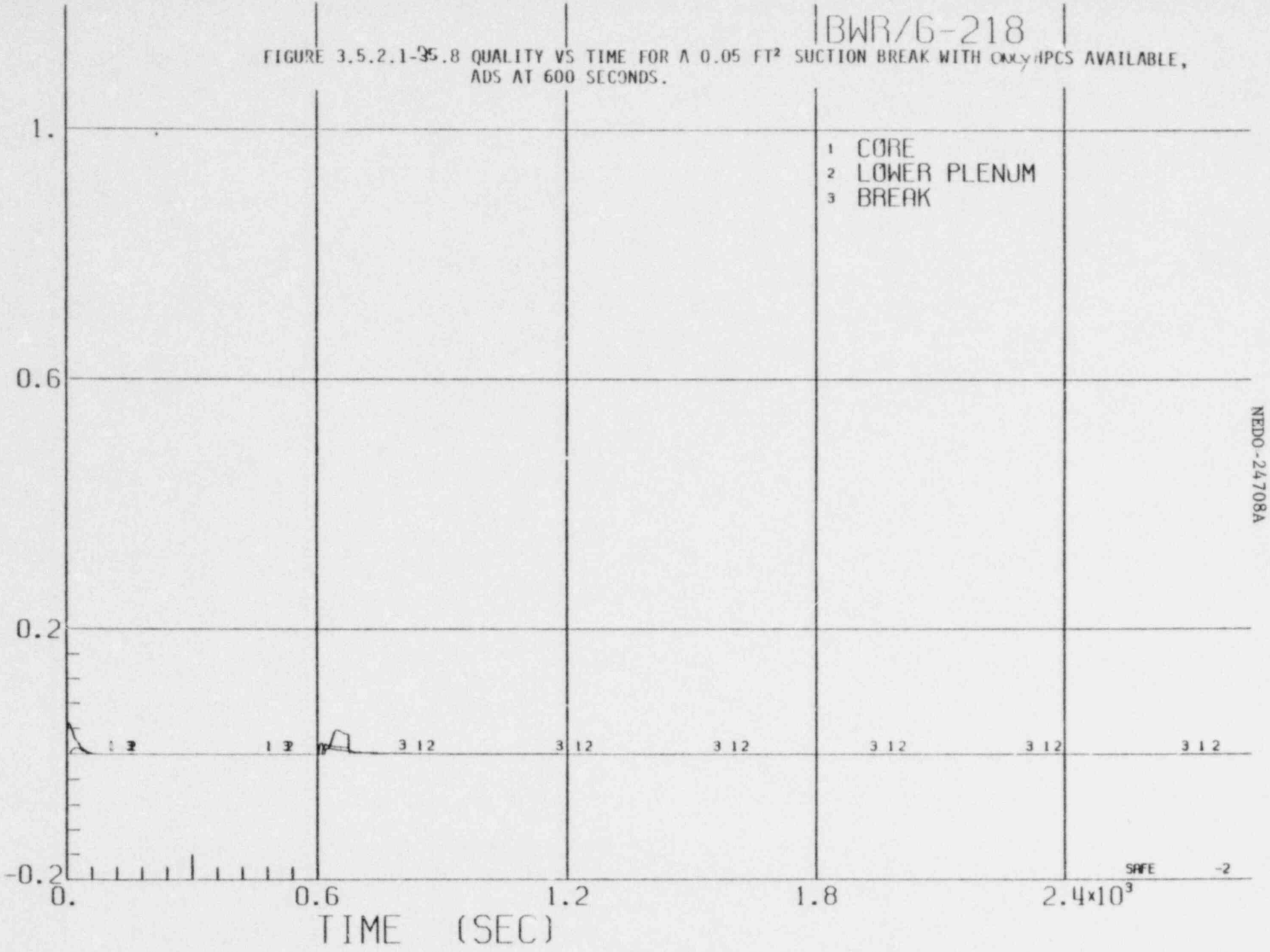


NEDO-24708A

4-1167

BWR/6-218

FIGURE 3.5.2.1-35.8 QUALITY VS TIME FOR A 0.05 FT² SUCTION BREAK WITH Oxy/HPCS AVAILABLE, ADS AT 600 SECONDS.

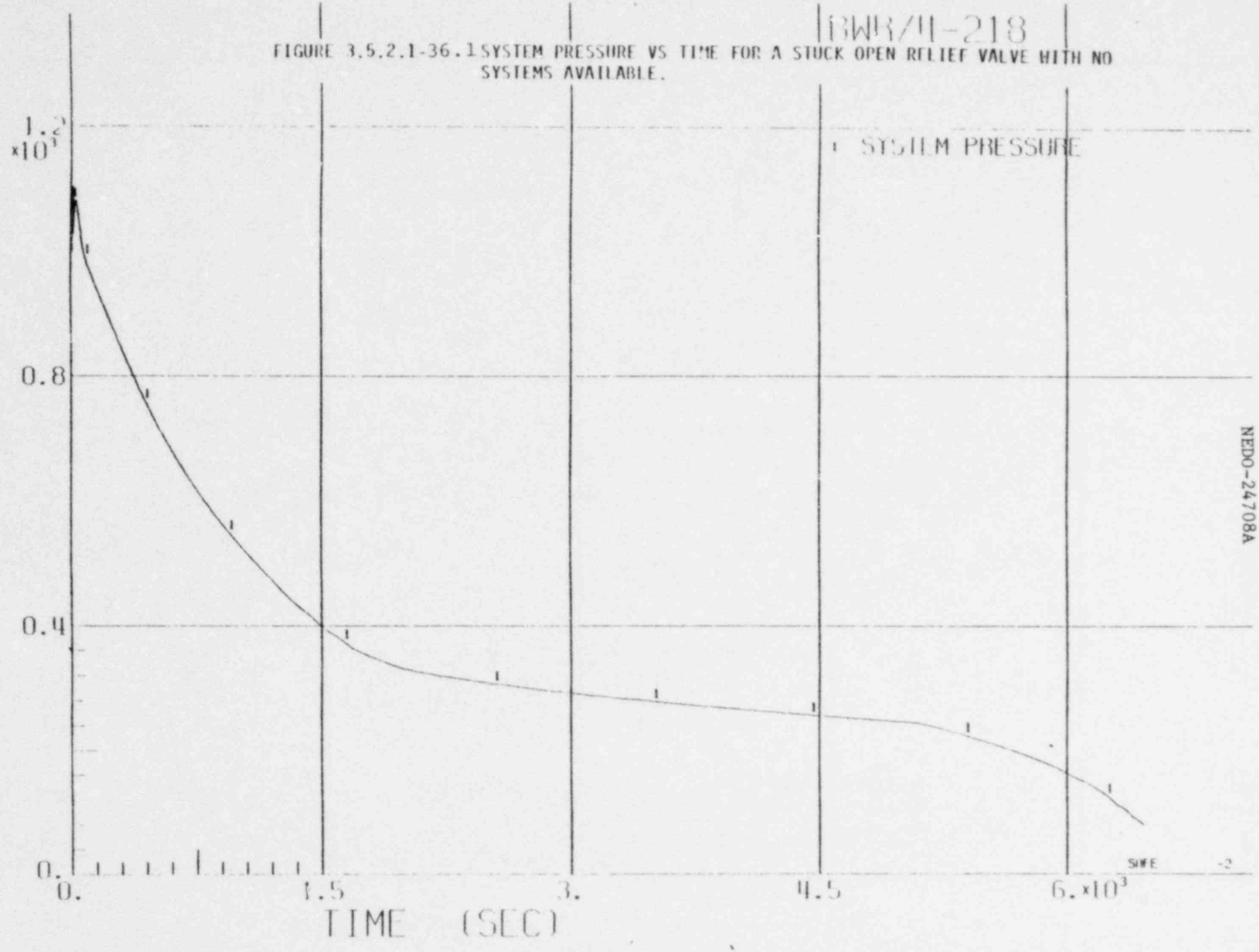


4-1168

NEDO-24708A

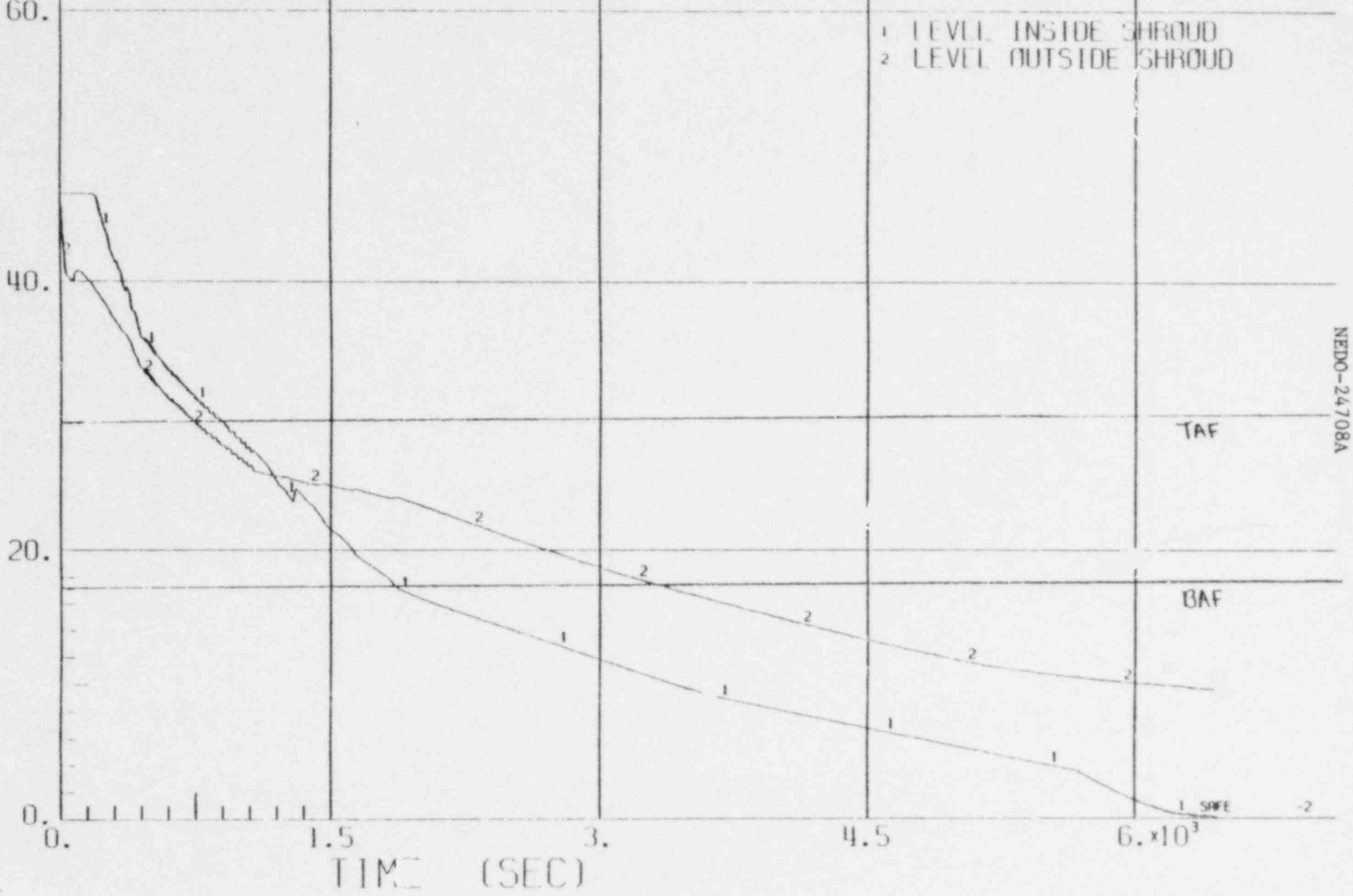
BWR/4-218

FIGURE 3.5.2.1-36.1 SYSTEM PRESSURE VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.



