Table 19.1-6—U.S. EPR Significant Initiating Event Contributions - Level 1 Internal Events

IE	Description	IE Frequency (1/yr)	CDF (1/yr)	Contribution (Total)
LOOP	Loss Of Offsite Power	1.9E-02	1.5E-07	49.3%
SLOCA	Small LOCA (0.6 to 3-inch Diameter)	1.4E-03	5.1E-08	15.8%
GT	General Transient (includes Turbine Trip and Reactor Trip)	7.5E-01	2.7E-08	8.5%
SGTR	Steam Generator Tube Rupture	3.5E-03	1.3E-08	3.9%
SLBI	Large Steam Line Break Inside Containment	1.0E-03	1.3E-08	3.9%
ATWS	Anticipated Transient Without Scram	4.1E-08	1.0E-08	3.1%
LOCCW-CH1L	Loss of CCWS - Common Header 1 Leakage	2.0E-01	8.6E-09	2.7%
LBOP	Loss of Balance of Plant (Closed Cooling Water (CLCWS) or Auxiliary Cooling (ACWS))	5.1E-02	6.2E-09	1.9%
LOMFW	Total Loss of Main Feedwater	9.6E-02	5.8E-09	1.8%
31BDA	Loss of 6.9kV Power from Bus 31BDA	3.5E-02	4.8E-09	1.5%
LOCCW-ALL	Loss of CCWS - Total Loss of CCWS	2.4E-06	3.8E-09	1.2%
SLBO	Large Steam Line Break Outside of Containment	2.1E-03	3.9E-09	1.2%
LOC	Loss of Main Condenser (Includes MSIV Closure)	8.1E-02	3.6E-09	1.1%

