

# ASP Screening Analysis - REJECT

Accident Sequence Precursor Program – Office of Nuclear Regulatory Research

<b>Fermi, Unit 2</b>	Loss of Both Divisions of the Residual Heat Removal Low Pressure Coolant Injection Functions Due to 480-Volt Swing Bus Inoperable		
<b>Event Date:</b> 3/9/2015	<b>LER:</b> 341-2015-002	<b>IR:</b> 50-341/15-002	
<b>Plant Type:</b> General Electric Type 4 BWR with Wet, Mark 1 Containment			
<b>Plant Operating Mode (Reactor Power Level):</b> Mode 1 (100 Percent Reactor Power)			
<b>Analyst:</b> Keith Tetter	<b>Reviewer:</b> David Aird	<b>Contributors:</b> N/A	<b>BC Approved Date:</b> 5/3/2016

**Event Description.** On March 9, 2015, a monthly Technical Specifications surveillance test of the 480V electrical swing bus 72CF Automatic Throwover scheme was being conducted. At 3:21 pm, the alternate power supply breaker failed to close as expected after the normal power supply breaker was opened, resulting in a loss of power to Reactor Recirculation Pump discharge valves and both divisions of Residual Heat Removal (RHR) Low Pressure Coolant Injection (LPCI) injection valves. Consequently, the 72CF Automatic Throwover scheme was declared inoperable. This condition required the plant to enter Limiting Condition for Operation (LCO) 3.0.3. Reactor power was reduced from 100% to 81% in preparation for meeting the requirement to be in Mode 2 within 7 hours. Operations de-energized and tagged out the 72CF Automatic Throwover scheme to support troubleshooting and maintenance activities in accordance with plant procedures. Following this maintenance activity, post maintenance testing was completed satisfactorily for the contact at 10:11 pm and the plant exited LCO 3.0.3.

**Causes.** Troubleshooting found a permissive contact in the close circuit for the alternate power supply breaker to be in the incorrect state. Oxidation was found to be the likely cause of the degraded condition of the contact. To remove the oxidation from the contacts, the contacts were de-termed and cleaned.

**IR Summary/SDP Result.** The inspectors did not identify any performance deficiency associated with this event. The component was about 30 years old, had no history of failures, and no specific preventive maintenance activity existed for cleaning or replacing it. The LER is closed.

**Modeling Assumptions.** The Fermi Unit 2 SPAR model Revision 8.20, created in May 2014, was used for this analysis. Results of the risk analysis are included in Appendix A at the end of this report. The following modeling assumptions were used to perform a bounding analysis of this condition:

- A condition assessment was performed with a duration of 7 hours, which includes the total length of time the two RHR LPCI injection valves were inoperable.
- The basic event RHR-MOV-CF-INJEC (*RHR LPCI Injection Valves Common Cause Failure to Open*) was set to TRUE. This events fails both RHR LPCI injection valves.
- All other safety systems were available.

**SPAR Model Modifications.** No SPAR model modifications were needed to perform this analysis.

**Rejection Basis.** The bounding increase in core damage probability ( $\Delta\text{CDP}$ ) for this analysis is  $3.9 \times 10^{-10}$ . The ASP Program threshold is a  $\Delta\text{CDP}$  of  $1 \times 10^{-6}$ . Therefore, this event is not a precursor and is screened out of the ASP Program.

**Dominant Sequence.** The dominant accident sequence is Medium Loss of Coolant Accident (MLOCA) Sequence 13 ( $\Delta\text{CDP} = 8.8 \times 10^{-11}$ ) that contributes approximately 23% of the total internal events  $\Delta\text{CDP}$ . Figure 1 in Appendix B illustrates this sequence. The cut sets/sequences that contribute to the top 95% and/or at least 1% of the total internal events  $\Delta\text{CDP}$  are provided in Appendix A.

The events and important component failures in MLOCA Sequence 13 are:

- Reactor scram succeeds,
- Vapor suppression during MLOCA succeeds,
- High pressure coolant injection succeeds,
- Low pressure coolant injection fails, and
- Alternate low pressure injection fails.

## Appendix A: SAPHIRE 8 Worksheet

### Summary of Conditional Event Changes

Event	Description	Cond Value	Nominal Value
RHR-MOV-CF-INJEC	LPCI INJECTION VALVES FAIL FROM COMMON CAUSE TO OPEN	True	1.86E-5

### Event Tree Dominant Results

Only items contributing at least 1.0% to the total CCDP are displayed.

<u>EVENT TREE</u>	<u>CCDP</u>	<u>CDP</u>	<u>Δ CDP</u>	<u>DESCRIPTION</u>
MLOCA	1.53E-10	8.06E-12	1.45E-10	MEDIUM LOSS-OF-COOLANT ACCIDENT
TRANS	1.06E-9	9.83E-10	8.01E-11	GENERAL PLANT TRANSIENT
LOOP-I	5.02E-11	1.61E-11	3.41E-11	LOSS OF OFFSITE POWER TO DIVISION I
LOCHS	3.11E-9	3.08E-9	2.92E-11	LOSS OF CONDENSER HEAT SINK
LOOPGR	4.49E-10	4.29E-10	1.99E-11	LOSS OF OFFSITE POWER (GRID-RELATED)
LLOCA	2.30E-11	3.35E-12	1.97E-11	LARGE LOSS-OF-COOLANT ACCIDENT
FWRU	1.68E-10	1.56E-10	1.25E-11	FEEDWATER RAMPUP EVENT (PSA)
LOOPSC	2.50E-10	2.39E-10	1.04E-11	LOSS OF OFFSITE POWER (SWITCHYARD-CENTERED)
LOMFw	9.45E-11	8.75E-11	6.94E-12	LOSS OF MAIN FEEDWATER
LOACB301	1.14E-10	1.07E-10	6.19E-12	LOSS OF AC BUS 301
LODWC	1.23E-10	1.18E-10	4.73E-12	LOSS OF DRY WELL COOLING
LOOPWR	1.17E-10	1.12E-10	4.44E-12	LOSS OF OFFSITE POWER (WEATHER-RELATED)
<b>Total</b>	<b>6.72E-9</b>	<b>6.34E-9</b>	<b>3.86E-10</b>	

### Dominant Sequence Results

Only items contributing at least 1.0% to the total CCDP are displayed.

