Final Precursor Analysis

Accident Sequence Precursor Program – Office of Nuclear Regulatory Research

Point Beach, Unit 1	Concurrent Loss of Station Auxiliary Transformer 1X-04 and 480V Safeguards Bus 1B-04.	
Event Date: 01/15/2008	***LER*:** 266/2008-001 ***IR*:** 50-266/2008-07	***ΔCDP =*** 7×10^{-6}

EVENT SUMMARY

Event Description. Unit 1 experienced a lockout and loss of Low Voltage Station Auxiliary Transformer 1X-04 (offsite power supply to the Unit 1 4.16 kV safeguards busses) at 1404, on January 15, 2008. The unit concurrently experienced a loss of 480V Safeguards Bus 1B-04. All four emergency diesel generators (EDGs) responded as designed. As a result of loss of Bus 1B-04, the normal letdown valve closed and the operator controlled the pressurizer level by aligning the excess letdown line and utilized minimum charging flow.

Safeguards Bus 1B-04 was recovered approximately 6.5 hours after it was lost. On recovering Safeguards Bus 1B-04, normal letdown could not immediately be established, owing to difficulties with Letdown Isolation Valve 1CV-371A. In compliance with Technical Specification requirements, Unit 1 shutdown commenced on January 16, 2008 at 1549, and Unit 1 was in Mode 3 at 1948 on January 16, 2008.

Further event information is provided in References 1 and 2.

Cause. The licensee concluded that the cause of the cable failure from the 1X-04 Transformer to Buses 1A-03 and 1A-04 was a direct fault to ground of the 'B5' cable for the feed to Bus 1A-03 and that this fault was caused by long-term water induced degradation of the cable's outer jacket, shield, and insulation. The licensee's root cause team concluded that the organization failed to assign the appropriate prioritization to address the issue of submerged power cables.

The spurious actuation of the 50G relay of Breaker 1A52-84 was likely due to high frequency transients caused by the repeated grounding of cabling associated with the low side of the 1X-04 Transformer. As a result, the licensee's root cause team concluded that the settings for this relay were too conservative. In addition, laboratory testing determined that the relay would actuate on primary current spike duration less than the existing time delay setting.

Additional Event Details. The sequence of key events is provided in Appendix A.

Recovery Opportunities. Safeguards Bus 1B-04 was recovered at 2049 on January 15 (approximately 6.5 hours after it was lost). The 6.5 hour concurrent loss of Station Auxiliary Transformer 1X-04 and 480V Safeguards Bus 1B-04 is the event window for this analysis.

Analysis Rules. The Accident Sequence Precursor (ASP) Program uses Significance Determination Process (SDP) results for degraded conditions when available. However, the ASP Program performs independent initiating event analysis when an initiator occurs and a condition analysis when there are no performance deficiencies identified for a particular event. In addition, the ASP Program analyzes separate degraded conditions that were present during

the same period and similar degraded conditions on an individual system or component that had different performance deficiencies.

Three GREEN findings have been identified for this event and are described in Reference 2. Since there was no plant trip and separate performance deficiencies were evaluated by the SDP, this analysis focuses solely on the risk due to concurrent loss of Station Auxiliary Transformer 1X-04 and 480V Safeguards Bus 1B-04.

ANALYSIS RESULTS

- **Importance**[1]

  The importance for this event is 7×10^{-6}. The results of an uncertainty assessment on the importance are summarized below.

	5%	Mean	95%
Point Beach 1	1.3×10^{-6}	6.5×10^{-6}	1.8×10^{-5}

  The ASP Program acceptance threshold is an importance of 1×10^{-6}.

- **Dominant Sequences**

  The dominant accident sequences, TRANS Sequences 02-06-05, 02-08-05, and 02-10-05, contribute to 63% (1.3×10^{-6} per sequence) of the total internal events' importance. The sequences involve a loss of reactor coolant pump seal cooling and subsequent seal loss-of-coolant accident (LOCA), failure to rapidly depressurize the secondary, failure to depressurize the reactor coolant system, and failure of high-pressure recirculation.

  The dominant sequences are shown in Figures B-1 and B-2 of Appendix B. The events and important component failures in TRANS Sequences 02-06-05, 02-08-05, and 02-10-05 are:

  - The reactor trips,
  - auxiliary feedwater is successful,
  - power-operated relief valves (PORV) correctly reseat (if opened),
  - reactor coolant pump seal cooling is lost,
  - operators successfully trip the RCPs,
  - rapid secondary depressurization fails,
  - reactor coolant pump seal LOCA initiates (o-ring extrusion of Stage 1 and/or Stage 2 seals),
  - feedwater is successful,
  - high-pressure injection is successful,
  - secondary side cooldown is successful,
  - reactor depressurization fails, and
  - high-pressure recirculation fails.

[1] For a conditional assessment, the parameter of interest is the measure of importance. This value is obtained subtracting the baseline core damage probability (CDP) from the conditional core damage probability (CCDP).

- **Results Tables**

  - The conditional probabilities for the dominant sequences are shown in Table 1.
  - The event tree sequence logics for the dominant sequences are presented in Table 2a.
  - Table 2b defines the nomenclature used in Table 2a.
  - The most important cutsets for the dominant sequences are listed in Table 3.
  - Definitions and probabilities for modified or dominant basic events are provided in Table 4.

MODELING ASSUMPTIONS

- **Analysis Type**

  The Revision 3-Plus (Change 3.45) of the Point Beach 1 and 2 Standardized Plant Analysis Risk (SPAR) model [Ref. 3] created in June 2008 was used for this assessment. This event was modeled as a Unit 1 concurrent loss of Station Auxiliary Transformer 1X-04 and 480V Safeguards Bus 1B-04.

- **Unique Design Features**

  Point Beach has a somewhat unique dependence on instrument air and a unique dependence of AFW on operator action. Manual action (basic event AFW-XHE-XM-MINGAG) is needed in order to preserve AFW function. This circumstance drives a relatively high SPAR model result for baseline CDF for this plant.

- **Modeling Assumptions Summary**

  Key Modeling Assumptions. This event is analyzed using the GEM module in SAPHIRE. The risk increase that this ASP analysis focuses is due to three event factors: (1) the increased probability of a reactor trip (i.e., failure of operators to initiate excess letdown and minimize charging flow, (2) the loss of Station Auxiliary Transformer 1X-04, and (3) concurrent loss of 480V Safeguards Bus 1B-04. The time window for this risk increase is 6.5 hours. This event analysis is conditional analysis; however, the GEM initiating event module was utilized because the conditional probability of reactor trip cannot be converted into a frequency. The base CDP for this short time window is considered negligible when compared the CCDP; therefore, the importance equals the CCDP for this analysis.