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
LOOP Sequences							
1	1, 2, 3 ,18, 20, 21, 22, 23, 24, 33, 34, 40, 41, 42, 43, 44, 45, 56, 57, 61, 62, 63, 64, 87, 88	1.22E-08 – 3.63E-10	19.3	19.3	**Sequence: LOOP-14: LOOP, REC LOOP, EFW , PBL**		
					IE LOOP	Initiator - Loss Of Offsite Power	LOOP sequence, no recovery of OSP in 2 hours; common cause failure of air cooled chillers with failure to recover (SAC maintenance train is not available because of LOOP) results in a loss of HVAC to SB 1 and SB 4, and in loss of Division 1 & 4 (the divisions that supply the running CCW pumps). As described in Section 19.1.4.1.1.3, this results in loss of HVAC to all SBs. Therefore, no EFW or feed and bleed will be available.
					REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours	
					QKA10GH001_FS_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Start	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
2	49, 50, 72, 73	7.75E-10 – 4.22E-10	0.8	20.1	**Sequence: LOOP-14: LOOP, REC LOOP, EFW , PBL**		
					IE LOOP	Initiator - Loss Of Offsite Power	LOOP sequence, no recovery of OSP in 2 hours; SAC1 in preventive maintenance, loss of HVAC maintenance train (due to LOOP) and failure to recover, results in a loss of HVAC to SB 1 and SB 2 and a loss of EFW1&2; failure of EDG 3 results in a loss of EFW3 and EFW 4 fails, therefore, all EFW pumps are unavailable and bleed fails because of a loss of Div 1.
					REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours	
					SAC01/QKA10 PM1	Normal SAC01/ QKA10 Train Unavailable due to Preventive Maintenance	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	
					XKA30_____DFR	ELEC, Emergency Diesel Generator XKA30, Fails to Run	
					LAS41AP001EFR	EFWS, Train 4 Motor Driven Pump LAS41AP001, Fails to Run	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
3	7	5.59E-09	1.9	22.0	**Sequence: LOOP-56: LOOP, EDG, I&C**		
					IE LOOP	Initiator - Loss Of Offsite Power	LOOP sequence where a loss of all 1E 2hr batteries prevents starting of EDGs and results in loss of all instrumentation. Given that no instrumentation is available, OSP recoveries or SBODGs (controlled from 12-hour batteries) are not credited.
					BTD01_BAT__ST_D-ALL	CCF of Safety-related Batteries on Demand	
4	19, 27, 28, 32, 84	1.85E-09 – 3.75E-10	2.1	24.1	**Sequence: LOOP-45: LOOP, EDG, REC LOOP, SBO**		
					IE LOOP	Initiator - Loss Of Offsite Power	LOOP sequence, no recovery of OSP in 2 hours; the CC failure of all 4 EDGs and failures of both SBODGs results in a station blackout
					REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours	
					XKA10_____DFR_D-ALL	CCF of EDGs to Run	
					XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run	
					XKA80_____DFR	ELEC, SBO Diesel Generator XKA80, Fails to Run	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
5	25, 26, 80, 81	1.36E-09 – 4.03E-10	1.2	25.3	**Sequence: LOOP-44: LOOP, EDG, REC LOOP, EFW**		
					IE LOOP	Initiator - Loss Of Offsite Power	LOOP sequence, no recovery of OSP in 2 hours; the CC failure of all 4 EDGs and a failure of one SBODGs. The only available electric division has its EFW pump in PM, so no EFW is available and F&B is not possible in SBO conditions.
					REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours	
					XKA10_____DFR_D-ALL	CCF of EDGs to Run	
					XKA80_____DFR	ELEC, SBO Diesel Generator XKA80, Fails to Run	
					EFWS PM1	EFWS Train 1 Unavailable due to Preventive Maintenance	
6	55	6.07E-10	0.2	25.5	**Sequence: LOOP-44: LOOP, EDG, REC LOOP, EFW**		
					IE LOOP	Initiator - Loss Of Offsite Power	LOOP sequence, no recovery of OSP in 2 hours; software CC failure of I&C results in failure to start EDGs & EFW, so no EFW is available and F&B is not possible in SBO conditions.
					REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours	
					CL-TXS-OSCCF	SW CCF of TXS operating system or multiple diversity groups	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
7	89, 90, 91, 92, 93, 94, 95, 96	3.62E-10	1.0	26.5	**Sequence: LOOP-53: LOOP, EDG, RCP LOCA, REC LOOP, OP FCD**		
					IE LOOP	Initiator - Loss Of Offsite Power	LOOP sequence, no recovery of OSP in 2 hours; the CC failure of all 4 EDGs (SBO conditions) leads to a loss of all RCP seal cooling, a seal LOCA occurs with 0.2 probability due to a failure to close RCP leakoff line valves; MHSI is not available in SBO conditions and operator failure to initiate a FCD leads to a loss of all injection.
					REC OSP 1HR	Failure to Recover Offsite Power Within 1 Hour	
					XKA10_____DFR_D-ALL	CCF of EDGs to Run	
					PROB SEAL LOCA	Probability of seal LOCA Occurring Given a Loss of Seal Cooling	
					JEB10AA010EFC	RCP, RCP1 Leakoff Isolation MOV JEB10AA010, Fails to Close on Demand	
					OPE-FCD-40MSBO	Operator Fails to Initiate Fast Cooldown for RCP During SBO Conditions	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
SLOCA Sequences							
8	4, 36, 39, 69, 70	6.82E-09 – 4.32E-10	3.3	29.8	**Sequence: SLOCA-34: SLOCA, MHSI, OP FCD**		
					IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)	SLOCA sequence with a CC failure of all MHSI pumps; operator failure to initiate FCD leads to a loss of all injection.
					JND10AP001EFR_D-ALL	CCF of MHSI Pumps to Run	
					OPE-FCD-40M	Operator Fails to Initiate Fast Cooldown for SLOCA	
9	5, 16, 35, 51, 97	6.66E-09 – 3.61E-10	3.8	33.6	**Sequence: SLOCA-17: SLOCA SSS, EFW, OP FB**		
					IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)	SLOCA sequence; a CC failure of all MSRIVs fails the PCD function; failure of operator to initiate F&B results in a loss of all cooling
					LBA13AA001PFO_D-ALL	CCF to Open Main Steam Relief Isolation Valves	
					OPE-FB-40M	Operator Fails to Initiate Feed & Bleed for SLOCA	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
10	46, 14, 59, 60	7.86E-10 – 5.24E-10	0.9	34.5	**Sequence: SLOCA-17: SLOCA SSS, EFW, OP FB**		
					IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)	SLOCA sequence with consequential LOOP and failure of EDG 3; ESW2 in PM results in failure of EDG2; operator failure to crosstie Division 2 to Division 1 and Division 3 to Division 4 leads to a loss of Division 2 and Division 3 and a failure of all MSRTs leading to a failure of the PCD function; operator failure to initiate F&B results in a loss of all cooling.
					LOOPCONL+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for LOCA IEs	
					XKA30_____DFR	ELEC, Emergency Diesel Generator XKA30, Fails to Run	