<u>EVENT TREE</u>	<u>SEQUENCE</u>	<u>CCDP</u>	<u>CDP</u>	<u>Δ CDP</u>	<u>DESCRIPTION</u>
MLOCA	13	8.82E-11	0.00E+0	8.82E-11	/RPS, /VSS, /HC1, LPI, VA
TRANS	62-4	4.44E-11	5.61E-13	4.38E-11	/RPS, P2, /LPI, SPC, CSS, /CVS, LI02
MLOCA	04	4.28E-11	5.41E-13	4.22E-11	/RPS, /VSS, /HC1, /LPI, SPC, CSS, /CVS, LI02
TRANS	62-7	3.71E-11	8.38E-13	3.63E-11	/RPS, P2, LPI
LOOP-I	20	2.51E-11	5.82E-14	2.50E-11	/RPS, /EPS01, /SRV, SFW, /HPI, SPC, /DEP, LPI, VA
LOCHS	06	3.01E-9	2.99E-9	1.44E-11	/RPS, /SRV, /SFW, RHR, PCSR, CVS, LI04
LLOCA	4	1.34E-11	4.53E-14	1.34E-11	/RPS, /VSS, /LPI, SPC, CSS, /CVS, LI02
MLOCA	26	1.17E-11	1.67E-14	1.17E-11	/RPS, /VSS, HC1, /DEP, LPI, VA
LOOPGR	18	9.51E-12	0.00E+0	9.51E-12	/RPS, /EPS, /SRV, SFW, /RCI, SPC, /DEP, SDC, CSS, /CVS, LI
LOCHS	61-4	8.06E-12	5.56E-14	8.01E-12	/RPS, P2, /LPI, SPC, CSS, /CVS, LI02
FWRU	62-4	7.02E-12	4.84E-14	6.97E-12	/RPS, P2, /LPI, SPC, CSS, /CVS, LI02
LOCHS	61-7	6.55E-12	1.51E-13	6.40E-12	/RPS, P2, LPI
LLOCA	7	9.02E-12	2.76E-12	6.27E-12	/RPS, /VSS, LPI
LOACB301	07	1.08E-10	1.03E-10	5.83E-12	/RPS, /EPS02, /SRV, /SFW, SPC, /DEP, SDC, CSS, CVS, LI04
FWRU	62-7	5.70E-12	1.32E-13	5.57E-12	/RPS, P2, LPI
LOOPGR	62	5.26E-12	4.18E-14	5.21E-12	/RPS, /EPS, /SRV, SFW, RCI, HCI, /DEP, LCS, LCI, VA
LOOPSC	18	5.10E-12	0.00E+0	5.10E-12	/RPS, /EPS, /SRV, SFW, /RCI, SPC, /DEP, SDC, CSS, /CVS, LI
LOOP-I	37-04	4.34E-12	3.00E-14	4.31E-12	/RPS, /EPS01, P2, /LCS, SPC, CSS, /CVS, LI02
LOMFw	61-4	3.98E-12	2.75E-14	3.95E-12	/RPS, P2, /LPI, SPC, CSS, /CVS, LI02
<b>Total</b>		<b>6.72E-9</b>	<b>6.34E-9</b>	<b>3.86E-10</b>	

### Referenced Fault Trees

Fault Tree	Description
CSS	CONTAINMENT SPRAY
CVS	CONTAINMENT VENTING

HC1	HPCI
HCI	HPCI
LCI	LOW PRESS COOLANT INJECTION
LCS	CORE SPRAY
LI	LATE INJECTION
LI02	LATE INJECTION
LI04	LATE INJECTION AFTER CONTAINMENT VENTING FAILURE
LPI	LOW PRESSURE INJECTION (CS or LPCI)
P2	TWO OR MORE STUCK OPEN SRVs
PCSR	POWER CONVERSION SYSTEM RECOVERY
RCI	RCIC
RHR	RESIDUAL HEAT REMOVAL
SDC	SHUTDOWN COOLING
SFW	STANDBY FEEDWATER
SPC	SUPPRESSION POOL COOLING
VA	ALTERNATE LOW PRESS INJECTION

### Cut Set Report - MLOCA 13

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	1.10E-7	100	Displaying 333 Cut Sets. (333 Original)
1	5.08E-9	4.60	IE-MLOCA,LCS-MDP-TM-TRNC,LCS-MDP-TM-TRND
2	5.08E-9	4.60	IE-MLOCA,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRND
3	5.08E-9	4.60	IE-MLOCA,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRNB
4	5.08E-9	4.60	IE-MLOCA,LCS-MDP-TM-TRNB,LCS-MDP-TM-TRNC
5	3.41E-9	3.09	IE-MLOCA,ECW-MDP-CF-START
6	1.86E-9	1.68	IE-MLOCA,LCS-MOV-CF-INJEC
7	1.80E-9	1.63	IE-MLOCA,ESW-MDP-FS-PMP2A,ESW-MDP-TM-PMP2B
8	1.80E-9	1.63	IE-MLOCA,ECW-MDP-FS-PUMPA,ESW-MDP-TM-PMP2B
9	1.80E-9	1.63	IE-MLOCA,ECW-MDP-FS-PUMPB,ESW-MDP-TM-PMP2A
10	1.80E-9	1.63	IE-MLOCA,ESW-MDP-FS-PMP2B,ESW-MDP-TM-PMP2A
11	1.32E-9	1.20	IE-MLOCA,ESW-MDP-TM-PMP2A,LCS-XHE-XR-TRND
12	1.32E-9	1.20	IE-MLOCA,ESW-MDP-TM-PMP2A,LCS-XHE-XR-TRNB
13	1.32E-9	1.20	IE-MLOCA,ECW-XHE-XR-PUMPA,ESW-MDP-TM-PMP2B
14	1.32E-9	1.20	IE-MLOCA,ESW-MDP-TM-PMP2A,ESW-XHE-XR-PMP2B
15	1.32E-9	1.20	IE-MLOCA,ECW-XHE-XR-PUMPB,ESW-MDP-TM-PMP2A
16	1.32E-9	1.20	IE-MLOCA,ESW-MDP-TM-PMP2B,LCS-XHE-XR-TRNC
17	1.32E-9	1.20	IE-MLOCA,ESW-MDP-TM-PMP2B,LCS-XHE-XR-TRNA
18	1.32E-9	1.20	IE-MLOCA,ESW-MDP-TM-PMP2B,ESW-XHE-XR-PMP2A
19	1.28E-9	1.16	IE-MLOCA,ESW-MDP-TM-PMP2A,LCS-MOV-CC-F005B
20	1.28E-9	1.16	IE-MLOCA,ESW-MDP-TM-PMP2B,LCS-MOV-CC-F005A
21	1.25E-9	1.14	IE-MLOCA,ESW-MDP-TM-PMP2A,LCS-MDP-FS-PUMPD
22	1.25E-9	1.14	IE-MLOCA,ESW-MDP-TM-PMP2A,LCS-MDP-FS-PUMPB
23	1.25E-9	1.14	IE-MLOCA,ESW-MDP-TM-PMP2B,LCS-MDP-FS-PUMPC
24	1.25E-9	1.14	IE-MLOCA,ESW-MDP-TM-PMP2B,LCS-MDP-FS-PUMPA
25	1.20E-9	1.09	IE-MLOCA,LCS-MDP-CF-START