- **Basic Event Probability Changes**

  Table 4 provides all the basic events that were modified to reflect the best estimate of the conditions during the event. The basis for these changes is provided below:

  - ***ACP-BAC-LP-1B04 set to TRUE.*** This basic event represents the Safeguards Bus 1B04 that failed during the event and was unavailable for 6.5 hours. This event was set to TRUE.

  - ***ACP-TFM-FC-1X04 set to TRUE.*** This basic event represents the Station Auxiliary Transformer 1X04 that failed during the event; therefore, this event was set to TRUE.

- ***ACP-XHE-XM-B089 set to 0.65.*** This basic event represents operators failing to align power to Busses B08 and B09 per abnormal operating procedures. In many of dominant cutsets, this operator action would follow ACP-XHE-XM-2A031A03 (operators fail to transfer power from Bus 2A03 to Bus 1A03) in the postulated accident sequence. After a review of the applicable sequences and cutsets, the staff determined that dependency needed to be addressed for ACP-XHE-XM-B089. Based on the dependency matrix provided in Reference 4, it was determined that this event was highly dependent (same crew, close time, different locations) on ACP-XHE-XM-2A031A03. Therefore, the failure probability of ACP-XHE-XM-B089 was calculated to be 0.65 using the dependency formula [Ref. 4].

- ***IE-TRANS set to 2×10^{-2}.*** In this analysis, IE-TRANS does not represent the reactor trip frequency. Rather, it represents the conditional probability of operators failing to establish excess letdown and minimize charging to flow to control pressurizer level and preclude a trip. This probability was calculated using the SPAR-H method [Ref. 4] and details of this evaluation are provided in Appendix C. All other initiating event frequencies were set to zero due to their very small probabilities during this short time window (i.e., the 6.5 hours of concurrent unavailability of the Station Auxiliary Transformer 1X-04 and Safeguards Bus 1B-04).

REFERENCES

1. LER 266/08-001 Rev. 0, “Manual Reactor Shutdown Required by Technical Specification LCO 3.8.1 AC Sources-Operating Not Met,” March 16, 2008.

2. U.S. Nuclear Regulatory Commission, “Point Beach Nuclear Plant– NRC Special Inspection Report 05000266/2008007,” April 21, 2008.

3. Idaho National Laboratory, “Standardized Plant Analysis Risk Model for Point Beach 1 and 2,” Revision 3 Plus (Change 3.45), June 2008.

4. Idaho National Laboratory, “The SPAR-H Human Reliability Analysis Method,” NUREG/CR-6883, August 2005.

Table 1. Conditional core damage probabilities of the dominating sequences.

Event Tree Name	Sequence Number	CCDP[1]	Contribution (%)
TRANS	02-06-05	1.3E-006	21.3
TRANS	02-08-05	1.3E-006	21.3
TRANS	02-09-05	1.3E-006	21.3
TRANS	20	7.5E-007	12.3
TRANS	02-07-05	6.5E-007	10.7
TRANS	02-10-05	6.5E-007	10.7
Total (all sequences)[2]		6.1E-006	**100**

1. Values are point estimates.
2. Total CCDP includes all sequences (including those not shown in this table).

Table 2a. Event tree sequence logic for dominating sequences.

Event Tree Name	Sequence Number	Logic ("/" denotes success; see Table 2b for top event names)
TRANS	02-06-05	/RPS /AFW /PORV LOSC /RCPT RSD /BP1 /O1 /BP2 O2 /FW /HPI /SSC PZR HPR
TRANS	02-08-05	/RPS /AFW /PORV LOSC /RCPT RSD /BP1 O1 /BP2 /O2 /FW /HPI /SSC PZR HPR
TRANS	02-09-05	/RPS /AFW /PORV LOSC /RCPT RSD /BP1 O1 /BP2 O2 /FW /HPI /SSC PZR HPR
TRANS	20	/RPS AFW MFW FAB
TRANS	02-07-05	/RPS /AFW /PORV LOSC /RCPT RSD /BP1 /O1 BP2 /FW /HPI /SSC PZR HPR
TRANS	02-10-05	/RPS /AFW /PORV LOSC /RCPT RSD /BP1 O1 BP2 /FW /HPI /SSC PZR HPR

Table 2b. Definitions of top events listed in Table 2a.

Top Event	Definition
AFW	AUXILIARY FEEDWATER
BP1	RCP SEAL STAGE 1 INTEGRITY
BP2	RCP SEAL STAGE 2 INTEGRITY
FAB	FEED AND BLEED
FW	FEEDWATER (AFW or MFW)
HPI	HIGH PRESSURE INJECTION
HPR	HIGH PRESSURE RECIRCULATION
LOSC	LOSS OF SEAL COOLING
MFW	MAIN FEEDWATER
O1	RCP SEAL STAGE 1 INTEGRITY
O2	RCP SEAL STAGE 2 INTEGRITY
PORV	PORV/SRVs ARE CLOSED
PZR	RCS DEPRESS FOR LPI/RHR
RCPT	REACTOR COOLANT PUMPS TRIPPED
RPS	REACTOR TRIP
RSD	RAPID SECONDARY DEPRESSURIZATION
SSC	SECONDARY SIDE COOLDOWN

Table 3. Conditional cutsets for the dominant sequences.

