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TOKYO, JAPAN

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Document Control Desk U.S. Nuclear Regulatory Commission Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021 MHI Ref: UAP-HF-09044

Subject: MHI's Responses to US-APWR DCD RAI No. 149-1744 Revision 1

Reference: 1) "Request for Additional Information No. 149-1744 Revision 1, SRP Section: 19-Probabilistic Risk Assessment and Severe Accident Evaluation, Application Section: 19.1," dated January 9, 2009

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document as listed in Enclosure.

Enclosed is the responses to the RAIs contained within Reference 1. Of these RAIs, the following 3 RAIs will not be answered within this package.

19-280 19-281 19-283

MHI will need additional analyses and surveys for the responses to these RAIs. The responses to these RAIs will be submitted by 10^{th} March.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittal. His contact information is below.

Sincerely,

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Yoshiki Ogata, General Manager- APWR Promoting Department Mitsubishi Heavy Industries, LTD.

Enclosure:

1. "Responses to Request for Additional Information No. 149-1744 Revision 1"

CC: J. A. Ciocco

C. K. Paulson

Contact Information

C. Keith Paulson, Senior Technical Manager Mitsubishi Nuclear Energy Systems, Inc. 300 Oxford Drive, Suite 301 Monroeville, PA 15146 E-mail: ck_paulson@mnes-us.com Telephone: (412) 373-6466

Docket No. 52-021 MHI Ref: UAP-HF-09044

Enclosure 1

UAP-HF-09044 Docket No. 52-021

Responses to Request for Additional Information No.149-1744 Revision 1

February 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

2/6/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: NO. 149-1744 REVISION 1

SRP SECTION: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation

APPLICATION SECTION: 19.1

DATE OF RAI ISSUE: 1/9/2009

QUESTION NO. : 19-278

The following statement is made in Section 7.3 "Other Data" of Revision 1 of the USAPWR PRA report: "The hardware failure probability of main feedwater is discussed in Attachment 6A.14.5 and is assessed to be 1E-1/d." However, such a discussion is not provided in Attachment 6A.14.5 where it is simply stated that "the unavailability of MFWS is conservatively judged to be 1E-1." Please provide the basis for stating that the hardware failure probability of main feedwater is conservatively judged to be 1E-1. Also, in evaluating the probability of operator failure to recover main feedwater (event MFWO002) it was assumed a "moderately high" operator stress level. Given loss of emergency feedwater and the time constraints to use the next line of defense (feed and bleed) should the main feedwater recovery fails, the use of an "extremely high" operator stress level seems more appropriate. Please discuss.

ANSWER:

Major causes that result in failure to recover main feedwater is described in Page 6A.14.5-1 Attachment A.14.5 and there associated probabilities are as follows:

- Random hardware failures
 - Any one of the 15 turbine bypass valves (AOV) fail to open
 - =1.2E-03×15 =1.8E-02
 - Motor-driven MFW pump fail to run (Fail to start and run for 24 hours) =2.0E-3 + 4.0E-4 [/hr]×1[hr] + 6.0E-06 [/hr]×23[hr] =2.5E-03
- Loss of offsite power (consequential LOOP after reactor trip) = 5.3E-03
- Human error (failure to open MFW bypass valve)

=3.8E-03 (Represented as "MFWWOO02" in the human reliability analysis)

Sum of probability of the causes to lead to failure of main feed water to recover is approximately 3E-2. Taking into account the causes that have not been evaluated above, the probability of the failure to recover main feed water is estimated to be 1E-1.

According to thermal hydraulic analyses, the time before steam generator dryout after loss of feed water is approximately 50 minutes. Taking into account this relatively long time available for main feed water recovery, the stress level for this operation was considered to be "moderately high".

Additionally, if the stress level is assumed to be "extremely high", the human error probability for operation is approximately 6E-2. And the resulting total failure probability of main feed water recovery will be less than 9E-2. The probability of failing to recover main feed water for this case is also bounded by the 1E-1 per demand probability used in the PRA.

Impact on DCD There is no impact on DCD.

Impact on COLA There is no impact on COLA.

Impact on PRA There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

2/6/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: NO. 149-1744 REVISION 1

SRP SECTION: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation

APPLICATION SECTION: 19.1

DATE OF RAI ISSUE: 1/9/2009

QUESTION NO. : 19-279

The following statement is made in Section 8.7 "Modeling for Asymmetrical Pump Configurations" of Revision 1 of the US-APWR PRA report: "The parameters obtained from NUREG/CR-5497 are overly conservative results as there has never been any CCF of normally running CCW or ESW pumps. All the CCF events cited in the NUREG report were reviewed but there was no CCF event in this database that involved the simultaneous failure of all normally operating pumps. Hence beta is reduced in relation to that listed for standby pumps to account for this. Based on engineering judgment, beta [prime] = 0.001 is assumed...." The staff requests more detailed information regarding the review of CCF to run events for CCW/SWS pumps reported in NUREG/CR-5497. Please provide a list of the events that were reviewed, including a summary of the review approach, assumptions and results that support the assumed beta value of 0.001. In addition, the assumption that the CCW/SWS pumps A and C are normally running and pumps B and D are normally standby simplifies PRA modeling but distorts the results and complicates their interpretation and use in risk informed applications, such as the proposed risk-managed technical specifications (RMTS) initiatives 4b and 5b. Please discuss.

ANSWER:

The treatment of common cause failures in normally running asymmetrical pump configurations in the US-APWR PRA in the DCD is based on our evaluation of the data for such events. We also consulted Mr. Karl N. Fleming who is well known for his contributions to the development of common cause models and data analyses. Mr. Fleming confirmed the modeling approach that was used for the CCW and ESWS pumps and it was his expert judgment that provided the basis for the adopted values of MGL parameters.

NUREG/CR-5497 provides estimates of common cause parameters such as MGL parameters and alpha factor parameters for different types of components such as service water pumps and component cooling water pumps, but does not provide the listing and descriptions of individual events, nor does it

include the impact vector assessment for individual events used to calculate the common cause parameters. Only statistical data derived from the aggregate impact vector counts are presented. The details on the individual events are not in the public domain due to the use of some proprietary data sources for some of the events. We understand that none of the events used to calculate the MGL parameters in NUREG/CR-5497 were applicable to normally operating pumps and none of the events, if assumed to occur in a system of normally operating pumps, would have any significant potential for leading to failure of any, even a single normally operating pump. Based upon this understanding the MGL parameters in NUREG/CR-5497 are not applicable to normally operating CCW and ESW system pumps. Another factor supporting this conclusion was the fact that if the NUREG values and reasonable estimates of pump failure rates were used in the analysis, an unreasonably high estimate of loss of ESW and loss of CCW would result – on the order of 10-3 per year. This would be true for most existing PWR plants.

This is a generic issue in common cause failure analysis. We understand that EPRI has a research project to investigate this issue. There is no US utility that we are aware of that uses MGL parameters from NUREG/CR-5497 to calculate loss of ESW and loss of CCW system initiating event frequencies. If they did, such plants would have CDF estimates that were artificially high because loss of CCW and/or loss of ESW either leads directly to core damage or has a very high conditional core damage probability at most existing plants. The recommended modeling approach and MGL parameters for this treatment is consistent with the approach that is typically used in existing PRAs for loss of CCW and ESW initiating event frequencies.

MHI does not have access to the proprietary data behind NUREG/CR-5497 but we expect that the treatment we have used is supported by that data.