### Cut Set Report - TRANS 62-4

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	5.56E-8	100	Displaying 24 Cut Sets. (24 Original)
1	5.19E-8	93.39	IE-TRANS,PPR-SRV-OO-2VLVS,RHR-XHE-XM-ERROR
2	1.93E-9	3.47	IE-TRANS,PPR-SRV-OO-2VLVS,RHR-MOV-CF-MINFL

**Cut Set Report - MLOCA 04**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	5.35E-8	100	Displaying 24 Cut Sets. (24 Original)
1	5.00E-8	93.40	IE-MLOCA,RHR-XHE-XM-ERROR
2	1.86E-9	3.47	IE-MLOCA,RHR-MOV-CF-MINFL

**Cut Set Report - TRANS 62-7**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	4.65E-8	100	Displaying 117 Cut Sets. (117 Original)
1	5.27E-9	11.34	IE-TRANS,LCS-MDP-TM-TRNB,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
2	5.27E-9	11.34	IE-TRANS,LCS-MDP-TM-TRNC,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
3	5.27E-9	11.34	IE-TRANS,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
4	5.27E-9	11.34	IE-TRANS,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS
5	1.93E-9	4.15	IE-TRANS,LCS-MOV-CF-INJEC,PPR-SRV-OO-2VLVS
6	1.25E-9	2.69	IE-TRANS,LCS-MDP-CF-START,PPR-SRV-OO-2VLVS
7	1.04E-9	2.23	IE-TRANS,PPR-SRV-OO-2VLVS,RHR-STR-CF-NLOCA
8	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRNB,LCS-XHE-XR-TRNA,PPR-SRV-OO-2VLVS
9	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRNB,LCS-XHE-XR-TRNC,PPR-SRV-OO-2VLVS
10	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRNC,LCS-XHE-XR-TRND,PPR-SRV-OO-2VLVS
11	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRNC,LCS-XHE-XR-TRNB,PPR-SRV-OO-2VLVS
12	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRND,LCS-XHE-XR-TRNA,PPR-SRV-OO-2VLVS
13	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRND,LCS-XHE-XR-TRNC,PPR-SRV-OO-2VLVS
14	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRNA,LCS-XHE-XR-TRND,PPR-SRV-OO-2VLVS
15	7.39E-10	1.59	IE-TRANS,LCS-MDP-TM-TRNA,LCS-XHE-XR-TRNB,PPR-SRV-OO-2VLVS
16	7.12E-10	1.53	IE-TRANS,LCS-MDP-TM-TRNB,LCS-MOV-CC-F005A,PPR-SRV-OO-2VLVS
17	7.12E-10	1.53	IE-TRANS,LCS-MDP-TM-TRNC,LCS-MOV-CC-F005B,PPR-SRV-OO-2VLVS
18	7.12E-10	1.53	IE-TRANS,LCS-MDP-TM-TRND,LCS-MOV-CC-F005A,PPR-SRV-OO-2VLVS
19	7.12E-10	1.53	IE-TRANS,LCS-MDP-TM-TRNA,LCS-MOV-CC-F005B,PPR-SRV-OO-2VLVS
20	7.02E-10	1.51	IE-TRANS,LCS-MDP-CF-RUN,PPR-SRV-OO-2VLVS
21	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPB,LCS-MDP-TM-TRNA,PPR-SRV-OO-2VLVS
22	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPB,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
23	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPC,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
24	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPC,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS
25	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPD,LCS-MDP-TM-TRNA,PPR-SRV-OO-2VLVS
26	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPD,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
27	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPA,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
28	7.00E-10	1.51	IE-TRANS,LCS-MDP-FS-PUMPA,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS

**Cut Set Report - LOOP-I 20**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	3.14E-8	100	Displaying 22 Cut Sets. (22 Original)
1	1.50E-8	47.82	IE-LOOP-I,RHR-STR-CF-NLOCA,SFW-XHE-XA-MISALIGN
2	7.50E-9	23.91	IE-LOOP-I,DCP-XHE-XM-2C1,RHR-STR-CF-NLOCA
3	5.34E-9	17.03	IE-LOOP-I,RHR-STR-CF-NLOCA,SFW-MDP-TM-PUMPB
4	7.50E-10	2.39	IE-LOOP-I,RHR-STR-CF-NLOCA,SFW-XHE-XM-INITIATE
5	7.50E-10	2.39	IE-LOOP-I,RHR-STR-CF-NLOCA,SFW-XHE-XR-PUMPB
6	7.22E-10	2.30	IE-LOOP-I,RHR-STR-CF-NLOCA,SFW-MOV-CC-F001
7	7.11E-10	2.27	IE-LOOP-I,RHR-STR-CF-NLOCA,SFW-MDP-FS-PUMPB

**Cut Set Report - LOCHS 06**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	3.76E-6	100	Displaying 128 Cut Sets. (128 Original)
1	3.54E-6	94.07	IE-LOCHS,CVS-XHE-XM-VENTXRHR,PCS-XHE-XL-LTLCBS,RHR-XHE-XM-ERROR
2	6.61E-8	1.76	IE-LOCHS,CVS-AOV-OO-F407,PCS-XHE-XL-LTLCBS,RHR-XHE-XM-ERROR
3	6.61E-8	1.76	IE-LOCHS,CVS-AOV-OO-F408,PCS-XHE-XL-LTLCBS,RHR-XHE-XM-ERROR
4	6.61E-8	1.76	IE-LOCHS,CVS-AOV-OO-F409,PCS-XHE-XL-LTLCBS,RHR-XHE-XM-ERROR

**Cut Set Report - LLOCA 4**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	1.68E-8	100	Displaying 33 Cut Sets. (33 Original)
1	1.00E-8	59.41	IE-LLOCA,RHR-XHE-XM-EECW
2	5.00E-9	29.70	IE-LLOCA,RHR-XHE-XM-ERROR
3	3.12E-10	1.85	IE-LLOCA,ESW-MDP-TM-PMP2A,RHR-HTX-TM-HTXB
4	3.12E-10	1.85	IE-LLOCA,ESW-MDP-TM-PMP2B,RHR-HTX-TM-HTXA
5	1.86E-10	1.10	IE-LLOCA,RHR-MOV-CF-MINFL

