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JOSEPH A. TIERNAN
VICE PRESIDENT
NUCLEAR ENERGY

May 25, 1988

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
TMI Action Item II.D.1, Performance Testing of Relief and Safety Valves

REFERENCES: (a) Letter from Mr. J. A. Tiernan to NRC Document Control Desk, dated January 6, 1988, same subject

(b) Letter from Mr. S. A. McNeil to Mr. J. A. Tiernan, dated April 30, 1987, Request for Additional Information

Gentlemen:

In Reference (a), we answered 16 of the 18 questions you had regarding our implementation of TMI Action Item II.D.1.

One of the two remaining questions addresses the ability of the motor operators to provide adequate torque to close the PORV block valves (Question 2, Reference b). We are now testing those valves during the Unit 1 refueling outage. We will provide the results to you shortly after completion.

The second question asks us to demonstrate that PORVs and safety valves will function properly during a feedwater line break. The feedwater line break was analyzed to determine the resultant increase in pressurizer level. The analysis was performed using the CENTS code. The code has been benchmarked and a topical report has been submitted to the NRC staff.

The analysis demonstrates the RCS pressure remains below 2750 psia, the two-phase pressurizer level remains far below the safety valve inlet nozzles, and reactor vessel upper head subcooling is maintained.

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Attachment (1) lists the assumptions used, Attachment (2) shows the sequence of events for the limiting feedwater line break, and Attachment (3) provides plots of the RCS and pressurizer pressures, pressurizer two-phase level, and reactor vessel upper head subcooling.

Should you have any further questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

J. A. Kiernan

JAT/WPM/dlm

Attachments

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
S. A. McNeil, NRC
W. T. Russell, NRC
D. C. Trimble, NRC

Calvert Cliffs 1 and 2 Feedline
Break Analysis Assumptions

1.0 Break

1.1 Location

The break is assumed to occur between the steam generator and the last check valve, resulting in a non-isolable break.

1.2 Size

A spectrum of breaks up to and including a double-ended guillotine were evaluated. The double-ended guillotine was found to be limiting because smaller breaks will trip on low level in the intact steam generator before high pressurizer pressure trip occurred.

1.3 Discharge

For conservatism, the feed line is assumed to be at the elevation of the tube sheet. Thus, saturated liquid discharge occurs until the steam generator is nearly dry.

1.4 Main Feedwater

Main feedwater flow is terminated instantaneously at the time of the break.

2.0 Pressurizer

2.1 Flashing

The water in the pressurizer flashes when pressurizer pressure falls below saturation.

2.2 Pressurizer Safety Valves

See Table 1.

2.3 Safety Valve Inlet

The safety valve inlet is 0.35 feet above the upper level tap.

3.0 Initial Conditions

See Table 2.

4.0 Offsite Power

Offsite power is lost 3 seconds after turbine trip on reactor trip.

5.0 Non-Safety Grade Equipment

Only safety grade equipment is assumed to mitigate the transient. Non-safety grade equipment, including the PORVs and steam bypass controls, are assumed unavailable.

6.0 Reactor Trip

The low level trip in the affected SG (the one with the break) will be neglected. Thus, the reactor will trip on high pressurizer pressure or low level in the unaffected SG.

7.0 Operator Action

No operator action is credited.

8.0 RPS/ESFAS

RPS and ESFAS setpoints and response times are taken from the Technical Specifications.

Table 1

Pressurizer Safety Valve Parameters

Design Pressure, psia	2,500
Design Temperature ^{o}F	700
Fluid	Saturated Steam, 0.1% (wt) Boric Acid
Set Pressure:	
RC-200, psig	2485 + 1% uncertainty
RC-201, psig	2550 + 1% uncertainty
Capacity, at set pressure:	
RC-200, lbm/hr	296,065
RC-201, lbm/hr	303,765
Blowdown:	
RC-200, psig	1985*
RC-201, psig	2037*

*These blowdown pressures correspond to a 20% blowdown which bounds the blowdowns resulting from the recommended ring settings in the "Calvert Cliffs Nuclear Power Plant Units 1 and 2, Pressurizer Safety Valve Operability Report", CEN-248(B), May 1983

Table 2

Initial Conditions

Core Power	2757 MW
RCP Heat	10 MW
RCS Pressure	2343 psia
Pressurizer Pressure	2298 psia
SG Pressure	884 psia
Feedwater Temperature	440°F
Feedwater Pressure	907 psia
Core Flow	38,674 lbm/sec.
Core Inlet Temp	549°F
MTC	$+0.5 \times 10^{-4}$ $\Delta\rho/^{\circ}F$
SG Level Above Tube Sheet	35.3 ft
Pressurizer Level	70.3%