With regard to the assumption about pump line ups during normal operation in the DCD PRA, we plan to provide a more comprehensive treatment of initial pump alignments when the PRA models are upgraded for risk informed technical specification (RITS) applications. The PRA for DCD is different from that developed to support RITS. The PRA for RITS will be modeled to adequately assess plant configurations that will be encountered during plant operation

Impact on DCD There is no impact on DCD.

Impact on COLA There is no impact on COLA.

Impact on PRA There is no impact on PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

2/6/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: NO. 149-1744 REVISION 1

SRP SECTION: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation

APPLICATION SECTION: 19.1

DATE OF RAI ISSUE: 1/9/2009

QUESTION NO. : 19-282

Please provide the 10 top cutsets for each of the 17 initiating event (IE) categories modeled in the US-APWR PRA for internal events at power operation (or the number of cutsets which contribute to 95% of an IE category's core damage frequency, if smaller than 10). For each cut set, please include information similar to that reported in Table 10.5-3 of the US-APWR PRA report..

ANSWER:

The 10 top cutsets for each of the 17 initiating event (IE) categories modeled in the US-APWR PRA for internal events at power operation are shown in Table 19-282-1 to 19-282-17.

Impact on DCD The tables provided in this response will be incorporated in DCD chapter 19, section 19.1.4.1.2.

Impact on COLA There is no impact on COLA.

Impact on PRA There is no impact on PRA.

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.3E-10	28.6	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			1.1E-04	HPICF4PMADSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO START CCF
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
2	1.2E-11	2.5	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
			9.7E-06	RWSCF4SUPRST01-ALL	RWSP SUMP STRAINER PLUG CCF
3	1.1E-11	2.4	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			9.5E-06	HPICF4PMADSIP-124	SAFETY INJECTION PUMP A,B,D FAIL TO START (Standby) CCF
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
4	1.1E-11	2.4	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			9.5E-06	HPICF4PMADSIP-234	SAFETY INJECTION PUMP B,C,D FAIL TO START (Standby) CCF
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
5	1.1E-11	2.4	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			9.5E-06	HPICF4PMADSIP-134	SAFETY INJECTION PUMP A,C,D FAIL TO START (Standby) CCF
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING

Table 19-282-1 Dominant Cut Sets of Large Pipe Break LOCA (Sheets 1 of 2)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
6	1.1E-11	2.4	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			9.5E-06	HPICF4PMADSIP-123	M/P FAIL TO START (Standby) CCF
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
7	1.0E-11	2.2	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			8.5E-06	HPICF4PMSRSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO RUN (Standby) (<1h) CCF
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
8	6.3E-12	1.3	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			9.9E-04	EPSCF4DLLRDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO RUN (>1H) CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
9	4.4E-12	0.9	1.2E-06	!01LLOCA	LARGE PIPE BREAK LOCA
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE
					COOLING
			3.7E-06		RWSP SUMP STRAINER PLUG CCF
10	4.4E-12	0.9	1.2E-06		LARGE PIPE BREAK LOCA
			1.0E+00	RSS-RHR-LL	FAIL TO PERFORM ALTERNATE CORE COOLING
			3.7E-06	RWSCF4SUPRST01-134	RWSP SUMP STRAINER PLUG CCF

Table 19-282-1 Dominant Cut Sets of Large Pipe Break LOCA (Sheets 2 of 2)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	4.9E-09	30.3	5.0E-04	!02MLOCA	MEDIUM PIPE BREAK LOCA
			9.7E-06	RWSCF4SUPRST01-ALL	RWSP SUMP STRAINER PLUG CCF
2	1.8E-09	11.4	5.0E-04	102MLOCA	MEDIUM PIPE BREAK LOCA
			3.7E-06	RWSCF4SUPRST01-234	RWSP SUMP STRAINER PLUG CCF
3	1.1E-09	6.6	5.0E-04	102MLOCA	MEDIUM PIPE BREAK LOCA
			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
			8.4E-05	RSSCF4MVOD114-ALL	CS/RHR HEAT EXCHANGER DISCHARGE LINE M/V MOV-145A,B,C,D(114A,B,C,D) FAIL TO OPEN CCF
4	5.0E-10	3.1	5.0E-04	102MLOCA	MEDIUM PIPE BREAK LOCA
			1.0E-06	ACCCF4CVOD8956-ALL	BOUNDARY C/V SI-V103A,B,C,D(8956A,B,C,D) FAIL TO OPEN CCF
5	5.0E-10	3.1	5.0E-04	!02MLOCA	MEDIUM PIPE BREAK LOCA
			1.0E-06	ACCCF4CVOD8948-ALL	DISCHARGE LINE SECONDARY ISOLATION C/V SI-V102A,B,C,D(8948A,B,C,D) FAIL TO OPEN CCF

Table 19-282-2 Dominant Cut Sets of Medium Pipe Break LOCA (Sheets 1 of 2)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
6	4.8E-10	3.0	5.0E-04	102MLOCA	MEDIUM PIPE BREAK LOCA
			1.1E-04	HPICF4PMADSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO START CCF
			8.5E-03	RSSOO02LNUP	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CORE COOLING (HE)
7	2.4E-10	1.5	5.0E-04	102MLOCA	MEDIUM PIPE BREAK LOCA
-			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
			1.9E-05	RSSCF4PMADCSP-ALL	CS/RHR PUMP A,B,C,D FAIL TO START CCF
8	1.4E-10	0.9	5.0E-04	102MLOCA	MEDIUM PIPE BREAK LOCA
			1.1E-04	HPICF4PMADSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO START CCF
			2.6E-03	MSPOO02STRV	MAIN STEAM RELIEF VALVE (MSRV) OPEN OPERATION FAIL (HE)
9	1.3E-10	0.8	5.0E-04	102MLOCA	MEDIUM PIPE BREAK LOCA
			2.7E-07	ACCCF4CVOD8956-234	BOUNDARY C/V SI-V103A,B,C,D(8956A,B,C,D) FAIL TO OPEN CCF
10	1.3E-10	0.8	5.0E-04	!02MLOCA	MEDIUM PIPE BREAK LOCA
			2.7E-07	ACCCF4CVOD8948-123	DISCHARGE LINE SECONDARY ISOLATION C/V SI-V102A,B,C,D(8948A,B,C,D) FAIL TO OPEN CCF

Table 19-282-2 Dominant Cut Sets of Medium Pipe Break LOCA (Sheets 2 of 2)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	3.5E-08	45.2	3.6E-03	!03SLOCA	SMALL PIPE BREAK LOCA
			9.7E-06	RWSCF4SUPRST01-ALL	RWSP SUMP STRAINER PLUG CCF
2	7.7E-09	9.9	3.6E-03	!03SLOCA	SMALL PIPE BREAK LOCA
			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
			8.4E-05	RSSCF4MVOD114-ALL	CS/RHR HEAT EXCHANGER DISCHARGE LINE M/V MOV-145A,B,C,D(114A,B,C,D) FAIL TO OPEN CCF
3	3.4E-09	4.4	3.6E-03	103SLOCA	SMALL PIPE BREAK LOCA
			1.1E-04	HPICF4PMADSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO
			8.5E-03	RSSOO02LNUP	START CCF OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CORE COOLING (HE)
4	1.7E-09	. 2.2	3.6E-03	103SLOCA	SMALL PIPE BREAK LOCA
			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
			1.9E-05	RSSCF4PMADCSP-ALL	CS/RHR PUMP A,B,C,D FAIL TO START CCF
5	1.0E-09	1.3	3.6E-03	103SLOCA	SMALL PIPE BREAK LOCA
			1.1E-04	HPICF4PMADSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO START CCF
			2.6E-03	MSPOO02STRV	MAIN STEAM RELIEF VALVE (MSRV) OPEN OPERATION FAIL (HE)