CCDP	Percent Contribution	Minimum Cutsets (of basic events)		
TRANS, Sequence 02-06-05				
3.4E-007	26.0	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03	/RCS-MDP-LK-O1 ACP-CRB-CC-57
7.8E-008	6.06	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2 EPS-DGN-FR-G02	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03 ACP-XHE-XM-B0809	/RCS-MDP-LK-O1 EPS-DGN-FR-G01
7.8E-008	6.01	RCS-MDP-LK-BP1 RCS-MDP-LK-O2 CVC-XHE-XM-112B	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03	/RCS-MDP-LK-O1 ACP-CRB-CC-57
6.5E-008	5.02	EPS-XHE-XM-G02-1A05 /RCS-MDP-LK-O1 EPS-DGN-FR-G01	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03
5.8E-008	4.50	ACP-TFM-FC-1X13 /RCS-MDP-LK-O1	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2	/RCS-MDP-LK-BP2 ACP-XHE-XM-B0809
1.3E-006	**100**	**Total (all cutsets)[1]**		
TRANS, Sequence 02-08-05				
3.4E-007	26.0	/RCS-MDP-LK-BP1 /RCS-MDP-LK-O2 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03	RCS-MDP-LK-O1 ACP-CRB-CC-57
7.8E-008	6.06	/RCS-MDP-LK-BP1 /RCS-MDP-LK-O2 EPS-DGN-FR-G02	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03 ACP-XHE-XM-B0809	RCS-MDP-LK-O1 EPS-DGN-FR-G01
7.8E-008	6.01	RCS-MDP-LK-BP1 /RCS-MDP-LK-O2 CVC-XHE-XM-112B	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03	RCS-MDP-LK-O1 ACP-CRB-CC-57
6.5E-008	5.02	EPS-XHE-XM-G02-1A05 RCS-MDP-LK-O1 EPS-DGN-FR-G01	/RCS-MDP-LK-BP1 /RCS-MDP-LK-O2 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03
5.8E-008	4.50	ACP-TFM-FC-1X13 RCS-MDP-LK-O1	/RCS-MDP-LK-BP1 /RCS-MDP-LK-O2	/RCS-MDP-LK-BP2 ACP-XHE-XM-B0809
1.3E-006	**100**	**Total (all cutsets)[1]**		
TRANS, Sequence 02-09-05				
3.4E-007	26.0	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03	RCS-MDP-LK-O1 ACP-CRB-CC-57
7.8E-008	6.06	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2 EPS-DGN-FR-G02	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03 ACP-XHE-XM-B0809	RCS-MDP-LK-O1 EPS-DGN-FR-G01
7.8E-008	6.01	RCS-MDP-LK-BP1 RCS-MDP-LK-O2 CVC-XHE-XM-112B	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03	RCS-MDP-LK-O1 ACP-CRB-CC-57
6.5E-008	5.02	EPS-XHE-XM-G02-1A05 RCS-MDP-LK-O1 EPS-DGN-FR-G01	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP2 ACP-XHE-XM-2A031A03
5.8E-008	4.50	ACP-TFM-FC-1X13 RCS-MDP-LK-O1	/RCS-MDP-LK-BP1 RCS-MDP-LK-O2	/RCS-MDP-LK-BP2 ACP-XHE-XM-B0809
1.3E-006	**100**	**Total (all cutsets)[1]**		

1. Total CCDP includes all cutsets (including those not shown in this table).

Table 3. Conditional cutsets for the dominant sequences (cont.).

CCDP	Percent Contribution	Minimum Cutsets (of basic events)		
TRANS, Sequence 20				
1.1E-007	14.5	IAS-MDC-CF-K2AB3ABR	AFW-XHE-XM-MINGAG	
8.6E-008	11.5	IAS-MDC-FR-K2A IAS-MDC-FR-K3B	AFW-XHE-XM-MINGAG	IAS-MDC-FR-K2B
5.3E-008	7.04	ACP-XHE-XM-2A031A03	AFW-XHE-XM-MINGAG	ACP-CRB-CC-57
2.6E-008	3.52	FPS-EDP-TM-P35B	ACP-XHE-XM-2A031A03	ACP-CRB-CC-57
7.5E-007	**100**	**Total (all cutsets)[1]**		
TRANS, Sequence 02-07-05				
1.7E-007	26.1	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03	RCS-MDP-LK-BP2 ACP-CRB-CC-57	/RCS-MDP-LK-O1 ACP-XHE-XM-B0809
3.9E-008	6.06	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03 ACP-XHE-XM-B0809	RCS-MDP-LK-BP2 EPS-DGN-FR-G01	/RCS-MDP-LK-O1 EPS-DGN-FR-G02
3.9E-008	6.01	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03	RCS-MDP-LK-BP2 ACP-CRB-CC-57	/RCS-MDP-LK-O1 CVC-XHE-XM-112B
3.3E-008	5.03	EPS-XHE-XM-G02-1A05 /RCS-MDP-LK-O1 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03	RCS-MDP-LK-BP2 EPS-DGN-FR-G01
2.9E-008	4.50	ACP-TFM-FC-1X13 /RCS-MDP-LK-O1	/RCS-MDP-LK-BP1 ACP-XHE-XM-B0809	RCS-MDP-LK-BP2
6.5E-007	**100**	**Total (all cutsets)[1]**		
TRANS, Sequence 02-10-05				
1.7E-007	26.1	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03	RCS-MDP-LK-BP2 ACP-CRB-CC-57	RCS-MDP-LK-O1 ACP-XHE-XM-B0809
3.9E-008	6.06	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03 ACP-XHE-XM-B0809	RCS-MDP-LK-BP2 EPS-DGN-FR-G01	RCS-MDP-LK-O1 EPS-DGN-FR-G02
3.9E-008	6.01	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03	RCS-MDP-LK-BP2 ACP-CRB-CC-57	RCS-MDP-LK-O1 CVC-XHE-XM-112B
3.3E-008	5.03	EPS-XHE-XM-G02-1A05 RCS-MDP-LK-O1 ACP-XHE-XM-B0809	/RCS-MDP-LK-BP1 ACP-XHE-XM-2A031A03	RCS-MDP-LK-BP2 EPS-DGN-FR-G01
2.9E-008	4.50	ACP-TFM-FC-1X13 RCS-MDP-LK-O1	/RCS-MDP-LK-BP1 ACP-XHE-XM-B0809	RCS-MDP-LK-BP2
6.5E-007	**100**	**Total (all cutsets)[1]**		

1. Total CCDP includes all cutsets (including those not shown in this table).

Table 4. Definitions and probabilities for modified and dominant basic events.

