

**Appendix A**

**BRUNSWICK MAAP CASES TO SUPPORT  
POWER UPRATE**

## **Appendix A**

### **BRUNSWICK MAAP CASES TO SUPPORT POWER UPRATE**

The Modular Accident Analysis Package (MAAP) are used to calculate changes in the thermal hydraulic profile for specific issues (e.g., boildown timing). The boildown time decreases as a result of increasing the current power of 2558 MWth to 2923 MWth.

MAAP is an industry recognized thermal hydraulics code used to evaluate design basis and beyond design basis accidents. MAAP (Version 3.0B) has been used to support the CP&L PSA for performing best estimate calculations. The Brunswick plant description is based on the BNP MAAP parameter file *bmaap10.exe*. This parameter file contains plant specific parameters representing the primary system and containment.

#### **A.1        PARAMETER FILE CHANGES**

A number of changes to the BNP base parameter file were made as part of the input decks of these runs to reflect the as-operated condition of the plant. These changes relate to RPV level setpoints.

The base BNP parameter file primarily uses Tech. Spec. setpoints. The changes to the base parameter file setpoints in support of these MAAP runs are summarized in Table A-1.

#### **A.2        MAAP RUN RESULTS**

A summary of the MAAP runs performed in support of this risk assessment is provided in Table A-2.

In addition, copies of the cover pages of the individual runs are also provided at the end of this appendix. The actual run documentation packages are included in the BNP PSA Deterministic Calculations Notebook. [A-1]

Table A-1  
BRUNSWICK PARAMETER FILE CHANGES  
- Changes to Parameters Via Input Decks for EPU PSA Runs -

Parameter	Definition	Original Value	Reference for Original Value	Modified Value	Reference for Modified Value	Reason for Change
ZLMSIV	Low water level for MSIV closure	64.29' = 2.5" above reactor 0	Ref 1: Table 7.3.1-3	67.83' = 45" above reactor 0	Ref. 2 LL3	Use actual level
ZLLPCI	Low water level setpoint to initiate LPCI	64.29' = 2.5" above reactor 0	Ref 1: Table 7.3.3-4	67.83' = 45" above reactor 0	Ref. 2 LL3	Use actual level
ZLLPCS	Low water level setpoint to initiate LPCS	64.29' = 2.5" above reactor 0	Ref 1: Table 7.3.3-3	67.83' = 45" above reactor 0	Ref. 2 LL3	Use actual level
ZLADS	Low water level for ADS initiation	64.29' = 2.5" above reactor 0	Ref 1: Table 6.3.3-5	67.83' = 45" above reactor 0	Ref. 2 LL3	Use actual level
ZLHPCI	Low water level setpoint to initiate HPCI	71.75' = 92" above reactor 0	Ref 1: Table 6.3.3-5	72.83' = 105" above reactor 0	Ref. 2 LL2	Use actual level
ZLRCIC	Low water level setpoint to initiate RCIC	71.75' = 92" above reactor 0	Ref 1: Table 7.3.3-1	72.83' = 105" above reactor 0	Ref. 2 LL2	Use actual level
ZLRPT	Low water level for Recirc Pump trip	71.75' = 92" above reactor 0	Ref 1: Table 7.3.1-3	72.83' = 105" above reactor 0	Ref. 2 LL2	Use actual level
ZSCRAM	Level 2 trip for scram	76.58' = 150" above reactor 0	Ref 1: Table 7.2.1-1	77.92' = 166" above reactor 0	Ref. 1 LL1	Use actual level

References:

- (1) Brunswick Steam Electric Plant Updated Final Safety Analysis Report June 1986. Docket-50324-46. Levels are "analytical" levels.
- (2) Telefax, V. Andersen (ERIN) to B. Schlenger-Faber (ERIN), 3/6/01 based on CP&L Brunswick Nuclear Plant EOP/SAMG Numerical Limits and Values, Rev. 5, 0EOP-01-NL. Levels are "actual" levels.

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core Temp (°F) <sup>(2)</sup>	HCTL Exceeded <sup>(3)</sup>	Comments
BNP1a	LOFW w/SORV, RCIC, No ED, and No LP Injection <ul style="list-style-type: none"> <li>Stick open 1 SRV at t=0 and do not reclose</li> <li>RCIC auto cycling (trip @ steam press. 50 psi)</li> <li>No Emergency Depressurization (OK to follow HCTL curve, if possible)</li> <li>No other injection</li> <li>SPC w/1 RHR train initiated at pool temp. 95F</li> </ul>	<ul style="list-style-type: none"> <li>Verify that RCIC operation can delay core damage for 24hrs. during a transient w/1SORV</li> </ul>	3.07 hr	12.9 hr	1.38 hr	Core damage
BNP1b	LOFW w/SORV, HPCI, No ED, and No LP Injection <ul style="list-style-type: none"> <li>Stick open 1 SRV at t=0 and do not reclose</li> <li>HPCI auto cycling (trip @ steam press. 100 psi)</li> <li>No Emergency Depressurization (OK to follow HCTL curve, if possible)</li> <li>No other injection</li> <li>SPC w/1 RHR train initiated at pool temp. 95F</li> </ul>	<ul style="list-style-type: none"> <li>Verify that HPCI operation can delay core damage for 24hrs. during a transient w/1SORV</li> </ul>	3.58 hr	4.20 hr	1.55 hr	Core damage

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core Temp <sup>(2)</sup> (°F)	HCTL <sup>(3)</sup> Exceeded	Comments
BNP2	Med. Water Break LOCA, HPCI, 1 LPCI pump, and No ED <ul style="list-style-type: none"> <li>MLOCA .0873 ft<sup>2</sup> (4" ID water break) at t=0</li> <li>HPCI auto cycling</li> <li>No Emergency Depressurization (OK to follow HCTL curve, if possible)</li> <li>Initiate 1 LPCI pump when LP interlock reached</li> </ul>	<ul style="list-style-type: none"> <li>Verify viability of LP injection for MLOCA with HPCI and no requirement for RPV ED on HCTL (MLOCA ET success criteria)</li> </ul>	Did not uncover	547 F @ 0 hr	3.28, 5.06 hr (depending on what level LPCI is throttled at)	No core damage
BNP3a	LOFW, no HP Injection, delayed ED (at MSCL), and 1 LPCI pump <ul style="list-style-type: none"> <li>LOFW and MSIV Closure at t=0</li> <li>Only 3 SRVs available for initial pressure transient</li> <li>No HP injection</li> <li>Emergency Depressurization at minimum steam cooling level (using only 3 SRVs)</li> <li>Initiate 1 LPCI pump at LP interlock</li> <li>SPC w/1 RHR train initiated at pool temp. 95F</li> </ul>	<ul style="list-style-type: none"> <li>Verify 3 SRVs sufficient for pressure control to prevent exceeding RPV pressure operability limits (success criteria)</li> <li>Verify 3 SRVs sufficient for RPV Emergency Depressurization (success criteria)</li> <li>Verify time allowable for manual initiation of ADS</li> </ul>	0.64 hr	958 F @ 0.71 hr	N/a	<p>No core damage</p> <p>RPV peak pressure remains well below 1500 psig</p> <p>Have ~1.0 hr to ED to avoid core damage (2200 F)</p>

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core Temp <sup>(2)</sup> (°F)	HCTL <sup>(3)</sup> Exceeded	Comments
BNP3b	LOFW, no HP Injection, delayed ED (at 1/3 core height), and 1 LPCI pump <ul style="list-style-type: none"> <li>• LOFW and MSIV Closure at t=0</li> <li>• Only 3 SRVs available for initial pressure transient</li> <li>• No HP injection</li> <li>• Emergency Depressurization at 1/3 core height (using only 3 SRVs)</li> <li>• Initiate 1 LPCI pump at LP interlock</li> <li>• SPC w/1 RHR train initiated at pool temp. 95F</li> </ul>	<ul style="list-style-type: none"> <li>• Verify 3 SRVs sufficient for RPV Emergency Depressurization (success criteria)</li> <li>• Verify time allowable for manual initiation of ADS</li> </ul>	0.66 hr	992 F @ 0.77 hr	N/a	No core damage
BNP4	Med. Water Break LOCA, no HP Injection, delayed ED (at MSCL), and 1 LPCI pump <ul style="list-style-type: none"> <li>• MLOCA .0873 ft<sup>2</sup> (4" ID water break) at t=0</li> <li>• Only 3 SRVs available</li> <li>• No HP injection</li> <li>• Emergency Depressurization at minimum steam cooling level (using only 3 SRVs)</li> <li>• Initiate 1 LPCI pump at LP interlock</li> <li>• SPC w/1 RHR train initiated at pool temp. 95F</li> </ul>	<ul style="list-style-type: none"> <li>• Verify time allowable for manual initiation of ADS</li> </ul>	7.6 min.	1103 F @ 10.8 min.	N/A	No core damage

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core <sup>(2)</sup> Temp (°F)	HCTL <sup>(3)</sup> Exceeded	Comments
BNP6a	LOFW ATWS with Level Control (using RCIC), SLC and 1 SORV <ul style="list-style-type: none"> <li>• LOFW ATWS at t=0</li> <li>• Stick open 1 SRV at t=0 and do not reclose</li> <li>• RPT (both pumps) at t=0</li> <li>• CRD injection</li> <li>• RCIC injection (trip @ steam press. 50 psi)</li> <li>• Level controlled at 6" above TAF at 4 mins.</li> <li>• SLC w/2 pumps initiated at 4 mins.</li> <li>• Decrease RPV power during boron injection period</li> <li>• SPC w/2 RHR trains initiated at pool temp. 95F</li> <li>• OK to follow HCTL curve, if possible (no LP systems available)</li> </ul>	<ul style="list-style-type: none"> <li>• Verify RCIC successful during ATWS w/SORV for 24 hour mission time and does not require RPV ED or other injection systems</li> </ul>	0.09 hr	2200 F @ 15.2 min	Never reached	CRD injection  Level controlled at 6" above TAF instead of exactly TAF  Core damage

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core <sup>(2)</sup> Temp (°F)	HCTL <sup>(3)</sup> Exceeded	Comments
BNP6b	LOFW ATWS with Level Control (using HPCI), SLC and 1 SORV <ul style="list-style-type: none"> <li>• LOFW ATWS at t=0</li> <li>• Stick open 1 SRV at t=0 and do not reclose</li> <li>• RPT (both pumps) at t=0</li> <li>• CRD injection</li> <li>• HPCI injection (trip @ steam press. 100 psi)</li> <li>• Level controlled at 6" TAF at 4 mins.</li> <li>• SLC w/2 pumps initiated at 4 mins.</li> <li>• Decrease RPV power during boron injection period</li> <li>• SPC w/2 RHR trains initiated at pool temp. 95F</li> <li>• OK to follow HCTL curve, if possible (no LP systems available)</li> </ul>	<ul style="list-style-type: none"> <li>• Verify HPCI successful during ATWS w/SORV for 24 hour mission time and does not require RPV ED or other injection systems</li> </ul>	0.33 hr	554 @ 0.038 hr	0.13 hr	CRD injection  Level controlled at 6" above TAF instead of exactly TAF  HPCI trips at 0.34 hr  No core damage

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core Temp <sup>(2)</sup> (°F)	HCTL <sup>(3)</sup> Exceeded	Comments
BNP7	LOFW ATWS with Level Control (using RCIC) and SLC <ul style="list-style-type: none"> <li>• LOFW ATWS at t=0</li> <li>• RPT (both pumps) at t=0</li> <li>• All SRVs allowed to operate as challenged</li> <li>• CRD injection</li> <li>• RCIC injection (trip @ steam press. 50 psi)</li> <li>• Level controlled at 6" above TAF at 4 mins.</li> <li>• SLC w/2 pumps initiated at 4 mins.</li> <li>• Decrease RPV power during boron injection period</li> <li>• SPC w/2 RHR trains initiated at pool temp. 95F</li> <li>• RPV ED if HCTL exceeded – OK to follow HCTL curve, if possible (no LP systems available)</li> </ul>	<ul style="list-style-type: none"> <li>• Verify RCIC successful during ATWS for 24 hour mission time and does not require RPV ED or other injection systems</li> </ul>	0.09 hr	1581 F @ 0.36 hr	Not reached	CRD injection  Level controlled at 6" above TAF instead of exactly TAF  No core damage

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core <sup>(2)</sup> Temp (°F)	HCTL <sup>(3)</sup> Exceeded	Comments
BNP8	Isolation ATWS, Level Control and SLC <ul style="list-style-type: none"> <li>MSIV Closure ATWS at t=0</li> <li>RPT (both pumps) at t=0</li> <li>Only 6 SVs available for initial pressure transient</li> <li>CRD injection</li> <li>HPCI injection source (trip @ steam press. 100 psi)</li> <li>Level controlled at 6" above TAF at 4 mins.</li> <li>SLC w/2 pumps initiated at 4 mins.</li> <li>Decrease RPV power during boron injection period</li> <li>SPC w/2 RHR trains initiated at pool temp. 95F</li> <li>OK to follow HCTL curve, if possible (no LP systems available)</li> </ul>	<ul style="list-style-type: none"> <li>Verify that RPT (both pumps) and 6 SVs sufficient to limit pressure transient during isolation ATWS</li> <li>Verify time allowable for SLC initiation</li> <li>Verify time allowable for ADS Inhibit for ATWS scenarios with initial HP injection</li> </ul>	N/A	560 @ 04.5 hr	0.090 hr	CRD injection  RPV peak pressure remains below 1500 psig  Level controlled at 6" above TAF instead of exactly TAF  No core damage.
BNP10	Loss of Containment Heat Removal with injection <ul style="list-style-type: none"> <li>MSIV Closure w/no SPC or Vent at t=0</li> <li>CRD injection</li> <li>HPCI initially</li> <li>HCTL curve followed</li> <li>1 LPCI pump until SRVs re-close when DW pressure &gt;104.7 psia (go to normal SRV operation)</li> </ul>	<ul style="list-style-type: none"> <li>Identify time frames (for information purposes) for vent initiation and ultimate containment failure pressure</li> </ul>	~32 hrs	>2200 F @33.4 hr	2.42 hr	CRD injection LPCI on @ 4.24 hr HPCI off @ 4.93 hr DW pressure > 104.7 psia @ 20.8 hr Containment failed due to overpressure in the DW at 31.4 hr

Table A-2

MAAP RUNS FOR BRUNSWICK EXTENDED POWER UPRATE<sup>(1)</sup>

Case ID	MAAP Run Description	Purpose	Core Uncovered	Max Core Temp (°F) <sup>(2)</sup>	HCTL <sup>(3)</sup> Exceeded	Comments
BNP2ED	Loss of HP Injection and 2 SRVs <ul style="list-style-type: none"> <li>• Loss of FW</li> <li>• MSIV closure</li> <li>• No HPCI, RCIC, or CRD</li> <li>• RPV ED using 2 SRVs @ MSCL</li> <li>• 1 LPCI pump available</li> <li>• SPC available</li> </ul>	<ul style="list-style-type: none"> <li>• Verify that 2 SRVs satisfy RPV ED</li> </ul>	42 mins.	1000F	N/A	No core damage
BNPMSIV	Loss of FW w/RCIC <ul style="list-style-type: none"> <li>• Loss of FW</li> <li>• RCIC only HP injection source</li> </ul>	<ul style="list-style-type: none"> <li>• Determine whether RCIC can prevent MSIV low level isolation during LOFW w/SORV</li> </ul>	N/A	N/A	N/A	LL3 reached in 44 seconds. MSIVs close before RCIC turns around the level drop.  Case ran for a few minute time frame

Notes to Table A-2

- (1) Sensitivity cases were run for some of the MAAP runs. These cases are described on the run cover sheets and in the BNP Deterministic Calculations Notebook. [A-1] These sensitivity case are not summarized in this table.
- (2) The Brunswick PSA Groundrules and Assumptions Document defines the onset of core damage as 2200F of any node in the core (best-estimate thermal-hydraulic calculation using MAAP or similar code). This is the definition used in these runs.
- (3) The suppression pool Heat Capacity Temperature Limit, HCTL, is one of the key parameters (along with low RPV water level) requiring RPV Emergency Depressurization per the EOPs (refer to Figure 3 of Brunswick EOP Users Guide, 0EOP-01-UG).

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASES  
BNP1A and BNP1B**

**I. RUN INFORMATION**

Date of Runs: 3/14-15/01

Title of Runs: Stuck Open SRV with RCIC or HPCI

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaap10.exe 5/4/99

Parameter File Version/Date: bsep.par 12/12/00

Input File Names: BNP1A\_R, BNP1B\_R

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&i\brunswick\febmar01\bnp1

**II. PURPOSE AND DESCRIPTION**

Determine if RCIC or HPCI operation can delay core damage for 24 hrs for a transient with 1 SORV. There is no other injection, and no emergency depressurization. The system is depressurized due to the HCTL curve. Suppression pool cooling is operating. The injection flow is throttled to maintain level at 104". Steam extraction is reduced in proportion to the injection flow.

**III. ADJUSTED PARAMETERS**

Injection: 1) RCIC (HPCI along with RCIC for the first 5 min) - Case BNP1A\_R  
2) HPCI - Case BNP1B\_R

**IV. KEY EVENT TIMING AND RESULTS**

**TIME**

Initial conditions..... 0

Loss of feedwater  
Loss of all injection except RCIC or HPCI  
MSIV closure (to prevent excessive drop in level)  
One stuck open SRV

Stop HPCI for RCIC case ..... 5 min

Depressurization due to HCTL ..... see table

Injection tripped on low pressure ..... see table

Core damage

Uncovers (level below TOAF).....see table

Max. temp. > 2200 F.....see table

Sequence	High Pressure Injection	Time (hr)			
		Depress. due to HCTL curve	Injection Tripped on Low Pressure	Core Uncovered	Hottest Core Node > 2200 F
BNP1A_R	RCIC	1.38	12.3	3.07	12.9
BNP1B_R	HPCI	1.55	2.73	3.58	4.20

**V. DISCUSSION**

RCIC and HPCI are not sufficient to provide adequate makeup to the vessel for more than approximately 13 and 4 hours, respectively.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASE BNP2**

**I. RUN INFORMATION**

Date of Runs: 4/5/01

Title of Runs: Medium LOCA with HPCI and LPCI, no ED

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaap10.exe 5/4/99

Parameter File Version/Date: bsep.par 4/5/01 (=12/12/00 + output control)

Input File Names: BNP2, BNP2A

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&\lbrunswick\febmar01\case2

**II. PURPOSE AND DESCRIPTION**

Determine if one loop of LP injection is adequate to prevent core damage for a 4" diameter LOCA with HPCI and no requirement for RPV ED. The RPV is depressurized due to the HCTL curve. HPCI injection flow is throttled to maintain level at 104". LP injection flow is throttled at two different levels - see the adjusted parameters. The steam extraction is reduced in proportion to the HPCI injection flow. There is one train of suppression pool cooling. The power is increased to 2923 MWth.

**III. ADJUSTED PARAMETERS**

Level at which LPCI is throttled:

- 1) 105" - Case BNP2
- 2) Level 8 = 209.5" - Case BNP2A

**IV. KEY EVENT TIMING AND RESULTS**

**TIME**

Initial conditions.....	0
4" LOCA at elevation of recirculation suction	
Loss of all injection except HPCI and 1 loop of LPCI	
MSIV closure.....	14.1 sec
BNP2 (LPCI controlled at 105")	
HPCI Injection tripped on low pressure .....	0.42 hr
Depressurization due to HCTL .....	3.28 hr
BNP2A (LPCI controlled at 209.5")	
Depressurization due to HCTL .....	2.35 hr
HPCI Injection tripped on low pressure .....	5.06 hr

The core is not uncovered.  
The case runs to 24 hours without core damage.

**V. DISCUSSION**

One loop of LP injection is adequate to prevent core damage for a 4" diameter LOCA with HPCI and no requirement for RPV ED.



Emergency depressurization .....0.62 hr (ED at MSCL)  
0.68 hr (ED at 1/3 core)

Maximum core temperature.....958 F @ 0.71 hr (ED at MSCL)  
992 F @ 0.77 hr (ED at 1/3 core)

**V. DISCUSSION**

The core uncovered briefly and experienced a spike in temperature, but this was not sufficient to lead to core damage. Three SRVs are sufficient to prevent over-pressurization of the vessel and core damage. Sensitivity sequences showed that the operators have up to 1 hr to manually depressurize.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASE**  
**BNP4**

**I. RUN INFORMATION**

Date of Runs: 3/19/01, 4/3/01

Title of Runs: Medium LOCA, no HP, delayed ED

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaap10.exe 5/4/99

Parameter File Version/Date: bsep.par 12/12/00, 3/21/01 (=12/12/00 + output control)

Input File Names: BNP4 and BNP4W

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&\brunswick\febmar01\bnp4

**II. PURPOSE AND DESCRIPTION**

Determine if 3 SRVs are sufficient to prevent RPV over-pressurization. Also investigate if core damage can be prevented for a 4" diameter LOCA with no HP injection. Emergency depressurization is delayed until the water level reaches the minimum steam cooling level (MSCL = -37"). The power is increased to 2923 MWth.

