WOLF CREEK
NUCLEAR OPERATING CORPORATION

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May 30, 1996

ET 96-0034

U. S. Nuclear Regulatory Commission
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Reference: Letter Number WM 95-0128 Dated August 30, 1995, from N. S. Carns, WCNOC, to U.S. Nuclear Regulatory Commission
Subject: Docket No. 50-482: Response to Request for Additional Information Associated to the Human Reliability Analysis

Gentlemen:

The reference letter provided Wolf Creek Nuclear Operating Corporation's (WCNOC) response to the Request for Additional Information (RAI) for the Wolf Creek Generating Station (WCGS) Individual Plant Examination (IPE). The RAI was transmitted to WCNOC by letter dated June 28, 1995, from J. C. Stone, NRC, to N. S. Carns. Included within the reference letter was a commitment by WCNOC to revise the Human Reliability Analysis (HRA) to improve the utilization of performance shaping factors, diagnostic errors, incorporation of plant specific practices and experiences, and dependencies of operator actions. The commitment included a completion date for the revised HRA of April 30, 1996 and a provision to notify the NRC of any new significant systematic core damage sequences which were identified as a result of the reanalysis.

On April 17, 1996, a teleconference call between NRC and WCNOC personnel took place during which the NRC expressed concerns regarding the HRA performed for the IPE and the RAI commitment to revise the HRA. The NRC outlined the specific areas of concern with the HRA performed for the IPE and indicated that they would be unable to conclude, based on the IPE HRA, that the WCGS IPE satisfied the intent of Generic Letter 88-20. The NRC also indicated that they would not be able to make any judgment regarding the suitability of the revised HRA analysis on the basis of a notification of any new significant systematic core damage sequences identified as a result of this reanalysis.

The NRC also indicated, during the April 17, 1996 teleconference call, that the Common Cause analysis portion of the IPE was perceived to be an "area of weakness."

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WCNOC committed to provide to the NRC, by the end of May 1996, a submittal to include a discussion of the revised HRA, a discussion of a revised Common Cause analysis utilizing generic Common Cause Factors (CCF) and the impact of the revised HRA and Common Cause analysis on the core damage frequency (Level 1) results. The attachment to this letter provides the information discussed above.

If you have any questions concerning this matter, please contact me at (316) 364-8831, extension 4034, or Mr. Terry S. Morrill at extension 8707.

Very truly yours,

Richard A Muench

Richard A. Muench

RAM/jra

Attachment

cc: L. J. Callan (NRC), w/a
W. D. Johnson (NRC), w/a
J. F. Ringwald (NRC), w/a
J. C. Stone (NRC), w/a

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Revised Human Reliability Analysis

WCNOC described the methodology utilized for the Human Reliability Analysis (HRA) for the IPE in the response to the NRC's RAI [WM 95-0128]. The HRA methodology utilized in the original analysis is described in the response to RAI Questions 11 through 22. The revised Human Reliability Analysis addresses the concerns outlined in the RAI and the telecon of April 17, 1996. The major differences in the revised HRA and that performed previously are as follows:

- The treatment of dependencies was changed significantly. In this analysis, the operator actions were generally divided into two parts, a cognitive and an execution portion. For those events requiring multiple operator actions to resolve, the cognitive portions of each operator action were examined for dependence and, in some cases, were common. For example, in the Steam Generator Tube Rupture (SGR) event, operator actions OD1 and OD2 both require the recognition of the SGR, so a common cognitive event was used for both actions. In some cases essentially the same operator action was given different values depending on the nature of the event being resolved, and the amount of time available for performing the action, i.e., if less time was available to perform the action, a higher failure probability resulted due to increased Performance Shaping Factors (PSFs). Dependencies were also addressed on recovery actions. For example, if a later procedure step was credited for recovering the failure of a previous step, then the dependency of the recovery step on the failure of the earlier step was addressed. Also, once a final core damage run was completed, a detailed review of the cutsets was performed so any remaining operator action dependencies could be addressed. In this step, 10 cutsets were identified which contained operator action dependencies previously overlooked. Table 4 lists these cutsets. Although the plant model will be revised in the long term to account for these additional dependencies, an analysis of these cutsets indicated an increase to the CDF of about 4% when the dependencies are taken into account.

- Cognitive errors were generally quantified using EPRI TR-100259, Section 4, "A Supplementary Cause-Based Approach to the Estimation of p_c." In some cases, the annunciator response model given in Table 20-17 of NUREG/CR-1278 was used to quantify operator actions, especially when the action was due to a single annunciator (or group of annunciators relating to the same action requirement). For example, the operator action for manual reactor trip, OPA-MANUALRT, was treated in this manner. A discussion was provided in the write-up for each operator action which explained how the operator arrived at the procedure step(s) for that action, starting with a reactor trip, or possibly an annunciator alarm.

- The 0.1 multiplier for commission errors used in the earlier HRA was eliminated.

- The execution errors were calculated using the Technique for Human Error Rate Prediction (THERP) tables contained in NUREG/CR-1278, "Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications, Final Report," dated 8/83. Values from these tables for errors of omission are divided by three based on Swain's notes in Chapter 15 of the NUREG. These notes describe adjustments to the nominal Swain values, in particular to credit the layout of the procedures into response/response not obtained format.

- Calibration errors were considered, and operator actions related to calibration of the Refueling Water Storage Tank (RWST) level, Auxiliary Feedwater (AFW) pumps suction pressure and Diesel Fuel Oil Day Tank level were added. Values for these actions were calculated in a similar manner to that used for the other actions; i.e., via an analysis of the calibration procedures.

- An additional multiplier of 10 was applied generically to the cognitive portion of all operator actions required during a flooding event. This was done to account for the additional stress on the operator if a flood occurred in conjunction with a plant transient. However, the multiplier was not added to the execution portion of the operator action, as once the correct diagnosis was made and the correct procedure was entered, then it was felt that the operators would be carrying out the steps of the relevant procedure, relatively independent of the existence of a flood.

- More emphasis was placed on the amount of time available to perform an action (time window) versus the time needed to complete the action. For all operator actions with time restraints, these time values were determined. The stress levels placed on the operators, and the Performance Shaping Factors used to modify the base values, were highly dependent on amount of 'extra' time available to perform the operator actions. In addition, a recovery action was credited only if sufficient time to perform the recovery was available. Note it was assumed that the pre-initiation actions were not time constrained. Credit for the special-one-of-a-kind recovery used previously for post-initiators was removed.

- Another review of the simulator control panel was performed to verify that the layout of the controls matched that assumed in the operator action individual calculations, e.g., verification of controls credited as being dissimilar to other nearby controls, or located in functional groups was performed.

Once the new values for the operator actions were determined, a core damage quantification was performed using the WCGS PRA model. Significant differences between the core damage quantification using the original HRA values and that performed using the new HRA values are as follows:

- The core damage frequency (CDF) value using an 1E-10 cutoff for the individual cutsets increased by about 24%.

- The percentage of cutsets with values greater than 1E-10 containing at least 1 operator action increased roughly 60%. This was largely due to splitting many of the actions into separate cognitive and execution portions.

- The number of cutsets with values greater than 1E-10 containing at least 2 operator actions nearly doubled. As above, this was due to the splitting of the operator actions.

- One cutset with an operator action increased to a value above or equal to 1E-06, whereas none existed previously. This cutset was a large LOCA initiating event, followed by failure to recognize the need to switch over to low pressure recirculation. This cutset has a value of 1.00E-06.

- The most significant increases in the HRA values were in the OPA-OST, OPA-RCD2, OPA-LTS, OPA-EC3 and OPA-MFW operator actions, which had increases varying from 201% to 34%. Several operator actions had significant decreases also, including OPA-MRT, OPA-MSISOL, OPA-MANUALRT, OPA-LPI and OPA-NK020A, with decreases in the two orders of magnitude range.

A comparison of the old and new HRA data is contained below in Table 1. Tables 2 and 3 give the top 100 cutsets containing at least one operator action and the top 100 cutsets containing at least two operator actions, respectively.

TABLE 1 - COMPARISON OF OLD AND NEW HRA VALUES

	Basic Event	ID in Original HRA Notebook	Value (Old)	pc (New)	pe (New)	Value (New)	Location	Time Limit (Old)	Time Limit (New)	Description
1	OPA-1EHVACA-B	IEHVAC	1.00E-01	1.00E-04	2.44E-02	2.45E-02	LOCAL	-----	30 MIN	OPERATOR FAILS TO PROVIDE COOLING TO SWITCHBOARD R
2	OPA-1WS01PC	WS1C2	1.48E-04	1.00E-04	6.00E-04	7.00E-04	CTRL RM	15 MIN	15 MIN	FAILURE TO START SERVICE WATER PUMP 1WS01PC
3	OPA-ABV0007	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN MANUAL VALVE ABV007 AFTER STS AB
4	OPA-ABV0018	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN MANUAL VALVE ABV0018 AFTER STS
5	OPA-ABV0029	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN MANUAL VALVE ABV029 AFTER STS AB
6	OPA-ABV0040	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN MANUAL VALVE ABV040 AFTER STS AB
7	OPA-ACNN	ACNN	2.60E-02	7.00E-05	2.80E-02	2.80E-02	CTRL RM	2 HRS	SVRL HRS	HRA FAILURE TO ALIGN NN SWITCHBORD TO ALTERNATE PO
8	OPA-AF4	Note 2	1.00E-02	4.60E-04	1.70E-03	2.20E-03	CTRL RM	-----	30 MIN	HRA FAILURE TO OPEN AFW ISOLATION VALVES TO STM GE
9	OPA-AFWACT	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY ACTUATE AFW COMPNTS AFTER SIGNAL FAILURE
10	OPA-ABPV0001	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN INSTR AIR ISOL VALVE AFTER AB-20
11	OPA-ABPV0002	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN INSTR AIR ISOL VALVE AFTER AB-20
12	OPA-ABPV0003	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN INSTR AIR ISOL VALVE AFTER AB-20
13	OPA-ABPV0004	ABVLS	3.74E-04	None	8.60E-04	8.60E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN INSTR AIR ISOL VALVE AFTER AB-20
14	OPA-ALHV0006	ALHVS	8.29E-04	None	1.40E-04	1.40E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN ALHV0006 FOLLOWING TEST PERFORMA
15	OPA-ALHV0008	ALHVS	8.29E-04	None	1.40E-04	1.40E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN ALHV0008 FOLLOWING TEST PERFORMA
16	OPA-ALHV0010	ALHVS	8.29E-04	None	1.40E-04	1.40E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN ALHV0010 FOLLOWING TEST PERFORMA
17	OPA-ALHV0012	ALHVS	8.29E-04	None	1.40E-04	1.40E-04	LOCAL	-----	Note 9	FAILURE TO REOPEN ALHV0012 FOLLOWING TEST PERFORMA
18	OPA-ALT	ALT	1.50E-01	1.30E-02	2.60E-02	3.90E-02	LOCAL	30 MIN	30 MIN	HRA FAILURE TO ESTABLISH ALTR COOLING - OFN EG-04
19	OPA-CCWHX	Note 8	N/A	1.00E-04	2.60E-03	2.70E-03	Local	30 MIN	30 MIN	FAILURE TO CLOSE CCW HEAT EXCHANGER BYPASS VALVE
20	OPA-CCWLPISO	Note 3	4.00E-02	8.50E-04	2.00E-02	2.10E-02	CTRL RM	-----	1 HR	HRA FAILURE TO MANUALLY ISOLATE CCW SERVICE LOOP
21	OPA-CCWSERLP	RCPSEL	1.43E-02	3.00E-03	1.30E-02	1.60E-02	CTRL RM	6 MIN	5 MIN	HRA FAILURE TO SWITCHOVER CCW SERVICE LOOP - CCWB

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	Basic Event	ID in Original HRA Notebook	Value (Old)	pc (New)	pe (New)	Value (New)	Location	Time Limit (Old)	Time Limit (New)	Description
22	OPA-DCSHED	AFC	1.36E-04	Neg	1.00E-03	1.00E-03	CTRL RM	8 HRS	1 HR	OPERATOR ACTION TO SHED LOAD ON SBO EVENT
23	OPA-EC3	EC3	2.15E-04	3.00E-04	7.90E-03	8.20E-03	CTRL RM	10 HRS	10 HRS	HRA FAILURE OF RCS COOLDOWN AND DEPRESSURIZE - SGR
24	OPA-ECCSTRP1	Note 2	1.00E-02	9.00E-03	2.00E-03	1.10E-02	CTRL RM	-----	30 MIN	HRA FAILURE TO STOP HP ECCS PUMPS ON LOSS OF COOLI
25	OPA-ECCSTRP2	Note 2	1.00E-02	9.00E-03	7.70E-04	9.77E-03	CTRL RM	-----	30 MIN	HRA FAILURE TO STOP HP ECCS PUMPS ON LOSS OF COOLI
26	OPA-EFHV0052	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY OPERATE EFHV0052
27	OPA-EFHV2325	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY CLOSE EFHV0023 AND/OR EFHV0025
28	OPA-EFHV2426	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY OPERATE EFHV0024 AND/OR EFHV0026
29	OPA-EFHV3738	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY OPERATE EFHV0037 AND/OR EFHV0038
30	OPA-EGHV6970	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY OPERATE ONE OR MORE LOOP ISO VLVS
31	OPA-EGTV0029	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY OPERATE EGTV0029
32	OPA-ES1	ES1	1.35E-04	3.00E-03	1.20E-02	1.50E-02	CTRL RM	10 HRS	10 HRS	HRA FAILURE OF RCS COOLDOWN AND DEPRESSURIZE - SLO
33	OPA-ESWA	ESWA	1.10E-03	1.00E-04	6.00E-04	7.00E-04	CTRL RM	-----	30 MIN	OPERATOR FAILS TO REALIGN ESW TRAIN A TO SERVICE WATER
34	OPA-ESWB	ESWB	1.10E-03	1.00E-04	6.00E-04	7.00E-04	CTRL RM	-----	30 MIN	OPERATOR FAILS TO REALIGN ESW TRAIN B TO SERVICE WATER
35	OPA-HPIACT	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	HRA FAILURE OF HPI ACTUATION ON AUTO SIGNAL FAILURE
36	OPA-HPR	LC2/LC3	4.97E-04	2.00E-03	1.20E-03	3.20E-03	CTRL RM	1 HR	20 MIN	HRA FAILURE DURING INJECTION-RECIRC SWITCHOVER
37	OPA-LPI	RRI22	7.35E-03	1.50E-04	3.9E-05	1.90E-04	CTRL RM	30 MIN	1 HR	HRA FAILURE TO ESTABLISH LOW PRESS INJECTION FUNCTION
38	OPA-LPR	LC1	9.17E-04	2.00E-03	1.90E-03	3.90E-03	CTRL RM	10 MIN	10 MIN	HRA FAILURE DURING INJECTION-RECIRC SWITCHOVER
39	OPA-LTS	LTS	4.38E-05	1.00E-04	1.70E-03	1.80E-03	CTRL RM	30 MIN	30 MIN	HUMAN ERROR FAILURE TO ESTABLISH LONG TERM SHUTDOWN
40	OPA-MANUALRT (Note 5)	RT	1.36E-02	1.00E-04	in pc	1.00E-04	CTRL RM	-----	30 SEC	OPERATOR FAILS TO MANUALLY INITIATE A REACTOR TRIP
41	OPA-MANUALSI (Note 6)	Note 1	1.02E-04	Included In OPA-AFWACT			CTRL RM	-----	Note 10	OPERATOR FAILS TO MANUALLY INITIATE A SAFETY INJECTION
42	OPA-MFW	MF1	6.02E-04	2.10E-04	2.10E-02	2.10E-02	CTRL RM	30 MIN	30 MIN	FAILURE OF OPERATOR TO RESTORE MAIN FEEDWATER

TABLE 1 - COMPARISON OF OLD AND NEW HRA VALUES

	Basic Event	ID in Original HRA Notebook	Value (Old)	pc (New)	pc (New)	Value (New)	Location	Time Limit (Old)	Time Limit (New)	Description
43	OPA-MRT	MRT	1.55E-01	1.00E-04	in pc	1.00E-04	CTRL RM	2 MIN	1 MIN	HRA FAILURE TO MANUALLY OPEN RDMG INPUT BREAKERS
44	OPA-MSI	MS1	1.59E-03	6.70E-03	1.70E-03	8.40E-03	CTRL RM	20 MIN	15 MIN	OPERATOR FAILS TO ISOLATE THE FAULTED STEAM GENERATOR
45	OPA-MSISOL	Note 3	4.00E-02	None	1.30E-04	1.30E-04	LOCAL	-----	40 MIN	HRA FAILURE TO LOCALLY ISOLATE BLDN AFTER REMOTE ISO FAILS
46	OPA-NB112209	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY OPEN ONE OR BOTH NRML FEEDER BRKRS
47	OPA-NE01NE02	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY START ONE OR BOTH DIESEL GENS
48	OPA-OD1	OD1-DP & OD1-COOL	1.51E-02	6.70E-03	6.35E-03	1.30E-02	CTRL RM	20 MIN	10 MIN	OD1 FAILS: COOLDOWN AND DEPRESSURIZE RCS IN SGR EVENT
49	OPA-OD2	OD2	2.90E-03	6.70E-03	3.20E-04	7.00E-03	CTRL RM	SVRL HRS	1 HR	HRA FAILURE OF RCS COOLDOWN AND DEPRESS AFTER OVRFILL
50	OPA-OF2	OFC	1.76E-03	1.11E-03	1.96E-03	3.00E-03	CTRL RM	35 MIN	30 MIN	OPERATOR FAILS TO ESTABLISH BLEED AND FEED COOLING
51	OPA-OFB	OFB	1.76E-03	1.11E-03	3.10E-02	3.20E-02	CTRL RM	35 MIN	30 MIN	OPERATOR FAILS TO ESTABLISH BLEED AND FEED COOLING
52	OPA-OFN-NK20A Note 7	DCNK01	5.61E-02	5.00E-05	1.60E-03	1.70E-03	CTRL RM	-----	20 MIN	HRA FAILURE TO PERFORM LOCAL ACTIONS OF OFN NK-020
53	OPA-OFN-NK20B Note 7	DCNK01	5.61E-02	5.00E-05	2.70E-02	2.70E-02	CTRL RM	-----	20 MIN	HRA FAILURE TO PERFORM LOCAL ACTIONS OF OFN NK-020
54	OPA-OP1	OP1	1.73E-04	2.15E-03	1.10E-02	1.31E-02	CTRL RM	15 MIN	15/30 MIN	OPERATOR FAILS RCS COOLDOWN AND DEPRESSURIZE/ES-11
55	OPA-OST	OST	5.78E-05	2.00E-03	9.70E-03	1.20E-02	CTRL RM	10 MIN	10 MIN	HRA FAILURE TO TERMINATE HPI FOR SLB EVENT
56	OPA-PEF01AB	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY START ONE OR BOTH ESW PUMPS
57	OPA-PEG01BCD	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY START A STANDBY CCW PUMP
58	OPA-PORVBLOK	PORVBLOCK	3.52E-04	2.50E-04	1.40E-04	3.90E-04	CTRL RM	30 MIN	30 MIN	HRA FAILURE TO CLOSE A PORV BLOCK VALVE FROM MCB
59	OPA-RCD1	RCD1	1.66E-03	3.00E-03	3.69E-03	6.69E-03	CTRL RM	1 HR	1 HR	OPERATOR FAILS RCS COOLDOWN AND DEPRESSURIZE/C-0
60	OPA-RCD2	RCD2	1.32E-04	3.00E-03	1.10E-02	1.40E-02	CTRL RM	-----	4 HRS	OPERATOR FAILS RCS COOLDOWN AND DEPRESSURIZE/ES-11
61	OPA-RCPSEAL	Note 4	4.46E-02	2.00E-03	2.20E-02	2.40E-02	CTRL RM	-----	30 MIN	HRA FAILURE TO ESTABLISH SEAL INJ AND THERMAL BARRIER CLG
62	OPA-REF	REF	7.89E-03	2.00E-03	9.41E-05	2.10E-03	LOCAL	1 HR	1 HR	HRA FAILURE TO ESTABLISH RWST REFILL PER STEP 54
63	OPA-RHR	RHR	5.01E-04	3.00E-04	2.00E-04	5.00E-04	CTRL RM	-----	135 MIN	HRA FAILURE TO STOP RHR PUMPS EARLY IN HIGH PRESS EVENT

TABLE 1 - COMPARISON OF OLD AND NEW HRA VALUES

	Basic Event	ID in Original HRA Notebook	Value (Old)	pc (New)	pe (New)	Value (New)	Location	Time Limit (Old)	Time Limit (New)	Description
64	OPA-RRI1	RRI11	5.64E-03	2.50E-04	9.10E-04	1.20E-03	CTRL RM	30 MIN	30 MIN	OPERATOR ACTION TO ALIGN AND START 1 SI OR CCP PUMPS
65	OPA-RRI2	RRI22	7.35E-03	2.50E-04	2.40E-03	2.70E-03	CTRL RM	30 MIN	30 MIN	OPERATOR ACTION TO ALIGN AND START 2 CCPS
66	OPA-RUPSG	RUPSG	6.33E-05	Included in OPA-SGR			CTRL RM	10 MIN	N/A	OPERATOR FAILS TO IDENTIFY THE RUPTURED STEAM GEN
67	OPA-SEALINJ	CCPB	4.05E-02	1.50E-04	2.80E-03	2.90E-03	CTRL RM	-----	30 MIN	HRA FAILURE TO ALIGN NORMAL OR ALT SEAL INJECTION
68	OPA-SGK05AB	MCB	1.59E-03	1.00E-04	3.50E-03	3.60E-03	CTRL RM	-----	Note 10	FAILURE TO MANUALLY START ONE OR BOTH HVAC UNITS
69	OPA-SGOVERFL	Note 2	1.00E-03	4.00E-03	3.10E-04	4.31E-03	CTRL RM	-----	30 MIN	HRA FAILURE TO MAINTAIN SG LEVEL - OVERFILL FAILS
70	OPA-SGR	SGTR	6.36E-06	2.85E-05	None	2.85E-05	CTRL RM	10 MIN	30 MIN	OPERATOR FAILS TO DIAGNOSE SGR EVENT HAS OCCURED
71	OPA-ALPT3789	Note 8	N/A	None	1.90E-04	1.90E-04	LOCAL		Note 9	OPERATOR FAILS TO CALIBRATE ALPT0037, -8, AND -9 PROPERLY
72	OPA-JELSL01A	Note 8	N/A	None	1.30E-03	1.30E-03	LOCAL		Note 9	OPERATOR FAILS TO CALIBRATE JELSL0001A PROPERLY
73	OPA-JELSL21A	Note 8	N/A	None	1.30E-03	1.30E-03	LOCAL		Note 9	OPERATOR FAILS TO CALIBRATE JELSL0021A PROPERLY
74	OPA-JELSL121	Note 8	N/A	None	6.70E-05	6.70E-05	LOCAL		Note 9	OPERATOR FAILS TO CALIBRATE JELSL0C01A & -21A PROPERLY
75	OPA-BNLT903	Note 8	N/A	None	1.90E-03	1.90E-03	LOCAL		Note 9	OPERATOR FAILS TO CALIBRATE BNLT0903 PROPERLY

TABLE 1 - COMPARISON OF OLD AND NEW HRA VALUES

NOTES:

Note 1: HRA value was calculated by Westinghouse prior to original HRA notebook completion, but was not included in notebook.
Note 2: HRA value was estimated by WCGS in the HRA notebook.
Note 3: HRA value was calculated informally by NUS Corporation subsequent to original HRA notebook completion.
Note 4: HRA value was calculated by WCGS subsequent to original HRA notebook completion.
Note 5: Basic event was originally HESF-MANUALRT-HE.
Note 6: Basic event was originally HESF-MANUALSI-HE.
Note 7: These actions were originally only one action, OPA-OFN-NK020.
Note 8: This is a new operator action.
Note 9: These preinitiator actions are not considered time critical.
Note 10: Manual actuation of an automatic actuation failure. Sufficient time for manual recovery is assumed as discussed in OPA-AFWACT analysis.