Table 19-282-3 Dominant Cut Sets of Small Pipe Break LOCA (Sheets 1 of 2)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
6	9.1E-10	1.2	3.6E-03	!03SLOCA	SMALL PIPE BREAK LOCA
			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
			1.0E-05	SGNBTSWCCF	S,P SIGNAL SOFTWARE CCF
7	9.1E-10	1.2	3.6E-03	!03SLOCA	SMALL PIPE BREAK LOCA
			1.0E-05	CCWBTSWCCF	CCW SOFTWARE CCF
			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
8	4.6E-10	0.6	3.6E-03	!03SLOCA	SMALL PIPE BREAK LOCA
			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
			5.0E-06	RSSCF4PMSRCSP-ALL	CS/RHR PUMP A,B,C,D FAIL TO RUN (<1H) CCF
9	4.4E-10	0.6	3.6E-03	103SLOCA	SMALL PIPE BREAK LOCA
			2.5E-02	NCCOO02CCW	OPERATOR FAILS TO LINE UP FOR ALTERNATIVE CONTAINMENT COOLING (HE)
			4.8E-06	RSSCF4RHPRRHEX-ALL	CS/RHR HEAT EXCHANGER PLUG CCF
10	4.3E-10	0.6	3.6E-03	!03SLOCA	SMALL PIPE BREAK LOCA
			1.0E-05	SGNBTSWCCF	S,P SIGNAL SOFTWARE CCF
			1.2E-02	SWSTMPESWPD	ESW PUMP-D OUTAGE

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 Table 19-282-3 Dominant Cut Sets of Small Pipe Break LOCA (Sheets 2 of 2)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.7E-10	20.5	1.5E-03	104VSLOCA	VERY SMALL PIPE BREAK LOCA
			9.9E-04	EPSCF4DLLRDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO RUN (>1H) CCF
			2.1E-02	EPSOO02RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
2	1.6E-10	19.9	1.5E-03	104VSLOCA	VERY SMALL PIPE BREAK LOCA
			2.0E-05	EPSCF4CBTD6H-ALL	6.9KV AC BUS INCOMER CIRCUIT BREAKER (6HA,B,C,D) FAIL TO OPEN CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
3	8.0E-11	9.9	1.5E-03	!04VSLOCA	VERY SMALL PIPE BREAK LOCA
			1.0E-05	EPSBTSWCCF	EPS SOFTWARE CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
4	5.4E-11	6.7	1.5E-03	104VSLOCA	VERY SMALL PIPE BREAK LOCA
			3.6E-08	CWSCF4RHPR-FF	ALL COMPONENT COOLING HEAT EXCHANGERS PLUG/FOUL OR LARGE EXTERNAL LEAK CCF
5	3.5E-11	4.4	1.5E-03	!04VSLOCA	VERY SMALL PIPE BREAK LOCA
			2.1E-04	EPSCF4DLADDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO START CCF
			2.1E-02	EPSOO02RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP

Table 19-282-4 Dominant Cut Sets of Very Small Pipe Break LOCA (Sheets 1 of 2)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
6	2.6E-11	3.2	1.5E-03	104VSLOCA	VERY SMALL PIPE BREAK LOCA
			1.6E-0 4	EPSCF4DLSRDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO RUN (<1H) CCF
			2.1E-02	EPSO002RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
7	1.8E-11	2.2	1.5E-03	104VSLOCA	VERY SMALL PIPE BREAK LOCA
			1.2E-08	SWSCF4PMYR-FF	ESW PUMP A,B,C,D FAIL TO RUN CCF
8	1.2E-11	1.5	1.5E-03	104VSLOCA	VERY SMALL PIPE BREAK LOCA
			1.5E-06	EPSCF4IVFFINV-ALL	INVERTERS (INVA,B,C,D) FAIL TO OPERATE CFF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR
9	1.2E-11	1.4	1.5E-03	!04VSLOCA	VERY SMALL PIPE BREAK LOCA
			1.5E-03	EPSCF2DLLRDGP-ALL	AAC GAS TURBINE GENERATOR (GTG P1,2) FAIL TO RUN (>1H) CCF
			9.9E-04	EPSCF4DLLRDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO RUN (>1H) CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
10	1.0E-11	1.3	1.5E-03	104VSLOCA	VERY SMALL PIPE BREAK LOCA
			6.7E-09	CWSCF4PCYR-FF	CCW PUMP ALL FAIL TO RUN CCF

Table 19-282-4 Dominant Cut Sets of Very Small Pipe Break LOCA (Sheets 2 of 2)

19-282-9

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250C1-DP2	TURBINE BYPASS LINE X/V 50C1 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500C2	A/V 500C2 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)
2	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250B1-DP2	TURBINE BYPASS LINE X/V 50B1 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500B3	A/V 500B3 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)
3	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
-			5.8E-02	MSPOO0250B1-DP2	TURBINE BYPASS LINE X/V 50B1 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500B2	A/V 500B2 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)

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Table 19-282-5 Dominant Cut Sets of Steam Generator Tube Rupture (Sheets 1 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
4	1.1E-10	1.6	4.0E-03	105SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250A2-DP2	TURBINE BYPASS LINE X/V 50A2 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500A5	A/V 500A5 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)
5	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250A2-DP2	TURBINE BYPASS LINE X/V 50A2 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500A4	A/V 500A4 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)
6	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250B2-DP2	TURBINE BYPASS LINE X/V 50B2 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500B4	A/V 500B4 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)

Table 19-282-5 Dominant Cut Sets of Steam Generator Tube Rupture (Sheets 2 of 4)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
7	1.1E-10	1.6	4.0E-03	105SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250A1-DP2	TURBINE BYPASS LINE X/V 50A1 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500A3	A/V 500A3 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)
8	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
		-	5.8E-02	MSPOO0250B1-DP2	TURBINE BYPASS LINE X/V 50B1 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500B1	A/V 500B1 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)
9	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250C1-DP2	TURBINE BYPASS LINE X/V 50C1 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500C1	A/V 500C1 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)

 Table 19-282-5 Dominant Cut Sets of Steam Generator Tube Rupture (Sheets 3 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
10	1.1E-10	1.6	4.0E-03	!05SGTR	STEAM GENERATOR TUBE RUPTURE
			1.5E-01	HITOO02-DP3	SAFETY INJECTION CONTROL HUMAN ERROR
			5.8E-02	MSPOO0250A1-DP2	TURBINE BYPASS LINE X/V 50A1 CLOSED OPERATION FAIL (HE)
			1.2E-03	MSRAVCD500A2	A/V 500A2 FAIL TO CLOSE
			2.6E-03	MSROO02533A	OPERATOR FAILS TO CLOSE MAIN STEAM ISOLATION VALVES (HE)

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 Table 19-282-5 Dominant Cut Sets of Steam Generator Tube Rupture (Sheets 4 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.0E-07	100	1.0E-07	!07RVR	REACTOR VESSEL RUPTURE

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Table 19-282-6 Dominant Cut Sets of Reactor Vessel Rupture