Event Name	Description	Probability/ Frequency (per year)
ACP-BAC-LP-1B04	480 VAC BUS 1B-04 IS UNAVAILABLE	TRUE[1]
ACP-CRB-CC-57	XFR 1X04 SUPPLY BREAKER TO BUS 1A05 FAILS TO CLOSE	2.5E-003
ACP-TFM-FC-1X04	13.8 KV XFR 1X04 FAILS	TRUE[1]
ACP-TFM-FC-1X13	TRANSFORMER 1X13 FAILS DUE TO LOSS OF POWER	2.2E-005
ACP-XHE-XM-2A031A03	OPERATOR FAILS TO TRANSFER POWER FROM 2A03 TO 1A03	5.0E-002
ACP-XHE-XM-B0809	OPERATOR FAILS TO ALIGN TO B08 / B09 PER AOP	6.5E-001[2]
AFW-XHE-XM-MINGAG	FAILURE TO GAG MINI RECIRC VALVE >1HR INTO EVENT	2.0E-002
CVC-XHE-XM-112B	OPERATORS FAILS TO MANUALLY OPEN CV-112B VALVE	1.5E-001
EPS-DGN-CF-RG0102	CCF OF DIESEL GENERATORS G01 AND G02 TO RUN	4.2E-004
EPS-DGN-FR-G01	DIESEL GENERATOR G01 FAILS TO RUN	2.4E-002
EPS-DGN-FR-G02	DIESEL GENERATOR G02 FAILS TO RUN	2.4E-002
EPS-DGN-TM-G01	DIESEL GENERATOR G01 UNAVAILABLE DUE TO T&M	1.2E-002
EPS-DGN-TM-G02	DIESEL GENERATOR G02 UNAVAILABLE DUE TO T&M	1.2E-002
EPS-XHE-XM-G02-1A05	OPERATOR FAILS TO ALIGN G-02 TO 1A-05	2.0E-002
FPS-EDP-TM-P35B	FP DIESEL DRIVEN PUMP 35B UNAVAILABLE DUE TO T&M	1.0E-002
IAS-MDC-CF-K2AB3ABR	CCF OF IAS COMPRESSORS K-2A, K-2B, K-3A & K-3	2.6E-004
IAS-MDC-FR-K2A	INSTRUMENT AIR COMPRESSOR K2A FAILS TO RUN	5.9E-002
IAS-MDC-FR-K2B	INSTRUMENT AIR COMPRESSOR K2B FAILS TO RUN	5.9E-002
IAS-MDC-FR-K3B	SERVICE AIR COMPRESSOR K-3B FAILS TO RUN	5.9E-002
IE-TRANS	REACTOR TRANSIENT	2.1E-002[3]
RCS-MDP-LK-BP1	RCP SEAL STAGE 1 INTEGRITY (BINDING/POPPING)	1.3E-002
RCS-MDP-LK-BP2	RCP SEAL STAGE 2 INTEGRITY (BINDING/POPPING)	2.0E-001
RCS-MDP-LK-O1	RCP SEAL STAGE 1 INTEGRITY (O-RING EXTRUSION)	5.0E-001
RCS-MDP-LK-O2	RCP SEAL STAGE 2 INTEGRITY (O-RING EXTRUSION)	5.0E-001

1. Set the event to TRUE to account for the unavailability of the component. See the Basic Event Probability Section for further details.
2. Adjusted the probability of the event to 0.65 to account for human error dependency.
3. Set the event to a probability of 2.1×10^{-2}. All other initiating event frequencies were set to zero. See the Basic Event Probability Section for further details.

APPENDIX A
SEQUENCE OF KEY EVENTS

Time	Event
0146; *1/15/08*	Multiple reports of loud noise heard on the north side of the Extension Building. The source was found to be Manhole Number 3 located on the east side of the G05 Building.
0230	Plant manager, operations manager, work-week manager, and duty call superintendent informed of noise heard in Manhole Number 3.
0505	NRC was informed of issue with manhole in vicinity of Transformer 1X-04.
0602	Manhole Number 3 was checked; water level about 1 foot and slowly rising. Cables were not in water.
0611	The operation control center is manned to support the reports of sounds coming from Manhole Number 3 area.
0708	Manhole Number 3 was checked; cables verified not to be in water although water level was slowly rising.
1015	Shift Manager implemented the quarantine procedure to control access to Manhole Number 3. Hourly inspections of the manhole were reduced to twice per shift per engineering direction.
1110	Manhole Number 3 was checked. Cables verified not to be in water although water level was slowly rising.
1150	Walk downs of all plant 4160V and 13.8kV buses completed; SAT and all indications are normal.
1354	Operations reported cables are submerged in Manhole Number 5.
1404	Loss of 1B-04, both units enter TSAC 3.8.9.A. 1X-04 Station Transformer is de-energized resulting is a loss of offsite power to 1A-05 and 1A-06 4160V Safeguards Buses. Unit 1 enters TSAC 3.8.1.C. Both units enter TSAC 3.8.1.D. All four EDGs started on a loss of offsite power to 1A-05 and 1A-06. EDG G01 immediately restored power to Bus 1A-05. EDG G-03 assumed load of Bus 1A-06. Unit 1 enters TSAC 3.8.1.B with required actions B.1 to restore 1X-04 Station Transformer to operable status within 24 hours.
1415	Classification made of an Unusual Event due to loss of offsite power to Unit 1.
1423	Unit 1 Pressurizer Level exceeded the parametric value of 48% due to the loss of CVCS letdown as a result of the 1X-04 Station Transformer lockout and loss of CVCS letdown. Minimum charging flow and excess letdown were established in response to the event.
1430	Control Room notified that 1-51N/X04, 1X-04 over-current neutral relay was found tripped in the 13.8 kV building.
1635	Z-65C manhole No. 3 was checked. Cables verified not to be in water although water level was slowly rising.
1815	Secured EDG G-04.
1828	NRC has entered "monitoring" phase of response related to the loss of Unit 1 1X-04 Low Voltage Station Auxiliary Transformer.
1830	1B-04 (480 Volt Bus) meggered.
1900	Maintenance reports that manhole No. 5 has been pumped out.
1905	Secured EDG G-02.
2032	1B-04 normal feed circuit breaker is shut.
2049	Commenced recovery of 1B-04, 480V AC Safeguards power supply.

Time	Event
2111	While attempting to restore CVCS letdown on Unit 1, Valve 1CV-371A, Letdown Line Containment Isolation would not open. Both main control board and containment isolation panel status lights indicated the 1CV-371A was shut.
2200	NRC 4 hour event notification EN No. 43908 for the press release was made.
2229	While attempting to establish normal letdown 1CV-371A was taken to the open position. The valve did not move from the full shut position.
0714; *1/16/08*	Task created to megger between Buses 1A-04 and 1A-06 (between Breakers 54 and 57).
1716	Completed 4-hour event notification worksheet for Unit 1; TS required shutdown commenced.
1917	Tripped main turbine generator output breaker.
1920	Entered Mode 2.
1924	Tripped Main Turbine.
2148	Manhole Number 3 visual inspection is complete. Inspection results, no visual indication of damage of any type noted.
2320	Reactor shutdown completed.