BWR/4-218

FIGURE 3.5.2.1-36.2 WATER LEVEL VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.

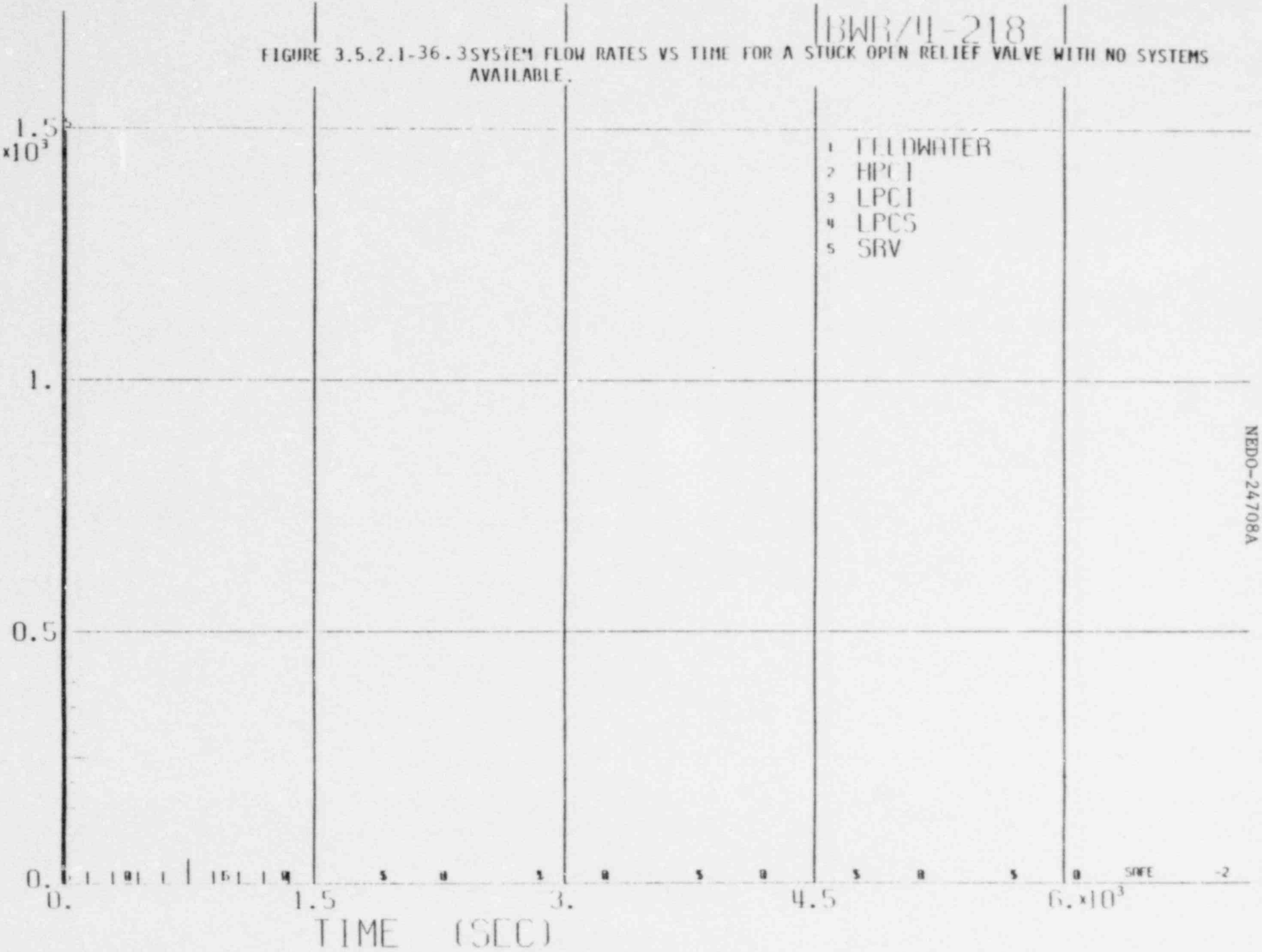


NEDO-24708A

4-1170

BWR/4-218

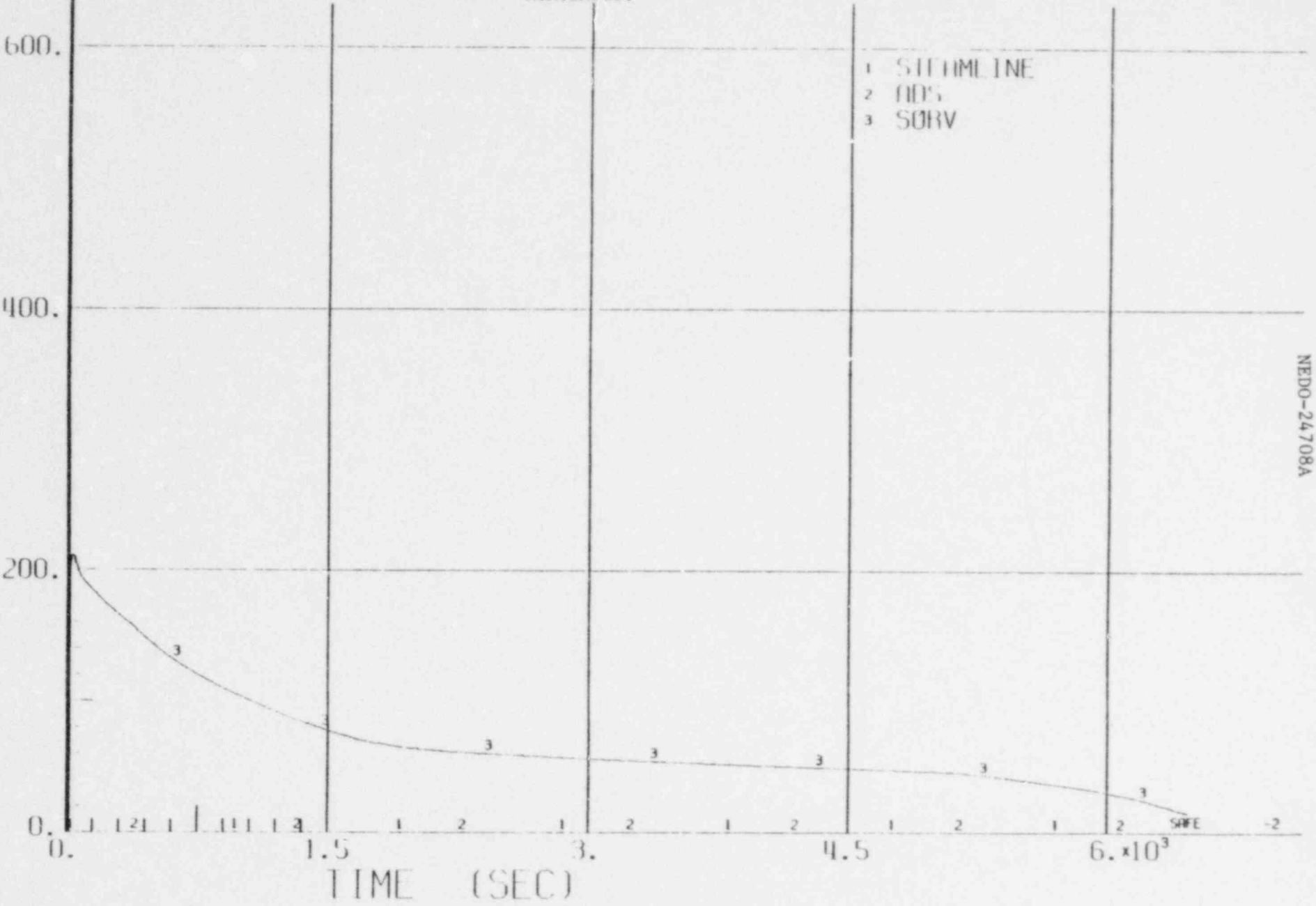
FIGURE 3.5.2.1-36.3SYSTEM FLOW RATES VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.



NEDO-24708A

4-1171

FIGURE 3.5.2.1-36.4 FLOW RATES VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.



BWR/4-218

FIGURE 3.5.2.1-36.5 NATURAL CIRCULATION FLOW RATE VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.

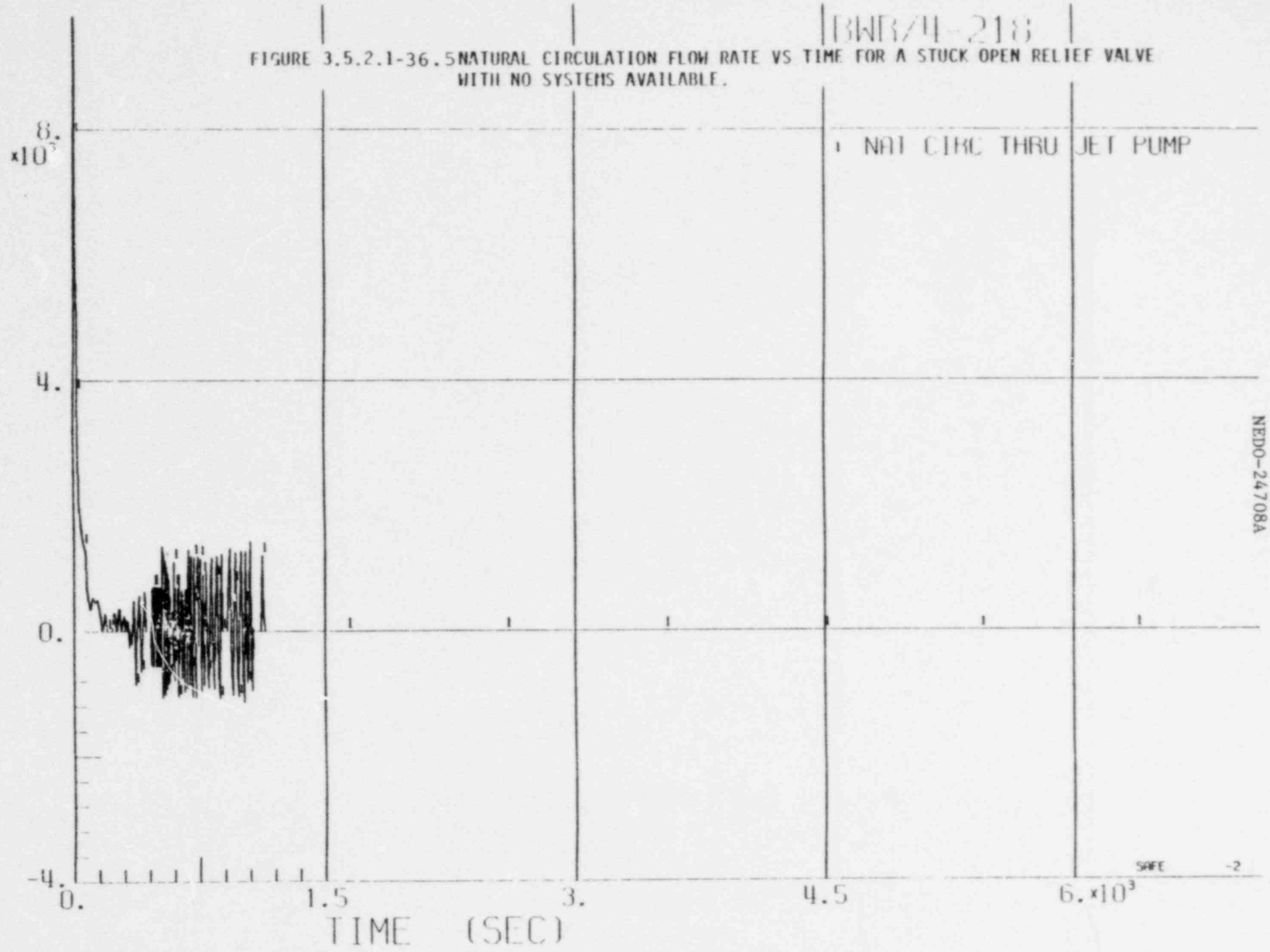


FIGURE 3.5.2.1-36.6A TEMPERATURE VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.