CALVERT CLIFF 1 AND 2 FEEDWATER LINE BREAK
SEQUENCE OF EVENTS

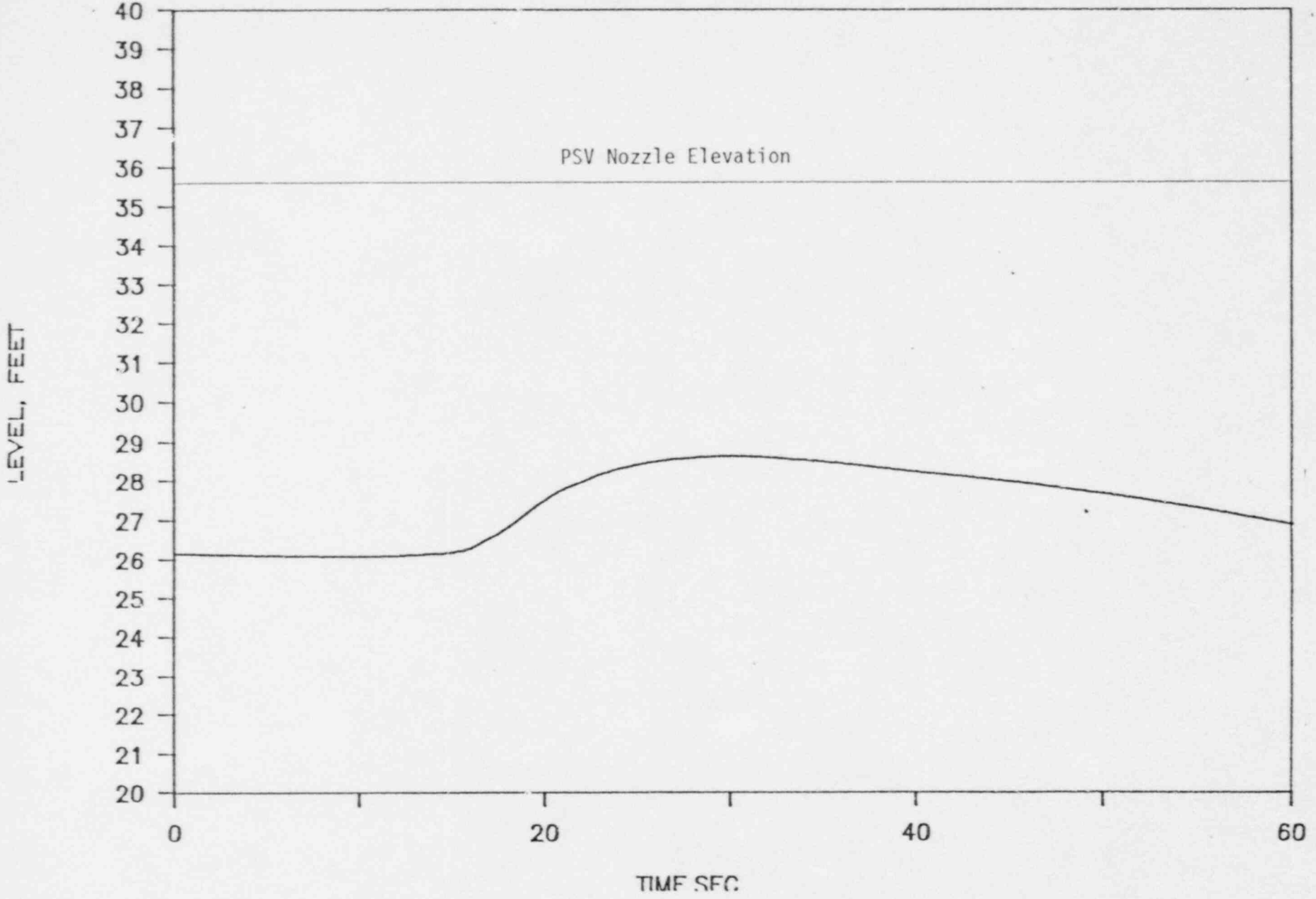
TIME	EVENT	VALUE
0.0	Double-ended break in main feedwater line of SG 1, ft^2	1.767
	Instantaneous loss of feedwater to both SGs	
17.0	Low level trip condition reached in SG 2, inches below top of feed ring	10.
17.2	High pressurizer pressure trip condition reached, psia	2400.
18.2	Electrical power to CEA holding coils is interupted	---
	Turbine-generator trips	---
18.6	SG 1 drys out	---
18.7	Control rods begin to fall into the reactor	---
18.8	Pressurizer safety valve RC-200 opens, psia	2525.
19.4	Pressurizer safety valve RC-201 opens, psia	2590.65
20.6	Maximum RCS pressure,psia	2655.3