					CCWS/ESWS PM2	CCWS/ESWS Train 2 Pump Unavailable due to Preventive Maintenance	
					OPF-XTDIV-NSC	Operator Fails to Xtie Division 1 to Division 2 or Division 4 to Division 3 During Non-SBO Conditions	
					OPE-FB-40M	Operator Fails to Initiate Feed & Bleed for SLOCA	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
11	6	6.18E-09	2.1	36.6	**Sequence: SLOCA-20: SLOCA, MHSI, ACC**		
					IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)	SLOCA sequence, CC failure to open MHSI/ACC/LHSI common discharge check valves results in a loss of all injection.
					JNG13AA005CFO_D-ALL	CCF to Open LHSI/ MHSI Common Injection Check Valves	
12	29, 31	1.22E-09 – 1.02E-09	0.8	37.4	**Sequence: SLOCA-3: SLOCA, LHSI, SAHR**		
					IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)	SLOCA sequence, common cause failure to open CCWS MOVs to LHSI HTX, SAHR train in PM results in a loss of all long term cooling.
					KAA12AA005EFO_D-ALL	CCF to Open CCWS to LHSI HTX Cooling MOV	
					SAHR PM4	SAHR Train Unavailable due to Preventive Maintenance	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
13	48	7.80E-10	0.3	37.7	**Sequence: SLOCA-19: SLOCA, MHSI, LHSI**		
					IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)	SLOCA sequence, a CC failure of common IRWST suction strainers to MHSI/ LHSI pumps results in a loss of all injection.
					JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	
14	52	7.52E-10	0.3	38.0	**Sequence: SLOCA-22: SLOCA, MHSI, SSS, LHSI**		
					IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)	SLOCA sequence, a consequential LOOP and a common cause failure of all EDGs result in a failure of all CCW/MHSI and no CCW to LHSI heat exchangers – no long term cooling (SAHR was not credited).
					LOOPCONL+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for LOCA IEs	
					XKA10_____DFR_D-ALL	CCF of EDGs to Run	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
SLBI Sequences							
15	8, 54, 74, 75, 76, 77	5.00E-09 – 4.18E-10	2.5	40.5	**Sequence: SLBI-40: SLBI, MSIV ISO (3), FW ISO**		
					IE SLBI	Initiator - Steam Break Inside Containment	SLBI sequence with software CC failure of protection system group B, leading to failure of all MS/FW isolation.
					CL-PS-B-SWCCF	SW CCF of Protection System diversity group B	
SGTR/Induced SGTR Sequences							
16	9, 11, 30	3.94E-09 – 1.21E-09	3.0	43.5	**Sequence: SGTR-18/IND SGTR-3: SGTR, SG ISO, OP RHR / IND SGTR, OP RHR**		
					IE SGTR	Initiator - Steam Generator Tube Rupture	SGTR sequence with failure to isolate the faulted SG (failure of MSRT to close); operator failure to depressurize RCS and initiate RHR leads to V-sequence.
					LBA40AA002PFC	MSS, Train 4 Main Steam Isolation Valve LBA40AA002, Fails to Close on Demand	
					OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
ATWS							
17	10, 12, 17, 53	3.93E-09 – 6.77E-10	3.5	47.0	**Sequence: ATWS-12**		
					IE LOMFW	Initiator - Total Loss of Main Feedwater	ATWS events, pressure relief was not credited for ATWS events w/o MFW
					STUCK ROD	Stuck Control Rods	
General Transient Sequences							
18	13, 14, 15, 78, 83, 85, 86	2.72E-09 – 3.68E-10	3.2	50.2	**Sequence: GT-15: GT, MFW, SSS, EFW, PBL**		
					IE GT	Initiator - General Transient (Includes Turbine Trip and Reactor Trip)	This is the same sequence as in Group 1, where instead of a LOOP initiator, the initiator is a plant trip (GT) followed by a consequential LOOP (no recovery).
					LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram	
					QKA10GH001_FS_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Start	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
19	99, 100	3.43E-10	0.2	50.4	**Sequence: GT-15: GT, MFW, SSS, EFW, PBL**		
					IE GT	Initiator - General Transient (Includes Turbine Trip and Reactor Trip)	GT sequence with an unrecoverable consequential LOOP, a failure of 2-hour battery in Division 1 leads to a loss of EDG1 and CCW1/ CH1 loss of HVAC to SB 1 and SB 2. A loss of SAC maintenance train (due to LOOP) and SAC4 in PM lead to a loss of HVAC to SB 4. As described in Section 19.1.4.1.1.3. This results in a loss of HVAC to all SBs. Therefore, no EFW or feed and bleed will be available.
					LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram	
					31BTD01_BATST	ELEC, 250V 1E 2-hr Battery 31BTD01, Fails on Demand	
					SAC04/QKA40 PM4	Normal SAC04/ QKA40 Train Unavailable due to Preventive Maintenance	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
20	79	4.11E-10	0.1	50.5	**Sequence: GT-14: GT, MFW, SSS, EFW, MHSI**		
					IE GT	Initiator - General Transient (Includes Turbine Trip and Reactor Trip)	This is the same sequence as in Group 4, where instead of a LOOP initiator, the initiator is a plant trip (GT) followed by a consequential LOOP (no recovery).
					LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram	
					XKA10_____DFR_D-ALL	CCF of EDGs to Run	
					XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run	
					XKA80_____DFR	ELEC, SBO Diesel Generator XKA80, Fails to Run	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
21	82	3.96E-10	0.1	50.6	**Sequence: GT-14: GT, MFW, SSS, EFW, MHSI**		
					IE GT	Initiator - General Transient (Includes Turbine Trip and Reactor Trip)	This is the same sequence as in Group 3, where instead of a LOOP initiator, the initiator is a plant trip (GT) followed by a consequential LOOP (no recovery).
					LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram	
					BTD01_BAT__ST_D-ALL	CCF of Safety-related Batteries on Demand	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
Loss of Balance of Plant Sequences							
22	37, 38, 71	8.81E-10 – 4.23E-10	0.8	51.4	**Sequence: LBOP-13: LBOP, EFW, PBL**		
					IE LBOP	Initiator - Loss of Balance of Plant - Closed Loop Cooling Water or Aux Cooling Water	LBOP sequence where a total loss of HVAC, and failure to recover, leads to a loss of all EFW and feed & bleed.
					SAC01AN001EFR_D-ALL	CCF to Run Normal Air Supply Fans	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	
SLBO Sequences							
23	58, 65, 66, 67, 68	5.36E-10 – 4.98E-10	0.9	52.3	**Sequence: SLBO-46: SLBO, MSIV ISO(4), EBS**		
					IE SLBO	Initiator - Steam Break Downstream of MSIV	SLBO sequence; a CC failure to close MSIVs results in all 4 SGs blowing down; operator fails to initiate EBS and to control reactivity.
					LBA10AA002PFC_D-ALL	CCF to Close Main Steam Isolation Valves	
					OPF-EBS-30M	Operator Fails to Manually Actuate EBS (SLB & ATWS)	