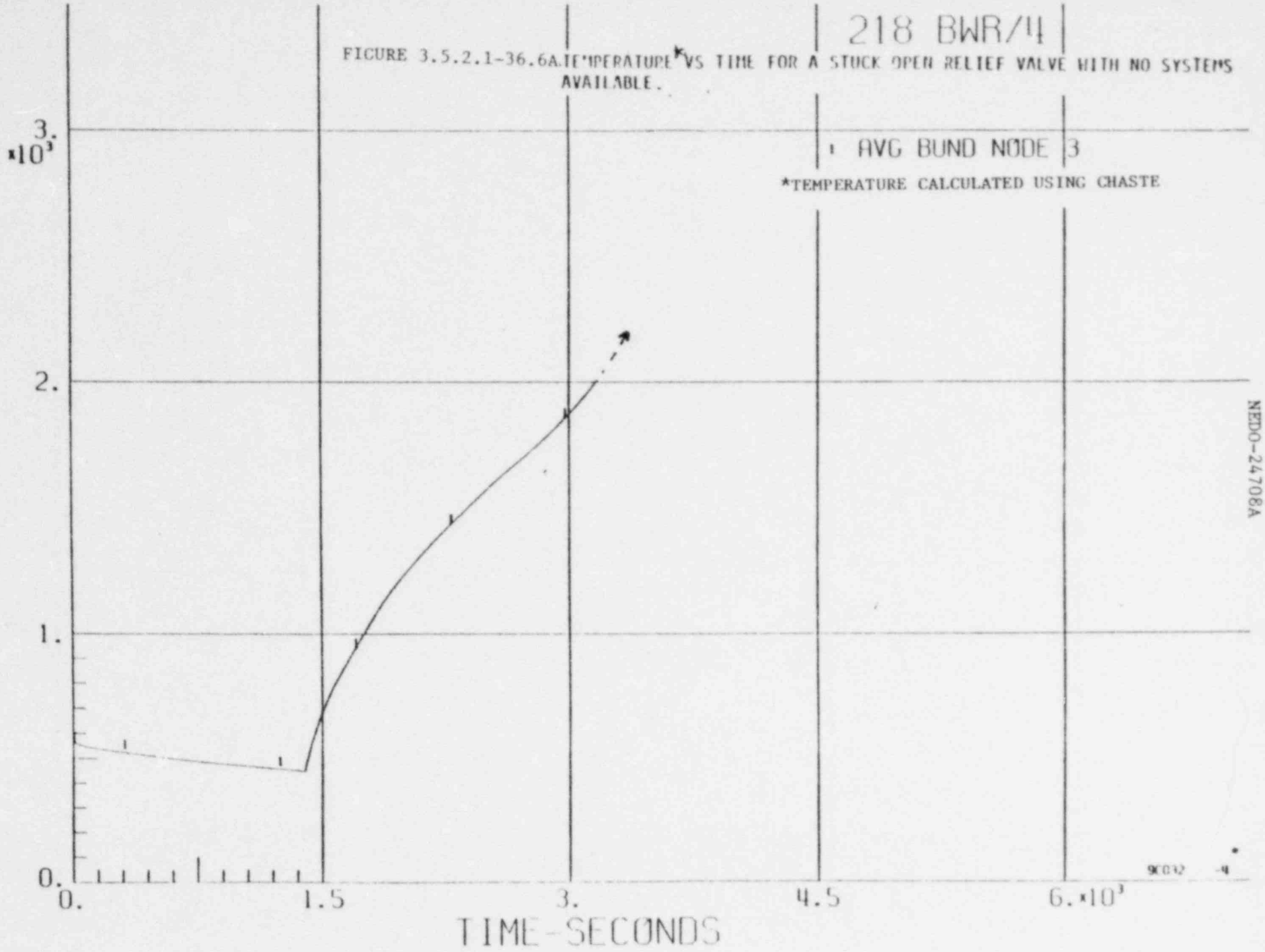
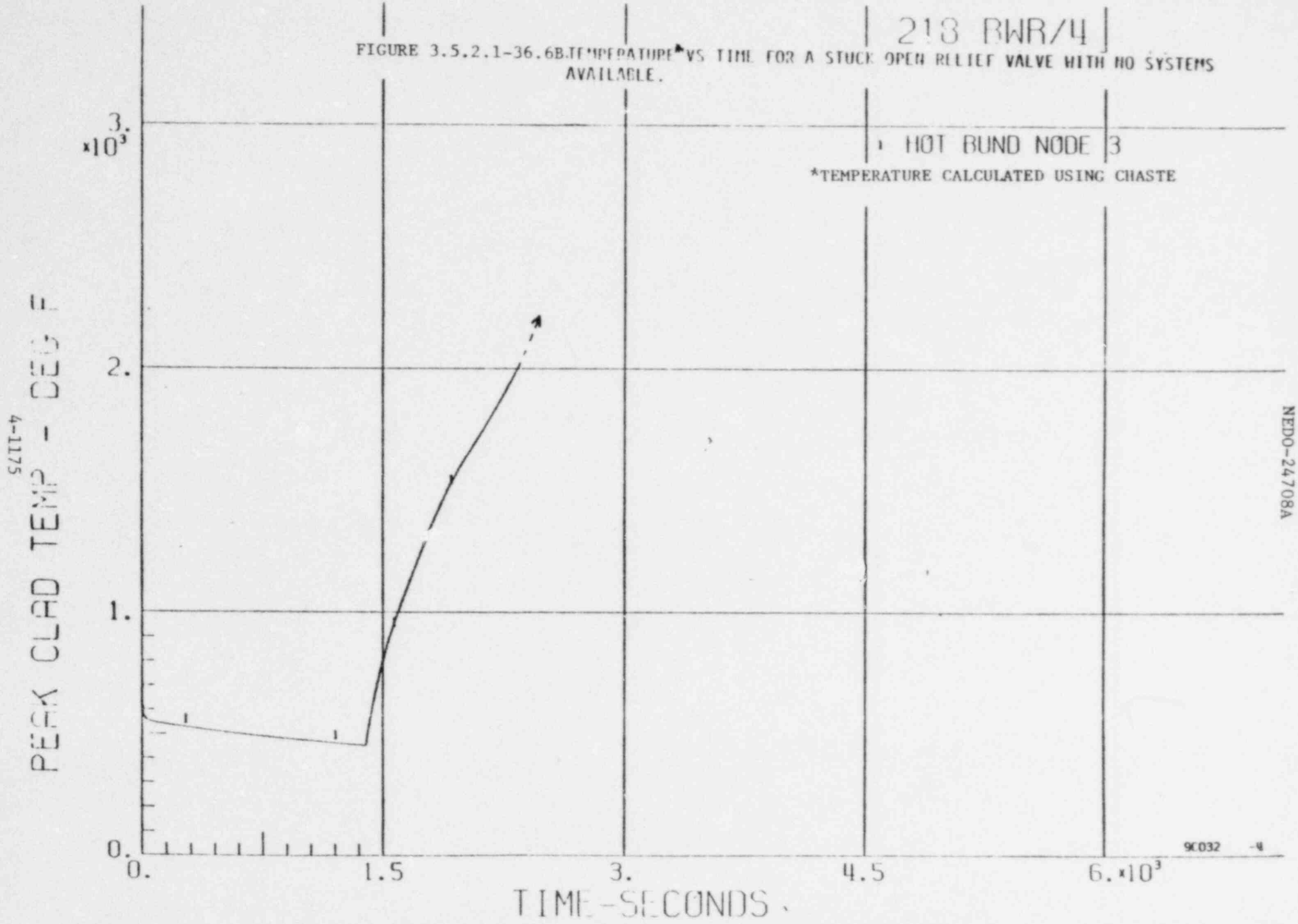


FIGURE 3.5.2.1-36.6B TEMPERATURE* VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.



4-1175

FIGURE 3.5.2.1-36.7ENTHALPY VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.

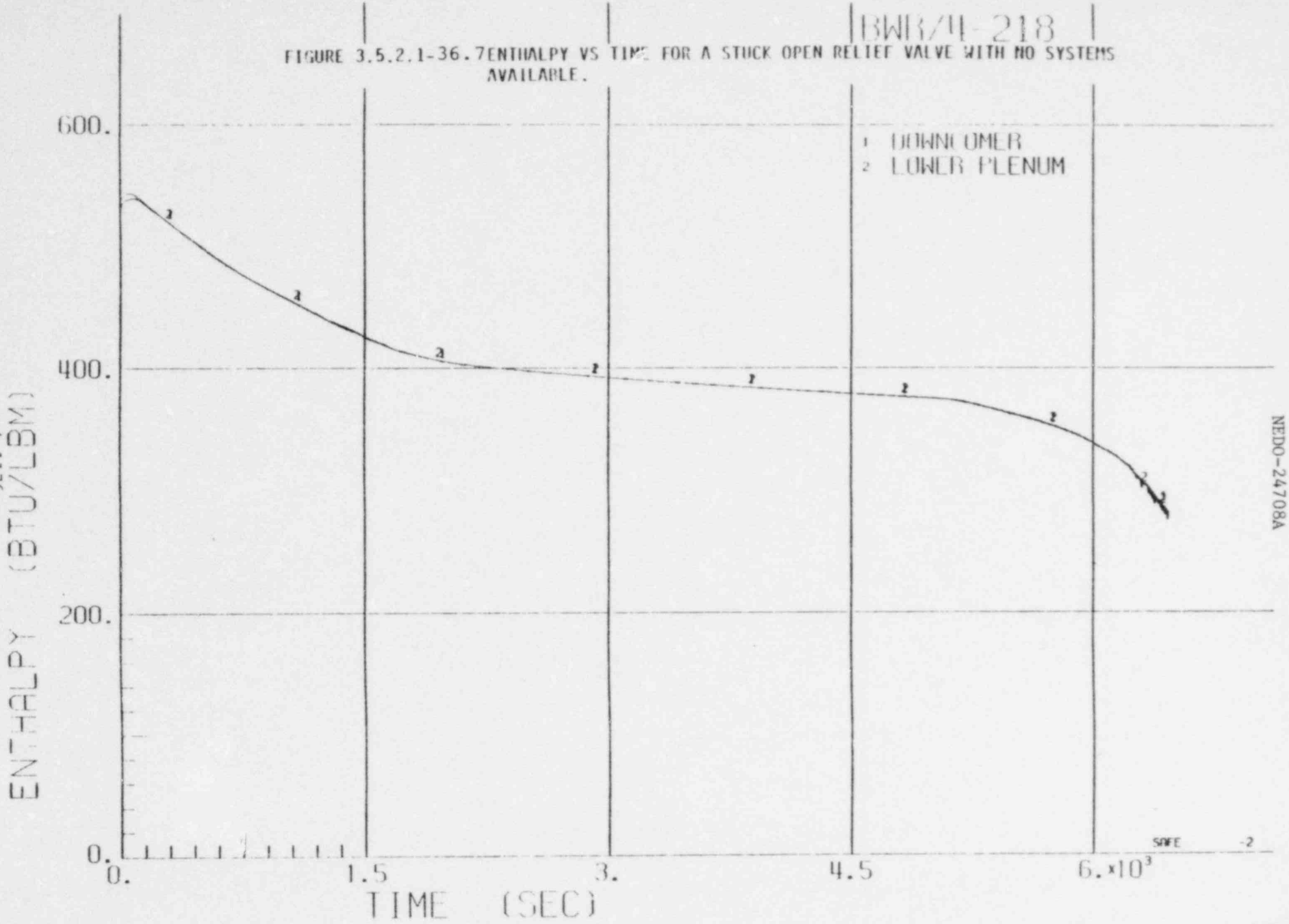


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FIGURE 3.5.2.1-36.8QUALITY VS TIME FOR A STUCK OPEN RELIEF VALVE WITH NO SYSTEMS AVAILABLE.