TABLE 2 - TOP 100 CUTSETS INCLUDING AT LEAST ONE OPERATOR ACTION

No	Prob.	Cutset Description				
1	1.00E-06	INIT-LLO	OPA-LPR-COG			
2	9.50E-07	INIT-LLO	OPA-LPR-EXE			
3	5.89E-07	INIT-TRO	XXALSTMBD-CCF1-4	OPA-OFB-EXE		
4	4.95E-07	INIT-SWS	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-ECCSTRP2-COG	
5	3.10E-07	INIT-F3C	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-ECCSTRP2FCOG	
6	2.84E-07	INIT-SGR	OPA-OD1-EXE	SSV-FAILS	OPA-EC3-EXE	
7	2.80E-07	INIT-CCW	CCR8-SUCCESSFUL	CNUC8-SUCCESSFUL	OPA-HPR-COG	
8	2.09E-07	INIT-MLO	OPA-BNLT9303-EXE			
9	1.84E-07	INIT-SWS	SWR8-FAILS	OPA-ALT-EXE		
10	1.58E-07	INIT-LSP	XXALSTMBD-CCF1-4	OPA-OFB-EXE		
11	1.48E-07	INIT-SGR	OPA-MSI-EXE	OPA-EC3-EXE		
12	1.36E-07	INIT-LSP	OPA-JELSL121-EXE	8HR-SUCCESSFUL	CNU8-FAILS	
13	1.33E-07	INIT-TRA	XXALSTMBD-CCF1-4	XXKA-INSTRAIR-SA	OPA-OFB-EXE	
14	9.69E-08	INIT-LSP	OPA-JELSL121-EXE	8HR-FAILURE	12HR-SUCCESSFUL	CNU12-FAILS
15	9.50E-08	INIT-LLO	OPA-BNLT9303-EXE			
16	9.17E-08	INIT-SWS	SWR8-FAILS	OPA-ALT-COG		
17	9.03E-08	INIT-TRA	XXALSTMBD-CCF1-4	OPA-MFW-COG		
18	7.76E-08	INIT-SWS	OPA-RCD2-EXE	SWR8-FAILS		
19	7.01E-08	INIT-FL1	XXALSTMBD-CCF1-4	OPA-OFB-EXE		
20	6.57E-08	INIT-LSP	OPA-JELSL121-EXE	8HR-FAILURE	12HR-FAILS	
21	6.12E-08	INIT-SWS	SWR8-FAILS	CNUS8-SUCCESSFUL	OPA-ECCSTRP1-COG	
22	6.12E-08	INIT-SWS	SWR8-FAILS	CNUS8-SUCCESSFUL	OPA-ECCSTRP2-COG	
23	5.86E-08	INIT-CCW	OPA-RCD2-EXE	CCR8-SUCCESSFUL	CNUC8F-FAILS	
24	5.75E-08	INIT-F3C	SWR8-FAILS	OPA-ALTF-COG		
25	5.52E-08	INIT-SWS	OPA-SGOVERFL-COG	SWR2-FAILS		
26	5.49E-08	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	TRNG----XNG02-FA	XXEF-----ESWA-TM
27	5.01E-08	INIT-SWS	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-RRJ1-EXE	
28	4.95E-08	INIT-TRA	XXALSTMBD-CCF1-4	MVAE---HV0102-CC	OPA-OFB-EXE	
29	4.95E-08	INIT-TRA	XXALSTMBD-CCF1-4	MVAE---HV0103-CC	OPA-OFB-EXE	
30	4.91E-08	INIT-SWS	SWR2-SUCCESS	CNUS2F-SUCCESSFL	OPA-DCSHED-EXE	
31	4.67E-08	INIT-TRA	XXALSTMBD-CCF1-4	OPA-MFW-EXE	OPA-OFB-EXE	
32	4.52E-08	INIT-FL1	XXALSTMBD-CCF1-4	OPA-HPRF-COG		
33	4.24E-08	INIT-SWS	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-ECCSTRP2-EXE	
34	4.10E-08	INIT-F3C	OPA-SGOVERFLFCOG	SWR2-SUCCESS	CNUS2F-SUCCESSFL	NR-ESWA
35	4.10E-08	INIT-F3C	OPA-SGOVERFLFCOG	SWR2-SUCCESS	CNUS2F-SUCCESSFL	NR-ESWB
36	4.03E-08	INIT-TRA	XXALSTMBD-CCF1-4	CBPA---PA0202-OO	OPA-OFB-EXE	
37	4.00E-08	INIT-TRA	XXALSTMBD-CCF1-4	CBPB---PB0406-OO	OPA-OFB-EXE	
38	4.00E-08	INIT-TRA	XXALSTMBD-CCF1-4	CBPA---PA0110-OO	OPA-OFB-EXE	
39	4.00E-08	INIT-TRA	XXALSTMBD-CCF1-4	CBPA---PA0211-CC	OPA-OFB-EXE	
40	4.00E-08	INIT-TRA	XXALSTMBD-CCF1-4	MPAE----PAE02-PS	OPA-OFB-EXE	
41	4.00E-08	INIT-TRA	XXALSTMBD-CCF1-4	CBPA---PA0101-CC	OPA-OFB-EXE	
42	3.84E-08	INIT-F3C	SWR8-FAILS	CNUS8-SUCCESSFUL	OPA-ECCSTRP2FCOG	
43	3.84E-08	INIT-F3C	SWR8-FAILS	CNUS8-SUCCESSFUL	OPA-ECCSTRP1FCOG	
44	3.80E-08	INIT-TRO	XXALSTMBD-CCF1-4	OPA-HPR-COG		

TABLE 2 - TOP 100 CUTSETS INCLUDING AT LEAST ONE OPERATOR ACTION

No	Prob.	Cutset Description				
45	3.46E-08	INIT-F3C	OPA-SGOVERFLFCOG	SWR2-FAILS		
46	3.45E-08	INIT-F3A	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-ECCSTRP2FCOG	
47	3.45E-08	INIT-F3B	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-ECCSTRP2FCOG	
48	3.41E-08	INIT-SGR	XXALSTMBD-CCF1-4	OPA-OFB-EXE		
49	3.25E-08	INIT-TRA	TRNG----XNG02-FA	SLA-SUCCESSFUL	OPA-CCWSERLP-EXE	XXEF-----ESWA-TM
50	3.20E-08	INIT-TRA	XXALSTMBD-CCF1-4	MPAE----PAE02-TM	OPA-OFB-EXE	
51	3.19E-08	INIT-LSP	OPA-JELSL121-EXE	TPALT---PAL02-PR	2HR-FAILS	
52	3.19E-08	INIT-LSP	OPA-JELSL21A-EXE	XXEF-----ESWA-TM	8HR-SUCCESSFUL	CNU8-FAILS
53	3.19E-08	INIT-LSP	OPA-JELSL01A-EXE	XXEF-----ESWB-TM	8HR-SUCCESSFUL	CNU8-FAILS
54	3.01E-08	INIT-SWS	OPA-RCD2-EXE	SWR8-SUCCESS	CNUS8F-FAILS	
55	2.98E-08	INIT-LSP	DGNE-----NE02-TM	OPA-JELSL01A-EXE	8HR-SUCCESSFUL	CNU8-FAILS
56	2.98E-08	INIT-LSP	DGNE-----NE01-TM	OPA-JELSL21A-EXE	8HR-SUCCESSFUL	CNU8-FAILS
57	2.87E-08	INIT-LSP	DGNE-----NE01-PR	OPA-JELSL21A-EXE	8HR-SUCCESSFUL	CNU8-FAILS
58	2.87E-08	INIT-LSP	DGNE-----NE02-PR	OPA-JELSL01A-EXE	8HR-SUCCESSFUL	CNU8-FAILS
59	2.75E-08	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	CBNB---NB0213-CO	XXEF-----ESWA-TM
60	2.75E-08	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	CBNG-52NG0201-CO	XXEF-----ESWA-TM
61	2.75E-08	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	CBNG-52NG0206-CO	XXEF-----ESWA-TM
62	2.67E-08	INIT-LSP	DGNE-----NE01-PR	TPAL----PAL02-PR	XXAL---MDAFWB-TM	OPA-OFB-EXE
63	2.67E-08	INIT-LSP	DGNE-----NE02-PR	TPAL----PAL02-PR	XXAL---MDAFWA-TM	OPA-OFB-EXE
64	2.67E-08	INIT-TRA	XXALSTMBD-CCF1-4	AVBM---TV0040-OO	OPA-OFB-EXE	
65	2.40E-08	INIT-SLB	TPAL----PAL02-PR	XXAL---MDAFWB-TM	OPA-OFB-EXE	
66	2.33E-08	INIT-SGR	OPA-OD1-EXE	SSV-SUCCESS	OPA-OD2-EXE	
67	2.28E-08	INIT-TRO	XXALSTMBD-CCF1-4	OPA-HPR-EXE		
68	2.28E-08	INIT-LSP	OPA-JELSL01A-EXE	XXEF-----ESWB-TM	8HR FAILURE	12HR-SUCCESSFUL CNU12-FAILS
69	2.28E-08	INIT-LSP	OPA-JELSL21A-EXE	XXEF-----ESWA-TM	8HR-FAILURE	12HR-SUCCESSFUL CNU12-FAILS
70	2.27E-08	INIT-TRO	MPPAL01AB-CCF12	TPAL----PAL02-PR	OPA-OFB-EXE	
71	2.24E-08	INIT-CCW	CCR8-FAILS	CNUC8-SUCCESSFUL	OPA-HPR-COG	
72	2.13E-08	INIT-LSP	DGNE-----NE01-TM	OPA-JELSL21A-EXE	8HR-FAILURE	12HR-SUCCESSFUL CNU12-FAILS
73	2.13E-08	INIT-LSP	DGNE-----NE02-TM	OPA-JELSL01A-EXE	8HR-FAILURE	12HR-SUCCESSFUL CNU12-FAILS
74	2.12E-08	INIT-SWS	OPA-RCD2-COG	SWR8-FAILS		
75	2.05E-08	INIT-LSP	DGNE-----NE01-PR	OPA-JELSL21A-EXE	8HR-FAILURE	12HR-SUCCESSFUL CNU12-FAILS
76	2.05E-08	INIT-LSP	DGNE-----NE02-PR	OPA-JELSL01A-EXE	8HR-FAILURE	12HR-SUCCESSFUL CNU12-FAILS
77	2.03E-08	INIT-FL1	XXALSTMBD-CCF1-4	OPA-OFBF-COG		
78	1.95E-08	INIT-LSP	OPA-JELSL01A-EXE	TPAL----PAL02-PR	XXAL---MDAFWB-TM	MVBB-BLCK-CLOSED
79	1.71E-08	INIT-TRO	XXALSTMBD-CCF1-4	OPA-OFB-COG		
80	1.70E-08	INIT-LSP	OPA-JELSL121-EXE	XXAL----TDAFW-TM	2HR-FAILS	
81	1.69E-08	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	MVEF---HV0023-OO	TRNG----XNG02-FA
82	1.68E-08	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	MVEF---HV0037-CC	TRNG----XNG02-FA
83	1.62E-08	INIT-TRA	OPA-CCWSERLP-EXE	SLA-SUCCESSFUL	CBNG-52NG0206-CO	XXEF-----ESWA-TM
84	1.62E-08	INIT-TRA	OPA-CCWSERLP-EXE	SLA-SUCCESSFUL	CBNB---NB0213-CO	XXEF-----ESWA-TM
85	1.62E-08	INIT-TRA	OPA-CCWSERLP-EXE	SLA-SUCCESSFUL	CBNG-52NG0201-CO	XXEF-----ESWA-TM
86	1.60E-08	INIT-TRO	MPAL---PAL01B-PS	TPAL----PAL02-PR	XXAL---MDAFWA-TM	OPA-OFB-EXE
87	1.60E-08	INIT-TRO	MPAL---PAL01A-PS	TPAL----PAL02-PR	XXAL---MDAFWB-TM	OPA-OFB-EXE
88	1.60E-08	INIT-CCW	OPA-RCD2-COG	CCR8-SUCCESSFUL	CNUC8F-FAILS	

TABLE 2 - TOP 100 CUTSETS INCLUDING AT LEAST ONE OPERATOR ACTION

No	Prob.	Cutset Description				
89	1.56E-08	INIT-SWS	TPALT---PAL02-PR	SWR2-SUCCESS	CNUS2F-SUCCESSFL	OPA-ECCSTRP2-COG
90	1.54E-08	INIT-LSP	OPA-JELSL21A-EXE	XXEF-----ESWA-TM	8HR-FAILURE	12HR-FAILS
91	1.54E-08	INIT-LSP	OPA-JELSL01A-EXE	XXEF-----ESWB-TM	8HR-FAILURE	12HR-FAILS
92	1.50E-08	INIT-SLO	OPA-ES1-COG	OPA-HPR-COG		
93	1.44E-08	INIT-LSP	DGNE-----NE01-TM	OPA-JELSL21A-EXE	8HR-FAILURE	12HR-FAILS
94	1.44E-08	INIT-LSP	DGNE-----NE02-TM	OPA-JELSL01A-EXE	8HR-FAILURE	12HR-FAILS
95	1.39E-08	INIT-LSP	DGNE-----NE01-PR	OPA-JELSL21A-EXE	8HR-FAILURE	12HR-FAILS
96	1.39E-08	INIT-LSP	DGNE-----NE02-PR	OPA-JELSL01A-EXE	8HR-FAILURE	12HR-FAILS
97	1.38E-08	INIT-SWS	OPA-DCSHED-EXE	SWR2-FAILS		
98	1.38E-08	INIT-SWS	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-RR11-COG	
99	1.37E-08	INIT-CCW	OPA-RCD2-EXE	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-ECCSTRP1-COG
100	1.36E-08	INIT-SWS	SWR8-FAILS	CNUS8-SUCCESSFUL	OPA-ECCSTRP1-EXE	

TABLE 3 TOP 100 CUTSETS WITH AT LEAST 2 OPERATOR ACTIONS

No	Prob.	Cutset Description					
1	2.84E-07	INIT-SGR	OPA-OD1-EXE	SSV-FAILS	OPA-EC3-EXE		
2	1.48E-07	INIT-SGR	OPA-MSI-EXE	OPA-EC3-EXE			
3	4.67E-08	INIT-TRA	XXALSTMBD-CCF1-4	OPA-MFW-EXE	OPA-OFB-EXE		
4	2.33E-08	INIT-SGR	OPA-OD1-EXE	SSV-SUCCESS	OPA-OD2-EXE		
5	1.50E-08	INIT-SLO	OPA-ES1-COG	OPA-HPR-COG			
6	1.37E-08	INIT-CCW	OPA-RCD2-EXE	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-ECCSTRP1-COG	
7	1.08E-08	INIT-SGR	OPA-OD1-EXE	SSV-FAILS	OPA-EC3-COG		
8	9.20E-09	INIT-F3C	OPA-RCD2F-COG	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-ECCSTRP2FCOG	
9	9.00E-09	INIT-SLO	OPA-ES1-COG	OPA-HPR-EXE			
10	8.69E-09	INIT-SGR	OPA-SGR-COG	OPA-EC3-EXE			
11	7.72E-09	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-RCD2-EXE	AVEG---TV0029-OO	MVEG---HV0102-CC
12	6.65E-09	INIT-SLO	OPA-ES1-EXE	OPA-HPR-COG			
13	6.60E-09	INIT-MLO	OPA-HPR-COG	OPA-OP1-COG			
14	6.15E-09	INIT-LSP	OPA-JELSL121-EXE	8HR-SUCCESSFUL	CNU8-SUCCESSFUL	OPA-HPR-COG	
15	5.61E-09	INIT-SGR	OPA-MSI-EXE	OPA-EC3-COG			
16	5.38E-09	INIT-SWS	OPA-RCD2-EXE	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-ECCSTRP2-COG	
17	4.82E-09	INIT-SWS	SWR8-FAILS	OPA-1EHVACAB-EXE	OPA-ACNN-EXE		
18	4.70E-09	INIT-SWS	SWR8-SUCCESS	OPA-1EHVACAB-EXE	CNUS8-SUCCESSFUL	OPA-HPIACT-EXE	
19	4.40E-09	INIT-MLO	OPA-HPR-COG	OPA-LPR-COG			
20	4.18E-09	INIT-MLO	OPA-HPR-COG	OPA-LPR-EXE			
21	3.99E-09	INIT-SLO	OPA-ES1-EXE	OPA-HPR-EXE			
22	3.96E-09	INIT-MLO	OPA-HPR-EXE	OPA-OP1-COG			
23	3.73E-09	INIT-CCW	OPA-RCD2-COG	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-ECCSTRP1-COG	
24	3.69E-09	INIT-LSP	OPA-JELSL121-EXE	8HR-SUCCESSFUL	CNU8-SUCCESSFUL	OPA-HPR-EXE	
25	3.62E-09	INIT-LSP	OPA-JELSL121-EXE	OPA-SGOVERFL-COG	2HR-FAILS		
26	3.42E-09	INIT-LSP	OPA-JELSL01A-EXE	OPA-JELSL21A-EXE	8HR-SUCCESSFUL	CNU8-FAILS	
27	3.37E-09	INIT-F3C	OPA-RCD2-EXE	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-ECCSTRP2FCOG	
28	3.29E-09	INIT-CCW	OPA-RCD2-EXE	CCR8-FAILS	OPA-ALT-EXE		
29	3.18E-09	INIT-LSP	TPAL----PAL02-PR	XXAL---MDAFWB-TM	OPA-JELSL01A-EXE	OPA-OFB-EXE	
30	3.18E-09	INIT-LSP	TPAL----PAL02-PR	XXAL---MDAFWA-TM	OPA-JELSL21A-EXE	OPA-OFB-EXE	
31	3.04E-09	INIT-CCW	OPA-RCD2-EXE	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-HPR-COG	
32	3.04E-09	INIT-CCW	OPA-RCD2-EXE	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-ECCSTRP1-EXE	
33	3.01E-09	INIT-TRA	XXALSTMBD-CCF1-4	OPA-MFW-EXE	OPA-HPR-COG		
34	2.80E-09	INIT-LSP	OPA-JELSL121-EXE	8HR-SUCCESSFUL	CNU8-SUCCESSFUL	OPA-RRH-EXE	
35	2.69E-09	INIT-SWS	SWR8-SUCCESS	OPA-1EHVACAB-EXE	CNUS8-SUCCESSFUL	OPA-HPR-COG	
36	2.64E-09	INIT-MLO	OPA-HPR-EXE	OPA-LPR-COG			
37	2.51E-09	INIT-MLO	OPA-HPR-EXE	OPA-LPR-EXE			
38	2.50E-09	INIT-LSP	OPA-JELSL121-EXE	2HR-SUCCESSFUL	CNU2-SUCCESSFUL	OPA-DCSHED-EXE	
39	2.46E-09	INIT-F3C	OPA-SGOVERFLFCOG	SWR2-SUCCESS	CNUS2F-SUCCESSFL	OPA-HPRF-COG	
40	2.45E-09	INIT-LSP	OPA-JELSL01A-EXE	OPA-JELSL21A-EXE	8HR-FAILURE	12HR-SUCCESSFUL	CNU12-FAILS
41	2.25E-09	INIT-SLO	OPA-ES1-COG	OPA-RHR-COG			
42	2.11E-09	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-RCD2-COG	AVEG---TV0029-OO	MVEG---HV0102-CC

