UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 21, 2015

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: LASALLE COUNTY STATION, UNITS 1 AND 2 – FINAL ACCIDENT SEQUENCE PRECURSOR ANALYSIS FOR THE APRIL 17, 2013, DUAL UNIT LOSS OF OFFSITE POWER

Dear Mr. Hanson:

This letter provides the final results of an accident sequence precursor (ASP) analysis by U.S. Nuclear Regulatory Commission (NRC or Commission) for the dual unit loss of offsite power that occurred at LaSalle County Station on April 17, 2013. This analysis has a final conditional core damage probability (CCDP) of 1×10^{-5} for Unit 1 and 2×10^{-5} for Unit 2, which is less than the threshold for a *significant* precursor (i.e., CCDP greater than or equal to 1×10^{-3}).

In accordance with NRC Regulatory Issue Summary 2006-24, "Revised Review and Transmittal Process for Accident Sequence Precursor Analyses," this analysis was not sent to you for formal review because the analysis had a preliminary CCDP of less than 1×10^{-4}. A response to this letter is not required; however, the NRC staff will review comments the licensee or other stakeholders choose to provide.

The ASP program continues to systematically review licensee event reports and other event reporting information for potential precursors, and to analyze those events which have the potential to be precursors. The complete summary of Fiscal Year 2013 ASP events was provided to the Commission in SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014.

If you have any questions regarding this matter, I may be reached at 301-415-1380.

Sincerely,

Blake Purnell, Project Manager
Plant Licensing III-2 and
Planning and Analysis Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-373 and 50-374

Enclosure:
Final Precursor Analysis

cc w/encl: Distribution via Listserv

Final Precursor Analysis

Accident Sequence Precursor Program – Office of Nuclear Regulatory Research		
LaSalle County Station Unit 1 and Unit 2	Dual Unit Loss of Offsite Power Due to Lightning Strike	
Event Date: April 17, 2013	**LER:** 373/13-002 **IR:** 05000374/2013009	**Unit 1:** CCDP = 1E-5 **Unit 2:** CCDP = 2E-5
Plant Type: Boiling-Water Reactor (BWR), General Electric Type 5, Wet Mark II Containment		
Plant Operating Mode (Reactor Power Level): Mode 1 (100% Reactor Power)		
Analyst: Dale Yeilding, 301-251-7577, Dale.Yeilding@nrc.gov	**Reviewers**: David Aird, Chris Hunter	**Contributors**: Don Marksberry, Song-hua Shen, Keith Tetter

1.0 EXECUTIVE SUMMARY

On April 17, 2013 at 2:59 p.m. Central Standard Time (CST), LaSalle County Station Units 1 and 2 automatically scrammed from 100 percent power, in conjunction with a loss of offsite power (LOOP). The loss of offsite power occurred when the breakers in the main 345kV switchyard opened, shortly following a lightning strike in the adjacent 138kV switchyard during a thunderstorm. The station's five emergency diesel generators (EDGs) immediately started, successfully loaded onto their respective safety-related buses, and began supplying power to the buses to support operation of essential loads, as expected. Plant systems on both units responded as expected. All control rods fully inserted. The main steam isolation valves closed, with decay heat being removed via the safety relief valves. High Pressure Core Spray (HPCS) automatically started on both units on low reactor water level; Reactor Core Isolation Cooling (RCIC) was used for level control. The licensee declared a Notification of Unusual Event (NOUE) at 3:11 p.m. because of the LOOP. The licensee was able to restore offsite power and exited the NOUE at 8:14 a.m. the following day, April 18.

Following the scrams of both reactors, plant safety-related equipment responded as expected, with a few exceptions. The Unit 2 Residual Heat Removal (RHR) Pump 2C failed to start following an Engineered Safety Features (ESF) actuation signal based on high drywell pressure, and the Unit 1 Low Pressure Core Spray (LPCS) System Injection Valve (1E21-F005) failed to open when control room operators attempted to manually open the valve using the control switch. Both failures had no significant effect on the ability of operators to respond to the event.

This event involved significant unexpected system interactions. Specifically, a lightning strike to a component of the 138kV electrical system in the switchyard resulted in the opening of all breakers in the 345kV electrical system ring bus and the loss of offsite power to both LaSalle Units. Section 8.2.3.2, "Adequacy of Offsite Power," and Section 8.1.2.5, "Unit Non-Class 1E DC [direct current] System" of the LaSalle County Station Updated Final Safety Analysis Report (UFSAR) indicates that this type of LOOP should not have occurred.

The lightning strike was coupled with a second event of a transformer failure which caused the opening of all 345kV breakers in the switchyard. The switchyard is designed against single failure, with the opening of all the breakers being unique to this LOOP event. The Special Inspection Team (SIT) report (Reference 5.4) identified four operator knowledge weaknesses regarding the event response, which did not have a significant contribution to risk for this event but could have affected risk if complications had developed.

1.1 Risk Insights

The Accident Sequence Precursor (ASP) Program systematically evaluates U.S. nuclear power plant (NPP) operating experience to identify, document, and rank the operating events most likely to lead to inadequate core cooling and severe core damage (i.e., precursors). The Conditional Core Damage Probability (CCDP) for both Unit I (1E-5) and Unit 2 (2E-5) qualify this LaSalle dual unit event as ASP Precursors as explained in Section 3 of this report. The RHR Pump 2C failure caused the higher CCDP for Unit 2. Typically, most LOOP events qualify as an ASP Precursor. The event CCDP for both units is not quantified near the 1E-3 threshold for a "significant" precursor. This analysis nor do others, try to further evaluate the event beyond the two categories of precursor and significant precursor.

The ASP Program evaluates the trend for all precursors as an input to the Industry Trends Program (ITP), which provides an input to the agency's safety performance measure of no significant adverse trend in industry safety performance. In the annual ASP report, the staff reviews events for risk-informed insights, looking at the systems causing the events, the dominant risk sequences, and the plant types affected by the events. A recent ITP report identified a trend of electrical failures similar to the LaSalle LOOP event not necessarily from a lighting strike, but resulting in losses of offsite power. Regulatory actions taken as a result of these electrical failure events include plant-specific SDP evaluations of the risk significance of the performance deficiencies associated with the events, information notices, and a bulletin.

A secondary objective of the ASP Program is to provide insights into the current state of practice in risk assessment. Past event analysis included an assessment of operator actions for the possibility of dependence described in section 4.6 of this report. After considering the potential modeling adjustments for Joint Human Event Probabilities (JHEP) and the resultant effect on the event CCDP, the ASP Program will no longer consider adjusting model failure probabilities when two human actions occur in the same cutset, until a sound technical basis can be established.

2.0 EVENT DETAILS

At 2:59 p.m. Central Standard Time (CST), LaSalle County Station Units 1 and 2 automatically scrammed from 100 percent power, in conjunction with a loss of offsite power. The LOOP occurred when the breakers in the main 345kV switchyard opened, shortly following a lightning strike in the adjacent 138kV switchyard during a thunderstorm.

The station's five EDGs immediately started, successfully loaded onto their respective safety-related buses, and began supplying power to the buses to support operation of essential loads, as expected. Plant systems on both Units responded as expected. All control rods fully inserted. The main steam isolation valves closed, with decay heat being removed via the safety relief valves. HPCS automatically started on both Units on low reactor water level; RCIC was used for level control. The licensee was able to restore offsite power to the Unit 2 Station Auxiliary Transformer, TR-242 and begin unloading the EDGs at 19:24 on April 17th approximately 4.5 hours after the LOOP. Three offsite power sources became available with

offsite power declared operable at 5:10 a.m. on April 18, 2013 and the Licensee terminated the NOUE at 08:14 a.m. Additional information is provided in References 5.1, (LaSalle County Station Unit 1 and 2, LER 373/13-002 – Unusual Event Declared Due to Loss of Offsite Power and Dual Unit Reactor Scram) and 5.4, (U.S. Nuclear Regulatory Commission, LaSalle County Station, Units 1 and 2 – NRC Special Inspection Team (SIT) Inspection Report 05000373/2013009; 05000374/2013009).

2.1 Switchyard Performance after Lightning Strike

The LOOP to both the 345-kV and 138kV switchyards was caused by a series of events initiated by a lightning strike in the 138kV switchyard. The root cause of the event was determined to be degradation of the 138kV switchyard grounding system that allowed a lightning induced fault to flash over onto the DC protective system. The degradation of the grounding system was due to poor workmanship during original construction. This degradation allowed a fault on the 138kV switchyard initiated by a lightning strike to damage the shared DC protection system. Another contributor to the event was inadequate lightning shielding of the 138kV switchyard.

Section 8.2.3.2, "Adequacy of Offsite Power," of the UFSAR stated, in part, that:

> *"The switchyard arrangement is such that offsite power to both units cannot be lost due to any single failure."*

Additionally, UFSAR Section 8.1.2.5, "Unit Non-Class 1E DC System," stated, in part, that:

> *"The design of the protective relay circuits for the 345-kV oil circuit breakers and the 345-kV transmission lines is such that the loss of either battery or the loss of both batteries and associated feeder cables will not cause the loss of offsite power sources."*

The design of the switchyard and the consequences of this event were also evaluated by the licensee against the requirements of General Design Criteria (GDC) 17 (Reference 5.13) as part of the root cause investigation. This review concluded that the LaSalle Offsite Power System design is in compliance with the requirements of GDC 17. It was determined that the degraded ground connections in the 138kV yard were the cause of the flashover onto the DC system therefore the design of switchyard was not the cause of the failure. As the common DC power supply allowed the faults experienced on the 138kV switchyard to ultimately propagate to the 345kV switchyard, the 138kV protection equipment was disconnected from the DC protection system. This second fault was initiated when the Capacitance Coupled Voltage Transformer that had been damaged in the lightning strike and then subjected to line voltage for two minutes, failed. Thus, a single event did not cause the opening of all breakers on the 345kV switchyard and the resultant loss of offsite power.

2.2 Unit 2 RHR Pump

On April 17, at about 4:27 p.m. CST, the Unit 2 RHR Pump 2C failed to start from an ESF actuation signal based on high drywell pressure after the 4.16-kV Safety Bus 242Y de-energized and subsequently reenergized during the event. Upon the ESF actuation signal, the breakers for RHR Pumps 2B and 2C closed, starting the LPCI system Trains 2B and 2C. Load shedding of the EDG 2A commenced per design. Approximately one second following the ESF signal, the RHR Pumps 2B and 2C tripped due to an under-voltage condition caused by the load shedding. The under-voltage condition cleared 0.157 seconds later when the EDG 2A output breaker reclosed onto Bus 242Y. Once Bus 242Y was reenergized, the RHR Pump 2C auto-start relay (K21) reenergized, giving a second LPCI system train actuation signal to Pumps 2B and 2C. The total amount of time from the first breaker closure for RHR Pump 2C to the second attempted closure (K21 relay energizing) was 1.606 seconds. This was not sufficient time for the breaker charging springs to fully charge.

The pump breaker anti-pumping circuit (Relay Y) was then left energized, which prevented the second closure of the breaker for RHR Pump 2C, (RHR Pump 2C Breaker Closing Circuit, Attachment G). The anti-pumping circuit contains a limit switch contact LSb whose actuation is based on the charge of the breaker charging coils. This contact will remain closed, therefore energizing a pump lockout relay (Relay Y) until the breaker charging springs are fully charged, roughly equal to three to five seconds. This circuit requires a manual reset and drop out of actuation Relay K21after the springs are fully charged in order for the Anti-Pump Lockout Relay Y to de-energize. If the breaker were to reopen after closure, as during load shedding of an EDG, and ample time (three to five seconds) is not allowed for the charging springs to charge, the seal-in feature of the anti-pumping circuit (contact Ya whose position is determined by relay Y) will prevent energizing closing coil x and prevent the pump breaker closure and pump actuation. The system worked per design.

The same anti-pumping circuit exists for RHR Pump 2A and 2B. The EDG loading sequence (UFSAR Table 8.3-1) shows these pump's start signal are delayed 5 seconds. The RHR Pump 2C in the EDG loading sequence is started immediately. RHR Pump 2B operation was not affected since the LOCA signal was removed upon SI signal and EDG sequencing, due to a relay sensing bus undervoltage/degraded voltage. The removal of the LOCA signal dropped out Relay K21 and permitted the reset of the charging spring circuit. Attachment G, pages 1-3 explain the RHR pump starting circuit logic.

This same condition did not occur on Unit 1 due to operators placing the RHR Pump 1A and LPCS Pumps in "pull to lock" two minutes prior to the high drywell pressure ECCS signal in anticipation of the Division 1 AC power being de-energized.

The Unit 2 control room operators, however, did not understand how the pump breaker would indicate an apparent start failure due to the simultaneous signals and, therefore, they concluded that the RHR Pump 2C had failed to start. Since it was not needed at the time for LPCI system injection, operators declared the pump inoperable, placed the pump's control switch in pull-to-lock, and made no attempt to immediately restart it. Subsequently, during troubleshooting, the pump was able to start when operators manually reset the logic with the pump's control switch and then started the pump. The inspectors reviewed the electrical schematic diagrams for the RHR Pump 2C and schematic diagrams of the internal control circuit of the 4.16-kV circuit breaker and determined that the Emergency Core Cooling Systems (ECCS) were designed for a simultaneous LOOP and ESF actuation signal, not a LOOP followed by a loss of coolant accident (LOCA).

The NRC posts on its public website different scenarios regarding Generic Safety Issue (GSI) 171, Evaluation of LOCA with Delayed LOOP and LOOP with Delayed LOCA Accident Scenarios, (Reference 5.14), stating:

> *"Two utility reports identify another failure mechanism in which circuit breaker protective devices lock out the circuit breaker to protect it from potential damage resulting from repeated opening and closing (referred to as "pumping"). The operator actions required to reset the circuit breakers may be quite complicated and could result in a high probability of failure to recover."*

2.3 Common EDG Overload

All five EDGs started, and loaded on to their respective busses as designed. The common EDG auto started and repowered both Unit 1 Bus 141Y and Unit 2 Bus 241Y. By design, the common EDG (DG0) should only automatically repower the bus for one Unit. The common

EDG Output Breakers 1413 and 2413 use 52S/b contacts (closed when opposite breaker is open / open when opposite breaker is closed) in their breaker closing logic to prevent the other unit's breaker from being closed while one breaker is already closed to ensure the swing EDG only supplies a single unit. When a loss of both Buses 141Y and 241Y occurs simultaneously, which occurred during the April 17th dual-Unit scram and LOOP, this interlock (52S/b contacts) did not prevent both breakers from closing in at the same moment. This occurred because the voltage and frequency permissive signals for closing both breakers were initiated and received at the same time. It is an unusual circumstance for simultaneous initiating signals to be sent to the EDG control logic; however, the design does not preclude this as the logic will not preferentially filter one Unit's relay over the other Unit's relay. LaSalle Calculation L-003364, "Auxiliary Power Analysis," Revision 1, verified that the total auto-connected loading on the swing EDG is within its continuous rating of 2600 kW when the EDG is connected to both Buses 141Y and 241Y when no LOCA has occurred.

2.4 Additional Details

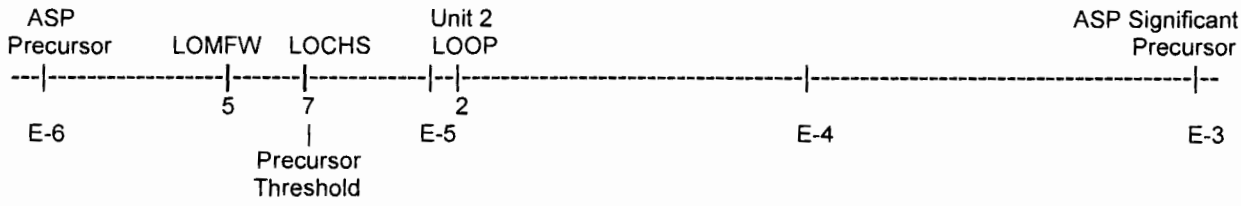
Additional details that did not have an effect of the analysis are described in Attachment F. The details are associated with HPCS and RCIC system leaks, LPCS Pump switch malfunction, subsequent scram from the secondary system and startup without RCIC operational.

3.0 ANALYSIS RESULTS

3.1 Unit 2 CCDP

The point estimate CCDP for Unit 2 is 1.5 E-5. The SAPHIRE Analysis report is in Attachment B.

The ASP Program acceptance threshold is a CCDP of 1E-6 or if higher, the CCDP equivalent of an uncomplicated reactor trip with a non-recoverable loss of secondary plant systems which for modeling purposes, is an initiating event for a Loss of Condenser Heat Sink (LOCHS) (7E-6 for LaSalle) and an initiating event of Loss of Main Feedwater (LOMFW) (5E-6 for LaSalle). Selecting the highest failure probability from these conditions establishes the LaSalle acceptance precursor threshold for the ASP program at 7E-6 in lieu of 1E-6. This Unit 2 LOOP event analyzed with a CCDP of 2E-5 is thus considered an ASP Precursor since it is just greater than the threshold than what is considered a standard plant transient for LaSalle Unit 2. The agency ASP Program defines a significant precursor with a CCDP of 1E-3, which is almost two decades higher than the Unit 2 LOOP.



3.2 Unit 2 Dominant Sequence(s)

The Loss of Offsite Power, Switchyard Centered (LOOPSC) Event Tree (Attachment A) has 44 sequences without considering transfers to other trees (i.e. SBO, ATWS, etc.) Four sequences contributed 74% towards the total Conditional Core Damage Probability (CCDP).

%	Name	Unit 2 Sequence ("/" slash signifies system success)
24%	LOOPSC-43-34-09	/RPS, EPS, P2, HCS-SBO, /RCI-SBO, OPR-01H, DGR-01H
24%	LOOPSC-42-13	/RPS, /EPS, P2, HCS, LPI
16%	LOOPSC-43-31	/RPS, EPS, /SRV, /RPSL, /HCS-SBO, RCI-SBO, OPR-30M, DGR-30M
10%	LOOPSC-07	/RPS, /EPS, /SRV, /HCS, SPC, /DEP, SDC, CSS, CVS, LI03
74%		

3.2.1 General – All four sequences began with:

/RPS - Success of the Reactor Protection System (RPS) to insert enough negative reactivity by the control rods to shut down the reactor.

3.2.2 Sequence LOOPSC-43-34-09 – transfers from the LOOPSC event tree to the station black out event tree involving more than one SRV failing open coupled with the failure of high pressure injection along with the failure to recover AC power within 1 hour.

EPS - Failure of the onsite Emergency Power System (EPS) with AC power not available on either the Division 1 or Division II bus.