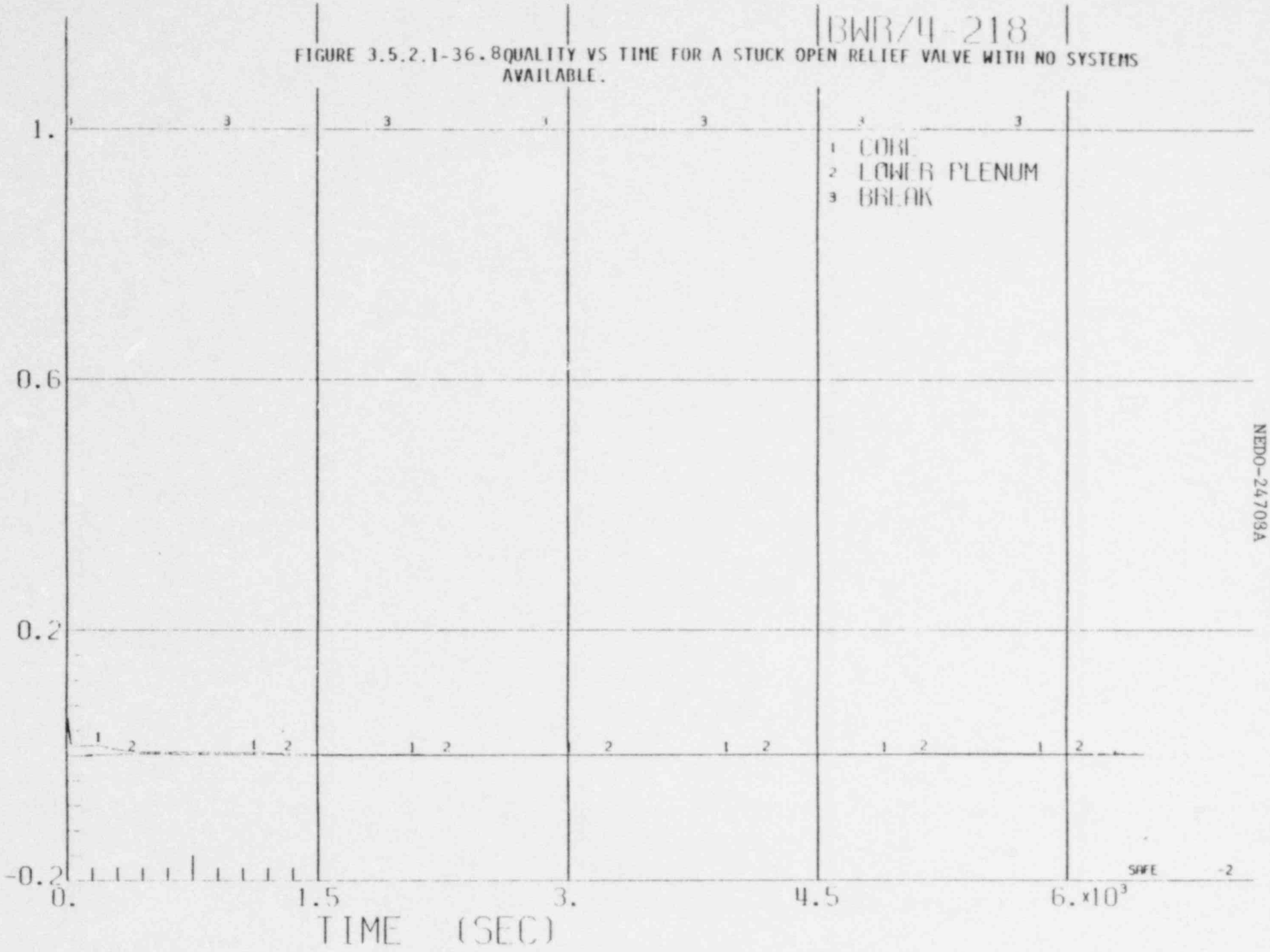

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FIGURE 3.5.2.1-37.1 SYSTEM PRESSURE VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

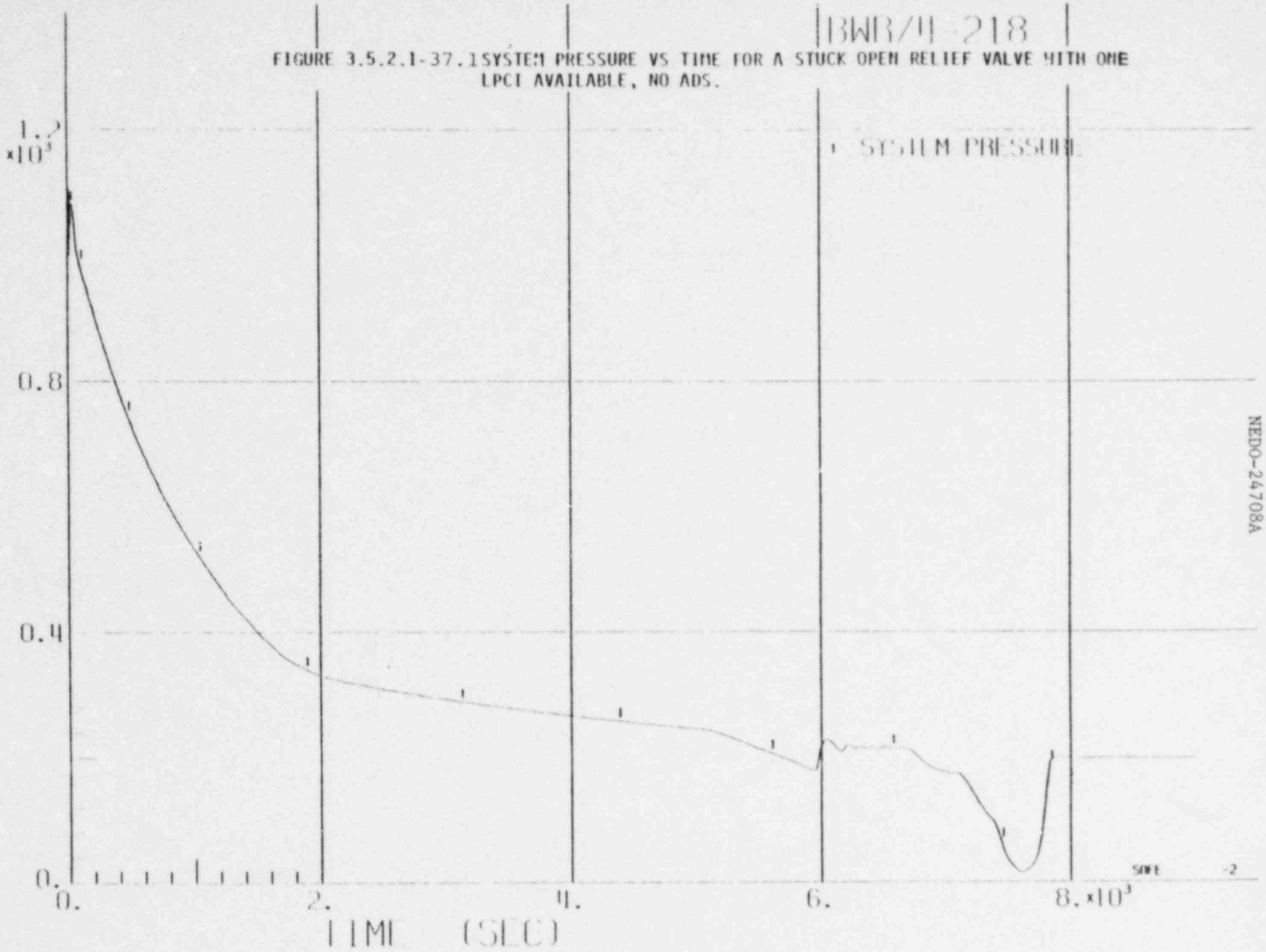

FIGURE 3.5.2.1-37.2 WATER LEVEL VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

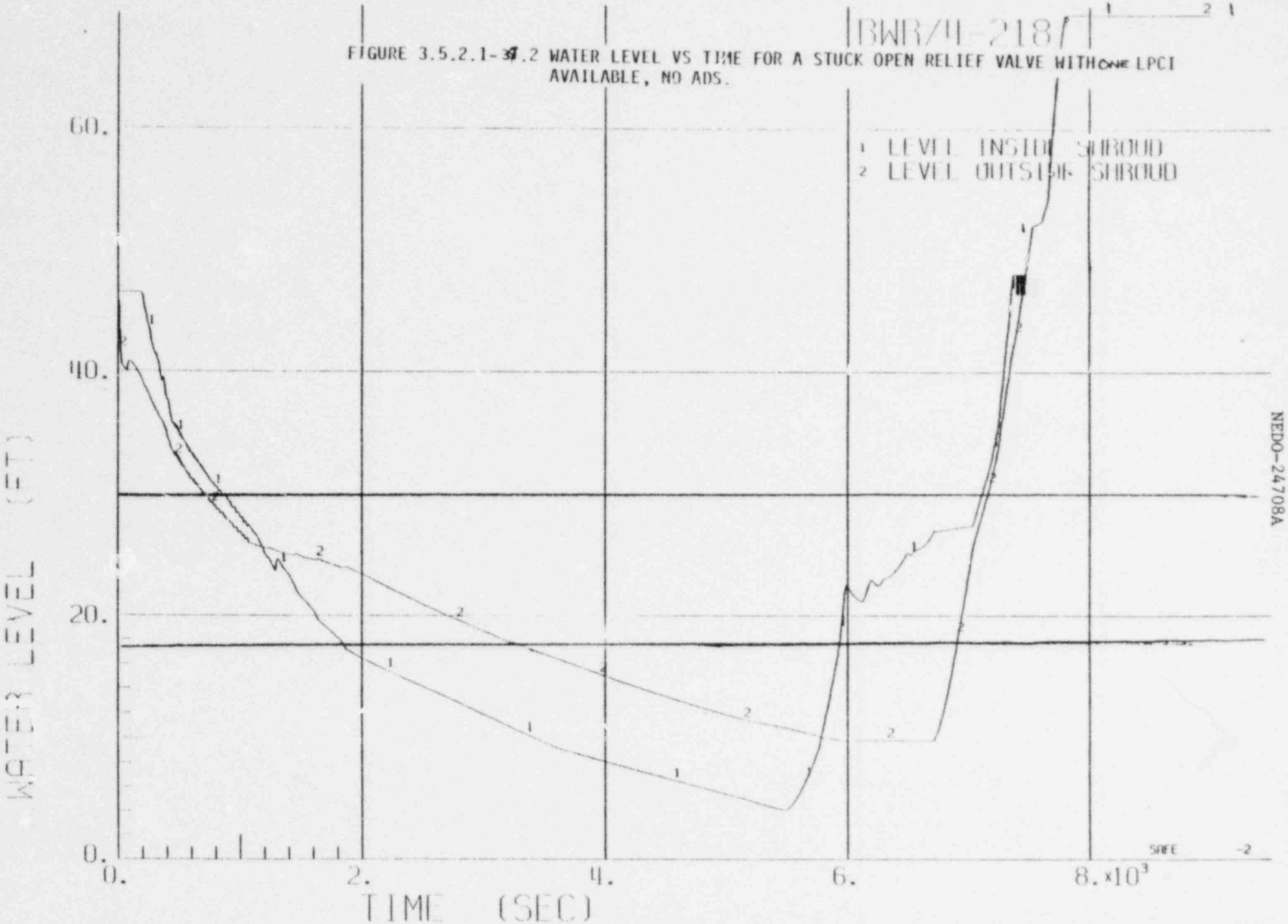

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FIGURE 3.5.2.1-39 3 SYSTEM FLOW RATES VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

