BALTIMORE GAS AND ELECTRIC

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ARTHUR E. LUNDVALL, JR.
VICE PRESIDENT
SUPPLY

June 7, 1982

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attn: Mr. R. A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing

Subject: Calvert Cliffs Nuclear Power Plant
Units Nos. 1 & 2; Dockets Nos. 50-317 & 50-318
Response to NUREG-0737 Items II.K.3.2 & II.K.3.17

Reference: (a) Letter from R. A. Clark to A. E. Lundvall, Jr. dated 1/20/82, same subject.
(b) Letter from A. E. Lundvall, Jr. to R. A. Clark dated 4/13.82, same subject.
(c) Letter from A. E. Lundvall, Jr. to D. G. Eisenhut dated 4/26/82, same subject.
(d) Letter from A. E. Lundvall, Jr. to R. A. Clark dated 5/13/82; TMI Action Plan Item II.K.3.17.

Gentlemen:

This letter supplements our previous submittals in response to Reference (a) (references (b), (c), (d)). All remaining information requested is provided as an attachment to this letter.

Please note that references (b) and (c) apply to Calvert Cliffs Units 1 and 2, Docket Nos. 50-317 & 50-318. If you have any further questions on this subject, please do not hesitate to contact us.

Very truly yours,

Arthur E. Lundvall Jr.

Attachment

cc: J. A. Biddison, Esquire
G. F. Trowbridge, Esquire
Messrs. D. H. Jaffe - NRC
R. E. Architzel - NRC

A044

ATTACHMENT

Response to Request for Additional Information
NUREG 0737 Item II.K.3.2

1. Q) Provide a justified estimate of how many multiple PORV openings per transient could be expected with each initiator event.

   A) Only one PORV opening is expected during a pressurization event in which the PORV's are actuated. As described in Section 3.9 of CEN-145, the coincidence of the PORV opening setpoint and the high pressure reactor trip at approximately 2400 psia on the Calvert Cliffs Nuclear Power Plant insures that the reactor is shutting down as the PORV's are opening, if not before. By the time the PORV's blow down to the reset pressure, the typical post-reactor trip pressure reduction is noted in the licensing and analyses of FSAR pressurization events. It should be noted that a more realistic best estimate analysis of the pressurization event, described in CEN-128, "Response of CE NSSS to Transients and Accidents," indicates that PORV's are not challenged when the pressure reduction due to systems such as pressurizer spray and turbine bypass are considered.

2. Q) The safety failure rate calculated in CEN-145 should have taken into account the effect, if any, of the additional challenges to the safety valve when the PORV is blocked intentionally. If this has not been done, recalculate the safety valve failure rate using the above criteria.

   A) As noted above, several plant systems besides PORV's operate to reduce plant pressure preventing safety valve actuation. These include the high pressure preventing safety valve actuation. These include the high pressure reactor trip, turbine trip on reactor trip, pressurizer spray, and turbine bypass. Analyses indicate that these systems are effective in preventing challenges to the primary safety valve and, therefore, no additional safety valve challenges would be expected due to the intentional blocking of PORV's.

3. Q) Submit an analysis of the probability of a small break LOCA caused by the stuck-open safety valve using the calculated safety valve failure rate.

   A) Attached.

LEGEND

Figure 1

Assumptions:

1. Given RCS pressure increase which does not challenge PORV, it will challenge SRV which is subject to premature operation.

2. Even though reactor trip may occur, if PORV is challenged and fails to open, the SRV will be challenged.

3. If PORV is challenged and operates (opens) successfully, no challenge to the SRV will occur (not true for ATWS events).

4. Multiple openings do not occur (see response to Question 1).

5. Only one SRV will open due to setpoint drift, while both PORV's open on a legitimate demand.

Data:

High RCS Pressure: 1 per year (IREP Table C.3.2 for CE Plants)

Challenge PORV's given that RCS High Pressure occurs: 0.1 (IREP Table C.3.2 for CE Plants)

Figure 2

Data:

Failure - Porv to Open, given signal - 3E-3/demand (IREP p.7-9, Table 7-1).