P2 - Failure of more than one SRV to close or to remain closed.

HCS-SBO - Failure of the High Pressure Core Spray (HPCS) during a station black out. HPCS involves automatic actuation and operation of the HPCS pump with initial pump suction from the Condensate Storage Tank (CST) and subsequent realignment of the pump suction to the suppression pool.

/RCI-SBO - Success of Reactor Core Isolation Cooling (RCIC) system during a station black out. RCIC involves automatic actuation and operation of the RCIC pump with initial pump suction from the CST and subsequent realignment of the pump suction to the suppression pool.

OPR-01H - Failure of the operator to recover offsite power to the emergency busses within an hour. Success implies that offsite power has been recovered and all plant loads can be energized from their normal supplies.

DGR-01H - Failure of operator to recover EDG power to the emergency busses to at least one emergency division within an hour.

3.2.3 Sequence LOOPSC-42-13 - This sequence involves the failure of safety relief valves (SRVs) to close and failure to inject.

/EPS - Success of the onsite Emergency Power System (EPS) with AC power available on either the Division I or Division II bus.

P2 - Failure of more than one SRV to close or to remain closed.

HCS - Failure of the HPCS system with automatic actuation and operation of the HPCS pump with initial pump suction from the CST and subsequent realignment of the pump suction to the suppression pool.

LPI - Failure of the low pressure coolant injection system for any one RHR pump operation and injection through at least one low-pressure coolant injection line.

3.2.4 Sequence LOOPSC-43-31 - This sequence involves the failure of emergency power, RCI to inject and failure of the operator to recovery of offsite power and an emergency power within 30 minutes.

EPS - Failure of the onsite Emergency Power System (EPS) with AC power not available on either the Division 1 or Division II bus.

/SRV - Success of the SRVs to open, relieves pressure, and recloses. The pressure relief function is assumed successful but failure to reclose is modeled with either one, or two or more SRVs having failed to reclose

/RPSL - Success of recirculation pump seal integrity. Success implies the recirculation pump seals do not fail during a station blackout.

/HCS-SBO - Success of the HPCS during a station black out. HPCS involves automatic actuation and operation of the HPCS pump with initial pump suction from the CST and subsequent realignment of the pump suction to the suppression pool.

RCI-SBO - Failure of RCIC system during a station black out. RCIC involves automatic actuation and operation of the RCIC pump with initial pump suction from the CST and subsequent realignment of the pump suction to the suppression pool.

OPR-30M - Failure of operator to recover offsite power to the emergency busses within 30 minutes. Success implies that offsite power has been recovered and all plant loads can be energized from their normal supplies.

DGR-30M - Failure of operator to recover EDG power to the emergency busses within 30 minutes to at least one emergency division.

3.2.5 Sequence LOOPSC-07 - This sequence involves the failure of SPC and SDC and a failure to spray and vent containment.

/EPS - Success of the onsite Emergency Power System (EPS) with AC power available on either the Division 1 or Division II bus.

/SRV - Success of the SRVs to open, relieve pressure, and reclose. The pressure relief function is assumed successful but failure to reclose is modeled with either one, or two or more SRVs having failed to reclose

/HCS - Success of the HPCS system with automatic actuation and operation of the high pressure core spray pump with initial pump suction from the CST and subsequent realignment of the pump suction to the suppression pool.

SPC - Failure of the Suppression Pool Cooling (SPC) mode of RHR without operation of any one of the RHR pumps and its associated heat exchanger and injection through at least one suppression pool cooling line.

/DEP - Success of reactor depressurization (DEP) for operators to manually depressurize the reactor when instructed by procedure.

SDC - Failure of the Shutdown Cooling (SDC) mode of RHR without operation of any one of the RHR pumps and its associated heat exchanger and injection through at least one shutdown cooling line.

CSS - Failure of the Containment Spray (CSS) mode of RHR without operation of any one of the RHR pumps and its associated heat exchanger and spray through at least one containment spray header.

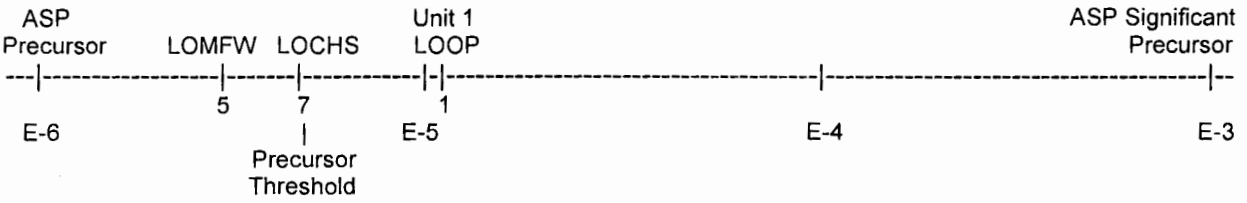
CVS - Failure of the Containment Venting System (CVS) with a vent path opened.

LI03 - Failure of late injection.

3.3 Unit 1 Conditional Core Damage Probability

The Unit 1 analysis is the same as Unit 2 with the Unit 2 RHR pump failure removed. The point estimate conditional core damage probability (CCDP) for Unit 1 is 1.3 E-5. The SAPHIRE Analysis report is in Attachment E.

The ASP Program acceptance threshold is a CCDP of 1E-6 or if higher, the CCDP equivalent of an uncomplicated reactor trip with a non-recoverable loss of secondary plant systems which for modeling purposes, is an initiating event for a Loss of Condenser Heat Sink (LOCHS) (7E-6 for LaSalle) and an initiating event of Loss of Main Feedwater (LOMFW) (5E-6 for LaSalle). Selecting the highest failure probability from these conditions establishes the LaSalle acceptance precursor threshold for the ASP program at 7E-6 in lieu of 1E-6. This Unit 1 LOOP event analyzed with a CCDP of 1.3E-5 is thus considered an ASP Precursor since it is just greater than the threshold than what is considered a standard plant transient for LaSalle Unit 1. The agency ASP Program defines a significant precursor with a CCDP of 1E-3, which is almost two decades higher than the Unit 1 LOOP.



3.4 Unit 1 Dominant Sequence(s)

The LOOPSC event tree has 44 sequences (Attachment A) without considering transfers to other trees (i.e. SBO, ATWS, etc.) Four sequences contributed 71% towards the total CCDP. The sequences are the same as Unit 2 with LOOP-42-13 dropping in percentage contribution from 24% to 10%.

%	Name	Unit 1 Sequence ("/" slash signifies system success)
29%	LOOPSC-43-34-09	/RPS, EPS, P2, HCS-SBO, /RCI-SBO, OPR-01H, DGR-01H
20%	LOOPSC-43-31	/RPS, EPS, /SRV, /RPSL, /HCS-SBO, RCI-SBO, OPR-30M, DGR-30M

12% LOOPSC-07: /RPS, /EPS, /SRV, /HCS, SPC, /DEP, SDC, CSS, CVS, LI03
10% LOOPSC-42-13 /RPS, /EPS, P2, HCS, LPI
71%

4.0 MODELING

4.1 Analysis Type
The SAPHIRE software version 8.1.0 was used for this event analysis with the LaSalle Standardized Plant Analysis (SPAR) risk model version 8.24 (created in September 2014). This event was modeled as a switchyard-centered LOOP initiating event.

4.2 Analysis Rules
The ASP program uses Significance Determination Process (SDP) results for degraded conditions when available. However, the ASP Program performs independent analysis for initiating events. The analysis was performed using Risk Assessment Standardization Project (RASP) Volume 1 (Internal Events) Appendix A, Road Map for Risk Analysis of Operational Events (Reference 5.10).

Scientific "E" notation will be used to reflect numbers less than zero in this report. The letter E will be used to represent *times ten raised to the power of.* For any two real numbers ***a*** and ***b***, the usage of "***a*** E ***b***" would indicate the value of $a \times 10^{b}$. Because superscripted exponents are visibly small and extremely important when dealing with probability or CCDP orders of magnitude, E notation will be used in lieu of scientific notation. For example, 0.00022 is equal to 2.2×10^{-4}, and reflected in this analysis report as 2.2E-4. "E" notation is also the default notation for reports using the SAPHIRE software.

4.3 Key Modeling Assumptions
The following modeling assumptions were made for the modeling of this event analysis:

4.3.1 Several additional events that occurred from 22 hours to 10 days after the LOOP were reviewed and determined to not factor into this analysis. They are described in detail in Attachment F.

- Unit 2 HPCS pin hole leak
- Unit 1 LPCS switch malfunction
- Unit 2 scram from secondary system
- Unit 1 RCIC not operational per technical specifications
- Unit 1 RCIC steam leak

4.3.2 A switchyard-related LOOP causes a subsequent reactor trip.

4.3.3 Offsite power was not recovered to a safety bus until 4.5 hours after the LOOP occurred. However, offsite power could have been restored within 2 hours using Operating Abnormal Procedure LOA-AP-201, AC Power System Abnormal. The basis is that no lightning repairs were necessary to the 345kV switchyard since the lightning only struck the 138kV side of the switchyard. Inspection for 345kV component integrity and procedure steps could have been performed in 2 hours during a postulated station blackout (SBO) event, which if occurred, would have hastened the restoration of offsite power.

4.3.4 Several operator action basic events are modeled allowing for recovery of offsite power at times associated with other modeled mitigation functions, ranging from 30 minutes to 12 hours. When the duration of the loss of offsite power is known, these recovery basic events can also

be adjusted. The offsite power recovery basic events with available times less than 2 hours are set to TRUE (i.e., failed), since offsite power could not be recovered by then. Those offsite power recovery basic events with available time of greater than 2 hours are adjusted using the Human Reliability Analysis (HRA) Worksheets (Attachment D) to adjust the nominal basic event failure probability using known performance shaping factors.

- Basic events for Operator Fails to Recover Offsite Power in 30 minutes and 1 hour are set to TRUE/ (i.e., failed).
- Basic events for Operator Fails to Recover Offsite Power in 4 hours, 7 hours, and 12 hours are analyzed by HRA and set to a value determined by the conditions.

4.3.5 The CCDP for this LOOP initiating event is calculated for a single point in time which typically affects the probabilities for certain components to function within an established mission time, 24 hours in this case. When it is know that the mission time is actually less than 24 hours, the reduced time will credit certain components, resulting in a lower probability of failure for those component basic events.

- Mission times for EDGs and the RCIC turbine driven pump were set to 2 hours. The EDG and TDP mission time is adjusted to lower values to differentiate between LOOPs of lesser duration.

- Mission times for motor driven pumps because the mission time is for the PRA is 24 hours.

4.3.6 Licensee calculation L-003364, "Auxiliary Power Analysis," Revision 1, verified that the total auto-connected loading on the swing EDG is within its continuous rating of 2600 kW when the EDG is connected to both Unit 1 and Unit 2 Buses 141Y and 241Y with no LOCA. The swing EDG0 was designed to supply only one unit but not both. After review of the probabilities for the most limiting LOCA, it was assumed that one or more SRV stuck-open events were most limiting. See section 4.4.8 of this report.

4.3.7 For Unit 2 only, the failure of Unit 2 RHR Pump 2C described in Section 2.2 of this report does not have common cause failure correlation to RHR Pumps 2A and 2B. The EDG loading sequence from UFSAR table 8.3-1 shows the RHR 2C pump starting immediately and the RHR Pump 2A and 2B delayed 5 seconds. The RHR Pump 2A and 2B circuit breaker anti-pumping circuit would not inhibit breaker reclosing since the EDG loading sequence delay allows sufficient time for the RHR pump breaker charging springs to recharge. It is assumed that the RHR Pump 2B, supplied from the same bus as RHR Pump 2C did not experience the same anti-pumping lock-out due to the operator performing a manual reset at the control switch (positioning to stop before start). The RHR Pump 2B was started and placed in suppression pool cooling mode of operation, 13 minutes after the lock-out of RHR Pump 2C. The failure of the RHR 2C pump was modeled with a new basic event such that common cause failure will not be considered as described by the fault tree modification in section 4.4.2 of this report.

4.3.8 An hour and a half into the event, Unit 1 operators placed the Division 1 electrically supplied RHR Pump 1A and LPCS Pump control switches in Pull-to-lock to secure pumps in anticipation of AC power being de-energized. Two minutes later, a Unit 2 high drywell pressure ESF actuation signal results in the common EDG0 to transfer to Unit 2 causing Unit 1 to lose Division 1 power to the two pumps placed in Pull-to-lock. These two pumps are assumed to be operable and available with no modeling adjustments for this analysis, understanding that

operator action would be required to take the pump switch out of pull-to-lock and the swing EDG would need to transfer if pump operation was required.

4.4 Fault Tree Modification

4.4.1 The LaSalle swing Diesel Generator (DG0) fault tree (Attachment C) was modified to account for design anomaly that appeared during this event. The swing diesel generator (one of five at the site) was not designed to supply both units simultaneously. The simultaneous starting logic from this LOOP event resulted in the DG0 loading onto both units as explained in Section 2.3 of this report. The licensee's load analysis and the Special Inspection Team report, identified the diesel can supply both units, except in the event of a LOCA. The most probable LOCA was determined to be one or more stuck open SRVs. The basic event EPS-DGN-DG0-LOCA was added to the DG0 Fault Tree and set to "ignore" and also added to a flag set ETF-SORV and set to "true" and invoked with the rule below to fail the swing EDG when a failed SRV appears in a cutset.

The LOOPSC initiating event has two failure paths for the SRV fault tree, SRV[1] and SRV[2]. Fault tree P1 involves the failure of one SRV and fault tree P2 involves the failure of two or more SRVs. When either exists in a cut set, a flag set will trigger a basic event from "ignore to true" to fail the swing EDG0. The following linkage rule was added to the LOOPSC event tree logic:

LOOPSC linkage rule:

```
if SRV[1] + SRV[2] then
  eventree(LOOPSC) = Flag(ETF-SORV);
endif
```

4.4.2 For Unit 2 only, the RHR Pump 2C fault tree (Attachment C) was modified to account for the failure of the Unit 2 RHR Pump 2C to start in response to a LOOP followed by an ESF Actuation as explained in detail in Section 2.2 of this report. The failure of the pump breaker to close was due to inadequate time for the breaker charging springs to recharge and not associated with any internal component of the pump. Thus, the pump Fail-To-Start failure mode was not adjusted in the model since this would result in additional common cause failure probability adjustments for similar pumps. A new basic event (RHR-MDP-SEQUENCER) was added to the fault tree to fail RHR Pump 2C and avoid common cause failure adjustments to the other pumps not subject to this failure mode.

4.5 Basic Event Probability Changes

Two separate analyses were performed for Unit 1 and Unit 2 with most of the changes indicated below related to both units except where indicated for Unit 2 only involving the RHR pumps. The results are reported separately for each unit in Attachment B (Unit 2) and Attachment E (Unit 1). The following initiating event frequencies and basic event probabilities were modified for this event analysis:

4.5.1 This analysis models the April 17, 2013 reactor trip at LaSalle County Station as a switchyard-related LOOP initiating event.

The probability of switchyard-centered LOOP was set to 1.0; all other initiating event probabilities were set to zero.

	Conditional	Nominal
IE LOOPSC (Loss of Offsite Power Initiator, Switchyard-Centered)	1.0	1.04E-2

4.5.2 For Unit 2 only, the RHR Pump 2C failed to start and the associated basic event was set to TRUE (i.e., failed).

	Conditional	Nominal
RHR-MDP-Sequencer RHR Pump C Unavailable Due To Lack of Time Delay (EDG Sequencer)	True	Ignore

4.5.3 Offsite power was not considered recoverable until approximately 2 hours after the LOOP occurred, considering a postulated SBO. The Recovery of Offsite Power fault tree (ROOP) is a special use fault tree that is used to credit the appropriate offsite power recovery period for each sequence on the LOOP event tree. The fault tree contains flags for 30-minutes, one-hour, four-hour, seven-hour and twelve-hour recovery periods. On any given LOOP sequence one flag will be set to TRUE and the others will remain FALSE. The basic event added to the sequence when a flag is set to TRUE indicates the AC recovery failure probability for the number of hours available on that sequence.

The following operator recovery basic events less than 2 hours were set to True (i.e., failed).

	Conditional	Nominal
OEP-XHE-XL-NR30MSC *Operator Fails to Recover Offsite Power in 30 Minutes*	True	6.02E-1
OEP-XHE-XL-NR01HSC *Operator Fails to Recover Offsite Power in 1 Hour*	True	4.01E-1

4.5.4 Offsite power was not considered recoverable until approximately 2 hours after the LOOP occurred. The following operator recovery basic events greater than 2 hours were set to the HRA conditional failure probability (Attachment D).

	Conditional	Nominal
OEP-XHE-XL-NR04HSC *Operator Fails to Recover Offsite Power in 4 Hours*	7E-3	1.02E-1
OEP-XHE-XL-NR07HSC *Operator Fails to Recover Offsite Power in 7 Hours*	7E-3	4.65E-2
OEP-XHE-XL-NR12HSC *Operator Fails to Recover Offsite Power in 12 Hours*	7E-3	1.9E-2

4.5.5 The offsite power was not considered recoverable until 2 hours after the LOOP occurred. The overall fail-to-run mission time for certain components is calculated as a compound event with an early and late failure time and probability input. The early nominal time is 1 hour, which is less than the 2 hour postulated recovery, thus there is no need to make any adjustments.

The following early diesel generator template basic event was not changed for the "early" input to the compound events.

ZT-DGN-FR-E (Diesel Generator Fails to Load and Run – Early)

Which did not change the "early" input to the following compound basic events:

EPS-DGN-FR-DG0 (Diesel Generator 0 Fails to Run)

EPS-DGN-FR-DG2A (Diesel Generator 2A Fails to Run)

EPS-DGN-FR-DG2B (Diesel Generator 2B Fails to Run)

EPS-DGN-FR-DG1A (Diesel Generator 1A Fails to Run)

EPS-DGN-FR-DG1B (Diesel Generator 1B Fails to Run)

The following early turbine driven pump template basic event was not changed for the "early" input to the compound events.

ZT-TDP-FR-E (Turbine Driven Pump Fails to Run – Early)

Which did not change the "early" input to the following compound basic event:

RCI-TDP-FR-TRAIN (RCIC Pump Fails to Run Given That It Started)

4.5.6 Offsite power was not considered recoverable until 2 hours after the LOOP occurred. The overall fail-to-run mission time for certain components is calculated as a compound event with an early and late failure time and probability input. The 23 hour "late" nominal time of certain basic events was then changed to 1 hour such that the sum of the "early" time plus the "late" time for each component would add up to the 2 hour postulated recovery time for this LOOP event in lieu of the typical 24 hour mission time.