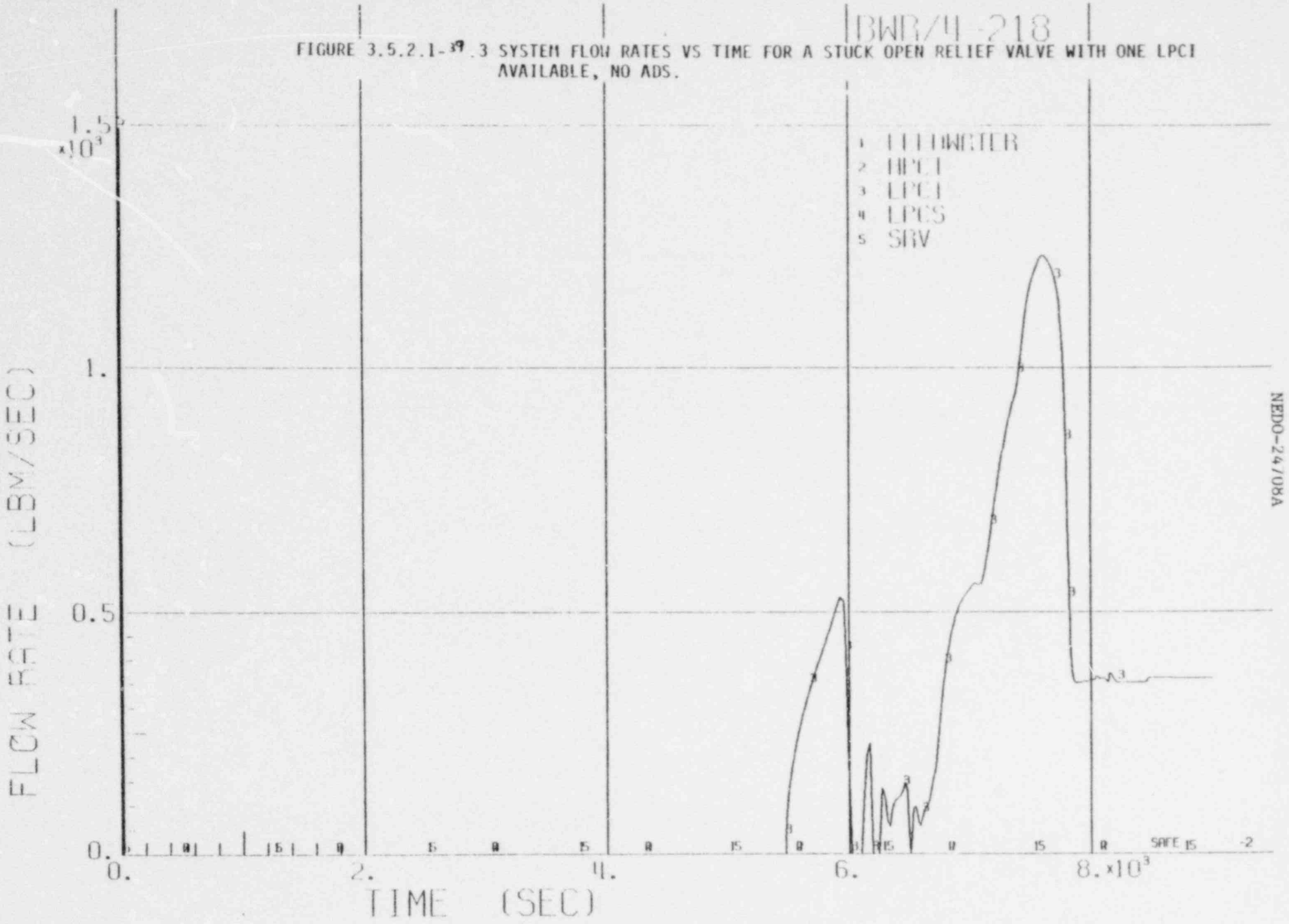

FIGURE 3.5.2.1-37.4FLOW RATES VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

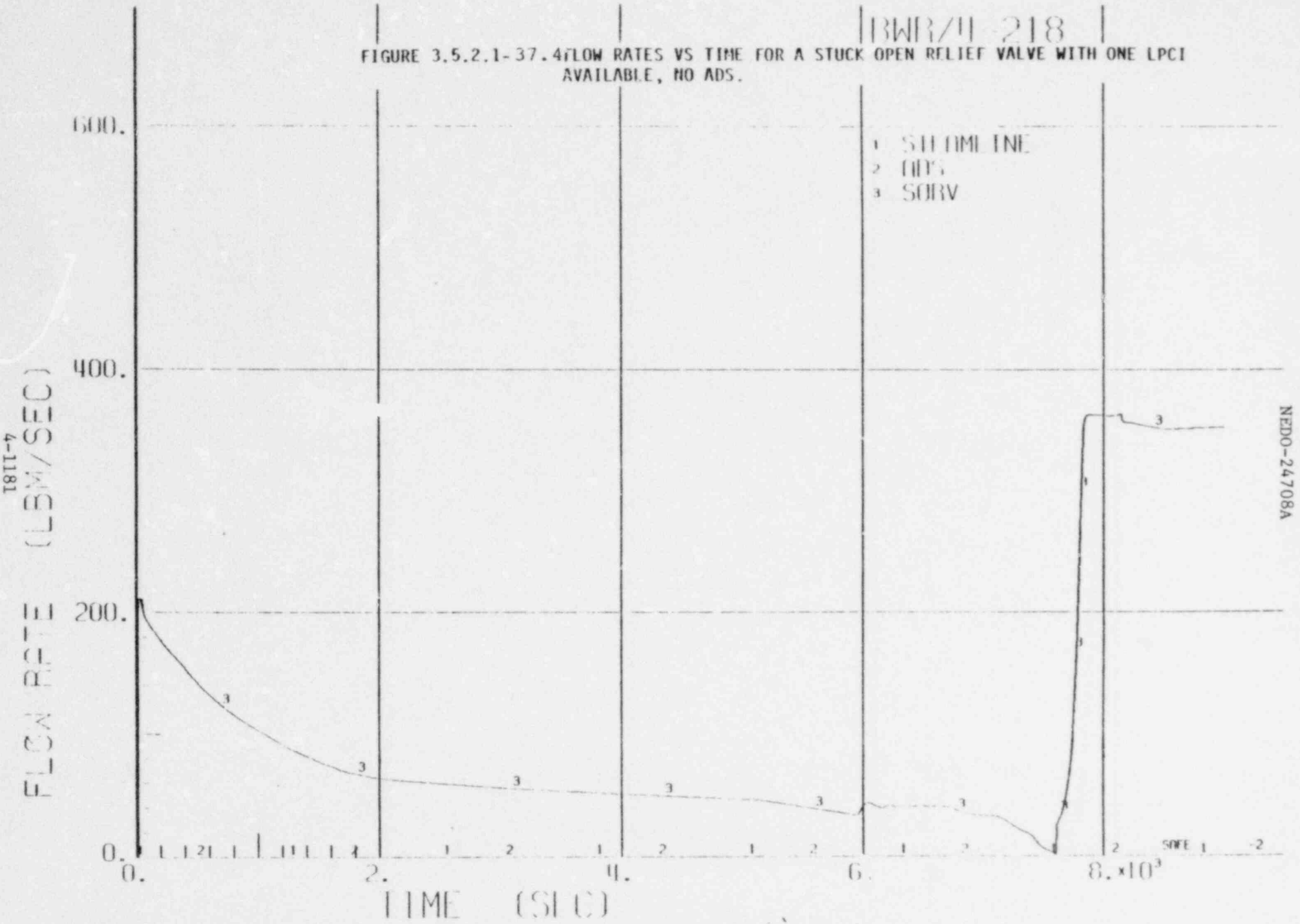

FIGURE 3.5.2.1-37. NATURAL CIRCULATION FLOW RATE VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS

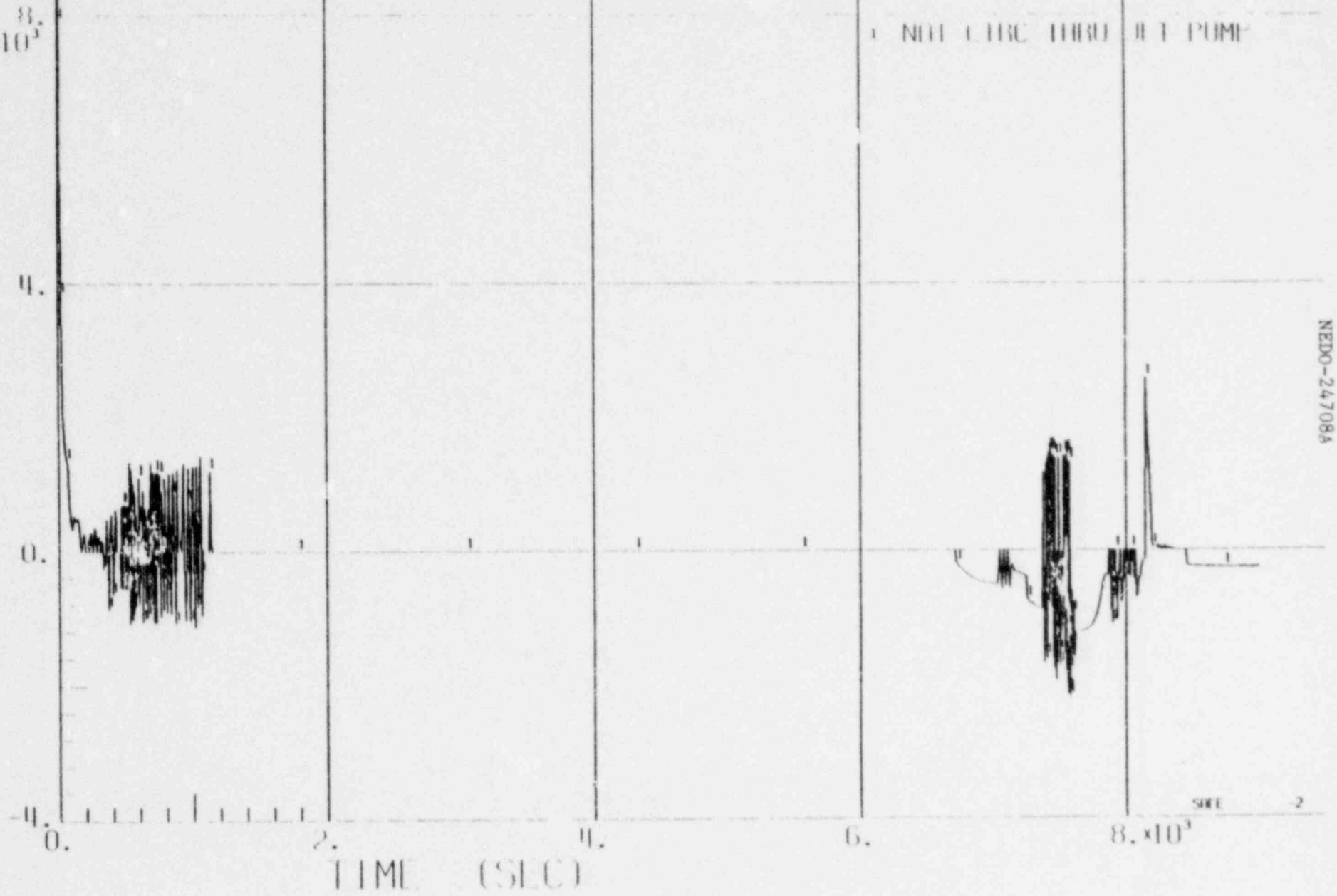

FIGURE 3.5.2.1-3[illegible].6A TEMPERATURE* VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