**III. ADJUSTED PARAMETERS**

MSIV closure pressure setpoint:

- 1) Close when PPS < 799.7 psia (plant value in par. file) - Case BNP4
- 2) Don't close on low pressure, just low level - Case BNP4W

**IV. KEY EVENT TIMING AND RESULTS**

**TIME**

Initial conditions..... 0  
    4" LOCA at elevation of recirculation suction  
    Loss of all injection except 1 loop of LPCI  
    Only 3 SRVs are available  
    Suppression pool cooling at pool temperature > 95 F

BNP4

MSIV closed.....	14 sec
Emergency depressurization.....	6.44 min
Core uncover.....	7.60 min
LPCI flow started.....	9.91 min
Tmax (= 1103 F) .....	10.8 min

Case runs to 24 hours without core damage.

BNP4W

Tmax (= 547 F) ..... 0.0  
LPCI flow started ..... 1.5 min  
MSIV closed ..... 25.1 min

No core uncover.

No emergency depressurization (level did not drop to MSCL).

Case runs to 24 hours without core damage.

**V. DISCUSSION**

With MSIV closure on low RPV pressure, MSCL was reached at 6.44 min, at which point the vessel was depressurized. Without MSIV closure on low pressure, the core did not uncover so there was no ED (case BNP4W). This is likely due to the extended time with feedwater injection for this case. This provides significant inventory makeup to limit the decrease in water level, preventing core uncover.

Both cases ran to 24 hours without core damage.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASES  
BNP6a AND BNP6b**

**I. RUN INFORMATION**

Date of Runs: 4/9/01

Title of Runs: LOFW ATWS with HP injection, 1 SORV

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaapslc.exe 9/6/00 (= bmaap10.exe 5/4/99 plus change so that the power decays linearly to decay power over the SLC injection period)

Parameter File Version/Date: bsep.par 4/5/01 (=12/12/2000 + output control)

Input File Names: BNP6ASLC and BNP6BSLC

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&\brunswick\febmar01\bnp6a,b

**II. PURPOSE AND DESCRIPTION**

Determine if RCIC or HPCI is sufficient to prevent core damage during a LOFW ATWS with a SORV. CRD is operational, and SLC is initiated at 4 min. There is no ED and no other injection. The level is controlled at 6" above TAF after 4 min. The power is increased to 2923 MWth.

**III. ADJUSTED PARAMETERS**

HP injection: 1) RCIC - Case BNP6ASLC  
2) HPCI - Case BNP6BSLC

**IV. KEY EVENT TIMING AND RESULTS**

**TIME**

Initial conditions..... 0  
    Loss of feedwater  
    ATWS  
    Loss of all injection except RCIC or HPCI, and CRD  
    One SORV  
    Recirculation pumps are tripped  
    Suppression pool cooling with 2 trains at pool temperature > 95 F  
  
SLC Injection..... 4 min  
  
Flow controlled on level ..... 4 min  
  
RCIC case:

Core uncovered ..... 5.3 min  
Core temperature > 2200 F ..... 15.2 min

HPCI case:

Max. core temperature ..... 554 F @ 2.3 min  
HCTL activated ..... 8.15 min  
HPCI tripped on low pressure ..... 2.04 hr  
Core never uncovered

**V. DISCUSSION**

RCIC and CRD are not sufficient to prevent early core damage, while HPCI and CRD are sufficient. HPCI shuts off at 2 hour, but from that point on CRD is sufficient to keep the core covered, and the case runs for 24 hours without core damage.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASE  
BNP7**

**I. RUN INFORMATION**

Date of Runs: 4/9/01

Title of Runs: LOFW ATWS with RCIC

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaapslc.exe 9/6/00 (= bmaap10.exe 5/4/99 plus change so that the power decays linearly to decay power over the SLC injection period)

Parameter File Version/Date: bsep.par 4/5/01 (= 12/12/00 + output control)

Input File Names: BNP7SLC

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&\brunswick\febmar01\bnp7

**II. PURPOSE AND DESCRIPTION**

Determine if RCIC is sufficient to prevent core damage during a LOFW ATWS. CRD is operational, and SLC is initiated at 4 min. There is no ED and no other injection. The level is controlled at 6" above TAF after 4 min. The power is increased to 2923 MWth.

**III. ADJUSTED PARAMETERS**

None

**IV. KEY EVENT TIMING AND RESULTS**

**TIME**

Initial conditions.....	0
Loss of feedwater	
ATWS	
Loss of all injection except RCIC and CRD	
Recirculation pumps are tripped	
Suppression pool cooling with 2 trains at pool temperature > 95 F	
SLC Injection.....	4 min
Flow controlled on level .....	4 min
Core uncovered .....	5.5 min
Max. core temperature .....	1581 F @ 21.8 min

**V. DISCUSSION**

RCIC and CRD are sufficient to prevent core damage. RCIC never trips on low pressure, and the HCTL curve is not reached.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASE**  
**BNP8**

**I. RUN INFORMATION**

Date of Runs: 4/9/01

Title of Runs: Isolation ATWS with HPCI

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaapslc.exe 9/6/00 (= bmaap10.exe 5/4/99 plus change so that the power decays linearly to decay power over the SLC injection period)

Parameter File Version/Date: bsep.par 4/5/01 (=12/12/00 + output control)

Input File Names: BNP8SLC, BNP8ASLC, BNP8APSL

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&\brunswick\febmar01\bnp8

**II. PURPOSE AND DESCRIPTION**

Determine if HPCI is sufficient to prevent core damage during an isolation ATWS. CRD is operational, and SLC is initiated at 4 min. There are only 6 SRVs. There is no ED and no other injection. The level is controlled at 6" above TAF after 4 min. The power is increased to 2923 MWth.

**III. ADJUSTED PARAMETERS FOR SENSITIVITY**

Base - Case BNP8SLC

No HPCI or CRD injection - Case BNP8ASLC

No HPCI or CRD injection and initial power level reduced to original value of 2558 MWth - Case BNP8APSL

**IV. KEY EVENT TIMING AND RESULTS**

**TIME**

Initial conditions..... 0  
    MSIV closure  
    ATWS  
    Loss of all injection except HPCI and CRD  
    Recirculation pumps are tripped

Only 6 SRVs are available

Suppression pool cooling with 2 trains at pool temperature > 95 F

SLC Injection.....4 min

Flow controlled on level .....4 min

Depressurization due to HCTL ..... 5.4 min

Max. core temperature ..... ~560 F starting @ 4.5 hr

The core did not uncover, and HPCI did not trip on low pressure

**V. DISCUSSION**

HPCI and CRD are sufficient to prevent core damage. With no HPCI or CRD the core uncovers in 4.9 min and the maximum core temperature reaches 2200 F in approximately 14.5 min. At the lower power level, these events occur at 5.4 min and 17.0 min, respectively.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASE  
BNP10**

**I. RUN INFORMATION**

Date of Runs: 4/4/01

Title of Runs: Loss of Containment Heat Removal with Injection

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaap10.exe 5/4/99

Parameter File Version/Date: bsep.par 3/21/00 (=12/12/2000 plus output control)

Input File Name: BNP10 V

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&l\brunswick\febmar01\bnp10

**II. PURPOSE AND DESCRIPTION**

Identify time frames for vent initiation and ultimate containment failure pressure for sequence initiated by MSIV closure. HPCI and CRD injection are available, along with 1 train of LPCI. The RPV is depressurized due to the HCTL curve until the drywell pressure exceeds 104.7 psia, at which time all SRVs are assumed to reclose due to increased drywell pressure.

The injection flow is throttled to maintain level near 105".

The power is increased to 2923 MWth.

**III. ADJUSTED PARAMETERS**

None

**IV. KEY EVENT TIMING AND RESULTS**

**TIME**

Initial conditions.....	0
MSIV closure	
Loss of all injection except HPCI and CRD	
Depressurization due to HCTL .....	2.42 hr
LPCI injecting .....	4.24 hr
HPCI tripped on low pressure.....	4.93 hr
DW pressure > 104.7 psia .....	20.8 hr
SRVs reclose	

Containment failed on overpressure in DW .....	31.4 hr
Max. core temperature > 2200 F .....	33.4 hr

**V. DISCUSSION**

There was no core damage prior to containment failure, as expected.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASE**  
**BNP2ED**

Error! Bookmark not defined.

**I. RUN INFORMATION**

Date Run: 4/4/01

Title of Run: 2ed

Analyst: J. Gabor

Reviewer: B. Schlenger-Faber

MAAP File Name/Date: bmaap10.exe 5/4/99

Parameter File Version/Date: bsep.par 11/27/00

Input File Name: 2ed.inp

Computer Used: Dell Inspiron 3800 Tag # F7M6601

Server Directory Where Results are Stored: M:\cp&\brunswick\2ed

**II. KEY EVENT TIMING INFORMATION**

**TIME**

(Enter time or else N/A)

Initial Conditions.....	0
MSIV Closure	
Loss of FW	
Failure of all injection except 1 LPCI pump	
Core Uncovers.....	42 min.
Emergency Depressurization w 2 SRVs at Min Steam Cooling (-37") .....	48 min.
Vessel failure.....	N/A

**III. KEY PARAMETERS**

Max Core Temperature..... 1000 °F

**IV. DISCUSSION**

This sequence was run to investigate if 2 SRVs opened when the level reaches the minimum steam cooling water level limit (-37") would result in core damage. This event is initiated with closure of all MSIVs and loss of feedwater. All injection to the RPV is assumed unavailable with the exception of 1 LPCI pump. The indicated water level reaches the top of active fuel (-8.4") at 42 minutes into the event. The minimum steam cooling water level limit (-37") is exceeded at about 48 minutes at which time 2 SRVs are manually opened to depressurize the vessel. At about 55 minutes into the accident the vessel pressure has decreased sufficiently for LPCI to begin to inject. A maximum core temperature of 1000 °F was reached at 56 minutes and then rapidly dropped as a result of successful injection of LPCI.

**SUMMARY OF MAAP3B RESULTS: BRUNSWICK EXTENDED POWER UPRATE CASE**  
**BNPMSIV**

Error! Bookmark not defined.

**I. RUN INFORMATION**

Date Run: 4/18/01

Title of Run: Loss of Feedwater with RCIC - Timing of MSIV closure

Analyst: B. Schlenger-Faber

Reviewer: J. Gabor

MAAP File Name/Date: bmaap10.exe 5/4/99

Parameter File Version/Date: bsep.par 4/5/01 (=12/12/00 + output control)

Input File Name: BNPMSIV

Computer Used: Dell Dimension V350 Tag # UY8MA

Server Directory Where Results are Stored: M:\cp&\brunswick\febmar01\msiv

**II. PURPOSE AND DESCRIPTION**

Determine the time for MSIV closure on low level for a loss of feedwater sequence with RCIC as the only operational high pressure injection system. The power is increased to 2923 MWth.

**III. ADJUSTED PARAMETERS FOR SENSITIVITY**

None

**IV. KEY EVENT TIMING AND RESULTS**

Initial Conditions..... 0  
    MSIV Closure  
    Loss of FW  
    Failure of all injection except 1 LPCI pump  
MSIV closure on low water level..... 43.9 sec  
RIC starts ..... 49.2 sec  
Max. core temperature..... ~545 starting @ ~45 min

**V. KEY PARAMETERS**

Max Core Temperature..... 1000 °F

**VI. DISCUSSION**

The MSIV will close on low water level at ~44 sec. RCIC starts soon after, and the water level rises well above the top of the core.

**REFERENCES**

- [A-1] BNP Deterministic Calculations Notebook, Doc. #P1100001-1730, April 2001.

## **Appendix B**

### **IMPACT OF 15% EPU ON SHUTDOWN OPERATOR ACTION RESPONSE TIMES**

## **Appendix B**

### **IMPACT OF 15% EPU ON SHUTDOWN OPERATOR ACTION RESPONSE TIMES**

This appendix describes the thermal hydraulic analyses performed to support the assessment that the BNP 15% EPU has a negligible impact on human response times during plant shutdown accident scenarios.

#### **B.1 INTRODUCTION**

The risk due to accidents during shutdown is strongly dependent upon the time available from the start of the event to the onset of core damage. As time elapses after shutdown, accidents leading to boiling of coolant within the RPV and consequential inventory losses take more time to evolve. The burden on plant systems decreases as well, introducing the chance of accident mitigation with non-safety, low capacity systems.

The effect of decreasing decay heat on the times to boil and core damage is accounted for in two ways. The first is the calculation of decay heat present at a particular point in the outage. The second takes into consideration the heat capacity of the water and structures in the system available to absorb decay heat before boiling and core damage occur. Both of these aspects are addressed in this appendix to support the assessment of the relationship of decay heat levels and times available in which to perform human actions to prevent core damage during shutdown accident scenarios.

#### **B.2 ASSUMPTIONS**

The following assumptions were used in the following calculation of the times to boil off the fuel coolant and reach core damage. These assumptions allow for some simplifications in the calculation, and also allow for an appropriate degree of conservatism in the results.

- The time to boil and time to core damage calculations are appropriate for conditions of RPV vented and maintained at atmospheric pressure.
- The time to core damage is conservatively estimated by calculating the time to reach 2/3 core height, and then extrapolating the time to gap release based on decay heat level ratios by assuming that gap release occurs 0.5 hours after 2/3 core height is reached one day after shutdown. Gap release is the release of fission products in the fuel pin gap, which occurs immediately after failure of the fuel cladding and is the first radiological indication of core damage.
- There is no heat loss from the system to the surroundings via the water surface or through the vessel walls.
- The calculation of decay heat levels and times to boiling and core damage nominally apply to conditions prior to movement of fuel. After fuel is moved to or from the fuel pool, the decay heat in the core is reduced by the fraction of spent fuel transferred to the fuel pool.
- The decay heat as a function of time after shutdown is derived from a curve fit to the ASB 9-2 Branch Technical Position methodology assuming 100% initial power and 16,000 hours of power operation.
- The effective heatup and boiloff water volumes and the heat capacities of the internal structures for the various configurations are nominal values based on review of other BWR PSSAs.

### B.3 DECAY HEAT LEVEL CALCULATION

There are several methods available to calculate decay heat as a function of time after shutdown. The NRC has provided an acceptable method of calculating the decay heat rate in Branch Technical Position ASB 9-2 [B-1]. This method uses the following equation:

$$P_s = P_o \left[ (1+K)(1/200) \sum_{n=1}^{11} A_n \exp(-a_n t_s) - (1/200) \sum_{n=1}^{11} A_n \exp[-a_n (t_s + t_o)] \right] \quad (B-1)$$

Where:  $P_s$  = decay heat level (MBtu/hr)  
 $P_o$  = normal operating power (MBtu/hr)

$t_s$	=	time after shutdown (seconds)
$t_o$	=	operating history
$K$	=	uncertainty factor
	=	0.2 for $t_s < 10^3$ , 0.1 for $10^3 < t_s < 10^7$
$A_n, a_n$	=	fit coefficients as specified in Reference B-1.

Other less complex formulas have been developed and provide reasonable estimates of decay heat rates. Reference B-2 provides the simplest of these, assuming an infinite power history:

$$P_s(t) = P_o (0.0950) t_s^{-0.26} \quad (B-2)$$

where  $P_s(t)$ ,  $P_o$  and  $t_s$  are as defined above. A comparison of Equation B-2 to Equation B-1, assuming 16,000 hours of power operation, shows that Equation B-2 underestimates the decay heat in the first day or two by 10-20%, and it overestimates the decay heat thereafter (by 10-75%). At 70 days after shutdown, the decay heat calculated by Equation B-2 is about 75% higher than that calculated using the ASB 9-2 method [B-1].

Another abbreviated formula is found in Reference B-3. This formula, called the Wigner-Way formula, also includes a factor for the power history:

$$P_s(t) = P_o (0.0622) [t_s^{-0.2} - (t_o + t_s)^{-2}] \quad (B-3)$$

As with Equation B-1,  $t_o$  is the operating history in seconds, also assumed to be 16,000 hours for comparison purposes. Equation B-3 shows a better correlation late in the outage, but the first twenty to thirty days after shutdown are under predicted (by 10-20% compared to the ASB 9-2 formula). A separate curve fit to the ASB 9-2 equation can be developed of the form:

$$P_s(t) = P_o (0.02561) t_{s(\text{hrs})}^{-0.42371} \quad (B-4)$$

where  $t_{S(\text{hrs})}$  is the time since shutdown in hours. This simple equation is considered to have an advantage over Equations B-2 and B-3 because it agrees with the ASB 9-2 data to within about 10% over the full time period of interest. Although the agreement is not quite as good as the Wigner-Way formula after about 40 days, the agreement at the critical earlier times is much better.

Using Equation B-4, the decay heat level as a function of time after shutdown is given as:

BNP 105% OLTP:  $P_s(t) = (2558 \text{ MWt}) (3.4118\text{E}6 \text{ Btu/hr} / 1 \text{ MWt}) (0.02561) t_{S(\text{hrs})}^{-0.42371}$

$$P_s(t) = (2.24\text{E}8) t_{S(\text{hrs})}^{-0.42371} \text{ Btu/hr} \quad (\text{B-5a})$$

BNP 120% OLTP:  $P_s(t) = (2923 \text{ MWt}) (3.4118\text{E}6 \text{ Btu/hr} / 1 \text{ MWt}) (0.02561) t_{S(\text{hrs})}^{-0.42371}$

$$P_s(t) = (2.55\text{E}8) t_{S(\text{hrs})}^{-0.42371} \text{ Btu/hr} \quad (\text{B-5b})$$

#### B.4 RPV HEATUP AND BOILOFF CALCULATIONS

Once the core decay heat rate has been calculated using Equation B-5, the times to fuel coolant boiling and core damage can be calculated using simple heat transfer formulas based on the volume of water available. The principal shutdown states are represented by the following water level configurations:

- normal level
- at the flange level
- reactor cavity flooded

Nominal water volumes and associated heat capacities (based on review of a number of

BWR PSSAs<sup>(1)</sup>) for use in this calculation are summarized in Table B-1.

### Time to Boil

The time required for the vessel water to reach the boiling temperature (given loss of coolant decay heat removal) is represented by the following equation:

$$t_b = E_{\text{boil}} / P_s(t) \quad \text{hrs.} \quad (\text{B-6})$$

where:

$t_b$  = time to boil (hours)

$E_{\text{boil}}$  =  $E_{\text{water}} + E_{\text{struct}}$

$E_{\text{water}}$  = energy absorbed by heated water volume to reach saturation (MBtu)

$E_{\text{struct}}$  = energy absorbed by fuel and clad (MBtu)

$P_s(t)$  = decay heat level (MBtu/hr),

and

$E_{\text{water}}$  =  $V/v * (h_{T_{\text{sat}}} - h_{T_{\text{init}}})$

$V$  = volume of water that heats up to the saturation temperature (ft<sup>3</sup>)

$v$  = specific volume of water at  $T_{\text{init}}$  (assumed constant at 0.0167 ft<sup>3</sup>/lb<sub>m</sub> over the temperature range of interest)

$h_{T_{\text{sat}}}$  = enthalpy of water at  $T_{\text{sat}}$ , 212°F (Btu/lb<sub>m</sub>),

$h_{T_{\text{init}}}$  = enthalpy of water at the initial RPV temperature,  $T_{\text{init}}$  (Btu/lb<sub>m</sub>),

and

$E_{\text{struct}}$  =  $MCp_{\text{struct}} (T_{\text{sat}} - T_{\text{init}})$

$MCp_{\text{struct}}$  = configuration specific structure heat capacity

---

<sup>(1)</sup> Cooper, DAEC, Dresden, LaSalle, NMP2, Quad Cities, Susquehanna, WNP-2.