TABLE 3 TOP 100 CUTSETS WITH AT LEAST 2 OPERATOR ACTIONS

No	Prob.	Cutset Description					
43	2.04E-09	INIT-F3C	OPA-RCD2F-COG	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-HPRF-COG	
44	2.03E-09	INIT-LSP	OPA-NE01NE02-COG	OPA-SGK05AB-COG	8HR-SUCCESSFUL	CNU8-FAILS	
45	1.89E-09	INIT-LSP	OPA-AFWACT-EXE	TPAL----PAL02-PR	OPA-SGK05AB-COG		
46	1.87E-09	INIT-SWS	SWR8-SUCCESS	OPA-1EHVACAB-EXE	OPA-ACNN-EXE	CNUS8F-FAILS	
47	1.81E-09	INIT-TRA	XXALSTMBD-CCF1-4	OPA-MFW-EXE	OPA-HPR-EXE		
48	1.80E-09	INIT-TRA	MPPAL01AB-CCF12	TPAL----PAL02-PR	OPA-MFW-EXE	OPA-OFB-EXE	
49	1.77E-09	INIT-SWS	OPA-SGOVERFL-COG	SWR2-SUCCESS	CNUS2F-SUCCESSFL	OPA-ECCSTRP2-COG	
50	1.73E-09	INIT-LSP	OPA-NE01NE02-COG	OPA-SGK05AB-EXE	OPA-1EHVACAB-EXE	8HR-SUCCESSFUL	CNU8-FAILS
51	1.68E-09	INIT-F3C	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-HPRF-COG	OPA-1EHVACAB-EXE	
52	1.66E-09	INIT-LSP	OPA-JELSL01A-EXE	OPA-JELSL21A-EXE	8HR-FAILURE	12HR-FAILS	
53	1.64E-09	INIT-CCW	OPA-RCD2-EXE	CCR8-FAILS	OPA-ALT-COG		
54	1.59E-09	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	AVEG---TV0029-OO	INAC-----NN14-FA	OPA-HPIACT-EXE
55	1.57E-09	INIT-SWS	SWR8-SUCCESS	OPA-1EHVACAB-EXE	CNUS8-SUCCESSFUL	NR-ESWA	OPA-PEG01BCD-EXE
56	1.57E-09	INIT-SWS	SWR8-SUCCESS	OPA-1EHVACAB-EXE	CNUS8-SUCCESSFUL	NR-ESWB	OPA-EGTV0029-EXE
57	1.57E-09	INIT-SWS	SWR8-SUCCESS	OPA-1EHVACAB-EXE	CNUS8-SUCCESSFUL	NR-ESWB	OPA-EGHV6970-EXE
58	1.57E-09	INIT-SWS	SWR8-SUCCESS	OPA-1EHVACAB-EXE	CNUS8-SUCCESSFUL	NR-ESWA	OPA-EFHV0052-EXE
59	1.50E-09	INIT-SLO	OPA-ES1-COG	OPA-RHR-EXE			
60	1.47E-09	INIT-SWS	OPA-RCD2-COG	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-ECCSTRP2-COG	
61	1.45E-09	INIT-LSP	OPA-NE01NE02-COG	OPA-SGK05AB-COG	8HR-FAILURE	12HR-SUCCESSFUL	CNU12-FAILS
62	1.43E-09	INIT-SLO	OPA-ES1-COG	OPA-BNLT9303-EXE			
63	1.40E-09	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	AVEG---TV0029-OO	MVEG---HV0102-CC	OPA-HPR-COG
64	1.38E-09	INIT-CCW	OPA-RCD2-EXE	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-RRI1-EXE	
65	1.38E-09	INIT-F3C	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-HPRF-COG	OPA-LPRF-COG	
66	1.36E-09	INIT-LSP	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-SGK05AB-COG	XXEF-----ESWA-TM	
67	1.35E-09	INIT-TRA	XXALSTMBD-CCF1-4	OPA-MFW-EXE	OPA-OFB-COG		
68	1.27E-09	INIT-LSP	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-SGK05AB-COG	DGNE-----NE01-TM	
69	1.27E-09	INIT-TRA	MPAL---PAL01A-PS	TPAL----PAL02-PR	XXAL---MDAFWB-TM	OPA-MFW-EXE	OPA-OFB-EXE
70	1.27E-09	INIT-TRA	MPAL---PAL01B-PS	TPAL----PAL02-PR	XXAL---MDAFWA-TM	OPA-MFW-EXE	OPA-OFB-EXE
71	1.24E-09	INIT-LSP	OPA-NE01NE02-COG	OPA-SGK05AB-EXE	OPA-1EHVACAB-EXE	8HR-FAILURE	12HR-SUCCESSFUL CNU12-FAILS
72	1.22E-09	INIT-LSP	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-SGK05AB-COG	DGNE-----NE01-PR	
73	1.20E-09	INIT-SWS	OPA-RCD2-EXE	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-HPR-COG	
74	1.16E-09	INIT-LSP	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-SGK05AB-EXE	OPA-1EHVACAB-EXE	XXEF-----ESWA-TM
75	1.11E-09	INIT-F3C	OPA-SGOVERFLFCOG	SWR2-SUCCESS	CNUS2F-SUCCESSFL	OPA-OF2F-COG	
76	1.10E-09	INIT-CCW	OPA-RCD2-EXE	CCR8-FAILS	CNUC8F-SUCCESSFL	OPA-ECCSTRP1-COG	
77	1.08E-09	INIT-LSP	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-SGK05AB-EXE	OPA-1EHVACAB-EXE	DGNE-----NE01-TM
78	1.04E-09	INIT-LSP	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-SGK05AB-EXE	OPA-1EHVACAB-EXE	DGNE-----NE01-PR
79	1.02E-09	INIT-F3A	OPA-RCD2F-COG	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-ECCSTRP2FCOG	
80	1.02E-09	INIT-F3B	OPA-RCD2F-COG	SWR8-SUCCESS	CNUS8F-SUCCESSFL	OPA-ECCSTRP2FCOG	
81	1.02E-09	INIT-FL1	OPA-SGOVERFLFCOG	MPPALC1AB-CCF12	OPA-OFB-EXE		
82	1.01E-09	INIT-LSP	OPA-SGOVERFL-COG	XXAL---MDAFWB-TM	DGNE-----NE01-PR	OPA-OFB-EXE	
83	1.01E-09	INIT-LSP	OPA-SGOVERFL-COG	XXAL---MDAFWA-TM	DGNE-----NE02-PR	OPA-OFB-EXE	
84	1.01E-09	INIT-TRA	OPA-RCD2-EXE	CCW8R-FAILS	OPA-ALT-EXE	AVEG---TV0029-OO	MVEF---HV0052-CC

TABLE 3 TOP 100 CUTSETS WITH AT LEAST 2 OPERATOR ACTIONS

No	Prob.	Cutset Description					
85	9.98E-10	INIT-SLO	OPA-ES1-EXE	OPA-RHR-COG			
86	9.90E-10	INIT-MLO	OPA-RHR-COG	OPA-OP1-COG			
87	9.80E-10	INIT-LSP	OPA-NE01NE02-COG	OPA-SGK05AB-COG	8HR-FAILURE	12HR-FAILS	
88	9.06E-10	INIT-LSP	OPA-JELSL121-EXE	OPA-DCSHED-EXE	2HR-FAILS		
89	9.05E-10	INIT-SLB	OPA-SGOVERFL-COG	XXAL---MDAFWB-TM	OPA-OFB-EXE		
90	8.97E-10	INIT-CCW	OPA-RCD2-COG	CCR8-FAILS	OPA-ALT-EXE		
91	8.87E-10	INIT-TRA	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	AVEG---TV0029-OO	CASF---LOGICB-TM	OPA-HPIACT-EXE
92	8.58E-10	INIT-LSP	OPA-RCPSEAL-EXE	SLA-SUCCESSFUL	OPA-RCD2-EXE	DGNE-----NE01-PR	XXEJ---TRAINB-TM
93	8.55E-10	INIT-TRO	OPA-SGOVERFL-COG	MPPAL01AB-CCF12	OPA-OFB-EXE		
94	8.50E-10	INIT-LSP	OPA-JELSL01A-EXE	XXEF-----ESWB-TM	OPA-SGOVERFL-COG	2HR-FAILS	
95	8.50E-10	INIT-LSP	OPA-JELSL21A-EXE	XXEF-----ESWA-TM	OPA-SGOVERFL-COG	2HR-FAILS	
96	8.37E-10	INIT-LSP	OPA-NE01NE02-COG	OPA-SGK05AB-EXE	OPA-1EHVACAB-EXE	8HR-FAILURE	12HR-FAILS
97	8.29E-10	INIT-CCW	OPA-RCD2-COG	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-ECCSTRP1-EXE	
98	8.29E-10	INIT-CCW	OPA-RCD2-COG	CCR8-SUCCESSFUL	CNUC8F-SUCCESSFL	OPA-HPR-COG	
99	8.04E-10	INIT-LSP	OPA-JELSL01A-EXE	OPA-JELSL21A-EXE	TPALT---PAL02-PR	2HR-FAILS	
100	7.94E-10	INIT-LSP	OPA-JELSL21A-EXE	DGNE---NE01-TM	OPA-SGOVERFL-COG	2HR-FAILS	

TABLE 4 CUTSETS CONTAINING MULTIPLE OPERATOR ACTIONS WITH DEPENDENCIES

No	Prob.	Cutset Description					
1	1.53E-10	INIT-F3A	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-HPRF-COG	OPA-LPRF-COG	
2	1.53E-10	INIT-F3B	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-HPRF-COG	OPA-LPRF-COG	
3	1.38E-09	INIT-F3C	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-HPRF-COG	OPA-LPRF-COG	
4	1.01E-10	INIT-FL1	MVBB--HV8000B-OO	OTH-PORVOPENSMFW	PVBB-PCV0456A-OO	OPA-HPRF-COG	OPA-LPRF-COG
5	2.20E-10	INIT-SWS	SWR8-SUCCESS	CNUS8-SUCCESSFUL	OPA-HPR-COG	OPA-LPR-COG	
6	6.27E-10	INIT-MLO	OPA-RHR-COG	OPA-LPR-EXE			
7	4.18E-10	INIT-MLO	OPA-RHR-EXE	OPA-LPR-EXE			
8	8.69E-10	INIT-SGR	OPA-SGR-COG	OPA-EC3-EXE			
9	3.30E-10	INIT-SGR	OPA-SGR-COG	OPA-EC3-COG			
10	3.99E-09	INIT-SLO	OPA-ES1-EXE	OPA-HPR-EXE			

Revised Common Cause Analysis

WCNOC described the methodology utilized for the Common Cause analysis for the IPE in the response to the NRC's RAI [WM 95-0128]. The Common Cause methodology utilized is described in the response to RAI Question 4. Included in the response to Question 4 was "Table 1" which provided a list of "Generic" Multiple Greek Letter (MGL) parameters originally used in the IPE development. Also provided in the response to Question 4 was "Table 2" which provided the list of "Plant Specific" MGL parameters utilized for final quantification of the IPE. The NRC identified that the "Plant Specific" MGL parameters were significantly less than "Generic" MGL parameters typically utilized in other IPE Submittals. The concern was that utilization of the "plant specific" MGL parameters could produce results which might not properly reflect the relative contribution of Common Cause failures to the core damage frequency.

Accordingly, the WCGS Probabilistic Safety Assessment (PSA) model has been requantified utilizing the "Generic" MGL parameters as identified in the response to RAI Question 4. These "Generic" MGL factors were determined using data from EPRI NP-3967, "Classification and Analysis of Reactor Operating Experience Involving Dependent Failures," Pickard, Lowe and Garrick, June 1985 and NUREG/CR-4780 "Procedures for Treating Common Cause Failures in Safety and Reliability Studies, Procedural Framework and Examples," Pickard, Lowe and Garrick, January 1989. The "Generic" MGL parameters from "Table 1" of the response to RAI Question 4 are provided in Table 5 below. The beta factors from Table 5 (below) are comparable to the generic beta factors provided in Table VI.1-1 of NUREG/CR-4550, "Analysis of Core Damage Frequency From Internal Events: Methodology Guidelines, Volume 1".

TABLE 5

GENERIC MGL PARAMETERS

Component	B (beta)	C (gamma)	D (delta)
Reactor Trip Breakers	0.160	0.40	0.61
Diesel Generators	0.025	0.15	0.25
Motor-Operated Valves	0.038	0.23	0.69
Safety/Relief Valves	0.094	0.66	0.66
Check Valves	0.060	0.33	0.52
Pumps			
High Head	0.100	0.28	0.19
Residual Heat Removal	0.077	0.15	0.43
Containment Spray	0.057	0.24	0.52
Auxiliary Feedwater	0.021	0.20	0.52
Service Water and Component Cooling Water	0.032	0.63	0.84
Chillers	0.110	0.33	0.52
Fans	0.130	0.33	0.52
All	0.080	0.33	0.52

The revised Common Cause event values are presented in Table 6 below. It is important to note that the revised Common Cause values were imported for quantification into a PSA model using the NUS Corporation NUPRA PSA software. The PSA model as reflected in the IPE Submittal was developed using the Westinghouse PSA software package. Subsequent to the time of the IPE Submittal, the Wolf Creek PSA core damage (Level I) model was converted to the NUPRA software.

A number of changes to the Wolf Creek PSA model were accomplished in concert with conversion to the NUPRA software. Some changes were required to accommodate differences between the Westinghouse and NUPRA software packages. Some changes were also made to allow for utilization of desirable features in the NUPRA software which were not available under the Westinghouse software. One desirable feature which resulted in PSA model changes was the Common Cause event generator. This feature was particularly attractive for common cause groups of three or four components. Based on the component failure event value and the appropriate MGL parameters from Table 5 above, events for common cause failure of two, three or four components in the component group would be automatically generated and appropriately placed at the component level within the fault tree models.

Determination of common cause event values for the PSA model using the Westinghouse software was accomplished by separate hand calculation. Placement of these calculated common cause failure events within the fault trees, for common cause component groups of two components, was generally at the component level. For groups of three or four components, the calculated common cause failure values were usually combined under a separate event placed at the fault tree top logic level. For the majority of the fault tree models which have been converted to the NUPRA software, the automatic common cause event generation feature was utilized for common cause component groups of three or four components. For these fault trees, the common cause failure event located at the top logic level was appropriately deleted. Note (B) to Table 6 identifies common cause failure events, previously located at the fault tree top logic level, which were expanded using the NUPRA automatic common cause failure event generation feature. The expanded common cause failure events are located in the fault tree at the component level.

The NUPRA automatic common cause event generation feature assigns a **-CCF*XX*** type suffix to the generated common cause events. For the sake of consistency, the common cause failure event identifiers, in the fault trees converted to the NUPRA software, include the **-CCF*XX*** type suffix instead of the **-CM** suffix previously used under the Westinghouse software.

Incorporation of the revised Common Cause failure event values, with quantification using the WCGS PSA model converted to the NUPRA software, results in an increase of approximately 34 % over the 4.2E-05/year core damage frequency value reported in the IPE Submittal.

Table 6

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
AVAB-HV005006-CM	1.40E-05	AVABHV056-CCF12	1.60E-04	Common Cause Failure of AOVS ABHV0005 & ABHV0006
AVAB-AF2PORVS-CM	1.43E-05	AVPV01234-CCF12	3.57E-05	Common Cause Failure of SG ARVs ABPV0001 & 0002
(B)		AVPV01234-CCF13	3.57E-05	Common Cause Failure of SG ARVs ABPV0001 & 0003
		AVPV01234-CCF14	3.57E-05	Common Cause Failure of SG ARVs ABPV0001 & 0004
		AVPV01234-CCF23	3.57E-05	Common Cause Failure of SG ARVs ABPV0002 & 0003
		AVPV01234-CCF24	3.57E-05	Common Cause Failure of SG ARVs ABPV0002 & 0004
		AVPV01234-CCF34	3.57E-05	Common Cause Failure of SG ARVs ABPV0003 & 0004
		AVPV01234-CCF123	8.45E-06	Common Cause Failure of SG ARVs ABPV0001, 0002 & 0003
		AVPV01234-CCF124	8.45E-06	Common Cause Failure of SG ARVs ABPV0001, 0002 & 0004
		AVPV01234-CCF134	8.45E-06	Common Cause Failure of SG ARVs ABPV0001, 0003 & 0004
		AVPV01234-CCF234	8.45E-06	Common Cause Failure of SG ARVs ABPV0002, 0003 & 0004
		AVPV01234-CCF1-4	2.75E-05	Global CC Failure of SG ARVs ABPV0001, 0002, 0003 & 0004
XXAB--N2-ACC-AF2	7.53E-06	CVA345678-CCF12	1.34E-05	Common Cause Failure of CVs ABV0345 & ABV0346
(B)		CVA345678-CCF13	1.34E-05	Common Cause Failure of CVs ABV0345 & ABV0347
		CVA345678-CCF14	1.34E-05	Common Cause Failure of CVs ABV0345 & ABV0348
		CVA345678-CCF23	1.34E-05	Common Cause Failure of CVs ABV0346 & ABV0347
		CVA345678-CCF24	1.34E-05	Common Cause Failure of CVs ABV0346 & ABV0348
		CVA345678-CCF34	1.34E-05	Common Cause Failure of CVs ABV0347 & ABV0348
		CVA345678-CCF123	3.17E-06	Common Cause Failure of CVs ABV0345, 0346 & 0347
		CVA345678-CCF124	3.17E-06	Common Cause Failure of CVs ABV0345, 0346 & 0348
		CVA345678-CCF134	3.17E-06	Common Cause Failure of CVs ABV0345, 0347 & 0348
		CVA345678-CCF234	3.17E-06	Common Cause Failure of CVs ABV0346, 0347 & 0348
		CVA345678-CCF1-4	1.03E-05	Global CC Failure of CVs ABV0345, 0346, 0347 & 0348

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
XXAB--N2-ACC-AF2	7.53E-06	CVA495012-CCF12	1.34E-06	Common Cause Failure of CVs ABV0349 & ABV0350
(B)		CVA495012-CCF13	1.34E-06	Common Cause Failure of CVs ABV0349 & ABV0351
		CVA495012-CCF14	1.34E-06	Common Cause Failure of CVs ABV0349 & ABV0352
		CVA495012-CCF23	1.34E-06	Common Cause Failure of CVs ABV0350 & ABV0351
		CVA495012-CCF24	1.34E-06	Common Cause Failure of CVs ABV0350 & ABV0352
		CVA495012-CCF34	1.34E-06	Common Cause Failure of CVs ABV0351 & ABV0352
		CVA495012-CCF123	3.16E-07	Common Cause Failure of CVs ABV0349, 0350 & 0351
		CVA495012-CCF124	3.16E-07	Common Cause Failure of CVs ABV0349, 0350 & 0352
		CVA495012-CCF134	3.16E-07	Common Cause Failure of CVs ABV0349, 0351 & 0352
		CVA495012-CCF234	3.16E-07	Common Cause Failure of CVs ABV0350, 0351 & 0352
		CVA495012-CCF1-4	1.03E-06	Global CC Failure of CVs ABV0349, 0350, 0351 & 0352
XXAB--N2-ACC-AF2	7.53E-06	RVV703456-CCF12	1.67E-06	Common Cause Failure of Relief Vlvs KAV0703 & KAV0704
(B)		RVV703456-CCF13	1.67E-06	Common Cause Failure of Relief Vlvs KAV0703 & KAV0705
		RVV703456-CCF14	1.67E-06	Common Cause Failure of Relief Vlvs KAV0703 & KAV0706
		RVV703456-CCF23	1.67E-06	Common Cause Failure of Relief Vlvs KAV0704 & KAV0705
		RVV703456-CCF24	1.67E-06	Common Cause Failure of Relief Vlvs KAV0704 & KAV0706
		RVV703456-CCF34	1.67E-06	Common Cause Failure of Relief Vlvs KAV0705 & KAV0706
		RVV703456-CCF123	3.95E-07	Common Cause Failure of Relief Vlvs KAV0703, 0704 & 0705
		RVV703456-CCF124	3.95E-07	Common Cause Failure of Relief Vlvs KAV0703, 0704 & 0706
		RVV703456-CCF134	3.95E-07	Common Cause Failure of Relief Vlvs KAV0703, 0705 & 0706
		RVV703456-CCF234	3.95E-07	Common Cause Failure of Relief Vlvs KAV0704, 0705 & 0706
		RVV703456-CCF1-4	1.28E-06	Global CC Failure of Relief Vlvs KAV0703, 0704, 0705 & 0706

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
XXAB--N2-ACC-AF2	7.53E-06	RVV710123-CCF12	1.67E-06	Common Cause Failure of Relief Vlvs KAV0710 & KAV0711
(B)		RVV710123-CCF13	1.67E-06	Common Cause Failure of Relief Vlvs KAV0710 & KAV0712
		RVV710123-CCF14	1.67E-06	Common Cause Failure of Relief Vlvs KAV0710 & KAV0713
		RVV710123-CCF23	1.67E-06	Common Cause Failure of Relief Vlvs KAV0711 & KAV0712
		RVV710123-CCF24	1.67E-06	Common Cause Failure of Relief Vlvs KAV0711 & KAV0713
		RVV710123-CCF34	1.67E-06	Common Cause Failure of Relief Vlvs KAV0712 & KAV0713
		RVV710123-CCF123	3.95E-07	Common Cause Failure of Relief Vlvs KAV0710, 0711 & 0712
		RVV710123-CCF124	3.95E-07	Common Cause Failure of Relief Vlvs KAV0710, 0711 & 0713
		RVV710123-CCF134	3.95E-07	Common Cause Failure of Relief Vlvs KAV0710, 0712 & 0713
		RVV710123-CCF234	3.95E-07	Common Cause Failure of Relief Vlvs KAV0711, 0712 & 0713
		RVV710123-CCF1-4	1.28E-06	Global CC Failure of Relief Vlvs KAV0710, 0711, 0712 & 0713
HVAB-11141720-CM	4.35E-05	HVO114720-CCF12	3.57E-05	Common Cause Failure (FTO) of MSIVs ABHV0011 & 0014
(B)		HVO114720 CCF13	3.57E-05	Common Cause Failure (FTO) of MSIVs ABHV0011 & 0017
		HVO114720-CCF14	3.57E-05	Common Cause Failure (FTO) of MSIVs ABHV0011 & 0020
		HVO114720-CCF23	3.57E-05	Common Cause Failure (FTO) of MSIVs ABHV0014 & 0017
		HVO114720-CCF24	3.57E-05	Common Cause Failure (FTO) of MSIVs ABHV0014 & 0020
		HVO114720-CCF34	3.57E-05	Common Cause Failure (FTO) of MSIVs ABHV0017 & 0020
		HVO114720-CCF123	8.45E-06	Common Cause Failure (FTO) of MSIVs ABHV0011, 0014 & 0017
		HVO114720-CCF124	8.45E-06	Common Cause Failure (FTO) of MSIVs ABHV0011, 0014 & 0020
		HVO114720-CCF134	8.45E-06	Common Cause Failure (FTO) of MSIVs ABHV0011, 0017 & 0020
		HVO114720-CCF234	8.45E-06	Common Cause Failure (FTO) of MSIVs ABHV0014, 0017 & 0020
		HVO114720-CCF1-4	2.75E-05	Global CC Failure (FTO) of MSIVs ABHV0011, 0014, 0017 & 0020