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	4.5E-09	24.6	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			1.8E-04	MSRCF4AVCD533-ALL	MAIN STEAM ISOLATION VALVE AOV- 515A,B,C,D(533A,B,C,D) FAIL TO CLOSED
2	1.3E-09	7.3	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-05	MSRCF4AVCD533-24	MAIN STEAM ISOLATION VALVE AOV- 515B,D(533B,D) FAIL TO CLOSED
3	1.3E-09	7.3	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-05	MSRCF4AVCD533-23	MAIN STEAM ISOLATION VALVE AOV- 515B,C(533B,C) FAIL TO CLOSED
4	1.3E-09	7.3	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-05	MSRCF4AVCD533-12	MAIN STEAM ISOLATION VALVE AOV- 515A,B(533A,B) FAIL TO CLOSED

Table 19-282-7 Dominant Cut Sets of Steam Line Break/Leak (Turbine Side) (Sheets 1 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	1.3E-09	7.3	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-05	MSRCF4AVCD533-13	MAIN STEAM ISOLATION VALVE AOV- 515A,C(533A,C) FAIL TO CLOSED
6	1.3E-09	7.3	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-05	MSRCF4AVCD533-34	MAIN STEAM ISOLATION VALVE AOV- 515C,D(533C,D) FAIL TO CLOSED
7	1.3E-09	7.3	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-05	MSRCF4AVCD533-14	MAIN STEAM ISOLATION VALVE AOV- 515A,D(533A,D) FAIL TO CLOSED
8	6.7E-10	3.6	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			2.6E-05	MSRCF4AVCD533-134	MAIN STEAM ISOLATION VALVE AOV- 515A,C,D(533A,C,D) FAIL TO CLOSED

Table 19-282-7 Dominant Cut Sets of Steam Line Break/Leak (Turbine Side) (Sheets 2 of 3)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
9	6.7E-10	3.6	1.0E-02	!10SLBO	STEAM LINE BREAK/LEAK (TURBINE SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			2.6E-05	MSRCF4AVCD533-124	MAIN STEAM ISOLATION VALVE AOV- 515A,B,D(533A,B,D) FAIL TO CLOSED
10	6.7E-10	3.6	1.0E-02 2.6E-03	!10SLBO HPIOO02FWBD-S	STEAM LINE BREAK/LEAK (TURBINE SIDE) OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
	 		2.6E-05	MSRCF4AVCD533-123	MAIN STEAM ISOLATION VALVE AOV- 515A,B,C(533A,B,C) FAIL TO CLOSED

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Table 19-282-7 Dominant Cut Sets of Steam Line Break/Leak (Turbine Side) (Sheets 3 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.0E-09	76.6	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			4.0E-04	SGNST-SGIA	FEED WATER LINE C/V VLV- 018A,B,C,D(AW1A,B,C,D) ISOLATION SIGNAL A FAILURE
2	5.1E-11	3.8	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			1.3E-04	PZRCF2MVOD58R-ALL	SAFETY DEPRESSURIZATION VALVE MOV- 117A,B(58RA,B) FAIL TO OPEN CCF
			4.0E-04	SGNST-SGIA	FEED WATER LINE C/V VLV- 018A,B,C,D(AW1A,B,C,D) ISOLATION SIGNAL A FAILURE
3	4.5E-11	3.3	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			1.1E-04	HPICF4PMADSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO START CCF
			4.0E-04	SGNST-SGIA	FEED WATER LINE C/V VLV- 018A,B,C,D(AW1A,B,C,D) ISOLATION SIGNAL A FAILURE
4	2.6E-11	1.9	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			1.0E-05	SGIBTSWCCF	EFW M/V AWA SG ISOLATION SIGNAL SOFTWARE CCF

 Table 19-282-8 Dominant Cut Sets of Steam Line Break/Leak (CV Side) (Sheets 1 of 2)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	1.4E-11	1.0	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-06	SGNCF4SGI-ALL	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
6	9.1E-12	0.7	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.5E-06	SGNCF4SGI-23	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
7	9.1E-12	0.7	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.5E-06	SGNCF4SGI-24	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
8	9.1E-12	0.7	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.5E-06	SGNCF4SGI-12	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
9	6.1E-12	0.5	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.4E-06	EFWCF2CVODEFW03- ALL	EFW PIT DISCHARGE LINE C/V VLV-008A,B(EFW03A,B) FAIL TO OPEN
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
10	4.5E-12	0.3	1.0E-03	!11SLBI	STEAM LINE BREAK/LEAK (CV SIDE)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			1.8E-06	SGNCF4SGI-124	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)

Table 19-282-8 Dominant Cut Sets of Steam Line Break/Leak (CV Side) (Sheets 2 of 2)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	3.5E-09	76.6	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			4.0E-04	SGNST-SGIA	FEED WATER LINE C/V VLV- 018A,B,C,D(AW1A,B,C,D) ISOLATION SIGNAL A FAILURE
2	1.7E-10	3.8	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			1.3E-04	PZRCF2MVOD58R-ALL	SAFETY DEPRESSURIZATION VALVE MOV- 117A,B(58RA,B) FAIL TO OPEN CCF
			4.0E-04	SGNST-SGIA	FEED WATER LINE C/V VLV- 018A,B,C,D(AW1A,B,C,D) ISOLATION SIGNAL A FAILURE
3	1.5E-10	3.3	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			1.1E-04	HPICF4PMADSIP-ALL	SAFETY INJECTION PUMP A,B,C,D FAIL TO START
			4.0E-04	SGNST-SGIA	FEED WATER LINE C/V VLV- 018A,B,C,D(AW1A,B,C,D) ISOLATION SIGNAL A
					FAILURE
4	8.7E-11	1.9	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			1.0E-05	SGIBTSWCCF	EFW M/V AWA SG ISOLATION SIGNAL SOFTWARE CCF

 Table 19-282-9 Dominant Cut Sets of Feed Water Line Break (Sheets 1 of 2)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	4.6E-11	1.0	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			5.3E-06	SGNCF4SGI-ALL	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
6	3.1E-11	0.7	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.5E-06	SGNCF4SGI-12	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
7	3.1E-11	0.7	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
	,		3.5E-06	SGNCF4SGI-24	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
8	3.1E-11	0.7	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.5E-06	SGNCF4SGI-23	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)
9	2.1E-11	0.5	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.4E-06	EFWCF2CVODEFW03- ALL	EFW PIT DISCHARGE LINE C/V VLV-008A,B(EFW03A,B) FAIL TO OPEN
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
10	1.5E-11	0.3	3.4E-03	!12FWLB	FEED WATER LINE BREAK
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			1.8E-06	SGNCF4SGI-123	SG ISOLATION SIGNAL A,B,C,D FAILURE (CCF)

Table 19-282-9 Dominant Cut Sets of Feed Water Line Break (Sheets 2 of 2)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	7.2E-10	5.0	8.0E-01	113TRANS	GENERAL TRANSIENT
			2.4E-06	EFWCF2CVODEFW03- ALL	EFW PIT DISCHARGE LINE C/V VLV-008A,B(EFW03A,B) FAIL TO OPEN
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
2	5.0E-10	3.5	8.0E-01	!13TRANS	GENERAL TRANSIENT
			1.7E-06	EFWCF4CVODXW1-ALL	EFW PUMP DISCHARGE LINE C/V VLV-
					012A,B,C,D(TW1A,B,MW1A,B) FAIL TO OPEN CCF
			3.8E-03		OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
3	5.0E-10	3.5		!13TRANS	GENERAL TRANSIENT
			1.7E-06	EFWCF4CVODAW1-ALL	FEED WATER LINE C/V VLV-018A,B,C,D(AW1A,B,C,D) FAIL TO OPEN CCF
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
4	4.8E-10	3.3	8.0E-01	!13TRANS	GENERAL TRANSIENT
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
			1.2E-02	SWSTMPESWPB	ESW PUMP-B OUTAGE