Modeling Note: The SAPHIRE process for making this change was performed outside of the Events and Conditions Assessment (ECA) SAPHIRE Workspace. The basic event ZT-DGN-FR-L was opened from a search where the template basic event mission time was temporarily changed from 23 hours to one hour. The apply button was clicked to identify the calculated probability (1.086 E-3) which was recorded on paper for later entry while in the SAPHIRE ECA workspace. The mission time was changed back to 23 hours before exiting the basic event change screen. This same procedure was performed for ZT-TDP-FR-L (1.559 E-3). The two recorded probabilities were then entered into the template ZT basic event(s) when using the ECA workspace. The reason for this procedure is that the ECA workspace requires the entry of a probability and not a time and many analysts prefer to only make changes in the ECA workspace and never make changes to actual basic events allowing for better administration and saving of the various sensitivity scenarios run on SAPHIRE.

The following template basic event was changed from 23 hours to 1 hour (1.086E-3) for the "late" input to the compound event, giving credit for a shorter EDG mission time and lowering the probability for failure:

	Conditional	Nominal
ZT-DGN-FR-L (Diesel Generator Fails to Load and Run-Late)	1.086E-3	2.47E-2

Which changed the "late" input to the following calculated compound basic events:

	Conditional	Nominal
EPS-DGN-FR-DG0 (Diesel Generator 0 Fails to Run),	6.61E-3	3.01E-2
EPS-DGN-FR-DG2A (Diesel Generator 2A Fails to Run),	6.61E-3	3.01E-2
EPS-DGN-FR-DG2B (Diesel Generator 2B Fails to Run),	6.61E-3	3.01E-2
EPS-DGN-FR-DG1A (Diesel Generator 1A Fails to Run),	6.61E-3	3.01E-2
EPS-DGN-FR-DG1B (Diesel Generator 1B Fails to Run),	6.61E-3	3.01E-2

The following template basic event was set to 1 hour (1.559E-3) for the "late" input to the compound event, giving credit for a shorter pump mission time and lowering the probability for failure:

	Conditional	Nominal
ZT-TDP-FR-L (Turbine Driven Pump Fails to Run – Late),	1.559E-3	3.52E-2

Which changed the "late" input to the following compound basic event:

	Conditional	Nominal
RCI-TDP-FR-TRAIN (RCIC Pump Fails to Run Given That It Started),	5.97E-3	3.95E-2

4.5.7 The SPAR model was developed with a capability to analyze both a site LOOP where offsite power was lost to both units or a single unit LOOP where the other unit not being analyzed remained with offsite power to account for shared components between the units. The following basic events were changed to identify that offsite power was lost to both units.

	Conditional	Nominal
OEP-VCF-LP-SITESC (Site LOOP-Switchyard Related)	TRUE	2.11E-1
OEP-VCF-LP-SNGLSC (Single Unit LOOP-Switchyard Related)	FALSE	8.06E-1

4.5.8 The SRV failure probability to close in the LOOP model was adjusted higher to reflect the total number of primary SRV demands that were observed during the transient. A binomial expansion of the nominal failure probability based on the number of demands was calculated. There were 26 successful open/close cycles of the SRVs (on each unit) to limit pressure after the reactor scram.

The following binomial formula was used for calculating the revised failure probability of the SRVs where:

r (failures) = 1,
N (demands) = 26, and
p (nominal SRV failure probability) = 8.56E-4.

$$\mathbf{P}[r \text{ failures in } N \text{ demands} | \mathbf{P}(\text{failure}) = \mathbf{p}] = \frac{N!}{r!\,(N-r)!} p^r (1-p)^{N-r}$$

P (new SRV conditional failure probability) = 2.2E-2

Therefore, the basic events which involve one or more SRVs failing to reclose need to be adjusted. The failure probability was changed to 2.2E-2 via binomial expansion to account for the increased probability that the valves could stick open.

	Conditional	Nominal
PPR-SRV-OO-1VLV (*One SRV Fails to Close*),	2.2E-2	8.56E-4
ZT-BWR-SRV-OO-P1 (*BWR ADS/SRV Fails to Reclose*)	2.2E-2	8.56E-4

Which resulted in recalculation of the following basic events:

	Conditional	Nominal
PPR-SRV-OO-2VLVS (*Two or more SRVs Fails to Close*)	3.5E-3	1.36E-4
PPR-SRV-OO-3VLVS (*Three or more SRVs Fails to Close*)	1.54E-3	5.5E-5

4.6 Dependency

Dependence exists when the occurrence of one event involving human action affects the likelihood of a second event. Dependence arises from the knowledge or lack of knowledge of the performer of the second task about the occurrence or effect of a previous task. Specifically related to the LaSalle LOOP event analyzed in this report, there were no dependencies and required no model changes for human performance for the actual event. Some Joint Human Event Probability (JHEP) dependencies in model sequences not actually occurring in this event were identified but not analyzed and not adjusted for this report.

One JHEP in the SPAR model for LaSalle, was the operator failure to depressurize the reactor to facilitate low pressure injection, following two failures to high pressure inject with RCIC and HPCS. The NRC and industry have not reached consensus for the treatment of JHEP appearing together in a cutset and any associated minimum failure probability to assign. The industry has provided examples where applying a minimum 1E-5 failure probability to JHEPs would raise a plant's CDP several orders of magnitude. Hypothetically for this analysis, assigning a high dependency under SPAR-H rules to the failure-to-depressurize operator action raises the Basic Event failure probability from 1E-3 to 5E-1, bringing the cutset failure probability to the JHEP recommended minimum of 1E-5. No modeling adjustments were made for this analysis.

The NRC has recommended a minimum JHEP of 1E-5 in the RASP, Volume 1, Section 9.4 (Reference 5.10) and also in NUREG 1792, Section 5.3.3.6, Good Practice #6: Account for Dependencies Among Post-Initiator HFEs (Reference 5.11). The Electric Power Research Institute (EPRI) also provides guidance on the treatment of JHEPs in a report titled: Establishing Minimum Acceptable Values for Probabilities of Human Failure Events, (Reference 5.12). An initiative to undertake incorporating a minimum JHEP in the SPAR model used for this analysis and all other SPAR models is currently under discussion. Thus, for this analysis, any two human failure events occurring in the same cutset will not be adjusted for dependency until a sound technical basis can be established.

5.0 REFERENCES

5.1 LaSalle County Station Unit 1 and 2, "LER 373/13-002– Unusual Event Declared Due to Loss of Offsite Power and Dual Unit Reactor Scram," dated July 26, 2013 (ML13207A371).

5.2 LaSalle County Station, Unit 2, "LER 374-2013-001 – Pin Hole Leaks Identified in High Pressure Core Spray Piping", dated June 17, 2013 (ML13168A576)

5.3 LaSalle County Station Unit 1, "LER 373/13-003– Low Pressure Core Spray System Declared Inoperable Due to Faulty Control Switch" dated June 17, 2013 (ML13168A577).

5.4 U.S. Nuclear Regulatory Commission, "LaSalle County Station, Units 1 and 2 - NRC Special Inspection Team (SIT) Inspection Report 05000373/2013009; 05000374/2013009," dated July 18, 2013 (ML13199A512).

5.5 Idaho National Laboratory, NUREG/CR-6883, "The SPAR-H Human Reliability Analysis Method," August 2005 (ML051950061).

5.6 Idaho National Laboratory, "INL/EXT-10-18533, SPAR-H Step-by-Step Guidance," May 2011 (ML112060305).

5.7 LaSalle County Station Unit 1, "LER 373/13-004– , Reactor Pressure Exceeded 150 psig With Reactor Core Isolation Cooling Inoperable" dated June 21, 2013 (ML13172AA402).

5.8 LaSalle County Station Unit 1, "LER 373/13-005– Technical Specification Required Shutdown Due to Pressure Boundary Leakage," dated June 26, 2013 (ML13177A278).

5.9 LaSalle County Station, Unit 2, "LER 374-2013-002 – Manual Reactor Scram Following Trip of Circulating Water Pumps", dated June 24, 2013 (ML13175A229)

5.10 Risk Assessment Standardization Project (RASP) Volume 1- Internal Events, Revision 2, dated January, 2013 (ML13109A518)

5.11 Good Practices for Implementing Human Reliability Analysis, NUREG 1792, dated April, 2005. (ML051160213)

5.12 Establishing Minimum Acceptable Values for Probabilities of Human Failure Events, EPRI Product ID 1021081, dated October 2010.
(http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001021081)

5.13 General Design Criteria 17, 10 CFR Part 50, Appendix A

> *Criterion 17—Electric power systems.* An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that (1) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (2) the core is cooled and containment integrity and other vital functions are maintained in the event of postulated accidents. The onsite electric power supplies, including the batteries, and the onsite electric distribution system, shall have sufficient independence, redundancy, and testability to perform their safety functions assuming a single failure. **Electric power from the transmission network to the onsite electric distribution system shall be supplied by two physically independent circuits (not necessarily on separate rights of way) designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A switchyard common to both circuits is acceptable**. Each of these circuits shall be designed to be available in sufficient time following a loss of all onsite alternating current power supplies and the other offsite electric power circuit, to assure that specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded. One of these circuits shall be designed to be available within a few seconds following a loss-of-coolant accident to assure that core cooling, containment integrity, and other vital safety functions are maintained. Provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit, the loss of power from the transmission network, or the loss of power from the onsite electric power supplies.

5.14 NUREG/CR-6538, Evaluation of LOCA With Delayed LOOP and LOOP with Delayed LOCA Accident Scenarios, technical Findings Related to GSI-171, "ESF Failure from LOOP Subsequent to LOCA, dated July 1997. [ML071630062]

6.0 ATTACHMENTS

A. Loss of Offsite Power – Switchyard Centered Event Tree

B. Unit 2 SAPHIRE Analysis Report

C. Fault Tree Modifications, Swing EDG and RHR Pump 2C

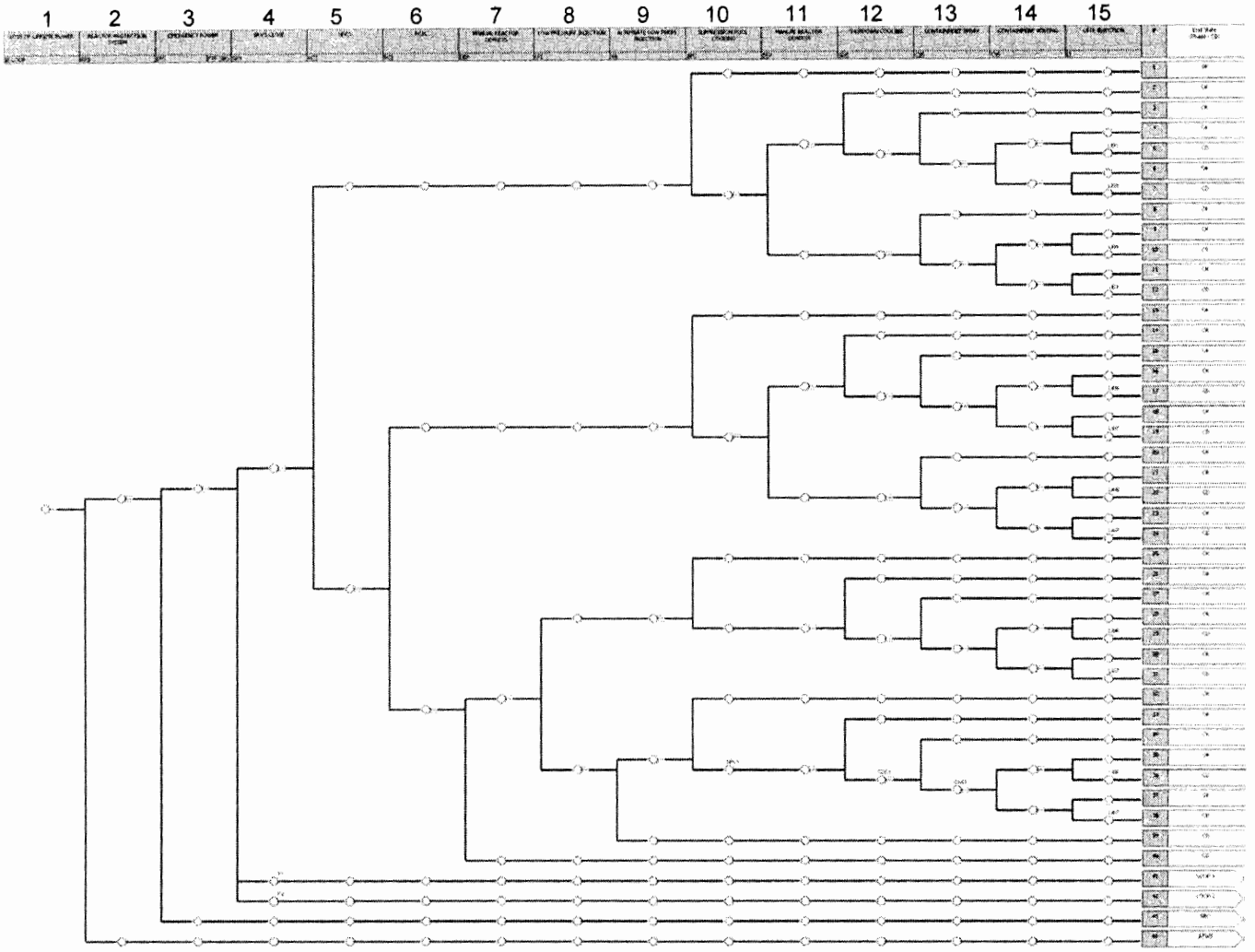
D. Human Reliability Analysis Worksheets

E. Unit 1 SAPHIRE Analysis Report

F. Additional Event Details - No Effect on the ASP Analysis

G. RHR Pump Breaker Closing Circuit

Loss Of Offsite Power – Switchyard Centered Event Tree



1-LOOPSC initiating event
2-RPS
3-EPS
4-SRV (P1/P2 failures)
5-HPCS
6-RCIC
7-Manual Depressurize
8-LPI
9-Alternate LPI
10-SPC
11-Manual Depressurize
12-Shutdown Cooling
13-Containment Spray
14-Containment Venting
15-Late Injection

LaSalle Unit 2
SAPHIRE Analysis Report

Initiating Event **IE-LOOPSC**
CCDP **1.50E-5**

Summary of Conditional Event Changes

Event	Description	Cond Value	Nominal Value
IE-LOOPSC	LOSS OF OFFSITE POWER INITIATOR (SWITCHYARD- CENTERED)	1.00E+0	1.04E-2
OEP-VCF-LP-SITESC	SITE LOOP (SWITCHYARD-RELATED)	True	2.11E-1
OEP-VCF-LP-SNGLSC	SINGLE UNIT LOOP (SWITCHYARD-RELATED)	False	8.06E-1
OEP-XHE-XL-NR01HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 1 HOUR (SWITCHYARD)	True	4.01E-1
OEP-XHE-XL-NR04HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 4 HOURS (SWITCHYARD)	7.00E-3	1.02E-1
OEP-XHE-XL-NR07HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 7 HOURS (SWITCHYARD)	7.00E-3	4.65E-2
OEP-XHE-XL-NR12HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 12 HOURS (SWITCHYARD)	7.00E-3	1.90E-2
OEP-XHE-XL-NR30MSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 30 MINUTES (SWITCHYARD)	True	6.02E-1
PPR-SRV-OO-1VLV	ONE SRV FAILS TO CLOSE	2.20E-2	8.56E-4
RHR-MDP-SEQUENCER	RHR PUMP C UNAVAILABLE DUE TO LACK OF TIME DELAY (EDG SEQUENCER)	True	0.00E+0
ZT-BWR-SRV-OO-P1	BWR ADS/SRV Fails To Reclose	2.20E-2	8.56E-4
ZT-DGN-FR-L	Diesel Generator Fails To Run	1.09E-3	2.47E-2
ZT-TDP-FR-L	Turbine Driven Pump Fails To Run	1.56E-3	3.52E-2
PPR-SRV-OO-2VLVS	TWO OR MORE SRVS FAIL TO CLOSE	3.50E-3	1.36E-4
PPR-SRV-OO-3VLVS	THREE OR MORE SRVS FAIL TO CLOSE	1.54E-3	5.50E-5
EPS-DGN-FR-DG0	DIESEL GENERATOR 0 FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG2A	DIESEL GENERATOR 2A FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG2B	DIESEL GENERATOR 2B FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG1A	DIESEL GENERATOR 1A FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG1B	DIESEL GENERATOR 1B FAILS TO RUN	6.61E-3	3.01E-2
ZT-BWR-SRV-OO-P2	BWR TWO ADS/SRVS FAIL TO RECLOSE	3.50E-3	1.36E-4
ZT-BWR-SRV-OO-P3	BWR THREE OR MORE ADS/SRVS FAIL TO RECLOSE	1.54E-3	5.50E-5
RCI-TDP-FR-TRAIN	RCIC PUMP FAILS TO RUN GIVEN THAT IT STARTED	5.97E-3	3.95E-2

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

Sequence	%	Description
43-34-09	24.3%	/RPS, EPS, P2, HCS-SBO, /RCI-SBO, OPR-01H, DGR-01H

Sequence	%	Description
42-13	24.2%	/RPS, /EPS, P2, HCS, LPI
43-31	16.4%	/RPS, EPS, /SRV, /RPSL, HCS-SBO, RCI-SBO, OPR-30M, DGR-30M
07	10.2%	/RPS, /EPS, /SRV, /HCS, SPC, /DEP, SDC, CSS, CVS, LI-VENT-FAILURE
43-33-15	5.9%	/RPS, EPS, P1, HCS-SBO, RCI-SBO
40	5.7%	/RPS, /EPS, /SRV, HCS, RCI, DEP
42-12	3.7%	/RPS, /EPS, P2, HCS, /LPI, SPC, CSS, CVS, LI-VENT-FAILURE
43-32-15	1.8%	/RPS, EPS, /SRV, RPSL, HCS-SBO, RCI-SBO
43-34-10	1.4%	/RPS, EPS, P2, HCS-SBO, RCI-SBO
39	1.3%	/RPS, /EPS, /SRV, HCS, RCI, /DEP, LPI, VA
	100.0%	