(Btu/°F - See Table B-1)

Since the specific heat of water is 1.0 Btu/lb<sub>m</sub>°F, the difference in the enthalpies in the E<sub>water</sub> expression above (h<sub>Tsat</sub> - h<sub>Tinit</sub>) is equivalent to the temperature difference in the E<sub>struct</sub> expression (T<sub>sat</sub> - T<sub>init</sub>). This allows the complete expression for E<sub>boil</sub> to simplify to:

$$E_{boil} = [(V/v) + MCp_{STRUCT}] * [T_{SAT} - T_{init}] \quad (B-7)$$

Substituting in the appropriate constant values, Equation B-7 can be rewritten as:

$$E_{boil} = C * [212 - T_{init}] \quad (B-8)$$

where the constant C is calculated for each of the water volumes and structure capacities given in Table B-1. Thus, with the initial temperature, T<sub>init</sub> in °F and the decay heat load, P<sub>s</sub>(t) in Btu/hr, the time to reach saturation for the different configurations are given by Equations B-9 through B-13.

$$t_{b, 2/3 \text{ core height}} = 0.55E6 * (212 - T_{init}) / P_s(t) \quad \text{hours} \quad (B-9)$$

$$t_{b, TAF} = 0.61E6 * (212 - T_{init}) / P_s(t) \quad \text{hours} \quad (B-10)$$

$$t_{b, \text{Normal Level}} = 0.98E6 * (212 - T_{init}) / P_s(t) \quad \text{hours} \quad (B-11)$$

$$t_{b, \text{Flange Level}} = 1.28E6 * (212 - T_{init}) / P_s(t) \quad \text{hours} \quad (B-12)$$

$$t_{b, \text{Cavity Flooded}} = 3.25E6 * (212 - T_{init}) / P_s(t) \quad \text{hours} \quad (B-13)$$

where P<sub>s</sub>(t) is the decay heat level (refer to Equation 5)

Table B-1

NOMINAL WATER VOLUMES AND HEAT CAPACITIES FOR THE  
TIME TO BOIL AND TIME TO CORE DAMAGE CALCULATIONS

Water Level	Water Volume (ft <sup>3</sup> )	Heat Capacity (Btu/°F)	
		Water	Structure
2/3 Core Height	7000	0.42E6	0.13E6
Top of Active Fuel	8000	0.48E6	0.13E6
Normal Level	12000	0.72E6	0.26E6
Flange Level	17000	1.02E6	0.26E6
Cavity Flooded	50000	2.99E6	0.26E6

### Time to Uncover Fuel (Boil Off) and Core Damage

The time to uncover the core due to boil off (due to loss of coolant decay heat removal) is the sum of the time required to bring the full heated water volume to saturation and the time to boil off an equivalent volume of water that lies above the core. This can be represented by an equation similar in format to the time to boil equation (Equation B-6):

$$t_{cu} = E_{total} / P_s (t) \quad (B-14)$$

where:

$t_{cu}$  = time to uncover the core (hours)

$E_{total}$  =  $E_{boil} + E_{boiloff}$

$E_{boil}$  = energy absorbed to reach saturation as defined for Equation B-6 (MBtu)

$E_{boiloff}$  = energy absorbed by the water that vaporizes during boiloff (MBtu),

and

$E_{boiloff} = V_b / v_{sat} * (h_{fg})$

$V_b$  = equivalent volume of water that must vaporize for the collapsed level to reach TAF (ft<sup>3</sup>)

$v_{sat}$  = specific volume of water at saturation ( $T_{sat} = 212^\circ\text{F}$ ), or 0.0167 ft<sup>3</sup>/lb<sub>m</sub>

$h_{fg}$  = heat of vaporization at 212°F and 14.7 psia, or 970.32 Btu/lb<sub>m</sub>.

With constant values again assumed where appropriate, Equations B-15 through B-17 below provide the time to uncover the core for the different shutdown water level configurations:

$$t_{cu, \text{Normal Level}} = [0.98E6 * (212 - T_{\text{init}}) + 2.32E8] / P_s(t) \quad \text{hours} \quad (\text{B-15})$$

$$t_{cu, \text{Flange Level}} = [1.28E6 * (212 - T_{\text{init}}) + 5.23E8] / P_s(t) \quad \text{hours} \quad (\text{B-16})$$

$$t_{cu, \text{Cavity Flooded}} = [3.25E6 * (212 - T_{\text{init}}) + 2.44E9] / P_s(t) \quad \text{hours} \quad (\text{B-17})$$

where  $P_s(t)$  is the decay heat level (refer to Equation 5)

Using an initial bulk water temperature of 140°F, the time to uncover the core with the existing power level (105% OLTP) is 10.5 hours (9.3 hrs for the 120% OLTP case) at one day into the outage from the flange level configuration, and the available time exceeds 24 hours from this level at about 8 days into the outage. From normal level, the time to uncover the core with the existing power level (105% OLTP) is 5.2 hours (4.5 hrs. for the 120% OLTP case) at one day, and exceeds 24 hours at about 35 days into the outage. At no time during the outage is the available time before the core becomes uncovered from a boiloff event from a flooded up configuration less than 24 hours for either the 105% or the 120% case.

For the impact on shutdown human error probabilities, it is necessary to know the approximate time of core damage so that this time can be used as the maximum allowable time window rather than conservatively estimating the time to reach an uncovered core. For BWRs with steam cooling available, extensive heatup of the fuel and cladding leading to gap release (i.e., core damage) will generally not begin to occur until the level drops below 2/3 core height. Based on information reported in SECY-93-190 [B-4], calculations for Grand Gulf performed by Sandia show that at 4 days after shutdown more than five hours are available between reaching TAF and before gap release occurs, and almost nine additional hours would be available at 15 days after shutdown. For these calculations, the time to core damage is estimated by incorporating the additional time available from boiloff down to 2/3 core height (nominally 1000 ft<sup>3</sup> of water), and then extrapolating the time to gap release by assuming that gap release occurs 0.5 hours after 2/3 core height is reached one day after shutdown. The resulting equation for core damage,  $t_{cd}$ , is of the form for boiloff cases:

$$t_{cd} = t_{cu} + [5.8E7 + 0.5 * P_s(1d)] / P_s(t) \quad \text{hours} \quad (B-18)$$

where:

5.8E7 represents the amount of decay heat required to boil down from TAF to 2/3 core height

$P_s(1d)$  is the decay heat level 1 day after shutdown (refer to Equation B-5)

$P_s(t)$  is the decay heat level as a function of time after shutdown (refer to Equation B-5)

Comparisons of the time to core damage due to boil off (given loss of coolant decay heat removal) for the normal and RPV flange water level configurations for the 105% OLTP and the 120% OLTP cases are provided in Tables B-2 and B-3. Information is not summarized for the flood-up configuration as the times to core damage are 50 hours and greater (much longer than the time frames considered in PSAs).

As can be seen from Tables B-2 and B-3, the reduction in times to core damage (i.e., 120% OLTP case compared to 105% OLTP case) are on the order of 2-3%. Such small changes in already lengthy allowable operator response times result in negligible changes (<<1%) in calculated human error probabilities.

Table B-2

TIME TO CORE DAMAGE DUE TO BOIL OFF  
(Initial Water Level: Normal Level)

Days After Shutdown	Time to Core Damage (hrs.)	
	105% OLTP	120% OLTP
1	6.7	6.5
5 <sup>(1)</sup>	13.2	12.9
10 <sup>(1)</sup>	17.7	17.3
15 <sup>(1)</sup>	21.1	20.5
20 <sup>(1)</sup>	23.8	23.2
25 <sup>(1)</sup>	26.2	25.4
30	28.3	27.5

**NOTE:**

- (1) This list of days after shutdown is summarized to show the increasing trend of time available. Thirty days is shown here to correspond with the current industry trend toward refueling outages on the order of a month in duration. Note that the days marked with the footnote are not directly applicable to a real outage schedule for this water level configuration (i.e., the first day or two the water level will be low, but then for the majority of the outage the water level will be at the spent fuel pool level, and then will be lowered again at the end of the outage).

Table B-3

TIME TO CORE DAMAGE DUE TO BOIL OFF  
(Initial Water Level: RPV Flange Level)

Days After Shutdown	Time to Core Damage (hrs.)	
	105% OLTP	120% OLTP
1	12.1	11.9
5 <sup>(1)</sup>	23.8	23.5
10 <sup>(1)</sup>	32.0	31.5
15 <sup>(1)</sup>	38.0	37.4
20 <sup>(1)</sup>	42.9	42.2
25 <sup>(1)</sup>	47.1	46.4
30	50.9	50.2

**NOTE:**

- (1) This list of days after shutdown is summarized to show the increasing trend of time available. Thirty days is shown here to correspond with the current industry trend toward refueling outages on the order of a month in duration. Note that the days marked with the footnote are not directly applicable to a real outage schedule for this water level configuration (i.e., the first day or two the water level will be low, but then for the majority of the outage the water level will be at the spent fuel pool level, and then will be lowered again at the end of the outage).

## REFERENCES

- [B-1] USNRC, Branch Technical Position 9-2, "Residual Decay Heat Energy for Light-Water Reactors for Long-Term Cooling."
- [B-2] M.M. El-Wakil, Nuclear Heat Transport, International Textbook Company, 1971.
- [B-3] K. Way, E. Wigner, "The Rate of Decay of Fission Products," (Phys. Rev., 73, 1948, pp. 1318-1330)
- [B-4] USNRC, "Regulatory Approach to Shutdown and Low Power Operations," SECY-93-190, July 12, 1993, Enclosure: Draft Regulatory Analysis in Accordance with 10CFR50.109 dated February 1993.

**Appendix C**  
**BRUNSWICK PSA QUALITY**

## **Appendix C**

### **BRUNSWICK PSA QUALITY**

The quality of the BNP PSA models used in performing the risk assessment for the BNP EPU is manifested by the following:

- Level of detail in PSA
- Maintenance of the PSA
- Comprehensive Critical Reviews

#### **C.1            LEVEL OF DETAIL**

The BNP PSA modeling is highly detailed, including a wide variety of initiating events, modeled systems, operator actions, and common cause events.

##### **C.1.1            Initiating Events**

The BNP at-power PSA explicitly models a large number of internal initiating events:

- General transients
- LOCAs
- Support system failures
- Internal Flooding events

The initiating events explicitly modeled in the BNP at-power PSA are summarized in Table C-1. The number of internal initiating events modeled in the BNP at-power PSA is equal to or greater than the majority of U.S. BWR PSAs currently in use.

Table C-1  
BNP PSA Initiating Events

Initiating Event Description	Modeling Designator
Turbine Trip	%T(T)
Total Loss of Feedwater	%T(F)
Loss of Offsite Power (Site)	%TE(S)
Loss of Offsite Power (Unit 1)	%TE(U1)
Loss of Offsite Power (Unit 2)	%TE(U2)
MSIV Closure	%T(M)
Loss of Condenser Vacuum	%T(C)
Stuck Open SRV	%T(S)
Loss of Nuclear Service Water	%TNSW
Loss of Conventional Service Water	%TCSW
Loss of Control Rod Drive	%TCRD
Loss of Instrument Air	%TIAN
Loss of RBCCW	%TRCC
Loss of TBCCW	%TTBC
Loss of DC Bus 1A1/2A1	%T(DC1A1 ), %T(DC2A1)
Loss of DC Bus 1A2/2A2	%T(DC1A2), %T(DC2A2)
Loss of DC Bus 1B1/2B1	%T(DC1B1), %T(DC2B1)
Loss of DC Bus 1B2/2B2	%T(DC1B2), %T(DC2B2)
Loss of 4160V AC Bus 1C/1D	%TE(1C), %TE(1D)
Loss of 4160V AC Bus 2C/2D	%TE(2C), %TE(2D)
Loss of 4160V AC Bus E1/E2/E3/E4	%TE(E1), %TE(E2), %TE(E3), %TE(E4)
Loss of 480V AC Substation E5/E6/E7/E8	%TE(E5), %TE(E6), %TE(E7), %TE(E8)
Large LOCA	%A
Medium LOCA	%S1
Small LOCA	%S2

Table C-1  
BNP PSA Initiating Events

Initiating Event Description	Modeling Designator
Internal Flood: Fails All CS Pumps	%TF2
Internal Flood: Fails RHR Pump Room A	%TF4
Internal Flood: Fails All RHR Pump Rooms and HPCI	%TF6
Internal Flood: Fails All Pumps at -17ft Level	%TF7
Internal Flood: Fails RHR Pump Room B	%TF9
Internal Flood: Fails HPCI Pump Only	%TF12
Internal Flood: Fails Condensate and Cable Spreading Room	%TF14
Excessive LOCA	%E
ISLOCA in CS A	ISL-CS-LOOPA
ISLOCA in CS B	ISL-CS-LOOPB
ISLOCA in LPCI A	ISL-RHR-LPCI-A
ISLOCA in LPCI B	ISL-RHR-LPCI-B
ISLOCA in SDC	ISL-RHR-SDC

### C.1.2      System Models

The BNP at-power PSA explicitly models a large number of frontline and support systems that are credited in the accident sequence analyses. The BNP systems explicitly modeled in the BNP at-power PSA are summarized in Table C-2. The number and level of detail of plant systems modeled in the BNP at-power PSA is equal to or greater than the majority of U.S. BWR PSAs currently in use. Where other PSAs may not develop logic for such systems as instrument air, ECCS instrumentation, circulating water, and fire protection, the BNP PSA specifically models these with fault tree logic. In addition, a number of support system initiating events are modeled with fault trees and linked directly into the PSA models.

### C.1.3      Operator Actions

The BNP at-power PSA explicitly models a large number of operator actions:

- Pre-Initiator actions
- Post-Initiator actions
- Recovery Actions
- Dependent Human Actions

Over two hundred operator actions (about 130 pre-initiators, about 60 post-initiators, about a dozen recovery actions, and about 25 dependent actions) are explicitly modeled. Given the large number of actions modeled in the BNP at-power internal events PSA, a summary table of the individual actions modeled is not provided here.

The human error probabilities for the actions are modeled with accepted industry HRA techniques and include input based on discussion with plant operators, trainers, and other cognizant personnel.

Table C-2  
SYSTEMS MODELED IN THE BNP PSA

System Name	PSA System Designator
Reactor Core Isolation Cooling	RCI
High Pressure Coolant Injection	HPC
Control Rod Drive	CRD
Safety Relief Valve	SRV
Core Spray System	CSS
Low Pressure Coolant Injection	RHR
Standby Liquid Control	SLC
Recirculation Pump Trip	RRS
AC Power	ACP
DC Power	DCP
Emergency Diesel Generators	EDG
Service Water System	SWS
Reactor Building Component Cooling Water	RCC
Turbine Building Component Cooling Water	TBC
Condensate System	CDS
Instrument Air and Nitrogen	IAN
Turbine Control System	TCS
Instrumentation & Control Circuitry	ICC
Containment Hardened Wetwell Venting	CAC
Circulating Water System	CWS
Screen Wash Water System	SCW
Feedwater System	FWS

Table C-2  
SYSTEMS MODELED IN THE BNP PSA

System Name	PSA System Designator
Main Steam System	MSS
Fire Protection System	FPS
Reactor Protection System	RPS
Diesel Generator Building HVAC	DGH
Reactor Water Cleanup	RWC
Suppression Pool Cooling	SPC

With regard to dependent actions, the human reliability analysis facet of the BNP PSA explicitly considers the dependent effects of individual modeled actions (considering such issues as relevant timing among actions, similar cues) and develops dependent operator actions that replace various combinations of the independent human actions appearing in the quantification results.

The number of operator actions modeled in the BNP at-power PSA, and the level of detail of the HRA, is equal to or greater than many U.S. BWR PSAs currently in use.

#### C.1.4 Common Cause Events

The BNP at-power PSA explicitly models a large number of common cause component failures. The components explicitly modeled in the BNP at-power PSA with common cause component failures are summarized in Table C-3. Many hundreds of common cause terms are explicitly included in the BNP PSA. Given the large number of CCF terms modeled in the BNP at-power internal events PSA, a summary table of them is not provided here. The number and level of detail of common cause component failures modeled in the BNP at-power PSA is equal to or greater than the majority of U.S. BWR PSAs currently in use.

#### C.1.5 Level 2 PSA

The Brunswick Level 2 has been updated to incorporate insights from the independent peer review and the NEI Guidelines, NEI 00-02, on PRA Peer Review. The updated analysis is designed to calculate the LERF frequency consistent with NRC Regulatory Guidance (e.g., Reg. Guides 1.174 and 1.177) and the PSA Application Guide.

The following aspects of the Level 2 model reflect the more than adequate level of detail and scope:

- Dependencies from Level 1 accidents are carried forward directly into the Level 2 by transfer of cutsets to ensure that their effects on Level 2 response is accurately treated.
- Virtually all phenomena identified by the NRC and industry for inclusion in BWR Mark I Level 2 analyses are treated explicitly within the model. Some phenomena are screened from consideration based on Brunswick plant design or subsumed by other phenomenological effects.
- The model truncation is sufficiently low to be consistent with the NEI PRA Peer Review Guidelines for Risk-Informed Applications.

## C.2 MAINTENANCE OF PSA

### C.2.1 History of BNP PSA Models Maintenance

The BNP PSA model and documentation has been maintained living and is routinely updated to reflect the current plant configuration following refueling outages and to reflect the accumulation of additional plant operating history and component failure data. The Level 1 and Level 2 BNP PSA analyses were originally developed and submitted to the NRC in August, 1992 as the Brunswick Individual Plant Examination (IPE) Submittal. The BNP Level 1 PSA models supporting the IPE have been subsequently updated in 1993 and 1996, and the Level 1 PSA models have been fully upgraded during 1998-2000. The Level 2 analysis has been fully upgraded during 2000-2001, and the Level 2 report is currently being finalized.

Table C-3

COMPONENTS RECEIVING COMMON CAUSE TREATMENT IN BNP PSA<sup>(1)</sup>

RCIC and HPCI	Inverters/Chargers
Core spray pumps	Circuit breakers
Residual heat removal pumps	Powered dampers
Service water pumps	Pneumatic/air/solenoid valves
CRD pumps	ADS/SRVs
Other misc. pumps	Batteries
Diesel generators	Relays (all types)
Check valves	Transmitters (all types)
Motor-operated valves	---

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<sup>(1)</sup> This is not the exhaustive list of the items modeled with common cause failure in the BNP PSA.

The Brunswick IPE model of 1992 was updated in 1993 and 1996 to reflect the changes made to the plant since the development of the submittal. Most notably, a comprehensive review of the loss of offsite power event tree was performed because the IPE results indicated that station blackout was the dominant contributor to the total core damage frequency (CDF). The IPE model conservatively assumed that after 2 hours, both DC power divisions would be lost and subsequently, offsite power would be unrecoverable. No credit was taken for restoring DC power because procedures for performing the actions did not exist. Since the development of the IPE submittal, new procedures on DC power recovery and station blackout have been implemented (AOP-39, "Loss of DC Power", and AOP-36.2, "Station Blackout"). These new procedures take advantage of the flexibility in the plant-specific design features of the Brunswick AC and DC power distribution systems. They provide an enhanced ability to cope with a LOOP, resulting in a significant decrease in the SBO induced CDF.

Another model change was based on the results of thermal hydraulic timing studies that were performed to assess the effects of the SBO procedure, AOP-36.2. The results indicated that for SBO sequences involving the failure of high pressure injection sources, there is inadequate time to perform the emergency bus cross-tie or to use firewater for low pressure injection. These actions were deleted from the event tree, contributing to a higher core damage frequency for some accident sequences.

The original Level 2 analysis was fully upgraded during 2000-2001 (the Level 2 models and documentation are currently undergoing final comment resolution at this time). See discussion under C.1.5 and C.3.3.

The PSA models are continually implemented and studied by plant PSA personnel in the performance of their duties. Electronic copies of the models are maintained in a controlled read-only server location. Potential model modifications/enhancements are itemized and maintained for further investigation and subsequent implementation, if necessary. The current list of potential modifications/enhancements were reviewed and

judged not to impact the results (i.e., no significant change in delta CDF or delta LERF expected) and conclusions of the BNP EPU risk assessment (refer to Section C.2.2).

Each supporting element of the BNP PSA is documented, typically in a stand-alone report. Each analysis element is reviewed by cognizant personnel and comments reconciled before final approval. The analysis element reviews are guided by checklists that cover both technical and document format/content issues.

Formal comprehensive model reviews are discussed in Section C.3.

#### C.2.2 Impact Of Current List Of Potential Model Changes on EPU

This section provides a discussion of potential modifications/enhancements and their impact on the BNP EPU. This list of potential modifications/enhancements was provided by CP&L as part of the PSA Maintenance and Update process.

1. Remove credit for DC battery chargers as alternative power supply source to batteries in response to NCR-20277.

The PSA modification to remove credit for the DC battery chargers as an alternate power supply source to the batteries would have a significant impact on the base CDF and LERF values. Preliminary calculations by CP&L indicate that the Level 1 CDF may increase from  $2.5E-5/\text{yr}$  to nearly  $5E-5/\text{yr}$ . However, the identified PSA model changes due to EPU (i.e., RPV level control during ATWS) are minor such that the increase in CDF over the revised base case is judged to remain small.

In addition, the proposed PSA modification would have little or no impact on the CDF contribution due to ATWS sequences. ATWS events are dominated by failure of the SCRAM system, failure of SLC pumps for reactivity control, and operator failure of level/power control. These events are not dependent on the DC battery chargers.