PORV Blocked Closed - because of infrequent operation and short detection intervals, no analysis performed. Estimate unavailability of 1E-3 per valve as conservative. Neither

Neither PORV commanded open - see Figure 3.

Figure 3

Data:

Failure - Relay to Energize: 1E-4 (IREP Table 7-1).

Failure - Contacts Fail Open: 3E-7 (IREP Table 7-1).

LEGEND
Continued

Figure 3 (continued)

Failure - Aux Logic (2/4): Estimate 1E-5 as conservative.

Failure - Loss of 125 VDC: Estimate from NUREG-0666 p. 37 (Probability of DC bus Failure) x (Mean Failure Exposure Time) x (1 + Demand Probability) < 1E-6

Minimum Cut Sets:

(Loss of 125 VDC at 1C06) + (RPS Aux Logic Failure) + (63X -1102 Coil Fails to Energize) + ((HS 1402 Contacts Fail Open) + (42 (Sch 1B1449) Relay Fails to Energize)) * ((HS 1404 Contacts Fail Open) + (42 (Sch 1BC449) Relay Fails to Energize))

Figure 4

Data:

Safety Valve (PWR) Fail [illegible] close: 3E-3 (Table 7.1, IREP) (given that it is open).

Figure 5

Data:

SRV Fails to Open: 3E-3/demand (IREP Table 7.1)

Figure 6

Assumptions:

*Both SRV's are open - since the setpoints for each are different, there is a high probability that only one will open during the transient, meaning that the other is already closed. For simplification, this is ignored.

Data:

SRV Fails to Reclose, given that it is open: 3E-3. (Table 7.1, IREP)

The value for BWR primary safety valve should approximate the code safety valve failure rate better than that given for PWR since "Fail to Reclose" is based on B&W PORV's.

LEGEND
Continued

Figure 7

Data:

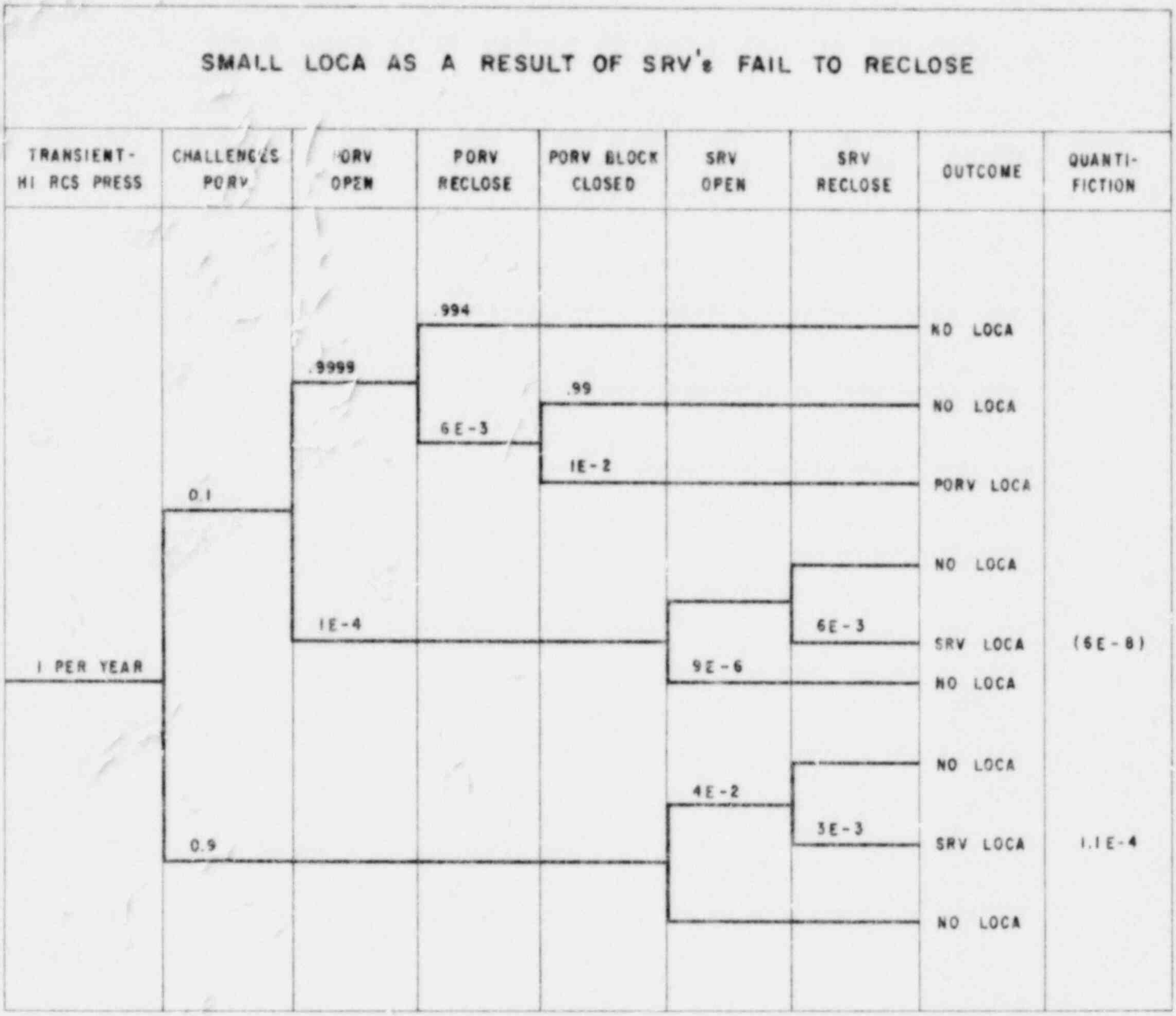
Failure - SRV Opens Prematurely: From Table 7.1, IREP (SRV Standby Failure Probability) x (Mean Failure Exposure Time) ≈ 2E-2