Referenced Fault Trees

Fault Tree	Description
CSS	CONTAINMENT SPRAY
CVS	CONTAINMENT VENTING
DEP	MANUAL REACTOR DEPRESS
DGR-01H	DIESEL GENERATOR RECOVERY (1 HOUR)
DGR-30M	DIESEL GENERATOR RECOVERY (30 MINUTES)
EPS	EMERGENCY POWER
HCS	HPCS
HCS-SBO	HPCS
LI-VENT-FAILURE	LATE INJECTION FOLLOWING VENTILATION FAILURE
LPI	LOW PRESSURE INJECTION
OPR-01H	OFFSITE POWER RECOVERY (1 HOUR)
OPR-30M	OFFSITE POWER RECOVERY (30 MINUTES)
P1	ONE SORV
P2	TWO OR MORE SORVs
RCI	RCIC
RCI-SBO	RCIC FAILS DURING STATION BLACKOUT
RPSL	RECIRC PUMP SEAL INTEGRITY
SDC	SHUTDOWN COOLING
SPC	SUPPRESSION POOL COOLING
VA	ALTERNATE LOW PRESS INJECTION

Cut Set Report - LOOPSC 43-34-09
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	3.64E-6	100	Displaying 2104 Cut Sets. (2104 Original)
1	6.28E-7	17.26	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
2	2.89E-7	7.95	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
3	2.89E-7	7.95	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS

#	CCDP	Total %	Cut Set
4	2.76E-7	7.58	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
5	2.67E-7	7.33	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
6	1.33E-7	3.66	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
7	1.27E-7	3.49	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
8	1.27E-7	3.49	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
9	1.27E-7	3.48	IE-LOOPSC,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
10	1.27E-7	3.48	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
11	1.17E-7	3.22	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS,SCW-MDP-TM-DG2A
12	1.17E-7	3.21	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
13	5.84E-8	1.61	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
14	5.82E-8	1.60	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-FS-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
15	5.82E-8	1.60	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FS-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
16	5.55E-8	1.53	IE-LOOPSC,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
17	5.55E-8	1.53	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
18	5.12E-8	1.41	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS,SCW-MDP-TM-DG2A
19	4.38E-8	1.20	IE-LOOPSC,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,EPS-XHE-XR-DG1B,PPR-SRV-OO-2VLVS
20	4.15E-8	1.14	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS,SCW-MDP-FS-DG2A
21	4.04E-8	1.11	IE-LOOPSC,EPS-XHE-XL-NR01H,EPS-XHE-XR-DG1B,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
22	3.96E-8	1.09	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS

Cut Set Report - LOOPSC 42-13
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	3.62E-6	100	Displaying 2522 Cut Sets. (2522 Original)
1	2.84E-7	7.85	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
2	2.62E-7	7.24	IE-LOOPSC,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B,SCW-MDP-TM-

#	CCDP	Total %	Cut Set
			DG2B
3	1.35E-7	3.73	IE-LOOPSC,HCS-MDP-TM-HPCS,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
4	1.25E-7	3.45	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS,RHR-MDP-TM-2B
5	1.15E-7	3.18	IE-LOOPSC,PPR-SRV-OO-3VLVS,RHR-MDP-TM-2B,SCW-MDP-TM-DG2B
6	1.00E-7	2.77	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC
7	9.27E-8	2.56	IE-LOOPSC,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC,SCW-MDP-TM-DG2B
8	5.94E-8	1.64	IE-LOOPSC,HCS-MOV-FT-SUCTR,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
9	5.93E-8	1.64	IE-LOOPSC,HCS-MDP-TM-HPCS,PPR-SRV-OO-3VLVS,RHR-MDP-TM-2B
10	5.73E-8	1.58	IE-LOOPSC,EPS-DGN-FS-DG1B,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
11	5.02E-8	1.39	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,SCW-XHE-TM-RHRB
12	4.84E-8	1.34	IE-LOOPSC,EPS-DGN-TM-DG1B,LCI-MOV-CC-42B,PPR-SRV-OO-2VLVS
13	4.84E-8	1.34	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-MOV-CC-MINFB
14	4.77E-8	1.32	IE-LOOPSC,HCS-MDP-TM-HPCS,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC
15	4.76E-8	1.31	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-MDP-FS-2B
16	4.74E-8	1.31	IE-LOOPSC,HCS-CRB-OO-MDP,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
17	4.63E-8	1.28	IE-LOOPSC,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2B,SCW-XHE-TM-RHRB
18	4.46E-8	1.23	IE-LOOPSC,PPR-SRV-OO-2VLVS,RHR-MOV-CC-MINFB,SCW-MDP-TM-DG2B
19	4.46E-8	1.23	IE-LOOPSC,LCI-MOV-CC-42B,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2B
20	4.41E-8	1.22	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS,RHR-FAN-TM-BC
21	4.39E-8	1.21	IE-LOOPSC,PPR-SRV-OO-2VLVS,RHR-MDP-FS-2B,SCW-MDP-TM-DG2B
22	4.23E-8	1.17	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-FAN-FS-BC
23	4.07E-8	1.12	IE-LOOPSC,PPR-SRV-OO-3VLVS,RHR-FAN-TM-BC,SCW-MDP-TM-DG2B
24	3.96E-8	1.09	IE-LOOPSC,HCS-FAN-TM-ROOM,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
25	3.90E-8	1.08	IE-LOOPSC,PPR-SRV-OO-2VLVS,RHR-FAN-FS-BC,SCW-MDP-TM-DG2B

Cut Set Report - LOOPSC 43-31
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	2.46E-6	100	Displaying 30480 Cut Sets. (30480 Original)

#	CCDP	Total %	Cut Set
1	2.38E-7	9.68	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M
2	1.30E-7	5.30	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-TDP-TM-TRAIN
3	8.72E-8	3.55	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M
4	7.73E-8	3.14	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-TDP-FS-TRAIN
5	7.11E-8	2.89	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-TDP-FR-TRAIN
6	4.77E-8	1.94	IE-LOOPSC,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M,RCI-TDP-TM-TRAIN
7	4.25E-8	1.73	IE-LOOPSC,DCP-BAT-CF-ALL,EPS-XHE-XL-NR30M
8	3.57E-8	1.45	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
9	2.83E-8	1.15	IE-LOOPSC,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M,RCI-TDP-FS-TRAIN
10	2.60E-8	1.06	IE-LOOPSC,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M,RCI-TDP-FR-TRAIN
11	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG0,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M
12	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1A,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M
13	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG0,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M
14	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG1A,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M

Cut Set Report - LOOPSC 07
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	1.52E-6	100	Displaying 30157 Cut Sets. (30157 Original)
1	6.45E-8	4.23	IE-LOOPSC,CRD-XHE-XM-PUMP,CTM-DW-BODY-FAILURE,CVS-MOV-TM-PURGE,RHR-XHE-XM-ERROR
2	4.89E-8	3.21	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG0,OEP-XHE-XL-NR12HSC,RHR-MDP-TM-2B
3	2.24E-8	1.47	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,SCW-MOV-TM-F068B
4	2.15E-8	1.41	IE-LOOPSC,CRD-XHE-XM-PUMP,CTM-DW-BODY-FAILURE,CVS-XHE-XM-VENT,RHR-XHE-XM-ERROR
5	2.03E-8	1.33	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG0,OEP-XHE-XL-NR12HSC,RHR-HTX-TM-HTXB
6	1.88E-8	1.23	IE-LOOPSC,CTM-DW-BODY-FAILURE,OEP-XHE-XL-NR12HSC,RHR-HTX-TM-HTXB,SCW-MDP-TM-DG0
7	1.73E-8	1.13	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG0,OEP-XHE-XL-NR12HSC,RHR-FAN-TM-BC
8	1.72E-8	1.13	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,SCW-XHE-TM-RHRB
9	1.70E-8	1.12	IE-LOOPSC,ACP-XHE-XM-DG0,CTM-DW-BODY-FAILURE,FLAG-DG0-ALIGNED-AWAY,OEP-XHE-XL-NR12HSC,RHR-MDP-TM-2B
10	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-MINFB

#	CCDP	Total %	Cut Set
11	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,SCW-MOV-CC-68B
12	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-F003B
13	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MOV-OO-BYPSB
14	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,SCW-MOV-CC-68A
15	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-MINFA
16	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-F003A
17	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MOV-OO-BYPSA
18	1.63E-8	1.07	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MDP-FS-2B
19	1.63E-8	1.07	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MDP-FS-2A
20	1.62E-8	1.06	IE-LOOPSC,ACP-BAC-LP-241Y,CTM-DW-BODY-FAILURE,RHR-MDP-TM-2B
21	1.62E-8	1.06	IE-LOOPSC,ACP-BAC-LP-242Y,CTM-DW-BODY-FAILURE,RHR-MDP-TM-2A
22	1.59E-8	1.05	IE-LOOPSC,CTM-DW-BODY-FAILURE,OEP-XHE-XL-NR12HSC,RHR-FAN-TM-BC,SCW-MDP-TM-DG0

Cut Set Report - LOOPSC 43-33-15
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	8.88E-7	100	Displaying 6347 Cut Sets. (6347 Original)
1	9.06E-8	10.20	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV
2	4.17E-8	4.70	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV
3	4.17E-8	4.70	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV
4	3.85E-8	4.33	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,SCW-MDP-TM-DG2A
5	2.94E-8	3.31	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FS-TRAIN
6	2.70E-8	3.04	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN
7	2.28E-8	2.57	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN
8	2.11E-8	2.37	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN,SCW-MDP-TM-DG2A
9	1.92E-8	2.16	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,PPR-SRV-OO-1VLV

#	CCDP	Total %	Cut Set
10	1.83E-8	2.06	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV
11	1.83E-8	2.06	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV
12	1.68E-8	1.90	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,PPR-SRV-OO-1VLV,SCW-MDP-TM-DG2A
13	1.36E-8	1.53	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
14	1.35E-8	1.52	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FS-TRAIN
15	1.35E-8	1.52	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FS-TRAIN
16	1.25E-8	1.41	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FS-TRAIN,SCW-MDP-TM-DG2A
17	1.24E-8	1.40	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN
18	1.24E-8	1.40	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN
19	1.15E-8	1.29	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN,SCW-MDP-TM-DG2A
20	1.05E-8	1.18	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN
21	9.99E-9	1.13	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN
22	9.22E-9	1.04	IE-LOOPSC,EPS-DGN-FS-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN,SCW-MDP-TM-DG2A
23	9.02E-9	1.02	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-MOV-FC-XFER,RCI-XHE-XL-XFER

Cut Set Report - LOOPSC 40
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	8.57E-7	100	Displaying 5616 Cut Sets. (5616 Original)
1	7.19E-8	8.38	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-XHE-XO-ERROR1,RCI-XHE-XO-ERROR
2	4.66E-8	5.44	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-TDP-FS-TRAIN
3	4.30E-8	5.02	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-TDP-FS-TRAIN,SCW-MDP-TM-DG2B
4	4.28E-8	5.00	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-TDP-FR-TRAIN
5	3.95E-8	4.61	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-TDP-FR-TRAIN,SCW-MDP-TM-DG2B
6	3.62E-8	4.22	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-TDP-TM-TRAIN
7	2.21E-8	2.58	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MDP-TM-HPCS,RCI-TDP-FS-TRAIN

#	CCDP	Total %	Cut Set
8	2.15E-8	2.51	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
9	2.14E-8	2.50	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-TDP-FS-TRAIN
10	2.03E-8	2.37	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MDP-TM-HPCS,RCI-TDP-FR-TRAIN
11	1.99E-8	2.32	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT,SCW-MDP-TM-DG2B
12	1.97E-8	2.30	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-TDP-FR-TRAIN
13	1.64E-8	1.92	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MOV-FT-SUCTR,RCI-TDP-TM-TRAIN
14	1.58E-8	1.85	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FS-DG1B,RCI-TDP-TM-TRAIN
15	1.43E-8	1.67	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-MOV-FC-XFER,RCI-XHE-XL-XFER
16	1.32E-8	1.54	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-MOV-FC-XFER,RCI-XHE-XL-XFER,SCW-MDP-TM-DG2B
17	1.31E-8	1.53	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-CRB-OO-MDP,RCI-TDP-TM-TRAIN
18	1.10E-8	1.28	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-FAN-TM-ROOM,RCI-TDP-TM-TRAIN
19	1.02E-8	1.19	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MDP-TM-HPCS,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
20	9.91E-9	1.16	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
21	9.74E-9	1.14	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MOV-FT-SUCTR,RCI-TDP-FS-TRAIN
22	9.39E-9	1.10	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FS-DG1B,RCI-TDP-FS-TRAIN
23	8.95E-9	1.04	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MOV-FT-SUCTR,RCI-TDP-FR-TRAIN
24	8.63E-9	1.01	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FS-DG1B,RCI-TDP-FR-TRAIN

Cut Set Report - LOOPSC 42-12
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	5.49E-7	100	Displaying 14851 Cut Sets. (14851 Original)
1	2.45E-8	4.46	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
2	2.26E-8	4.11	IE-LOOPSC,CTM-DW-BODY-FAILURE,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B,SCW-MDP-TM-DG2B
3	1.16E-8	2.12	IE-LOOPSC,CTM-DW-BODY-FAILURE,HCS-MDP-TM-HPCS,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
4	1.07E-8	1.96	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS,RHR-MDP-TM-2B

#	CCDP	Total %	Cut Set
5	1.02E-8	1.85	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-HTX-TM-HTXB
6	9.90E-9	1.81	IE-LOOPSC,CTM-DW-BODY-FAILURE,PPR-SRV-OO-3VLVS,RHR-MDP-TM-2B,SCW-MDP-TM-DG2B
7	9.39E-9	1.71	IE-LOOPSC,CTM-DW-BODY-FAILURE,PPR-SRV-OO-2VLVS,RHR-HTX-TM-HTXB,SCW-MDP-TM-DG2B
8	5.62E-9	1.02	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,SCW-MOV-TM-F068B

Cut Set Report - LOOPSC 43-32-15
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	2.67E-7	100	Displaying 13460 Cut Sets. (13460 Original)
1	2.59E-8	9.72	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-R4,RRS-MDP-LK-SEALS
2	1.42E-8	5.32	IE-LOOPSC,EPS-DGN-CF-R4,RCI-TDP-TM-TRAIN,RRS-MDP-LK-SEALS
3	9.50E-9	3.56	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-S4,RRS-MDP-LK-SEALS
4	8.42E-9	3.16	IE-LOOPSC,EPS-DGN-CF-R4,RCI-TDP-FS-TRAIN,RRS-MDP-LK-SEALS
5	7.74E-9	2.90	IE-LOOPSC,EPS-DGN-CF-R4,RCI-TDP-FR-TRAIN,RRS-MDP-LK-SEALS
6	5.20E-9	1.95	IE-LOOPSC,EPS-DGN-CF-S4,RCI-TDP-TM-TRAIN,RRS-MDP-LK-SEALS
7	4.63E-9	1.73	IE-LOOPSC,DCP-BAT-CF-ALL,RRS-MDP-LK-SEALS
8	3.89E-9	1.46	IE-LOOPSC,EPS-DGN-CF-R4,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT,RRS-MDP-LK-SEALS
9	3.08E-9	1.16	IE-LOOPSC,EPS-DGN-CF-S4,RCI-TDP-FS-TRAIN,RRS-MDP-LK-SEALS
10	2.83E-9	1.06	IE-LOOPSC,EPS-DGN-CF-S4,RCI-TDP-FR-TRAIN,RRS-MDP-LK-SEALS
11	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1A,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS
12	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG0,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS
13	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG0,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS
14	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG1A,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS

Cut Set Report - LOOPSC 43-34-10
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	2.03E-7	100	Displaying 6784 Cut Sets. (6784 Original)
1	1.44E-8	7.10	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS
2	6.64E-9	3.27	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS
3	6.64E-9	3.27	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS
4	6.33E-9	3.12	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-TM-DG1B,EPS-DGN-

#	CCDP	Total %	Cut Set
			TM-DG2A,PPR-SRV-OO-3VLVS
5	6.12E-9	3.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
6	4.68E-9	2.31	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-FS-TRAIN
7	4.30E-9	2.12	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-FR-TRAIN
8	3.63E-9	1.79	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-TM-TRAIN
9	3.35E-9	1.65	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-2VLVS,RCI-TDP-TM-TRAIN,SCW-MDP-TM-DG2A
10	3.05E-9	1.50	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,PPR-SRV-OO-2VLVS
11	2.91E-9	1.43	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-3VLVS
12	2.91E-9	1.43	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS
13	2.90E-9	1.43	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS
14	2.90E-9	1.43	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS
15	2.69E-9	1.32	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,PPR-SRV-OO-3VLVS,SCW-MDP-TM-DG2A
16	2.68E-9	1.32	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
17	2.16E-9	1.07	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
18	2.15E-9	1.06	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RCI-TDP-FS-TRAIN
19	2.15E-9	1.06	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-FS-TRAIN
20	2.05E-9	1.01	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-3VLVS,RCI-TDP-FS-TRAIN