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Table 19-282-10 Dominant Cut Sets of General Transient (Sheets 1 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	4.0E-10	2.8	8.0E-01	!13TRANS	GENERAL TRANSIENT
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
			1.0E-02	VCWCHBDB	CHILLER FAIL TO START (RUNNING)
6	3.9E-10	2.7	8.0E-01	!13TRANS	GENERAL TRANSIENT
			2.4E-06	EFWCF2CVODEFW03- ALL	EFW PIT DISCHARGE LINE C/V VLV-008A,B(EFW03A,B) FAIL TO OPEN
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)
7	3.6E-10	2.5	8.0E-01	!13TRANS	GENERAL TRANSIENT
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.0E-03	EFWTMTAA	A-EMERGENCY FEED WATER PUMP(FWP1A) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
			1.2E-02	SWSTMPESWPB	ESW PUMP-B OUTAGE

 Table 19-282-10 Dominant Cut Sets of General Transient (Sheets 2 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
8	3.0E-10	2.1	8.0E-01	!13TRANS	GENERAL TRANSIENT
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.0E-03	EFWTMTAA	A-EMERGENCY FEED WATER PUMP(FWP1A) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
			1.0E-02	VCWCHBDB	CHILLER FAIL TO START (RUNNING)
9	2.7E-10	1.9	8.0E-01	!13TRANS	GENERAL TRANSIENT
			1.7E-06	EFWCF4CVODAW1-ALL	FEED WATER LINE C/V VLV- 018A,B,C,D(AW1A,B,C,D) FAIL TO OPEN CCF
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)
10	2.7E-10	1.9	8.0E-01	!13TRANS	GENERAL TRANSIENT
			1.7E-06	EFWCF4CVODXW1-ALL	EFW PUMP DISCHARGE LINE C/V VLV- 012A,B,C,D(TW1A,B,MW1A,B) FAIL TO OPEN CCF
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)

Table 19-282-10 Dominant Cut Sets of General Transient (Sheets 3 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.7E-09	7.5	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			2.4E-06	EFWCF2CVODEFW03- ALL	EFW PIT DISCHARGE LINE C/V VLV-008A,B(EFW03A,B) FAIL TO OPEN
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
2	1.2E-09	5.2	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			1.7E-06	EFWCF4CVODXW1-ALL	EFW PUMP DISCHARGE LINE C/V VLV- 012A,B,C,D(TW1A,B,MW1A,B) FAIL TO OPEN CCF
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
3	1.2E-09	5.2	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			1.7E-06	EFWCF4CVODAW1-ALL	FEED WATER LINE C/V VLV-018A,B,C,D(AW1A,B,C,D) FAIL TO OPEN CCF
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
4	1.1E-09	4.9	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.2E-02	SWSTMPESWPB	ESW PUMP-B OUTAGE

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Table 19-282-11 Dominant Cut Sets of Loss of Feed Water Flow (Sheets 1 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	9.4E-10	4.1	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
-			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-02	VCWCHBDB	CHILLER FAIL TO START (RUNNING)
6	8.6E-10	3.8	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.0E-03	EFWTMTAA .	A-EMERGENCY FEED WATER PUMP(FWP1A) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.2E-02	SWSTMPESWPB	ESW PUMP-B OUTAGE
7	7.2E-10	3.1	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.0E-03	EFWTMTAA	A-EMERGENCY FEED WATER PUMP(FWP1A) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-02	VCWCHBDB	CHILLER FAIL TÓ START (RUNNING)

Table 19-282-11 Dominant Cut Sets of Loss of Feed Water Flow (Sheets 2 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
8	4.1E-10	1.8	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			2.4E-03	EFWPTSRFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO RUN (<1H)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.2E-02	SWSTMPESWPB	ESW PUMP-B OUTAGE
9	3.8E-10	1.7	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			4.0E-03	EFWTMPAA	B-EMERGENCY FEED WATER PUMP(FWP2A) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)

Table 19-282-11 Dominant Cut Sets of Loss of Feed Water Flow (Sheets 3 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
10	3.8E-10	1.7	1.9E-01	!14LOFF	LOSS OF FEED WATER FLOW
			2,0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1B	D-EMERGENCY FEED WATER PUMP(FWP1B) FAIL TO START
			4.0E-03	EFWTMPAB	C-EMERGENCY FEED WATER PUMP(FWP2B) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)

 Table 19-282-11 Dominant Cut Sets of Loss of Feed Water Flow (Sheets 4 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	2.3E-07	76.8	2.3E-05	!15LOCCW	LOSS OF COMPONENT COOLING WATER
			5.1E-01	ACWOO02CT-DP2	OPERATOR FAILS TO CONNECT COOLING TOWER SYSTEM TO CCWS FOR ALTERNATIVE CCW, UNDER THE CONDITION OF FAILING THEIR PREVIOUS TASK (HE)
				ACWOO02FS	OPERÀTÓR FAILS TO CONNECT FIRE SERVICE WATER TO CCWS FOR ALTERNATIVE CCW (HE) RCP SEAL LOCA
	1.0E-08	2.5		RCPSEAL !15LOCCW	
2	1.0E-08	3.5	2.3E-05 4.5E-04		LOSS OF COMPONENT COOLING WATER A,D-EMERGENCY FEED WATER PUMP(FWP1A,B) FAIL TO START CCF
			1.0E+00	RCPSEAL	RCP.SEAL LOCA
3	4.7E-09	1.6	2.0E-04	!15LOCCW CHICF2PMBD-R-ALL RCPSEAL	LOSS OF COMPONENT COOLING WATER CHARGING PUMP FAIL TO START CCF RCP SEAL LOCA
4	3.6E-09	1.2	2.0E-02 8.0E-03	15LOCCW ACWOO02FS ACWTMPZCLTP RCPSEAL	LOSS OF COMPONENT COOLING WATER OPERATOR FAILS TO CONNECT FIRE SERVICE WATER TO CCWS FOR ALTERNATIVE CCW (HE) COOLING TOWER PUMP OUTAGE RCP SEAL LOCA

Table 19-282-12 Dominant Cut Sets of Loss of Component Cooling Water (Sheets 1 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	3.0E-09	1.0	2.3E-05	15LOCCW	LOSS OF COMPONENT COOLING WATER
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT
					DISCHARGE CROSS TIE-LINE FOR
					CONTINUOUS SG FEED WATER (HE) D-EMERGENCY FEED WATER
			6.6E-03	EFWPTADFWP1B	PUMP(FWP1B) FAIL TO START
			1.0E+00	RCPSEAL	RCP SEAL LOCA
6	3.0E-09	1.0		115LOCCW	LOSS OF COMPONENT COOLING WATER
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT
					DISCHARGE CROSS TIE-LINE FOR
					CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	
			1.05+00	RCPSEAL	PUMP(FWP1A) FAIL TO START RCP SEAL LOCA
7	2.6E-09	0.9	2.3E-05		LOSS OF COMPONENT COOLING WATER
	2.00-03	0.5	1.1E-04		A.D-EMERGENCY FEED WATER
			1.12 04		PUMP(FWP1A,B) FAIL TO RUN (<1H) CCF
			1.0E+00	RCPSEAL	RCP SEAL LOCA
8	2.3E-09	0.8	2.3E-05	!15LOCCW	LOSS OF COMPONENT COOLING WATER
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT
					DISCHARGE CROSS TIE-LINE FOR
					CONTINUOUS SG FEED WATER (HE)
		· ·	5.0E-03	EFWTMTAA	PUMP(FWP1A) OUTAGE
			1.0E+00	RCPSEAL	RCP SEAL LOCA