A more realistic assessment was performed by C-E. This value was found to be approximately one order of magnitude too high based on operating experience data.

Figure 8

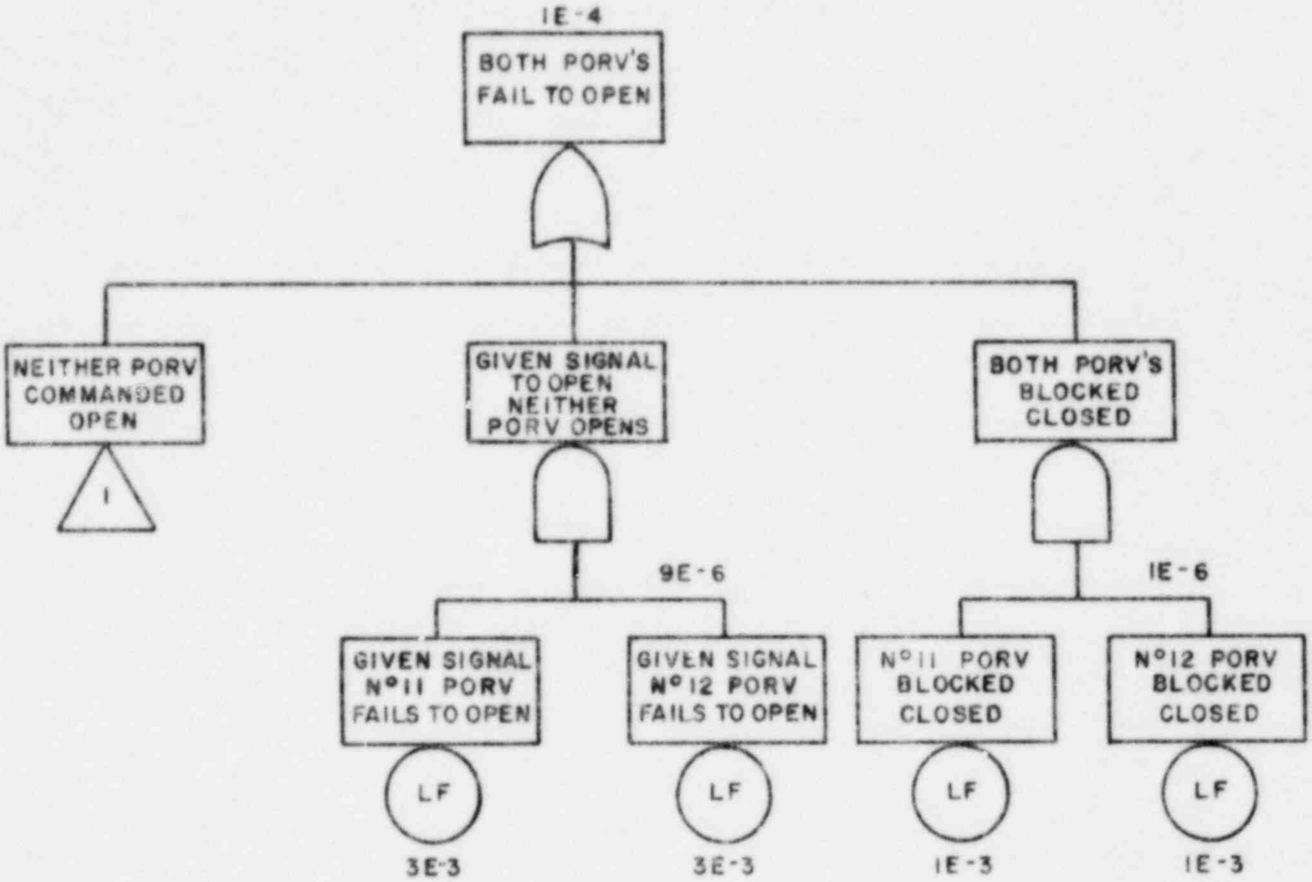
Data:

See Figure 4.



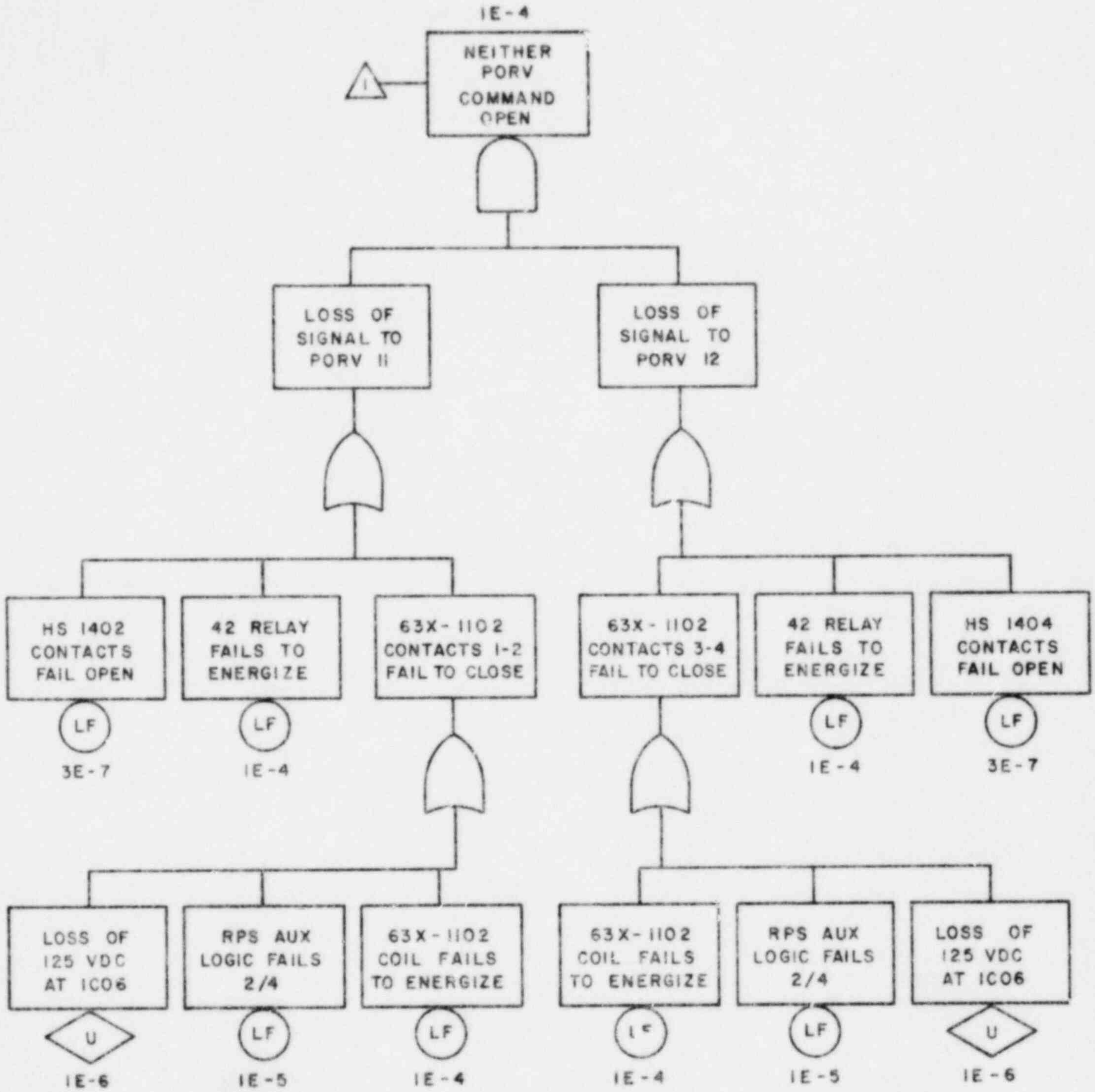
SMALL LOCA AS A RESULT OF SRV's FAIL TO RECLOSE
TRANSIENT-HI RCS PRESS
CHALLENGES PORV
PORV OPEN
PORV RECLOSE
PORV BLOCK CLOSED
SRV OPEN
SRV RECLOSE
OUTCOME
QUANTI-FICTION
.994
.9999
.99
6E-3
1E-2
0.1
1E-4
6E-3
9E-6
1 PER YEAR
4E-2
3E-3
0.9
NO LOCA
NO LOCA
PORV LOCA
NO LOCA
SRV LOCA
(6E-8)
NO LOCA
NO LOCA
SRV LOCA
1.1E-4
NO LOCA