**Cut Set Report - MLOCA 26**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	1.46E-8	100	Displaying 141 Cut Sets. (141 Original)
1	1.00E-8	68.45	IE-MLOCA,RHR-STR-CF-MLOCA
2	2.01E-10	1.38	IE-MLOCA,HCI-TDP-FR-TRAIN,LCS-MDP-TM-TRNB,LCS-MDP-TM-TRNC
3	2.01E-10	1.38	IE-MLOCA,HCI-TDP-FR-TRAIN,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRNB
4	2.01E-10	1.38	IE-MLOCA,HCI-TDP-FR-TRAIN,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRND
5	2.01E-10	1.38	IE-MLOCA,HCI-TDP-FR-TRAIN,LCS-MDP-TM-TRNC,LCS-MDP-TM-TRND

**Cut Set Report - LOOPGR 18**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	1.19E-8	100	Displaying 114 Cut Sets. (114 Original)
1	1.23E-9	10.34	IE-LOOPGR,CRD-MDP-FC-BRUN,EPS-XHE-XM-CTG,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
2	1.23E-9	10.34	IE-LOOPGR,CRD-MDP-FC-ARUN,EPS-XHE-XM-CTG,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
3	1.23E-9	10.34	IE-LOOPGR,CRD-MDP-FC-BRUN,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
4	1.23E-9	10.34	IE-LOOPGR,CRD-MDP-FC-ARUN,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
5	4.45E-10	3.74	IE-LOOPGR,CRD-MDP-FC-BRUN,ECW-MDP-TM-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
6	4.45E-10	3.74	IE-LOOPGR,CRD-MDP-FC-ARUN,ECW-MDP-TM-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
7	4.45E-10	3.74	IE-LOOPGR,CRD-MDP-FC-BRUN,ECW-MDP-TM-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
8	4.45E-10	3.74	IE-LOOPGR,CRD-MDP-FC-ARUN,ECW-MDP-TM-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
9	2.74E-10	2.30	IE-LOOPGR,CRD-MDP-FC-ARUN,EPS-CTG-FR-11-1,EPS-DGN-FR-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
10	2.74E-10	2.30	IE-LOOPGR,CRD-MDP-FC-BRUN,EPS-CTG-FR-11-1,EPS-DGN-FR-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
11	1.38E-10	1.16	IE-LOOPGR,CRD-MDP-FC-ARUN,EPS-CTG-FR-11-1,EPS-DGN-TM-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR

#	PROB/FREQ	TOTAL%	CUT SET
12	1.38E-10	1.16	IE-LOOPGR,CRD-MDP-FC-BRUN,EPS-CTG-FR-11-1,EPS-DGN-TM-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
13	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-BRUN,ECW-MDP-FS-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
14	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-ARUN,ECW-MDP-FS-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
15	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-BRUN,EPS-XHE-XM-CTG,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR
16	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-ARUN,EPS-XHE-XM-CTG,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR
17	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-BRUN,ECW-MDP-FS-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
18	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-ARUN,ECW-MDP-FS-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
19	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-BRUN,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
20	1.27E-10	1.06	IE-LOOPGR,CRD-MDP-FC-ARUN,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN

### Cut Set Report - LOCHS 61-4

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	1.01E-8	100	Displaying 10 Cut Sets. (10 Original)
1	9.46E-9	93.79	IE-LOCHS,PPR-SRV-OO-2VLVS,RHR-XHE-XM-ERROR
2	3.52E-10	3.49	IE-LOCHS,PPR-SRV-OO-2VLVS,RHR-MOV-CF-MINFL

### Cut Set Report - FWRU 62-4

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	8.78E-9	100	Displaying 10 Cut Sets. (10 Original)
1	8.24E-9	93.79	IE-FWRU,PPR-SRV-OO-2VLVS,RHR-XHE-XM-ERROR
2	3.06E-10	3.49	IE-FWRU,PPR-SRV-OO-2VLVS,RHR-MOV-CF-MINFL

### Cut Set Report - LOCHS 61-7

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	8.20E-9	100	Displaying 61 Cut Sets. (61 Original)
1	9.61E-10	11.72	IE-LOCHS,LCS-MDP-TM-TRNB,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
2	9.61E-10	11.72	IE-LOCHS,LCS-MDP-TM-TRNC,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
3	9.61E-10	11.72	IE-LOCHS,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
4	9.61E-10	11.72	IE-LOCHS,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS
5	3.52E-10	4.29	IE-LOCHS,LCS-MOV-CF-INJEC,PPR-SRV-OO-2VLVS
6	2.28E-10	2.78	IE-LOCHS,LCS-MDP-CF-START,PPR-SRV-OO-2VLVS
7	1.89E-10	2.31	IE-LOCHS,PPR-SRV-OO-2VLVS,RHR-STR-CF-NLOCA
8	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRNB,LCS-XHE-XR-TRNA,PPR-SRV-OO-2VLVS
9	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRNB,LCS-XHE-XR-TRNC,PPR-SRV-OO-2VLVS
10	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRNC,LCS-XHE-XR-TRND,PPR-SRV-OO-2VLVS
11	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRNC,LCS-XHE-XR-TRNB,PPR-SRV-OO-2VLVS
12	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRND,LCS-XHE-XR-TRNA,PPR-SRV-OO-2VLVS
13	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRND,LCS-XHE-XR-TRNC,PPR-SRV-OO-2VLVS
14	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRNA,LCS-XHE-XR-TRND,PPR-SRV-OO-2VLVS
15	1.35E-10	1.65	IE-LOCHS,LCS-MDP-TM-TRNA,LCS-XHE-XR-TRNB,PPR-SRV-OO-2VLVS
16	1.30E-10	1.58	IE-LOCHS,LCS-MDP-TM-TRNB,LCS-MOV-CC-F005A,PPR-SRV-OO-2VLVS
17	1.30E-10	1.58	IE-LOCHS,LCS-MDP-TM-TRNC,LCS-MOV-CC-F005B,PPR-SRV-OO-2VLVS

#	PROB/FREQ	TOTAL%	CUT SET
18	1.30E-10	1.58	IE-LOCHS,LCS-MDP-TM-TRND,LCS-MOV-CC-F005A,PPR-SRV-OO-2VLVS
19	1.30E-10	1.58	IE-LOCHS,LCS-MDP-TM-TRNA,LCS-MOV-CC-F005B,PPR-SRV-OO-2VLVS
20	1.28E-10	1.56	IE-LOCHS,LCS-MDP-CF-RUN,PPR-SRV-OO-2VLVS
21	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPB,LCS-MDP-TM-TRNA,PPR-SRV-OO-2VLVS
22	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPB,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
23	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPC,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
24	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPC,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS
25	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPD,LCS-MDP-TM-TRNA,PPR-SRV-OO-2VLVS
26	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPD,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
27	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPA,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
28	1.28E-10	1.56	IE-LOCHS,LCS-MDP-FS-PUMPA,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS

### Cut Set Report - LLOCA 7

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	1.13E-8	100	Displaying 156 Cut Sets. (156 Original)
1	1.00E-9	8.86	IE-LLOCA,RHR-STR-CF-LLOCA
2	5.08E-10	4.50	IE-LLOCA,LCS-MDP-TM-TRNB,LCS-MDP-TM-TRNC
3	5.08E-10	4.50	IE-LLOCA,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRNB
4	5.08E-10	4.50	IE-LLOCA,LCS-MDP-TM-TRNC,LCS-MDP-TM-TRND
5	5.08E-10	4.50	IE-LLOCA,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRND
6	3.40E-10	3.02	IE-LLOCA,ECW-MDP-CF-START
7	1.86E-10	1.65	IE-LLOCA,LCS-MOV-CF-INJEC
8	1.80E-10	1.60	IE-LLOCA,ECW-MDP-FS-PUMPA,ESW-MDP-TM-PMP2B
9	1.80E-10	1.60	IE-LLOCA,ESW-MDP-FS-PMP2A,ESW-MDP-TM-PMP2B
10	1.80E-10	1.60	IE-LLOCA,ECW-MDP-FS-PUMPB,ESW-MDP-TM-PMP2A
11	1.80E-10	1.60	IE-LLOCA,ESW-MDP-FS-PMP2B,ESW-MDP-TM-PMP2A
12	1.32E-10	1.17	IE-LLOCA,ESW-MDP-TM-PMP2A,ESW-XHE-XR-PMP2B
13	1.32E-10	1.17	IE-LLOCA,ECW-XHE-XR-PUMPA,ESW-MDP-TM-PMP2B
14	1.32E-10	1.17	IE-LLOCA,ESW-MDP-TM-PMP2A,LCS-XHE-XR-TRNB
15	1.32E-10	1.17	IE-LLOCA,ESW-MDP-TM-PMP2A,LCS-XHE-XR-TRND
16	1.32E-10	1.17	IE-LLOCA,ECW-XHE-XR-PUMPB,ESW-MDP-TM-PMP2A
17	1.32E-10	1.17	IE-LLOCA,ESW-MDP-TM-PMP2B,ESW-XHE-XR-PMP2A
18	1.32E-10	1.17	IE-LLOCA,ESW-MDP-TM-PMP2B,LCS-XHE-XR-TRNA
19	1.32E-10	1.17	IE-LLOCA,ESW-MDP-TM-PMP2B,LCS-XHE-XR-TRNC
20	1.28E-10	1.13	IE-LLOCA,ESW-MDP-TM-PMP2A,LCS-MOV-CC-F005B
21	1.28E-10	1.13	IE-LLOCA,ESW-MDP-TM-PMP2B,LCS-MOV-CC-F005A
22	1.25E-10	1.11	IE-LLOCA,ESW-MDP-TM-PMP2A,LCS-MDP-FS-PUMPB
23	1.25E-10	1.11	IE-LLOCA,ESW-MDP-TM-PMP2A,LCS-MDP-FS-PUMPD
24	1.25E-10	1.11	IE-LLOCA,ESW-MDP-TM-PMP2B,LCS-MDP-FS-PUMPA
25	1.25E-10	1.11	IE-LLOCA,ESW-MDP-TM-PMP2B,LCS-MDP-FS-PUMPC
26	1.20E-10	1.07	IE-LLOCA,LCS-MDP-CF-START

### Cut Set Report - LOACB301 07

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	1.36E-7	100	Displaying 284 Cut Sets. (284 Original)
1	1.08E-7	79.57	IE-LOACB301,CVS-XHE-XM-VENTXRHR,RHR-XHE-XM-ERROR
2	2.02E-9	1.49	IE-LOACB301,ACP-XHE-XM-64T65T,EPS-DGN-FR-DG13,EPS-DGN-FR-DG14,RHR-HTX-TM-HTXA
3	2.02E-9	1.49	IE-LOACB301,CVS-AOV-OO-F407,RHR-XHE-XM-ERROR
4	2.02E-9	1.49	IE-LOACB301,CVS-AOV-OO-F408,RHR-XHE-XM-ERROR
5	2.02E-9	1.49	IE-LOACB301,CVS-AOV-OO-F409,RHR-XHE-XM-ERROR



**Cut Set Report - FWRU 62-7**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	7.14E-9	100	Displaying 61 Cut Sets. (61 Original)
1	8.36E-10	11.72	IE-FWRU,LCS-MDP-TM-TRNB,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
2	8.36E-10	11.72	IE-FWRU,LCS-MDP-TM-TRNC,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
3	8.36E-10	11.72	IE-FWRU,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS
4	8.36E-10	11.72	IE-FWRU,LCS-MDP-TM-TRNA,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
5	3.06E-10	4.29	IE-FWRU,LCS-MOV-CF-INJEC,PPR-SRV-OO-2VLVS
6	1.98E-10	2.78	IE-FWRU,LCS-MDP-CF-START,PPR-SRV-OO-2VLVS
7	1.65E-10	2.31	IE-FWRU,PPR-SRV-OO-2VLVS,RHR-STR-CF-NLOCA
8	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRNB,LCS-XHE-XR-TRNC,PPR-SRV-OO-2VLVS
9	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRNB,LCS-XHE-XR-TRNA,PPR-SRV-OO-2VLVS
10	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRNC,LCS-XHE-XR-TRNB,PPR-SRV-OO-2VLVS
11	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRNC,LCS-XHE-XR-TRND,PPR-SRV-OO-2VLVS
12	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRND,LCS-XHE-XR-TRNC,PPR-SRV-OO-2VLVS
13	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRND,LCS-XHE-XR-TRNA,PPR-SRV-OO-2VLVS
14	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRNA,LCS-XHE-XR-TRNB,PPR-SRV-OO-2VLVS
15	1.17E-10	1.65	IE-FWRU,LCS-MDP-TM-TRNA,LCS-XHE-XR-TRND,PPR-SRV-OO-2VLVS
16	1.13E-10	1.58	IE-FWRU,LCS-MDP-TM-TRNB,LCS-MOV-CC-F005A,PPR-SRV-OO-2VLVS
17	1.13E-10	1.58	IE-FWRU,LCS-MDP-TM-TRNC,LCS-MOV-CC-F005B,PPR-SRV-OO-2VLVS
18	1.13E-10	1.58	IE-FWRU,LCS-MDP-TM-TRND,LCS-MOV-CC-F005A,PPR-SRV-OO-2VLVS
19	1.13E-10	1.58	IE-FWRU,LCS-MDP-TM-TRNA,LCS-MOV-CC-F005B,PPR-SRV-OO-2VLVS
20	1.11E-10	1.56	IE-FWRU,LCS-MDP-CF-RUN,PPR-SRV-OO-2VLVS
21	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPB,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
22	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPB,LCS-MDP-TM-TRNA,PPR-SRV-OO-2VLVS
23	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPC,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS
24	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPC,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS
25	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPD,LCS-MDP-TM-TRNC,PPR-SRV-OO-2VLVS
26	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPD,LCS-MDP-TM-TRNA,PPR-SRV-OO-2VLVS
27	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPA,LCS-MDP-TM-TRNB,PPR-SRV-OO-2VLVS
28	1.11E-10	1.56	IE-FWRU,LCS-MDP-FS-PUMPA,LCS-MDP-TM-TRND,PPR-SRV-OO-2VLVS