Referenced Events

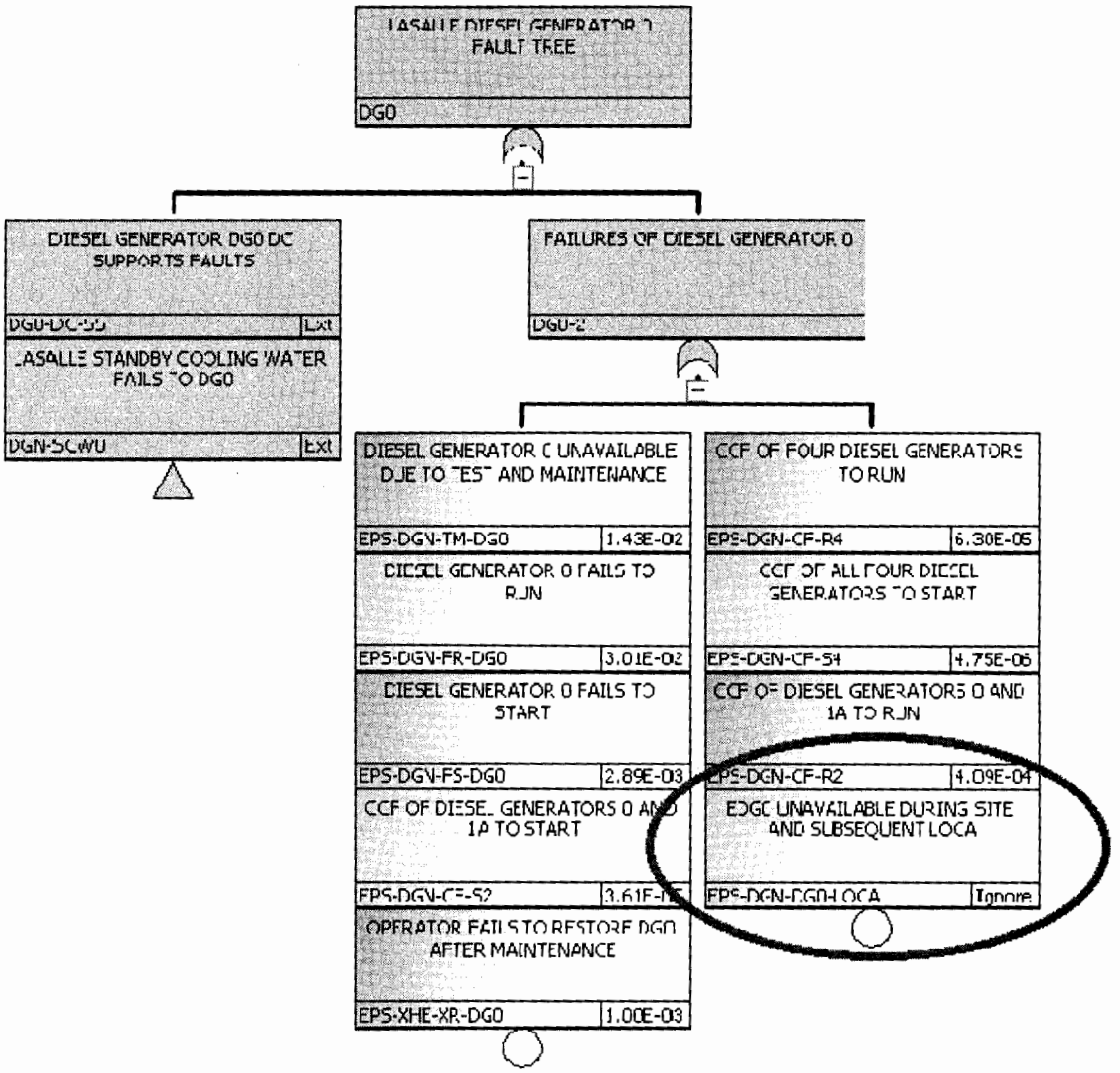
Event	Description	Probability
ACP-BAC-LP-241Y	4160 V BUS 241Y HARDWARE FAILURES	3.33E-5
ACP-BAC-LP-242Y	4160 V BUS 242Y HARDWARE FAILURES	3.33E-5
ACP-BAC-TM-241Y	4160 V BUS 241Y IN MAINTENANCE (PSA)	2.00E-4
ACP-BAC-TM-242Y	4160 V BUS 242Y IN MAINTENANCE (PSA)	2.00E-4
ACP-XHE-XM-DG0	OPERATOR FAILS TO ALIGN DG0 TO DIV-1 BUS 241Y	1.00E-2
ADS-XHE-XM-MDEPR	OPERATOR FAILS TO DEPRESSURIZE THE REACTOR	5.00E-4
CRD-XHE-XM-PUMP	OPERATOR FAILS TO START THE STANDBY PUMP	5.00E-1
CTM-DW-BODY-FAILURE	CATASTROPHIC CONTAINMANT DW BODY FAILURE CAUSES LOSS OF INJECTION	8.60E-2
CVS-MOV-TM-PURGE	CONTAINMENT VENT/PURGE SYSTEM IN MAINTENANCE (PSA)	3.00E-3

CVS-XHE-XM-VENT	OPERATOR FAILS TO VENT CONTAINMENT	1.00E-3
DCP-BAT-CF-ALL	CCF OF 125VDC BATTERYS (3)	4.63E-8
DCP-XHE-XM-STRIP30M	OPERATOR FAILS TO SHED 125 VDC NON-ESSENTIAL LOADS	2.00E-2
EPS-DGN-CF-R4	CCF OF FOUR DIESEL GENERATORS TO RUN	1.30E-5
EPS-DGN-CF-S4	CCF OF ALL FOUR DIESEL GENERATORS TO START	4.75E-6
EPS-DGN-FR-DG0	DIESEL GENERATOR 0 FAILS TO RUN	6.61E-3
EPS-DGN-FR-DG1A	DIESEL GENERATOR 1A FAILS TO RUN	6.61E-3
EPS-DGN-FR-DG1B	DIESEL GENERATOR 1B FAILS TO RUN	6.61E-3
EPS-DGN-FR-DG2A	DIESEL GENERATOR 2A FAILS TO RUN	6.61E-3
EPS-DGN-FS-DG1B	DIESEL GENERATOR 1B FAILS TO START	2.89E-3
EPS-DGN-FS-DG2A	DIESEL GENERATOR 2A FAILS TO START	2.89E-3
EPS-DGN-TM-DG0	DIESEL GENERATOR 0 UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-DGN-TM-DG1A	DIESEL GENERATOR 1A UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-DGN-TM-DG1B	DIESEL GENERATOR 1B UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-DGN-TM-DG2A	DIESEL GENERATOR 2A UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-XHE-XL-NR01H	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 1 HOUR	8.71E-1
EPS-XHE-XL-NR30M	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 30 MINUTES	9.18E-1
EPS-XHE-XR-DG1B	OPERATOR FAILS TO RESTORE DG1B AFTER MAINTENANCE	1.00E-3
FLAG-DG0-ALIGNED-AWAY	DG0 ALIGNED TO U1 INITIALLY	5.00E-1
HCS-CRB-OO-MDP	HCS MDP 4.1kV CBRKR FAILS TO CLOSE (PSA)	2.39E-3
HCS-FAN-TM-ROOM	HPCS ROOM COOLER FAN UNAVAILABLE DUE TO T&M	2.00E-3
HCS-MDP-TM-HPCS	HPCI TRAIN IS UNAVAILABLE BECAUSE OF MAINTENANCE	6.82E-3
HCS-MOV-FT-SUCTR	HPCS SUCTION TRANSFER FAILS	3.00E-3
HCS-XHE-XO-ERROR1	OPERATOR FAILS TO START/CONTROL HPCS INJECTION	1.44E-1
IE-LOOPSC	LOSS OF OFFSITE POWER INITIATOR (SWITCHYARD-CENTERED)	1.00E+0
LCI-MOV-CC-42B	LPCI INJECTION MOV 42B FAILS TO OPEN	9.63E-4
OEP-XHE-XL-NR12HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 12 HOURS (SWITCHYARD)	7.00E-3
PPR-SRV-OO-1VLV	ONE SRV FAILS TO CLOSE	2.20E-2
PPR-SRV-OO-2VLVS	TWO OR MORE SRVS FAIL TO CLOSE	3.50E-3
PPR-SRV-OO-3VLVS	THREE OR MORE SRVS FAIL TO CLOSE	1.54E-3
RCI-MOV-FC-XFER	RCIC FAILS TO TRANSFER DURING RECIRCULATION	7.97E-3
RCI-RESTART	RESTART OF RCIC IS REQUIRED	1.50E-1
RCI-TDP-FR-TRAIN	RCIC PUMP FAILS TO RUN GIVEN THAT IT STARTED	5.97E-3
RCI-TDP-FS-RSTRT	RCIC FAILS TO RESTART GIVEN START AND SHORT-TERM RUN	8.00E-2

RCI-TDP-FS-TRAIN	RCIC PUMP FAILS TO START	6.49E-3
RCI-TDP-TM-TRAIN	RCIC PUMP TRAIN IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.10E-2
RCI-XHE-XL-RSTRT	OPERATOR FAILS TO RECOVER RCIC FAILURE TO RESTART	2.50E-1
RCI-XHE-XL-XFER	OPERATOR FAILS TO RECOVER RCIC FAILURE TO TRANSFER	2.50E-1
RCI-XHE-XO-ERROR	OPERATOR FAILS TO START/CONTROL RCIC INJECTION	1.00E-3
RHR-FAN-FS-BC	RHR MDP 2B/2C ROOM COOLER FAN FAILS TO START	8.42E-4
RHR-FAN-TM-BC	RHR MDP 2B/2C ROOM COOLER FAN UNAVAILABLE DUE TO T&M	2.00E-3
RHR-HTX-TM-HTXB	RHR HTX-B IN MAINTENANCE (PSA)	2.36E-3
RHR-MDP-FS-2A	RHR TRAIN 2A FAILS TO START	9.47E-4
RHR-MDP-FS-2B	RESIDUAL HEAT REMOVAL MDP 2B FAILS TO START	9.47E-4
RHR-MDP-TM-2A	RHR MDP 2A IS UNAVAILABLE BECAUSE OF MAINTENANCE (PSA)	5.66E-3
RHR-MDP-TM-2B	RHR MDP 2B IS UNAVAILABLE BECAUSE OF MAINTENANCE (PSA)	5.66E-3
RHR-MOV-CC-F003A	RHR HTX A DISCHARGE MOV 3A FAILS TO OPEN	9.63E-4
RHR-MOV-CC-F003B	RHR HTX B DISCHARGE MOV 3B FAILS TO OPEN	9.63E-4
RHR-MOV-CC-MINFA	RHR TRAIN A MINFLOW MOV FAILS TO OPEN	9.63E-4
RHR-MOV-CC-MINFB	RHR TRAIN B MINFLOW LINE MOV FAILS TO OPEN	9.63E-4
RHR-MOV-OO-BYPSA	RHR LOOP A HTX BYPASS MOV 48A FAILS TO CLOSE	9.63E-4
RHR-MOV-OO-BYPSB	RHR LOOP B HTX BYPASS MOV 48B FAILS TO CLOSE	9.63E-4
RHR-XHE-XM-ERROR	OPERATOR FAILS TO START/CONTROL RHR	5.00E-4
RRS-MDP-LK-SEALS	RECIRCULATION PUMP SEALS FAIL	1.00E-1
SCW-MDP-FS-DG2A	STANDBY COOLING WATER MDP TO DG2A FAILS TO START	9.47E-4
SCW-MDP-TM-DG0	SCW PUMP TO DG0 IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.32E-2
SCW-MDP-TM-DG2A	SCW PUMP TO DG2A IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.32E-2
SCW-MDP-TM-DG2B	SCW PUMP TO DG2B IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.32E-2
SCW-MOV-CC-68A	RHR HTX A DISCHARGE ISOLATION VALVE 68A FAILS TO OPEN	9.63E-4
SCW-MOV-CC-68B	RHR HTX B DISCHARGE ISOLATION VALVE 68B FAILS TO OPEN	9.63E-4
SCW-MOV-TM-F068B	SCW MOV F068B IN MAINTENANCE (PSA)	1.30E-3
SCW-XHE-TM-RHRB	OPERATOR FAILS TO ALIGN THE TRAIN B AFTER TM (PRA)	1.00E-3

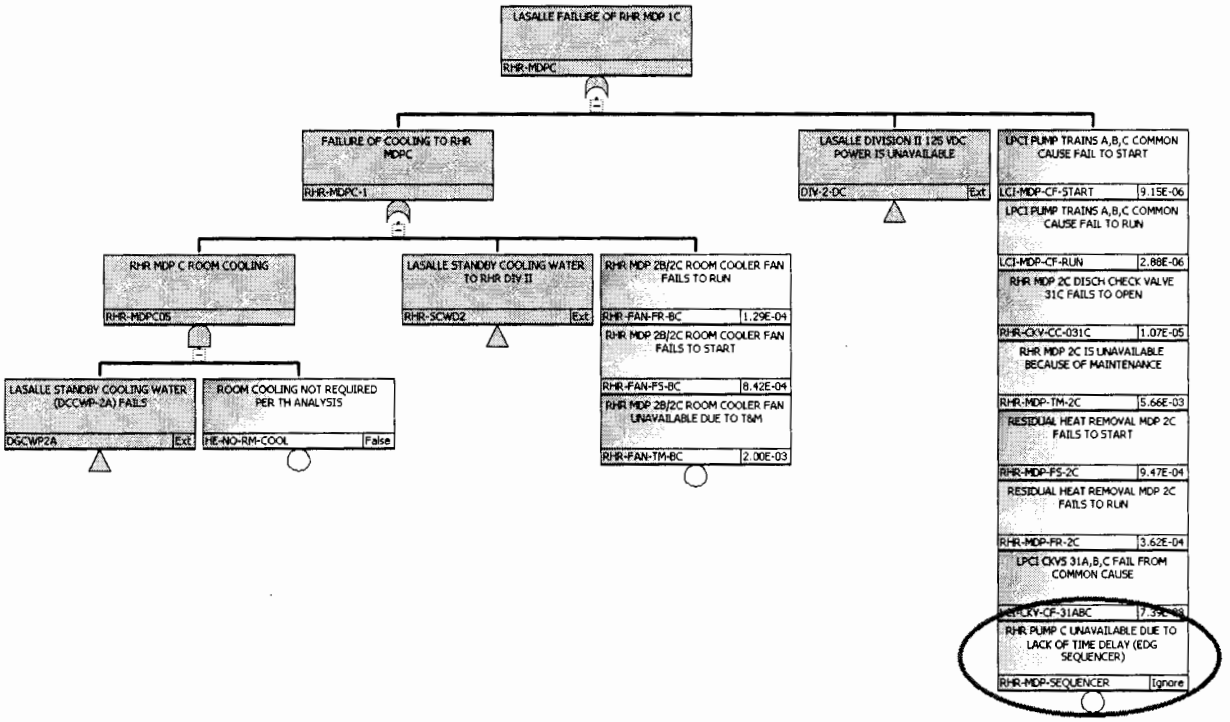
Swing Diesel Generator (DG0) Fault Tree Modification

The LaSalle swing Diesel Generator (DG0) fault tree was modified to account for design anomaly that appeared during this event. The swing diesel generator (one of five at the site) was not designed to supply both units simultaneously. The simultaneous starting logic from this LOOP event resulted in the DG0 loading onto both Units as explained in section 2.3 of this report. The Licensee's load analysis and the Site Inspection Team report, identified the diesel can supply both units, except in the event of a LOCA. The most limiting LOCA was determined to be one or more stuck open SRVs. The basic event EPS-DGN-DG0-LOCA was added to the DG0 Fault Tree and set to "ignore" as indicated in the chart below and invoked with a flag set and rule described in section 4.4 of this report to be set to "true" and fail the swing EDG when a failed SRV appears in a cutset.



RHR Pump 2C Fault Tree Modification

For Unit 2 only, the RHR Pump 2C fault tree was modified to account for the failure of the Unit 2 C RHR pump to start in response to a LOOP followed by an ESF Actuation as explained in detail in Section 2.2 of this report. The failure of the pump breaker to close was due to inadequate time for the breaker charging springs to recharge and not associated with any internal component of the pump. Thus, the pump was not failed in the model since this would result in additional common cause failure probability adjustments for similar pumps. Other RHR pumps were not affected thus the new basic event (RHR-MDP-SEQUENCER) was added to the fault tree to fail RHR Pump 2C and avoid common cause failure adjustments.



HRA Worksheets - SPAR-H Human Error Worksheet - Diagnosis

Plant: LaSalle Unit 2 Initiating Event: LOOP Basic Event: OEP-XHE-XL-NR04HSC

Basic Event Context: Evaluation of diagnosis/actions to recover with a postulated SBO

Basic Event Description: Operator Fails to Recover Offsite Power in 4 Hours

Does this task contain a significant amount of diagnosis activity? YES ☒ (start with Part I–Diagnosis) NO ☐ (skip Part I – Diagnosis; start with Part II – Action) Why? Complexity of the task considering conditions

Part I. Evaluate Each PSF for Diagnosis
A. Evaluate PSFs for the Diagnosis Portion of the Task, If Any.

PSFs	PSF Levels	Multiplier for Diagnosis	Note specific reasons for PSF level selection in this column.
Available Time	Inadequate time	P(failure) = 1.0 ☐	The operator would need less than 2 hours to diagnose this condition based upon indicators. This basic event allows for 4 hours and is thus greater than twice nominal and assigned "Expansive".
	Barely adequate time (≈2/3 x nominal)	10 ☐	
	Nominal time	1 ☐	
	Extra time (between 1 and 2 x nominal and > than 30 min)	0.1 ☐	
	Expansive time (> 2 x nominal and > 30 min)	0.01 ☒	
	Insufficient information	1 ☐	
Stress/ Stressors	Extreme	5 ☐	Due to a postulated Station Black Out (SBO) stress is assigned "High".
	High	2 ☒	
	Nominal	1 ☐	
	Insufficient Information	1 ☐	
Complexity	Highly complex	5 ☐	Due to multiple equipment unavailabilities requiring concurrent actions from multiple procedures during a SBO, assigned "Moderately Complex".
	Moderately complex	2 ☒	
	Nominal	1 ☐	
	Obvious diagnosis	0.1 ☐	
	Insufficient Information	1 ☐	
Experience/ Training	**Low**	10 ☒	Due to several operator knowledge weaknesses related to: RHR pump failure, LPCS failure, SRV operation and Swing EDG loading, identified in the SIT report (Reference 5.4), assigned value of "Low".
	Nominal	1 ☐	
	High	0.5 ☐	
	Insufficient Information	1 ☐	
Procedures	Not available	50 ☐	Operating Abnormal Procedure LOA-AP-201 for the AC Power System permits assignment of "Nominal".
	Incomplete	20 ☐	
	Available, but poor	5 ☐	
	Nominal	1 ☒	
	Diagnostic/symptom oriented	0.5 ☐	
	Insufficient Information	1 ☐	
Ergonomics / HMI	Missing/Misleading	50 ☐	No event information is available to warrant a change from Nominal for this Performance Shaping Factor (PSF).
	Poor	10 ☐	
	Nominal	1 ☐	
	Good	0.5 ☐	
	Insufficient Information	1 ☒	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	No event information is available to warrant a change from Nominal for this Performance Shaping Factor (PSF).
	Degraded Fitness	5 ☐	
	Nominal	1 ☐	
	Insufficient Information	1 ☒	
Work	Poor	2 ☐	

Processes	Nominal	1	☐	No event information is available to warrant a change from Nominal for this Performance Shaping Factor (PSF).
	Good	0.8	☐	
	Insufficient Information	1	☒	

SPAR-H HUMAN ERROR WORKSHEET - DIAGNOSIS

Plant: LaSalle Unit 2 Initiating Event: LOOP Basic Event: OEP-XHE-XL-NR04HSC

Basic Event Context: Evaluation of diagnosis/actions to recover with a postulated SBO

Basic Event Description: Operator Fails to Recover Offsite Power in 4 Hours

B. Calculate the Diagnosis Failure Probability.

(1) If all PSF ratings are nominal, then the Diagnosis Failure Probability = 1.0E-2

(2) Otherwise, the Diagnosis Failure Probability is the product of all the PSFs:

Diagnostic	Nominal	Time	Stress	Complexity	Exp/Trng	Procedure	Ergonomic	Fitness	Process es	Diag HEP
	1E-2	1E-2	2	2	1E1	1	1	1	1	4E-3
		Diagnostic PSF Composite = 4E-1								

3 or more negative PSF present? ☐ No, ☒ Yes, Calculate Adjustment Factor

C. Calculate the Adjustment Factor IF Negative Multiple (≥3) PSFs are Present.

When 3 or more negative PSF influences are present, in lieu of the equation above, you must compute a composite PSF score used in conjunction with the adjustment factor. Negative PSFs are present anytime a multiplier greater than 1 is selected. The Nominal HEP (NHEP) is 1.0E-2 for Diagnosis. The composite PSF score is computed by multiplying all the assigned PSF values. Then the adjustment factor below is applied to compute the HEP:

$$HEP = \frac{NHEP \cdot PSF_{composite}}{NHEP \cdot (PSF_{composite} - 1) + 1}$$ **= (1E-2 x 4E-1) / { [1E-2 x (4E-1 – 1)] + 1 } = 4.02E-3**

Diagnosis HEP with Adjustment Factor = 4.0E-3

D. Record Final Diagnosis HEP.

If no adjustment factor was applied, record the value from Part B as your final diagnosis HEP. If an adjustment factor was applied, record the value from Part C.