APPENDIX B
EVENT TREES CONTAINING DOMINANT SEQUENCES

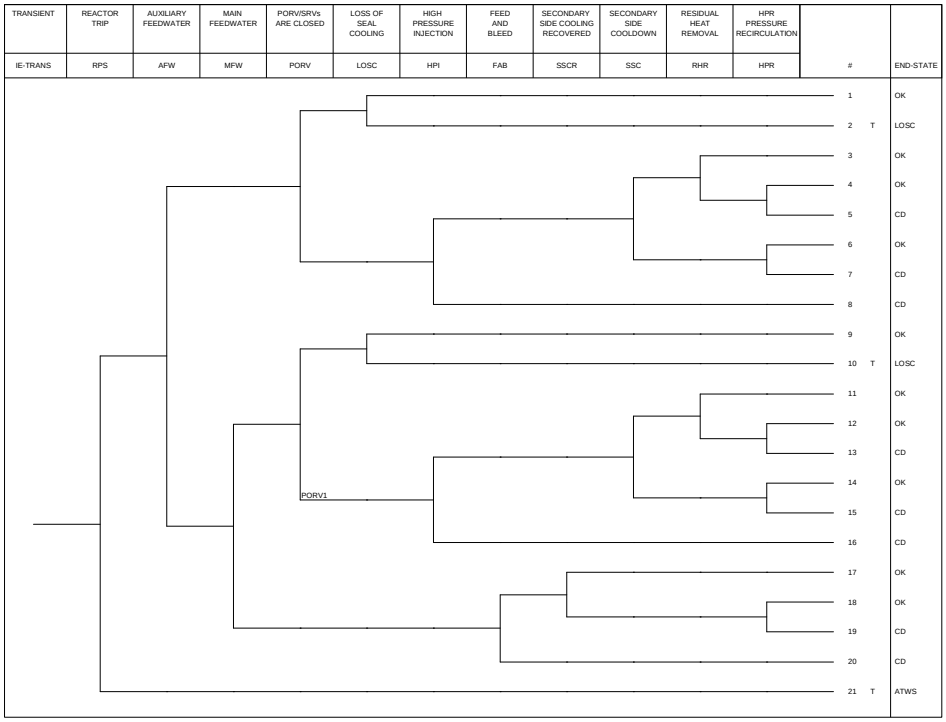

Figure B-1. Point Beach 1 transient event tree.

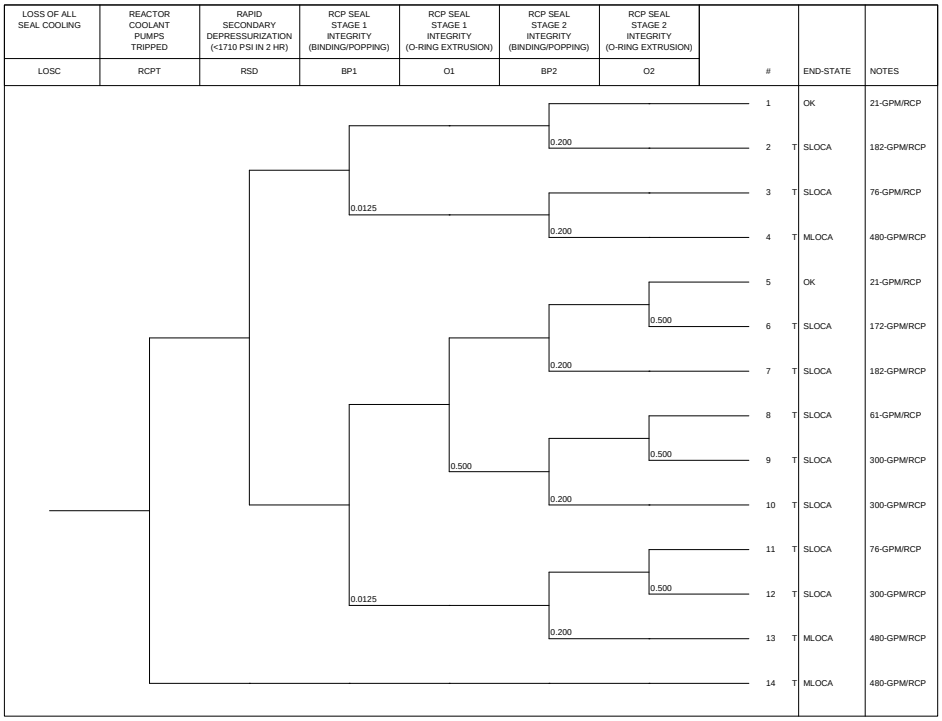

Figure B-2. Point Beach 1 loss of RCP seal cooling event tree.

APPENDIX C
SPAR HUMAN ERROR WORKSHEET

Plant: *Point Beach 1* **Initiating Event:** *Transient* **Basic Event:** *IE-TRANS*

Basic Event Context: *Failure of operators to diagnose loss of normal letdown, initiate excess letdown, and minimize charging flow will result in a scram due to high pressurizer level.*

Basic Event Description: *Operator fails to control pressurizer level when let down valves have gone shut to prevent scram annunciation. Operator can only utilize excess let down line and operator charging pumps on a min flow.*

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?** *N/A*

PART I. EVALUATE EACH PSF FOR DIAGNOSIS

Evaluate PSFs for the Diagnosis Portion of the Task, if any.

PSFs	PSF Levels	Multiplier for Diagnosis	Please note specific reasons for PSF level selection in this column.
Available Time	Inadequate Time	P(failure) = 1.0	
	Barely Adequate Time (≈2/3×nominal)	10 ☐	
	Nominal Time	1 ☒	
	Extra Time (between 1-2×nominal and > than 30 min)	0.1 ☐	
	Expansive Time (> 2×nominal and > 30 min)	0.01 ☐	
	Insufficient Information	1 ☐	
Stress/ Stressors	Extreme	5 ☐	
	High	2 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Complexity	Highly Complex	5 ☐	Diagnosis considered moderately complex due to presence of multiple annunciators (e.g., loss of transformer and vital bus) alarming at the same time as the loss of letdown.
	Moderately Complex	2 ☒	
	Nominal	1 ☐	
	Obvious Diagnosis	0.1 ☐	
	Insufficient Information	1 ☐	
Experience/ Training	Low	10 ☐	
	Nominal	1 ☒	
	High	0.5 ☐	
	Insufficient Information	1 ☐	

PSFs	PSF Levels	Multiplier for Diagnosis	Please note specific reasons for PSF level selection in this column.
Procedures	Not Available	50 ☐	
	Incomplete	20 ☐	
	Available, but Poor	5 ☐	
	Nominal	1 ☒	
	Diagnostic/Symptom Oriented	0.5 ☐	
	Insufficient Information	1 ☐	
Ergonomics/ HMI	Missing/Misleading	50 ☐	
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
	Insufficient Information	1 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Work Processes	Poor	2 ☐	
	Nominal	1 ☒	
	Good	0.8 ☐	
	Insufficient Information	1 ☐	

Calculate the Diagnosis Failure Probability.