**Cut Set Report - LOOPGR 62**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	6.58E-9	100	Displaying 56 Cut Sets. (56 Original)
1	3.72E-9	56.55	IE-LOOPGR,EPS-XHE-XM-CTG,RHR-STR-CF-NLOCA
2	8.29E-10	12.60	IE-LOOPGR,EPS-CTG-FR-11-1,EPS-DGN-FR-BLKSTRT,RHR-STR-CF-NLOCA
3	4.18E-10	6.35	IE-LOOPGR,EPS-CTG-FR-11-1,EPS-DGN-TM-BLKSTRT,RHR-STR-CF-NLOCA
4	2.65E-10	4.02	IE-LOOPGR,EPS-CTG-TM-11-1,EPS-DGN-FR-BLKSTRT,RHR-STR-CF-NLOCA
5	1.33E-10	2.03	IE-LOOPGR,EPS-CTG-TM-11-1,EPS-DGN-TM-BLKSTRT,RHR-STR-CF-NLOCA
6	1.12E-10	1.70	IE-LOOPGR,EPS-CTG-FR-11-1,EPS-CTG-FR-11-2,EPS-CTG-FR-11-3,EPS-CTG-FR-11-4,RHR-STR-CF-NLOCA
7	8.42E-11	1.28	IE-LOOPGR,EPS-CTG-FR-11-1,EPS-DGN-FS-BLKSTRT,RHR-STR-CF-NLOCA
8	8.26E-11	1.26	IE-LOOPGR,EPS-CTG-FS-11-1,EPS-DGN-FR-BLKSTRT,RHR-STR-CF-NLOCA

**Cut Set Report - LOOPSC 18**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	6.38E-9	100	Displaying 76 Cut Sets. (76 Original)
1	6.88E-10	10.80	IE-LOOPSC,CRD-MDP-FC-BRUN,EPS-XHE-XM-CTG,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
2	6.88E-10	10.80	IE-LOOPSC,CRD-MDP-FC-ARUN,EPS-XHE-XM-CTG,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
3	6.88E-10	10.80	IE-LOOPSC,CRD-MDP-FC-BRUN,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
4	6.88E-10	10.80	IE-LOOPSC,CRD-MDP-FC-ARUN,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
5	2.49E-10	3.91	IE-LOOPSC,CRD-MDP-FC-BRUN,ECW-MDP-TM-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
6	2.49E-10	3.91	IE-LOOPSC,CRD-MDP-FC-ARUN,ECW-MDP-TM-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
7	2.49E-10	3.91	IE-LOOPSC,CRD-MDP-FC-BRUN,ECW-MDP-TM-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
8	2.49E-10	3.91	IE-LOOPSC,CRD-MDP-FC-ARUN,ECW-MDP-TM-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
9	1.53E-10	2.40	IE-LOOPSC,CRD-MDP-FC-ARUN,EPS-CTG-FR-11-1,EPS-DGN-FR-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
10	1.53E-10	2.40	IE-LOOPSC,CRD-MDP-FC-BRUN,EPS-CTG-FR-11-1,EPS-DGN-FR-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
11	7.73E-11	1.21	IE-LOOPSC,CRD-MDP-FC-ARUN,EPS-CTG-FR-11-1,EPS-DGN-TM-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
12	7.73E-11	1.21	IE-LOOPSC,CRD-MDP-FC-BRUN,EPS-CTG-FR-11-1,EPS-DGN-TM-BLKSTRT,ESW-MDP-TM-PMP2B,RHR-XHE-XM-ERROR
13	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-BRUN,ECW-MDP-FS-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
14	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-ARUN,ECW-MDP-FS-PUMPB,EPS-XHE-XM-CTG,RHR-XHE-XM-ERROR
15	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-BRUN,ECW-MDP-FS-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
16	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-ARUN,ECW-MDP-FS-PUMPB,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
17	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-BRUN,EPS-XHE-XM-CTG,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR
18	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-ARUN,EPS-XHE-XM-CTG,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR
19	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-BRUN,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN
20	7.08E-11	1.11	IE-LOOPSC,CRD-MDP-FC-ARUN,ESW-MDP-FS-PMP2B,RHR-XHE-XM-ERROR,SFW-XHE-XA-MISALIGN

**Cut Set Report - LOOP-I 37-04**

Only items contributing at least 1% to the total are displayed.

#	PROB/FREQ	TOTAL%	CUT SET
	5.43E-9	100	Displaying 8 Cut Sets. (8 Original)
1	5.11E-9	94.10	IE-LOOP-I,PPR-SRV-OO-2VLVS,RHR-XHE-XM-ERROR
2	1.90E-10	3.50	IE-LOOP-I,PPR-SRV-OO-2VLVS,RHR-MOV-CF-MINFL

**Cut Set Report - LOMFW 61-4**

Only items contributing at least 1% to the total are displayed.