FIGURE 1



1E-4
BOTH PORV'S FAIL TO OPEN
NEITHER PORV COMMANDED OPEN
1
GIVEN SIGNAL TO OPEN NEITHER PORV OPENS
BOTH PORV'S BLOCKED CLOSED
9E-6
1E-6
GIVEN SIGNAL N°11 PORV FAILS TO OPEN
GIVEN SIGNAL N°12 PORV FAILS TO OPEN
N°11 PORV BLOCKED CLOSED
N°12 PORV BLOCKED CLOSED
LF
LF
LF
LF
3E-3
3E-3
1E-3
1E-3

FIGURE 2



IE-4
NEITHER PORV COMMAND OPEN
1
LOSS OF SIGNAL TO PORV 11
LOSS OF SIGNAL TO PORV 12
HS 1402 CONTACTS FAIL OPEN
LF
3E-7
42 RELAY FAILS TO ENERGIZE
LF
IE-4
63X-1102 CONTACTS 1-2 FAIL TO CLOSE
63X-1102 CONTACTS 3-4 FAIL TO CLOSE
42 RELAY FAILS TO ENERGIZE
LF
IE-4
HS 1404 CONTACTS FAIL OPEN
LF
3E-7
LOSS OF 125 VDC AT 1C06
U
IE-6
RPS AUX LOGIC FAILS 2/4
LF
IE-5
63X-1102 COIL FAILS TO ENERGIZE
LF
IE-4
63X-1102 COIL FAILS TO ENERGIZE
IE-4
RPS AUX LOGIC FAILS 2/4
LF
IE-5
LOSS OF 125 VDC AT 1C06
U
IE-6