The BNP EPU PSA evaluation has identified that the PSA model changes required as a result of the EPU are related to RPV level control during ATWS events. The PSA modification to the DC battery chargers would result in a significantly higher base CDF (Pre-EPU), but the change in CDF due to EPU

would remain small because the PSA modification would not significantly impact the ATWS CDF contribution. Similar judgement would apply that the change in LERF due to EPU would also remain small despite the DC battery charger modification. Therefore, the proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

2. Revise the common cause failure data (2/4, 3/4, and 4/4) for the DC batteries in accordance with more recent RSC information.

Revising the DC battery common cause failure data has the potential for changing the base CDF (Pre-EPU). Similar to previous arguments, the identified EPU modifications are minor such that any potential increase in CDF over the revised base case would still be small. In addition, the PSA modification does not significantly impact the ATWS CDF contribution, and thus, does not impact the EPU modifications. The change in CDF and LERF due to EPU is judged to remain small. Therefore, the proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

3. Update the equipment database from 18-month to 24-month exposure interval to account for longer operating cycle.

The PSA modification has the potential for increasing the base CDF (Pre-EPU) because system reliability may be reduced. If the exposure interval is increased from 18 months to 24 months, the standby failure rate for particular components (e.g., manual valves) could be increased by as much as 33%. Similar to previous arguments, the identified EPU modifications are minor such that the increase in CDF over the revised base case would still be small. Therefore, the proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

4. Correct the power supply logic in HVAC system and circular logic model associated with the DG supply fans to eliminate multiple failures of the diesels.

See similar discussion under Item 2 above. The proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

5. Modify the DG supply breaker logic in the circular logic model to mimic proper EOOS response.

See similar discussion under Item 2 above. The proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

6. Add the SCW cross-tie SCW-V5 and traveling screens for the opposite unit to provide EOOS status flexibility.

See similar discussion under Item 2 above. The proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

7. Alter circular logic model to include failure of DG cooling from loss of SCW traveling screens to clarify EOOS status.

See similar discussion under Item 2 above. The proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

8. Change IAN system success criteria and logic to require two out of three JOY air compressors for support of IAN loads based upon plant operating experience.

See similar discussion under Item 2 above. The proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

9. Add IAN system logic to model the bypass of the IA and SA dryers to indicate the proper EOOS status of operation with one dryer available..

See similar discussion under Item 2 above. The proposed PSA model change is judged to have no impact on the conclusions of the BNP EPU.

### C.3 COMPREHENSIVE CRITICAL REVIEWS

The BNP PSA model has benefited from the following comprehensive critical technical reviews:

- Independent Peer Review (Level 1)
- NEI PRA Peer Review Process
- Level 2 Acceptance Review

#### C.3.1 Independent Peer Review

A comprehensive independent peer review of the BNP at-power Level 1 and Level 2 PSA models was contracted and performed in early 2000. [C-1]

The scope of the independent peer review included the following key aspects:

1. Accident Sequences, especially dominant sequences or sequences important at other BWRs were examined in detail to ensure cutsets, assumptions, and success criteria are appropriate.
2. For those “selected” sequences, the top 10 cutsets from each sequence were examined plus 2 lower cutsets at random.
3. Sequences that have high contributions to CDF at Brunswick were reviewed by performing cutset review.
4. A cutset review was performed to identify:
  - a. Inappropriate high-order cutsets
  - b. More than one initiator in a cutset
  - c. Number of HEPs in a cutset and appropriate dependency
  - d. Dependencies within cutsets not correctly represented
  - e. Reasonable common-cause terms
5. A search for those opportunities for recovery, for important cutsets was performed
6. A search for “missing cutsets” (those that judgment implies should be there, but are not) was performed
7. A review of “merged” cutsets covering a large portion of CDF, plus a few cutsets from the “middle” and “bottom” was performed.
8. A comparison of the CDF with other comparable BWRs was performed noting differences caused by differences in the plant features.
9. A review of the supporting documentation for the key PRA elements was performed (including, event sequence evaluation, success criteria, initiating events, HRA, data analysis, system notebooks, internal floods, ISLOCA, and groundrules document).
10. An assessment of dependency treatment was performed.
11. A review of the nine (9) PSA Technical elements specified in the NEI PRA Peer Review Certification Process was also performed.

The comments from the Independent Review were prioritized into four categories A-D based upon importance to the completeness of the model. All comments in Categories A and B (recommended actions and items for consideration) have been resolved in the model upgrade. The comments in Categories C and D (good practices and editorial) are potential enhancements and remain for consideration in future updates of the Level 1 and 2 PSA models.

### C.3.2 NEI PRA Peer Reviews

The Brunswick internal events PSA has not yet received a formal industry PRA Peer Review based on the NEI guidelines. The Peer Review of the BNP PSA is scheduled for September 2001. However, the detailed documented results of the independent peer review (based on the NEI PRA Peer Review process) are being used to enhance, where applicable, the BNP PSA modeling and documentation. When the NEI PRA Peer Review is performed and the documented results received, these will also be used to modify/enhance the modeling and documentation where appropriate. Because the independent review performed using the NEI Guidelines (NEI 00-02) has been performed already, additional significant comments from the formal implementation are not expected.

### C.3.3 Level 2 Review

The Level 2 PSA for Brunswick has been completely updated including addressing the PRA Peer Review items from NEI 00-02. The Level 2 PSA has been thoroughly reviewed by the contractor and has received an extensive in-house review by CP&L as part of the QA acceptance process. The extensive Level 2 comments provided significantly improved the presentation of the methodology and results. No significant technical issues arose in the review process.

#### C.4 PSA QUALITY SUMMARY

The quality of modeling and documentation of the BNP PSA models has been demonstrated by the foregoing discussions on the following aspects:

- Level of detail in PSA
- Maintenance of the PSA
- Comprehensive Critical Reviews

Results of previous internal and external reviews have identified several items that could be modified in the models. These items may have a small impact on the absolute value of the CDF or LERF; however, they will not discernibly affect the change in CDF or LERF associated with the EPU change.

It is found that the Brunswick Level 1 and Level 2 PSAs provide the necessary and sufficient scope and level of detail to allow the calculation of CDF and LERF changes due to the Extended Power Uprate (EPU). This has been confirmed by the critical reviews performed on the PSA and their positive results.

REFERENCES

- [C-1] Letter from Dr. E.T. Burns (ERIN Engineering and Research, Inc.) to Dan Labelle (CP&L), "Independent Peer Review of Brunswick PSA", #C1109901-4138/1, May 30, 2000.

**Appendix D**  
**CUTSET RESULTS**

## **Appendix D**

### **CUTSET RESULTS**

The top 50 cutsets of each BNP PSA quantification performed in support of this risk assessment are included in this appendix. The quantification runs performed are summarized in Table D-1.

The cutset results are included in the following attachments:

- D.1: Base Level 1 CDF cutsets (pre-EPU)
- D.2: Base EPU CDF cutsets (EPU)
- D.3: Sensitivity #1 CDF cutsets
- D.4: Sensitivity #2 CDF cutsets
- D.5: Sensitivity #3 CDF cutsets
- D.6: Sensitivity #4 CDF cutsets
- D.7: Sensitivity #5 CDF cutsets
- D.8: Sensitivity #6 CDF cutsets
- D.9: Base Level 2 LERF cutsets (pre-EPU)
- D.10: Base EPU LERF cutsets (EPU)
- D.11: Sensitivity #1 LERF cutsets
- D.12: Sensitivity #2 LERF cutsets
- D.13: Sensitivity #3 LERF calculation
- D.14: Sensitivity #4 LERF cutsets
- D.15: Sensitivity #5 LERF cutsets
- D.16: Sensitivity #6 LERF calculation

Table D-1  
BRUNSWICK PSA QUANTIFICATION CASES IN SUPPORT OF EPU

Case	Description	CDF <sup>(5)</sup>	LERF <sup>(1),(6)</sup>
Base	Base Level 1 Model (pre-EPU)	2.55E-05	4.27E-06
Base EPU	Base Level 1 EPU Model	2.59E-05	4.46E-06
Sensitivity #1	Base EPU with Turbine Trip IE increased by 10%	2.71E-05	4.84E-06
Sensitivity #2	Base EPU with probability for Operator Failure to Maintain FW Post Trip increased by factor of 2 (basic event OPER-FWSCNT)	2.62E-05	4.46E-06
Sensitivity #3	Base EPU with revised SBLC success criteria <sup>(2), (3)</sup>	2.32E-05	3.07E-06
Sensitivity #4	Base EPU wit no credit for alternate RPV Injection (FP/RHRSW) during ATWS	2.59E-05	4.46E-06
Sensitivity #5	Base EPU with Sensitivity #1, #2, and #4	2.73E-05	4.84E-06
Sensitivity #6	Base EPU with Sensitivity #1, #2, #3, and #4 <sup>(2), (4)</sup>	2.43E-05	3.30E-06

Notes to Table D-1:

- (1) Includes LERF contribution of  $3.49\text{E-}7/\text{yr}$  from ISLOCA ( $2.99\text{E-}7/\text{yr}$ ) and Excessive LOCA ( $5\text{E-}8/\text{yr}$ ); although, ISLOCA and Excessive LOCA LERF cutsets are not included in the attached cutset printouts.
- (2) LERF calculated based on the fact that decrease in CDF only applies to Class IVA. Decrease in LERF estimated using Class IVA LERF multiplier of 0.514.
- (3) LERF for Sensitivity #3 estimated based on decrease in CDF compared between Base EPU and Sensitivity #3.
- (4) LERF for Sensitivity #6 estimated based on decrease in CDF compared between Sensitivity #5 and Sensitivity #6.
- (5) The Level 1 (single top model) PSA truncation limit used was  $2\text{E-}9/\text{yr}$ .
- (6) The truncation limit for the base Level 2 PRAQuant sequence quantification ranged from  $1\text{E-}10/\text{yr}$  to  $1\text{E-}11/\text{yr}$  on a sequence-by-sequence basis.

## **ATTACHMENT D.1**

### **BASE LEVEL 1 CDF CUTSETS (PRE-EPU)**

**(6 pages)**

# Cutsets with Descriptions Report

2CDF = 2.54E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T) RPS2MBIND SLC2MDP-FR-PMPA IVA1	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 1.00E-05 2.60E-02	2.70E+00 1.00E-05 2.60E-02	7.02E-07
2	%T(T) RPS2MBIND SLC2MDP-FR-PMPB IVA1	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.70E+00 1.00E-05 2.60E-02	2.70E+00 1.00E-05 2.60E-02	7.02E-07
3	%TE(S) ACP0BKR-44-1234 X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS		1.50E-02 2.04E-04	1.50E-02 2.04E-04	6.67E-07
4	%T(DC2B2) BUSFAULT EDG2DGN-FR-003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16 ID	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 FAILS TO RUN OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 1.00E+00 7.90E-03 1.00E+00	6.61E-07
5	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1A2B2 IA	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		2.70E+00 1.00E+00 1.00E+00 2.37E-07	2.70E+00 1.00E+00 1.00E+00 2.37E-07	6.40E-07
6	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1B1B2 IA	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2		2.70E+00 1.00E+00 1.00E+00 2.37E-07	2.70E+00 1.00E+00 1.00E+00 2.37E-07	6.40E-07
7	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B IA	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER		2.70E+00 1.76E-07 1.00E+00 1.00E+00	2.70E+00 1.76E-07 1.00E+00 1.00E+00	4.75E-07
8	%T(T) CRD2SCRAM SLC2MDP-FR-PMPA IVA1	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 6.00E-06 2.60E-02	2.70E+00 6.00E-06 2.60E-02	4.21E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
9	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.21E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	IVA1				1.00E+00	
10	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	3.66E-07
	EDG1DGN-FR-001	DIESEL GENERATOR 1 FAILS TO RUN		7.40E-02	7.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	
11	IB				1.00E+00	3.66E-07
	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	
	EDG1DGN-FR-002	DIESEL GENERATOR 2 FAILS TO RUN		7.40E-02	7.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
12	X-AC-16H				1.69E-02	3.50E-07
	IB				1.00E+00	
	%TF14	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM	3.50E-07	3.50E-07	3.50E-07	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00	1.00E+00	1.00E+00	1.00E+00	
13	OPER-DC2BALT	OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2	1.00E+00	1.00E+00	1.00E+00	2.38E-07
	ID				1.00E+00	
	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	
	DGH0FAN-44FTSEXH	COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		4.58E-05	4.58E-05	
14	X-AC-1H				3.46E-01	2.38E-07
	IB				1.00E+00	
	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	
	DGH0FAN-44FTSSUP	COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		4.58E-05	4.58E-05	
15	X-AC-1H				3.46E-01	2.36E-07
	IB				1.00E+00	
	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	
	EDG0DGN-44-EDGS	COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		7.22E-05	7.22E-05	
16	X-AC-2H				2.18E-01	1.74E-07
	IB				1.00E+00	
	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2	2.90E-03	2.90E-03	2.90E-03	
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE	3.90E-01	3.90E-01	3.90E-01	
17	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	1.55E-07
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	OPER-DCPALTDC2	OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		3.00E-01	1.00E+00	
	XOP-COM2-16				7.90E-03	
18	ID				1.00E+00	1.47E-07
	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	IB				1.00E+00	
19	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	1.47E-07
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	
20	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.47E-07
	DCP2REC-34A1A2B2	COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		2.37E-07	2.37E-07	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	ID				1.00E+00	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
19	%TE(S) EDG0CKV-44-CAALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
20	%TE(S) EDG0CKV-44-DALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
21	%TE(S) EDG0CKV-44-DCPCV X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
22	%TE(S) EDG0CKV-44-DLALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
23	%TE(S) EDG0CKV-44-DWALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
24	%TE(S) EDG0CKV-44-VDALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
25	%TE(S) EDG0CKV-44-XCALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
26	%TE(S) SWS0CKV-44-DGALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01 1.00E+00	1.47E-07
27	%TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09 ID	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01	1.55E-05 1.00E+00 1.00E+00 9.40E-03 1.00E+00	1.46E-07
28	%T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP IA	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01 1.00E+00	1.38E-07
29	%T(T) RPS2MBIND SLC2XVN-OC-F001 IVA1	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	2.70E+00 1.00E-05 8.76E+04	2.70E+00 1.00E-05 4.81E-03 1.00E+00	1.30E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
30	%T(T) OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 RPS2MBIND XOP-COM2-15 IVA2	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS MECHANICAL BINDING OF CONTROL RODS		2.70E+00 4.30E-02 3.00E-01 3.00E-01 1.00E-05	2.70E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05 4.80E-03 1.00E+00	1.30E-07
31	%TE(S) EDG0MDC-44SX-AC X-AC-5H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04	1.50E-02 1.08E-04 7.87E-02 1.00E+00	1.27E-07
32	%T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16 ID	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 1.00E+00 7.90E-03 1.00E+00	1.25E-07
33	%TE(S) EDG1DGN-TM-D001 EDG2DGN-24-DG34R X-AC-12H IB	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02 1.00E+00	1.21E-07
34	%TE(S) EDG1DGN-TM-D002 EDG2DGN-24-DG34R X-AC-12H IB	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02 1.00E+00	1.21E-07
35	%T(DC2A1) BUSFAULT DCP2BAT-XXDEP2B DCP2REC-LP2B2 IA	LOSS OF 125V DC PANEL 2A1 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER CHARGER 2B-2 FAILS		2.90E-03 3.90E-01 1.00E+00 4.40E-06	2.90E-03 3.90E-01 1.00E+00 2.40E+01 1.00E+00	1.19E-07
36	%T(DC2B2) BUSFAULT DCP2BAT-XXDEP2A DCP2REC-LP2A1 IA	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER CHARGER 2A-1 FAILS		2.90E-03 3.90E-01 1.00E+00 4.40E-06	2.90E-03 3.90E-01 1.00E+00 2.40E+01 1.00E+00	1.19E-07
37	%TE(S) EDG0DGN-34-D134S X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		1.50E-02 3.43E-05	1.50E-02 3.43E-05 2.18E-01 1.00E+00	1.12E-07
38	%TE(S) EDG0DGN-34-D234S X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		1.50E-02 3.43E-05	1.50E-02 3.43E-05 2.18E-01 1.00E+00	1.12E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
39	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A RCI2TDP-FR-RCTDP ID	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.76E-07 1.00E+00 2.30E-01	2.70E+00 1.76E-07 1.00E+00 2.30E-01	1.09E-07
40	%TF7 OPER-DEPRESS XOP-DEPRESS IA	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		1.55E-05 6.90E-03 1.00E+00 6.90E-03	1.55E-05 1.00E+00 6.90E-03 1.00E+00	1.07E-07
41	%TE(U2) EDG2DGN-24-DG34R IB OPER-ALTUNITXC X-AC-12H XOP-ALTUNITXC	LOSS OF OFFSITE POWER TO UNIT 2 COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		9.80E-03 1.95E-02 1.00E+00 2.95E-02	9.80E-03 1.95E-02 1.00E+00 1.80E-02	1.01E-07
42	%TE(S) EDG2MDC-44SU2AC IB OPER-ALTUNITXC X-AC-5H XOP-ALTUNITXC1	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.50E-02 1.22E-03 1.00E+00 7.87E-02 7.00E-02	1.50E-02 1.22E-03 1.00E+00 7.87E-02 7.00E-02	1.00E-07
43	%T(T) RPS2MBIND SLC2MDP-FS-PMPA IVA1	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO START		2.70E+00 1.00E-05 3.70E-03 1.00E+00	2.70E+00 1.00E-05 3.70E-03 1.00E+00	9.99E-08
44	%T(T) RPS2MBIND SLC2MDP-FS-PMPB IVA1	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO START		2.70E+00 1.00E-05 3.70E-03 1.00E+00	2.70E+00 1.00E-05 3.70E-03 1.00E+00	9.99E-08
45	%TE(S) EDG1DGN-24-DG12R EDG2DGN-24-DG34R X-AC-16H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1 AND 2 COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.95E-02 1.95E-02 1.69E-02 1.00E+00	1.50E-02 1.95E-02 1.95E-02 1.69E-02 1.00E+00	9.64E-08
46	%T(C) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-24A1B2 IA	LOSS OF CONDENSER VACUUM BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		1.80E-01 1.00E+00 1.00E+00 5.20E-07 1.00E+00	1.80E-01 1.00E+00 1.00E+00 5.20E-07 1.00E+00	9.36E-08
47	%TE(S) SWS0MOV-44-DGALL X-AC-2H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY VALVES		1.50E-02 2.82E-05 2.18E-01 1.00E+00	1.50E-02 2.82E-05 2.18E-01 1.00E+00	9.22E-08
48	%TE(S) EDG0DGN-44-EDGR X-AC-12H IB	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO RUN		1.50E-02 2.01E-04 2.95E-02 1.00E+00	1.50E-02 2.01E-04 2.95E-02 1.00E+00	8.89E-08

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
49	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	8.55E-08
	IIA				1.00E+00	
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		9.60E-02	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.40E-03	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	XOP-WVDHR				1.50E-03	
50	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	8.36E-08
	EDG0DGN-34-D134R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1, 3 AND 4		1.89E-04	1.89E-04	
	X-AC-12H				2.95E-02	
	IB				1.00E+00	

Report Summary:

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## **ATTACHMENT D.2**

### **BASE EPU CDF CUTSETS (EPU)**

**(5 pages)**

# Cutsets with Descriptions Report

2CDF = 2.59E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T) RPS2MBIND SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 1.00E-05 2.60E-02	2.70E+00 1.00E-05 2.60E-02	7.02E-07
2	%T(T) RPS2MBIND SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.70E+00 1.00E-05 2.60E-02	2.70E+00 1.00E-05 2.60E-02	7.02E-07
3	%TE(S) ACPOBKR-44-1234 X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS		1.50E-02 2.04E-04	1.50E-02 2.04E-04	6.67E-07
4	%T(DC2B2) BUSFAULT EDG2DGN-FR-003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 FAILS TO RUN OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 7.90E-03	6.61E-07
5	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1A2B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		2.70E+00 1.00E+00 1.00E+00 2.37E-07	2.70E+00 1.00E+00 1.00E+00 2.37E-07	6.40E-07
6	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1B1B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2		2.70E+00 1.00E+00 1.00E+00 2.37E-07	2.70E+00 1.00E+00 1.00E+00 2.37E-07	6.40E-07
7	%T(T) DCPOREC-44ALL DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER		1.76E-07 1.00E+00 1.00E+00	1.76E-07 1.00E+00 1.00E+00	4.75E-07
8	%T(T) CRD2SCRAM SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 6.00E-06 2.60E-02	2.70E+00 6.00E-06 2.60E-02	4.21E-07
9	%T(T) CRD2SCRAM SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.70E+00 6.00E-06 2.60E-02	2.70E+00 6.00E-06 2.60E-02	4.21E-07
10	%TE(S) EDG1DGN-FR-001 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	3.66E-07
					1.69E-02	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
11	%TE(S) EDG1DGN-FR-002 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02 1.69E-02	3.66E-07
12	%TF14 DCP2BAT-KXDEP2B OPER-DC2BALT	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2		3.50E-07 1.00E+00 1.00E+00	3.50E-07 1.00E+00 1.00E+00	3.50E-07
13	%T(T) OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 RPS2MBIND XOP-COM2-15	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS MECHANICAL BINDING OF CONTROL RODS		2.70E+00 4.30E-02 3.00E-01 3.00E-01 1.00E-05 1.00E-02	2.70E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05 1.00E-02	2.70E-07
14	%TE(S) DGHOFAN-44FTSEXH X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		1.50E-02 4.58E-05 3.46E-01	1.50E-02 4.58E-05 3.46E-01	2.38E-07
15	%TE(S) DGHOFAN-44FTSSUP X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		1.50E-02 4.58E-05 3.46E-01	1.50E-02 4.58E-05 3.46E-01	2.38E-07
16	%TE(S) EDGODGN-44-EDGS X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		1.50E-02 7.22E-05 2.18E-01	1.50E-02 7.22E-05 2.18E-01	2.36E-07
17	%T(DC2B2) BUSFAULT EDG2DGN-24-DG34R OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.95E-02 1.00E+00 3.00E-01 7.90E-03	2.90E-03 3.90E-01 1.95E-02 1.00E+00 1.00E+00 7.90E-03	1.74E-07
18	%T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 XOP-COM2-15	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		2.70E+00 6.00E-06 4.30E-02 3.00E-01 3.00E-01 1.00E-02	2.70E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 1.00E-02	1.62E-07
19	%TE(S) EDG2DGN-24-DG34R OPER-ALTUNITXC X-AC-12H XOP-ALTUNITXC	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.50E-02 1.95E-02 1.00E+00 2.95E-02 1.80E-02	1.50E-02 1.95E-02 1.00E+00 2.95E-02 1.80E-02	1.55E-07
20	%T(T) DCP2BAT-KXDEP2A DCP2REC-34A1A2B2 RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.00E+00 2.37E-07 2.30E-01	2.70E+00 1.00E+00 2.37E-07 2.30E-01	1.47E-07
21	%TE(S) EDGOCKV-44-CAALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07
22	%TE(S) EDGOCKV-44-DALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
23	*TE(S) EDG0CKV-44-DCPCV X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
24	*TE(S) EDG0CKV-44-DLALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
25	*TE(S) EDG0CKV-44-DWALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
26	*TE(S) EDG0CKV-44-VDALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
27	*TE(S) EDG0CKV-44-XCALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
28	*TE(S) SWS0CKV-44-DGALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
29	*TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01	1.55E-05 1.00E+00 1.00E+00 9.40E-03	1.46E-07
30	*T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.38E-07
31	*T(T) RPS2MBIND SLC2XVN-OC-F001	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	2.70E+00 1.00E-05 8.76E+04	2.70E+00 1.00E-05 4.81E-03	1.30E-07
32	*TE(S) EDG0MDC-44SX-AC X-AC-5H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04	1.50E-02 1.08E-04 7.87E-02	1.27E-07
33	*T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 1.00E+00 7.90E-03	1.25E-07
34	*TE(S) EDG1DGN-TM-D001 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07
35	*TE(S) EDG1DGN-TM-D002 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
36	%T(DC2A1)	LOSS OF 125V DC PANEL 2A1		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2B2	CHARGER 2B-2 FAILS	4.40E-06	2.40E+01	1.06E-04	
37	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2A1	CHARGER 2A-1 FAILS	4.40E-06	2.40E+01	1.06E-04	
38	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D134S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
39	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D234S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
40	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.09E-07
	DCP0REC-44ALL	COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS		1.76E-07	1.76E-07	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
41	%TF7	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL		1.55E-05	1.55E-05	1.07E-07
	OPER-DEPRESS	OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		6.90E-03	1.00E+00	
	XOP-DEPRESS				6.90E-03	
42	%TE(U2)	LOSS OF OFFSITE POWER TO UNIT 2		9.80E-03	9.80E-03	1.01E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
43	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.00E-07
	EDG2MDC-44SU2AC	COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START		1.22E-03	1.22E-03	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-5H				7.87E-02	
	XOP-ALTUNITXC1				7.00E-02	
44	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
45	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
46	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.94E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	XOP-COM2-14				1.60E-02	
47	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.64E-08
	EDG1DGN-24-DG12R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1 AND 2		1.95E-02	1.95E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
48	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	9.36E-08
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-24A1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		5.20E-07	5.20E-07	
49	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.22E-08
	SWS0MOV-44-DGALL	COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY VALVES		2.82E-05	2.82E-05	
	X-AC-2H				2.18E-01	
50	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	8.89E-08
	EDG0DGN-44-EDGR	COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO RUN		2.01E-04	2.01E-04	
	X-AC-12H				2.95E-02	

Report Summary:

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## **ATTACHMENT D.3**

### **SENSITIVITY 1 CDF CUTSETS**

**(5 pages)**

# Cutsets with Descriptions Report

2CDF = 2.71E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T) RPS2MBIND SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 1.00E-05 2.60E-02	3.00E+00 1.00E-05 2.60E-02	7.80E-07
2	%T(T) RPS2MBIND SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.70E+00 1.00E-05 2.60E-02	3.00E+00 1.00E-05 2.60E-02	7.80E-07
3	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1A2B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2	1.00E+00 1.00E+00 1.00E+00	1.00E+00 1.00E+00 2.37E-07	3.00E+00 1.00E+00 2.37E-07	7.11E-07
4	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1B1B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2	1.00E+00 1.00E+00 1.00E+00	1.00E+00 1.00E+00 2.37E-07	3.00E+00 1.00E+00 2.37E-07	7.11E-07
5	%TE(S) ACP0BKR-44-1234 X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS	1.50E-02 2.04E-04	1.50E-02 2.04E-04	1.50E-02 2.04E-04	6.67E-07
6	%T(DC2B2) BUSFAULT EDG2DGN-FR-003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 FAILS TO RUN OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 7.90E-03	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 7.90E-03	6.61E-07
7	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00 1.00E+00 1.00E+00	1.00E+00 1.00E+00 1.00E+00	3.00E+00 1.76E-07 1.00E+00	5.28E-07
8	%T(T) CRD2SCRAM SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR	2.70E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	4.68E-07
9	%T(T) CRD2SCRAM SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR	2.70E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	4.68E-07
10	%TE(S) EDG1DGN-FR-001 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4	1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	3.66E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
11	%TE(S) EDG1DGN-FR-002 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	3.66E-07
12	%TF14 DCP2BAT-XXDEP2B OPER-DC2BALT	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2		3.50E-07 1.00E+00 1.00E+00	3.50E-07 1.00E+00 1.00E+00	3.50E-07
13	%T(T) OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 RPS2MBIND XOP-COM2-15	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS MECHANICAL BINDING OF CONTROL RODS		2.70E+00 4.30E-02 3.00E-01 3.00E-01 1.00E-05	3.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05	3.00E-07
14	%TE(S) DGHOFAN-44FTSEXH X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05	2.38E-07
15	%TE(S) DGHOFAN-44FTSSUP X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05	2.38E-07
16	%TE(S) EDG0DGN-44-EDGS X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		1.50E-02 7.22E-05	1.50E-02 7.22E-05	2.36E-07
17	%T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 XOP-COM2-15	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		2.70E+00 6.00E-06 4.30E-02 3.00E-01 3.00E-01	3.00E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00	1.80E-07
18	%T(DC2B2) BUSFAULT EDG2DGN-24-DG34R OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.95E-02 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.95E-02 1.00E+00 1.00E+00	1.74E-07
19	%T(T) DCP2BAT-XXDEP2A DCP2REC-34A1A2B2 RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.00E+00 2.37E-07 2.30E-01	3.00E+00 1.00E+00 2.37E-07 2.30E-01	1.64E-07
20	%TE(S) EDG2DGN-24-DG34R OPER-ALTUNITXC X-AC-12H XOP-ALTUNITXC	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.50E-02 1.95E-02 1.00E+00	1.50E-02 1.95E-02 1.00E+00	1.55E-07
21	%TE(S) EDG0CKV-44-CAALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		1.50E-02 4.50E-05	1.50E-02 4.50E-05	1.47E-07
22	%TE(S) EDG0CKV-44-DALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05	1.47E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
23	%TE(S) EDG0CKV-44-DCPCV X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07
24	%TE(S) EDG0CKV-44-DLALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07
25	%TE(S) EDG0CKV-44-DWALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07
26	%TE(S) EDG0CKV-44-VDALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07
27	%TE(S) EDG0CKV-44-XCALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07
28	%TE(S) SWS0CKV-44-DGALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05 2.18E-01	1.50E-02 4.50E-05 2.18E-01	1.47E-07
29	%TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01 9.40E-03	1.55E-05 1.00E+00 1.00E+00 9.40E-03	1.46E-07
30	%T(T) RPS2MBIND SLC2XVN-OC-F001	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	2.70E+00 1.00E-05 8.76E+04	3.00E+00 1.00E-05 4.81E-03	1.44E-07
31	%T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.38E-07
32	%TE(S) EDG0MDC-44SX-AC X-AC-5H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04 7.87E-02	1.50E-02 1.08E-04 7.87E-02	1.27E-07
33	%T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01 7.90E-03	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 1.00E+00 7.90E-03	1.25E-07
34	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.76E-07 1.00E+00 2.30E-01	3.00E+00 1.76E-07 1.00E+00 2.30E-01	1.21E-07
35	%TE(S) EDG1DGN-TM-D001 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
36	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.21E-07
	EDG1DGN-TM-D002	DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER)		1.40E-02	1.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-12H				2.95E-02	
37	%T(DC2A1)	LOSS OF 125V DC PANEL 2A1		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2B2	CHARGER 2B-2 FAILS	4.40E-06	2.40E+01	1.06E-04	
38	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2A1	CHARGER 2A-1 FAILS	4.40E-06	2.40E+01	1.06E-04	
39	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D134S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
40	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D234S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
41	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.11E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
42	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.11E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
43	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.10E-07
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	XOP-COM2-14				1.60E-02	
44	%TF7	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL		1.55E-05	1.55E-05	1.07E-07
	OPER-DEPRESS	OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		6.90E-03	1.00E+00	
	XOP-DEPRESS				6.90E-03	
45	%TE(U2)	LOSS OF OFFSITE POWER TO UNIT 2		9.80E-03	9.80E-03	1.01E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
46	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.00E-07
	EDG2MDC-44SU2AC	COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START		1.22E-03	1.22E-03	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-5H				7.87E-02	
	XOP-ALTUNITXC1				7.00E-02	
47	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.64E-08
	EDG1DGN-24-DG12R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1 AND 2		1.95E-02	1.95E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
48	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	9.50E-08
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		9.60E-02	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.40E-03	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	XOP-WVDHR				1.50E-03	
49	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	9.36E-08
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-24A1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		5.20E-07	5.20E-07	
50	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.22E-08
	SWS0MOV-44-DGALL	COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY VALVES		2.82E-05	2.82E-05	
	X-AC-2H				2.18E-01	

Report Summary:

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## **ATTACHMENT D.4**

### **SENSITIVITY 2 CDF CUTSETS**

**(5 pages)**

# Cutsets with Descriptions Report

2CDF = 2.62E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	7.02E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
2	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	7.02E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
3	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	6.67E-07
	ACP0BKR-44-1234	COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS		2.04E-04	2.04E-04	
	X-AC-2H				2.18E-01	
4	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	6.61E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	EDG2DGN-FR-003	DIESEL GENERATOR 3 FAILS TO RUN		7.40E-02	7.40E-02	
	OPER-480X2	OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8		1.00E+00	1.00E+00	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	OPER-DCPALTDC2	OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		3.00E-01	1.00E+00	
	XOP-COM2-16				7.90E-03	
5	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	6.40E-07
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-34A1A2B2	COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		2.37E-07	2.37E-07	
6	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	6.40E-07
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-34A1B1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2		2.37E-07	2.37E-07	
7	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.75E-07
	DCP0REC-44ALL	COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS		1.76E-07	1.76E-07	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
8	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.21E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
9	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.21E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
10	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	3.66E-07
	EDG1DGN-FR-001	DIESEL GENERATOR 1 FAILS TO RUN		7.40E-02	7.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
11	%TE(S) EDG1DGN-FR-002 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02 1.69E-02	3.66E-07
12	%TF14 DCP2BAT-XXDEP2B OPER-DC2BALT	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2		3.50E-07 1.00E+00 1.00E+00	3.50E-07 1.00E+00 1.00E+00	3.50E-07
13	%T(T) OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 RPS2MBIND XOP-COM2-15	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS MECHANICAL BINDING OF CONTROL RODS		2.70E+00 4.30E-02 3.00E-01 3.00E-01 1.00E-05 1.00E-02	2.70E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05 1.00E-02	2.70E-07
14	%TE(S) DGH0FAN-44FTSEXH X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
15	%TE(S) DGH0FAN-44FTSSUP X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
16	%TE(S) EDG0DGN-44-EDGS X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		1.50E-02 7.22E-05	1.50E-02 7.22E-05 2.18E-01	2.36E-07
17	%T(DC2B2) BUSFAULT EDG2DGN-24-DG34R OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.95E-02 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.95E-02 1.00E+00 1.00E+00 7.90E-03	1.74E-07
18	%T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 XOP-COM2-15	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		2.70E+00 6.00E-06 4.30E-02 3.00E-01 3.00E-01	2.70E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 1.00E-02	1.62E-07
19	%TE(S) EDG2DGN-24-DG34R OPER-ALTUNITXC X-AC-12H XOP-ALTUNITXC	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.50E-02 1.95E-02 1.00E+00	1.50E-02 1.95E-02 1.00E+00 2.95E-02 1.80E-02	1.55E-07
20	%T(T) DCP2BAT-XXDEP2A DCP2REC-34A1A2B2 RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.00E+00 2.37E-07 2.30E-01	2.70E+00 1.00E+00 2.37E-07 2.30E-01	1.47E-07
21	%TE(S) EDG0CKV-44-CAALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
22	%TE(S) EDG0CKV-44-DALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
23	*TE(S) EDG0CKV-44-DCPCV X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
24	*TE(S) EDG0CKV-44-DLALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
25	*TE(S) EDG0CKV-44-DWALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
26	*TE(S) EDG0CKV-44-VDALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
27	*TE(S) EDG0CKV-44-XCALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
28	*TE(S) SWS0CKV-44-DGALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
29	*TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01	1.55E-05 1.00E+00 1.00E+00 9.40E-03	1.46E-07
30	*T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.38E-07
31	*T(T) RPS2MBIND SLC2XVN-OC-F001	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	2.70E+00 1.00E-05 8.76E+04	2.70E+00 1.00E-05 4.81E-03	1.30E-07
32	*TE(S) EDG0MDC-44SX-AC X-AC-5H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04	1.50E-02 1.08E-04 7.87E-02	1.27E-07
33	*T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 7.90E-03	1.25E-07
34	*T(T) HPC2TDP-FR-HPTDP IAN2CKV-44ALL OPER-FWSCNT RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN OPERATOR FAILS TO CONTROL FEEDWATER FLOW AND FEEDWATER LOST AFTER TRIP RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 7.40E-02 4.50E-05 3.00E-02 2.30E-01	2.70E+00 7.40E-02 4.50E-05 6.00E-02 2.30E-01	1.24E-07
35	*TE(S) EDG1DGN-TM-D001 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
36	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.21E-07
	EDG1DGN-TM-D002	DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER)		1.40E-02	1.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-12H				2.95E-02	
37	%T(DC2A1)	LOSS OF 125V DC PANEL 2A1		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2B2	CHARGER 2B-2 FAILS	4.40E-06	2.40E+01	1.06E-04	
38	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2A1	CHARGER 2A-1 FAILS	4.40E-06	2.40E+01	1.06E-04	
39	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D134S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
40	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D234S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
41	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.09E-07
	DCP0REC-44ALL	COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS		1.76E-07	1.76E-07	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
42	%TF7	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL		1.55E-05	1.55E-05	1.07E-07
	OPER-DEPRESS	OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		6.90E-03	1.00E+00	
	XOP-DEPRESS				6.90E-03	
43	%TE(U2)	LOSS OF OFFSITE POWER TO UNIT 2		9.80E-03	9.80E-03	1.01E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
44	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.00E-07
	EDG2MDC-44SU2AC	COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START		1.22E-03	1.22E-03	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-5H				7.87E-02	
	XOP-ALTUNITXC1				7.00E-02	
45	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
46	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
47	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.94E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	XOP-COM2-14				1.60E-02	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
48	*TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.64E-08
	EDG1DGN-24-DG12R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1 AND 2		1.95E-02	1.95E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	
49	*T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	9.36E-08
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-24A1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		5.20E-07	5.20E-07	
50	*TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.22E-08
	SWS0MOV-44-DGALL	COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY VALVES		2.82E-05	2.82E-05	
	X-AC-2H				2.18E-01	

Report Summary:

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## **ATTACHMENT D.5**

### **SENSITIVITY 3 CDF CUTSETS**

**(5 pages)**

# Cutsets with Descriptions Report

2CDF = 2.32E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%TE(S) ACP0BKR-44-1234 X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS		1.50E-02 2.04E-04	1.50E-02 2.04E-04	6.67E-07
2	%T(DC2B2) BUSFAULT EDG2DGN-FR-003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 FAILS TO RUN OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 7.90E-03	6.61E-07
3	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1A2B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		1.00E+00 1.00E+00 2.37E-07	1.00E+00 1.00E+00 2.37E-07	6.40E-07
4	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1B1B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2		2.70E+00 1.00E+00 1.00E+00 2.37E-07	2.70E+00 1.00E+00 1.00E+00 2.37E-07	6.40E-07
5	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER		2.70E+00 1.76E-07 1.00E+00 1.00E+00	2.70E+00 1.76E-07 1.00E+00 1.00E+00	4.75E-07
6	%T(T) RPS2MBIND SLC2EPV-CC-F04AB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS COMMON CAUSE FAILURE OF EXPLOSIVE VALVES C41-F004A/B TO OPEN		2.70E+00 1.00E-05 1.40E-02	2.70E+00 1.00E-05 1.40E-02	3.78E-07
7	%TE(S) EDG1DGN-FR-001 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	3.66E-07
8	%TE(S) EDG1DGN-FR-002 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	3.66E-07
9	%TF14 DCP2BAT-XXDEP2B OPER-DC2BALT	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2		3.50E-07 1.00E+00 1.00E+00	3.50E-07 1.00E+00 1.00E+00	3.50E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
10	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.70E-07
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		3.00E-01	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	XOP-COM2-15				1.00E-02	
11	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	2.38E-07
	DGH0FAN-44FTSEXH	COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		4.58E-05	4.58E-05	
	X-AC-1H				3.46E-01	
12	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	2.38E-07
	DGH0FAN-44FTSSUP	COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		4.58E-05	4.58E-05	
	X-AC-1H				3.46E-01	
13	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	2.36E-07
	EDG0DGN-44-EDGS	COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		7.22E-05	7.22E-05	
	X-AC-2H				2.18E-01	
14	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.27E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2EPV-CC-F04AB	COMMON CAUSE FAILURE OF EXPLOSIVE VALVES C41-F004A/B TO OPEN		1.40E-02	1.40E-02	
15	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.74E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	OPER-DCPALTDC2	OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		3.00E-01	1.00E+00	
	XOP-COM2-16				7.90E-03	
16	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.62E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		3.00E-01	1.00E+00	
	XOP-COM2-15				1.00E-02	
17	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.55E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
18	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.47E-07
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00		1.00E+00	1.00E+00	
	DCP2REC-34A1A2B2	COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		2.37E-07	2.37E-07	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
19	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.47E-07
	EDG0CKV-44-CAALL	COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		4.50E-05	4.50E-05	
	X-AC-2H				2.18E-01	
20	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.47E-07
	EDG0CKV-44-DALL	COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		4.50E-05	4.50E-05	
	X-AC-2H				2.18E-01	
21	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.47E-07
	EDG0CKV-44-DCPCV	COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		4.50E-05	4.50E-05	
	X-AC-2H				2.18E-01	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
22	*TE(S) EDG0CKV-44-DLALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
23	*TE(S) EDG0CKV-44-DWALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
24	*TE(S) EDG0CKV-44-VDALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
25	*TE(S) EDG0CKV-44-XCALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
26	*TE(S) SWS0CKV-44-DGALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
27	*TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01	1.55E-05 1.00E+00 1.00E+00 9.40E-03	1.46E-07
28	*T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.38E-07
29	*T(T) RPS2MBIND SLC2XVN-OC-F001	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	1.00E-05 8.76E+04	1.00E-05 4.81E-03	1.30E-07
30	*TE(S) EDG0MDC-44SX-AC X-AC-5H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04	1.50E-02 1.08E-04 7.87E-02	1.27E-07
31	*T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 1.00E+00 7.90E-03	1.25E-07
32	*TE(S) EDG1DGN-TM-D001 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07
33	*TE(S) EDG1DGN-TM-D002 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07
34	*T(DC2A1) BUSFAULT DCP2BAT-XXDEP2B DCP2REC-LP2B2	LOSS OF 125V DC PANEL 2A1 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER CHARGER 2B-2 FAILS		2.90E-03 3.90E-01 1.00E+00 4.40E-06	2.90E-03 3.90E-01 1.00E+00 1.06E-04	1.19E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
35	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2A1	CHARGER 2A-1 FAILS	4.40E-06	2.40E+01	1.06E-04	
36	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D134S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
37	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D234S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
38	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.09E-07
	DCP0REC-44ALL	COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS		1.76E-07	1.76E-07	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
39	%TF7	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL		1.55E-05	1.55E-05	1.07E-07
	OPER-DEPRESS	OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		6.90E-03	1.00E+00	
	XOP-DEPRESS				6.90E-03	
40	%TE(U2)	LOSS OF OFFSITE POWER TO UNIT 2		9.80E-03	9.80E-03	1.01E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
41	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.00E-07
	EDG2MDC-44SU2AC	COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START		1.22E-03	1.22E-03	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-5H				7.87E-02	
	XOP-ALTUNITXC1				7.00E-02	
42	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.94E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	XOP-COM2-14				1.60E-02	
43	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.64E-08
	EDG1DGN-24-DG12R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1 AND 2		1.95E-02	1.95E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	
44	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	9.36E-08
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-24A1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		5.20E-07	5.20E-07	
45	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.22E-08
	SWS0MOV-44-DGALL	COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY VALVES		2.82E-05	2.82E-05	
	X-AC-2H				2.18E-01	
46	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	8.89E-08
	EDG0DGN-44-EDGR	COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO RUN		2.01E-04	2.01E-04	
	X-AC-12H				2.95E-02	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
47	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	8.55E-08
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		9.60E-02	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.40E-03	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	XOP-WVDHR				1.50E-03	
48	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	8.36E-08
	EDG0DGN-34-D134R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1, 3 AND 4		1.89E-04	1.89E-04	
	X-AC-12H				2.95E-02	
49	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	8.36E-08
	EDG0DGN-34-D234R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 2, 3 AND 4		1.89E-04	1.89E-04	
	X-AC-12H				2.95E-02	
50	%TE(E3)	LOSS OF 4160V AC BUS E3		2.00E-03	2.00E-03	8.24E-08
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2B2	CHARGER 2B-2 FAILS	4.40E-06	2.40E+01	1.06E-04	

Report Summary:

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## **ATTACHMENT D.6**

### **SENSITIVITY 4 CDF CUTSETS**

**(5 pages)**

# Cutsets with Descriptions Report

2CDF = 2.59E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T) RPS2MBIND SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 1.00E-05 2.60E-02	2.70E+00 1.00E-05 2.60E-02	7.02E-07
2	%T(T) RPS2MBIND SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.70E+00 1.00E-05 2.60E-02	2.70E+00 1.00E-05 2.60E-02	7.02E-07
3	%TE(S) ACP0BKR-44-1234 X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS		1.50E-02 2.04E-04 2.18E-01	1.50E-02 2.04E-04 2.18E-01	6.67E-07
4	%T(DC2B2) BUSFAULT EDG2DGN-FR-003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 FAILS TO RUN OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 3.00E-01 7.90E-03	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 1.00E+00 7.90E-03	6.61E-07
5	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1A2B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		2.70E+00 1.00E+00 1.00E+00 2.37E-07	2.70E+00 1.00E+00 1.00E+00 2.37E-07	6.40E-07
6	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1B1B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2		2.70E+00 1.00E+00 1.00E+00 2.37E-07	2.70E+00 1.00E+00 1.00E+00 2.37E-07	6.40E-07
7	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER		2.70E+00 1.76E-07 1.00E+00 1.00E+00	2.70E+00 1.76E-07 1.00E+00 1.00E+00	4.75E-07
8	%T(T) CRD2SCRAM SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 6.00E-06 2.60E-02	2.70E+00 6.00E-06 2.60E-02	4.21E-07
9	%T(T) CRD2SCRAM SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.70E+00 6.00E-06 2.60E-02	2.70E+00 6.00E-06 2.60E-02	4.21E-07
10	%TE(S) EDG1DGN-FR-001 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02 1.69E-02	1.50E-02 7.40E-02 1.95E-02 1.69E-02	3.66E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
11	%TE(S) EDG1DGN-FR-002 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02 1.69E-02	3.66E-07
12	%TF14 DCP2BAT-XXDEP2B OPER-DC2BALT	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2		3.50E-07 1.00E+00 1.00E+00	3.50E-07 1.00E+00 1.00E+00	3.50E-07
13	%T(T) OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 RPS2MBIND XOP-COM2-15	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS MECHANICAL BINDING OF CONTROL RODS		2.70E+00 4.30E-02 3.00E-01 3.00E-01 1.00E-05	2.70E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05 1.00E-02	2.70E-07
14	%TE(S) DGHOFAN-44FTSEXH X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
15	%TE(S) DGHOFAN-44FTSSUP X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
16	%TE(S) EDG0DGN-44-EDGS X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		1.50E-02 7.22E-05	1.50E-02 7.22E-05 2.18E-01	2.36E-07
17	%T(DC2B2) BUSFAULT EDG2DGN-24-DG34R OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.95E-02 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.95E-02 1.00E+00 1.00E+00 7.90E-03	1.74E-07
18	%T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 XOP-COM2-15	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		2.70E+00 6.00E-06 4.30E-02 3.00E-01 3.00E-01	2.70E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 1.00E-02	1.62E-07
19	%TE(S) EDG2DGN-24-DG34R OPER-ALTUNITXC X-AC-12H XOP-ALTUNITXC	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.50E-02 1.95E-02 1.00E+00	1.50E-02 1.95E-02 1.00E+00 2.95E-02 1.80E-02	1.55E-07
20	%T(T) DCP2BAT-XXDEP2A DCP2REC-34A1A2B2 RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.00E+00 2.37E-07 2.30E-01	2.70E+00 1.00E+00 2.37E-07 2.30E-01	1.47E-07
21	%TE(S) EDG0CKV-44-CAALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
22	%TE(S) EDG0CKV-44-DALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
23	*TE(S) EDG0CKV-44-DCPCV X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
24	*TE(S) EDG0CKV-44-DLALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
25	*TE(S) EDG0CKV-44-DWALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
26	*TE(S) EDG0CKV-44-VDALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
27	*TE(S) EDG0CKV-44-XCALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
28	*TE(S) SWS0CKV-44-DGALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
29	*TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01	1.55E-05 1.00E+00 1.00E+00 9.40E-03	1.46E-07
30	*T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.38E-07
31	*T(T) RPS2MBIND SLC2XVN-OC-F001	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	2.70E+00 1.00E-05 8.76E+04	2.70E+00 1.00E-05 4.81E-03	1.30E-07
32	*TE(S) EDG0MDC-44SX-AC X-AC-5H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04	1.50E-02 1.08E-04 7.87E-02	1.27E-07
33	*T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 1.00E+00 7.90E-03	1.25E-07
34	*TE(S) EDG1DGN-TM-D001 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07
35	*TE(S) EDG1DGN-TM-D002 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
36	%T(DC2A1)	LOSS OF 125V DC PANEL 2A1		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2B2	CHARGER 2B-2 FAILS	4.40E-06	2.40E+01	1.06E-04	
37	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2A1	CHARGER 2A-1 FAILS	4.40E-06	2.40E+01	1.06E-04	
38	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D134S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
39	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D234S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
40	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.09E-07
	DCP0REC-44ALL	COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS		1.76E-07	1.76E-07	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
41	%TF7	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL		1.55E-05	1.55E-05	1.07E-07
	OPER-DEPRESS	OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		6.90E-03	1.00E+00	
	XOP-DEPRESS				6.90E-03	
42	%TE(U2)	LOSS OF OFFSITE POWER TO UNIT 2		9.80E-03	9.80E-03	1.01E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
43	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.00E-07
	EDG2MDC-44SU2AC	COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START		1.22E-03	1.22E-03	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-5H				7.87E-02	
	XOP-ALTUNITXC1				7.00E-02	
44	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
45	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
46	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.94E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	XOP-COM2-14				1.60E-02	
47	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.64E-08
	EDG1DGN-24-DG12R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1 AND 2		1.95E-02	1.95E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
48	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	9.36E-08
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-24A1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		5.20E-07	5.20E-07	
49	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.22E-08
	SWS0MOV-44-DGALL	COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY VALVES		2.82E-05	2.82E-05	
	X-AC-2H			2.18E-01		
50	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	8.89E-08
	EDG0DGN-44-EDGR	COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO RUN		2.01E-04	2.01E-04	
	X-AC-12H			2.95E-02		

Report Summary:

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## **ATTACHMENT D.7**

### **SENSITIVITY 5 CDF CUTSETS**

**(5 pages)**

# Cutsets with Descriptions Report

2CDF = 2.73E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T) RPS2MBIND SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.70E+00 1.00E-05 2.60E-02	3.00E+00 1.00E-05 2.60E-02	7.80E-07
2	%T(T) RPS2MBIND SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.70E+00 1.00E-05 2.60E-02	3.00E+00 1.00E-05 2.60E-02	7.80E-07
3	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1A2B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2	1.00E+00 1.00E+00 1.00E+00	2.70E+00 1.00E+00 1.00E+00 2.37E-07	3.00E+00 1.00E+00 1.00E+00 2.37E-07	7.11E-07
4	%T(T) DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B DCP2REC-34A1B1B2	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2	1.00E+00 1.00E+00 1.00E+00	2.70E+00 1.00E+00 1.00E+00 2.37E-07	3.00E+00 1.00E+00 1.00E+00 2.37E-07	7.11E-07
5	%TE(S) ACP0BKR-44-1234 X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS	1.50E-02 2.04E-04	1.50E-02 2.04E-04	1.50E-02 2.04E-04	6.67E-07
6	%T(DC2B2) BUSFAULT EDG2DGN-FR-003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 FAILS TO RUN OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 7.90E-03	2.90E-03 3.90E-01 7.40E-02 1.00E+00 1.00E+00 7.90E-03	6.61E-07
7	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A DCP2BAT-XXDEP2B	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00 1.00E+00 1.00E+00	2.70E+00 1.76E-07 1.00E+00 1.00E+00	3.00E+00 1.76E-07 1.00E+00 1.00E+00	5.28E-07
8	%T(T) CRD2SCRAM SLC2MDP-FR-PMPA	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR	2.70E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	4.68E-07
9	%T(T) CRD2SCRAM SLC2MDP-FR-PMPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR	2.70E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	3.00E+00 6.00E-06 2.60E-02	4.68E-07
10	%TE(S) EDG1DGN-FR-001 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4	1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02	3.66E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
11	%TE(S) EDG1DGN-FR-002 EDG2DGN-24-DG34R X-AC-16H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 2 FAILS TO RUN COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 7.40E-02 1.95E-02	1.50E-02 7.40E-02 1.95E-02 1.69E-02	3.66E-07
12	%TF14 DCP2BAT-XXDEP2B OPER-DC2BALT	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2		3.50E-07 1.00E+00 1.00E+00	3.50E-07 1.00E+00 1.00E+00	3.50E-07
13	%T(T) OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 RPS2MBIND XOP-COM2-15	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS MECHANICAL BINDING OF CONTROL RODS		2.70E+00 4.30E-02 3.00E-01 3.00E-01 1.00E-05	3.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05 1.00E-02	3.00E-07
14	%TE(S) DGH0FAN-44FTSEXH X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
15	%TE(S) DGH0FAN-44FTSSUP X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
16	%TE(S) EDG0DGN-44-EDGS X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		1.50E-02 7.22E-05	1.50E-02 7.22E-05 2.18E-01	2.36E-07
17	%T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 XOP-COM2-15	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		2.70E+00 6.00E-06 4.30E-02 3.00E-01 3.00E-01	3.00E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 1.00E-02	1.80E-07
18	%T(DC2B2) BUSFAULT EDG2DGN-24-DG34R OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.95E-02 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.95E-02 1.00E+00 1.00E+00 7.90E-03	1.74E-07
19	%T(T) DCP2BAT-XXDEP2A DCP2REC-34A1A2B2 RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.00E+00 2.37E-07 2.30E-01	3.00E+00 1.00E+00 2.37E-07 2.30E-01	1.64E-07
20	%TE(S) EDG2DGN-24-DG34R OPER-ALTUNITXC X-AC-12H XOP-ALTUNITXC	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.50E-02 1.95E-02 1.00E+00	1.50E-02 1.95E-02 1.00E+00 2.95E-02 1.80E-02	1.55E-07
21	%TE(S) EDG0CKV-44-CAALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
22	%TE(S) EDG0CKV-44-DALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
23	%TE(S) EDG0CKV-44-DCPCV X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
24	%TE(S) EDG0CKV-44-DLALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
25	%TE(S) EDG0CKV-44-DWALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
26	%TE(S) EDG0CKV-44-VDALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
27	%TE(S) EDG0CKV-44-XCALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
28	%TE(S) SWSOCKV-44-DGALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
29	%TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01	1.55E-05 1.00E+00 1.00E+00 9.40E-03	1.46E-07
30	%T(T) RPS2MBIND SLC2XVN-OC-F001	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	2.70E+00 1.00E-05 8.76E+04	3.00E+00 1.00E-05 4.81E-03	1.44E-07
31	%T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.38E-07
32	%T(T) HPC2TDP-FR-HPTDP IAN2CKV-44ALL OPER-FWSCNT RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN OPERATOR FAILS TO CONTROL FEEDWATER FLOW AND FEEDWATER LOST AFTER TRIP RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 7.40E-02 4.50E-05 3.00E-02 2.30E-01	3.00E+00 7.40E-02 4.50E-05 6.00E-02 2.30E-01	1.38E-07
33	%TE(S) EDG0MDC-44SX-AC X-AC-5H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04	1.50E-02 1.08E-04 7.87E-02	1.27E-07
34	%T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 7.90E-03	1.25E-07
35	%T(T) DCP0REC-44ALL DCP2BAT-XXDEP2A RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.76E-07 1.00E+00 2.30E-01	3.00E+00 1.76E-07 1.00E+00 2.30E-01	1.21E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
36	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.21E-07
	EDG1DGN-TM-D001	DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER)		1.40E-02	1.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-12H				2.95E-02	
37	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.21E-07
	EDG1DGN-TM-D002	DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER)		1.40E-02	1.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-12H				2.95E-02	
38	%T(DC2A1)	LOSS OF 125V DC PANEL 2A1		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00		1.00E+00	1.00E+00	
	DCP2REC-LP2B2	CHARGER 2B-2 FAILS 4.40E-06		2.40E+01	1.06E-04	
39	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00		1.00E+00	1.00E+00	
	DCP2REC-LP2A1	CHARGER 2A-1 FAILS 4.40E-06		2.40E+01	1.06E-04	
40	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D134S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
41	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D234S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
42	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.11E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
43	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.11E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
44	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.10E-07
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	KOP-COM2-14				1.60E-02	
45	%TF7	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL		1.55E-05	1.55E-05	1.07E-07
	OPER-DEPRESS	OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		6.90E-03	1.00E+00	
	KOP-DEPRESS				6.90E-03	
46	%TE(U2)	LOSS OF OFFSITE POWER TO UNIT 2		9.80E-03	9.80E-03	1.01E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	KOP-ALTUNITXC				1.80E-02	
47	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.00E-07
	EDG2MDC-44SU2AC	COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START		1.22E-03	1.22E-03	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-5H				7.87E-02	
	KOP-ALTUNITXC1				7.00E-02	

# **ATTACHMENT D.8**

## **SENSITIVITY 6 CDF CUTSETS**

**(5 pages)**

# Cutsets with Descriptions Report

2CDF = 2.43E-05

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	7.11E-07
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-34A1A2B2	COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2		2.37E-07	2.37E-07	
2	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	7.11E-07
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-34A1B1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1, 2B-1 AND 2B-2		2.37E-07	2.37E-07	
3	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	6.67E-07
	ACPOBKR-44-1234	COMMON CAUSE FAILURE OF AT LEAST ONE BREAKER FOR EACH E-BUS		2.04E-04	2.04E-04	
	X-AC-2H				2.18E-01	
4	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	6.61E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	EDG2DGN-FR-003	DIESEL GENERATOR 3 FAILS TO RUN		7.40E-02	7.40E-02	
	OPER-480X2	OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8		1.00E+00	1.00E+00	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	OPER-DCPALTDC2	OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		3.00E-01	1.00E+00	
	XOP-COM2-16				7.90E-03	
5	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	5.28E-07
	DCP0REC-44ALL	COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS		1.76E-07	1.76E-07	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
6	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	4.20E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2EPV-CC-F04AB	COMMON CAUSE FAILURE OF EXPLOSIVE VALVES C41-F004A/B TO OPEN		1.40E-02	1.40E-02	
7	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	3.66E-07
	EDG1DGN-FR-001	DIESEL GENERATOR 1 FAILS TO RUN		7.40E-02	7.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	
8	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	3.66E-07
	EDG1DGN-FR-002	DIESEL GENERATOR 2 FAILS TO RUN		7.40E-02	7.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	
9	%TF14	INTERNAL FLOOD TF14: FAILS CONDENSATE AND FLOODS CABLE SPREADING ROOM		3.50E-07	3.50E-07	3.50E-07
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	OPER-DC2BALT	OPERATOR FAILS TO SWITCH CHARGER TO ALTERNATE AC POWER SUPPLY-UNIT 2		1.00E+00	1.00E+00	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
10	%T(T) OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 RPS2MBIND XOP-COM2-15	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS MECHANICAL BINDING OF CONTROL RODS		2.70E+00 4.30E-02 3.00E-01 3.00E-01 1.00E-05	3.00E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-02	3.00E-07
11	%T(T) CRD2SCRAM SLC2EPV-CC-F04AB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES COMMON CAUSE FAILURE OF EXPLOSIVE VALVES C41-F004A/B TO OPEN		2.70E+00 6.00E-06 1.40E-02	3.00E+00 6.00E-06 1.40E-02	2.52E-07
12	%TE(S) DGHOFAN-44FTSEXH X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF EXHAUST FANS E, F, G, AND H TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
13	%TE(S) DGHOFAN-44FTSSUP X-AC-1H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF SUPPLY FANS A, B, C, AND D TO START		1.50E-02 4.58E-05	1.50E-02 4.58E-05 3.46E-01	2.38E-07
14	%TE(S) EDG0DGN-44-EDGS X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO START		1.50E-02 7.22E-05	1.50E-02 7.22E-05 2.18E-01	2.36E-07
15	%T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 XOP-COM2-15	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		2.70E+00 6.00E-06 4.30E-02 3.00E-01 3.00E-01	3.00E+00 6.00E-06 1.00E+00 1.00E+00 1.00E-02	1.80E-07
16	%T(DC2B2) BUSFAULT EDG2DGN-24-DG34R OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.95E-02 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.95E-02 1.00E+00 1.00E+00 7.90E-03	1.74E-07
17	%T(T) DCP2BAT-XXDEP2A DCP2REC-34A1A2B2 RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER COMMON CAUSE FAILURE OF CHARGER 2A-1, 2A-2 AND 2B-2 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.00E+00 2.37E-07 2.30E-01	3.00E+00 1.00E+00 2.37E-07 2.30E-01	1.64E-07
18	%TE(S) EDG2DGN-24-DG34R OPER-ALTUNITXC X-AC-12H XOP-ALTUNITXC	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.50E-02 1.95E-02 1.00E+00	1.50E-02 1.95E-02 1.00E+00 2.95E-02 1.80E-02	1.55E-07
19	%TE(S) EDG0CKV-44-CAALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 AND UNIT 2 RECEIVER CHECK VALVES - CONTROL		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
20	%TE(S) EDG0CKV-44-DALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DAY TANK CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
21	%TE(S) EDG0CKV-44-DCPCV X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVES V46, V76, V106, AND V136 TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
22	%TE(S) EDG0CKV-44-DLALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V241, V277, V313, AND V349		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
23	%TE(S) EDG0CKV-44-DWALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF CHECK VALVE V150, V186, V222, AND V258		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
24	%TE(S) EDG0CKV-44-VDALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL DD PUMP DISCHARGE CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
25	%TE(S) EDG0CKV-44-XCALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL (8/8) FUEL OIL TRANSFER PUMPS CV TO OPEN		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
26	%TE(S) SWS0CKV-44-DGALL X-AC-2H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY CHECK VALVES		1.50E-02 4.50E-05	1.50E-02 4.50E-05 2.18E-01	1.47E-07
27	%TF7 OPER-FPS1 OPER-FWS-INJ XOP-COM2-09	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO PROPERLY CONTROL CONDENSATE INJECTION FLOW RATE		1.55E-05 9.60E-02 3.00E-01	1.55E-05 1.00E+00 1.00E+00 9.40E-03	1.46E-07
28	%T(T) RPS2MBIND SLC2XVN-OC-F001	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	2.70E+00 1.00E-05 8.76E+04	3.00E+00 1.00E-05 4.81E-03	1.44E-07
29	%T(C) HPC2TDP-FR-HPTDP IAN2CKV-44ALL RCI2TDP-FR-RCTDP	LOSS OF CONDENSER VACUUM HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.80E-01 7.40E-02 4.50E-05 2.30E-01	1.38E-07
30	%T(T) HPC2TDP-FR-HPTDP IAN2CKV-44ALL OPER-FWSCNT RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR HPCI TURBINE-DRIVEN PUMP FAILS TO RUN COMMON CAUSE FAILURE OF ALL SRV AIR CHECK VALVES TO OPEN OPERATOR FAILS TO CONTROL FEEDWATER FLOW AND FEEDWATER LOST AFTER TRIP RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 7.40E-02 4.50E-05 3.00E-02 2.30E-01	3.00E+00 7.40E-02 4.50E-05 6.00E-02 2.30E-01	1.38E-07
31	%TE(S) EDG0MDC-44SX-AC X-AC-5H	LOSS OF OFFSITE POWER (SITE) COMMON CAUSE FAILURE OF UNIT 1 & 2 DG AIR COMPRESSORS TO START		1.50E-02 1.08E-04	1.50E-02 1.08E-04 7.87E-02	1.27E-07
32	%T(DC2B2) BUSFAULT EDG2DGN-TM-D003 OPER-480X2 OPER-ALTUNITXC OPER-DCPALTDC2 XOP-COM2-16	LOSS OF 125V DC PANEL 2B2 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE DIESEL GENERATOR 3 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) OPERATORS FAIL TO MANUALLY CONNECT UNIT 2 SUBSTATIONS E7 AND E8 OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT OPERATOR FAILS TO ALIGN DC BUS TO STANDBY DC POWER SUPPLY - UNIT2		2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 3.00E-01	2.90E-03 3.90E-01 1.40E-02 1.00E+00 1.00E+00 7.90E-03	1.25E-07
33	%T(T) DCPOREC-44ALL DCP2BAT-XXDEP2A RCI2TDP-FR-RCTDP	TURBINE TRIP INITIATOR COMMON CAUSE FAILURE OF BOTH UNIT 1 AND UNIT 2 CHARGERS BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1.00E+00 RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.70E+00 1.76E-07 1.00E+00 2.30E-01	3.00E+00 1.76E-07 1.00E+00 2.30E-01	1.21E-07
34	%TE(S) EDG1DGN-TM-D001 EDG2DGN-24-DG34R X-AC-12H	LOSS OF OFFSITE POWER (SITE) DIESEL GENERATOR 1 UNAVAILABLE DUE TO MAINTENANCE (AT POWER) COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.50E-02 1.40E-02 1.95E-02	1.50E-02 1.40E-02 1.95E-02 2.95E-02	1.21E-07