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
HVAB-11141720-CM	4.35E-05	SVMSVBACT-CCF12	3.57E-05	CC Failure of MSIV Active SOVs (B) for ABHV0011 & 0014
(B)		SVMSVBACT-CCF13	3.57E-05	CC Failure of MSIV Active SOVs (B) for ABHV0011 & 0017
		SVMSVBACT-CCF14	3.57E-05	CC Failure of MSIV Active SOVs (B) for ABHV0011 & 0020
		SVMSVBACT-CCF23	3.57E-05	CC Failure of MSIV Active SOVs (B) for ABHV0014 & 0017
		SVMSVBACT-CCF24	3.57E-05	CC Failure of MSIV Active SOVs (B) for ABHV0014 & 0020
		SVMSVBACT-CCF34	3.57E-05	CC Failure of MSIV Active SOVs (B) for ABHV0017 & 0020
		SVMSVBACT-CCF123	8.45E-06	CC Failure of MSIV Active SOVs (B) for ABHV0011, 0014 & 0017
		SVMSVBACT-CCF124	8.45E-06	CC Failure of MSIV Active SOVs (B) for ABHV0011, 0014 & 0020
		SVMSVBACT-CCF134	8.45E-06	CC Failure of MSIV Active SOVs (B) for ABHV0011, 0017 & 0020
		SVMSVBACT-CCF234	8.45E-06	CC Failure of MSIV Active SOVs (B) for ABHV0014, 0017 & 0020
		SVMSVBACT-CCF1-4	2.75E-05	Global CCF of MSIV Active SOVs (B) for ABHV11, 14, 17 & 20
HVAB-11141720-CM	4.35E-05	SVMSVBSDB-CCF12	3.57E-05	CC Failure of MSIV Standby SOVs (B) for ABHV0011 & 0014
(B)		SVMSVBSDB-CCF13	3.57E-05	CC Failure of MSIV Standby SOVs (B) for ABHV0011 & 0017
		SVMSVBSDB-CCF14	3.57E-05	CC Failure of MSIV Standby SOVs (B) for ABHV0011 & 0020
		SVMSVBSDB-CCF23	3.57E-05	CC Failure of MSIV Standby SOVs (B) for ABHV0014 & 0017
		SVMSVBSDB-CCF24	3.57E-05	CC Failure of MSIV Standby SOVs (B) for ABHV0014 & 0020
		SVMSVBSDB-CCF34	3.57E-05	CC Failure of MSIV Standby SOVs (B) for ABHV0017 & 0020
		SVMSVBSDB-CCF123	8.45E-06	CC Failure of MSIV Standby SOVs (B) for ABHV011, 014 & 017
		SVMSVBSDB-CCF124	8.45E-06	CC Failure of MSIV Standby SOVs (B) for ABHV011, 014 & 020
		SVMSVBSDB-CCF134	8.45E-06	CC Failure of MSIV Standby SOVs (B) for ABHV011, 017 & 020
		SVMSVBSDB-CCF234	8.45E-06	CC Failure of MSIV Standby SOVs (B) for ABHV014, 017 & 020
		SVMSVBSDB-CCF1-4	2.75E-05	Global CCF of MSIV Standby SOVs (B) for ABHV11, 14, 17 & 20

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Ider fier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
XXAB------MS2-CM	4.24E-05	HVC114720-CCF12	3.57E-05	Common Cause Failure (FTC) of MSIVs ABHV0011 & 0014
(B)		HVC114720-CCF13	3.57E-05	Common Cause Failure (FTC) of MSIVs ABHV0011 & 0017
		HVC114720-CCF14	3.57E-05	Common Cause Failure (FTC) of MSIVs ABHV0011 & 0020
		HVC114720-CCF23	3.57E-05	Common Cause Failure (FTC) of MSIVs ABHV0014 & 0017
		HVC114720-CCF24	3.57E-05	Common Cause Failure (FTC) of MSIVs ABHV0014 & 0020
		HVC114720-CCF34	3.57E-05	Common Cause Failure (FTC) of MSIVs ABHV0017 & 0020
		HVC114720-CCF123	8.45E-06	Common Cause Failure (FTC) of MSIVs ABHV0011, 0014 & 0017
		HVC114720-CCF124	8.45E-06	Common Cause Failure (FTC) of MSIVs ABHV0011, 0014 & 0020
		HVC114720-CCF134	8.45E-06	Common Cause Failure (FTC) of MSIVs ABHV0011, 0017 & 0020
		HVC114720-CCF234	8.45E-06	Common Cause Failure (FTC) of MSIVs ABHV0014, 0017 & 0020
		HVC114720-CCF1-4	2.75E-05	Global CC Failure (FTC) of MSIVs ABHV0011, 0014, 0017 & 0020
XXAB------MS2-CM	4.24E-05	SVMSVAACT-CCF12	3.57E-05	CC Failure of MSIV Active SOVs (A) for ABHV0011 & 0014
(B)		SVMSVAACT-CCF13	3.57E-05	CC Failure of MSIV Active SOVs (A) for ABHV0011 & 0017
		SVMSVAACT-CCF14	3.57E-05	CC Failure of MSIV Active SOVs (A) for ABHV0011 & 0020
		SVMSVAACT-CCF23	3.57E-05	CC Failure of MSIV Active SOVs (A) for ABHV0014 & 0017
		SVMSVAACT-CCF24	3.57E-05	CC Failure of MSIV Active SOVs (A) for ABHV0014 & 0020
		SVMSVAACT-CCF34	3.57E-05	CC Failure of MSIV Active SOVs (A) for ABHV0017 & 0020
		SVMSVAACT-CCF123	8.45E-06	CC Failure of MSIV Active SOVs (A) for ABHV0011, 0014 & 0017
		SVMSVAACT-CCF124	8.45E-06	CC Failure of MSIV Active SOVs (A) for ABHV0011, 0014 & 0020
		SVMSVAACT-CCF134	8.45E-06	CC Failure of MSIV Active SOVs (A) for ABHV0011, 0017 & 0020
		SVMSVAACT-CCF234	8.45E-06	CC Failure of MSIV Active SOVs (A) for ABHV0014, 0017 & 0020
		SVMSVAACT-CCF1-4	2.75E-05	Global CCF of MSIV Active SOVs (A) for ABHV1[illegible] 14, 17 & 20

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
XXAB------MS2-CM	4.24E-05	SVMSVASDB-CCF12	3.57E-05	CC Failure of MSIV Standby SOVs (A) for ABHV0011 & 0014
(B)		SVMSVASDB-CCF13	3.57E-05	CC Failure of MSIV Standby SOVs (A) for ABHV0011 & 0017
		SVMSVASDB-CCF14	3.57E-05	CC Failure of MSIV Standby SOVs (A) for ABHV0011 & 0020
		SVMSVASDB-CCF23	3.57E-05	CC Failure of MSIV Standby SOVs (A) for ABHV0014 & 0017
		SVMSVASDB-CCF24	3.57E-05	CC Failure of MSIV Standby SOVs (A) for ABHV0014 & 0020
		SVMSVASDB-CCF34	3.57E-05	CC Failure of MSIV Standby SOVs (A) for ABHV0017 & 0020
		SVMSVASDB-CCF123	8.45E-06	CC Failure of MSIV Standby SOVs (A) for ABHV0011, 0014 & 017
		SVMSVASDB-CCF124	8.45E-06	CC Failure of MSIV Standby SOVs (A) for ABHV0011, 0014 & 020
		SVMSVASDB-CCF134	8.45E-06	CC Failure of MSIV Standby SOVs (A) for ABHV0011, 0017 & 020
		SVMSVASDB-CCF234	8.45E-06	CC Failure of MSIV Standby SOVs (A) for ABHV0014, 0017 & 020
		SVMSVASDB-CCF1-4	2.75E-05	Global CCF of MSIV Standby SOVs (A) for ABHV11, 14, 17 & 20
PVAB--SRVA2-5-CM	1.80E-07	PVSRVA2-5-CCF25	1.07E-06	Common Cause Failure of 2 out of 5 Main Steam Safety Vlvs - SG A
PVAB--SRVA4-5-CM	3.20E-08	PVSRVA4-5-CCF45	4.09E-07	Common Cause Failure of 4 out of 5 Main Steam Safety Vlvs - SG A
PVAB--SRVB2-5-CM	1.80E-07	PVSRVB2-5-CCF25	1.07E-06	Common Cause Failure of 2 out of 5 Main Steam Safety Vlvs - SG B
PVAB--SRVB4-5-CM	3.20E-08	PVSRVB4-5-CCF45	4.09E-07	Common Cause Failure of 4 out of 5 Main Steam Safety Vlvs - SG B
PVAB--SRVC2-5-CM	1.80E-07	PVSRVC2-5-CCF25	1.07E-06	Common Cause Failure of 2 out of 5 Main Steam Safety Vlvs - SG C
PVAB--SRVC4-5-CM	3.20E-08	PVSRVC4-5-CCF45	4.09E-07	Common Cause Failure of 4 out of 5 Main Steam Safety Vlvs - SG C
PVAB--SRVD2-5-CM	1.80E-07	PVSRVD2-5-CCF25	1.07E-06	Common Cause Failure of 2 out of 5 Main Steam Safety Vlvs - SG D
PVAB--SRVD4-5-CM	3.20E-08	PVSRVD4-5-CCF45	4.09E-07	Common Cause Failure of 4 out of 5 Main Steam Safety Vlvs - SG D
AVAD-LV79BABB-CM	1.40E-05	AVAD79ABB-CCF12	1.60E-04	Common Cause Failure of AOVs ADLV0079BA & ADLV0079BB
XXAD-CONDSSYS-CM	1.87E-05	XXAD-COND-CCF12	7.74E-05	Common Cause Failures of the Condensate System

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
XXAL------AF2-CM	1.09E-06	CVA124567-CCF12	1.34E-06	Common Cause Failure of CVs AEV0124 & AEV0125
(B)		CVA124567-CCF13	1.34E-06	Common Cause Failure of CVs AEV0124 & AEV0126
		CVA124567-CCF14	1.34E-06	Common Cause Failure of CVs AEV0124 & AEV0127
		CVA124567-CCF23	1.34E-06	Common Cause Failure of CVs AEV0125 & AEV0126
		CVA124567-CCF24	1.34E-06	Common Cause Failure of CVs AEV0125 & AEV0127
		CVA124567-CCF34	1.34E-06	Common Cause Failure of CVs AEV0126 & AEV0127
		CVA124567-CCF123	3.16E-07	Common Cause Failure of CVs AEV0124, 0125 & 0126
		CVA124567-CCF124	3.16E-07	Common Cause Failure of CVs AEV0124, 0125 & 0127
		CVA124567-CCF134	3.16E-07	Common Cause Failure of CVs AEV0124, 0126 & 0127
		CVA124567-CCF234	3.16E-07	Common Cause Failure of CVs AEV0125, 0126 & 0127
		CVA124567-CCF1-4	1.03E-06	Global CC Failure of CVs AEV0124, 0125, 0126 & 0127
MVAE-HV017018-CM	9.12E-09	MVHV01718-CCF12	9.12E-08	Common Cause Failure of MOVs AEHV0017 & AEHV0018
MVAE-HV033034-CM	9.12E-09	MVHV03334-CCF12	9.12E-08	Common Cause Failure of MOVs AEHV0033 & AEHV0034
XXAE------MF1-CM	4.40E-05	XXAE--MF1-CCF12	1.91E-04	Common Cause Failure of the Main Feedwater System
XXAL------AFT-CM	1.44E-06	AVAL68102-CCF12	6.43E-08	Common Cause Failure of AOVs ALHV0006 & ALHV0008
(B)		AVAL68102-CCF13	6.43E-08	Common Cause Failure of AOVs ALHV0006 & ALHV0010
		AVAL68102-CCF14	6.43E-08	Common Cause Failure of AOVs ALHV0006 & ALHV0012
		AVAL68102-CCF23	6.43E-08	Common Cause Failure of AOVs ALHV0008 & ALHV0010
		AVAL68102-CCF24	6.43E-08	Common Cause Failure of AOVs ALHV0008 & ALHV0012
		AVAL68102-CCF34	6.43E-08	Common Cause Failure of AOVs ALHV0010 & ALHV0012
		AVAL68102-CCF123	1.52E-08	Common Cause Failure of AOVs ALHV0006, 0008 & 0010
		AVAL68102-CCF124	1.52E-08	Common Cause Failure of AOVs ALHV0006, 0008 & 0012
		AVAL68102-CCF134	1.52E-08	Common Cause Failure of AOVs ALHV0006, 0010 & 0012
		AVAL68102-CCF234	1.52E-08	Common Cause Failure of AOVs ALHV0008, 0010 & 0012
		AVAL68102-CCF1-4	4.94E-08	Global CC Failure of AOVs ALHV0006, 0008, 0010 & 0012

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
CVAL-V0001002-CM	2.10E-07	CVA010203-CCF12	2.01E-06	Common Cause Failure (FTO) of CVs ALV0001 & 0002
CVAL-V0001003-CM	2.10E-07	CVA010203-CCF13	2.01E-06	Common Cause Failure (FTO) of CVs ALV0001 & 0003
CVAL-V0002003-CM	2.10E-07	CVA010203-CCF23	2.01E-06	Common Cause Failure (FTO) of CVs ALV0002 & 0003
		CVA010203-CCF123	1.98E-06	Global CC Failure (FTO) of CVs ALV0001, 0002 & 0003
(A)		CVO010203-CCF12	2.01E-05	Common Cause Failure (FTRC) of CVs ALV0001 & 0002
		CVO010203-CCF13	2.01E-05	Common Cause Failure (FTRC) of CVs ALV0001 & 0003
		CVO010203-CCF23	2.01E-05	Common Cause Failure (FTRC) of CVs ALV0002 & 0003
		CVO010203-CCF123	1.98E-05	Global CC Failure (FTRC) of CVs ALV0001, 0002 & 0003
(A)		CVA691215-CCF12	1.34E-06	Common Cause Failure of CVs ALV0006 & ALV0009
		CVA691215-CCF13	1.34E-06	Common Cause Failure of CVs ALV0006 & ALV0012
		CVA691215-CCF14	1.34E-06	Common Cause Failure of CVs ALV0006 & ALV0015
		CVA691215-CCF23	1.34E-06	Common Cause Failure of CVs ALV0009 & ALV0012
		CVA691215-CCF24	1.34E-06	Common Cause Failure of CVs ALV0009 & ALV0015
		CVA691215-CCF34	1.34E-06	Common Cause Failure of CVs ALV0012 & ALV0015
		CVA691215-CCF123	3.17E-07	Common Cause Failure of CVs ALV0006, 0009 & 0012
		CVA691215-CCF124	3.17E-07	Common Cause Failure of CVs ALV0006, 0009 & 0015
		CVA691215-CCF134	3.17E-07	Common Cause Failure of CVs ALV0006, 0012 & 0015
		CVA691215-CCF234	3.17E-07	Common Cause Failure of CVs ALV0009, 0012 & 0015
		CVA691215-CCF1-4	1.03E-06	Global CC Failure of CVs ALV0006, 0009, 0012 & 0015
CVAL-V0030042-CM	2.10E-07	CVA304254-CCF12	2.01E-06	Common Cause Failure (FTO) of CVs ALV0030 & 0042
CVAL-V0030054-CM	2.10E-07	CVA304254-CCF13	2.01E-06	Common Cause Failure (FTO) of CVs ALV0030 & 0054
CVAL-V0042054-CM	2.10E-07	CVA304254-CCF23	2.01E-06	Common Cause Failure (FTO) of CVs ALV0042 & 0054
		CVA304254-CCF123	1.98E-06	Global CC Failure (FTO) of CVs ALV0030, 0042 & 0054

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
XXAL------AF2-CM	1.09E-06	CVA336458-CCF12	1.34E-06	Common Cause Failure of CVs ALV0033 & ALV0036
(B)		CVA336458-CCF13	1.34E-06	Common Cause Failure of CVs ALV0033 & ALV0045
		CVA336458-CCF14	1.34E-06	Common Cause Failure of CVs ALV0033 & ALV0048
		CVA336458-CCF23	1.34E-06	Common Cause Failure of CVs ALV0036 & ALV0045
		CVA336458-CCF24	1.34E-06	Common Cause Failure of CVs ALV0036 & ALV0048
		CVA336458-CCF34	1.34E-06	Common Cause Failure of CVs ALV0045 & ALV0048
		CVA336458-CCF123	3.16E-07	Common Cause Failure of CVs ALV0033, 0036 & 0045
		CVA336458-CCF124	3.16E-07	Common Cause Failure of CVs ALV0033, 0036 & 0048
		CVA336458-CCF134	3.16E-07	Common Cause Failure of CVs ALV0033, 0045 & 0048
		CVA336458-CCF234	3.16E-07	Common Cause Failure of CVs ALV0036, 0045 & 0048
		CVA336458-CCF1-4	1.03E-06	Global CC Failure of CVs ALV0033, 0036, 0045 & 0048
XXAL------AF2-CM	1.09E-06	CVA576272-CCF12	1.34E-06	Common Cause Failure of CVs ALV0057 & ALV0062
(B)		CVA576272-CCF13	1.34E-06	Common Cause Failure of CVs ALV0057 & ALV0067
		CVA576272-CCF14	1.34E-06	Common Cause Failure of CVs ALV0057 & ALV0072
		CVA576272-CCF23	1.34E-06	Common Cause Failure of CVs ALV0062 & ALV0067
		CVA576272-CCF24	1.34E-06	Common Cause Failure of CVs ALV0062 & ALV0072
		CVA576272-CCF34	1.34E-06	Common Cause Failure of CVs ALV0067 & ALV0072
		CVA576272-CCF123	3.16E-07	Common Cause Failure of CVs ALV0057, 0062 & 0067
		CVA576272-CCF124	3.16E-07	Common Cause Failure of CVs ALV0057, 0062 & 0072
		CVA576272-CCF134	3.16E-07	Common Cause Failure of CVs ALV0057, 0067 & 0072
		CVA576272-CCF234	3.16E-07	Common Cause Failure of CVs ALV0062, 0067 & 0072
		CVA576272-CCF1-4	1.03E-06	Global CC Failure of CVs ALV0057, 0062, 0067 & 0072
MPAL--PAL01AB-CM	3.63E-05	MPPAL01AB-CCF12	5.07E-05	Common Cause Failure of MDAFW Pumps PAL01A & B

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
XX4L------AF2-CM	1.09E-06	MVAL57911-CCF12	1.10E-06	Common Cause Failure of MOVs ALHV0005 & ALHV0007
(B)		MVAL57911-CCF13	1.10E-06	Common Cause Failure of MOVs ALHV0005 & ALHV0009
		MVAL57911-CCF14	1.10E-06	Common Cause Failure of MOVs ALHV0005 & ALHV0011
		MVAL57911-CCF23	1.10E-06	Common Cause Failure of MOVs ALHV0007 & ALHV0009
		MVAL57911-CCF24	1.10E-06	Common Cause Failure of MOVs ALHV0007 & ALHV0011
		MVAL57911-CCF34	1.10E-06	Common Cause Failure of MOVs ALHV0009 & ALHV0011
		MVAL57911-CCF123	1.02E-07	Common Cause Failure of MOVs ALHV0005, 0007 & 0009
		MVAL57911-CCF124	1.02E-07	Common Cause Failure of MOVs ALHV0005, 0007 & 0011
		MVAL57911-CCF134	1.02E-07	Common Cause Failure of MOVs ALHV0005, 0009 & 0011
		MVAL57911-CCF234	1.02E-07	Common Cause Failure of MOVs ALHV0007, 0009 & 0011
		MVAL57911-CCF1-4	6.81E-07	Global CC Failure of MOVs ALHV0005, 0007, 0009 & 0011
(A)		MVAL30123-CCF12	3.62E-05	Common Cause Failure of MOVs ALHV0030 & ALHV0031
		MVAL30123-CCF13	3.62E-05	Common Cause Failure of MOVs ALHV0030 & ALHV0032
		MVAL30123-CCF14	3.62E-05	Common Cause Failure of MOVs ALHV0030 & ALHV0033
		MVAL30123-CCF23	3.62E-05	Common Cause Failure of MOVs ALHV0031 & ALHV0032
		MVAL30123-CCF24	3.62E-05	Common Cause Failure of MOVs ALHV0031 & ALHV0033
		MVAL30123-CCF34	3.62E-05	Common Cause Failure of MOVs ALHV0032 & ALHV0033
		MVAL30123-CCF123	3.35E-06	Common Cause Failure of MOVs ALHV0030, 0031 & 0032
		MVAL30123-CCF124	3.35E-06	Common Cause Failure of MOVs ALHV0030, 0031 & 0033
		MVAL30123-CCF134	3.35E-06	Common Cause Failure of MOVs ALHV0030, 0032 & 0033
		MVAL30123-CCF234	3.35E-06	Common Cause Failure of MOVs ALHV0031, 0032 & 0033
		MVAL30123-CCF1-4	2.24E-05	Global CC Failure of MOVs ALHV0030, 0031, 0032 & 0033
MVAL-HV034035-CM	8.76E-09	MVAL34356-CCF12	5.27E-08	Common Cause Failure (FTRO) of MOVs ALHV0034 & 0035
MVAL-HV034036-CM	8.76E-09	MVAL34356-CCF13	5.27E-08	Common Cause Failure (FTRO) of MOVs ALHV0034 & 0036
MVAL-HV035036-CM	8.76E-09	MVAL34356-CCF23	5.27E-08	Common Cause Failure (FTRO) of MOVs ALHV0035 & 0036
		MVAL34356-CCF123	3.15E-08	Global CC Failure (FTRO) of MOVs ALHV0034, 0035 & 0036

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
(A)		MVAO34356-CCF12	5.43E-05	Common Cause Failure (FTC) of MOVs ALHV0034 & 0035
		MVAO34356-CCF13	5.43E-05	Common Cause Failure (FTC) of MOVs ALHV0034 & 0036
		MVAO34356-CCF23	5.43E-05	Common Cause Failure (FTC) of MOVs ALHV0035 & 0036
		MVAO34356-CCF123	3.24E-05	Global CC Failure (FTC) of MOVs ALHV0034, 0035 & 0036
CVBB-8948ABCD-CM	1.40E-06	CVB8948AD-CCF12	1.34E-06	Common Cause Failure of CVs BB8948A & BB8948B
(B)		CVB8948AD-CCF13	1.34E-06	Common Cause Failure of CVs BB8948A & BB8948C
		CVB8948AD-CCF14	1.34E-06	Common Cause Failure of CVs BB8948A & BB8948D
		CVB8948AD-CCF23	1.34E-06	Common Cause Failure of CVs BB8948B & BB8948C
		CVB8948AD-CCF24	1.34E-06	Common Cause Failure of CVs BB8948B & BB8948D
		CVB8948AD-CCF34	1.34E-06	Common Cause Failure of CVs BB8948C & BB8948D
		CVB8948AD-CCF123	3.17E-07	Common Cause Failure of CVs BB8948A, B & C
		CVB8948AD-CCF124	3.17E-07	Common Cause Failure of CVs BB8948A, B, & D
		CVB8948AD-CCF134	3.17E-07	Common Cause Failure of CVs BB8948A, C & D
		CVB8948AD-CCF234	3.17E-07	Common Cause Failure of CVs BB8948B, C & D
		CVB8948AD-CCF1-4	1.03E-06	Global CC Failure of CVs BB8948A, B, C & D
CVBB-V1224059-CM	1.40E-06	CVB122459-CCF12	1.34E-06	Common Cause Failure of CVs BBV0001 & BBV0022
(B)		CVB122459-CCF13	1.34E-06	Common Cause Failure of CVs BBV0001 & BBV0040
		CVB122459-CCF14	1.34E-06	Common Cause Failure of CVs BBV0001 & BBV0059
		CVB122459-CCF23	1.34E-06	Common Cause Failure of CVs BBV0022 & BBV0040
		CVB122459-CCF24	1.34E-06	Common Cause Failure of CVs BBV0022 & BBV0059
		CVB122459-CCF34	1.34E-06	Common Cause Failure of CVs BBV0040 & BBV0059
		CVB122459-CCF123	3.17E-07	Common Cause Failure of CVs BBV0001, 0022 & 0040
		CVB122459-CCF124	3.17E-07	Common Cause Failure of CVs BBV0001, 0022 & 0059
		CVB122459-CCF134	3.17E-07	Common Cause Failure of CVs BBV0001, 0040 & 0059
		CVB122459-CCF234	3.17E-07	Common Cause Failure of CVs BBV0022, 0040 & 0059
		CVB122459-CCF1-4	1.03E-06	Global CC Failure of CVs BBV0001, 0022, 0040 & 0059