Table 19.1-7—U.S. EPR Important Cutset Groups - Level 1 Internal Events
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
Loss of Main Feedwater Sequences							
24	98	3.47E-10	0.1	52.4	**Sequence: LOMFW-14: LOMFW, SSS, EFW, PBL**		
					IE LOMFW	Initiator - Total Loss of Main Feedwater	This is the same sequence as in Group 1, where instead of a LOOP initiator, the initiator is a loss of MFW followed by a consequential LOOP (no recovery)
					LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram	
					QKA10GH001_FS_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Start	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	

Table 19.1-8—U.S. EPR Risk-Significant Equipment based on FV Importance - Level 1 Internal Events

Rank	System	Component ID	Description	FV	RAW
1	ELEC	30XKA10/20/30/40	ELEC, Emergency Diesel Generator Train	0.187	2.5
2	SCWS	30QKA10/40GH001	SCWS, Chiller Unit Trains 1 and 4	0.168	18.7
3	ELEC	30XKA50/80	ELEC, SBO Diesel Generator Train	0.058	1.8
4	ELEC	31/32/33/34BTD01_BAT	ELEC, 250V 1E 2-hr Battery Train	0.050	23.0
5	SIS/RHRS	30JND10/20/30/40AP001	MHSI, Motor Driven Pump Train	0.044	1.4
6	EFWS	30LAS11/41AP001	EFWS, Motor Driven Pump Trains 1 and 4	0.042	3.3
7	MSS	30LBA40AA002	MSS, Main Steam Isolation Valve Train 4	0.034	14.8
8	SIS/RHRS	30JNG13/23/33/43AA005	LHSI, CL First SIS Isolation Check Valve	0.028	1.1
9	MSS	30LBA13/23/33/43AA001	MSS, Main Steam Relief Isolation Valve Train	0.026	1.0
10	SCWS	30QKA10/40AP107	SCWS, Motor Driven Safety Chiller Pump Trains 1 and 4	0.020	17.8
11	HVAC	30SAC31/32/33/34AN001 30SAC01/02/03/04AN001	SAC, Normal Air Exhaust/Supply Fan Train	0.020	18.0
12	EFWS	30LAS21/31AP001	EFWS, Motor Driven Pump Trains 2 and 3	0.018	1.6
13	MSS	30LBA10/20/30AA002	MSS, Main Steam Isolation Valve Trains 1, 2, and 3	0.015	1.0
14	RCS	30JEB10/20/30/40AA020	RCP Seal, RCP Seal Nitrogen Venting Isolation MOV Train	0.011	4.2
15	ESWS	30PEB20/30AP001	ESWS, Motor Driven Pump Trains 2 and 3	0.010	2.6
16	ESWS	30PED10/20/30/40AN002	UHS, Cooling Tower Cooling Fan Train	0.009	1.3
17	CCWS	30KAA12/22/32/42AA005	CCWS, Train to LHSI HTX Cooling MOV Train	0.009	1.3

Table 19.1-9—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Internal Events

Rank	System	Component ID	Description	RAW	FV
1	EFWS	30LAR10/20/30/40BB001	EFWS, EFW Storage Tank Train	33.8	0.000
2	ELEC	34BUC	ELEC, 250V DC Bus	33.3	0.001
3	ELEC	34BTD01_BAT	ELEC, 250V 1E 2-hr Battery	23.0	0.050
4	ELEC	34BDA	ELEC, 6.9kV SWGR	22.7	0.001
5	SCWS	30QKA10/40GH001	SCWS, Chiller Unit Trains 1 and 4	18.7	0.168
6	HVAC	30SAC31AN001/30SAC34AN001 30SAC01AN001/30SAC04AN001	SAC, Normal Air Exhaust/ Supply Fan Train	18.0	0.020
7	SCWS	30QKA10/40AP107	SCWS, Motor Driven Safety Chiller Pump Trains 1 and 4	17.8	0.020
8	CCWS	30KAB20AA192	CCWS, CH2 Safety Valve	17.7	0.001
9	ELEC	30BRW70BUW71	ELEC, 24V DC I&C Power Rack	17.7	0.000
10	ELEC	31BUC	ELEC, 250V DC Bus	15.7	0.000
11	HVAC	30SAC01/04AA005	SAC, Normal Air Inlet Supply Fan Discharge Check Damper Trains 1 and 4	15.6	0.001
12	MSS	30LBA40AA002	MSS, Main Steam Isolation Valve Train 4	14.8	0.034
13	MSS	30LBA41/42AA191	MSS, Main Steam Safety Relief Valve Train	14.6	0.007
14	HVAC	30SAC31/34AA002	SAC, Normal Air Exhaust Motor Operated Damper Trains 1 and 4	13.0	0.000

Table 19.1-10—U.S. EPR Risk-Significant Human Actions based on FV Importance - Level 1 Internal Events

Rank	Basic Event	Description	Nominal Value	FV	RAW
1	OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	1.3E-02	0.430	33.6
2	OPE-FB-40M	Operator Fails to Initiate Feed & Bleed for SLOCA	1.3E-01	0.082	1.5
3	OPE-FCD-40M	Operator Fails to Initiate Fast Cooldown for SLOCA	1.3E-01	0.067	1.4
4	OPF-XTDIV-NSC	Operator Fails to Xtie Division 1 to Division 2 or Division 4 to Division 3 During Non-SBO Conditions	5.0E-01	0.054	1.1
5	OPF-XTLDSBO-NSC	Operator Fails to Connect and Load SBO DGs to Div 1 or 4 During Non-SBO Conditions	1.0E-01	0.037	1.3
6	OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours	1.0E-03	0.027	27.2
7	OPE-FCD-40MSBO	Operator Fails to Initiate Fast Cooldown for RCP During SBO Conditions	5.0E-01	0.020	1.0
8	OPF-EBS-30M	Operator Fails to Manually Actuate EBS (SLB & ATWS)	2.2E-02	0.020	1.9
9	OPF-SGTR-1H	Operator Fails to Isolate SGTR and Initiate Cooldown	2.0E-03	0.012	7.1
10	OPD-RHR4H/ SGTR1H	Dependency (MED) Between Operator Actions for Stabilizing SGTR and Initiating RHR	1.4E-01	0.012	1.1

Table 19.1-11—U.S. EPR Risk-Significant Human Actions based on RAW Importance - Level 1 Internal Events

Rank	Basic Event	Description	Nominal Value	RAW	FV
1	OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	1.3E-02	33.6	0.430
2	OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours	1.0E-03	27.2	0.027
3	OPE-FB-90M	Operator Fails to Initiate Feed & Bleed for Transient	5.0E-04	16.4	0.008
4	OPF-SGTR-1H	Operator Fails to Isolate SGTR and Initiate Cooldown	2.0E-03	7.1	0.012
5	OPF-XTLDSBO-2H	Operator Fails to Connect and Load SBODGs to Div 1 and 4	6.0E-04	5.5	0.003
6	OPF-SAC-1H	Operator Fails to Start Maintenance HVAC Trains After Failure of Normal SAC Safety Train	2.0E-04	3.4	0.000

Table 19.1-12—U.S. EPR Risk-Significant Common Cause Events based on RAW Importance - Level 1 Internal Events