Final Diagnosis HEP = **4.0E-3**

SPAR-H HUMAN ERROR WORKSHEET - ACTION

Plant: LaSalle Unit 2 Initiating Event: LOOP Basic Event: OEP-XHE-XL-NR04HSC

Basic Event Context: Evaluation of diagnosis/actions to recover with a postulated SBO

Basic Event Description: Operator Fails to Recover Offsite Power in 4 Hours

Part II. EVALUATE EACH PSF FOR ACTION

A. Evaluate PSFs for the Action Portion of the Task, If Any.

PSFs	PSF Levels	Multiplier for Action	Note specific reasons for PSF level selection in this column.
Available Time	Inadequate time	P(failure) = 1.0 ☐	Sufficient time was available for the 2 hour action component of the recovery but not 5 times for the higher PSF and assigned "nominal".
	Time available is ≈ the time required	10 ☐	
	Nominal time	1 ☒	
	Time available ≥ 5x the time required	0.1 ☐	
	Time available is ≥ 50x the time required	0.01 ☐	
	Insufficient Information	1 ☐	
Stress/ Stressors	Extreme	5 ☐	The PSF was not determined to be a performance driver and assigned "nominal".
	High	2 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Complexity	Highly complex	5 ☐	The PSF was not determined to be a performance driver and assigned "nominal".
	Moderately complex	2 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Experience/ Training	Low	3 ☒	Due to several operator knowledge gaps related to: RHR pump failure, LPCS failure, SRV operation and Swing EDG loading, identified in the SIT report, assigned value of "Low".
	Nominal	1 ☐	
	High	0.5 ☐	
	Insufficient Information	1 ☐	
Procedures	Not available	50 ☐	The PSF was not determined to be a performance driver and assigned "nominal".
	Incomplete	20 ☐	
	Available, but poor	5 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Ergonomics / HMI	Missing/Misleading	50 ☐	The PSF was not determined to be a performance driver and assigned "nominal".
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
	Insufficient Information	1 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0 ☐	The PSF was not determined to be a performance driver and assigned "nominal".
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Work Processes	Poor	5 ☐	The PSF was not determined to be a performance driver and assigned "nominal".
	Nominal	1 ☒	
	Good	0.5 ☐	
	Insufficient Information	1 ☐	

SPAR-H HUMAN ERROR WORKSHEET - ACTION

Plant: LaSalle Unit 2 Initiating Event: LOOP Basic Event: OEP-XHE-XL-NR04HSC

Basic Event Context: Evaluation of diagnosis/actions to recover with a postulated SBO

Basic Event Description: Operator Fails to Recover Offsite Power in 4 Hours

---

B. Calculate the Action Failure Probability.

(1) If all PSF ratings are nominal, then the Action Failure Probability = 1.0E-3
(2) Otherwise, the Action Failure Probability is:

Action	Nominal	Time	Stress	Complexity	Exp/Trng	Procedure	Ergonomic	Fitness	Processes	Action HEP
	1E-3	1	1	1	3	1	1	1	1	3E-3
		Action PSF Composite = 3								

3 or more negative PSF present? ☒ No, ☐ Yes, Calculate Adjustment Factor

C. Calculate the Adjustment Factor IF Negative Multiple (≥3) PSFs are Present.

When 3 or more negative PSF influences are present, in lieu of the equation above, you must compute a composite PSF score used in conjunction with the adjustment factor. Negative PSFs are present anytime a multiplier greater than 1 is selected. The Nominal HEP (NHEP) is 1.0E-3 for Action. The composite PSF score is computed by multiplying all the assigned PSF values. Then the adjustment factor below is applied to compute the HEP:

$$HEP = \frac{NHEP \cdot PSF_{composite}}{NHEP \cdot \left(PSF_{composite} - 1\right) + 1}$$

Action HEP with Adjustment Factor = N/A

D. Record Final Action HEP.

If no adjustment factor was applied, record the value from Part B as your final action HEP. If an adjustment factor was applied, record the value from Part C.

Final Action HEP = **3.0E-3**

SPAR-H HUMAN ERROR WORKSHEET

Plant: LaSalle Unit 2 Initiating Event: LOOP Basic Event: OEP-XHE-XL-NR04HSC

Basic Event Context: Evaluation of diagnosis/actions to recover with a postulated SBO

Basic Event Description: Operator Fails to Recover Offsite Power in 4 Hours

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PART III. CALCULATE TASK FAILURE PROBABILITY WITHOUT FORMAL DEPENDENCE ($P_{W/OD}$)

Calculate the Task Failure Probability Without Formal Dependence ($P_{w/od}$) by adding the Diagnosis Failure Probability from Part I and the Action Failure Probability from Part II. In instances where an action is required without a diagnosis and there is no dependency, then this step is omitted.

$P_{w/od}$ = Diagnosis HEP 4.0E-3 + Action HEP 3.0E-3 = **7.0E-3**

Part IV. DEPENDENCY

For all tasks, except the first task in the sequence, use the table and formulae below to calculate the Task Failure Probability With Formal Dependence ($P_{w/d}$). If there is a reason why failure on previous tasks should not be considered, such as it is impossible to take the current action unless the previous action has been properly performed, explain here: Dependency is not considered for this single basic event

Final Basic Event HEP for OEP-XHE-XL-NR04HSC, $P_{w/od} = P_{w/d} = 7.0E-3$

HRA Worksheets

SPAR-H HUMAN ERROR WORKSHEET

Plant: LaSalle Unit 2 Initiating Event: LOOP Basic Event: OEP-XHE-XL-NR07HSC

Basic Event Context: Evaluation of diagnosis/actions to recover with a postulated SBO

Basic Event Description: Operator Fails to Recover Offsite Power in 7 Hours

This HRA analysis for an operator recover in 7 hours from a postulated SBO is identical to the 4 hour recovery basic event OEP-XHE-XL-NR04HSC, since the additional time will not affect any performance shaping factors.

Final Basic Event HEP for OEP-XHE-XL-NR07HSC, $P_{w/od}$ = $P_{w/d}$ = 7.0E-3

SPAR-H HUMAN ERROR WORKSHEET

Plant: LaSalle Unit 2 Initiating Event: LOOP Basic Event: OEP-XHE-XL-NR012HSC

Basic Event Context: Evaluation of diagnosis/actions to recover with a postulated SBO

Basic Event Description: Operator Fails to Recover Offsite Power in 12 Hours

This HRA analysis for an operator recover in 12 hours from a postulated SBO is identical to the 4 hour recovery basic event OEP-XHE-XL-NR04HSC, since the additional time will not affect any performance shaping factors.

Final Basic Event HEP for OEP-XHE-XL-NR012HSC, $P_{w/od}$ = $P_{w/d}$ = 7.0E-3

LaSalle Unit 1
SAPHIRE Analysis Report

Initiating Event	IE-LOOPSC
CCDP	1.25E-5

Summary of Conditional Event Changes

Event	Description	Cond Value	Nominal Value
IE-LOOPSC	LOSS OF OFFSITE POWER INITIATOR (SWITCHYARD- CENTERED)	1.00E+0	1.04E-2
OEP-VCF-LP-SITESC	SITE LOOP (SWITCHYARD-RELATED)	True	2.11E-1
OEP-VCF-LP-SNGLSC	SINGLE UNIT LOOP (SWITCHYARD-RELATED)	False	8.06E-1
OEP-XHE-XL-NR01HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 1 HOUR (SWITCHYARD)	True	4.01E-1
OEP-XHE-XL-NR04HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 4 HOURS (SWITCHYARD)	7.00E-3	1.02E-1
OEP-XHE-XL-NR07HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 7 HOURS (SWITCHYARD)	7.00E-3	4.65E-2
OEP-XHE-XL-NR12HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 12 HOURS (SWITCHYARD)	7.00E-3	1.90E-2
OEP-XHE-XL-NR30MSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 30 MINUTES (SWITCHYARD)	True	6.02E-1
PPR-SRV-OO-1VLV	ONE SRV FAILS TO CLOSE	2.20E-2	8.56E-4
ZT-BWR-SRV-OO-P1	BWR ADS/SRV Fails To Reclose	2.20E-2	8.56E-4
ZT-DGN-FR-L	Diesel Generator Fails To Run	1.09E-3	2.47E-2
ZT-TDP-FR-L	Turbine Driven Pump Fails To Run	1.56E-3	3.52E-2
PPR-SRV-OO-2VLVS	TWO OR MORE SRVS FAIL TO CLOSE	3.50E-3	1.36E-4
PPR-SRV-OO-3VLVS	THREE OR MORE SRVS FAIL TO CLOSE	1.54E-3	5.50E-5
EPS-DGN-FR-DG0	DIESEL GENERATOR 0 FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG2A	DIESEL GENERATOR 2A FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG2B	DIESEL GENERATOR 2B FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG1A	DIESEL GENERATOR 1A FAILS TO RUN	6.61E-3	3.01E-2
EPS-DGN-FR-DG1B	DIESEL GENERATOR 1B FAILS TO RUN	6.61E-3	3.01E-2
ZT-BWR-SRV-OO-P2	BWR TWO ADS/SRVS FAIL TO RECLOSE	3.50E-3	1.36E-4
ZT-BWR-SRV-OO-P3	BWR THREE OR MORE ADS/SRVS FAIL TO RECLOSE	1.54E-3	5.50E-5
RCI-TDP-FR-TRAIN	RCIC PUMP FAILS TO RUN GIVEN THAT IT STARTED	5.97E-3	3.95E-2

Dominant Sequence Results

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

Sequence	%	Description
43-34-09	29.1%	/RPS, EPS, P2, HCS-SBO, /RCI-SBO, OPR-01H, DGR-01H
43-31	19.7%	/RPS, EPS, /SRV, /RPSL, HCS-SBO, RCI-SBO, OPR-30M, DGR-30M
07	12.2%	/RPS, /EPS, /SRV, /HCS, SPC, /DEP, SDC, CSS, CVS, LI-VENT-FAILURE

Sequence	%	Description
42-13	9.9%	/RPS, /EPS, P2, HCS, LPI
43-33-15	7.1%	/RPS, EPS, P1, HCS-SBO, RCI-SBO
40	6.8%	/RPS, /EPS, /SRV, HCS, RCI, DEP
42-12	4.4%	/RPS, /EPS, P2, HCS, /LPI, SPC, CSS, CVS, LI-VENT-FAILURE
43-32-15	2.1%	/RPS, EPS, /SRV, RPSL, HCS-SBO, RCI-SBO
43-34-10	1.6%	/RPS, EPS, P2, HCS-SBO, RCI-SBO
31	1.1%	/RPS, /EPS, /SRV, HCS, RCI, /DEP, /LPI, SPC, SDC, CSS, CVS, LI-VENT-FAILURE
	100.0%	

Referenced Fault Trees

Fault Tree	Description
CSS	CONTAINMENT SPRAY
CVS	CONTAINMENT VENTING
DEP	MANUAL REACTOR DEPRESS
DGR-01H	DIESEL GENERATOR RECOVERY (1 HOUR)
DGR-30M	DIESEL GENERATOR RECOVERY (30 MINUTES)
EPS	EMERGENCY POWER
HCS	HPCS
HCS-SBO	HPCS
LI-VENT-FAILURE	LATE INJECTION FOLLOWING VENTILATION FAILURE
LPI	LOW PRESSURE INJECTION
OPR-01H	OFFSITE POWER RECOVERY (1 HOUR)
OPR-30M	OFFSITE POWER RECOVERY (30 MINUTES)
P1	ONE SORV
P2	TWO OR MORE SORVs
RCI	RCIC
RCI-SBO	RCIC FAILS DURING STATION BLACKOUT
RPSL	RECIRC PUMP SEAL INTEGRITY
SDC	SHUTDOWN COOLING
SPC	SUPPRESSION POOL COOLING

Cut Set Report - LOOPSC 43-34-09
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	3.64E-6	100	Displaying 2104 Cut Sets. (2104 Original)
1	6.28E-7	17.26	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
2	2.89E-7	7.95	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
3	2.89E-7	7.95	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
4	2.76E-7	7.57	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS

#	CCDP	Total %	Cut Set
5	2.67E-7	7.33	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
6	1.33E-7	3.66	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
7	1.27E-7	3.49	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
8	1.27E-7	3.49	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
9	1.27E-7	3.48	IE-LOOPSC,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
10	1.27E-7	3.48	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
11	1.17E-7	3.22	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS,SCW-MDP-TM-DG2A
12	1.17E-7	3.21	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
13	5.85E-8	1.61	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
14	5.83E-8	1.60	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-FS-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
15	5.83E-8	1.60	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FS-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS
16	5.55E-8	1.53	IE-LOOPSC,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
17	5.55E-8	1.53	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS
18	5.12E-8	1.41	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-3VLVS,SCW-MDP-TM-DG2A
19	4.38E-8	1.20	IE-LOOPSC,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR01H,EPS-XHE-XR-DG1B,PPR-SRV-OO-2VLVS
20	4.15E-8	1.14	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS,SCW-MDP-FS-DG2A
21	4.04E-8	1.11	IE-LOOPSC,EPS-XHE-XL-NR01H,EPS-XHE-XR-DG1B,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
22	3.96E-8	1.09	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR01H,PPR-SRV-OO-2VLVS

Cut Set Report - LOOPSC 43-31

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

#	CCDP	Total %	Cut Set
	2.46E-6	100	Displaying 30480 Cut Sets. (30480 Original)
1	2.38E-7	9.68	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M
2	1.30E-7	5.30	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-TDP-TM-TRAIN
3	8.72E-8	3.54	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M
4	7.74E-8	3.14	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-TDP-FS-TRAIN
5	7.11E-8	2.89	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-TDP-FR-TRAIN

#	CCDP	Total %	Cut Set
6	4.77E-8	1.94	IE-LOOPSC,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M,RCI-TDP-TM-TRAIN
7	4.25E-8	1.73	IE-LOOPSC,DCP-BAT-CF-ALL,EPS-XHE-XL-NR30M
8	3.57E-8	1.45	IE-LOOPSC,EPS-DGN-CF-R4,EPS-XHE-XL-NR30M,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
9	2.83E-8	1.15	IE-LOOPSC,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M,RCI-TDP-FS-TRAIN
10	2.60E-8	1.06	IE-LOOPSC,EPS-DGN-CF-S4,EPS-XHE-XL-NR30M,RCI-TDP-FR-TRAIN
11	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG0,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M
12	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1A,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M
13	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG0,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M
14	2.50E-8	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG1A,EPS-DGN-TM-DG2A,EPS-XHE-XL-NR30M

Cut Set Report - LOOPSC 07
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	1.52E-6	100	Displaying 30157 Cut Sets. (30157 Original)
1	6.45E-8	4.23	IE-LOOPSC,CRD-XHE-XM-PUMP,CTM-DW-BODY-FAILURE,CVS-MOV-TM-PURGE,RHR-XHE-XM-ERROR
2	4.89E-8	3.21	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG0,OEP-XHE-XL-NR12HSC,RHR-MDP-TM-2B
3	2.24E-8	1.47	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,SCW-MOV-TM-F068B
4	2.15E-8	1.41	IE-LOOPSC,CRD-XHE-XM-PUMP,CTM-DW-BODY-FAILURE,CVS-XHE-XM-VENT,RHR-XHE-XM-ERROR
5	2.03E-8	1.33	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG0,OEP-XHE-XL-NR12HSC,RHR-HTX-TM-HTXB
6	1.88E-8	1.23	IE-LOOPSC,CTM-DW-BODY-FAILURE,OEP-XHE-XL-NR12HSC,RHR-HTX-TM-HTXB,SCW-MDP-TM-DG0
7	1.73E-8	1.13	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG0,OEP-XHE-XL-NR12HSC,RHR-FAN-TM-BC
8	1.72E-8	1.13	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,SCW-XHE-TM-RHRB
9	1.70E-8	1.12	IE-LOOPSC,ACP-XHE-XM-DG0,CTM-DW-BODY-FAILURE,FLAG-DG0-ALIGNED-AWAY,OEP-XHE-XL-NR12HSC,RHR-MDP-TM-2B
10	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-MINFB
11	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,SCW-MOV-CC-68B
12	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-F003B
13	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MOV-OO-BYPSB
14	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,SCW-MOV-CC-68A

#	CCDP	Total %	Cut Set
15	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-MINFA
16	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MOV-CC-F003A
17	1.66E-8	1.09	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MOV-OO-BYPSA
18	1.63E-8	1.07	IE-LOOPSC,ACP-BAC-TM-241Y,CTM-DW-BODY-FAILURE,RHR-MDP-FS-2B
19	1.63E-8	1.07	IE-LOOPSC,ACP-BAC-TM-242Y,CTM-DW-BODY-FAILURE,RHR-MDP-FS-2A
20	1.62E-8	1.06	IE-LOOPSC,ACP-BAC-LP-241Y,CTM-DW-BODY-FAILURE,RHR-MDP-TM-2B
21	1.62E-8	1.06	IE-LOOPSC,ACP-BAC-LP-242Y,CTM-DW-BODY-FAILURE,RHR-MDP-TM-2A
22	1.59E-8	1.05	IE-LOOPSC,CTM-DW-BODY-FAILURE,OEP-XHE-XL-NR12HSC,RHR-FAN-TM-BC,SCW-MDP-TM-DG0