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
PVBB---PRC-CM	1.26E-07	PV8010ABC-CCF12	1.60E-07	Common Cause Failure of Press Safety Vlvs BBPV8010A & B
(B)		PV8010ABC-CCF13	1.60E-07	Common Cause Failure of Press Safety Vlvs BBPV8010A & C
		PV8010ABC-CCF23	1.60E-07	Common Cause Failure of Press Safety Vlvs BBPV8010B & C
		PV8010ABC-CCF123	6.20E-07	Global CC Failure of Press Safety Valves BBPV8010A, B & C
SVBB-PCV4556A-CM	1.40E-05	SVBB4556A-CCF12	1.60E-04	Common Cause Failure of Press PORVs BBPCV0455A & 0456A
CVBG---8481AB-CM	2.90E-07	CV-8481AB-CCF12	6.00E-06	Common Cause Failure of CVs BG8481A & BG8481B
CVBG---8546AB-CM	2.90E-07	CV-8546AB-CCF12	6.00E-06	Common Cause Failure (FTO) of CVs BG85346A & BG8546B
CVBGR--8546AB-CM	2.90E-06	CVC8546AB-CCF12	6.00E-05	Common Cause Failure (FTC) of CVs BG8546A & BG8546B
CVBG-V0147165-CM	2.90E-07	CVV147165-CCF12	6.00E-06	Common Cause Failure of CVs BGV0147 & BGV0165
(A)		CV-V58990-CCF12	6.00E-06	Common Cause Failure of CVs BGV0589 & BGV0590
MPBG--PBG02AB-CM	5.58E-05	MPPBG02AB-CCF12	2.98E-04	Common Cause Failure of BAT Pumps PBG02A & B
MPBG--PBG05AB-CM	5.70E-05	MPPBG05AB-CCF12	1.78E-04	Common Cause Failure of Centrif Charging Pumps PBG05A & B
MVBG-HV810506-CM	1.41E-05	MVBG81056-CCF12	1.41E-04	Common Cause Failure (FTC) of MOVs BGHV8105 & 8106
MVBGSDHV81056-CM	1.41E-05	MVHV81056-CCF12	1.41E-04	Common Cause Failure (FTO) of MOVs BGHV8105 & 8106
MVBGI-HV81101-CM	1.41E-05	MVBG81101-CCF12	1.41E-04	Common Cause Failure of MOVs BGHV8110 & 8111
MVBGILCV112BC-CM	1.41E-05	MVBG112BC-CCF12	1.41E-04	Common Cause Failure of MOVs BGLCV0112B & C
(A)		SVB8357AB-CCF12	1.60E-04	Common Cause Failure of SOVs BGHV8357A & B
(A)		SVBM03ABC-CCF12	5.36E-05	Common Cause Failure of SOVs BMHY0003A & B
		SVBM03ABC-CCF13	5.36E-05	Common Cause Failure of SOVs BMHY0003A & C
		SVBM03ABC-CCF23	5.36E-05	Common Cause Failure of SOVs BMHY0003B & C
		SVBM03ABC-CCF123	5.28E-05	Global CC Failure of SOVs BMHY0003A, B & C
MVBNRHV8806AB-CM	1.41E-05	MVC8806AB-CCF12	1.41E-04	Common Cause Failure (FTC) of MOVs BNHV8806A & B
MVBNIHV8806AB-CM	4.75E-09	MV-8806AB-CCF12	4.75E-08	Common Cause Failure (FTRO) of MOVs BNHV8806A & B
MVBN-HV8812AB-CM	1.41E-05	MVB8812AB-CCF12	1.41E-04	Common Cause Failure (FTC) of MOVs BNHV8812A & B
MVBNIHV8812AB-CM	4.75E-09	MV-8812AB-CCF12	4.75E-08	Common Cause Failure (FTRO) of MOVs BNHV8812A & B
MVBNILCV112DE-CM	1.41E-05	MVBN112DE-CCF12	1.41E-04	Common Cause Failure (FTO) of MOVs BNLCV0112D & E

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
MVBNRLCV112DE-CM	1.41E-05	MVC-112DE-CCF12	1.41E-04	Common Cause Failure (FTC) of MOVs BNLCV0112D & E
CVEF-V0001004-CM	2.90E-07	CVEF-V14-CCCF12	6.00E-06	Common Cause Failure of CVs EFV0001 & EFV0004
FLEF--FEF01AB-CM	1.13E-05	FLFEF01AB-CCF12	1.30E-04	Common Cause Failure of Traveling Screens FEF01A & B
MPEF--PEF01AB-CM	2.90E-05	MPPEF01AB-CCF12	7.73E-05	Common Cause Failure of ESW Pumps PEF01A & B
		MVHV23456-CCF12	3.62E-05	Common Cause Failure of MOVs EFHV0023 & 0024
MVEF-HV002325-CM	6.89E-06	MVHV23456-CCF13	3.62E-05	Common Cause Failure of MOVs EFHV0023 & 0025
		MVHV23456-CCF14	3.62E-05	Common Cause Failure of MOVs EFHV0023 & 0026
		MVHV23456-CCF23	3.62E-05	Common Cause Failure of MOVs EFHV0024 & 0025
MVEF-HV002426-CM	6.89E-06	MVHV23456-CCF24	3.62E-05	Common Cause Failure of MOVs EFHV0024 & 0026
		MVHV23456-CCF34	3.62E-05	Common Cause Failure of MOVs EFHV0025 & 0026
		MVHV23456-CCF123	3.35E-06	Common Cause Failure of MOVs EFHV0023, 0024 & 0025
		MVHV23456-CCF124	3.35E-06	Common Cause Failure of MOVs EFHV0023, 0024 & 0026
		MVHV23456-CCF134	3.35E-06	Common Cause Failure of MOVs EFHV0023, 0025 & 0026
		MVHV23456-CCF234	3.35E-06	Common Cause Failure of MOVs EFHV0024, 0025 & 0026
MVEF-HV023456-CM	3.01E-06	MVHV23456-CCF1-4	2.24E-05	Global CC Failure of MOVs EFHV0023, 0024, 0025 & 0026
MVEF-HV003738-CM	1.41E-05	MVHV3738--CCF12	1.41E-04	Common Cause Failure of MOVs EFHV0037 & 0038
MVEF-HV009192-CM	1.41E-05	MVHV00912-CCF12	1.41E-04	Common Cause Failure of MOVs EFHV0091 & 0092

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
AVEG-HV0069AB-CM	3.62E-06	AVHV6970--CCF12	3.57E-05	Common Cause Failure of AOVs EGHV0069A & EGHV0069B
		AVHV6970--CCF13	3.57E-05	Common Cause Failure of AOVs EGHV0069A & EGHV0070A
		AVHV6970--CCF14	3.57E-05	Common Cause Failure of AOVs EGHV0069A & EGHV0070B
		AVHV6970--CCF23	3.57E-05	Common Cause Failure of AOVs EGHV0069B & EGHV0070A
		AVHV6970--CCF24	3.57E-05	Common Cause Failure of AOVs EGHV0069B & EGHV0070B
AVEG-HV0070AB-CM	3.62E-06	AVHV6970--CCF34	3.57E-05	Common Cause Failure of AOVs EGHV0070A & EGHV0070B
		AVHV6970--CCF123	8.45E-06	Common Cause Failure of AOVs EGHV0069A, B & EGHV0070A
		AVHV6970--CCF124	8.45E-06	Common Cause Failure of AOVs EGHV0069A, B & EGHV0070B
		AVHV6970--CCF134	8.45E-06	Common Cause Failure of AOVs EGHV0069A, EGHV0070A & B
		AVHV6970--CCF234	8.45E-06	Common Cause Failure of AOVs EGHV0069B, EGHV0070A & B
AVEG---HV6970-CM	6.43E-06	AVHV6970--CCF1-4	2.75E-05	Global CC Failure of AOVs EGHV0069A, B, EGHV0070A & B
		CVV371216-CCF12	1.34E-06	Common Cause Failure of CVs EGV0003 & EGV0007
		CVV371216-CCF13	1.34E-06	Common Cause Failure of CVs EGV0003 & EGV0012
		CVV371216-CCF14	1.34E-06	Common Cause Failure of CVs EGV0003 & EGV0016
		CVV371216-CCF23	1.34E-06	Common Cause Failure of CVs EGV0007 & EGV0012
		CVV371216-CCF24	1.34E-06	Common Cause Failure of CVs EGV0007 & EGV0016
CVEG--V001216-CM	2.90E-07	CVV371216-CCF34	1.34E-06	Common Cause Failure of CVs EGV0012 & EGV0016
		CVV371216-CCF123	3.17E-07	Common Cause Failure of CVs EGV0003, 0007 & 0012
		CVV371216-CCF124	3.17E-07	Common Cause Failure of CVs EGV0003, 0007 & 0016
		CVV371216-CCF134	3.17E-07	Common Cause Failure of CVs EGV0003, 0012 & 0016
		CVV371216-CCF234	3.17E-07	Common Cause Failure of CVs EGV0007, 0012 & 0016
		CVV371216-CCF1-4	1.03E-06	Global CC Failure of CVs EGV0003, 0007, 0012 & 0016

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
		MPPEG01AD-CCF12	9.53E-06	Common Cause Failure of CCW Pumps PEG01A & PEG01B
		MPPEG01AD-CCF13	9.53E-06	Common Cause Failure of CCW Pumps PEG01A & PEG01C
		MPPEG01AD-CCF14	9.53E-06	Common Cause Failure of CCW Pumps PEG01A & PEG01D
		MPPEG01AD-CCF23	9.53E-06	Common Cause Failure of CCW Pumps PEG01B & PEG01C
MPEG--PEG01BD-CM	5.16E-06	MPPEG01AD-CCF24	9.53E-06	Common Cause Failure of CCW Pumps PEG01B & PEG01D
		MPPEG01AD-CCF34	9.53E-06	Common Cause Failure of CCW Pumps PEG01C & PEG01D
		MPPEG01AD-CCF123	2.60E-06	Common Cause Failure of CCW Pumps PEG01A, B & C
		MPPEG01AD-CCF124	2.60E-06	Common Cause Failure of CCW Pumps PEG01A, B & D
		MPPEG01AD-CCF134	2.60E-06	Common Cause Failure of CCW Pumps PEG01A, C & D
		MPPEG01AD-CCF234	2.60E-06	Common Cause Failure of CCW Pumps PEG01B, C & D
		MPPEG01AD-CCF1-4	4.09E-05	Global CC Failure of CCW Pumps PEG01A, B, C & D
MVEGRHV010102-CM	1.41E-05	MVEG10102-CCF12	1.41E-04	Common Cause Failure of MOVs EGHV0101 & 0102
AVEJRFCV61819-CM	8.05E-08	AVFCV6189-CCF12	9.20E-07	Common Cause Failure of AOVs EJFCV0618 & EJFCV0619
AVEJIHCV60607-CM	2.50E-08	AVEJ60607-CCF12	2.88E-07	Common Cause Failure of AOVs EJHCV0606 & EJHCV0607
CVEJ---8730AB-CM	2.90E-07	CV-8730AB-CCF12	6.00E-06	Common Cause Failure of CVs EJ8730A & EJ8730B
CVEJ---8958AB-CM	2.90E-07	CV-8958AB-CCF12	6.00E-06	Common Cause Failure of CVs EJ8958A & EJ8958B
CVEJ---8969AB-CM	2.90E-07	CV-8969AB-CCF12	6.00E-06	Common Cause Failure of CVs EJ8969A & EJ8969B
MPEJ--PEJ01AB-CM	8.19E-06	MPPEJ01AB-CCF12	1.37E-04	Common Cause Failure of RHR Pumps PEJ01A & B

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
MVEJ-HV87012A-CM	6.87E-06	MV87012AB-CCF12	3.62E-05	Common Cause Failure of MOVs EJHV8701A & BBPV8702A
		MV87012AB-CCF13	3.62E-05	Common Cause Failure of MOVs EJHV8701A & B
		MV87012AB-CCF14	3.62E-05	Common Cause Failure of MOVs EJHV8701A & BBPV8702B
		MV87012AB-CCF23	3.62E-05	Common Cause Failure of MOVs BBPV8702A & EJHV8701B
		MV87012AB-CCF24	3.62E-05	Common Cause Failure of MOVs BBPV8702A & B
MVEJ-HV87012B-CM	6.87E-06	MV87012AB-CCF34	3.62E-05	Common Cause Failure of MOVs EJHV8701B & BBPV8702B
		MV87012AB-CCF123	3.35E-06	Common Cause Failure of MOVs EJHV8701A, B & BBPV8702A
		MV87012AB-CCF124	3.35E-06	Common Cause Failure of MOVs EJHV8701A, BBPV8702A & B
		MV87012AB-CCF134	3.35E-06	Common Cause Failure of MOVs EJHV8701A, B & BBPV8702B
		MV87012AB-CCF234	3.35E-06	Common Cause Failure of MOVs BBPV8702A, B & EJHV8701B
MVEJR-HV87012-CM	3.01E-06	MV87012AB-CCF1-4	2.24E-05	Global CC Failure of MOVs EJHV8701A & B, BBPV8702A & B
MVEJ-HV8716AB-CM	1.41E-05	MVE8716AB-CCF12	1.41E-04	Common Cause Failure of MOVs EJHV8716A & B
MVEJ-HV8804AB-CM	1.41E-05	MV-8804AB-CCF12	1.41E-04	Common Cause Failure of MOVs EJHV8804A & B
MVEJ-HV8811AB-CM	1.41E-05	MVE8811AB-CCF12	1.41E-04	Common Cause Failure of MOVs EJHV8811A & B
MVEJIFCV61011-CM	1.50E-07	MVEJ61011-CCF12	1.50E-06	Common Cause Failure of MOVs EJFCV0610 & 0611
CVEM---8922AB-CM	2.90E-07	CV-8922AB-CCF12	6.00E-06	Common Cause Failure of CVs EM8922A & EM8922B
CVEM---8926AB-CM	2.90E-07	CV-8926AB-CCF12	6.00E-06	Common Cause Failure (FTO) of CVs EM8926A & EM8926B
CVEMR--8926AB-CM	2.90E-06	CVC8926AB-CCF12	6.00E-05	Common Cause Failure (FTC) of CVs EM8926A & EM8926B
CVEM-V0005007-CM	2.90E-07	CV-005007-CCF12	6.00E-06	Common Cause Failure of CVs EMV0005 & EMV0007
MPEM--PEM01AB-CM	5.70E-05	MPPEM01AB-CCF12	1.78E-04	Common Cause Failure of SI Pumps PEM01A & B
MVEMIHV8801AB-CM	1.41E-05	MV-8801AB-CCF12	1.41E-04	Common Cause Failure of MOVs EMHV8801A & B
MVEMIHV8803AB-CM	1.41E-05	MV-8803AB-CCF12	1.41E-04	Common Cause Failure of MOVs EMHV8803A & B
MVEM-HV8807AB-CM	1.41E-05	MV-8807AB-CCF12	1.41E-04	Common Cause Failure of MOVs EMHV8807A & B
MVEMIHV8814AB-CM	4.75E-09	MV-8814AB-CCF12	4.75E-08	Common Cause Failure (FTRO) of MOVs EMHV8814A & B
MVEMRHV8814AB-CM	1.41E-05	MVC8814AB-CCF12	1.41E-04	Common Cause Failure (FTC) of MOVs EMHV8814A & B
MVEMIHV8821AB-CM	1.37E-08	MV-8821AB-CCF12	1.37E-07	Common Cause Failure of MOVs EMHV8821A & B

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
MVEMIHV8923AB-CM	1.37E-08	MV-8923AB-CCF12	1.37E-07	Common Cause Failure of MOVs EMHV8923A & B
CVEP-8818ABCD-CM	1.40E-06	CVE8818AD-CCF12	1.34E-06	Common Cause Failure (FTO) of CVs EP8818A & EP8818B
(B)		CVE8818AD-CCF13	1.34E-06	Common Cause Failure (FTO) of CVs EP8818A & EP8818C
		CVE8818AD-CCF14	1.34E-06	Common Cause Failure (FTO) of CVs EP8818A & EP8818D
		CVE8818AD-CCF23	1.34E-06	Common Cause Failure (FTO) of CVs EP8818B & EP8818C
		CVE8818AD-CCF24	1.34E-06	Common Cause Failure (FTO) of CVs EP8818B & EP8818D
		CVE8818AD-CCF34	1.34E-06	Common Cause Failure (FTO) of CVs EP8818C & EP8818D
		CVE8818AD-CCF123	3.17E-07	Common Cause Failure (FTO) of CVs EP8818A, 8818B & 8818C
		CVE8818AD-CCF124	3.17E-07	Common Cause Failure (FTO) of CVs EP8818A, 8818B & 8818D
		CVE8818AD-CCF134	3.17E-07	Common Cause Failure (FTO) of CVs EP8818A, 8818C & 8818D
		CVE8818AD-CCF234	3.17E-07	Common Cause Failure (FTO) of CVs EP8818B, 8818C & 8818D
		CVE8818AD-CCF1-4	1.03E-06	Global CC Failure (FTO) of CVs EP8818A, 8818B, 8818C & 8818D
(A)		CVC8818AD-CCF12	1.34E-05	Common Cause Failure (FTRC) of CVs EP8818A & EP8818B
		CVC8818AD-CCF13	1.34E-05	Common Cause Failure (FTRC) of CVs EP8818A & EP8818C
		CVC8818AD-CCF14	1.34E-05	Common Cause Failure (FTRC) of CVs EP8818A & EP8818D
		CVC8818AD-CCF23	1.34E-05	Common Cause Failure (FTRC) of CVs EP8818B & EP8818C
		CVC8818AD-CCF24	1.34E-05	Common Cause Failure (FTRC) of CVs EP8818B & EP8818D
		CVC8818AD-CCF34	1.34E-05	Common Cause Failure (FTRC) of CVs EP8818C & EP8818D
		CVC8818AD-CCF123	3.17E-06	Common Cause Failure (FTRC) of CVs EP8818A, 8818B & 8818C
		CVC8818AD-CCF124	3.17E-06	Common Cause Failure (FTRC) of CVs EP8818A, 8818B & 8818D
		CVC8818AD-CCF134	3.17E-06	Common Cause Failure (FTRC) of CVs EP8818A, 8818C & 8818D
		CVC8818AD-CCF234	3.17E-06	Common Cause Failure (FTRC) of CVs EP8818B, 8818C & 8818D
		CVC8818AD-CCF1-4	1.03E-05	Global CC Failure (FTRC) of CVs EP8818A, B, C & D

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
CVEP-8956ABCD-CM	1.40E-05	CVC8956AD-CCF12	1.34E-05	Common Cause Failure of CVs EP8956A & EP8956B
(B)		CVC8956AD-CCF13	1.34E-05	Common Cause Failure of CVs EP8956A & EP8956C
		CVC8956AD-CCF14	1.34E-05	Common Cause Failure of CVs EP8956A & EP8956D
		CVC8956AD-CCF23	1.34E-05	Common Cause Failure of CVs EP8956B & EP8956C
		CVC8956AD-CCF24	1.34E-05	Common Cause Failure of CVs EP8956B & EP8956D
		CVC8956AD-CCF34	1.34E-05	Common Cause Failure of CVs EP8956C & EP8956D
		CVC8956AD-CCF123	3.17E-06	Common Cause Failure of CVs EP8956A, 8956B & 8956C
		CVC8956AD-CCF124	3.17E-06	Common Cause Failure of CVs EP8956A, 8956B & 8956D
		CVC8956AD-CCF134	3.17E-06	Common Cause Failure of CVs EP8956A, 8956C & 8956D
		CVC8956AD-CCF234	3.17E-06	Common Cause Failure of CVs EP8956B, 8956C & 8956D
		CVC8956AD-CCF1-4	1.03E-05	Global CC Failure of CVs EP8956A, 8956B, 8956C & 8956D
CVEP------ACC-CM	4.16E-06	CVEPACCUM-CCF1-6	2.35E-05	Global CC Failure of Accumulator Safety Injection Check Valves
CVEPV10203040-CM	1.40E-06	CVE102340-CCF12	1.34E-06	Common Cause Failure of CVs EPV0010 & EPV0020
(B)		CVE102340-CCF13	1.34E-06	Common Cause Failure of CVs EPV0010 & EPV0030
		CVE102340-CCF14	1.34E-06	Common Cause Failure of CVs EPV0010 & EPV0040
		CVE102340-CCF23	1.34E-06	Common Cause Failure of CVs EPV0020 & EPV0030
		CVE102340-CCF24	1.34E-06	Common Cause Failure of CVs EPV0020 & EPV0040
		CVE102340-CCF34	1.34E-06	Common Cause Failure of CVs EPV0030 & EPV0040
		CVE102340-CCF123	3.17E-07	Common Cause Failure of CVs EPV0010, V0020 & V0030
		CVE102340-CCF124	3.17E-07	Common Cause Failure of CVs EPV0010, V0020 & V0040
		CVE102340-CCF134	3.17E-07	Common Cause Failure of CVs EPV0010, V0030 & V0040
		CVE102340-CCF234	3.17E-07	Common Cause Failure of CVs EPV0020, V0030 & V0040
		CVE102340-CCF1-4	1.03E-06	Global CC Failure of CVs EPV0010, V0020, V0030 & V0040