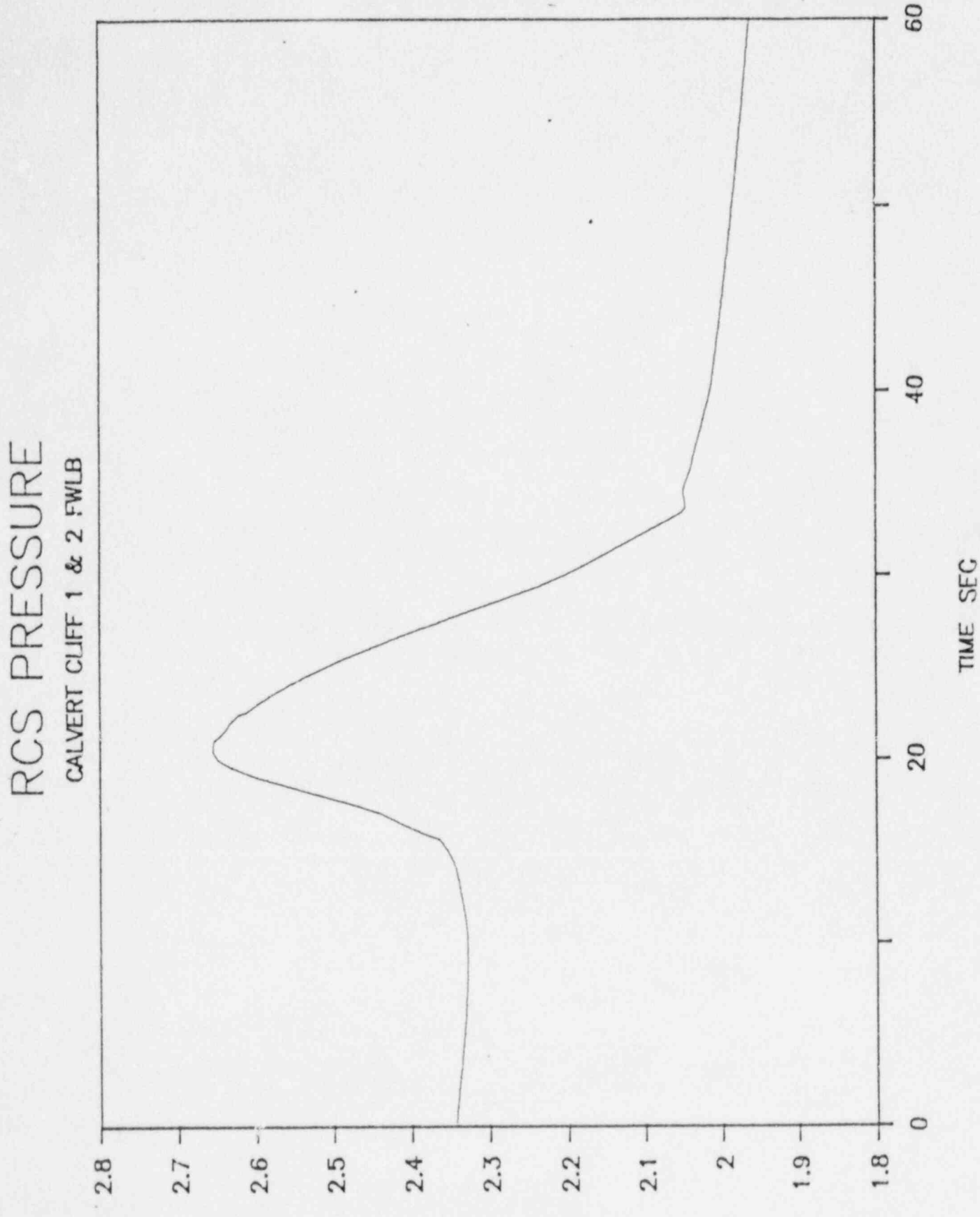
CALVERT CLIFF 1 AND 2 FEEDWATER LINE BREAK
SEQUENCE OF EVENTS (CONTINUED)

TIME	EVENT	VALUE
21.2	Loss of offsite power	---
	RCPs trip	---
	Letdown valves close	---
29.6	Maximum two phase level in the pressurizer, ft. below the PSVs' inlet nozzles	6.9
33.2	Pressurizer safety valve RC-201 closes, psia	2052.
40.2	Pressurizer safety valve RC-200 closes, psia	2000.