Cut Set Report - LOOPSC 42-13
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	1.24E-6	100	Displaying 3409 Cut Sets. (3409 Original)
1	1.00E-7	8.08	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC
2	9.27E-8	7.45	IE-LOOPSC,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC,SCW-MDP-TM-DG2B
3	5.02E-8	4.04	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,SCW-XHE-TM-RHRB
4	4.77E-8	3.84	IE-LOOPSC,HCS-MDP-TM-HPCS,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC
5	4.63E-8	3.73	IE-LOOPSC,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2B,SCW-XHE-TM-RHRB
6	4.41E-8	3.55	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS,RHR-FAN-TM-BC
7	4.23E-8	3.40	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-FAN-FS-BC
8	4.07E-8	3.27	IE-LOOPSC,PPR-SRV-OO-3VLVS,RHR-FAN-TM-BC,SCW-MDP-TM-DG2B
9	3.90E-8	3.14	IE-LOOPSC,PPR-SRV-OO-2VLVS,RHR-FAN-FS-BC,SCW-MDP-TM-DG2B
10	2.39E-8	1.92	IE-LOOPSC,HCS-MDP-TM-HPCS,PPR-SRV-OO-2VLVS,SCW-XHE-TM-RHRB
11	2.21E-8	1.77	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS,SCW-XHE-TM-RHRB
12	2.10E-8	1.69	IE-LOOPSC,HCS-MOV-FT-SUCTR,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC
13	2.10E-8	1.68	IE-LOOPSC,HCS-MDP-TM-HPCS,PPR-SRV-OO-3VLVS,RHR-FAN-TM-BC
14	2.03E-8	1.64	IE-LOOPSC,PPR-SRV-OO-3VLVS,SCW-MDP-TM-DG2B,SCW-XHE-TM-RHRB
15	2.02E-8	1.63	IE-LOOPSC,EPS-DGN-FS-DG1B,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC

#	CCDP	Total %	Cut Set
16	2.01E-8	1.62	IE-LOOPSC,HCS-MDP-TM-HPCS,PPR-SRV-OO-2VLVS,RHR-FAN-FS-BC
17	1.86E-8	1.49	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS,RHR-FAN-FS-BC
18	1.71E-8	1.38	IE-LOOPSC,PPR-SRV-OO-3VLVS,RHR-FAN-FS-BC,SCW-MDP-TM-DG2B
19	1.67E-8	1.35	IE-LOOPSC,HCS-CRB-OO-MDP,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC
20	1.51E-8	1.21	IE-LOOPSC,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,SCW-STR-TM-TRNB
21	1.40E-8	1.13	IE-LOOPSC,HCS-FAN-TM-ROOM,PPR-SRV-OO-2VLVS,RHR-FAN-TM-BC
22	1.39E-8	1.12	IE-LOOPSC,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2B,SCW-STR-TM-TRNB

Cut Set Report - LOOPSC 43-33-15
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	8.89E-7	100	Displaying 6347 Cut Sets. (6347 Original)
1	9.06E-8	10.20	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV
2	4.17E-8	4.70	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV
3	4.17E-8	4.70	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV
4	3.85E-8	4.33	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,SCW-MDP-TM-DG2A
5	2.94E-8	3.31	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FS-TRAIN
6	2.70E-8	3.04	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN
7	2.28E-8	2.57	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN
8	2.11E-8	2.37	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN,SCW-MDP-TM-DG2A
9	1.92E-8	2.16	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,PPR-SRV-OO-1VLV
10	1.83E-8	2.05	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV
11	1.83E-8	2.05	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV
12	1.68E-8	1.90	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,PPR-SRV-OO-1VLV,SCW-MDP-TM-DG2A
13	1.36E-8	1.53	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
14	1.35E-8	1.52	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FS-TRAIN
15	1.35E-8	1.52	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FS-TRAIN
16	1.25E-8	1.41	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FS-

#	CCDP	Total %	Cut Set
			TRAIN,SCW-MDP-TM-DG2A
17	1.25E-8	1.40	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN
18	1.25E-8	1.40	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN
19	1.15E-8	1.29	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-FR-TRAIN,SCW-MDP-TM-DG2A
20	1.05E-8	1.18	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN
21	9.99E-9	1.12	IE-LOOPSC,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN
22	9.22E-9	1.04	IE-LOOPSC,EPS-DGN-FS-DG1B,PPR-SRV-OO-1VLV,RCI-TDP-TM-TRAIN,SCW-MDP-TM-DG2A
23	9.02E-9	1.02	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-1VLV,RCI-MOV-FC-XFER,RCI-XHE-XL-XFER

Cut Set Report - LOOPSC 40
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	8.57E-7	100	Displaying 5616 Cut Sets. (5616 Original)
1	7.19E-8	8.38	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-XHE-XO-ERROR1,RCI-XHE-XO-ERROR
2	4.66E-8	5.44	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-TDP-FS-TRAIN
3	4.30E-8	5.01	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-TDP-FS-TRAIN,SCW-MDP-TM-DG2B
4	4.28E-8	5.00	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-TDP-FR-TRAIN
5	3.95E-8	4.61	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-TDP-FR-TRAIN,SCW-MDP-TM-DG2B
6	3.62E-8	4.22	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-TDP-TM-TRAIN
7	2.21E-8	2.58	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MDP-TM-HPCS,RCI-TDP-FS-TRAIN
8	2.15E-8	2.51	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
9	2.15E-8	2.50	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-TDP-FS-TRAIN
10	2.04E-8	2.37	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MDP-TM-HPCS,RCI-TDP-FR-TRAIN
11	1.99E-8	2.32	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT,SCW-MDP-TM-DG2B
12	1.97E-8	2.30	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-TDP-FR-TRAIN
13	1.64E-8	1.92	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MOV-FT-SUCTR,RCI-TDP-TM-TRAIN
14	1.58E-8	1.85	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FS-DG1B,RCI-TDP-TM-

#	CCDP	Total %	Cut Set
			TRAIN
15	1.43E-8	1.67	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-TM-DG1B,RCI-MOV-FC-XFER,RCI-XHE-XL-XFER
16	1.32E-8	1.54	IE-LOOPSC,ADS-XHE-XM-MDEPR,RCI-MOV-FC-XFER,RCI-XHE-XL-XFER,SCW-MDP-TM-DG2B
17	1.31E-8	1.53	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-CRB-OO-MDP,RCI-TDP-TM-TRAIN
18	1.10E-8	1.28	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-FAN-TM-ROOM,RCI-TDP-TM-TRAIN
19	1.02E-8	1.19	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MDP-TM-HPCS,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
20	9.91E-9	1.16	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FR-DG1B,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
21	9.74E-9	1.14	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MOV-FT-SUCTR,RCI-TDP-FS-TRAIN
22	9.39E-9	1.09	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FS-DG1B,RCI-TDP-FS-TRAIN
23	8.95E-9	1.04	IE-LOOPSC,ADS-XHE-XM-MDEPR,HCS-MOV-FT-SUCTR,RCI-TDP-FR-TRAIN
24	8.63E-9	1.01	IE-LOOPSC,ADS-XHE-XM-MDEPR,EPS-DGN-FS-DG1B,RCI-TDP-FR-TRAIN

Cut Set Report - LOOPSC 42-12
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	5.49E-7	100	Displaying 14851 Cut Sets. (14851 Original)
1	2.45E-8	4.46	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
2	2.26E-8	4.11	IE-LOOPSC,CTM-DW-BODY-FAILURE,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B,SCW-MDP-TM-DG2B
3	1.16E-8	2.12	IE-LOOPSC,CTM-DW-BODY-FAILURE,HCS-MDP-TM-HPCS,PPR-SRV-OO-2VLVS,RHR-MDP-TM-2B
4	1.07E-8	1.96	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS,RHR-MDP-TM-2B
5	1.02E-8	1.85	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RHR-HTX-TM-HTXB
6	9.90E-9	1.81	IE-LOOPSC,CTM-DW-BODY-FAILURE,PPR-SRV-OO-3VLVS,RHR-MDP-TM-2B,SCW-MDP-TM-DG2B
7	9.39E-9	1.71	IE-LOOPSC,CTM-DW-BODY-FAILURE,PPR-SRV-OO-2VLVS,RHR-HTX-TM-HTXB,SCW-MDP-TM-DG2B
8	5.62E-9	1.02	IE-LOOPSC,CTM-DW-BODY-FAILURE,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,SCW-MOV-TM-F068B

Cut Set Report - LOOPSC 43-32-15
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	2.67E-7	100	Displaying 13464 Cut Sets. (13464 Original)

#	CCDP	Total %	Cut Set
1	2.60E-8	9.72	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-R4,RRS-MDP-LK-SEALS
2	1.42E-8	5.32	IE-LOOPSC,EPS-DGN-CF-R4,RCI-TDP-TM-TRAIN,RRS-MDP-LK-SEALS
3	9.50E-9	3.56	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-CF-S4,RRS-MDP-LK-SEALS
4	8.43E-9	3.16	IE-LOOPSC,EPS-DGN-CF-R4,RCI-TDP-FS-TRAIN,RRS-MDP-LK-SEALS
5	7.75E-9	2.90	IE-LOOPSC,EPS-DGN-CF-R4,RCI-TDP-FR-TRAIN,RRS-MDP-LK-SEALS
6	5.20E-9	1.95	IE-LOOPSC,EPS-DGN-CF-S4,RCI-TDP-TM-TRAIN,RRS-MDP-LK-SEALS
7	4.63E-9	1.73	IE-LOOPSC,DCP-BAT-CF-ALL,RRS-MDP-LK-SEALS
8	3.89E-9	1.46	IE-LOOPSC,EPS-DGN-CF-R4,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT,RRS-MDP-LK-SEALS
9	3.08E-9	1.15	IE-LOOPSC,EPS-DGN-CF-S4,RCI-TDP-FS-TRAIN,RRS-MDP-LK-SEALS
10	2.84E-9	1.06	IE-LOOPSC,EPS-DGN-CF-S4,RCI-TDP-FR-TRAIN,RRS-MDP-LK-SEALS
11	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1A,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS
12	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG0,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS
13	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG0,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS
14	2.72E-9	1.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG1A,EPS-DGN-TM-DG2A,RRS-MDP-LK-SEALS

Cut Set Report - LOOPSC 43-34-10
Only items contributing at least 1% to the total are displayed.

#	CCDP	Total %	Cut Set
	2.03E-7	100	Displaying 6784 Cut Sets. (6784 Original)
1	1.44E-8	7.10	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS
2	6.64E-9	3.27	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS
3	6.64E-9	3.27	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS
4	6.33E-9	3.12	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-3VLVS
5	6.13E-9	3.02	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
6	4.68E-9	2.30	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-FS-TRAIN
7	4.30E-9	2.12	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-FR-TRAIN
8	3.64E-9	1.79	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-TM-TRAIN
9	3.35E-9	1.65	IE-LOOPSC,EPS-DGN-FR-DG1B,PPR-SRV-OO-2VLVS,RCI-TDP-TM-TRAIN,SCW-MDP-TM-DG2A
10	3.06E-9	1.51	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-FR-DG2A,PPR-SRV-OO-2VLVS

#	CCDP	Total %	Cut Set
11	2.91E-9	1.44	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-3VLVS
12	2.91E-9	1.44	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-3VLVS
13	2.90E-9	1.43	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS
14	2.90E-9	1.43	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS
15	2.69E-9	1.32	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FR-DG1B,PPR-SRV-OO-3VLVS,SCW-MDP-TM-DG2A
16	2.68E-9	1.32	IE-LOOPSC,DCP-XHE-XM-STRIP30M,EPS-DGN-FS-DG1B,PPR-SRV-OO-2VLVS,SCW-MDP-TM-DG2A
17	2.16E-9	1.06	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-RESTART,RCI-TDP-FS-RSTRT,RCI-XHE-XL-RSTRT
18	2.16E-9	1.06	IE-LOOPSC,EPS-DGN-FR-DG2A,EPS-DGN-TM-DG1B,PPR-SRV-OO-2VLVS,RCI-TDP-FS-TRAIN
19	2.16E-9	1.06	IE-LOOPSC,EPS-DGN-FR-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-2VLVS,RCI-TDP-FS-TRAIN
20	2.05E-9	1.01	IE-LOOPSC,EPS-DGN-TM-DG1B,EPS-DGN-TM-DG2A,PPR-SRV-OO-3VLVS,RCI-TDP-FS-TRAIN

Referenced Events

Event	Description	Probability
ACP-BAC-LP-241Y	4160 V BUS 241Y HARDWARE FAILURES	3.33E-5
ACP-BAC-LP-242Y	4160 V BUS 242Y HARDWARE FAILURES	3.33E-5
ACP-BAC-TM-241Y	4160 V BUS 241Y IN MAINTENANCE (PSA)	2.00E-4
ACP-BAC-TM-242Y	4160 V BUS 242Y IN MAINTENANCE (PSA)	2.00E-4
ACP-XHE-XM-DG0	OPERATOR FAILS TO ALIGN DG0 TO DIV-1 BUS 241Y	1.00E-2
ADS-XHE-XM-MDEPR	OPERATOR FAILS TO DEPRESSURIZE THE REACTOR	5.00E-4
CRD-XHE-XM-PUMP	OPERATOR FAILS TO START THE STANDBY PUMP	5.00E-1
CTM-DW-BODY-FAILURE	CATASTROPHIC CONTAINMANT DW BODY FAILURE CAUSES LOSS OF INJECTION	8.60E-2
CVS-MOV-TM-PURGE	CONTAINMENT VENT/PURGE SYSTEM IN MAINTENANCE (PSA)	3.00E-3
CVS-XHE-XM-VENT	OPERATOR FAILS TO VENT CONTAINMENT	1.00E-3
DCP-BAT-CF-ALL	CCF OF 125VDC BATTERYS (3)	4.63E-8
DCP-XHE-XM-STRIP30M	OPERATOR FAILS TO SHED 125 VDC NON-ESSENTIAL LOADS	2.00E-2
EPS-DGN-CF-R4	CCF OF FOUR DIESEL GENERATORS TO RUN	1.30E-5
EPS-DGN-CF-S4	CCF OF ALL FOUR DIESEL GENERATORS TO START	4.75E-6
EPS-DGN-FR-DG0	DIESEL GENERATOR 0 FAILS TO RUN	6.61E-3
EPS-DGN-FR-DG1A	DIESEL GENERATOR 1A FAILS TO RUN	6.61E-3
EPS-DGN-FR-DG1B	DIESEL GENERATOR 1B FAILS TO RUN	6.61E-3
EPS-DGN-FR-DG2A	DIESEL GENERATOR 2A FAILS TO RUN	6.61E-3
EPS-DGN-FS-DG1B	DIESEL GENERATOR 1B FAILS TO START	2.89E-3

EPS-DGN-FS-DG2A	DIESEL GENERATOR 2A FAILS TO START	2.89E-3
EPS-DGN-TM-DG0	DIESEL GENERATOR 0 UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-DGN-TM-DG1A	DIESEL GENERATOR 1A UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-DGN-TM-DG1B	DIESEL GENERATOR 1B UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-DGN-TM-DG2A	DIESEL GENERATOR 2A UNAVAILABLE DUE TO TEST AND MAINTENANCE	1.43E-2
EPS-XHE-XL-NR01H	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 1 HOUR	8.71E-1
EPS-XHE-XL-NR30M	OPERATOR FAILS TO RECOVER EMERGENCY DIESEL IN 30 MINUTES	9.18E-1
EPS-XHE-XR-DG1B	OPERATOR FAILS TO RESTORE DG1B AFTER MAINTENANCE	1.00E-3
FLAG-DG0-ALIGNED-AWAY	DG0 ALIGNED TO U1 INITIALLY	5.00E-1
HCS-CRB-OO-MDP	HCS MDP 4.1kV CBRKR FAILS TO CLOSE (PSA)	2.39E-3
HCS-FAN-TM-ROOM	HPCS ROOM COOLER FAN UNAVAILABLE DUE TO T&M	2.00E-3
HCS-MDP-TM-HPCS	HPCI TRAIN IS UNAVAILABLE BECAUSE OF MAINTENANCE	6.82E-3
HCS-MOV-FT-SUCTR	HPCS SUCTION TRANSFER FAILS	3.00E-3
HCS-XHE-XO-ERROR1	OPERATOR FAILS TO START/CONTROL HPCS INJECTION	1.44E-1
IE-LOOPSC	LOSS OF OFFSITE POWER INITIATOR (SWITCHYARD-CENTERED)	1.00E+0
OEP-XHE-XL-NR12HSC	OPERATOR FAILS TO RECOVER OFFSITE POWER IN 12 HOURS (SWITCHYARD)	7.00E-3
PPR-SRV-OO-1VLV	ONE SRV FAILS TO CLOSE	2.20E-2
PPR-SRV-OO-2VLVS	TWO OR MORE SRVS FAIL TO CLOSE	3.50E-3
PPR-SRV-OO-3VLVS	THREE OR MORE SRVS FAIL TO CLOSE	1.54E-3
RCI-MOV-FC-XFER	RCIC FAILS TO TRANSFER DURING RECIRCULATION	7.97E-3
RCI-RESTART	RESTART OF RCIC IS REQUIRED	1.50E-1
RCI-TDP-FR-TRAIN	RCIC PUMP FAILS TO RUN GIVEN THAT IT STARTED	5.97E-3
RCI-TDP-FS-RSTRT	RCIC FAILS TO RESTART GIVEN START AND SHORT-TERM RUN	8.00E-2
RCI-TDP-FS-TRAIN	RCIC PUMP FAILS TO START	6.49E-3
RCI-TDP-TM-TRAIN	RCIC PUMP TRAIN IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.10E-2
RCI-XHE-XL-RSTRT	OPERATOR FAILS TO RECOVER RCIC FAILURE TO RESTART	2.50E-1
RCI-XHE-XL-XFER	OPERATOR FAILS TO RECOVER RCIC FAILURE TO TRANSFER	2.50E-1
RCI-XHE-XO-ERROR	OPERATOR FAILS TO START/CONTROL RCIC INJECTION	1.00E-3
RHR-FAN-FS-BC	RHR MDP 2B/2C ROOM COOLER FAN FAILS TO START	8.42E-4
RHR-FAN-TM-BC	RHR MDP 2B/2C ROOM COOLER FAN UNAVAILABLE	2.00E-3