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
CVFC-V0122425-CM	1.40E-06	CVF122425-CCF12	1.34E-06	Common Cause Failure of CVs FCV0001 & FCV0002
(B)		CVF122425-CCF13	1.34E-06	Common Cause Failure of CVs FCV0001 & FCV0024
		CVF122425-CCF14	1.34E-06	Common Cause Failure of CVs FCV0001 & FCV0025
		CVF122425-CCF23	1.34E-06	Common Cause Failure of CVs FCV0002 & FCV0024
		CVF122425-CCF24	1.34E-06	Common Cause Failure of CVs FCV0002 & FCV0025
		CVF122425-CCF34	1.34E-06	Common Cause Failure of CVs FCV0024 & FCV0025
		CVF122425-CCF123	3.17E-07	Common Cause Failure of CVs FCV0001, V0002 & V0024
		CVF122425-CCF124	3.17E-07	Common Cause Failure of CVs FCV0001, V0002 & V0025
		CVF122425-CCF134	3.17E-07	Common Cause Failure of CVs FCV0001, V0024 & V0025
		CVF122425-CCF234	3.17E-07	Common Cause Failure of CVs FCV0002, V0024 & V0025
		CVF122425-CCF1-4	1.03E-06	Global CC Failure of CVs FCV0001, V0002, V0024 & V0025
HDGD-TZ01A11A-CM	3.36E-08	HDTZ1A11A-CCF12	3.84E-07	Common Cause Failure of Dampers GDTZ0001A & GDTZ0011A
HDGD-TZ01C11C-CM	3.36E-08	HDTZ1C11C-CCF12	3.84E-07	Common Cause Failure of Dampers GDTZ0001C & GDTZ0011C
MFGD--CGD01AB-CM	6.48E-06	MFCGD01AB-CCF12	7.02E-05	Common Cause Failure of Fan Units CGD01A & B
MFGF--SGF02AB-CM	6.48E-06	MFSGF02AB-CCF12	7.02E-05	Common Cause Failure of Fan Units SGF02A & B
MFGL--SGL09AB-CM	3.66E-06	MFSGL09AB-CCF12	3.97E-05	Common Cause Failure of Fan Units SGL09A & B
MFGL--SGL10AB-CM	3.66E-06	MFSGL10AB-CCF12	3.97E-05	Common Cause Failure of Fan Units SGL10A & B
MFGL--SGL12AB-CM	3.66E-06	MFSGL12AB-CCF12	3.97E-05	Common Cause Failure of Fan Units SGL12A & B
ACGK---BOTHAC-CM	1.73E-06	ACSGK05AB-CCF12	1.58E-05	Common Cause Failure of AC Units SGK05A & B
XXGM-BOTHHVAC-CM	3.19E-05	XXGM-BOT-CCCF12	1.94E-04	Common Cause Failure of EDG Rooms HVAC Systems
XXJE--FUELOIL-CM	4.63E-05	XXJE--FU-CCCF12	2.52E-04	Common Cause Failure of EDG Fuel Oil Transfer Systems
DGNE-BOTHEDGS-CM	1.08E-04	DGNE-BOT-CCCF12	3.85E-04	Common Cause Failure of Emer Diesel Gens NE01 & NE02

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
(A)		BTNK11234-CCF12	4.29E-07	Common Cause Failure of Batteries NK11 & NK12
		BTNK11234-CCF13	4.29E-07	Common Cause Failure of Batteries NK11 & NK13
		BTNK11234-CCF14	4.29E-07	Common Cause Failure of Batteries NK11 & NK14
		BTNK11234-CCF23	4.29E-07	Common Cause Failure of Batteries NK12 & NK13
		BTNK11234-CCF24	4.29E-07	Common Cause Failure of Batteries NK12 & NK14
		BTNK11234-CCF34	4.29E-07	Common Cause Failure of Batteries NK13 & NK14
		BTNK11234-CCF123	1.01E-07	Common Cause Failure of Batteries NK11, NK12 & NK13
		BTNK11234-CCF124	1.01E-07	Common Cause Failure of Batteries NK11, NK12 & NK14
		BTNK11234-CCF134	1.01E-07	Common Cause Failure of Batteries NK11, NK13 & NK14
		BTNK11234-CCF234	1.01E-07	Common Cause Failure of Batteries NK12, NK13 & NK14
		BTNK11234-CCF1-4	3.29E-07	Global CC Failure of Batteries NK11, NK12, NK13 & NK14
(A)		BXNK21234-CCF12	4.29E-07	Common Cause Failure of Chargers NK21 & NK22
		BXNK21234-CCF13	4.29E-07	Common Cause Failure of Chargers NK21 & NK23
		BXNK21234-CCF14	4.29E-07	Common Cause Failure of Chargers NK21 & NK24
		BXNK21234-CCF23	4.29E-07	Common Cause Failure of Chargers NK22 & NK23
		BXNK21234-CCF24	4.29E-07	Common Cause Failure of Chargers NK22 & NK24
		BXNK21234-CCF34	4.29E-07	Common Cause Failure of Chargers NK23 & NK24
		BXNK21234-CCF123	1.01E-07	Common Cause Failure of Chargers NK21, NK22 & NK23
		BXNK21234-CCF124	1.01E-07	Common Cause Failure of Chargers NK21, NK22 & NK24
		BXNK21234-CCF134	1.01E-07	Common Cause Failure of Chargers NK21, NK23 & NK24
		BXNK21234-CCF234	1.01E-07	Common Cause Failure of Chargers NK22, NK23 & NK24
		BXNK21234-CCF1-4	3.29E-07	Global CC Failure of Chargers NK21, NK22, NK23 & NK24

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
INAC--NN11/14-CM	8.03E-06	INNN11-14-CCF12	4.29E-05	Common Cause Failure of Inverters NN11 & NN12
(B)		INNN11-14-CCF13	4.29E-05	Common Cause Failure of Inverters NN11 & NN13
		INNN11-14-CCF14	4.29E-05	Common Cause Failure of Inverters NN11 & NN14
		INNN11-14-CCF23	4.29E-05	Common Cause Failure of Inverters NN12 & NN13
		INNN11-14-CCF24	4.29E-05	Common Cause Failure of Inverters NN12 & NN14
		INNN11-14-CCF34	4.29E-05	Common Cause Failure of Inverters NN13 & NN14
		INNN11-14-CCF123	1.01E-05	Common Cause Failure of Inverters NN11, NN12 & NN13
		INNN11-14-CCF124	1.01E-05	Common Cause Failure of Inverters NN11, NN12 & NN14
		INNN11-14-CCF134	1.01E-05	Common Cause Failure of Inverters NN11, NN13 & NN14
		INNN11-14-CCF234	1.01E-05	Common Cause Failure of Inverters NN12, NN13 & NN14
		INNN11-14-CCF1-4	3.29E-05	Global CC Failure of Inverters NN11, NN12, NN13 & NN14
(A)		INSN11-14-CCF12	1.43E-05	Common Cause Failure of Inverters NN11 & NN12 (SBO)
		INSN11-14-CCF13	1.43E-05	Common Cause Failure of Inverters NN11 & NN13 (SBO)
		INSN11-14-CCF14	1.43E-05	Common Cause Failure of Inverters NN11 & NN14 (SBO)
		INSN11-14-CCF23	1.43E-05	Common Cause Failure of Inverters NN12 & NN13 (SBO)
		INSN11-14-CCF24	1.43E-05	Common Cause Failure of Inverters NN12 & NN14 (SBO)
		INSN11-14-CCF34	1.43E-05	Common Cause Failure of Inverters NN13 & NN14 (SBO)
		INSN11-14-CCF123	3.38E-06	Common Cause Failure of Inverters NN11, NN12 & NN13 (SBO)
		INSN11-14-CCF124	3.38E-06	Common Cause Failure of Inverters NN11, NN12 & NN14 (SBO)
		INSN11-14-CCF134	3.38E-06	Common Cause Failure of Inverters NN11, NN13 & NN14 (SBO)
		INSN11-14-CCF234	3.38E-06	Common Cause Failure of Inverters NN12, NN13 & NN14 (SBO)
		INSN11-14-CCF1-4	1.10E-05	Global CC Failure of Inverters NN11, NN12, NN13 & NN14 (SBO)

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
FLSW-1SW01FAB-CM	6.05E-06	FLSW-ABCD-CCF12	5.36E-05	Common Cause Failure of Traveling Screens 1SW01FA & B
		FLSW-ABCD-CCF13	5.36E-05	Common Cause Failure of Traveling Screens 1SW01FA & C
		FLSW-ABCD-CCF14	5.36E-05	Common Cause Failure of Traveling Screens 1SW01FA & D
		FLSW-ABCD-CCF23	5.36E-05	Common Cause Failure of Traveling Screens 1SW01FB & C
		FLSW-ABCD-CCF24	5.36E-05	Common Cause Failure of Traveling Screens 1SW01FB & D
FLSW-1SW01FCD-CM	6.05E-06	FLSW-ABCD-CCF34	5.36E-05	Common Cause Failure of Traveling Screens 1SW01FC & D
		FLSW-ABCD-CCF123	1.27E-05	Common Cause Failure of Traveling Screens 1SW01FA, B & C
		FLSW-ABCD-CCF124	1.27E-05	Common Cause Failure of Traveling Screens 1SW01FA, B & D
		FLSW-ABCD-CCF134	1.27E-05	Common Cause Failure of Traveling Screens 1SW01FA, C & D
		FLSW-ABCD-CCF234	1.27E-05	Common Cause Failure of Traveling Screens 1SW01FB, C & D
FLSW-SW1FABCD-CM	1.08E-05	FLSW-ABCD-CCF1-4	4.12E-05	Global CC Failure of Traveling Screens 1SW01FA, B, C & D
ESSF-LOCASEQX-CM	7.54E-06	ESLOCASEQ-CCF12	8.64E-05	Common Cause Failure of Both LOCA Sequencer Trains
ESSF-SDSEQA/B-CM	7.54E-06	ESSDSEQAB-CCF12	8.64E-05	Common Cause Failure of Both Shutdown Sequencer Trains
RESF-FS917/CD-CM	2.66E-06	REFS917CD-CCF12	3.03E-05	Common Cause Failure of Relays FS0917C & FS0917D
RESF--K1/4101-CM	2.39E-05	REK1-4101-CCF12	2.73E-04	Common Cause Failure of Relays K1101 & K4101
RESF--K1/4102-CM	2.39E-05	REK1-4102-CCF12	2.73E-04	Common Cause Failure of Relays K1102 & K4102
RESF--K1/4105-CM	2.39E-05	REK1-4105-CCF12	2.73E-04	Common Cause Failure of Relays K1105 & K4105
RESF--K1/4106-CM	2.39E-05	REK1-4106-CCF12	2.73E-04	Common Cause Failure of Relays K1106 & K4106
RESF--K1/4107-CM	2.39E-05	REK1-4107-CCF12	2.73E-04	Common Cause Failure of Relays K1107 & K4107
RESF--K1/4108-CM	2.39E-05	REK1-4108-CCF12	2.73E-04	Common Cause Failure of Relays K1108 & K4108
RESF--K1/4109-CM	2.39E-05	REK1-4109-CCF12	2.73E-04	Common Cause Failure of Relays K1109 & K4109
RESF--K1/4112-CM	2.39E-05	REK1-4112-CCF12	2.73E-04	Common Cause Failure of Relays K1112 & K4112
RESF--K1/4113-CM	2.39E-05	REK1-4113-CCF12	2.73E-04	Common Cause Failure of Relays K1113 & K4113
RESF--K1/4115-CM	2.39E-05	REK1-4115-CCF12	2.73E-04	Common Cause Failure of Relays K1115 & K4115
RESF--K1/4116-CM	2.39E-05	REK1-4116-CCF12	2.73E-04	Common Cause Failure of Relays K1116 & K4116
RESF--K1/4118-CM	2.39E-05	REK1-4118-CCF12	2.73E-04	Common Cause Failure of Relays K1118 & K4118

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
RESF--K1/4120-CM	2.39E-05	REK1-4120-CCF12	2.73E-04	Common Cause Failure of Relays K1120 & K4120
RESF--K1/4121-CM	2.39E-05	REK1-4121-CCF12	2.73E-04	Common Cause Failure of Relays K1121 & K4122
RESF--K1/4123-CM	2.39E-05	REK1-4123-CCF12	2.73E-04	Common Cause Failure of Relays K1123 & K4123
RESF--K1/4124-CM	2.39E-05	REK1-4124-CCF12	2.73E-04	Common Cause Failure of Relays K1124 & K4124
RESF--K1/4125-CM	2.39E-05	REK1-4125-CCF12	2.73E-04	Common Cause Failure of Relays K1125 & K4125
RESF--K1/4126-CM	2.39E-05	REK1-4126-CCF12	2.73E-04	Common Cause Failure of Relays K1126 & K4126
RESF--K1/4127-CM	2.39E-05	REK1-4127-CCF12	2.73E-04	Common Cause Failure of Relays K1127 & K4127
RESF--K1/4128-CM	2.39E-05	REK1-4128-CCF12	2.73E-04	Common Cause Failure of Relays K1128 & K4128
RESF--K1/4131-CM	2.39E-05	REK1-4131-CCF12	2.73E-04	Common Cause Failure of Relays K1131 & K4131
RESF--K1/4132-CM	2.39E-05	REK1-4132-CCF12	2.73E-04	Common Cause Failure of Relays K1132 & K4132
RESF--K1/4133-CM	2.39E-05	REK1-4133-CCF12	2.73E-04	Common Cause Failure of Relays K1133 & K4133
RESF--K1/4135-CM	2.39E-05	REK1-4135-CCF12	2.73E-04	Common Cause Failure of Relays K1135 & K4135
RESF--K1/4137-CM	2.39E-05	REK1-4137-CCF12	2.73E-04	Common Cause Failure of Relays K1137 & K4137
RESF--K1/4138-CM	2.39E-05	REK1-4138-CCF12	2.73E-04	Common Cause Failure of Relays K1138 & K4138
RESF--K1/4173-CM	2.39E-05	REK1-4173-CCF12	2.73E-04	Common Cause Failure of Relays K1173 & K4173
RESF-K101/102-CM	2.39E-05	REK101-2--CCF12	2.73E-04	Common Cause Failure of Relays K101 & K102
RESF-K114/116-CM	2.39E-05	REK114-6--CCF12	2.73E-04	Common Cause Failure of Relays K114A & K116B
RESF-K116/118-CM	2.39E-05	REK116118-CCF12	2.73E-04	Common Cause Failure of Relays K116A & K118B
RESF-K117/119-CM	2.39E-05	REK117119-CCF12	2.73E-04	Common Cause Failure of Relays K117A & K119B
RESF-K119/121-CM	2.39E-05	REK119121-CCF12	2.73E-04	Common Cause Failure of Relays K119A & K121B
RESF-K127/131-CM	2.39E-05	REK127131-CCF12	2.73E-04	Common Cause Failure of Relays K127 & K131
RESF-K140/149-CM	2.39E-05	REK140149-CCF12	2.73E-04	Common Cause Failure of Relays K140A & K149B
RESF-K141/150-CM	2.39E-05	REK141150-CCF12	2.73E-04	Common Cause Failure of Relays K141A & K150B
RESF-K142/151-CM	2.39E-05	REK142151-CCF12	2.73E-04	Common Cause Failure of Relays K142A & K151B
RESF-K162/436-CM	2.39E-05	REK162436-CCF12	2.73E-04	Common Cause Failure of Relays K162A & K436B
RESF--K501A/B-CM	2.66E-06	REK501A-B-CCF12	3.04E-05	Common Cause Failure of Relays K501A & B

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
RESF--K502A/B-CM	2.66E-06	REK502A-B-CCF12	3.04E-05	Common Cause Failure of Relays K502A & B
RESF--K503A/B-CM	2.66E-06	REK503A-B-CCF12	3.04E-05	Common Cause Failure of Relays K503A & B
RESF--K504A&B-CM	2.66E-06	REK504A-B-CCF12	3.04E-05	Common Cause Failure of Relays K504A & B
RESF--K505A/B-CM	2.66E-06	REK505A-B-CCF12	3.04E-05	Common Cause Failure of Relays K505A & B
RESF--K507A/B-CM	2.66E-06	REK507A-B-CCF12	3.04E-05	Common Cause Failure of Relays K507A & B
RESF--K514A/B-CM	2.66E-06	REK514A-B-CCF12	3.04E-05	Common Cause Failure of Relays K514A & B
RESF--K519A/B-CM	2.66E-06	REK519A-B-CCF12	3.04E-05	Common Cause Failure of Relays K519A & B
RESF--K520A/B-CM	2.66E-06	REK520A-B-CCF12	3.04E-05	Common Cause Failure of Relays K520A & B
RESF--K521A/B-CM	2.66E-06	REK521A-B-CCF12	3.04E-05	Common Cause Failure of Relays K521A & B
RESF--K525A/B-CM	2.66E-06	REK525A-B-CCF12	3.04E-05	Common Cause Failure of Relays K525A & B
RESF--K527A/B-CM	2.66E-06	REK527A-B-CCF12	3.04E-05	Common Cause Failure of Relays K527A & B
RESF--K601A/B-CM	3.98E-06	REK601A-B-CCF12	4.55E-05	Common Cause Failure of Relays K601A & B
RESF--K602A/B-CM	2.39E-05	REK602A-B-CCF12	2.73E-04	Common Cause Failure of Relays K602A & B
RESF--K603A/B-CM	3.98E-06	REK603A-B-CCF12	4.55E-05	Common Cause Failure of Relays K603A & B
RESF--K604A&B-CM	3.98E-06	REK604A-B-CCF12	4.55E-05	Common Cause Failure of Relays K604A & B
RESF--K605A/B-CM	3.98E-06	REK605A-B-CCF12	4.55E-05	Common Cause Failure of Relays K605A & B
RESF--K606A/B-CM	3.98E-06	REK606A-B-CCF12	4.55E-05	Common Cause Failure of Relays K606A & B
RESF--K607A/B-CM	3.98E-06	REK607A-B-CCF12	4.55E-05	Common Cause Failure of Relays K607A & B
RESF--K608A/B-CM	3.98E-06	REK608A-B-CCF12	4.55E-05	Common Cause Failure of Relays K608A & B
RESF--K609A/B-CM	3.98E-06	REK609A-B-CCF12	4.55E-05	Common Cause Failure of Relays K609A & B
RESF--K610A/B-CM	3.98E-06	REK610A-B-CCF12	4.55E-05	Common Cause Failure of Relays K610A & B
RESF--K615A/B-CM	3.98E-06	REK615A-B-CCF12	4.55E-05	Common Cause Failure of Relays K615A & B
RESF--K616A/B-CM	3.98E-06	REK616A-B-CCF12	4.55E-05	Common Cause Failure of Relays K616A & B
RESF--K630A/B-CM	2.39E-05	REK630A-B-CCF12	2.73E-04	Common Cause Failure of Relays K630A & B
RESF--K634A&B-CM	3.98E-06	REK634A-B-CCF12	4.55E-05	Common Cause Failure of Relays K634A & B
RESF--K637A/B-CM	3.98E-06	REK637A-B-CCF12	4.55E-05	Common Cause Failure of Relays K637A & B

Table 6 (Continued)

Revised Common Cause Values

IPE Submittal Event Identifier	IPE Submittal Common Cause Value	Current WCGS PSA Event Identifier	Revised Common Cause Value	Common Cause Event Identifier Description
RESF--K643A/B-CM	3.98E-06	REK643A-B-CCF12	4.55E-05	Common Cause Failure of Relays K643A & B
RESF--K644A/B-CM	3.98E-06	REK644A-B-CCF12	4.55E-05	Common Cause Failure of Relays K644A & B
RESF--K647A/B-CM	3.98E-06	REK647A-B-CCF12	4.55E-05	Common Cause Failure of Relays K647A & B
RESF--K648A/B-CM	3.98E-06	REK648A-B-CCF12	4.55E-05	Common Cause Failure of Relays K648A & B
RESF--K649A/B-CM	3.98E-06	REK649A-B-CCF12	4.55E-05	Common Cause Failure of Relays K649A & B
RESF--K713A/B-CM	3.98E-06	REK713A-B-CCF12	4.55E-05	Common Cause Failure of Relays K713A & B
RESF--K740A/B-CM	2.39E-05	REK740A-B-CCF12	2.73E-04	Common Cause Failure of Relays K740A & B
RESF--K741A/B-CM	2.39E-05	REK741A-B-CCF12	2.73E-04	Common Cause Failure of Relays K741A & B
RESF--K743A/B-CM	3.98E-06	REK743A-B-CCF12	4.55E-05	Common Cause Failure of Relays K743A & B
RESF--K744A/B-CM	3.98E-06	REK744A-B-CCF12	4.55E-05	Common Cause Failure of Relays K744A & B
RESF--K745A/B-CM	3.98E-06	REK745A-B-CCF12	4.55E-05	Common Cause Failure of Relays K745A & B
RESF--K752A/B-CM	3.98E-06	REK752A-B-CCF12	4.55E-05	Common Cause Failure of Relays K752A & B
CASF-----WESF-CM	2.04E-05	CA-ESF----CCF12	1.75E-04	Common Cause Actuation Signal Failures Without OPA
CASF----WESFO-CM	2.08E-09	CA-ESFO---CCF12	1.79E-08	Common Cause Actuation Signal Failures With OPA
SSSS-----RT1O-CM	5.68E-07	SS-RT1O---CCF12	1.35E-05	Common Cause RTRIP1 Failure With OPA
SSSS-----RT2O-CM	3.14E-07	SS-RT2O---CCF12	1.16E-05	Common Cause RTRIP2 Failure With OPA
MPWS-1WS01PAB-CM	1.08E-05	MPWS-1WS01PAB-CM	2.30E-05	Common Cause Failure of Service Water Pumps 1WS01PA & B

(A) Common cause failure events added to the WCGS PSA model subsequent to the time of the IPE Submittal.

(B) Common cause failure events previously located at the fault tree top logic level which have been expanded using the NUPRA automatic common cause failure event generation feature, with the expanded common cause failure events located in the fault tree at the component level.

Core Damage Sequence Quantification Results

The WCGS PSA model event tree sequences leading to core damage were quantified using the revised HRA and Common Cause values. Discussion of the determination of the revised HRA and Common Cause values, along with presentation of the revised values, has been previously provided in this document.

Quantification of the WCGS PSA model using the revised HRA and Common Cause values resulted in a total core damage frequency of 6.19E-05/year. This is an increase of approximately 47 % over the 4.2E-05/year core damage frequency value reported in the IPE Submittal. The 6.19E-05/year core damage frequency value was quantified using a truncation limit of 1.0E-10, with a resultant 19,738 core damage cutsets.