Table 19-282-12 Dominant Cut Sets of Loss of Component Cooling Water (Sheets 2 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
9	2.3E-09	0.8	2.3E-05	!15LOCCW	LOSS OF COMPONENT COOLING WATER
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.0E-03	EFWTMTAB	D-EMERGENCY FEED WATER PUMP(FWP1B) OUTAGE
			1.0E+00	RCPSEAL	RCP SEAL LOCA
10	1.7E-09	0.6	2.3E-05	115LOCCW	LOSS OF COMPONENT COOLING WATER
			7.2E-05	EFWCF2PTLRFWP1-ALL	A,D-EMERGENCY FEED WATER PUMP(FWP1A,B) FAIL TO RUN (>1H) CCF
			1.0E+00	RCPSEAL	RCP SEAL LOCA

Table 19-282-12 Dominant Cut Sets of Loss of Component Cooling Water (Sheets 3 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.1E-09	6.9	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING
			2.0E-02	EFWOO01PW2AB	WATER OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
2	8.2E-10	5.3	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING
•			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
		ſ	5.0E-03	EFWTMTAA	A-EMERGENCY FEED WATER PUMP(FWP1A) OUTAGE
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
3	4.9E-10	3.2	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING WATER
			2.6E-03	CHIOO01CHIB	OPERATOR FAILS TO ACTUATE B-CHARGING PUMP (HE)
			1.0E+00	RCPSEAL	RCP SEAL LOCA
			5.0E-03	RSSTMRPRHEXC	C-CONTAINMENT SPRAY/RESIDUAL HEAT REMOVAL HEAT EXCHANGER OUTAGE
			1.2E-02	SWSTMPESWPD	ESW PUMP-D OUTAGE

 Table 19-282-13 Dominant Cut Sets of Partial Loss of Component Cooling Water (Sheets 1 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
4	3.9E-10	2.5	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING
			2.6E-03	CHIOO01CHIB	WATER OPERATOR FAILS TO ACTUATE B-CHARGING PUMP (HE)
			1.0E+00	RCPSEAL	RCP SÈAL LOCA
			4.0E-03	RSSTMPICSPC	C-CONTAINMENT SPRAY/RESIDUAL HEAT REMOVAL PUMP OUTAGE
			1.2E-02	SWSTMPESWPD	ESW PUMP-D OUTAGE
5	3.9E-10	2.5	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING WATER
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			2.4E-03	EFWPTSRFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO RUN (<1H)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
6	3.5E-10	2.2	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING WATER
			1.8E-03	CHIPMBDCHPB-R	B-CHARGING PUMP FAIL TO START
			1.0E+00	RCPSEAL	RCP SEAL LOCA
			5.0E-03	RSSTMRPRHEXC	C-CONTAINMENT SPRAY/RESIDUAL HEAT REMOVAL HEAT EXCHANGER OUTAGE
			1.2E-02	SWSTMPESWPD	ESW PUMP-D OUTAGE

Table 19-282-13 Dominant Cut Sets of Partial Loss of Component Cooling Water (Sheets 2 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
7	2.9E-10	1.9	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING
			2.6E-03	CHIOO01CHIB	WATER OPERATOR FAILS TO ACTUATE B-CHARGING PUMP (HE)
			7.0E-03	CWSTMRCCWHXD	D-COMPONENT COOLING HEAT EXCHENGER
			1.0E+00	RCPSEAL	RCP SEAL LOCA
			5.0E-03	RSSTMRPRHEXC	C-CONTAINMENT SPRAY/RESIDUAL HEAT REMOVAL HEAT EXCHANGER OUTAGE
8	2.8E-10	1.8	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING WATER
			1.8E-03	CHIPMBDCHPB-R	B-CHARGING PUMP FAIL TO START
			1.0E+00	RCPSEAL	RCP SEAL LOCA
			4.0E-03	RSSTMPICSPC	C-CONTAINMENT SPRAY/RESIDUAL HEAT REMOVAL PUMP OUTAGE
			1.2E-02	SWSTMPESWPD	ESW PUMP-D OUTAGE
9	2.5E-10	1.6	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING WATER
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR
			1.5E-03	EFWPTLRFWP1A	CONTINUOUS SG FEED WATER (HE) A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO RUN (>1H)
			2.6E-03	HPIOO02FWBD-S	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)

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Table 19-282-13 Dominant Cut Sets of Partial Loss of Component Cooling Water (Sheets 3 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
10	2.5E-10	1.6	3.2E-03	!16PLOCW	PARTIAL LOSS OF COMPONENT COOLING
					WATER
			2.6E-03	CHIOO01CHIB	OPERATOR FAILS TO ACTUATE B-CHARGING
					PUMP (HE)
			6.0E-03	CWSTMPCCWPD	D-CCW PUMP OUTAGE
			1.0E+00	RCPSEAL	RCP SEAL LOCA
			5.0E-03	RSSTMRPRHEXC	C-CONTAINMENT SPRAY/RESIDUAL HEAT
					REMOVAL HEAT EXCHANGER OUTAGE

 Table 19-282-13 Dominant Cut Sets of Partial Loss of Component Cooling Water (Sheets 4 of 4)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.8E-07	30.8	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			9.9E-04	EPSCF4DLLRDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO RUN (>1H) CCF
			2.1E-02	EPSOO02RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-01	OPSPRBF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 1hr
			4.1E-01	OPSPRCF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 3hrs
			1.0E+00	RCPSEAL	RCP SEAL LOCA
2	1.7E-07	29.9	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			2.0E-05	EPSCF4CBTD6H-ALL	6.9KV AC BUS INCOMER CIRCUIT BREAKER (6HA,B,C,D) FAIL TO OPEN CCF
			5.3E-01	OPSPRBF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 1hr
			4.1E-01	OPSPRCF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 3hrs
			1.0E+00	RCPSEAL	RCP SEAL LOCA

 Table 19-282-14 Dominant Cut Sets of Loss of Offsite Power (Sheets 1 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
3	3.8E-08	6.6	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			2.1E-04	EPSCF4DLADDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO START CCF
			2.1E-02	EPSOO02RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-01	OPSPRBF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 1hr
			4.1E-01	OPSPRCF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 3hrs
			1.0E+00	RCPSEAL	RCP SEAL LOCA
4	2.8E-08	4.9	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			1.6E-04	EPSCF4DLSRDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO RUN (<1H) CCF
			2.1E-02	EPSOO02RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-01	OPSPRBF	FAILURE OF OFFSITE POWER RECOVERY
			4.1E-01	OPSPRCF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 3hrs
			1.0E+00	RCPSEAL	RCP SEAL LOCA