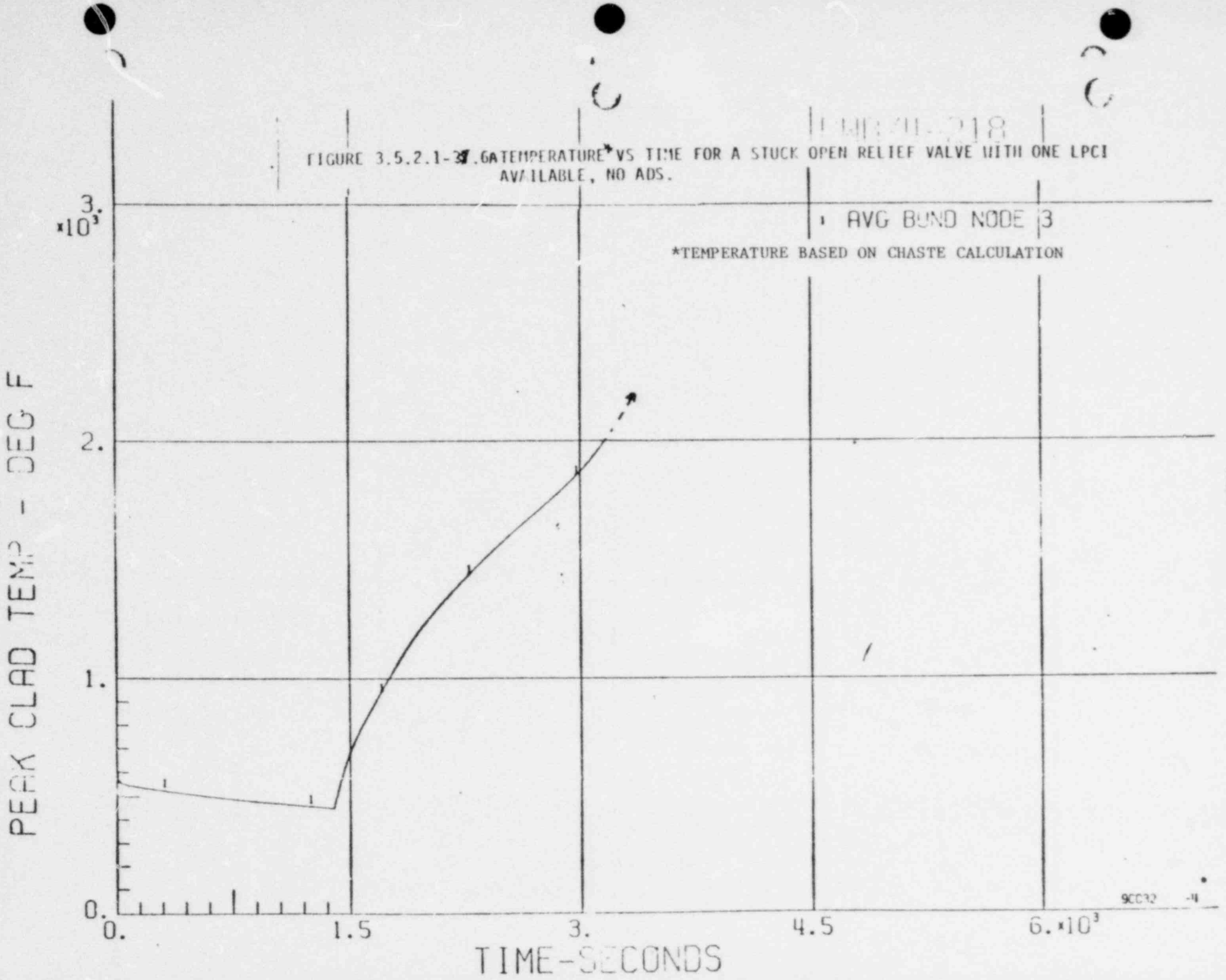

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FIGURE 3.5.2.1-37.6B TEMPERATURE* VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

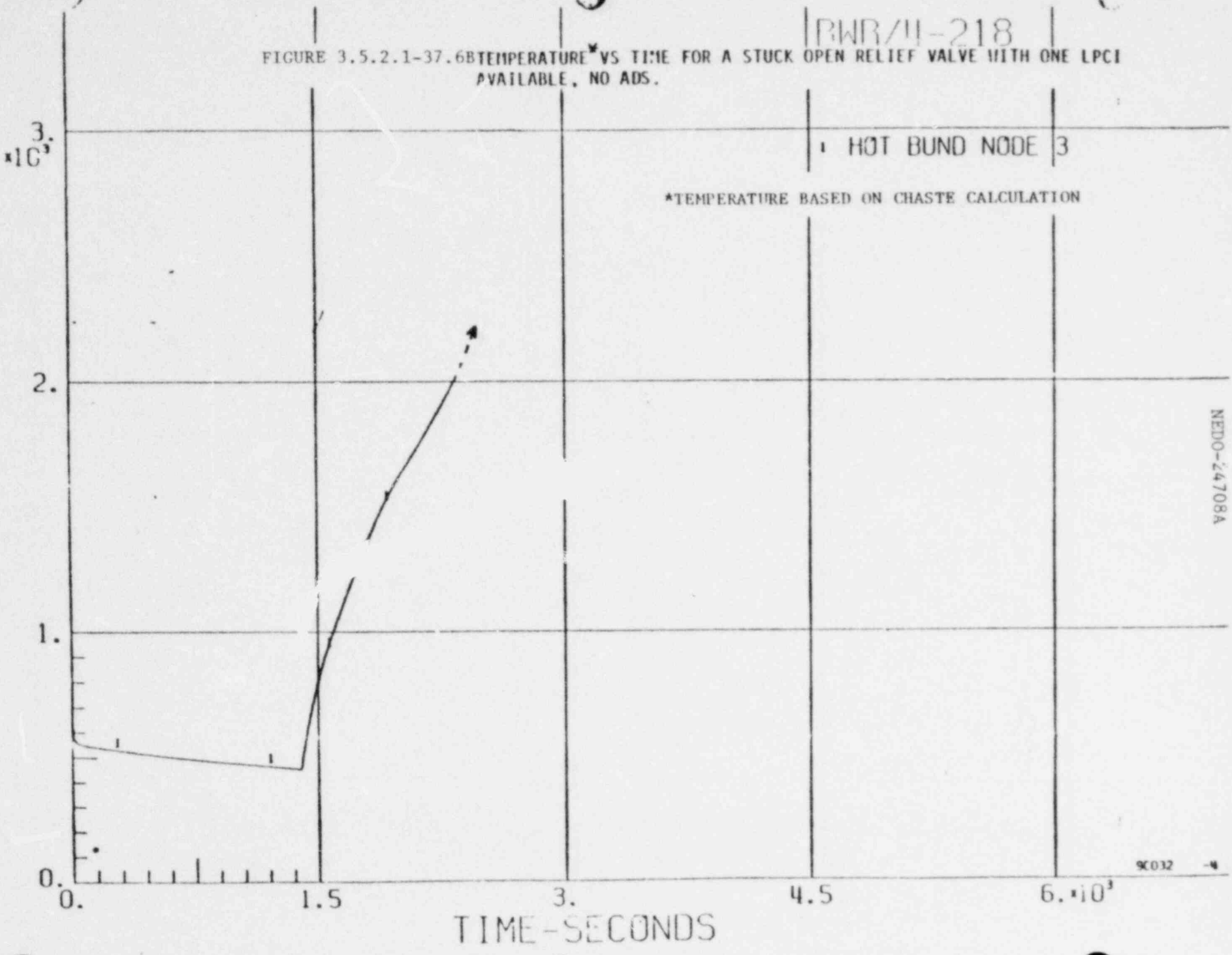

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FIGURE 3.5.2.1-37.7ENTHALPY VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

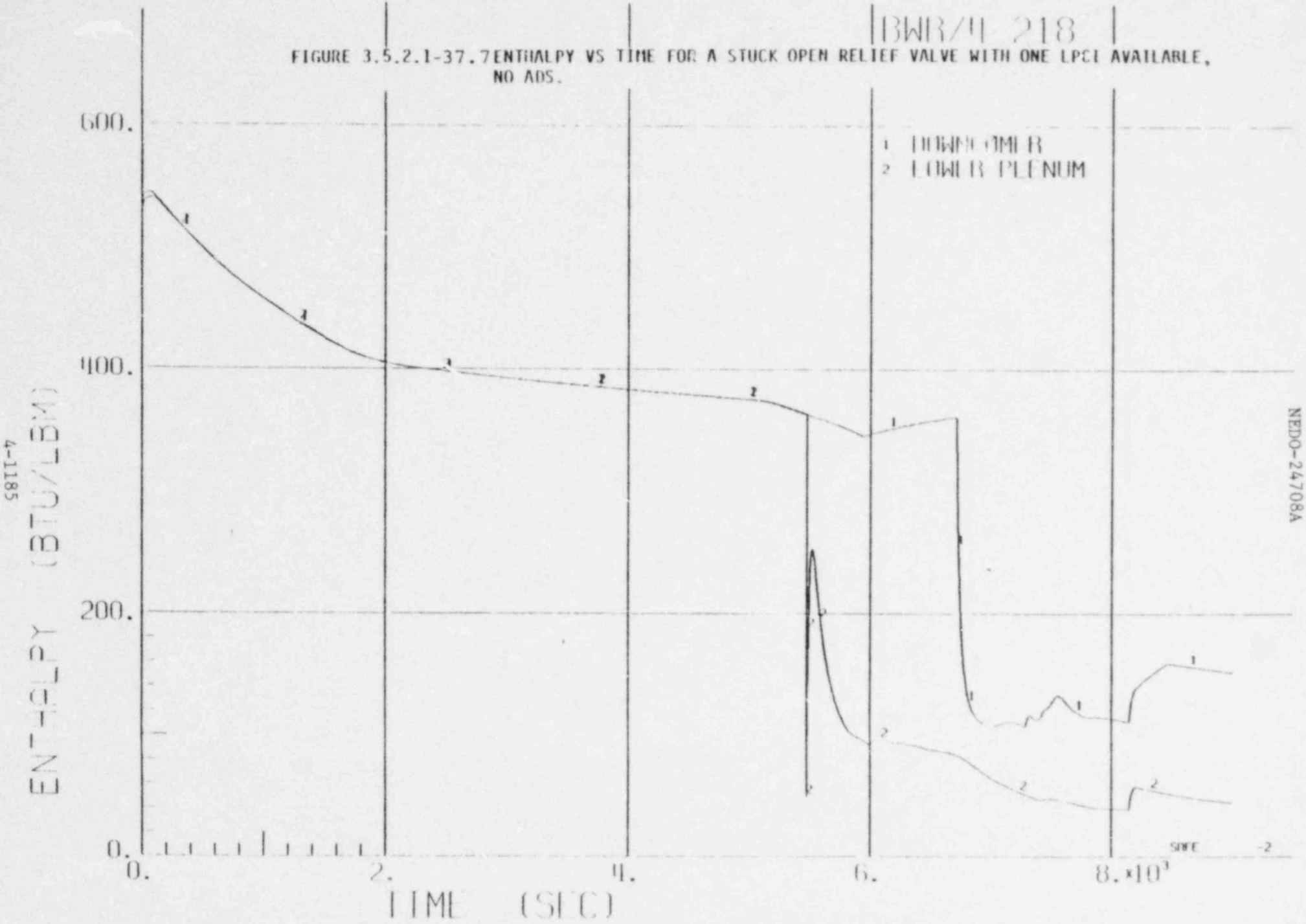

FIGURE 3.5.2.1-37. QUALITY VS TIME FOR A STUCK OPEN RELIEF VALVE WITH ONE LPCI AVAILABLE, NO ADS.