(1) If all PSF ratings are nominal, then the Diagnosis Failure Probability = 1×10^{-2}

(2) Otherwise, the Diagnosis Failure Probability = 1×10^{-2} × Time × Stress or Stressors × Complexity × Experience or Training × Procedures × Ergonomics or HMI × Fitness for Duty × Processes

Diagnosis HEP: $1\times10^{-2} \times 1 \times 2 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 = \mathbf{2\times10^{-2}}$

PART II. EVALUATE EACH PSF FOR ACTION

Evaluate PSFs for the Action Portion of the Task, if any.

PSFs	PSF Levels	Multiplier for Diagnosis	Please note specific reasons for PSF level selection in this column.
Available Time	Inadequate Time	P(failure) = 1.0	
	Time available ≈ Time Required	10 ☐	
	Nominal Time	1 ☒	
	Time available ≥ 5× the time required	0.1 ☐	
	Time available is ≥ 50× the time required	0.01 ☐	
	Insufficient Information	1 ☐	
Stress/ Stressors	Extreme	5 ☐	
	High	2 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Complexity	Highly Complex	5 ☐	
	Moderately Complex	2 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Experience/ Training	Low	3 ☐	
	Nominal	1 ☒	
	High	0.5 ☐	
	Insufficient Information	1 ☐	
Procedures	Not Available	50 ☐	
	Incomplete	20 ☐	
	Available, but Poor	5 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Ergonomics/ HMI	Missing/Misleading	50 ☐	
	Poor	10 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
	Insufficient Information	1 ☐	
Fitness for Duty	Unfit	P(failure) = 1.0	
	Degraded Fitness	5 ☐	
	Nominal	1 ☒	
	Insufficient Information	1 ☐	
Work Processes	Poor	5 ☐	
	Nominal	1 ☒	
	Good	0.5 ☐	
	Insufficient Information	1 ☐	

Calculate the Action Failure Probability.

(1) If all PSF ratings are nominal, then the Action Failure Probability = 1×10^{-3}

(2) Otherwise, the Action Failure Probability = 1×10^{-3} × Time × Stress or Stressors × Complexity × Experience or Training × Procedures × Ergonomics or HMI × Fitness for Duty × Processes

Action HEP: $1\times10^{-3} \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 = \mathbf{1\times10^{-3}}$

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 [$\mathbf{2\times10^{-2}}$] + Action HEP [$\mathbf{1\times10^{-3}}$] = $\mathbf{2.1\times10^{-2}}$

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:

This event is the postulated event initiator; therefore, no dependence is considered.

APPENDIX D
BEST ESTIMATE GEM RUN

I N I T I A T I N G E V E N T A S S E S S M E N T

Code Ver : 7:27
Fam : PBCH_3P
Model Ver : 2008/07/08
User : INEEL
Init Event: IE-TRANS
Ev ID: BEST-ESTIMATE
Total CCDP: 6.1E-006

Desc : Concurrent Loss of Station Auxiliary Transformer 1X-04 and 480V Safeguards Bus 1B-04.

BASIC EVENT CHANGES

Event Name	Description	Base Prob	Curr Prob	Type
ACP-BAC-LP-1B04	480 VAC BUS 1B-04 IS UA	9.6E-006	1.0E+000	TRUE
ACP-TFM-FC-1X04	13.8 KV XFR 1X04 Fails	2.2E-005	1.0E+000	TRUE
ACP-XHE-XM-B0809	OPERATOR FAILS TO ALIGN	3.0E-001	6.5E-001	
IE-FLB	FEED/STEAM LINE BREAK	3.0E-003	+0.0E+000	
IE-ISL-HPI	ISLOCA IE HPI Interface	2.3E-006	+0.0E+000	
IE-ISL-LPI	ISLOCA IE LPI Interface	2.0E-009	+0.0E+000	
IE-ISL-RHR	RHR Pipe Ruptures	4.0E-006	+0.0E+000	
IE-LLOCA	LARGE LOCA	2.5E-006	+0.0E+000	
IE-LOCCW	Loss OF CCW	4.0E-004	+0.0E+000	
IE-LOCHS	LOSS OF CONDENSER HEAT SINK	8.0E-002	+0.0E+000	
IE-LODCD01	LOSS OF 125 VDC BUS D01	6.0E-004	+0.0E+000	
IE-LODCD02	Loss OF 125 VDC BUS D02	6.0E-004	+0.0E+000	
IE-LOIA	LOSS OF INSTRUMENT AIR	1.0E-002	+0.0E+000	
IE-LOMFW	LOSS OF MAIN FEEDWATER	1.0E-001	+0.0E+000	
IE-LOOP	LOSS OF OFFSITE POWER	+0.0E+000	+0.0E+000	
IE-LOSWS	LOSS OF SERVICE WATER	4.0E-004	+0.0E+000	
IE-MLOCA	MEDIUM LOCA	2.0E-004	+0.0E+000	
IE-RXVRUPT	REACTOR VESSEL RUPTURE	1.0E-007	+0.0E+000	
IE-SGTR	STEAM GENERATOR TUBE RUPTURE	4.0E-003	+0.0E+000	
IE-SLB	STEAM LINE BREAK	1.2E-002	+0.0E+000	
IE-SLOCA	SMALL LOCA	6.0E-004	+0.0E+000	
IE-TRANS	TRANSIENT	8.0E-001	2.1E-002	

SEQUENCE PROBABILITIES

Truncation : Cumulative : 95.0% Individual : 1.0%

Event Tree Name	Sequence Name	CCDP
TRANS	02-06-05	1.3E-006
TRANS	02-08-05	1.3E-006
TRANS	02-09-05	1.3E-006
TRANS	20	7.5E-007
TRANS	02-07-05	6.5E-007
TRANS	02-10-05	6.5E-007