 Table 19-282-14 Dominant Cut Sets of Loss of Offsite Power (Sheets 2 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	1.9E-08	3.3	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			5.1E-01	ACWOO02CT-DP2	OPERATOR FAILS TO CONNECT COOLING TOWER SYSTEM TO CCWS FOR ALTERNATIVE CCW, UNDER THE CONDITION OF FAILING THEIR PREVIOUS TASK (HE)
			2.0E-02	ACWOO02FS	OPERATOR FAILS TO CONNECT FIRE SERVICE WATER TO CCWS FOR ALTERNATIVE CCW (HE)
			1.0E+00	RCPSEAL	RCP SEAL LOCA
	•		4.8E-05	SWSCF4PMBD-R-ALL	ESW PUMP A, B, C, D FAIL TO RE-START CCF
6	1.3E-08	2.2	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			1.5E-03	EPSCF2DLLRDGP-ALL	AAC GAS TURBINE GENERATOR (GTG P1,2) FAIL TO RUN (>1H) CCF
			9.9E-04	EPSCF4DLLRDG-ALL	EMERGENCY GAS TURBINE GENERATOR (GTG A,B,C,D) FAIL TO RUN (>1H) CCF
			5.3E-01	OPSPRBF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 1hr
			4.1E-01	OPSPRCF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 3hrs
			1.0E+00	RCPSEAL	RCP SEAL LOCA

Table 19-282-14 Dominant Cut Sets of Loss of Offsite Power (Sheets 3 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
7	1.1E-08	1.8	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			5.1E-01	ACWOO02CT-DP2	OPERATOR FAILS TO CONNECT COOLING TOWER SYSTEM TO CCWS FOR ALTERNATIVE CCW, UNDER THE CONDITION OF FAILING THEIR PREVIOUS
			2.0E-02	ACWOO02FS	TASK (HE) OPERATOR FAILS TO CONNECT FIRE SERVICE WATER TO CCWS FOR ALTERNATIVE CCW (HE)
			2.6E-05	CWSCF4PCBD-R-ALL	CCW PUMP ALL FAIL TO RE-START CCF
			1.0E+00	RCPSEAL	RCP SEAL LOCA
8	6.8E-09	1.2	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			3.8E-05	EPSCF4SEFFDG-ALL	GAS TURBINE GENERATOR SEQUENCER FAIL TO OPERATE CCF
			2.1E-02	EPSOO02RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-01	OPSPRBF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 1hr
			4.1E-01	OPSPRCF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 3hrs
			1.0E+00	RCPSEAL	RCP SEAL LOCA

 Table 19-282-14 Dominant Cut Sets of Loss of Offsite Power (Sheets 4 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
9	4.0E-09	0.7	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			5.1E-01	ACWOO02CT-DP2	OPERATOR FAILS TO CONNECT COOLING TOWER SYSTEM TO CCWS FOR ALTERNATIVE CCW, UNDER THE CONDITION OF FAILING THEIR PREVIOUS TASK (HE)
			2.0E-02	ACWOO02FS	OPERATOR FAILS TO CONNECT FIRE SERVICE WATER TO CCWS FOR ALTERNATIVE CCW (HE)
			1.0E-05	BOSBTSWCCF	B.O SIGNAL SOFTWARE CCF
			1.0E+00	RCPSEAL	RCP SEAL LOCA
10	3.6E-09	0.6	4.0E-02	!19LOOP	LOSS OF OFFSITE POWER
			2.0E-05	EPSCF4CBTDDG-ALL	GAS TURBINE DISCHARGE CIRCUIT BREAKER (GTGBA,B,C,D) FAIL TO CLOSE CCF
			2.1E-02	EPSOO02RDG	OPERATOR FAILS TO CONNECT ALTERNATIVE GTG TO SAFETY BUS (HE)
			5.3E-01	OPSPRBF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 1hr
			4.1E-01	OPSPRCF	FAILURE OF OFFSITE POWER RECOVERY WITHIN 3hrs
			1.0E+00	RCPSEAL	RCP SEAL LOCA

 Table 19-282-14 Dominant Cut Sets of Loss of Offsite Power (Sheets 5 of 5)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.0E-08	71.5	1.0E+00	!20ATWS	ATWS
			1.0E-07	RTPCRDF	ROD INJECTION FAILURE (4< RODS)
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT
2	3.0E-09	21.2	1.0E+00	!20ATWS	ATWS
			3.0E-06	RTPBTRTB	TRIP BREAKER CCF
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT
3	1.0E-09	7.2	1.0E+00	!20ATWS	ATWS
			1.0E-07	RTPBTSWCCF	SUPPORT SOFTWARE CCF
			1.0E-02	RTPDASF	DAS HARD FAILURE
4	8.0E-12	0.1	1.0E+00	!20ATWS	ATWS
			1.5E-06	EPSCF4IVFFINV-ALL	INVERTERS (INVA,B,C,D) FAIL TO OPERATE
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT
5	4.4E-12	0.03	1.0E+00	!20ATWS	ATWS
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT
			6.7E-05	RTPOO04ICVR6001	CALIBRATION MISS (RTPICVRRT6001A-D) (HE)
			6.7E-05	RTPOO04ICVR7001	CALIBRATION MISS (RTPICVRRT7001A-D) (HE)

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Table 19-282-15 Dominant Cut Sets of ATWS (Sheets 1 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
6	2.7E-12	0.02	1.0E+00	!20ATWS	ATWS
			5.0E-07	EPSCF4IVFFINV-234	EPS INVA,B,C,D FAIL TO OPERATE CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT
7	2.7E-12	0.02	1.0E+00	!20ATWS	ATWS
			5.0E-07	EPSCF4IVFFINV-123	EPS INVA,B,C,D FAIL TO OPERATE CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR TRIP
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT
8	2.7E-12	0.02	1.0E+00	!20ATWS	ATWS
			5.0E-07	EPSCF4IVFFINV-134	EPS INVA,B,C,D FAIL TO OPERATE CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT
9	2.7E-12	0.02	1.0E+00	!20ATWS	ATWS
			5.0E-07	EPSCF4IVFFINV-124	EPS INVA,B,C,D FAIL TO OPERATE CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT

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Table 19-282-15 Dominant Cut Sets of ATWS (Sheets 2 of 3)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
10	8.4E-13	0.01	1.0E+00	!20ATWS	ATWS
			1.6E-07	EPSCF4CBWRVIT4-ALL	CIRCUIT BREAKER BETWEEN 125V DC BUS AND INVERTER (VIT4A,B,C,D) FAIL TO REMAIN CLOSED CCF
			5.3E-03	OPSLOOP	CONSEQUENTIAL LOOP GIVEN A REACTOR
			1.0E-02	RTPDASF	DAS HARD FAILURE
			1.0E-01	RTPMTCF	MODERATOR TEMPERATURE COEFFICIENT

 Table 19-282-15 Dominant Cut Sets of ATWS (Sheets 3 of 3)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	4.5E-10	20.7	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
2	3.4E-10	15.8	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.0E-03	EFWTMTAA	A-EMERGENCY FEED WATER PUMP(FWP1A) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL

 Table 19-282-16 Dominant Cut Sets of Loss of Vital AC Bus (Sheets 1 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
3	2.4E-10	11.1	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			6.6E-03	EFWPTADFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO START
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)
4	1.8E-10	8.5	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.0E-03	EFWTMTAA	A-EMERGENCY FEED WATER PUMP(FWP1A) OUTAGE
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)

 Table 19-282-16 Dominant Cut Sets of Loss of Vital AC Bus (Sheets 2 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
5	1.6E-10	7.6	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			2.4E-03	EFWPTSRFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO RUN (<1H)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
6	1.1E-10	4.9	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			1.5E-03	EFWPTLRFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO RUN (>1H)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL

Table 19-282-16 Dominant Cut Sets of Loss of Vital AC Bus (Sheets 3 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
7	8.7E-11	4.1	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			2.4E-03	EFWPTSRFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO RUN (<1H)
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)
8	6.5E-11	3.0	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			9.6E-04	EFWMVODTS1A	M/V TS1A FAIL TO OPEN
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT
					DISCHARGE CROSS TIE-LINE FOR
					CONTINUOUS SG FEED WATER (HE)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL

 Table 19-282-16 Dominant Cut Sets of Loss of Vital AC Bus (Sheets 4 of 5)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
9	5.6E-11	2.6	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			1.5E-03	EFWPTLRFWP1A	A-EMERGENCY FEED WATER PUMP(FWP1A) FAIL TO RUN (>1H)
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)
10	3.5E-11	1.6	9.0E-03	!21LOAC	LOSS OF VITAL AC BUS (B TRAIN)
			9.6E-04		M/V TS1A FAIL TO OPEN
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)

 Table 19-282-16 Dominant Cut Sets of Loss of Vital AC Bus (Sheets 5 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
1	1.1E-10	11.6	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT
					DISCHARGE CROSS TIE-LINE FOR
					CONTINUOUS SG FEED WATER (HE)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED
			1.0E-01	MFWHARD	OPERATION (HE) MAIN FEED WATER HARD WARE FAIL
			1.0⊑-01 1.2E-02		ESW PUMP-B OUTAGE
		0.7	1.2E-02		LOSS OF VITAL DC BUS (A TRAIN)
2	8.9E-11	9.7			· · · ·
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR
					CONTINUOUS SG FEED WATER (HE)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED
			0.02 00		OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
			1.0E-02	VCWCHBDB	CHILLER FAIL TO START (RUNNING)
3	5.7E-11	6.2	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT
					DISCHARGE CROSS TIE-LINE FOR
					CONTINUOUS SG FEED WATER (HE)
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES
					FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED
					WATER SYSTEM (HE)
			1.2E-02	SWSTMPESWPB	ESW PUMP-B OUTAGE

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 Table 19-282-17 Dominant Cut Sets of Loss of Vital DC Bus (Sheets 1 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
4	4.7E-11	5.2	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELÌEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)
			1.0E-02	VCWCHBDB	CHILLER FAIL TO START (RUNNING)
5	3.5E-11	3.9	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			4.0E-03	EFWTMPAA	B-EMERGENCY FEED WATER PUMP(FWP2A) OUTAGE
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL

 Table 19-282-17 Dominant Cut Sets of Loss of Vital DC Bus (Sheets 2 of 5)

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No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
6	2.5E-11	2.8	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			2.9E-03	HVAFAADDGFAA	B-EMERGENCY FEED WATER PUMP AREA HVAC SYSTEM FAN FAIL TO START (STANDBY)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
7	2.3E-11	2.5	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			2.6E-03	HVAFALRDGFAA	B-EMERGENCY FEED WATER PUMP AREA HVAC SYSTEM FAN FAIL TO RUN (STANDBY) (>1H)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL

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Table 19-282-17 Dominant Cut Sets of Loss of Vital DC Bus (Sheets 3 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
8	1.9E-11	2.1	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			4.0E-03	EFWTMPAA	B-EMERGENCY FEED WATER PUMP(FWP2A) OUTAGE
			5.4E-02	HPIOO02FWBD-DP2	OPERATOR FAILS TO OPEN RELIEF VALVES FOR BLEED AND FEED (HE)
			3.8E-03	MFWOO02R	OPERATOR FAILS TO RECOVER MAIN FEED WATER SYSTEM (HE)
9	1.8E-11	2.0	1.2E-03	!22LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
			2.1E-03	VCWCHYRB	B-EMERGENCY FEED WATER PUMP AREA HVAC System CHILLER FAIL TO RUN (RUNNING)

 Table 19-282-17 Dominant Cut Sets of Loss of Vital DC Bus (Sheets 4 of 5)

No.	Cut Sets Freq. (/ry)	Percent (%)	Basic Event Prob.	Cut Sets	Basic Event Name
10	1.8E-11	1.9	1.2E-03	122LODC	LOSS OF VITAL DC BUS (A TRAIN)
			2.0E-02	EFWOO01PW2AB	OPERATOR FAILS TO OPEN EFW PIT DISCHARGE CROSS TIE-LINE FOR CONTINUOUS SG FEED WATER (HE)
			3.8E-03	HPIOO02FWBD	OPERATOR FAILS BLEED AND FEED OPERATION (HE)
			1.0E-01	MFWHARD	MAIN FEED WATER HARD WARE FAIL
			2.0E-03	VCWPMBDB	B-SAFETY CHILLER PUMP FAIL TO START (Running)

Table 19-282-17 Dominant Cut Sets of Loss of Vital DC Bus (Sheets 5 of 5)

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RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

2/6/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: NO. 149-1744 REVISION 1

SRP SECTION: 19 – Probabilistic Risk Assessment and Severe Accident Evaluation

APPLICATION SECTION: 19.1

DATE OF RAI ISSUE: 1/9/2009

QUESTION NO. : 19-284

The results of importance analyses include many artificial "asymmetries" due to simplifying modeling assumptions (e.g., LOCA always occurs in loop A) made in the PRA. These asymmetries make some trains of the same system appear to be artificially much less important than others. This is an issue that needs to be addressed before the PRA can be used effectively to support risk-informed applications, such as risk-managed technical specifications (RMTS). In addition, there are some results of the risk importance analysis that cannot be explained solely on the basis of simplifying assumptions. For example, the common cause failure of all emergency feedwater (EFW) pump discharge line check valves VLV-012A, B, C and D to open on demand (event EFWCF4CVODXW1-ALL) has a risk achievement worth (RAW) value of 1 for internal events CDF but RAW values of 8.5E+2 for internal events LRF, 6E+2 for internal fires CDF, and 4.4E+2 for internal flooding. Please discuss.

ANSWER:

With regard to the assumption about asymmetric configurations during normal operations and initiating events in the DCD PRA, we plan to provide a more comprehensive treatment of initial pump alignments when the PRA models are upgraded for risk informed technical specification applications. When PRA insights are used as inputs to other programs, such as the reliability assurance program (RAP), the artificial asymmetries in the PRA model is taken in to consideration in order to not disturb the results. For instance when importance results for a redundant train show different values due to simplified assumptions, the higher value is chosen as a representative value.

In MUAP-0730(R1), basic event EFWCF4CVODXW1-ALL has risk achievement worth (RAW) value shown below:

• 1.3E+03 for internal events CDF (as shown in Table 18.2-2 (Sheet 2 of 29) of Page 18-24),

• 8.5E+02 for internal events LRF (as shown in Table 18.6-2 (Sheet 2 of 32) of Page 18-102),

9.2E+02 for internal fires CDF (as shown in Table 23R-9 (Sheet 1 of 43) of Page 23R-180-24), and
6.3E+02 for internal flooding CDF (as shown in Table 22.6-8 (Sheet 1 of 65) of Page 22-433).
The RAW values in the PRA report are reasonable and are different from the values pointed out by the staff in the question.

Impact on DCD There is no impact on DCD.

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Impact on COLA There is no impact on COLA.

Impact on PRA There is no impact on PRA.