Table 7 presents the relative contribution of each initiating event, or transfer event, to the 6.19E-05/year total core damage frequency. Figure 1 provides a graphical representation of the breakdown of the total core damage frequency by initiating, or transfer, event.

Table 8 presents, in order of descending frequency, all of the event tree sequences with a core damage frequency value of 1.0E-08/year or greater. These top 98 core damage sequences account for 99.74 % of the total core damage frequency.

Observations and Notes Concerning the Revised Core Damage Results

- Indications of the relative contribution of each initiating event are provided in Table 3.4-2 of the IPE Submittal Document for the IPE Submittal CDF results, and in Table 7 of this document for the revised CDF results. The percentage contribution to the total CDF changed for several initiators with the magnitude of the change being significantly influenced by the impact of the revised HRA and Common Cause failure values on the core damage sequence quantification results for the specific initiator. The dominant core damage sequences for the IPE Submittal are provided in Table 3.4-1 of the IPE Submittal Document. The dominant core damage sequences for the revised CDF results are provided in Table 8 of this document. Examples of core damage sequences in Table 8 which increased in frequency from their Table 3.4-1 value primarily due to the revised common cause failure values include:

Table 8	IPE Submittal Table 3.4-1
Sequence Number 6 (5.8 %)	Sequence Number 14 (2.68 %);
Sequence Number 7 (4.9 %)	Sequence Number 9 (4.35 %);
Sequence Number 9 (3.0 %)	Below the Table 3.4-1 Cutoff of 1.0E-08;
Sequence Number 10 (2.7 %)	Sequence Number 24 (0.66 %);
Sequence Number 13 (2.0 %)	Sequence Number 29 (0.49 %);
Sequence Number 14 (2.0 %)	Sequence Number 18 (1.57 %);
Sequence Number 15 (1.6 %)	Sequence Number 30 (0.41 %).

Examples of core damage sequences in Table 8 which increased in frequency from their Table 3.4-1 value primarily due to the revised HRA values include:

Table 8	Table 3.4-1
Sequence Number 8 (3.3 %)	Sequence Number 20 (1.14 %);
Sequence Number 16 (1.5 %)	Sequence Number 34 (0.21 %);
Sequence Number 19 (1.2 %)	Sequence Number 25 (0.62 %).

- The WCNOC response to Question 6 of the NRC RAI on the IPE Submittal included a brief discussion regarding the performance of a reanalysis of the internal flooding events. The revised CDF results presented in Tables 7 and 8 include the reanalyzed internal flooding scenarios. The reanalyzed internal flooding scenarios provided a more significant reduction in the relative contribution of internal flooding initiators to the total CDF than the relative increase which is provided by incorporation of the revised HRA or Common Cause failure values. Examples of core damage sequences in Table 8 which decreased in frequency from their Table 3.4-1 value due to the internal flooding reanalysis include:

Table 8	IPE Submittal Table 3.4-1
Sequence Number 17 (1.4 %)	Sequence Number 2 (10.44 %);
Sequence Numbers 26 (0.7 %), 33 (0.5 %), 39 (0.3 %), 48 (0.2 %), 51 (0.2 %), 53 (0.1 %), and others less than 0.1 %	Sequence Numbers 7 (5.13 %) and 16 (2.09 %).

- The conversion of the WCGS PSA model to the NUPRA software facilitated the transfer of sequence end points, as appropriate, from one event tree into a second event tree structure. Transfer of sequence cutset files from one event tree into a second event tree provides for improved handling of dependencies within the sequence. For the WCGS IPE, only the Loss of Offsite Power initiator cutsets which progressed to Station Blackout were transferred into a second event tree structure. For this revised CDF quantification, cutsets associated with occurrence of the following conditions subsequent to a transient type initiating event were transferred, as appropriate, into a second event tree structure: Cutsets representing failure of the Reactor Trip Function following a transient type initiator were transferred into the Anticipated Transient Without Scram (ATW) event tree. Cutsets representing failure of a challenged Pressurizer Power Operated Relief Valve (PORV) to reclose, or to be isolated, following a transient type initiator were transferred into the Stuck Open Pressurizer PORV (PRV) event tree. Cutsets representing failure of the Reactor Coolant Pump (RCP) Seal Cooling Function following a transient type initiator were transferred into the Loss of RCP Seal Cooling (RCP) event tree. Cutsets representing local component or HRA related failures of the RCP Seal Cooling Function following a transient type initiator, where at least one CCW train remains available, were transferred into the Loss of RCP Seal Cooling With One CCW Train Available (SLR)

event tree. The ATW event was included in the IPE core damage results with the initiating event frequency input as a scalar value. The three remaining transfer events were not specifically addressed as separate events in the IPE results and do not appear in Table 3.4-2 of the IPE Submittal. Examples of Loss of RCP Seal Cooling core damage sequences which appear as transfer event type sequences in Table 8 and their corresponding Loss of RCP Seal Cooling type sequence from Table 3.4-1 of the IPE Submittal include:

Table 8	IPE Submittal Table 3.4-1
Numbers 12 (2.1 %), 18 (1.4 %), 20 (1.2 %), and 23 (0.9 %)	Same type as Sequence Numbers 8 (5.11 %), and 13 (3.06 %).

- Quantification of the Station Blackout (SBO) event tree sequences using the NUPRA software proceeded in a slightly different manner than quantification of this event tree for the IPE Submittal. Quantification of the SBO event tree sequences for the IPE Submittal included consideration for recovery of either Offsite AC Power, or recovery of at least one Emergency Diesel Generator (EDG). Quantification of the SBO event tree sequences for this revised CDF considered recovery of Offsite AC Power but did not include consideration for recovery of an EDG. Additionally, the SBO event tree includes two top events for consideration of Offsite AC Power recovery. If Offsite AC Power was not recovered within the "XHR" time period, then recovery within the "YHR" period was considered. Quantification of the SBO event tree for the IPE Submittal did not utilize the "YHR" Offsite AC Power recovery probability (i.e., failure of the "YHR" top event was assigned a value of 1.0). Quantification of the SBO event tree sequences for this revised CDF included consideration for the "YHR" Offsite AC Power recovery probability. The above two changes in the manner of quantifying the SBO event tree were made strictly for the purpose of simplifying the overall core damage quantification process. Simplifying the process resulted in a reduction in the time required for accomplishing the core damage quantification. The above two changes were, for the most part, offsetting in their net impact on the total SBO and overall CDF results. The above two changes did, however, result in a change in the core damage frequency for many of the individual SBO sequences and, therefore, a change in the relative contribution of a given sequence to the overall CDF. Examples of SBO sequences in Table 8 which changed in frequency, and thereby relative contribution, from their Table 3.4-1 value include:

Table 8	IPE Submittal Table 3.4-1
Sequence Number 1 (16.0 %)	Sequence Number 3 (6.7 %);
Sequence Number 2 considers "YHR" recovery and, therefore, did not appear in Table 3.4-1	Sequence Numbers 6 (5.14 %) and 11 (3.83 %) which consider EDG recovery and do not appear in Table 8
Sequence Number 3 (7.7 %)	Similar to Sequence Number 1 (13.77 %);
Sequence Number 4 (6.3 %)	Sequence Number 10 (3.84 %);
Sequence Number 21 (1.2 %)	Sequence Number 28 (0.54 %);
Sequence Number 24 (0.9 %)	Sequence Number 21 (0.93 %).

- Quantification of the Station Blackout (SBO) event tree sequences using the NUPRA software proceeded in a slightly different manner than quantification of this event tree for the IPE Submittal in one additional area. Quantification of the SBO event tree sequences for the IPE Submittal included consideration for operation of the Essential Service Water (ESW) System upon recovery of either Offsite or Onsite AC Power. ESW related failures contained in cutsets which proceeded to SBO, therefore, were retained as failures even though an AC power supply was recovered. Quantification of the SBO event tree sequences for this revised CDF included consideration for operation of both the ESW System and Normal Service Water System upon recovery of Offsite AC Power. Accordingly, operation of the Normal Service Water System was considered for cutsets which proceeded to SBO and contained ESW related failures. Examples of SBO sequences in Table 8 which benefited from the consideration of Normal Service Water System operation include:

Table 8	IPE Submittal Table 3.4-1
Sequence Number 22 (1.0 %)	Sequence Number 5 (6.48 %);
Sequence Number 92 (< 0.1 %)	Sequence Number 12 (3.56 %).

- HRA interview discussions with WCGS Operations and Training personnel, which occurred subsequent to completion of the IPE Submittal, lead to the conclusion that the placement of the Low Pressure Injection (LPI) and Low Pressure Recirculation (LPR) top events within the Loss of Component Cooling Water (CCW) event tree did not correspond well with plant procedures. While Low Pressure Injection may be successfully accomplished without CCW cooling, the Wolf Creek Emergency Operating Procedures require the existence of CCW cooling in order to accomplish the Low Pressure Recirculation function. Therefore, the LPI and LPR top events were relocated within the CCW event tree such that CCW cooling must be successfully restored before either the LPI or LPR functions are considered. This top event relocation results in an increase in the frequency of several CCW core damage sequences which previously included consideration for failure of the LPI function. Examples of CCW sequences in Table 8 which increased in frequency due to the relocation of the LPI and LPR top events include:

Table 8	IPE Submittal Table 3.4-1
Sequence Number 5 (5.9 %)	Sequence Number 47 (0.06 %);
Sequence Number 31 (0.5 %)	Sequence Number 46 (0.06 %);
Sequence Number 32 (0.5 %)	Sequence Number 33 (0.24 %).

- A problem was identified in the Westinghouse software input files used for quantification of the Loss of Offsite Power (LSP) transient event tree during conversion of the WCGS PSA model to the NUPRA software. This flaw in the input file allowed some cutsets which progressed to a Station Blackout (SBO) condition to be retained in the quantified LSP core damage sequences. This resulted in higher frequencies, and therefore higher relative contributions to the overall CDF, for the LSP core damage sequences. The NUPRA software input files for quantification of the LSP sequences for the CDF which includes the revised HRA and Common Cause values prevents inclusion of cutsets leading to SBO. Examples of LSP sequences in Table 8 which decreased in frequency due to correction of the quantification input files include:

Table 8	IPE Submittal Table 3.4-1
Sequence Number 11 (2.2 %)	Sequence Number 4 (6.67 %);
Sequence Number 52 (0.1 %)	Sequence Number 17 (1.93 %).

- For the IPE Submittal, recovery of at least one train of either the Essential Service Water (ESW) or Component Cooling Water (CCW) system was addressed in the quantification of the Loss of All Service Water (SWS) and Loss of Component Cooling Water (CCW) event trees by selecting a specific train of the failed system to assign as recovered. For this revised CDF, recovery of at least one train of either the ESW or CCW system was accomplished by assigning a split fraction to recovery of either of the two trains or recovery of both trains. Quantification with consideration of recovery terms in this manner resulted in a decrease in frequency for several core damage sequences. An example of a sequence in Table 8 which decreased in frequency due to consideration of recovery terms in this manner is:

Table 8	IPE Submittal Table 3.4-1
Sequence Number 43 (0.2 %)	Sequence Number 15 (2.31 %).

- The Loss of a Vital DC Bus (DCC) initiating event in the IPE included loss of both bus NK01 and NK04. The WCGS PSA model converted to the NUPRA software separates out the failures of these two DC Buses and treats them as separate initiating events. The Loss of Vital DC Bus NK01 initiating event is assigned the DC1 identifier with the Loss of Vital DC Bus NK04 event assigned the DC4 identifier.

- The Very Small LOCA (VLO) initiating event was added to the WCGS PSA model at the time of conversion to the NUPRA software. For the IPE, this initiator was not assumed to provide a significant contribution to the overall CDF and was, therefore, not included. This initiating event is frequently included in PSA evaluations and was, therefore, added to the WCGS PSA model. The small relative contribution (0.2 %) of the VLO event to the revised total CDF provides confirmation of the validity of the original assumption that this initiator is not a significant contributor to the overall CDF.

Level 2 Impact Due To Revised Level 1 Core Damage Sequences

A review of the revised core damage sequences in Table 8 was performed to determine what impact the results would have upon the Level 2 Conclusions in the IPE Submittal. A summary of the sequence review is listed below. Although changes have been made in the event trees and fault trees, new software used for quantification, and common cause and HRA re-analyzed, no significant sequences were identified that would alter the basic Level 2 Conclusions in the IPE Submittal.

As noted in the Level 2 Conclusions, 86.5% of the WCGS Source Term is due to containment bypass. Based upon the revised PSA model results, containment bypass will continue to dominate the WCGS Total Release Fraction. The containment bypass release mode will increase due to steam generator tube rupture sequence #60 (Table 8). The sequence is affected by both the common cause and HRA re-analysis. Sequence #60 was previously identified as SGR19D in Table 4.3-2 of the IPE Submittal.

Key Sequences For Containment Bypass:

Table 8	Table 8 CDF	IPE Submittal Table 3.4-1	IPE CDF	Change In CDF From IPE
Sequence Number 57	6.11E-08	Sequence Number 36	6.11E-08	0.00E+00
Sequence Number 60	5.28E-08	Sequence Number 53	1.20E-08	4.08E-08
	1.14E-07		7.31E-08	**4.08E-08**

The impact on source term from containment overpressure failures is expected to be neutral or a minor reduction. The reason for little or no change for this failure mode is that the top affected sequences have lower CDFs in the revised model results.

Key Sequences For Containment Overpressure -- Bins 2, 3, 8, 9

Table 8	Table 8 CDF	IPE Submittal Table 3.4-1	IPE CDF	Change In CDF From IPE
Sequence Number 22	6.05E-07	Sequence Number 11	1.64E-06	-1.04E-06
Sequence Number 11	1.36E-06	Sequence Number 4	2.86E-06	-1.50E-06
	1.97E-06		4.50E-06	**-2.54E-06**

The Containment Isolation failure mode contains sequences that both increased and decreased in core damage frequency. An internal flooding sequence, #17, and a station blackout sequence, #22 (See Table 8), had the greatest decreases in CDF. Station blackout sequence #2 had the greatest increase in CDF. The net result is most likely to be a slight positive increase in the containment isolation failure mode release fraction.

Key Sequences For Containment Isolation -- Bin 14

Table 8	Table 8 CDF	IPE Submittal Table 3.4-1	IPE CDF	Change In CDF From IPE
Sequence Number 17	8.93E-07	Sequence Number 2	4.46E-06	-3.57E-06
Sequence Number 22	6.05E-07	Sequence Number 5/11	4.42E-06	-3.82E-06
Sequence Number 1	9.90E-06	Sequence Number 3	2.87E-06	7.03E-06
Sequence Number 3	4.76E-06	Sequence Number 1	5.89E-06	-1.13E-06
Sequence Number 49	1.10E-07	Like Seq. Number 1		1.10E-07
Sequence Number 92	1.28E-08	Sequence Number 12	1.53E-06	-1.52E-06
Sequence Number 2	7.06E-06	Sequence Number 7	2.20E-06	4.86E-06
Sequence Number 4	3.89E-06	Sequence Number 10	1.65E-06	2.24E-06
TOTAL	2.72E-05		2.30E-05	4.21E-06

The CDF for sequences in the Containment Intact (Normal Leakage) mode has increased. However, due to the small contribution to the Total Release Fraction as reported in the IPE Submittal, it is unlikely to affect the conclusions.

CCW6 and SWS4 (IPE Submittal Table 3.4-1 #47 and 20, respectively) are functionally similar. Neither of these sequences added to the Total Release Fraction in the IPE Submittal. This is due to the relatively low CDF of CCW6, and the cooling support systems are recovered prior to the core being uncovered (CCW6 and SWS4). The equivalent sequences, in the revised core damages sequence list, are CCW S08 and SWS S06 (Table 8, #5 and 8, respectively). Since the revised core damage frequencies are considerably higher than in the IPE, it is expected that both would now contribute to the Total Release Fraction. Sequence 5 and 8 would map to the containment intact release mode bin.

An initiating event category that rose in CDF is Anticipated Transient Without Scram (ATWS). Sequence ATW S06 (Table 8 #9) and other ATWS sequences, increased due to the common cause and HRA reanalysis. Most of these sequences are likely to be binned the same as the TRA5 and TRO4 sequences in the IPE Submittal; that is, they will be binned in the containment normal leakage release mode.

Based upon the CDF increases in the normal containment leakage bin, both the individual release mode and Total Release Fraction would increase. However, the impact upon the totals would be minimal and the Level 2 Conclusions would not be altered. Normal leakage accounted for only one percent (1%) of the IPE total source term. A fifty percent increase in CDF, in the one-percent release mode, is not a significant release increase overall.

Key Sequences For Containment Normal Leakage -- Bins 1, 4, 5, 6, 7, 10, 12

Table 8	Table 8 CDF	IPE Submittal Table 3.4-1	IPE CDF	Change in CDF From IPE
Sequence Number 17	8.93E-07	Sequence Number 2	4.46E-06	-3.57E-06
Sequence Number 3	4.76E-06	Sequence Number 1	5.89E-06	-1.13E-06
Sequence Number 2	7.06E-06	Sequence Number 7	2.20E-06	4.86E-06
Sequence Number 4	3.89E-06	Sequence Number 10	1.65E-06	2.24E-06
Sequence Number 5	3.64E-06	Sequence Number 47	2.42E-08	3.62E-06
Sequence Number 8	2.07E-06	Sequence Number 20	4.86E-07	1.58E-06
Sequence Number 6	3.62E-06	Sequence Number 14	1.15E-06	2.47E-06
Sequence Number 10	1.69E-06	Sequence Number 24	2.83E-07	1.41E-06
	2.76E-05		1.61E-05	**1.15E-05**

TABLE 7

Core Damage Frequency By Initiating Event

Total Core Damage Frequency = 6.19E-05/year

Initiating Event	Initiating Event Frequency (/yr)	Core Damage Frequency (/yr)	Percent Contribution
SBO - Station Blackout	2.51E-04	2.78E-05	44.9%
LLO - Large LOCA	5.00E-04	5.32E-06	8.6%
SWS - Loss of All Service Water	6.49E-05	4.91E-06	7.9%
CCW - Loss of Component Cooling Water	1.55E-04	4.39E-06	7.1%
RCP - Loss of Reactor Coolant Pump Seal Cooling Following a Transient Initiator	4.43E-04	3.40E-06	5.5%
ATW - Anticipated Transient Without Scram	5.05E-05	3.09E-06	5.0%
MLO - Medium LOCA	1.10E-03	3.06E-06	4.9%
LSP - Loss of Offsite Power	5.10E-02	1.45E-06	2.3%
TRA - Transients With Power Conversion Systems Available	4.30E+00	1.40E-06	2.3%
SLO - Small LOCA	2.50E-03	1.26E-06	2.0%
FL3 - Control Building Basement Floods	4.91E-06	1.24E-06	2.0%
TRO - Transients Without Power Conversion Systems Available	1.90E-01	1.23E-06	2.0%
FLN - Nonrecoverable ESF Switchgear Room Floods	8.93E-07	8.93E-07	1.4%
SGR - Steam Generator Tube Rupture	1.10E-02	8.12E-07	1.3%

TABLE 7 (Continued)

Core Damage Frequency By Initiating Event

Initiating Event	Initiating Event Frequency (/yr)	Core Damage Frequency (/yr)	Percent Contribution
SLR - Loss of Reactor Coolant Pump Seal Cooling With At Least One CCW Train Available	3.47E-04	7.51E-07	1.2%
VEF - Reactor Vessel Failure	3.00E-07	3.00E-07	0.5%
FL1 - Turbine Building Flood	2.26E-02	2.38E-07	0.4%
VLO - Very Small LOCA	1.30E-02	1.33E-07	0.2%
ISL - Interfacing Systems LOCA	6.11E-08	6.11E-08	0.1%
SLB - Steamline/Feedline Break	5.00E-04	5.07E-08	0.1%
DC4 - Loss of Vital DC Bus NK04	2.64E-03	4.69E-08	0.1%
DC1 - Loss of Vital DC Bus NK01	2.64E-03	4.64E-08	0.1%
FL5 - Auxiliary Building Level 2026 Floods	4.46E-07	3.99E-08	0.1%
PRV - Stuck Open Pressurizer PORV Following a Transient Initiator	1.19E-05	2.07E-08	0.0%
FL2 - Room 3302 Spray Event	7.45E-05	4.37E-09	0.0%
FL4 - Recoverable ESF Switchgear Room Floods	8.13E-06	0.00E+00	0.0%