PRZ 2-PHASE LEVEL & PSV ELEVATION

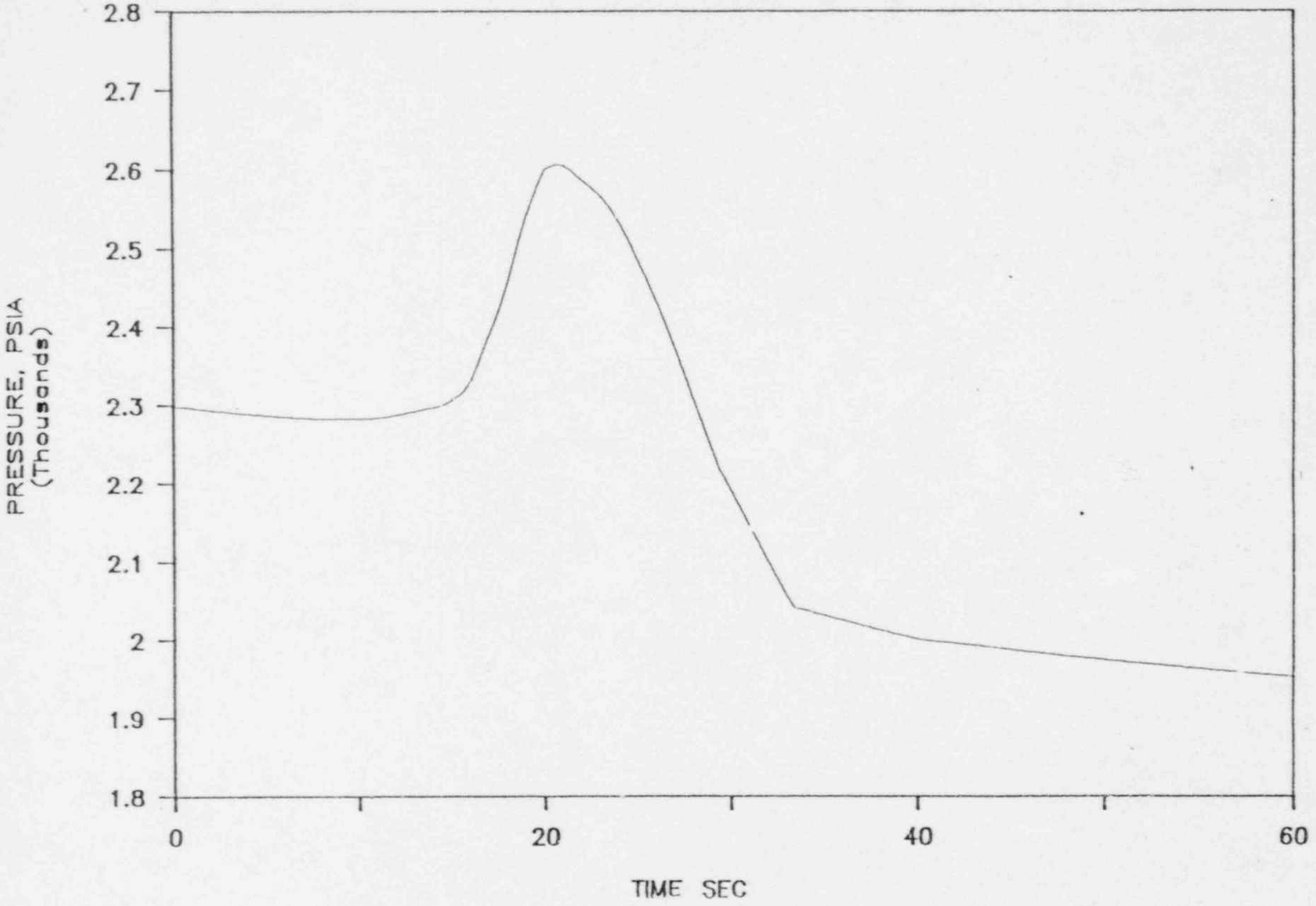
CALVERT CLIFF 1 & 2 FWLB




RCS PRESSURE
CALVERT CLIFF 1 & 2 FWLB
PRESSURE, PSIA
(Thousands)
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
0
20
40
60
TIME SEC

PRESSURIZER PRESSURE

CALVERT CLIFF 1 & 2 FWLB



RV UPPER HEAD SUBCOOLING

CALVERT CLIFF 1 & 2 FWLB