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
35	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.21E-07
	EDG1DGN-TM-D002	DIESEL GENERATOR 2 UNAVAILABLE DUE TO MAINTENANCE (AT POWER)		1.40E-02	1.40E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-12H				2.95E-02	
36	%T(DC2A1)	LOSS OF 125V DC PANEL 2A1		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2B2	CHARGER 2B-2 FAILS	4.40E-06	2.40E+01	1.06E-04	
37	%T(DC2B2)	LOSS OF 125V DC PANEL 2B2		2.90E-03	2.90E-03	1.19E-07
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-LP2A1	CHARGER 2A-1 FAILS	4.40E-06	2.40E+01	1.06E-04	
38	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D134S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 1,3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
39	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.12E-07
	EDG0DGN-34-D234S	COMMON CAUSE FAILURE TO START OF DIESEL GENERATORS 2, 3 AND 4		3.43E-05	3.43E-05	
	X-AC-2H				2.18E-01	
40	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.10E-07
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		4.30E-02	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		3.00E-01	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	XOP-COM2-14				1.60E-02	
41	%TF7	INTERNAL FLOOD TF7: FAILS ALL PUMPS AT -17 LEVEL		1.55E-05	1.55E-05	1.07E-07
	OPER-DEPRESS	OPERATOR FAILS TO MANUALLY INITIATE AND ALIGN LOW-PRESSURE SYSTEMS		6.90E-03	1.00E+00	
	XOP-DEPRESS				6.90E-03	
42	%TE(U2)	LOSS OF OFFSITE POWER TO UNIT 2		9.80E-03	9.80E-03	1.01E-07
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-12H				2.95E-02	
	XOP-ALTUNITXC				1.80E-02	
43	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	1.00E-07
	EDG2MDC-44SU2AC	COMMON CAUSE FAILURE OF UNIT 2 DG AIR COMPRESSORS TO START		1.22E-03	1.22E-03	
	OPER-ALTUNITXC	OPERATORS FAIL TO MANUALLY ALIGN POWER FROM OPPOSITE UNIT		1.00E+00	1.00E+00	
	X-AC-5H				7.87E-02	
	XOP-ALTUNITXC1				7.00E-02	
44	%TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.64E-08
	EDG1DGN-24-DG12R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 1 AND 2		1.95E-02	1.95E-02	
	EDG2DGN-24-DG34R	COMMON CAUSE FAILURE TO RUN OF DIESEL GENERATORS 3 AND 4		1.95E-02	1.95E-02	
	X-AC-16H				1.69E-02	
45	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	9.50E-08
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		9.60E-02	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.40E-03	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	XOP-WVDHR				1.50E-03	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
46	*T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	9.36E-08
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-24A1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		5.20E-07	5.20E-07	
47	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	9.36E-08
	DCP2BAT-XXDEP2A	BATTERY BANK 2A DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DCP2REC-24A1B2	COMMON CAUSE FAILURE OF CHARGER 2A-1 AND 2B-2		5.20E-07	5.20E-07	
	OPER-FWSCNT	OPERATOR FAILS TO CONTROL FEEDWATER FLOW AND FEEDWATER LOST AFTER TRIP		3.00E-02	6.00E-02	
48	*TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	9.22E-08
	SWS0MOV-44-DGALL	COMMON CAUSE FAILURE OF ALL UNIT 1 & 2 DG COOLING SUPPLY VALVES		2.82E-05	2.82E-05	
	X-AC-2H			2.18E-01		
49	*TE(S)	LOSS OF OFFSITE POWER (SITE)		1.50E-02	1.50E-02	8.89E-08
	EDG0DGN-44-EDGR	COMMON CAUSE FAILURE OF 4 OF 4 DIESEL GENERATORS TO RUN		2.01E-04	2.01E-04	
	X-AC-12H			2.95E-02		
50	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	8.65E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2XVN-OC-F001	SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	8.76E+04	4.81E-03	

Report Summary:

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## **ATTACHMENT D.9**

### **BASE LEVEL 2 LERF CUTSETS (PRE-EPU)**

**(5 pages)**

# Cutsets with Descriptions Report

LERF = 3.92E-06

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.51E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
2	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.51E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
3	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.11E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
4	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.11E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
5	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	6.49E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2XVN-OC-F001	SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	8.76E+04	4.81E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
6	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	6.48E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-15			4.80E-03	4.80E-03	
7	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	5.52E-08
	DWT2EST-NM-INTA	DRYWELL INTACT (CLASS II)		6.45E-01	6.45E-01	
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	XOP-WVDHR			1.50E-03	1.50E-03	
8	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
9	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
10	*T(T) CRD2SCRAM SLC2XVN-OC-F001 WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	5.50E-08	2.70E+00 6.00E-06 8.76E+04 5.00E-01	2.70E+00 6.00E-06 4.81E-03 5.00E-01	3.89E-08
11	*T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 WWB2EST-NM-BYPB XOP-COM2-15	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 5.00E-01 4.80E-03	2.70E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 5.00E-01 4.80E-03	3.89E-08
12	*T(T) RPS2MBIND SLC2EPV-CC-F004A WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS EXPLOSIVE VALVE C41-F004A FAILS TO OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	2.40E-03	2.70E+00 1.00E-05 1.00E+00 5.00E-01	2.70E+00 1.00E-05 2.40E-03 5.00E-01	3.24E-08
13	*T(T) RPS2MBIND SLC2EPV-CC-F004B WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS EXPLOSIVE VALVE C41-F004B FAILS TO OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	2.40E-03	2.70E+00 1.00E-05 1.00E+00 5.00E-01	2.70E+00 1.00E-05 2.40E-03 5.00E-01	3.24E-08
14	*T(T) CRD2SCRAM SLC2MDP-FS-PMPA WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A FAILS TO START WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 3.70E-03 5.00E-01	2.70E+00 6.00E-06 3.70E-03 5.00E-01	3.00E-08
15	*T(T) CRD2SCRAM SLC2MDP-FS-PMPB WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001B FAILS TO START WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 3.70E-03 5.00E-01	2.70E+00 6.00E-06 3.70E-03 5.00E-01	3.00E-08
16	*T(T) RPS2MBIND SLC2TTT-HI-N006 WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC STORAGE TANK TEMPERATURE ELEMENT C41-N006 FAIL WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	1.90E-06	2.70E+00 1.00E-05 1.10E+03 5.00E-01	2.70E+00 1.00E-05 2.10E-03 5.00E-01	2.83E-08
17	*TE(E4) BUSFAULT DCP2BAT-XXDEP2B DWT2EST-NM-INTA OPER-FPS1 SWS2CKV-OO-V22 XOP-FPS1	LOSS OF 4160V AC BUS E4 FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER1 DRYWELL INTACT (CLASS II) OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) CHECK VALVE SW V-22 FAILS TO CLOSE	1.00E+00 5.40E-04	2.00E-03 3.90E-01 1.00E+00 6.45E-01 1.00E+00 1.00E+00 9.60E-02	2.00E-03 3.90E-01 1.00E+00 6.45E-01 1.00E+00 5.40E-04 9.60E-02	2.61E-08
18	*T(T) OPER-DILUTE OPER-INHIBITADS RPS2MBIND WWB2EST-NM-BYPB XOP-COM2-13	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO INHIBIT ADS DURING ATWS MECHANICAL BINDING OF CONTROL RODS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E+00 1.00E+00 1.00E-05 5.00E-01 1.80E-03	2.70E+00 1.00E+00 1.00E+00 1.00E-05 5.00E-01 1.80E-03	2.43E-08
19	*T(C) RPS2MBIND SLC2MDP-FR-PMPA WWB2EST-NM-BYPB	LOSS OF CONDENSER VACUUM MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		1.80E-01 1.00E-05 2.60E-02 5.00E-01	1.80E-01 1.00E-05 2.60E-02 5.00E-01	2.34E-08

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
20	*T(C) RPS2MBIND SLC2MDP-FR-PMPB WWB2EST-NM-BYPB	LOSS OF CONDENSER VACUUM MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		1.80E-01 1.00E-05 2.60E-02 5.00E-01	1.80E-01 1.00E-05 2.60E-02 5.00E-01	2.34E-08
21	*T(T) ICC2SIGN01 OPER-DILUTE OPER-INHIBITADS OPER-SCRAM WWB2EST-NM-BYPB XOP-SCRAM	TURBINE TRIP INITIATOR FAILURE OF RPS TRIP SIGNAL OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO INHIBIT ADS DURING ATWS OPERATOR FAILS TO INITIATE MANUAL SCRAM WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E-05 1.00E+00 1.00E+00 1.00E+00 5.00E-01 1.70E-03	2.70E+00 1.00E-05 1.00E+00 1.00E+00 1.00E+00 5.00E-01 1.70E-03	2.30E-08
22	*T(T) ICC2SIGN01 OPER-DILUTE OPER-LLEVEL1 OPER-LLEVEL2 OPER-SCRAM WWB2EST-NM-BYPB XOP-SCRAM	TURBINE TRIP INITIATOR FAILURE OF RPS TRIP SIGNAL OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS OPERATOR FAILS TO INITIATE MANUAL SCRAM WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E-05 1.00E+00 1.00E+00 1.00E+00 1.00E+00 5.00E-01 1.70E-03	2.70E+00 1.00E-05 1.00E+00 1.00E+00 1.00E+00 1.00E+00 5.00E-01 1.70E-03	2.30E-08
23	*T(T) OPER-DILUTE OPER-LLEVEL1 RCI2TDP-FR-RCTDP RPS2MBIND WWB2EST-NM-BYPB XOP-COM2-14	TURBINE TRIP INITIATOR OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS RCIC TURBINE-DRIVEN PUMP FAILS TO RUN MECHANICAL BINDING OF CONTROL RODS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E+00 1.00E+00 2.30E-01 1.00E-05 5.00E-01 7.00E-03	2.70E+00 1.00E+00 1.00E+00 2.30E-01 1.00E-05 5.00E-01 7.00E-03	2.17E-08
24	*T(T) RPS2MBIND SLC2MDP-TM-PMPA WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A UNAVAILABLE DUE TO MAINTENANCE WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E-05 1.60E-03 5.00E-01	2.70E+00 1.00E-05 1.60E-03 5.00E-01	2.16E-08
25	*T(T) RPS2MBIND SLC2MDP-TM-PMPB WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B UNAVAILABLE DUE TO MAINTENANCE WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E-05 1.60E-03 5.00E-01	2.70E+00 1.00E-05 1.60E-03 5.00E-01	2.16E-08
26	*T(T) ICC2SIGN01 OPER-SCRAM OPER-SLCS WWB2EST-NM-BYPB XOP-SLCS	TURBINE TRIP INITIATOR FAILURE OF RPS TRIP SIGNAL OPERATOR FAILS TO INITIATE MANUAL SCRAM OPERATORS FAIL TO INITIATE SLCS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E-05 1.00E+00 1.00E+00 5.00E-01 1.50E-03	2.70E+00 1.00E-05 1.00E+00 1.00E+00 5.00E-01 1.50E-03	2.03E-08
27	*T(T) OPER-INHIBITADS OPER-SPCATWS OPER-WVDHR RPS2MBIND WWB2EST-NM-BYPB XOP-WVDHR	TURBINE TRIP INITIATOR OPERATOR FAILS TO INHIBIT ADS DURING ATWS OPERATORS FAIL TO INITIATE SUPPRESSION POOL COOLING DURING AN ATWS OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR MECHANICAL BINDING OF CONTROL RODS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05 5.00E-01 1.50E-03	2.70E+00 1.00E+00 1.00E+00 1.00E+00 1.00E-05 5.00E-01 1.50E-03	2.03E-08

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
28	%T(T) OPER-SLCS RPS2MBIND WWB2EST-NM-BYPB XOP-SLCS	TURBINE TRIP INITIATOR OPERATORS FAIL TO INITIATE SLCS MECHANICAL BINDING OF CONTROL RODS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E+00 1.00E-05 5.00E-01 1.50E-03	2.70E+00 1.00E+00 1.00E-05 5.00E-01 1.50E-03	2.03E-08
29	%T(T) CRD2SCRAM SLC2EPV-CC-F004A WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES EXPLOSIVE VALVE C41-F004A FAILS TO OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	2.40E-03	2.70E+00 6.00E-06 1.00E+00 5.00E-01	2.70E+00 6.00E-06 2.40E-03 5.00E-01	1.94E-08
30	%T(T) CRD2SCRAM SLC2EPV-CC-F004B WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES EXPLOSIVE VALVE C41-F004B FAILS TO OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	2.40E-03	2.70E+00 6.00E-06 1.00E+00 5.00E-01	2.70E+00 6.00E-06 2.40E-03 5.00E-01	1.94E-08
31	%T(T) CRD2SCRAM SLC2TTT-HI-N006 WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC STORAGE TANK TEMPERATURE ELEMENT C41-N006 FAIL WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	1.90E-06	2.70E+00 6.00E-06 1.10E+03 5.00E-01	2.70E+00 6.00E-06 2.10E-03 5.00E-01	1.70E-08
32	%T(T) RPS2MBIND RRS2BKR-CC-RRS-A WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS CIRCUIT BREAKER FOR RECIRCULATION PUMP A FAILS TO OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	1.20E-03	2.70E+00 1.00E-05 1.00E+00 5.00E-01	2.70E+00 1.00E-05 1.20E-03 5.00E-01	1.62E-08
33	%T(T) RPS2MBIND RRS2BKR-CC-RRS-B WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS CIRCUIT BREAKER FOR RECIRCULATION PUMP B FAILS TO OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	1.20E-03	2.70E+00 1.00E-05 1.00E+00 5.00E-01	2.70E+00 1.00E-05 1.20E-03 5.00E-01	1.62E-08
34	%T(T) OPER-FPS1 OPER-WVDHR SWS2XVN-OC-V442 WWB2EST-NM-BYPA XOP-WVDHR	TURBINE TRIP INITIATOR OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS II)	5.50E-08	1.00E+00 1.00E+00 3.84E+02 1.80E-01 1.50E-03	1.00E+00 1.00E+00 2.11E-05 1.80E-01 1.50E-03	1.54E-08
35	%TCSW ACPOTFM-LP-E8 DCP2BAT-XXDEF2B DWT2EST-NM-INTA OPER-FPS1 SWS2MDP-33_CSW2 XOP-FPS1	LOSS OF CONVENTIONAL SERVICE WATER TRANSFORMER 4160/480 E4 TO E8 FAILURE NO POWER BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER DRYWELL INTACT (CLASS II) OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT) COMMON CAUSE FAILURE OF ALL UNIT 2 CSW PUMPS TO RUN	1.30E-06 1.00E+00	1.00E+00 2.40E+01 1.00E+00 6.45E-01 1.00E+00 7.59E-03 9.60E-02	1.00E+00 3.12E-05 1.00E+00 6.45E-01 1.00E+00 7.59E-03 9.60E-02	1.47E-08
36	%T(T) CRD2SCRAM OPER-DILUTE OPER-INHIBITADS WWB2EST-NM-BYPB XOP-COM2-13	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO INHIBIT ADS DURING ATWS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 1.00E+00 1.00E+00 5.00E-01 1.80E-03	2.70E+00 6.00E-06 1.00E+00 1.00E+00 5.00E-01 1.80E-03	1.46E-08
37	%T(C) CRD2SCRAM SLC2MDP-FR-PMPA WWB2EST-NM-BYPB	LOSS OF CONDENSER VACUUM FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		1.80E-01 6.00E-06 2.60E-02 5.00E-01	1.80E-01 6.00E-06 2.60E-02 5.00E-01	1.40E-08