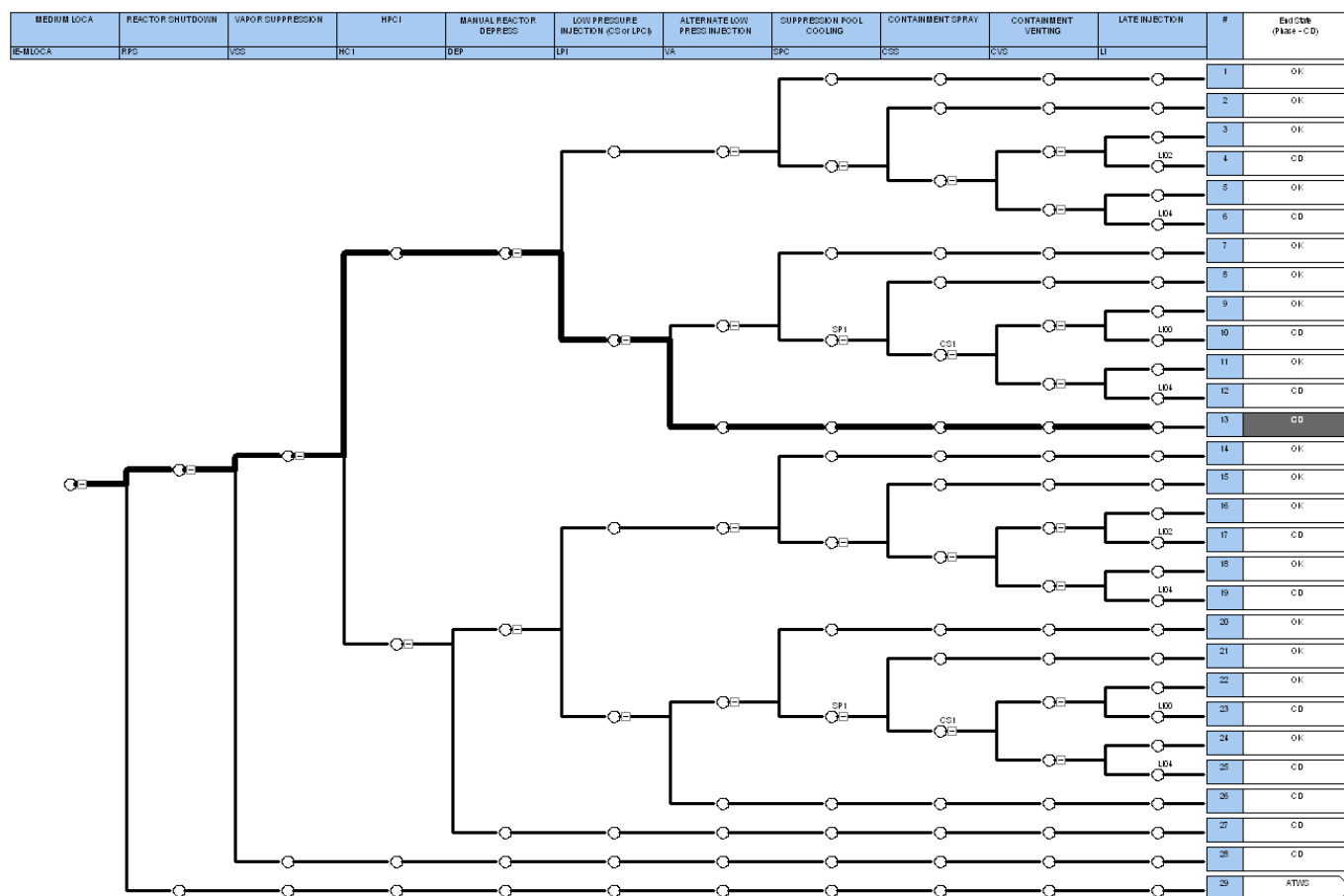
#	PROB/FREQ	TOTAL%	CUT SET
	4.98E-9	100	Displaying 7 Cut Sets. (7 Original)
1	4.69E-9	94.28	IE-LOMFW,PPR-SRV-OO-2VLVS,RHR-XHE-XM-ERROR
2	1.74E-10	3.51	IE-LOMFW,PPR-SRV-OO-2VLVS,RHR-MOV-CF-MINFL