	DUE TO T&M	
RHR-HTX-TM-HTXB	RHR HTX-B IN MAINTENANCE (PSA)	2.36E-3
RHR-MDP-FS-2A	RHR TRAIN 2A FAILS TO START	9.47E-4
RHR-MDP-FS-2B	RESIDUAL HEAT REMOVAL MDP 2B FAILS TO START	9.47E-4
RHR-MDP-TM-2A	RHR MDP 2A IS UNAVAILABLE BECAUSE OF MAINTENANCE (PSA)	5.66E-3
RHR-MDP-TM-2B	RHR MDP 2B IS UNAVAILABLE BECAUSE OF MAINTENANCE (PSA)	5.66E-3
RHR-MOV-CC-F003A	RHR HTX A DISCHARGE MOV 3A FAILS TO OPEN	9.63E-4
RHR-MOV-CC-F003B	RHR HTX B DISCHARGE MOV 3B FAILS TO OPEN	9.63E-4
RHR-MOV-CC-MINFA	RHR TRAIN A MINFLOW MOV FAILS TO OPEN	9.63E-4
RHR-MOV-CC-MINFB	RHR TRAIN B MINFLOW LINE MOV FAILS TO OPEN	9.63E-4
RHR-MOV-OO-BYPSA	RHR LOOP A HTX BYPASS MOV 48A FAILS TO CLOSE	9.63E-4
RHR-MOV-OO-BYPSB	RHR LOOP B HTX BYPASS MOV 48B FAILS TO CLOSE	9.63E-4
RHR-XHE-XM-ERROR	OPERATOR FAILS TO START/CONTROL RHR	5.00E-4
RRS-MDP-LK-SEALS	RECIRCULATION PUMP SEALS FAIL	1.00E-1
SCW-MDP-FS-DG2A	STANDBY COOLING WATER MDP TO DG2A FAILS TO START	9.47E-4
SCW-MDP-TM-DG0	SCW PUMP TO DG0 IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.32E-2
SCW-MDP-TM-DG2A	SCW PUMP TO DG2A IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.32E-2
SCW-MDP-TM-DG2B	SCW PUMP TO DG2B IS UNAVAILABLE BECAUSE OF MAINTENANCE	1.32E-2
SCW-MOV-CC-68A	RHR HTX A DISCHARGE ISOLATION VALVE 68A FAILS TO OPEN	9.63E-4
SCW-MOV-CC-68B	RHR HTX B DISCHARGE ISOLATION VALVE 68B FAILS TO OPEN	9.63E-4
SCW-MOV-TM-F068B	SCW MOV F068B IN MAINTENANCE (PSA)	1.30E-3
SCW-STR-TM-TRNB	RHR SW TRAIN B STRAINER IN MAINTENANCE (PSA)	3.00E-4
SCW-XHE-TM-RHRB	OPERATOR FAILS TO ALIGN THE TRAIN B AFTER TM (PRA)	1.00E-3

Additional Details
No Effect on the ASP Analysis

F.1 Unit 2 HPCS Pinhole Leak

As reported in LER 374-2013-001 (Reference 5.2), on April 18, 2013, at 2:00 p.m. CST (23 hours after the LOOP), with the Unit in Mode 3, the licensee identified three grouped, pencil-sized, through-wall leaks on the first elbow downstream of a flow reducing orifice on the Unit 2 HPCS minimum flow line. The total leakage was estimated to be about ½ gallon-per-minute. Because of the location (i.e., just before the minimum flow line connection to the full flow test line and return to the suppression pool), the leaks were not isolable from the suppression pool and could have affected the operability of the HPCS system and primary containment. Operators declared the Unit 2 HPCS system and primary containment inoperable and implemented the applicable Technical Specifications (TS) actions. Though declared inoperable, the Unit 2 HPCS system remained available for operation (i.e., the pump could have performed its safety function) until 9:00 a.m. on April 21st when the water leg pump was secured to support repair of the elbow. Therefore, since the HPCS pump was ran successfully during the event and would have successfully fulfilled its mission time, no modeling changes were necessary for this analysis.

F.2 Unit 1 LPCS Switch

As reported in LER 373-2013-003 (Reference 5.3), on April 18,2013 at about 1:00 p.m. (22 hours after the LOOP). CST, with Unit 1 operating in Mode 3, control room operators were attempting to raise Unit 1 reactor vessel level with the LPCS system when they discovered that LPCS Injection Valve 1E21-F005 failed to open when the valve control switch was held in the "open" position. High resistance of control switch S2 Contact 1-1T may not allow sufficient voltage across the open contact coil for 1E21-F005. This would prevent manual opening of the valve from the control room, but does not prevent the automatic opening of 1E21-F005 when the switch is in the "AUTO" position because none of the contacts of S2 are used in the auto-opening circuit of the valve. Control Switch S2 is spring-returned to the "AUTO" position. On April 17th, the previous day during the 5.5 hour LOOP the LPCS system would have functioned properly with the switch in the "AUTO" position, therefore, no modeling changes were necessary for this analysis.

F.3 Unit 2 Scram from Secondary System

As reported in LER 374-2013-002 (Reference 5.9), on April 25, 2013 (8 days after the LOOP), at 56 percent power, the circulating water pumps tripped on high condenser pit water level, requiring Unit 2 to be manually scrammed. While dewatering the east condenser waterbox an inlet isolation valve was moved past its closed position, which allowed flow from the running circulating water pumps to overflow the waterbox through the open upper manways. This event was screened out due to not meeting the prescribed criteria for the agency's Accident Sequence Precursor program as to having minimal risk significance.

F.4 Unit 1 RCIC Not Operational per Technical Specifications

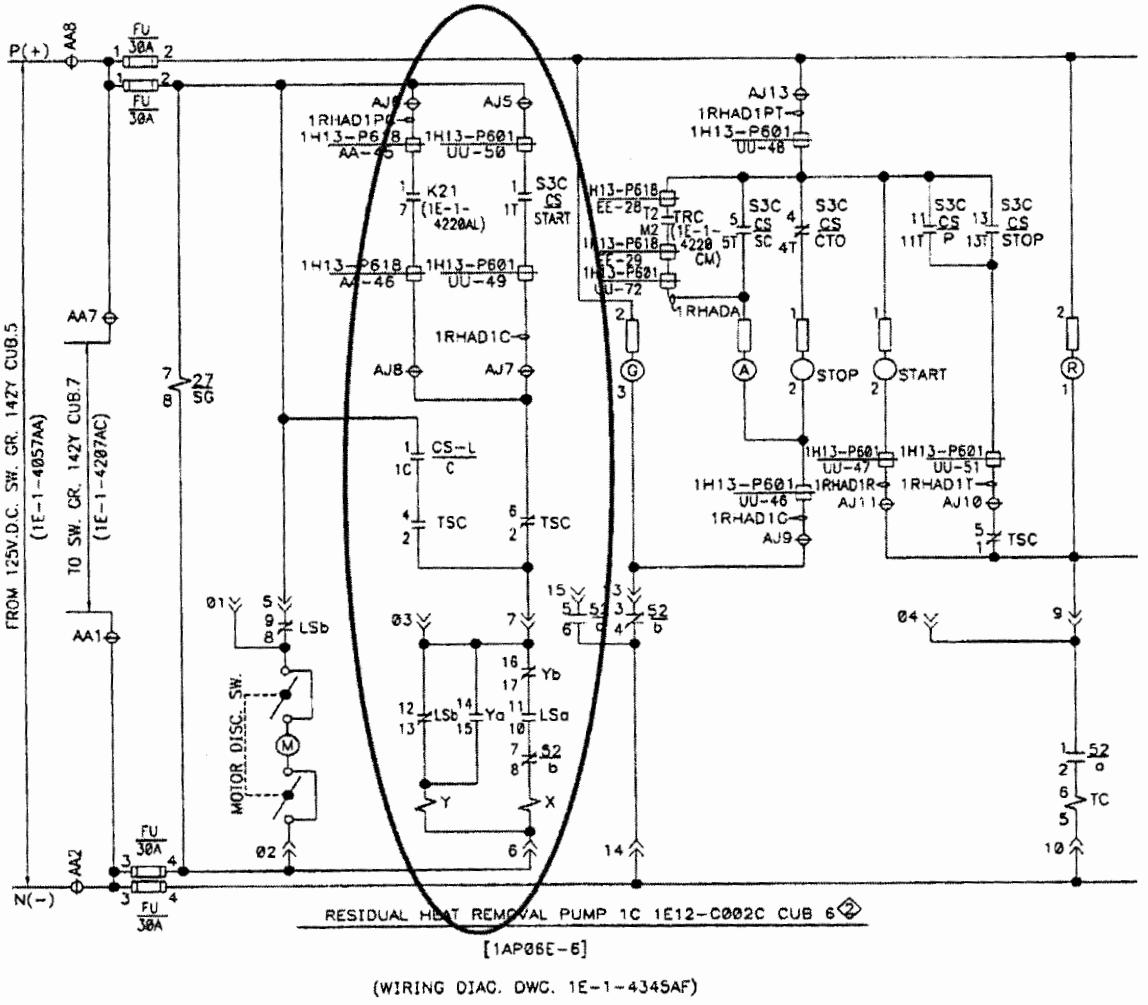
As reported in LER 373-2013-004 (Reference 5.7), on April 22, 2013 (5 days after the LOOP), at approximately 0723 hours CDT, while in Mode 2 (Startup), reactor pressure was increased above 150 psig with the RCIC system isolated and inoperable. Technical Specification requires RCIC to be operable in Mode 1, 2, & 3 with reactor steam dome pressure greater than 150 psig. This event was screened out due to not meeting the prescribed criteria for the agency's Accident Sequence Precursor program as to having minimal risk significance.

F.5 Unit 1 RCIC Steam Leak

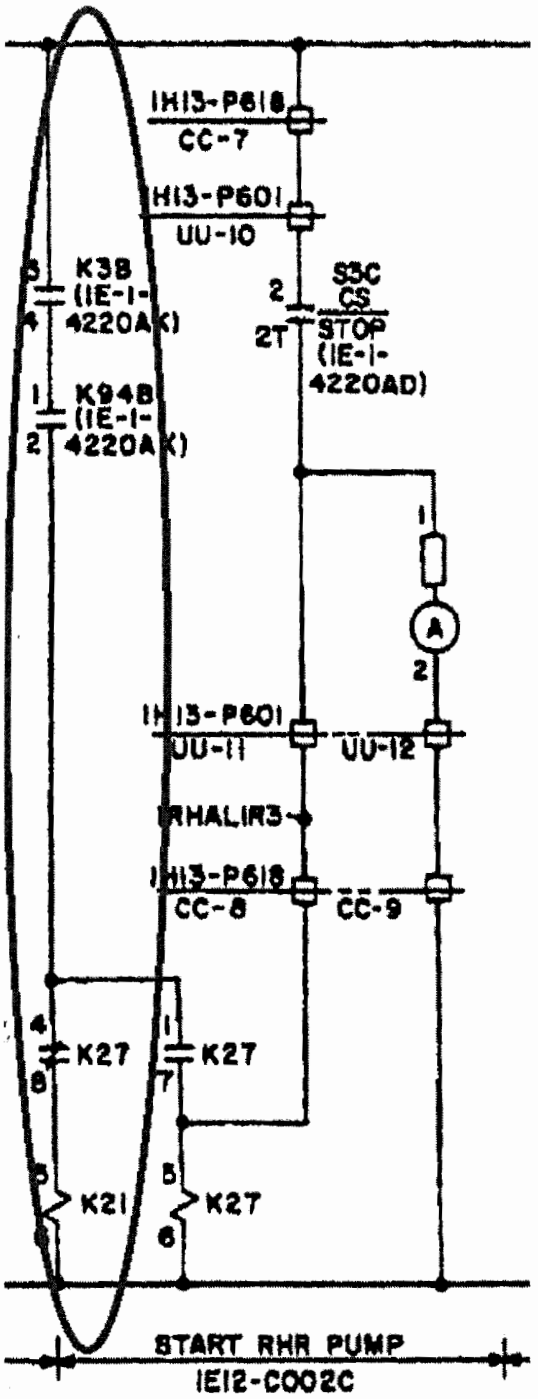
As reported in LER 373-2013-005 (Reference 5.8), on April 27, 2013 (10 days after the LOOP), Unit 1 was in Mode 2 (Startup) following a forced outage. At 1800 hours CDT, during a walk down of the drywell, a steam leak was observed coming from the RCIC Steam Supply Inboard Isolation Bypass/Warm up Valve (1E51-F076), a normally-closed, one inch, motor operated valve. The leak was determined to be on the valve bonnet extension-to-bonnet upper seal weld. At 2124 hours CDT the leak was classified as reactor coolant pressure boundary. The apparent cause was a weld defect or discontinuity from the original weld construction (i.e., manufacturing, installation/construction errors, etc.) of the upper seal weld that propagated through wall as result of system loading and conditions (i.e., high pressure steam) during normal plant operations. This condition has no impact for the LOOP ASP analysis where the RCIC system functioned.

RHR Pump 2C Breaker Closing Circuit
(Page 1 of 3)

Circuit Breaker Closing Coil X is energized with a start signal from the control switch or an auto-start signal from relay K21 as long as the Circuit Breaker Closing Springs are fully charged as controlled by the Closing Springs Limit Switch LSa contact. As soon as the Circuit Breaker Closing Springs discharge to close the breaker, Closing Spring Limit Switch contact LSb, closes to energize the Anti-Pumping Relay Y. Simultaneously, Closing Spring Limit Switch contact LSa opens to deenergize the Circuit Breaker Closing Coil X since the breaker is now closed. The Anti-Pumping Relay Y remains energized through its own Ya contact until the circuit logic is manually reset or Relay K21 drops out from removal of the initiating signal or a low or degraded voltage condition, even after the 3-5 seconds it takes for the springs to recharge. Closing Coil X, thus cannot be reenergized a second time without these conditions, since the Anti-Pumping Circuit Relay Yb contact opens the circuit to the Circuit Breaker Closing Coil X. A manual reset occurs by placing the control switch in Stop to energize the Trip Coil TC and deenergize the Anti-Pumping Relay Y logic.



RHR Pump 2C Auto Start Relay K21 Logic
(Page 2 of 3)

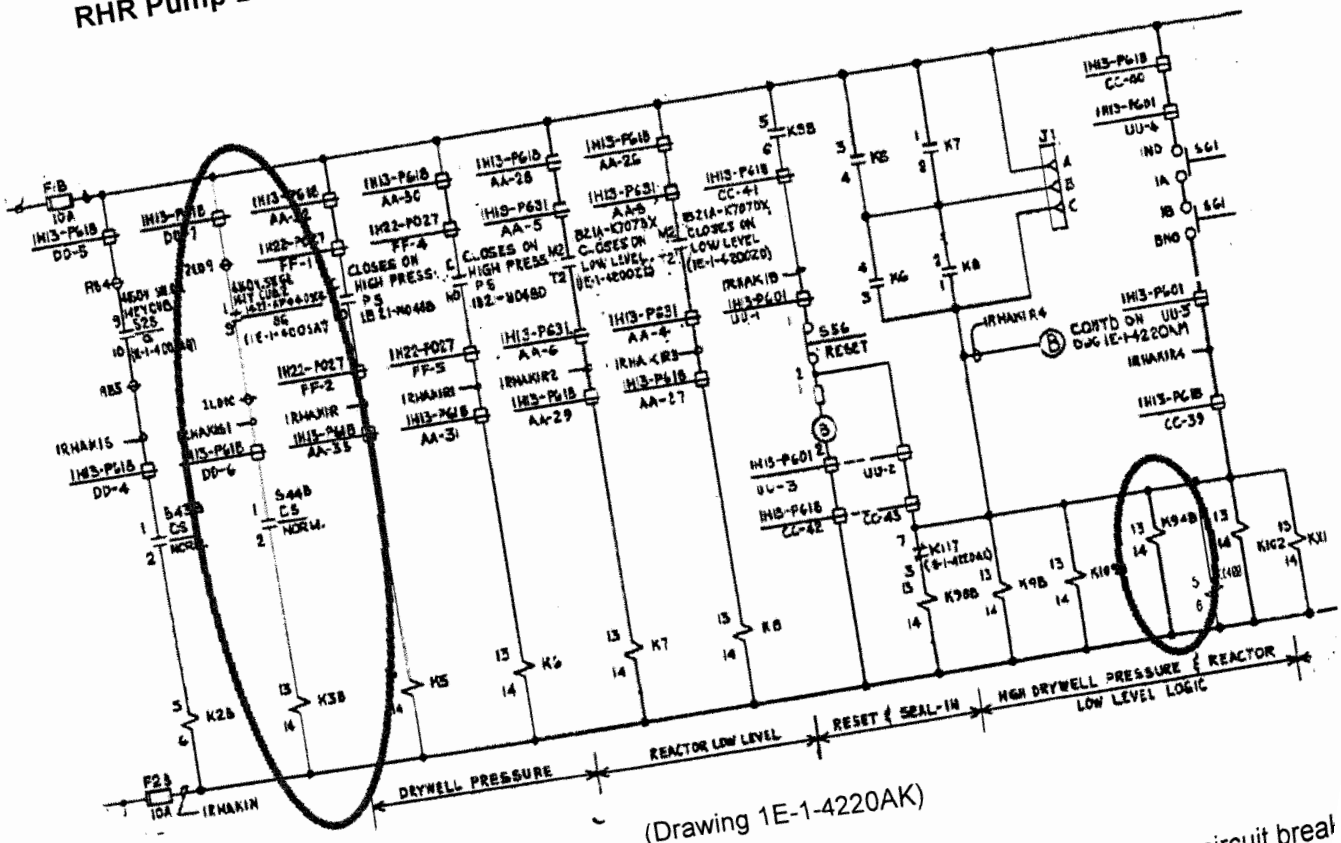


Relay K21 has contacts in the RHR Pump circuit breaker closing circuit (Attachment G, page 1 of 3) to close the breaker on high drywell pressure and reactor low level from relay K94B and inhibit the breaker closing on degraded voltage from relay K3B

(Drawing 1E-1-4220AL)

RHR Pump 2C Auto Start Relay K3B and K94B Logic with Degraded Voltage Inhibit

(Page 3 of 3)



(Drawing 1E-1-4220AK)

RHR Pump 2C control relays K3B and K94 have contacts to control Relay K21 in the pump circuit breal circuit, (Attachment G page 2 of 3). Relay K94B is actuated from high drywell pressure and reactor lov Relay K3B inhibits the pump circuit breaker from closing with low or degraded voltage from Relay 142 AP040X4/SG shown on Drawing 1E-1-400SAT.

If you have any questions regarding this matter, I may be reached at 301-415-1380.

Sincerely,

/RA/

Blake Purnell, Project Manager
Plant Licensing III-2 and
Planning and Analysis Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-373 and 50-374

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