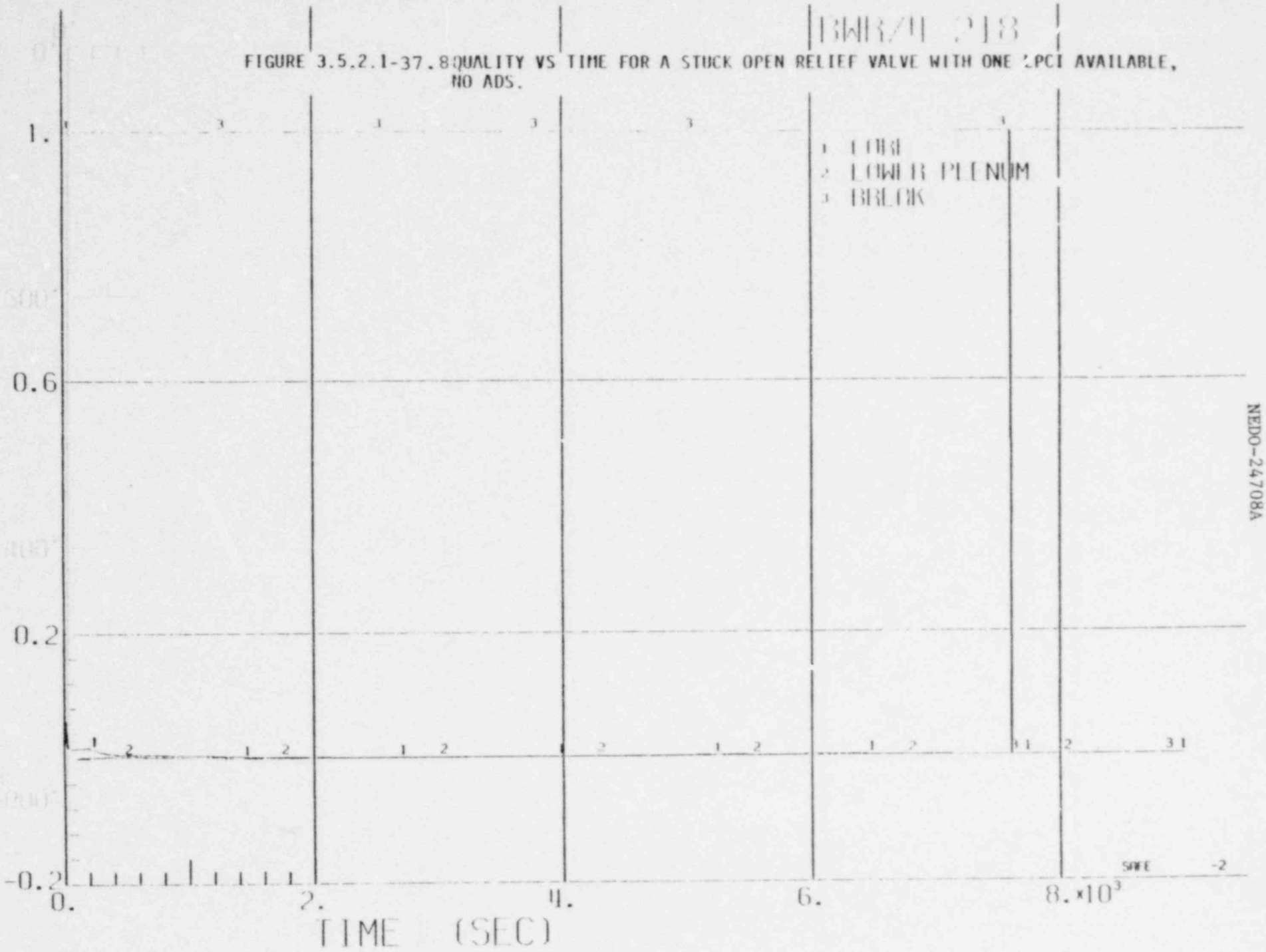

Table 3.5.2.3.3-1

GAMMA FLUX AFTER SHUTDOWN

Time After Shutdown t(sec)	$f_{\gamma_{LOCA}}(t)$	Ratio of Gamma Flux After Shutdown to Gamma Flux Prior to Shutdown
0.0	1.0	
1.0	0.28	
1.0×10^1	0.22	
1.0×10^2	0.14	(∿1.7 minutes)
1.0×10^3	0.087	(∿0.28 hour)
1.0×10^4	0.044	(∿2.8 hours)
1.0×10^5	0.0[illegible]	(∿1.2 days)
1.0×10^6	0.013	(∿11.6 days)
1.0×10^7	0.0057	(∿116 days)
1.0×10^8	0.0027	(∿1157 days; ∿3.2 years)

Table 3.5.2.3.3-2

GAMMA FLUX SENSITIVITY TO VOID FRACTION CHANGES (IN CHANNEL)
UNDER HOT OPERATING CONDITIONS
(GAMMA SOURCE FIXED FOR EACH LATTICE)

Exposure GWd/ST	In-Channel Void Fraction	T_γ (Relative Gamma Flux at TIP Location)		
		7x7	8x8	8x8
2.0	0	1.24	1.13	1.05
2.0	40	1.37	1.06	0.99
2.0	70	1.30	1.12	1.04
15.0	0	1.28	1.09	1.09
15.0	40	1.39	1.14	1.05
15.0	70	1.45	1.19	1.11
30.0	0	1.51	1.35	1.18
30.0	40	1.49	---	1.11
30.0	70	1.49	1.35	1.17

Table 3.5.2.3.3-3

IN-CORE NUCLEAR INSTRUMENTATION CAPABILITY

Instrumentation	Sensitive To	On Scale (Sensitive)	Results
Source Range Monitor	Thermal Neutrons	Yes (Yes)	Expected to indicate anomalously low count rate response indicating a potential inadequate core cooling condition when detector is inserted into a completely voided (uncovered) core.
Intermediate Range Monitor (IRM)	Thermal Neutrons	No	
Local Power Range Monitor (LPRM)	Thermal Neutrons	No	
Average Power Range Mointor (APRM)	Thermal Neutrons	No	
Thermal TIP	Thermal Neutrons	No	
Gamma TIP	Gamma Photons	Yes (No)	Not expected to indicate obvious anomalous response indicating a completely voided core because of the relative insensitivity of gamma flux flux levels to core moderator density.

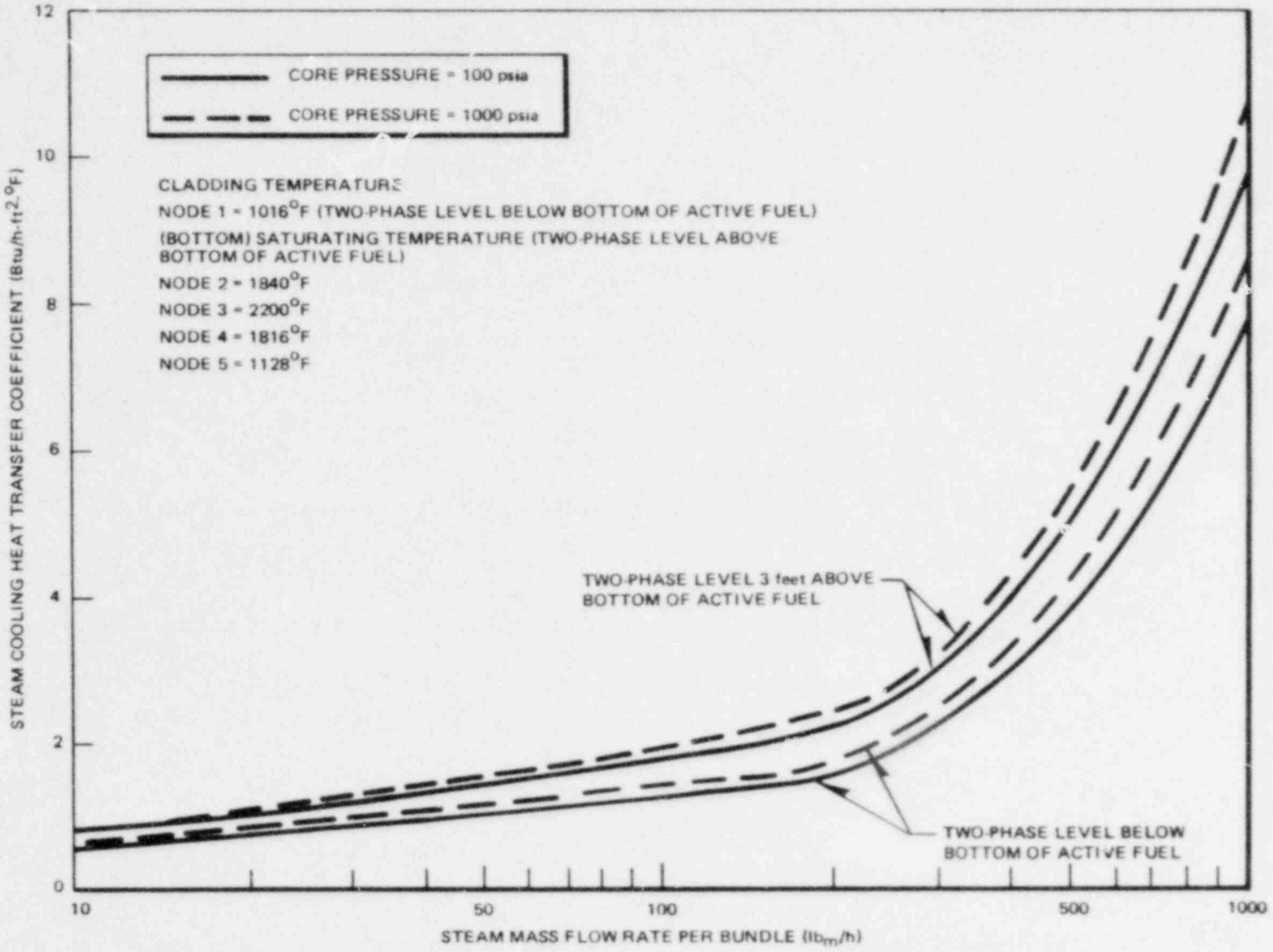

Figure 3.5.2.4-1. Typical Steam Cooling Heat Transfer Coefficients as Functions of Two-Phase Level, Core Pressure, and Steam Mass Flow Rate