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
38	*T(C) CRD2SCRAM SLC2MDP-FR-PMPB WWB2EST-NM-BYPB	LOSS OF CONDENSER VACUUM FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		1.80E-01 6.00E-06 2.60E-02 5.00E-01	1.80E-01 6.00E-06 2.60E-02 5.00E-01	1.40E-08
39	*T(T) RPS2MBIND SLC2SYS-TM-PMPAB WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR MECHANICAL BINDING OF CONTROL RODS SLC SYSTEM UNAVAILABLE DUE TO MAINTENANCE (CLOSURE OF C41-F001 DURING PT) WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 1.00E-05 1.00E-03 5.00E-01	2.70E+00 1.00E-05 1.00E-03 5.00E-01	1.35E-08
40	*T(T) CRD2SCRAM OPER-DILUTE OPER-LLEVEL1 RCI2TDP-FR-RCTDP WWB2EST-NM-BYPB XOP-COM2-14	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS RCIC TURBINE-DRIVEN PUMP FAILS TO RUN WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 1.00E+00 1.00E+00 2.30E-01 5.00E-01 7.00E-03	2.70E+00 6.00E-06 1.00E+00 1.00E+00 2.30E-01 5.00E-01 7.00E-03	1.30E-08
41	*T(T) CRD2SCRAM SLC2MDP-TM-PMPA WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001A UNAVAILABLE DUE TO MAINTENANCE WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 1.60E-03 5.00E-01	2.70E+00 6.00E-06 1.60E-03 5.00E-01	1.30E-08
42	*T(T) CRD2SCRAM SLC2MDP-TM-PMPB WWB2EST-NM-BYPB	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES SLC PUMP C41-C001B UNAVAILABLE DUE TO MAINTENANCE WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 1.60E-03 5.00E-01	2.70E+00 6.00E-06 1.60E-03 5.00E-01	1.30E-08
43	*T(T) CRD2SCRAM OPER-INHIBITADS OPER-SPCATWS OPER-WVDHR WWB2EST-NM-BYPB XOP-WVDHR	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATOR FAILS TO INHIBIT ADS DURING ATWS OPERATORS FAIL TO INITIATE SUPPRESSION POOL COOLING DURING AN ATWS OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 5.00E-01 1.50E-03	2.70E+00 6.00E-06 1.00E+00 1.00E+00 1.00E+00 5.00E-01 1.50E-03	1.22E-08
44	*T(T) CRD2SCRAM OPER-SLCS WWB2EST-NM-BYPB XOP-SLCS	TURBINE TRIP INITIATOR FAILURE OF CONTROL ROD DRIVE SCRAM VALVES OPERATORS FAIL TO INITIATE SLCS WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00 6.00E-06 1.00E+00 5.00E-01 1.50E-03	2.70E+00 6.00E-06 1.00E+00 5.00E-01 1.50E-03	1.22E-08
45	*TCRD CRD2FLT-PG_D003A RPS2MBIND SLC2MDP-FR-PMPA WWB2EST-NM-BYPB	LOSS OF CONTROL ROD DRIVE CRD DRIVE WATER FILTER C11/C12-D003A PLUGS MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	9.80E-06	1.00E+00 8.76E+03 1.00E-05 2.60E-02 5.00E-01	1.00E+00 8.23E-02 1.00E-05 2.60E-02 5.00E-01	1.07E-08
46	*TCRD CRD2FLT-PG_D003A RPS2MBIND SLC2MDP-FR-PMPB WWB2EST-NM-BYPB	LOSS OF CONTROL ROD DRIVE CRD DRIVE WATER FILTER C11/C12-D003A PLUGS MECHANICAL BINDING OF CONTROL RODS SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)	9.80E-06	1.00E+00 8.76E+03 1.00E-05 2.60E-02 5.00E-01	1.00E+00 8.23E-02 1.00E-05 2.60E-02 5.00E-01	1.07E-08

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
47	%TCRD	LOSS OF CONTROL ROD DRIVE		1.00E+00	1.00E+00	1.07E-08
	CRD2FLT-PG_S001A	FILTER S001A PLUGGED	9.80E-06	8.76E+03	8.23E-02	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
48	%TCRD	LOSS OF CONTROL ROD DRIVE		1.00E+00	1.00E+00	1.07E-08
	CRD2FLT-PG_S001A	FILTER S001A PLUGGED	9.80E-06	8.76E+03	8.23E-02	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
49	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.88E-09
	HPC2TDP-FR-HPTDP	HPCI TURBINE-DRIVEN PUMP FAILS TO RUN		7.40E-02	7.40E-02	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-DILUTE			4.30E-02	4.30E-02	
50	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.72E-09
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	RRS2BKR-CC-RRS-A	CIRCUIT BREAKER FOR RECIRCULATION PUMP A FAILS TO OPEN	1.20E-03	1.00E+00	1.20E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	

Report Summary:

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**ATTACHMENT D.10**

**BASE EPU LERF CUTSETS (EPU)**

**(5 pages)**

# Cutsets with Descriptions Report

LERF = 4.11E-06

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.51E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
2	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.51E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
3	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.11E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
4	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.11E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
5	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.35E-07
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-15			4.80E-03	1.00E-02	
6	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	8.10E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-15			4.80E-03	1.00E-02	
7	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	6.49E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2XVN-OC-F001	SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	8.76E+04	4.81E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
8	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	5.52E-08
	DWT2EST-NM-INTA	DRYWELL INTACT (CLASS II)		6.45E-01	6.45E-01	
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	XOP-WVDHR			1.50E-03	1.50E-03	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
9	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
10	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.99E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
11	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	4.97E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-14			7.00E-03	1.60E-02	
				2.70E+00	2.70E+00	
12	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.89E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2XVN-OC-F001	SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	8.76E+04	4.81E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
13	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.24E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2EPV-CC-F004A	EXPLOSIVE VALVE C41-F004A FAILS TO OPEN	2.40E-03	1.00E+00	2.40E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
14	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.24E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2EPV-CC-F004B	EXPLOSIVE VALVE C41-F004B FAILS TO OPEN	2.40E-03	1.00E+00	2.40E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
15	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.00E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
16	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	3.00E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
17	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.98E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-14			7.00E-03	1.60E-02	
				2.70E+00	2.70E+00	
18	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.83E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2TTT-HI-N006	SLC STORAGE TANK TEMPERATURE ELEMENT C41-N006 FAIL	1.90E-06	1.10E+03	2.10E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
19	%TE(E4)	LOSS OF 4160V AC BUS E4		2.00E-03	2.00E-03	2.61E-08
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DWT2EST-NM-INTA	DRYWELL INTACT (CLASS II)		6.45E-01	6.45E-01	
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	SWS2CKV-OO-V22	CHECK VALVE SW V-22 FAILS TO CLOSE	5.40E-04	1.00E+00	5.40E-04	
	XOP-FPS1			9.60E-02	9.60E-02	
20	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.43E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-13			1.80E-03	1.80E-03	
21	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	2.34E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
22	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	2.34E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
23	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.30E-08
	ICC2SIGN01	FAILURE OF RPS TRIP SIGNAL		1.00E-05	1.00E-05	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	OPER-SCRAM	OPERATOR FAILS TO INITIATE MANUAL SCRAM		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SCRAM			1.70E-03	1.70E-03	
24	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.30E-08
	ICC2SIGN01	FAILURE OF RPS TRIP SIGNAL		1.00E-05	1.00E-05	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	OPER-SCRAM	OPERATOR FAILS TO INITIATE MANUAL SCRAM		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SCRAM			1.70E-03	1.70E-03	
25	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.16E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-TM-PMPA	SLC PUMP C41-C001A UNAVAILABLE DUE TO MAINTENANCE		1.60E-03	1.60E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
26	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.16E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-TM-PMPB	SLC PUMP C41-C001B UNAVAILABLE DUE TO MAINTENANCE		1.60E-03	1.60E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
27	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.03E-08
	ICC2SIGN01	FAILURE OF RPS TRIP SIGNAL		1.00E-05	1.00E-05	
	OPER-SCRAM	OPERATOR FAILS TO INITIATE MANUAL SCRAM		1.00E+00	1.00E+00	
	OPER-SLCS	OPERATORS FAIL TO INITIATE SLCS		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SLCS			1.50E-03	1.50E-03	
28	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.03E-08
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	OPER-SPCATWS	OPERATORS FAIL TO INITIATE SUPPRESSION POOL COOLING DURING AN ATWS		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-WVDHR			1.50E-03	1.50E-03	
29	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	2.03E-08
	OPER-SLCS	OPERATORS FAIL TO INITIATE SLCS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SLCS			1.50E-03	1.50E-03	
30	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.94E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2EPV-CC-F004A	EXPLOSIVE VALVE C41-F004A FAILS TO OPEN	2.40E-03	1.00E+00	2.40E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
31	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.94E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2EPV-CC-F004B	EXPLOSIVE VALVE C41-F004B FAILS TO OPEN	2.40E-03	1.00E+00	2.40E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
32	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.70E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2TTT-HI-N006	SLC STORAGE TANK TEMPERATURE ELEMENT C41-N006 FAIL	1.90E-06	1.10E+03	2.10E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
33	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.62E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	RRS2BKR-CC-RRS-A	CIRCUIT BREAKER FOR RECIRCULATION PUMP A FAILS TO OPEN	1.20E-03	1.00E+00	1.20E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
34	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.62E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	RRS2BKR-CC-RRS-B	CIRCUIT BREAKER FOR RECIRCULATION PUMP B FAILS TO OPEN	1.20E-03	1.00E+00	1.20E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
35	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.54E-08
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	WWB2EST-NM-BYPA	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS II)		1.80E-01	1.80E-01	
	XOP-WVDHR			1.50E-03	1.50E-03	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
36	%TCSW	LOSS OF CONVENTIONAL SERVICE WATER		1.00E+00	1.00E+00	1.47E-08
	ACP0TFM-LP-E8	TRANSFORMER 4160/480 E4 TO E8 FAILURE NO POWER	1.30E-06	2.40E+01	3.12E-05	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DWT2EST-NM-INTA	DRYWELL INTACT (CLASS II)		6.45E-01	6.45E-01	
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	SWS2MDP-33_CSW2	COMMON CAUSE FAILURE OF ALL UNIT 2 CSW PUMPS TO RUN		7.59E-03	7.59E-03	
	XOP-FPS1			9.60E-02	9.60E-02	
37	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.46E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-13			1.80E-03	1.80E-03	
38	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	1.40E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
39	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	1.40E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
40	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.35E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2SYS-TM-PMPAB	SLC SYSTEM UNAVAILABLE DUE TO MAINTENANCE (CLOSURE OF C41-F001 DURING PT)		1.00E-03	1.00E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
41	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.30E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-TM-PMPA	SLC PUMP C41-C001A UNAVAILABLE DUE TO MAINTENANCE		1.60E-03	1.60E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
42	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.30E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-TM-PMPB	SLC PUMP C41-C001B UNAVAILABLE DUE TO MAINTENANCE		1.60E-03	1.60E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
43	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.22E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	OPER-SPCATWS	OPERATORS FAIL TO INITIATE SUPPRESSION POOL COOLING DURING AN ATWS		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-WVDHR			1.50E-03	1.50E-03	
44	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	1.22E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	OPER-SLCS	OPERATORS FAIL TO INITIATE SLCS		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SLCS			1.50E-03	1.50E-03	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
45	%TCRD	LOSS OF CONTROL ROD DRIVE		1.00E+00	1.00E+00	1.07E-08
	CRD2FLT-PG_D003A	CRD DRIVE WATER FILTER C11/C12-D003A PLUGS	9.80E-06	8.76E+03	8.23E-02	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
46	%TCRD	LOSS OF CONTROL ROD DRIVE		1.00E+00	1.00E+00	1.07E-08
	CRD2FLT-PG_D003A	CRD DRIVE WATER FILTER C11/C12-D003A PLUGS	9.80E-06	8.76E+03	8.23E-02	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
47	%TCRD	LOSS OF CONTROL ROD DRIVE		1.00E+00	1.00E+00	1.07E-08
	CRD2FLT-PG_S001A	FILTER S001A PLUGGED	9.80E-06	8.76E+03	8.23E-02	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
48	%TCRD	LOSS OF CONTROL ROD DRIVE		1.00E+00	1.00E+00	1.07E-08
	CRD2FLT-PG_S001A	FILTER S001A PLUGGED	9.80E-06	8.76E+03	8.23E-02	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
49	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.99E-09
	HPC2TDP-FR-HPTDP	HPCI TURBINE-DRIVEN PUMP FAILS TO RUN		7.40E-02	7.40E-02	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-15			4.80E-03	1.00E-02	
50	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	2.70E+00	9.88E-09
	HPC2TDP-FR-HPTDP	HPCI TURBINE-DRIVEN PUMP FAILS TO RUN		7.40E-02	7.40E-02	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-DILUTE			4.30E-02	4.30E-02	

Report Summary:

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**ATTACHMENT D.11**

**SENSITIVITY 1 LERF CUTSETS**

(5 pages)

# Cutsets with Descriptions Report

LERF = 4.49E-06

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
1	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	3.90E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
2	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	3.90E-07
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
3	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.34E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
4	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.34E-07
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
5	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.50E-07
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-15			4.80E-03	1.00E-02	
6	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	9.00E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-15			4.80E-03	1.00E-02	
7	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	7.21E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2XVN-OC-F001	SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	8.76E+04	4.81E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
8	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	6.13E-08
	DWT2EST-NM-INTA	DRYWELL INTACT (CLASS II)		6.45E-01	6.45E-01	
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	XOP-WVDHR			1.50E-03	1.50E-03	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
9	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	5.55E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
10	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	5.55E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		3.70E-03	3.70E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
11	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	5.52E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		2.30E-01	2.30E-01	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-14			7.00E-03	1.60E-02	
				2.70E+00	3.00E+00	
12	*T(T)	TURBINE TRIP INITIATOR		6.00E-06	6.00E-06	4.33E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		8.76E+04	4.81E-03	
	SLC2XVN-OC-F001	SLC TANK DISCHARGE VALVE C41-F001 FAILS TO REMAIN OPEN	5.50E-08	5.00E-01	5.00E-01	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00	3.00E+00	
13	*T(T)	TURBINE TRIP INITIATOR		1.00E-05	1.00E-05	3.60E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E+00	2.40E-03	
	SLC2EPV-CC-F004A	EXPLOSIVE VALVE C41-F004A FAILS TO OPEN	2.40E-03	5.00E-01	5.00E-01	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00	3.00E+00	
14	*T(T)	TURBINE TRIP INITIATOR		1.00E-05	1.00E-05	3.60E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E+00	2.40E-03	
	SLC2EPV-CC-F004B	EXPLOSIVE VALVE C41-F004B FAILS TO OPEN	2.40E-03	5.00E-01	5.00E-01	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00	3.00E+00	
15	*T(T)	TURBINE TRIP INITIATOR		6.00E-06	6.00E-06	3.33E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		3.70E-03	3.70E-03	
	SLC2MDP-FS-PMPA	SLC PUMP C41-C001A FAILS TO START		5.00E-01	5.00E-01	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00	3.00E+00	
16	*T(T)	TURBINE TRIP INITIATOR		6.00E-06	6.00E-06	3.33E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		3.70E-03	3.70E-03	
	SLC2MDP-FS-PMPB	SLC PUMP C41-C001B FAILS TO START		5.00E-01	5.00E-01	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		2.70E+00	3.00E+00	
17	*T(T)	TURBINE TRIP INITIATOR		6.00E-06	6.00E-06	3.31E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		1.00E+00	1.00E+00	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		2.30E-01	2.30E-01	
	RCI2TDP-FR-RCTDP	RCIC TURBINE-DRIVEN PUMP FAILS TO RUN		5.00E-01	5.00E-01	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		7.00E-03	1.60E-02	
	XOP-COM2-14			2.70E+00	3.00E+00	
				1.00E-05	1.00E-05	
18	*T(T)	TURBINE TRIP INITIATOR		1.10E+03	2.10E-03	3.14E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		5.00E-01	5.00E-01	
	SLC2TTT-HI-N006	SLC STORAGE TANK TEMPERATURE ELEMENT C41-N006 FAIL	1.90E-06			
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)				

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
19	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.70E-08
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-COM2-13			1.80E-03	1.80E-03	
20	%TE(E4)	LOSS OF 4160V AC BUS E4		2.00E-03	2.00E-03	2.61E-08
	BUSFAULT	FRACTION OF LOSS OF BUS THAT ARE NON-RECOVERABLE		3.90E-01	3.90E-01	
	DCP2BAT-XXDEP2B	BATTERY BANK 2B DEPLETION FOLLOWING LOSS OF POWER FROM CHARGER	1.00E+00	1.00E+00	1.00E+00	
	DWT2EST-NM-INTA	DRYWELL INTACT (CLASS II)		6.45E-01	6.45E-01	
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	SWS2CKV-OO-V22	CHECK VALVE SW V-22 FAILS TO CLOSE	5.40E-04	1.00E+00	5.40E-04	
	XOP-FPS1			9.60E-02	9.60E-02	
21	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.55E-08
	ICC2SIGN01	FAILURE OF RPS TRIP SIGNAL		1.00E-05	1.00E-05	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	OPER-SCRAM	OPERATOR FAILS TO INITIATE MANUAL SCRAM		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SCRAM			1.70E-03	1.70E-03	
22	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.55E-08
	ICC2SIGN01	FAILURE OF RPS TRIP SIGNAL		1.00E-05	1.00E-05	
	OPER-DILUTE	OPERATOR FAILS TO PRECLUDE BORON WASHOUT DURING LOW PRESSURE INJECTION		1.00E+00	1.00E+00	
	OPER-LLEVEL1	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH HPCI DURING ATWS		1.00E+00	1.00E+00	
	OPER-LLEVEL2	OPERATOR FAILS TO CONTROL LOWERED WATER LEVEL WITH RCIC DURING ATWS		1.00E+00	1.00E+00	
	OPER-SCRAM	OPERATOR FAILS TO INITIATE MANUAL SCRAM		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SCRAM			1.70E-03	1.70E-03	
23	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.40E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-TM-PMPA	SLC PUMP C41-C001A UNAVAILABLE DUE TO MAINTENANCE		1.60E-03	1.60E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
24	%T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.40E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-TM-PMPB	SLC PUMP C41-C001B UNAVAILABLE DUE TO MAINTENANCE		1.60E-03	1.60E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
25	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	2.34E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPA	SLC PUMP C41-C001A FAILS TO RUN FOR 1 HR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
26	%T(C)	LOSS OF CONDENSER VACUUM		1.80E-01	1.80E-01	2.34E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	SLC2MDP-FR-PMPB	SLC PUMP C41-C001B FAILS TO RUN FOR 1 HOUR		2.60E-02	2.60E-02	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	

#	Inputs	Description	Rate	Exposure	Event Prob	Probability
27	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.25E-08
	ICC2SIGN01	FAILURE OF RPS TRIP SIGNAL		1.00E-05	1.00E-05	
	OPER-SCRAM	OPERATOR FAILS TO INITIATE MANUAL SCRAM		1.00E+00	1.00E+00	
	OPER-SLCS	OPERATORS FAIL TO INITIATE SLCS		1.00E+00	1.00E+00	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SLCS			1.50E-03	1.50E-03	
28	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.25E-08
	OPER-INHIBITADS	OPERATOR FAILS TO INHIBIT ADS DURING ATWS		1.00E+00	1.00E+00	
	OPER-SPCATWS	OPERATORS FAIL TO INITIATE SUPPRESSION POOL COOLING DURING AN ATWS		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-WVDHR			1.50E-03	1.50E-03	
29	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.25E-08
	OPER-SLCS	OPERATORS FAIL TO INITIATE SLCS		1.00E+00	1.00E+00	
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
	XOP-SLCS			1.50E-03	1.50E-03	
30	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.16E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2EPV-CC-F004A	EXPLOSIVE VALVE C41-F004A FAILS TO OPEN	2.40E-03	1.00E+00	2.40E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
31	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	2.16E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2EPV-CC-F004B	EXPLOSIVE VALVE C41-F004B FAILS TO OPEN	2.40E-03	1.00E+00	2.40E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
32	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.89E-08
	CRD2SCRAM	FAILURE OF CONTROL ROD DRIVE SCRAM VALVES		6.00E-06	6.00E-06	
	SLC2TTT-HI-N006	SLC STORAGE TANK TEMPERATURE ELEMENT C41-N006 FAIL	1.90E-06	1.10E+03	2.10E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
33	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.80E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	RRS2BKR-CC-RRS-A	CIRCUIT BREAKER FOR RECIRCULATION PUMP A FAILS TO OPEN	1.20E-03	1.00E+00	1.20E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
34	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.80E-08
	RPS2MBIND	MECHANICAL BINDING OF CONTROL RODS		1.00E-05	1.00E-05	
	RRS2BKR-CC-RRS-B	CIRCUIT BREAKER FOR RECIRCULATION PUMP B FAILS TO OPEN	1.20E-03	1.00E+00	1.20E-03	
	WWB2EST-NM-BYPB	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS IV)		5.00E-01	5.00E-01	
35	*T(T)	TURBINE TRIP INITIATOR		2.70E+00	3.00E+00	1.71E-08
	OPER-FPS1	OPERATOR FAILS TO ALIGN FIREWATER FOR COOLANT INJECTION FLOW (ONE UNIT)		1.00E+00	1.00E+00	
	OPER-WVDHR	OPERATORS FAIL TO INITIATE WETWELL VENTING FOR DHR		1.00E+00	1.00E+00	
	SWS2XVN-OC-V442	MANUAL VALVE 2 SW V442 FAILS TO REMAIN OPEN	5.50E-08	3.84E+02	2.11E-05	
	WWB2EST-NM-BYPA	WETWELL AIRSPACE AND POOL NOT BYPASSED (CLASS II)		1.80E-01	1.80E-01	
	XOP-WVDHR			1.50E-03	1.50E-03	