SEQUENCE LOGIC

Event Tree	Sequence Name	Logic	
TRANS	02-06-05	/RPS	/AFW
		/PORV	LOSC
		/RCPT	RSD
		/BP1	/O1
		/BP2	O2
		/FW	/HPI
		/SSC	PZR
		HPR	
TRANS	02-08-05	/RPS	/AFW
		/PORV	LOSC
		/RCPT	RSD
		/BP1	O1
		/BP2	/O2
		/FW	/HPI
		/SSC	PZR
		HPR	
TRANS	02-09-05	/RPS	/AFW
		/PORV	LOSC
		/RCPT	RSD
		/BP1	O1
		/BP2	O2
		/FW	/HPI
		/SSC	PZR
		HPR	
TRANS	20	/RPS	AFW
		MFW	FAB
TRANS	02-07-05	/RPS	/AFW
		/PORV	LOSC
		/RCPT	RSD
		/BP1	/O1
		BP2	/FW
		/HPI	/SSC
		PZR	HPR
TRANS	02-10-05	/RPS	/AFW
		/PORV	LOSC
		/RCPT	RSD
		/BP1	O1
		BP2	/FW
		/HPI	/SSC
		PZR	HPR

Fault Tree Name	Description
AFW	AUXILIARY FEEDWATER
BP1	RCP SEAL STAGE 1 INTEGRITY
BP2	RCP SEAL STAGE 2 INTEGRITY
FAB	FEED AND BLEED
FW	FEEDWATER (AFW or MFW)
HPI	HIGH PRESSURE INJECTION
HPR	HPR PRESSURE RECIRCULATION
LOSC	LOSS OF SEAL COOLING
MFW	MAIN FEEDWATER
O1	RCP SEAL STAGE 1 INTEGRITY
O2	RCP SEAL STAGE 2 INTEGRITY
PORV	PORV/SRVs ARE CLOSED
PZR	RCS DEPRESS FOR LPI/RHR
RCPT	REACTOR COOLANT PUMPS TRIPPED
RPS	REACTOR TRIP
RSD	RAPID SECONDARY DEPRESS
SSC	SECONDARY SIDE COOLDOWN

SEQUENCE CUT SETS

Truncation: Cumulative: 90.0% Individual: 2.5%

Event Tree: TRANS CCDP: 1.3E-006
Sequence: 02-06-05

CCDP	% Cut Set	Cut Set Events	
3.4E-007	26.05	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	ACP-CRB-CC-57
		ACP-XHE-XM-B0809	
7.8E-008	6.06	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-FR-G01
		EPS-DGN-FR-G02	ACP-XHE-XM-B0809
7.8E-008	6.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	ACP-CRB-CC-57
		CVC-XHE-XM-112B	
6.5E-008	5.02	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	/RCS-MDP-LK-O1
		RCS-MDP-LK-O2	ACP-XHE-XM-2A031A03
		EPS-DGN-FR-G01	ACP-XHE-XM-B0809
5.8E-008	4.50	ACP-TFM-FC-1X13	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	/RCS-MDP-LK-O1
		RCS-MDP-LK-O2	ACP-XHE-XM-B0809
5.6E-008	4.35	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	RCS-MDP-LK-O2
		EPS-DGN-CF-RG0102	ACP-XHE-XM-2A031A03
		ACP-XHE-XM-B0809	
3.9E-008	3.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G01

		EPS-DGN-FR-G02	ACP-XHE-XM-B0809
3.9E-008	3.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G02
		EPS-DGN-FR-G01	ACP-XHE-XM-B0809
3.2E-008	2.50	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	/RCS-MDP-LK-O1
		RCS-MDP-LK-O2	ACP-XHE-XM-2A031A03
		EPS-DGN-TM-G01	ACP-XHE-XM-B0809

Event Tree: TRANS CCDP: 1.3E-006
Sequence: 02-08-05

CCDP	% Cut Set	Cut Set Events	
3.4E-007	26.05	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	/RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	ACP-CRB-CC-57
		ACP-XHE-XM-B0809	
7.8E-008	6.06	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	/RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-FR-G01
		EPS-DGN-FR-G02	ACP-XHE-XM-B0809
7.8E-008	6.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	/RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	ACP-CRB-CC-57
		CVC-XHE-XM-112B	
6.5E-008	5.02	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		/RCS-MDP-LK-O2	ACP-XHE-XM-2A031A03
		EPS-DGN-FR-G01	ACP-XHE-XM-B0809
5.8E-008	4.50	ACP-TFM-FC-1X13	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		/RCS-MDP-LK-O2	ACP-XHE-XM-B0809
5.6E-008	4.35	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	/RCS-MDP-LK-O2
		EPS-DGN-CF-RG0102	ACP-XHE-XM-2A031A03
		ACP-XHE-XM-B0809	
3.9E-008	3.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	/RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G01
		EPS-DGN-FR-G02	ACP-XHE-XM-B0809
3.9E-008	3.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	/RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G02
		EPS-DGN-FR-G01	ACP-XHE-XM-B0809
3.2E-008	2.50	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		/RCS-MDP-LK-O2	ACP-XHE-XM-2A031A03
		EPS-DGN-TM-G01	ACP-XHE-XM-B0809

Event Tree: TRANS CCDP: 1.3E-006
Sequence: 02-09-05

CCDP	% Cut Set	Cut Set Events	
3.4E-007	26.05	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	ACP-CRB-CC-57
		ACP-XHE-XM-B0809	
7.8E-008	6.06	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-FR-G01
		EPS-DGN-FR-G02	ACP-XHE-XM-B0809
7.8E-008	6.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	ACP-CRB-CC-57
		CVC-XHE-XM-112B	
6.5E-008	5.02	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		RCS-MDP-LK-O2	ACP-XHE-XM-2A031A03
		EPS-DGN-FR-G01	ACP-XHE-XM-B0809
5.8E-008	4.50	ACP-TFM-FC-1X13	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		RCS-MDP-LK-O2	ACP-XHE-XM-B0809
5.6E-008	4.35	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	RCS-MDP-LK-O2
		EPS-DGN-CF-RG0102	ACP-XHE-XM-2A031A03
		ACP-XHE-XM-B0809	
3.9E-008	3.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G01
		EPS-DGN-FR-G02	ACP-XHE-XM-B0809
3.9E-008	3.01	/RCS-MDP-LK-BP1	/RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	RCS-MDP-LK-O2
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G02
		EPS-DGN-FR-G01	ACP-XHE-XM-B0809
3.2E-008	2.50	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		/RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		RCS-MDP-LK-O2	ACP-XHE-XM-2A031A03
		EPS-DGN-TM-G01	ACP-XHE-XM-B0809

Event Tree: TRANS CCDP: 7.5E-007
Sequence: 20

CCDP	% Cut Set	Cut Set Events	
1.1E-007	14.47	IAS-MDC-CF-K2AB3ABR	AFW-XHE-XM-MINGAG
8.6E-008	11.49	IAS-MDC-FR-K2A	IAS-MDC-FR-K2B
		AFW-XHE-XM-MINGAG	IAS-MDC-FR-K3B
5.3E-008	7.04	ACP-XHE-XM-2A031A03	AFW-XHE-XM-MINGAG
		ACP-CRB-CC-57	
2.6E-008	3.52	FPS-EDP-TM-P35B	ACP-XHE-XM-2A031A03
		ACP-CRB-CC-57	