FIGURE 1

WCGS PSA CORE DAMAGE BY INITIATING EVENT

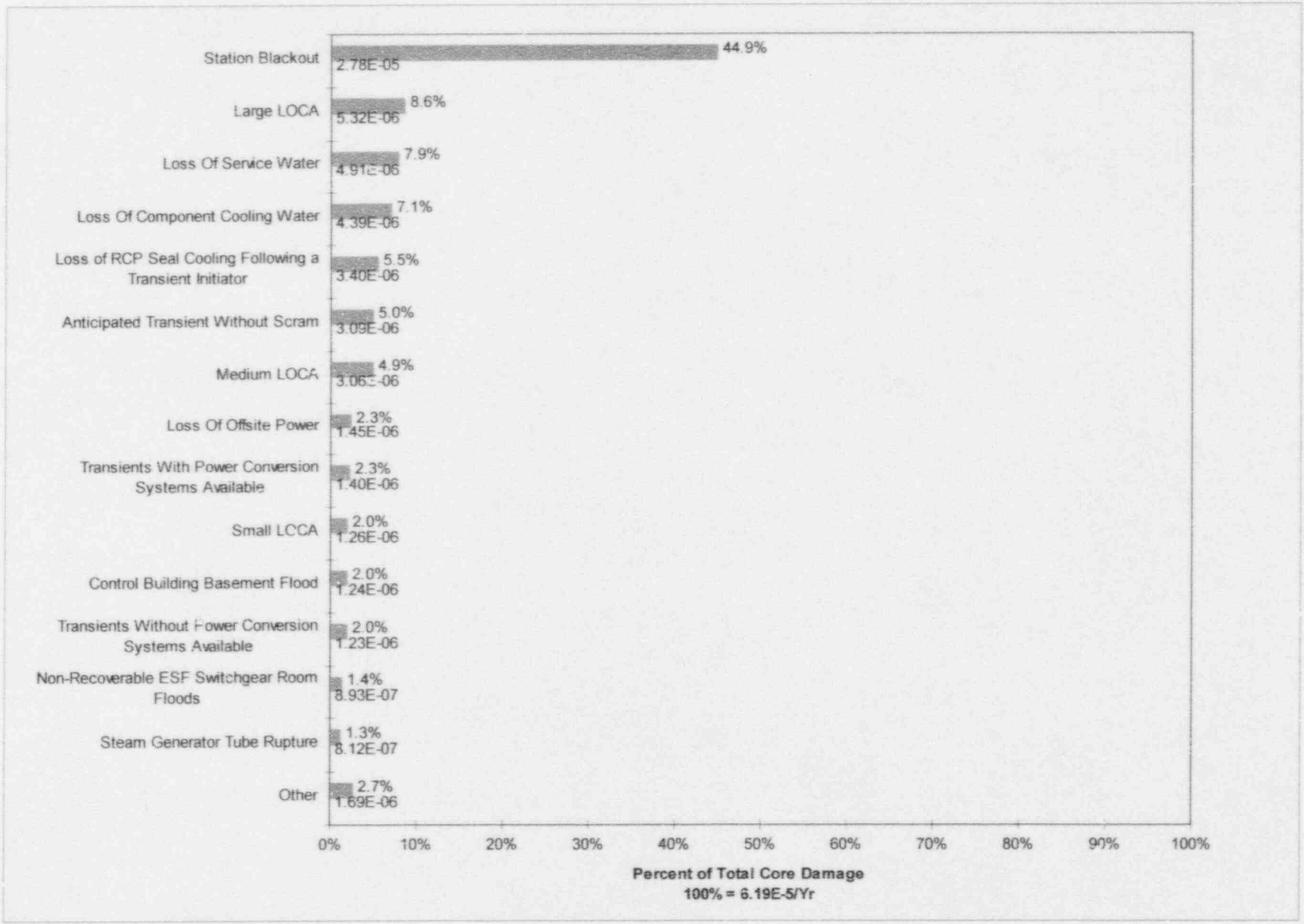

TABLE 8

Core Damage Sequences

Total Core Damage Frequency = 6.19E-05

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
1	SBOS04	9.90E-06	16.0%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization is successful; Offsite AC power recovered within 8 hours; Core uncovery occurs within 8 hours.
2	SBOS09	7.06E-06	11.4%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization is successful; Offsite AC power is not recovered within 8 hours; Offsite AC power is recovered within 12 hours; Core uncovery occurs within 12 hours.
3	SBOS10	4.76E-06	7.7%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization is successful; Offsite AC power is not recovered within 8 hours; Offsite AC power is not recovered within 12 hours.
4	SBOS26	3.89E-06	6.3%	Station Blackout Initiating Event Occurs; Auxiliary Feedwater System Fails; Offsite AC power is not recovered within 2 hours.
5	CCWS08	3.64E-06	5.9%	Loss of Component Cooling Water Initiating Event Occurs; RCS Cooldown and Depressurization is successful; CCW recovered within 8 hours; Core uncovery occurs within 8 hours.
6	LLOS02	3.62E-06	5.8%	Large LOCA Initiating Event Occurs; Low Pressure Recirculation function fails.
7	MLOS03	3.02E-06	4.9%	Medium LOCA Initiating Event Occurs; High Pressure Safety Injection function is successful; High Pressure Recirculation Function fails; RCS Cooldown and Depressurization is successful; Low Pressure Recirculation function fails.
8	SWSS06	2.07E-06	3.3%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization is successful; Service Water recovered within 8 hours; Core uncovery occurs within 8 hours.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
9	ATWS06	1.87E-06	3.0%	ATWS Event Occurs Following a Transient Initiator; Reactor power level greater than 40 percent; Manual trip by opening the RDMG breakers successful; AMSAC System actuation successful; Pressurizer Safety Valve(s) fail to reclose.
10	LLOS03	1.69E-06	2.7%	Large LOCA Initiating Event Occurs; Low Pressure Safety Injection function fails.
11	LSPS04	1.36E-06	2.2%	Loss of Offsite Power Initiating Event Occurs; Auxiliary Feedwater System fails; Bleed portion of the Feed and Bleed function fails.
12	RCPS14	1.28E-06	2.1%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; RCS Cooldown and Depressurization successful; CCW recovery within 8 hours fails; Alternate cooling to the CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours does not occur; RCS inventory restoration function fails; Low Pressure Safety Injection function fails.
13	TRAS05	1.23E-06	2.0%	Transient With Power Conversion System Available Initiating Event Occurs; Auxiliary Feedwater System fails; Main Feedwater Restoration fails; Bleed portion of Feed and Bleed function fails.
14	SLOS03	1.21E-06	2.0%	Small LOCA Initiating Event Occurs; RCS Cooldown and Depressurization per EMG ES-11 fails; High Pressure Recirculation function fails.
15	TROS04	1.01E-06	1.6%	Transient Without Power Conversion System Available Initiating Event Occurs; Auxiliary Feedwater System fails; Bleed portion of Feed and Bleed function fails.
16	SWSS24	9.56E-07	1.5%	Loss of All Service Water Initiating Event Occurs; Auxiliary Feedwater System fails; Service Water is not recovered within 2 hours.
17	FLNS02	8.93E-07	1.4%	Non-Recoverable ESF Switchgear Rooms Floods Occur.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
18	RCPS15	8.65E-07	1.4%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; RCS Cooldown and Depressurization successful; CCW recovery within 8 hours fails; Alternate cooling to the CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours occurs.
19	SWSS05	7.50E-07	1.2%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization successful; Service Water is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS inventory restoration function fails.
20	RCPS61	7.31E-07	1.2%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; Auxiliary Feedwater System fails; Main Feedwater Restoration fails; CCW recovery within 2 hours fails.
21	SBOS03	7.14E-07	1.2%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization successful; Offsite AC power recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS inventory restoration function fails.
22	SBOS02	6.05E-07	1.0%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization successful; Offsite AC power recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS inventory restoration function successful; High Pressure Recirculation function fails.
23	SLRS17	5.88E-07	0.9%	Loss of RCP Seal Cooling Event With at Least One CCW Train Available Occurs; High Pressure Safety Injection function fails; RCS Cooldown and Depressurization is successful; Low Pressure Safety Injection function fails.
24	SBOS24	5.41E-07	0.9%	Station Blackout Initiating Event Occurs; Auxiliary Feedwater System fails; Offsite AC power recovered within 2 hours; Core uncovery within 2 hours does not occur; High Pressure RCS inventory restoration function fails.
25	ATWS15	4.98E-07	0.8%	ATWS Event Occurs Following a Transient Initiator; Reactor power level greater than 40 percent; Manual trip by opening the RDMG breakers is successful; AMSAC System actuation fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
26	FL3S05	4.06E-07	0.7%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization is successful; Service Water is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS inventory restoration function fails.
27	SGRS05	3.92E-07	0.6%	Steam Generator Tube Rupture Initiating Event Occurs; Auxiliary Feedwater System successful; High Pressure Safety Injection function successful; Isolation of ruptured Steam Generator is successful; RCS and ruptured Steam Generator Pressure stabilization before overfill fails; Main steam relief valve(s) fail to reclose; RCS and Steam Generator Cooldown and Depressurization per EMG C-31/32 fails.
28	ATWS11	3.26E-07	0.5%	ATWS Event Occurs Following a Transient Initiator; Reactor power level is greater than 40 percent; Manual trip by opening the RDMG breakers is successful; AMSAC System actuation successful; Auxiliary Feedwater from 3 of 3 AFW pumps fails; Auxiliary Feedwater from 2 of 2 MDAFW Pumps or the TDAFW pump is successful; Pressurizer Safety Valve(s) fail to reclose.
29	VEFS02	3.00E-07	0.5%	Vessel Failure or Equivalent LOCA Initiating Event Occurs.
30	SWSS11	2.96E-07	0.5%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization successful; Service Water is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours fails.
31	CCWS14	2.91E-07	0.5%	Loss of Component Cooling Water Initiating Event Occurs; RCS Cooldown and Depressurization is successful; CCW is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core uncovery occurs within 8 hours.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
32	CCWS03	2.87E-07	0.5%	Loss of Component Cooling Water Initiating Event Occurs; RCS Cooldown and Depressurization is successful; CCW is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function is successful; High Pressure Recirculation function fails; Refill of the RWST fails.
33	FL3S22	2.83E-07	0.5%	Control Building Basement Flood Occurs; Auxiliary Feedwater System fails; Service Water is recovered within 2 hours; Core uncovery within 2 hours does not occur; RCS inventory restoration function fails.
34	ATWS14	2.63E-07	0.4%	ATWS Event Occurs Following a Transient Initiator; Reactor power level is greater than 40 percent; Manual trip by opening the RDMG breakers is successful; AMSAC System actuation successful; Auxiliary Feedwater from 3 of 3 AFW pumps fails; Auxiliary Feedwater from 2 of 2 MDAFW Pumps or the TDAFW pump fails.
35	SWSS10	2.55E-07	0.4%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization successful; Service Water is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours occurs.
36	RCPS17	2.55E-07	0.4%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; RCS Cooldown and Depressurization is successful; CCW recovery within 8 hours fails; Alternate cooling to CCPs and SI Pumps within 8 hours fails; Low Pressure Safety Injection function is successful; Refill of the RWST fails.
37	SGRS07	2.10E-07	0.3%	Steam Generator Tube Rupture Initiating Event Occurs; Auxiliary Feedwater System successful; High Pressure Safety Injection function successful; Isolation of ruptured Steam Generator fails; RCS and Steam Generator Cooldown and Depressurization per EMG C-31/32 fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
38	TROS03	1.61E-07	0.3%	Transient Without Power Conversion System Available Initiating Event Occurs; Auxiliary Feedwater System fails; Feed and Bleed function is successful; High Pressure Recirculation function fails.
39	FL3S06	1.57E-07	0.3%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization is successful; Service Water is recovered within 8 hours; Core uncovery within 8 hours occurs.
40	SWSS09	1.55E-07	0.3%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization is successful; Service Water is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function fails.
41	RCPS18	1.55E-07	0.3%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; RCS Cooldown and Depressurization is successful; CCW recovery within 8 hours fails; Alternate cooling to CCPs and SI Pumps within 8 hours fails; Low Pressure Safety Injection function fails.
42	FL1S04	1.52E-07	0.2%	Turbine Building Flood Occurs; Auxiliary Feedwater System fails; Bleed portion of Feed and Bleed function fails.
43	SWSS22	1.45E-07	0.2%	Loss of All Service Water Initiating Event Occurs; Auxiliary Feedwater System fails; Service Water is recovered within 2 hours; Core uncovery within 2 hours does not occur; RCS Inventory Restoration function fails.
44	TRAS04	1.33E-07	0.2%	Transient With Power Conversion System Available Initiating Event Occurs; Auxiliary Feedwater System fails; Main Feedwater Restoration fails; Feed and Bleed function is successful; High Pressure Recirculation function fails.
45	VLOS07	1.23E-07	0.2%	Very Small LOCA Initiating Event Occurs; High Pressure Safety Injection function fails; RCS Cooldown and Depressurization is successful; Low Pressure Safety Injection function fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
46	SGRS17	1.21E-07	0.2%	Steam Generator Tube Rupture Initiating Event Occurs; Reactor Trip function fails (ATWS occurs - Core Damage Assumed).
47	ATWS05	1.13E-07	0.2%	ATWS Event Occurs Following a Transient Initiator; Reactor power level is greater than 40 percent; Manual trip by opening the RDMG breakers is successful; AMSAC System actuation is successful; Auxiliary Feedwater from 3 of 3 AFW pumps is successful; Pressurizer Safety Valves successfully reclose; Long Term Shutdown function fails.
48	FL3S24	1.10E-07	0.2%	Control Building Basement Flood Occurs; Auxiliary Feedwater System fails; Service Water is not recovered within 2 hours.
49	SBOS08	1.10E-07	0.2%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization is successful; Offsite AC power is not recovered within 8 hours; Offsite AC power is not recovered within 12 hours; Core uncovery within 12 hours does not occur; High Pressure RCS inventory restoration function fails.
50	SWSS17	1.07E-07	0.2%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization function fails; Service Water is not recovered within 8 hours.
51	FL3S09	9.67E-08	0.2%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization is successful; Service Water is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function fails.
52	LSPS03	9.27E-08	0.1%	Loss of Offsite Power Initiating Event Occurs; Auxiliary Feedwater System fails; Feed and Bleed function is successful; High Pressure Recirculation function fails.
53	FL3S11	8.57E-08	0.1%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization is successful; Service Water is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
54	SWSS23	8.53E-08	0.1%	Loss of All Service Water Initiating Event Occurs; Auxiliary Feedwater System fails; Service Water is recovered within 2 hours; Core uncovery within 2 hours occurs.
55	FL1S03	8.01E-08	0.1%	Turbine Building Flood Occurs; Auxiliary Feedwater System fails; Feed and Bleed function is successful; High Pressure Recirculation function fails.
56	CCWS22	7.44E-08	0.1%	Loss of Component Cooling Water Initiating Event Occurs; RCS Cooldown and Depressurization fails; CCW is recovered within 8 hours; Core uncovery within 8 hours occurs.
57	ISLS02	6.11E-08	0.1%	Interfacing Systems LOCA Initiating Event Occurs.
58	SLRS16	5.92E-08	0.1%	Loss of RCP Seal Cooling Event With at Least One CCW Train Available Occurs; High Pressure Safety Injection function fails; RCS Cooldown and Depressurization is successful; Low Pressure Safety Injection function is successful; Low Pressure Recirculation function fails.
59	RCPS08	5.70E-08	0.1%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; RCS Cooldown and Depressurization is successful; CCW is recovered within 8 hours; Core Uncovery within 8 hours does not occur; RCS Inventory Restoration function fails; Low Pressure Safety Injection function fails.
60	SGRS15	5.28E-08	0.1%	Steam Generator Tube Rupture Initiating Event Occurs; Auxiliary Feedwater System fails; Bleed portion of Feed and Bleed function fails.
61	SBOS14	5.24E-08	0.1%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization fails; Offsite AC power is recovered within 8 hours; Core uncovery within 8 hours occurs.
62	SLRS06	5.24E-08	0.1%	Loss of RCP Seal Cooling Event With at Least One CCW Train Available Occurs; High Pressure Safety Injection function is successful; Auxiliary Feedwater System is successful; RCS Cooldown and Depressurization per EMG ES-11 fails; High Pressure Recirculation function fails; RCS Cooldown and Depressurization fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
63	TROS05	5.21E-08	0.1%	Transient Without Power Conversion System Available Initiating Event Occurs; Auxiliary Feedwater System fails; Feed portion of Feed and Bleed function fails.
64	SLBS05	4.54E-08	0.1%	Steamline/Feedline Break Initiating Event Occurs; High Pressure Safety Injection function is successful; Isolation of faulted steam generator is successful; Auxiliary Feedwater System fails; Bleed portion of Feed and Bleed function fails.
65	SBOS25	4.50E-08	0.1% fails;	Station Blackout Initiating Event Occurs; Auxiliary Feedwater System Offsite AC power is recovered within 2 hours; Core uncovery within 2 hours occurs.
66	SWSS16	4.11E-08	0.1%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization function fails; Service Water is recovered within 8 hours; Core uncovery within 8 hours occurs.
67	SBOS20	3.74E-08	0.1%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization function fails; Offsite AC power is not recovered within 8 hours; Offsite AC power is not recovered within 10 hours.
68	TRAS06	3.43E-08	0.1%	Transient With Power Conversion System Available Initiating Event Occurs; Auxiliary Feedwater System fails; Main Feedwater Restoration fails; Feed portion of Feed and Bleed function fails.
69	SBOS19	3.28E-08	0.1%	Station Blackout Initiating Event Occurs; RCS Cooldown and Depressurization function fails; Offsite AC power is not recovered within 8 hours; Offsite AC power is recovered within 10 hours; Core uncovery within 10 hours occurs.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
70	SLRS05	3.22E-08	0.1%	Loss of RCP Seal Cooling Event With at Least One CCW Train Available Occurs; High Pressure Safety Injection function is successful; Auxiliary Feedwater System is successful; RCS Cooldown and Depressurization per EMG ES-11 fails; High Pressure Recirculation function fails; RCS Cooldown and Depressurization is successful; Low Pressure Recirculation function fails; Refill of the RWST fails.
71	CCWS16	2.97E-08	0.0%	Loss of Component Cooling Water Initiating Event Occurs; RCS Cooldown and Depressurization is successful; CCW is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours fails; Low Pressure Safety Injection function is successful; Refill of the RWST fails.
72	DC4S08	2.91E-08	0.0%	Loss of Vital DC Bus NK04 Initiating Event Occurs; Reactor Trip function fails (ATWS occurs - Core Damage Assumed).
73	DC1S08	2.91E-08	0.0%	Loss of Vital DC Bus NK01 Initiating Event Occurs; Reactor Trip function fails (ATWS occurs - Core Damage Assumed).
74	SLOS12	2.75E-08	0.0%	Small LOCA Initiating Event Occurs; High Pressure Safety Injection function fails; RCS Cooldown and Depressurization is successful; Low Pressure Safety Injection function is successfu' Low Pressure Recirculation function fails.
75	CCWS21	2.35E-08	0.0%	Loss of Component Cooling Water Initiating Event Occurs; RCS Cooldown and Depressurization function fails; CCW is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
76	SGRS03	2.35E-08	0.0%	Steam Generator Tube Rupture Initiating Event Occurs; Auxiliary Feedwater System successful; High Pressure Safety Injection function successful; Isolation of ruptured Steam Generator is successful; RCS and Steam Generator pressure stabilization before overfill fails; Steam Generator relief valves successfully reclose; RCS and Steam Generator pressure stabilization after overfill fails.
77	CCWS10	2.34E-08	0.0%	Loss of Component Cooling Water Initiating Event Occurs; RCS Cooldown and Depressurization is successful; CCW is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function is successful; Refill of the RWST fails.
78	FL3S17	2.25E-08	0.0%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization function fails; Service Water is not recovered within 8 hours.
79	RCPS26	2.17E-08	0.0%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; RCS Cooldown and Depressurization function fails; CCW is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core Uncovery within 8 hours does not occur; RCS Inventory Restoration function fails.
80	SLOS13	2.02E-08	0.0%	Small LOCA Initiating Event Occurs; High Pressure Safety Injection function fails; RCS Cooldown and Depressurization is successful; Low Pressure Safety Injection function fails.
81	MLOS04	2.01E-08	0.0%	Medium LOCA Initiating Event Occurs; High Pressure Injection function is successful; High Pressure Recirculation function fails; Auxiliary Feedwater System is successful; RCS Cooldown and Depressurization fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
82	RCPS11	1.95E-08	0.0%	Loss of RCP Seal Cooling Event Occurs Following a Transient Initiator; RCS Cooldown and Depressurization is successful; CCW is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core Uncovery within 8 hours does not occur; RCS Inventory Restoration function is successful; Refill of the RWST fails.
83	FL3S10	1.94E-08	0.0%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization is successful; Service Water is not recovered within 8 hours; Alternate cooling to the CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours occurs.
84	ATWS10	1.70E-08	0.0%	ATWS Event Occurs Following a Transient Initiator; Reactor power level is greater than 40 percent; Manual trip by opening the RDMG breakers is successful; AMSAC System actuation is successful; Auxiliary Feedwater from 3 of 3 AFW pumps fails; Auxiliary Feedwater from 2 of 2 MDAFW Pumps or the TDAFW pump is successful; Pressurizer Safety Valves successfully reclose; Long Term Shutdown function fails.
85	FL5S21	1.63E-08	0.0%	Auxiliary Building Level 2026 Flood Occurs; RCS Cooldown and Depressurization function fails; CCW is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function fails.
86	FL3S15	1.60E-08	0.0%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization function fails; Service Water is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function fails.
87	DC1S03	1.56E-08	0.0%	Loss of Vital DC Bus NK01 Initiating Event Occurs; Auxiliary Feedwater System fails; Feed and Bleed function is successful; High Pressure Recirculation function fails.
88	DC4S03	1.54E-08	0.0%	Loss of Vital DC Bus NK04 Initiating Event Occurs; Auxiliary Feedwater

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
				System fails; Feed and Bleed function is successful; High Pressure Recirculation function fails.
89	SLRS14	1.48E-08	0.0%	Loss of RCP Seal Cooling Event With at Least One CCW Train Available Occurs; High Pressure Safety Injection function is successful; Auxiliary Feedwater System fails; Restoration of Main Feedwater fails; Bleed portion of RCS Feed and Bleed function fails.
90	PRVS03	1.44E-08	0.0%	Stuck Open/Unisolatable Pressurizer PORV Occurs Following a Transient Initiator; High Pressure Safety Injection function is successful; Auxiliary Feedwater System is successful; High Pressure Recirculation function fails; RCS Cooldown and Depressurization function is successful; Low Pressure Recirculation function fails.
91	SWSS08	1.44E-08	0.0%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization function is successful; Service Water is not recovered within 8 hours; Alternate cooling to the CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function is successful; Refill of the RWST fails.
92	SBOS22	1.28E-08	0.0%	Station Blackout Initiating Event Occurs; Auxiliary Feedwater System fails; Offsite AC power is recovered within 2 hours; Core uncovery within 2 hours does not occur; High Pressure RCS Inventory Restoration function is successful; High Pressure Recirculation function fails.
93	LLOS04	1.17E-08	0.0%	Large LOCA Initiating Event Occurs; Accumulator Safety Injection function fails.

TABLE 8 (Continued)

Core Damage Sequences

Number	Sequence Identifier	Sequence Frequency (/yr)	Percent Contribution	Sequence Description
94	SBOS23	1.08E-08	0.0%	Station Blackout Initiating Event Occurs; Auxiliary Feedwater System fails; Offsite AC power is recovered within 2 hours; Core uncovery within 2 hours does not occur; Bleed portion of High Pressure RCS Inventory Restoration function fails.
95	FL5S08	1.05E-08	0.0%	Auxiliary Building Level 2026 Flood Occurs; RCS Cooldown and Depressurization is successful; CCW is recovered within 8 hours; Core uncovery within 8 hours occurs.
96	FL3S08	1.04E-08	0.0%	Control Building Basement Flood Occurs; RCS Cooldown and Depressurization is successful; Service Water is not recovered within 8 hours; Alternate cooling to CCPs and SI Pumps within 8 hours is successful; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function is successful; Refill of the RWST fails.
97	SWSS04	1.03E-08	0.0%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization function is successful; Service Water is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function is successful; High Pressure Recirculation function fails; Low Pressure Recirculation function fails; Refill of the RWST fails.
98	SWSS15	1.03E-08	0.0%	Loss of All Service Water Initiating Event Occurs; RCS Cooldown and Depressurization function fails; Service Water is recovered within 8 hours; Core uncovery within 8 hours does not occur; RCS Inventory Restoration function fails.