## Referenced Events

Event	Description	Probability
ACP-XHE-XM-64T65T	OPERATOR FAILS TO ALIGN 4160V MAINT CROSS TIE 65T/64T	2.50E-1
CRD-MDP-FC-ARUN	CRD PUMP A IS RUNNING, PUMP B IS IN STANDBY	5.00E-1
CRD-MDP-FC-BRUN	CRD PUMP B IS RUNNING, PUMP A IS IN STANDBY	5.00E-1
CVS-AOV-OO-F407	REACTOR BUILDING HVAC ISOLATION FAILS	9.51E-4
CVS-AOV-OO-F408	SBGT ISOLATION FAILS	9.51E-4
CVS-AOV-OO-F409	SBGT ISOLATION FAILS	9.51E-4
CVS-XHE-XM-VENTXRHR	Operator fails to vent containment given operator fail to establish RHR	5.09E-2
DCP-XHE-XM-2C1	OPERATOR FAILS TO ALIGN SPARE CHARGER TO REPLACE 2C-1	1.00E-2
ECW-MDP-CF-START	DIVISION I, II PUMPS FAIL FROM COMMON CAUSE TO START	3.41E-5
ECW-MDP-FS-PUMPA	EECW PUMP A FAILS TO START	1.36E-3
ECW-MDP-FS-PUMPB	EECW PUMP B FAILS TO START	1.36E-3
ECW-MDP-TM-PUMPB	EECW PUMP B IS IN TEST OR MAINTENANCE	4.79E-3
ECW-XHE-XR-PUMPA	OPERATOR FAILS TO RESTORE PUMP A AFTER TEST OR MAINT	1.00E-3
ECW-XHE-XR-PUMPB	OPERATOR FAILS TO RESTORE PUMP B AFTER TEST OR MAINT	1.00E-3
EPS-CTG-FR-11-1	CTG 11-1 FAILS TO RUN	1.57E-1
EPS-CTG-FR-11-2	CTG 11-2 FAILS TO RUN	1.57E-1
EPS-CTG-FR-11-3	CTG 11-3 FAILS TO RUN	1.57E-1
EPS-CTG-FR-11-4	CTG 11-4 FAILS TO RUN	1.57E-1
EPS-CTG-FS-11-1	CTG 11-1 FAILS TO START	1.56E-2
EPS-CTG-TM-11-1	CTG 11-1 OUT FOR TEST & MAINTENANCE	5.00E-2
EPS-DGN-FR-BLKSTRT	BLACK START DIESEL GENERATOR FOR CTGs 11-2 3 4 FAILS TO RUN	2.85E-2
EPS-DGN-FR-DG13	DIESEL GENERATOR 13 FAILS TO RUN	2.85E-2
EPS-DGN-FR-DG14	DIESEL GENERATOR 14 FAILS TO RUN	2.85E-2
EPS-DGN-FS-BLKSTRT	BLACK START DIESEL GENERATOR FOR CTGs 11-2 3 4 FAILS TO START	2.89E-3
EPS-DGN-TM-BLKSTRT	BLACK START DG FOR CTGs 11-2 3 4 IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.43E-2
EPS-XHE-XM-CTG	OPERATOR FAILS TO START CTG	2.00E-2
ESW-MDP-FS-PMP2A	EESW PUMP 2A FAILS TO START	1.36E-3
ESW-MDP-FS-PMP2B	EESW PUMP 2B FAILS TO START	1.36E-3
ESW-MDP-TM-PMP2A	EESW PUMP 2A IS IN TEST OR MAINTENANCE	1.32E-2
ESW-MDP-TM-PMP2B	EESW PUMP 2B IS IN TEST OR MAINTENANCE	1.32E-2
ESW-XHE-XR-PMP2A	OPERATOR FAILS TO RESTORE PUMP 2A AFTER TEST OR MAINT	1.00E-3
ESW-XHE-XR-PMP2B	OPERATOR FAILS TO RESTORE PUMP 2B AFTER TEST OR MAINT	1.00E-3
HCI-TDP-FR-TRAIN	HPCI PUMP TRAIN FAILS TO RUN GIVEN IT STARTED	3.97E-2
IE-FWRU	FEEDWATER RAMPUP INITIATING EVENT	1.21E-1
IE-LLOCA	LARGE LOCA	1.00E-5
IE-LOACB301	BUS 301 INITIATING EVENT (PSA)	4.24E-3
IE-LOCHS	LOSS OF CONDENSER HEAT SINK	1.39E-1
IE-LOMFW	LOSS OF FEEDWATER	6.89E-2
IE-LOOPGR	LOSS OF OFFSITE POWER INITIATOR (GRID-RELATED)	1.86E-2
IE-LOOP-I	LOSS OF OFFSITE POWER TO DIVISION I	7.50E-2
IE-LOOPSC	LOSS OF OFFSITE POWER INITIATOR (SWITCHYARD-RELATED)	1.04E-2
IE-MLOCA	MEDIUM LOCA	1.00E-4
IE-TRANS	GENERAL PLANT TRANSIENT	7.62E-1
LCS-MDP-CF-RUN	CORE SPRAY PUMPS FAIL FROM COMMON CAUSE TO RUN	6.76E-6
LCS-MDP-CF-START	CORE SPRAY PUMPS FAIL FROM COMMON CAUSE TO START	1.20E-5
LCS-MDP-FS-PUMPA	CORE SPRAY PUMP A FAILS TO START	9.47E-4
LCS-MDP-FS-PUMPB	CORE SPRAY PUMP B FAILS TO START	9.47E-4
LCS-MDP-FS-PUMPC	COR SPRAY PUMP C FAILS TO START	9.47E-4
LCS-MDP-FS-PUMPD	CORE SPRAY PUMP D FAILS TO START	9.47E-4
LCS-MDP-TM-TRNA	CORE SPRAY TRAIN A IS UNAVAILABLE BECAUSE OF MAINTENANCE	7.12E-3
LCS-MDP-TM-TRNB	CORE SPRAY TRAIN B IS UNAVAILABLE BECAUSE OF MAINTENANCE	7.12E-3

LCS-MDP-TM-TRNC	CORE SPRAY TRAIN C IS UNAVAILABLE BECAUSE OF MAINTENANCE	7.12E-3
LCS-MDP-TM-TRND	CORE SPRAY TRAIN D IS UNAVAILABLE BECAUSE OF MAINTENANCE	7.12E-3
LCS-MOV-CC-F005A	LOOP A INJECTION VALVE F005A FAILS TO OPEN	9.63E-4
LCS-MOV-CC-F005B	LOOP A INJECTION VALVE F005B FAILS TO OPEN	9.63E-4
LCS-MOV-CF-INJEC	CS INJECTION VALVES FAIL FROM COMMON CAUSE	1.86E-5
LCS-XHE-XR-TRNA	CORE SPRAY TRAIN A NOT RESTORED AFTER MAINTENANCE	1.00E-3
LCS-XHE-XR-TRNB	CORE SPRAY TRAIN B NOT RESTORED AFTER MAINTENANCE	1.00E-3
LCS-XHE-XR-TRNC	CORE SPRAY TRAIN C NOT RESTORED AFTER MAINTENANCE	1.00E-3
LCS-XHE-XR-TRND	CORE SPRAY TRAIN D NOT RESTORED AFTER MAINTENANCE	1.00E-3
PCS-XHE-XL-LTLCHS	OPERATORS FAIL TO RECOVER THE POWER COVERSION SYSTEM	1.00E+0
PPR-SRV-OO-2VLVS	TWO OR MORE SRVS FAIL TO CLOSE	1.36E-4
RHR-HTX-TM-HTXA	RHR LOOP A HEAT EXCHANGER TRAIN OUT FOR T&M	2.36E-3
RHR-HTX-TM-HTXB	RHR LOOP B HEAT EXCHANGER TRAIN OUT FOR T&M	2.36E-3
RHR-MOV-CF-MINFL	RHR PUMP MINFLOW LINE MOVES FAIL FROM COMMON CAUSE TO OPEN	1.86E-5
RHR-STR-CF-LLOCA	SUPPRESSION POOL STRAINERS FAIL FROM COMMON CAUSE (LLOCA)	1.00E-4
RHR-STR-CF-MLOCA	SUPPRESSION POOL STRAINERS FAIL FROM COMMON CAUSE (MLOCA)	1.00E-4
RHR-STR-CF-NLOCA	SUPPRESSION POOL STRAINERS FAIL FROM COMMON CAUSE (NON-LOCA)	1.00E-5
RHR-XHE-XM-EECW	OPERATOR FAILS TO ALIGN EECW COOLING FLOW	1.00E-3
RHR-XHE-XM-ERROR	OPERATOR FAILS TO START/CONTROL RHR	5.00E-4
SFW-MDP-FS-PUMPB	SFW PUMP B FAILS TO START	9.47E-4
SFW-MDP-TM-PUMPB	SFW PUMP B IS IN TEST OR MAINTENANCE	7.12E-3
SFW-MOV-CC-F001	BOUNDARY VALVE F001 FAILS TO OPEN	9.63E-4
SFW-XHE-XA-MISALIGN	FERMI STANDBY FEEDWATER MISALIGNMENT ERROR FOLLOWING 24_107_03	2.00E-2
SFW-XHE-XM-INITIATE	OPERATOR FAILS TO INITIATE SBFW INJECTION	1.00E-3
SFW-XHE-XR-PUMPB	OPERATOR FAILS TO RESTORE PUMP AFTER TEST OR MAINT	1.00E-3

## Appendix B: Dominant Sequence



**Figure 1: MLOCA Sequence 13**