Event Tree: TRANS CCDP: 6.5E-007
Sequence: 02-07-05

CCDP	% Cut Set	Cut Set Events	
1.7E-007	26.05	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		ACP-CRB-CC-57	ACP-XHE-XM-B0809
3.9E-008	6.06	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		EPS-DGN-FR-G01	EPS-DGN-FR-G02
		ACP-XHE-XM-B0809	
3.9E-008	6.01	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		ACP-CRB-CC-57	CVC-XHE-XM-112B
3.3E-008	5.03	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		RCS-MDP-LK-BP2	/RCS-MDP-LK-O1
		ACP-XHE-XM-2A031A03	EPS-DGN-FR-G01
		ACP-XHE-XM-B0809	
2.9E-008	4.50	ACP-TFM-FC-1X13	/RCS-MDP-LK-BP1
		RCS-MDP-LK-BP2	/RCS-MDP-LK-O1
		ACP-XHE-XM-B0809	
2.8E-008	4.35	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	EPS-DGN-CF-RG0102
		ACP-XHE-XM-2A031A03	ACP-XHE-XM-B0809
2.0E-008	3.02	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		EPS-DGN-TM-G02	EPS-DGN-FR-G01
		ACP-XHE-XM-B0809	
2.0E-008	3.02	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		/RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		EPS-DGN-TM-G01	EPS-DGN-FR-G02
		ACP-XHE-XM-B0809	
1.6E-008	2.50	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		RCS-MDP-LK-BP2	/RCS-MDP-LK-O1
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G01
		ACP-XHE-XM-B0809	

Event Tree: TRANS CCDP: 6.5E-007
Sequence: 02-10-05

CCDP	% Cut Set	Cut Set Events	
1.7E-007	26.05	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		ACP-CRB-CC-57	ACP-XHE-XM-B0809
3.9E-008	6.06	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		EPS-DGN-FR-G01	EPS-DGN-FR-G02
		ACP-XHE-XM-B0809	
3.9E-008	6.01	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		ACP-CRB-CC-57	CVC-XHE-XM-112B
3.3E-008	5.03	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		ACP-XHE-XM-2A031A03	EPS-DGN-FR-G01
		ACP-XHE-XM-B0809	

2.9E-008	4.50	ACP-TFM-FC-1X13	/RCS-MDP-LK-BP1
		RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		ACP-XHE-XM-B0809	
2.8E-008	4.35	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	EPS-DGN-CF-RG0102
		ACP-XHE-XM-2A031A03	ACP-XHE-XM-B0809
2.0E-008	3.02	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		EPS-DGN-TM-G02	EPS-DGN-FR-G01
		ACP-XHE-XM-B0809	
2.0E-008	3.02	/RCS-MDP-LK-BP1	RCS-MDP-LK-BP2
		RCS-MDP-LK-O1	ACP-XHE-XM-2A031A03
		EPS-DGN-TM-G01	EPS-DGN-FR-G02
		ACP-XHE-XM-B0809	
1.6E-008	2.50	EPS-XHE-XM-G02-1A05	/RCS-MDP-LK-BP1
		RCS-MDP-LK-BP2	RCS-MDP-LK-O1
		ACP-XHE-XM-2A031A03	EPS-DGN-TM-G01
		ACP-XHE-XM-B0809	

BASIC EVENTS (Cut Sets Only)

Event Name	Description	Curr Prob
ACP-CRB-CC-57	XFR 1X04 SUPPLY BREAKER TO BUS 1A05 FAILS TO	2.5E-003
ACP-TFM-FC-1X13	TRANSFORMER 1X13 FAILS DUE TO LOSS OF POWER	2.2E-005
ACP-XHE-XM-2A031A03	OPERATOR FAILS TO TRANSFER POWER FROM 2A03 TO	5.0E-002
ACP-XHE-XM-B0809	OPERATOR FAILS TO ALIGN TO B08 / B09 PER AOP	6.5E-001
AFW-XHE-XM-MINGAG	FAILURE TO GAG MINI RECIRC VALVE >1HR INTO EV	2.0E-002
CVC-XHE-XM-112B	OP. FAILS TO MAN. OPEN CV-112B VALVE (RWST TO	1.5E-001
EPS-DGN-CF-RG0102	CCF OF DIESEL GENERATORS G01 AND G02 TO RUN	4.2E-004
EPS-DGN-FR-G01	DIESEL GENERATOR G01 FAILS TO RUN	2.4E-002
EPS-DGN-FR-G02	DIESEL GENERATOR G02 FAILS TO RUN	2.4E-002
EPS-DGN-TM-G01	DIESEL GENERATOR G01 UNAVAILABLE DUE TO T&M	1.2E-002
EPS-DGN-TM-G02	DIESEL GENERATOR G02 UNAVAILABLE DUE TO T&M	1.2E-002
EPS-XHE-XM-G02-1A05	OPERATOR FAILS TO ALIGN G-02 TO 1A-05U1 ECA-0	2.0E-002
FPS-EDP-TM-P35B	FP DIESEL DRIVEN PUMP 35B UNAVAILABLE DUE TO	1.0E-002
IAS-MDC-CF-K2AB3ABR	CCF OF IAS COMPRESSORS K-2A, K-2B, K-3A & K-3	2.6E-004
IAS-MDC-FR-K2A	INSTRUMENT AIR COMPRESSOR K2A FAILS TO RUN	5.9E-002
IAS-MDC-FR-K2B	INSTRUMENT AIR COMPRESSOR K2B FAILS TO RUN	5.9E-002
IAS-MDC-FR-K3B	SERVICE AIR COMPRESSOR K-3B FAILS TO RUN	5.9E-002
RCS-MDP-LK-BP1	RCP SEAL STAGE 1 INTEGRITY (BINDING/POPPING O	1.3E-002
RCS-MDP-LK-BP2	RCP SEAL STAGE 2 INTEGRITY (BINDING/POPPING O	2.0E-001
RCS-MDP-LK-O1	RCP SEAL STAGE 1 INTEGRITY (O-RING EXTRUSION)	5.0E-001
RCS-MDP-LK-O2	RCP SEAL STAGE 2 INTEGRITY (O-RING EXTRUSION)	5.0E-001