Rank	System	ID	Description	RAW
1	ELEC	BTD01_BAT__ST_D-ALL	CCF of Safety-related Batteries on Demand	72,580.0
2	IRWST	JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	5,341.0
3	SIS/RHRS	JNG13AA005CFO_D-ALL	CCF to Open LHSI/MHSI Common Injection Check Valves	5,140.0
4	HVAC	SAC31AN001EFR_D-ALL	CCF to Run Normal Air Exhaust/ Supply Fans	4,967.0
5	SCWS	QKA10AP107EFR_D-ALL	CCF of SCWS Pumps to Run	4,911.0
6	ELEC	XKA10_DFR_D-ALL	CCF of EDGs to Run/Start	909.3
7	SIS/RHRS	JND10AP001EFR_D-ALL	CCF of MHSI Pumps to Run/Start	685.8
8	MSS	LBA13AA001PFO_D-ALL	CCF to Open Main Steam Relief Isolation Valves	685.7
9	MSS	LBA11AA191SFO_H-ALL	CCF to Open Main Steam Safety Relief Valves	588.2
10	ESWS	PEB10AA004CFO_D-ALL	CCF to Open ESWS Pump Discharge Check Valves	554.5
11	SCWS	QKA10GH001_FR_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Run/Start	388.1
12	MSS	LBA10AA002PFC_D-ALL	CCF to Close Main Steam Isolation Valves	358.5
13	SCWS	QKA10AP107EFS_D-ALL	CCF of SCWS Pumps to Start	357.2
14	ESWS	PED10AN001EFR_D-ALL	CCF to Run Normally Running Cooling Tower Fans	338.9
15	CCWS	KAA12AA005EFO_D-ALL	CCF to Open CCWS to LHSI HTX Cooling MOV	328.5
16	ESWS	PED10AN002EFS_D-ALL	CCF to Start/Run Standby Cooling Tower Fans	327.4
17	EFWS	LAS11AP001EFS_D-ALL	CCF of EFWS Pumps to Start/Run	302.3
18	SIS/RHRS	JNG10AP001EFS_D-ALL	CCF of LHSI Pumps to Start/Run	284.1
19	ESWS	PEB20AP001EFS_B-ALL	CCF of ESWS Pumps 2 and 3 to Start (Standby)	20.5

Table 19.1-13—U.S. EPR Risk-Significant Common Cause I&C Events based on RAW Importance - Level 1 Internal Event

Rank	ID	Description	Nominal Value	RAW
1	CL-TXS-OSCCF	SW CCF of TXS operating system or multiple diversity groups	1.0E-07	35,340.0
2	CL-PS-B-SWCCF	SW CCF of Protection System diversity group B	5.0E-06	5,128.0
3	ALU-B CCF NS-ALL	CCF of ALU-B Protection System Computer Processors (Non-Self-Monitored)	3.3E-07	4,998.0
4	ALU-B CCF SM-ALL	CCF of ALU-B Protection System Computer Processors (Self-Monitored)	9.0E-08	4,971.0
5	APU4 CCF NS-ALL	CCF of APU-4 Protection System Computer Processors (Non-Self-Monitored)	3.3E-07	3,756.0
6	APU4 CCF SM-ALL	CCF of APU-4 Protection System Computer Processors (Self-Monitored)	9.0E-08	3,729.0
7	SG4 PRES CCF-ALL	CCF of SG4 pressure sensors	6.7E-07	3,715.0
8	SAS CCF-ALL	CCF of SAS Divisions	5.0E-07	1,231.0
9	PZR PRES CCF-ALL	CCF of pressurizer (RCS) pressure sensors	6.7E-07	661.6
10	APU3 CCF SM-ALL	CCF of APU-3 Protection System Computer Processors (Self-Monitored)	9.0E-08	622.7
11	APU3 CCF NS-ALL	CCF of APU-3 Protection System Computer Processors (Non-Self-Monitored)	3.3E-07	622.7
12	CL-PS-A-SWCCF	SW CCF of Protection System diversity group A	5.0E-06	291.4
13	ALU-A CCF NS-ALL	CCF of ALU-A Protection System Computer Processors (Non-Self-Monitored)	3.3E-07	207.6
14	APU2 CCF NS-ALL	CCF of APU-2 Protection System Computer Processors (Non-Self-Monitored)	3.3E-07	207.6
15	APU2 CCF SM-ALL	CCF of APU-2 Protection System Computer Processors (Self-Monitored)	9.0E-08	122.2
16	ALU-A CCF SM-ALL	CCF of ALU-A Protection System Computer Processors (Self-Monitored)	9.0E-08	122.2

Table 19.1-14—U.S. EPR Risk-Significant PRA Parameters - Level 1 Internal Events
Sheet 1 of 2

ID	Description	Nominal Value	FV	RAW
PRA Modeling Parameters				
PROB SEAL LOCA	Probability of seal LOCA Occurring Given a Loss of Seal Cooling	2.0E-01	0.108	1.4
STUCK ROD	Stuck Control Rods	4.1E-08	0.035	782,300
Preventive Maintenance				
CCWS/ESWS PM2	CCWS/ESWS Train 2 Pump Unavailable due to Preventive Maintenance	6.0E-02	0.024	1.4
CCWS/ESWS PM3	CCWS/ESWS Train 3 Pump Unavailable due to Preventive Maintenance	6.0E-02	0.026	1.4
CVCS32 PM4	CVCS Train 2 Unavailable due to Preventive Maintenance	6.0E-02	0.005	1.1
EDG PM1	EDG Train 1 Unavailable due to Preventive Maintenance	4.0E-02	0.007	1.2
EDG PM2	EDG Train 2 Unavailable due to Preventive Maintenance	4.0E-02	0.013	1.3
EDG PM3	EDG Train 3 Unavailable due to Preventive Maintenance	4.0E-02	0.013	1.3
EDG PM4	EDG Train 4 Unavailable due to Preventive Maintenance	4.0E-02	0.007	1.2
EFWS PM1	EFWS Train 1 Unavailable due to Preventive Maintenance	4.0E-02	0.028	1.7
EFWS PM2	EFWS Train 2 Unavailable due to Preventive Maintenance	4.0E-02	0.006	1.1
EFWS PM3	EFWS Train 3 Unavailable due to Preventive Maintenance	4.0E-02	0.006	1.1
EFWS PM4	EFWS Train 4 Unavailable due to Preventive Maintenance	4.0E-02	0.027	1.7
MHSI PM1	MHSI Train 1 Unavailable due to Preventive Maintenance	4.0E-02	0.005	1.1
MHSI PM4	MHSI Train 4 Unavailable due to Preventive Maintenance	4.0E-02	0.006	1.1
SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance	3.0E-02	0.122	5.0
SAC02/QKA20 PM2	Normal SAC02/QKA20 Train Unavailable due to Preventive Maintenance	3.0E-02	0.005	1.2