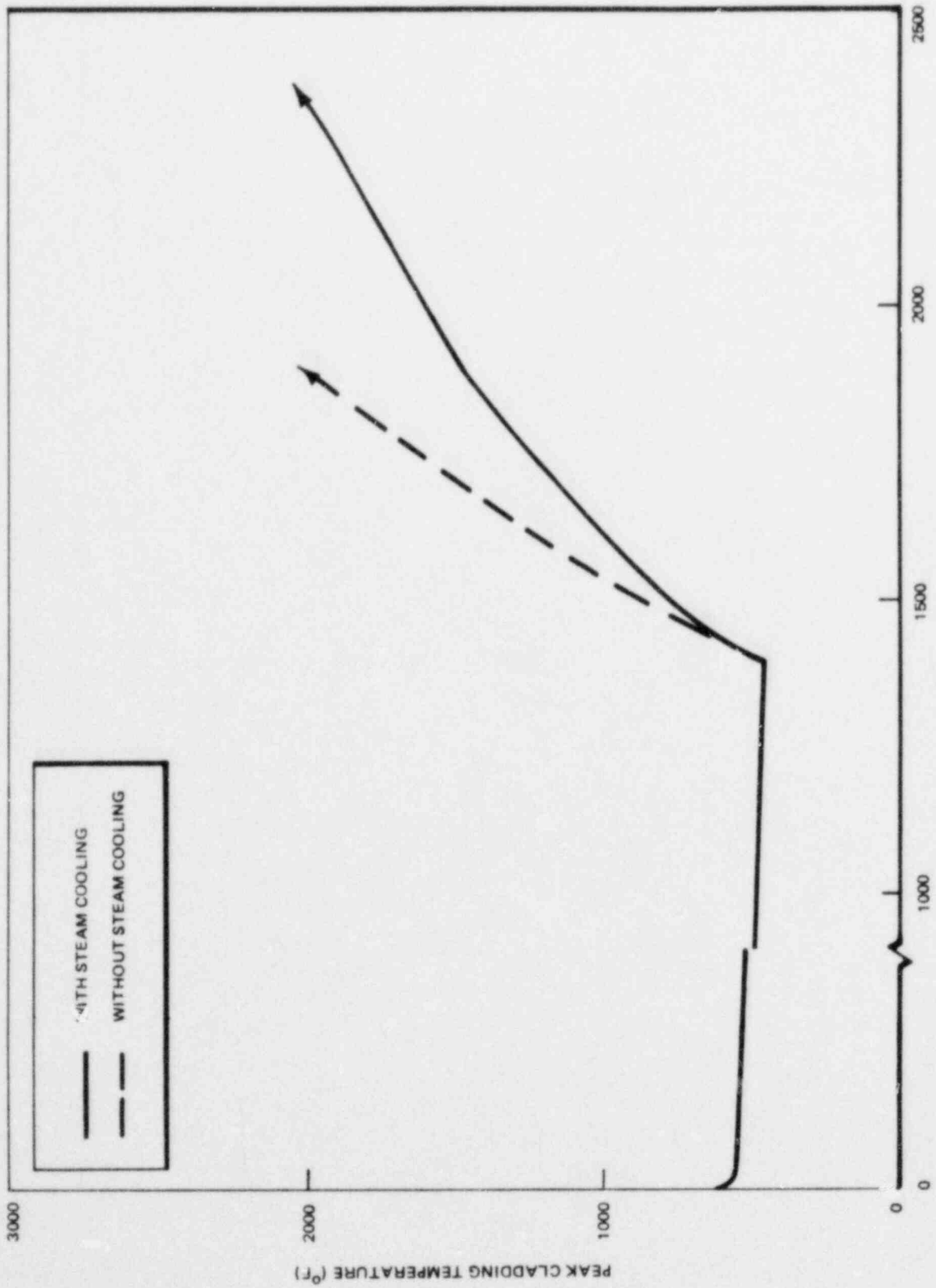

Figure 3.5.2.4-2. The Effect of Steam Cooling on Peak Cladding Temperature

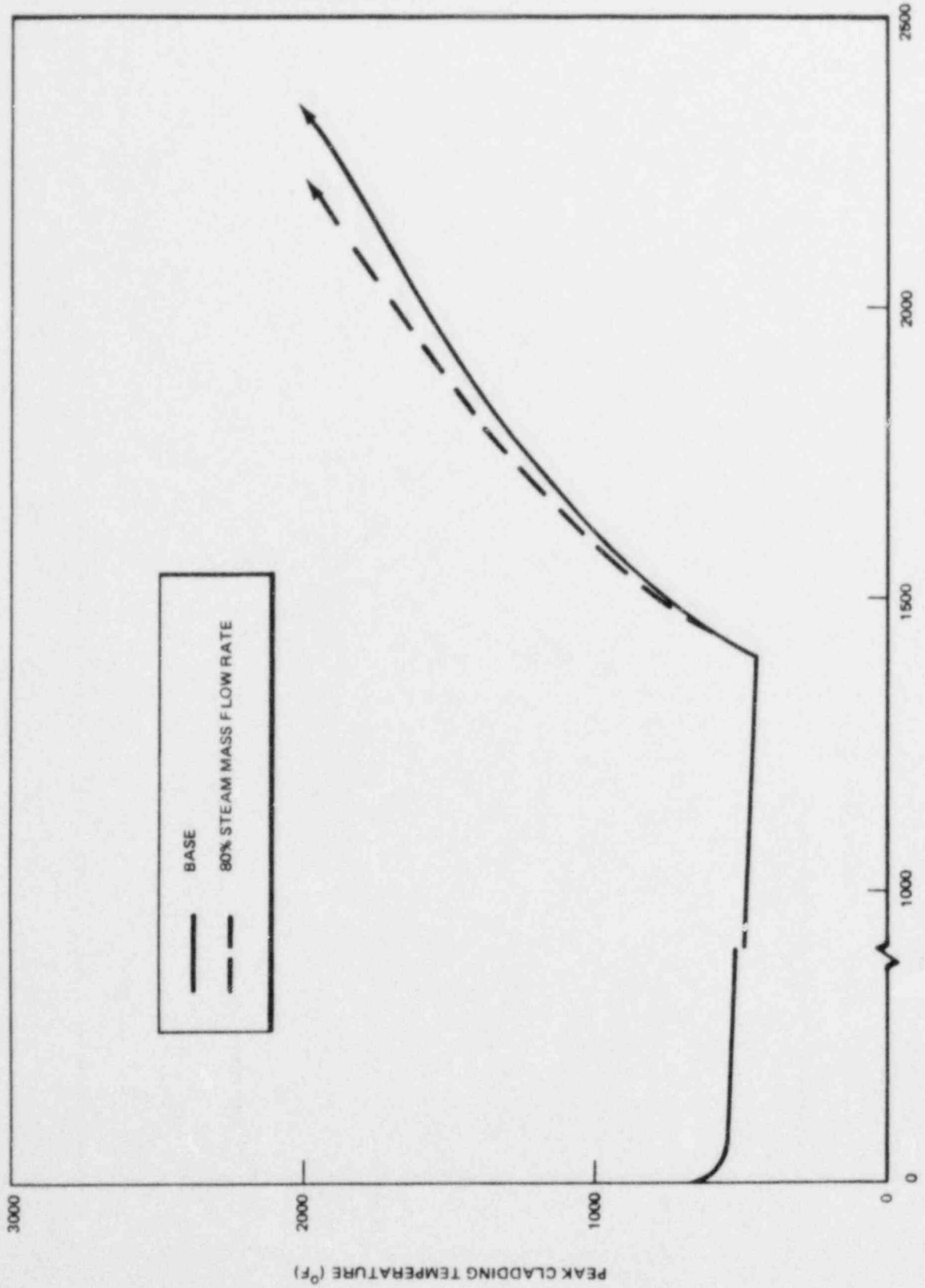

Figure 3.5.2.4-3. The Effect of Reduced Steam Mass Flow Rate on Peak Cladding Temperature

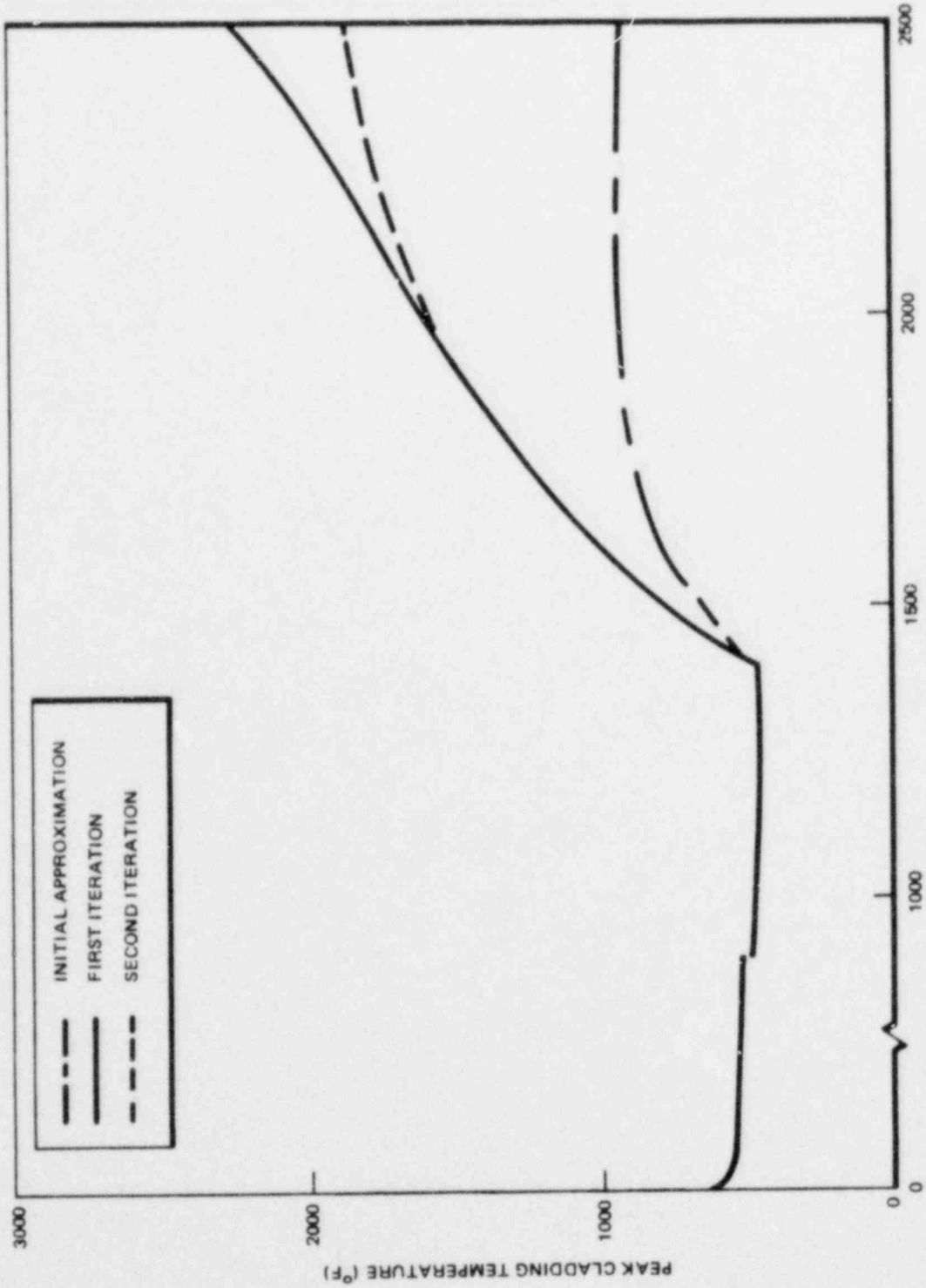

Figure 3.5.2.4-4. The Results of Peak Cladding Temperature