FIGURE 3

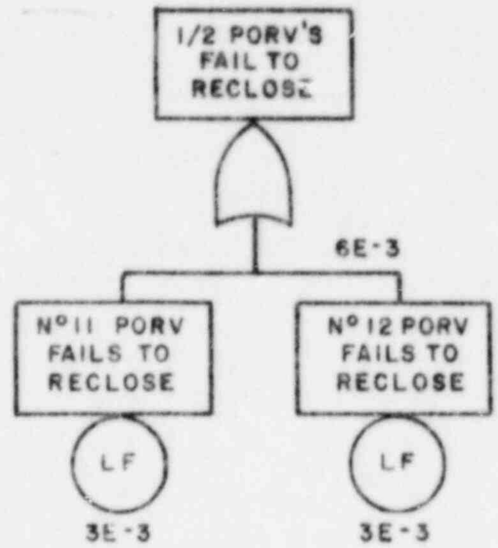


FIGURE 4

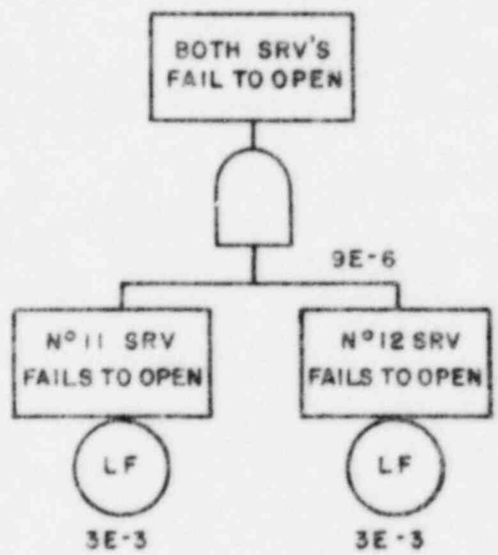


FIGURE 5

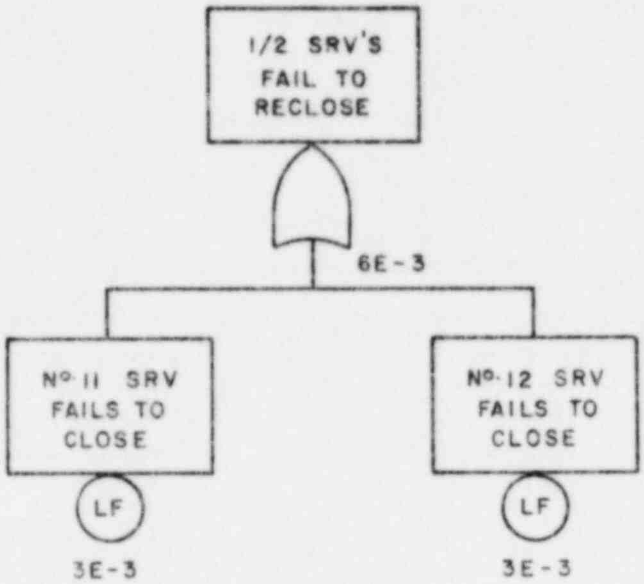


FIGURE 6

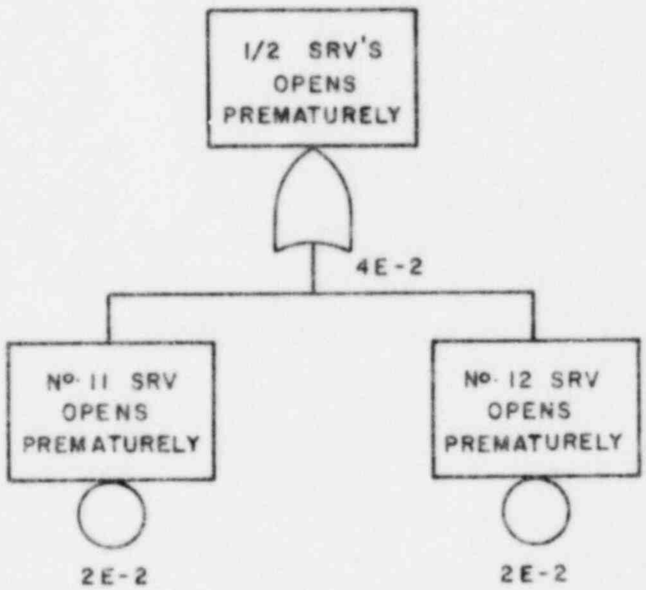


FIGURE 7

FIGURE 8