Table 19.1-14—U.S. EPR Risk-Significant PRA Parameters - Level 1 Internal Events
Sheet 2 of 2

ID	Description	Nominal Value	FV	RAW
SAC03/QKA30 PM3	Normal SAC03/QKA30 Train Unavailable due to Preventive Maintenance	3.0E-02	0.005	1.2
SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance	3.0E-02	0.130	5.2
SAHR PM4	SAHR Train Unavailable due to Preventive Maintenance	4.0E-02	0.016	1.4
SBODG5 PM1	SBO-DG Train 1 Unavailable due to Preventive Maintenance	4.0E-02	0.013	1.3
SBODG8 PM4	SBO-DG Train 4 Unavailable due to Preventive Maintenance	4.0E-02	0.013	1.3
Offsite Power Related Events				
LOOP24+REC	Loss Of Offsite Power During Mission Time and Failure of Recovery Within 1 Hour	4.8E-05	0.004	85.0
LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram	1.8E-03	0.113	63.6
LOOPCONL+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for LOCA IEs	5.3E-03	0.034	7.3
LOOPCSD+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to a Controlled Shutdown	1.8E-04	0.009	51.2
REC OSP 1HR	Failure to Recover Offsite Power Within 1 Hour	5.3E-01	0.076	1.1
REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours	3.2E-01	0.397	1.9

Table 19.1-15—U.S. EPR Level 1 Internal Events Sensitivity Studies
Sheet 1 of 2

Sensitivity Case Group	Case #	Sensitivity Case Description	SC CDF (1/yr)	Delta CDF
0	0	Base Case (Internal Events)	2.9E-07	0%
1		**Common Cause Assumption**		
	1a	Common cause events not considered	1.6E-07	-45%
	1b	EDGs & SBODGs in the same CC group	1.1E-06	287%
	1c	CC for I&C Software - recovery not credited	3.0E-07	3%
2		**LOOP Assumptions**		
	2a	No Credit was given for LOOP recoveries (DG MT also set back to 24 hours)	8.0E-07	178%
	2b	DG Mission Time set to 24 hours	4.0E-07	39%
	2c	SBO DG Mission Time set to 18 hours	2.8E-07	-2%
	2d	Consequential LOOP events were not considered	2.5E-07	-15%
	2e	All Consequential LOOP values set to 5.3E-03 (value for LOCA)	4.5E-07	57%
3		**Assumptions on Electrical Dependencies**		
	3a	MSRT Realignment to One Power Train per Train	2.7E-07	-7%
	3b	For CVCS seal injection, assume that a switchover from the VCT to the IRWST is always required (Div1 & Div4 required)	3.0E-07	4%
	3c	UHS 4 assumed unavailable during SBO Conditions (no credit for SBO x-tie for dedicated ESW)	3.0E-07	4%
	3d	The same credit given to the operators to X-tie two divisions in SBO (HEP=7E-2) & non-SBO conditions (HEP=0.5)	2.7E-07	-5%
4		**Assumptions on HVAC Recoveries**		
	4a	Room heat-up was not considered	1.8E-07	-39%
	4b	Operator recovery of HVAC not credited	9.8E-06	3281%

Table 19.1-15—U.S. EPR Level 1 Internal Events Sensitivity Studies
Sheet 2 of 2

Sensitivity Case Group	Case #	Sensitivity Case Description	SC CDF (1/yr)	Delta CDF
	4c	Circular logic adjustment: Failure of HVAC 1 disables HVAC 2 (HVAC4 disables HVAC 3)	3.0E-07	3%
5		**Sensitivity to HEPs Values**		
	5a	All HEPs Set to 5% Value	9.5E-08	-67%
	5b	All HEPs Set to 95% Value	1.0E-06	257%
6		**Assumptions on Probabilities of an RCP LOCA**		
	6a	RCP seal LOCA Probability - 1.0	4.4E-07	51%
	6b	RCP seal LOCA Probability - 0.5	3.4E-07	19%
	6c	RCP seal LOCA Probability - 0.1	2.7E-07	-6%
7		**Assumptions on Long Term Cooling Mission Time**		
	7a	SAHR Mission Time set to 36 hours	2.9E-07	0%
	7b	SAHR Mission Time set to 72 hours	2.9E-07	0%
8		**Preventive Maintenance Assumptions**		
	8a	Train 3 assumed to be in Preventive Maintenance for all year	8.8E-07	206%
	8b	W/o Preventive Maintenance	1.5E-07	-48%
9		**Isolation of EFW Tank Leak**		
	9	EFW Isolation not possible	2.9E-07	0%
10		**Combination of Different Cases**		
	10	Combination of Cases 1b, 2b, 2e, 3a, 3b, 5b, 6a	4.6E-06	1499%

Table 19.1-16—Core Damage End States and their Treatment in the CETs
Sheet 1 of 6

Bin (Short Code)	Description of Sequences in Bin	CET	Treatment in CET
TR	Core damage from transient sequences where pressurizer valves have not been opened prior to core damage.	CET1 HI Pressure	CET1 HI PRESSURE interrogates the sequence, and determines whether the sequence will be depressurized by operator action or hot leg rupture, as well as the status of feedwater. If the sequence results in SGTR, it is sent to the SGTR tree. If the sequence is depressurized, it is sent to the CET LO PRESSURE tree. If it is not, it is sent to the CET2 HI PRESSURE tree.
TRD	Core damage from transient sequences where the pressurizer valves have not been opened prior to core damage, and where a Steam Line Break has not been isolated		
TR1	Core damage from transient sequences with feed and bleed not successful (based on the Level 1 success criteria).	CET LIMITED CD CET1 HI Pressure	If LHSI and depressurization are both available, the sequence is sent to the Limited CD tree. CET1 HI PRESSURE interrogates the sequence, and determines whether the sequence will be depressurized by operator action or hot leg rupture, as well as the status of feedwater. If the sequence results in SGTR, it is sent to the SGTR Tree. If the sequence is depressurized, it is sent to the CET LO PRESSURE tree. If it is not, it is sent to the CET2 HI PRESSURE tree.
TR1D	Core damage from transient sequences where feed and bleed was not successful (based on the Level 1 success criteria) and where a Steam Line Break has not been isolated.		
TP	Core damage from sequences initiated by loss of offsite power, with offsite power not recovered prior to core damage, and pressurizer valves have not been opened.	CET1 HI Pressure	Similar to TR above.
TP1	Core damage from sequences initiated by loss of offsite power, with offsite power not recovered before core damage, and where feed and bleed was not successful (based on the Level 1 success criteria)	CET LIMITED CD CET1 HI Pressure	Similar to TR1 above

Table 19.1-16—Core Damage End States and their Treatment in the CETs
Sheet 2 of 6

Bin (Short Code)	Description of Sequences in Bin	CET	Treatment in CET
LL	Core damage sequences initiated by Large LOCA where LHSI is not available.	CET-LO Pressure	CET LO Pressure analyzes the core melt and containment failure progression when the primary system is depressurized.
LL1	Core damage sequences initiated by LL where LHSI is available, but core damage commences due to accumulator injection failure	CET LIMITED CD CET-LO Pressure	If LHSI is successful, the sequence is sent to the Limited CD tree. If LHSI is not successful, the sequence is sent to the CET-LO Pressure tree.
ML	Sequences initiated by ML with core damage.	CET LIMITED CD CET-LO Pressure	If LHSI is successful, the sequence is sent to the Limited CD tree. If LHSI is not successful, the sequence is sent to the CET-LO Pressure tree..
SL	Core damage from small LOCA sequences where fast cooldown has not been successful and the pressurizer valves have not been opened prior to core damage.	CET1 HI Pressure.	CET1 HI PRESSURE interrogates the sequence, and determines whether the sequence will be depressurized by operator action or hot leg rupture, as well as the status of feedwater. If the sequence results in SGTR, it is sent to the SGTR Tree. If the sequence is depressurized, it is sent to the CET LO PRESSURE tree. If it is not, it is sent to the CET2 HI PRESSURE tree.

Table 19.1-16—Core Damage End States and their Treatment in the CETs
Sheet 3 of 6

Bin (Short Code)	Description of Sequences in Bin	CET	Treatment in CET
SL1	Core damage from small LOCA sequences where fast cooldown has not been successful, and where feed and bleed was not successful (based on the Level 1 success criteria).	CET LIMITED CD CET1 HI Pressure	If LHSI and depressurization are both available, the sequence is sent to the Limited CD tree. CET1 HI PRESSURE interrogates the sequence, and determines whether the sequence will be depressurized by operator action or hot leg rupture, as well as the status of feedwater. If the sequence results in SGTR, it is sent to the SGTR Tree. If the sequence is depressurized, it is sent to the CET LO PRESSURE tree. If it is not, it is sent to the CET2 HI PRESSURE tree.
SLD	Core damage from small LOCA sequences where fast cooldown has been successful, but the pressurizer valves have not been opened prior to core damage.	CET1 HI Pressure.	CET1 HI PRESSURE interrogates the sequence, and determines whether the sequence will be depressurized by operator action or hot leg rupture, as well as the status of feedwater. If the sequence results in SGTR, it is sent to the SGTR Tree. If the sequence is depressurized, it is sent to the CET LO PRESSURE tree. If it is not, it is sent to the CET2 HI PRESSURE tree.
SL1D	Core damage from small LOCA sequences where fast cooldown has been successful, and where feed and bleed was not successful (based on the Level 1 success criteria).	CET LIMITED CD CET1 HI Pressure	If LHSI and depressurization are both successful, the sequence is sent to the Limited CD tree. CET1 HI PRESSURE interrogates the sequence, and determines whether the sequence will be depressurized by operator action or hot leg rupture, as well as the status of feedwater. If the sequence results in SGTR, it is sent to the SGTR Tree. If the sequence is depressurized, it is sent to the CET LO PRESSURE tree. If it is not, it is sent to the CET2 HI PRESSURE tree.

Table 19.1-16—Core Damage End States and their Treatment in the CETs
Sheet 4 of 6

Bin (Short Code)	Description of Sequences in Bin	CET	Treatment in CET
PL	Any sequence where core damage occurs and pressurizer valves are open.	CET LIMITED CD CET1 LO Pressure	If LHSI and depressurization are both successful, the sequence is sent to the Limited CD tree. CET LO Pressure analyzes the core melt and containment failure progression when the primary system is depressurized.
SS	Core damage from seal LOCA sequences where fast cooldown has not been successful, the pressurizer valves have not been opened prior to core damage and offsite power is available.	CET1 HI Pressure	Similar to SL above.
SS1	Core damage from seal LOCA sequences where fast cooldown has not been successful, feed and bleed was not successful (based on the Level 1 success criteria), and offsite power is available.	CET LIMITED CD CET1 HI Pressure	Similar to SL1 above.
SSD	Core damage from seal LOCA sequences where fast cooldown has been successful, the pressurizer valves have not been opened prior to core damage and offsite power is available.	CET1 HI Pressure.	Similar to SLD above.
SS1D	Core damage from small LOCA sequences where fast cooldown has been successful, feed and bleed was not successful (based on the Level 1 success criteria) and offsite power is available.	CET LIMITED CD CET1 HI Pressure	Similar to SL1D above

Table 19.1-16—Core Damage End States and their Treatment in the CETs
Sheet 5 of 6

Bin (Short Code)	Description of Sequences in Bin	CET	Treatment in CET
SP	Core damage from seal LOCA sequences where fast cooldown has not been successful, the pressurizer valves have not been opened prior to core damage and offsite power is not available.	CET1 HI Pressure	Similar to SS above.
SP1	Core damage from seal LOCA sequences where fast cooldown has not been successful, feed and bleed not successful (based on the Level 1 success criteria) and offsite power is not available.	CET LIMITED CD CET1 HI Pressure	Similar to SS1 above.
SPD	Core damage from seal LOCA sequences where fast cooldown has been successful, the pressurizer valves have not been opened prior to core damage and offsite power is not available.	CET1 HI Pressure.	Similar to SSD above.
SP1D	Core damage from small LOCA sequences where fast cooldown has been successful, feed and bleed was not successful (based on the Level 1 success criteria), and offsite power is not available.	CET LIMITED CD CET1 HI Pressure	Similar to SS1D above
RV	Core damage from reactor vessel rupture following failure to control pressure during ATWS.	CET1 LO Pressure	CET LO Pressure analyzes the core melt and containment failure progression when the primary system is depressurized.

Table 19.1-16—Core Damage End States and their Treatment in the CETs
Sheet 6 of 6

Bin (Short Code)	Description of Sequences in Bin	CET	Treatment in CET
AT	Core damage from ATWS sequences with no operator initiated SG depressurization	CET1 HI Pressure	CET1 HI PRESSURE interrogates the sequence, and determines whether the sequence will be depressurized by operator action or hot leg rupture, as well as the status of feedwater. If the sequence results in SGTR, it is sent to the SGTR Tree. If the sequence is depressurized, it is sent to the CET LO PRESSURE tree. If it is not, it is sent to the CET2 HI PRESSURE tree.
ATI	Core damage from ATWS sequences with an uncontrolled reactivity transient following a Steam Line Break Inside Containment	CET CF	CET CF takes the sequence directly to containment failure before vessel breach
IS	Core Damage from Interfacing System LOCA sequences	CET ISL	CET ISL determines whether or not there is water available to cover break outside containment and scrub the fission products released from the leak.
SG	Steam Generator Tube Rupture sequences with the SG isolated and pressurizer valves closed	CET-SGTR	CET-SGTR treats the sequence as an unscrubbed release
SG1	Steam Generator Tube Rupture sequences with the SG isolated and with feed and bleed not successful (based on the Level 1 success criteria).	CET LIMITED CD CET- SGTR	If LHSI and depressurization are both successful, the sequence is sent to the Limited CD tree. CET-SGTR treats the sequence as an unscrubbed release
SG2	Steam Generator Tube Rupture sequences with the SG not isolated and Feedwater available	CET- SGTR	CET-SGTR treats the sequence as a scrubbed release, because feedwater is available to cover the break
SG3	Steam Generator Tube Rupture sequences with the SG not isolated, and with Feedwater not available	CET- SGTR	CET-SGTR treats the sequence as an unscrubbed release

Table 19.1-17—Summary of Long Term Challenges Probabilistic Evaluation

Phenomenon	Conditions		Conditional Failure Probability
	CDES	Other - Applicable DET path - outcome DET Header	
DET Header - No containment overpressure failure due to debris quench	TP, TR	Passive flooding successful	3E-06
	PL, SL, ML, SS, LL		0.0
DET Header - No significant MCCI	all	Passive flooding unsuccessful	1.0
		Passive flooding successful	1E-03
DET Header - No containment overpressure failure before basemat penetration	all	Passive flooding unsuccessful	1E-02
DET Header - No basemat penetration	all	Flooding not effective AND Significant MCCI	0.99
		Flooding effective AND Significant MCCI AND SAHRS sprays not available AND Active cooling available	
		Flooding effective AND Significant MCCI AND SAHRS available	
DET Header – Containment overpressure failure due to incomplete melt transfer	all	Flooding effective AND SAHRS Active cooling available and actuated AND No hot leg rupture	1E-02
	TR, TP, SS, SL	Flooding effective AND SAHRS Active cooling available and actuated AND Hot leg rupture	0.5

Table 19.1-18—Description of Level 2 Containment Event Trees
Sheet 1 of 2

CET ID	Description of CET	Figures and Tables presenting further details
#CET CF	This CET is used for core damage sequences assigned the ATI CDES. Entry is via the link tree for the ATI CDES. Sequences in this CDES are steam line breaks inside containment with failure to fulfill the Level 1 reactivity control success criteria. The core damage sequence arising is therefore considered to be an accident at full reactor power with blowdown of the secondary side directly into containment. It is assumed that the steam generation and pressurization of containment in such a scenario would overpressure the containment causing its failure. Thus the sequences in this CET are assigned directly to an early containment failure release category.	Table 19.1.C-1 Figure 19.1.C-1
#CET ISL	This CET is used for core damage sequences assigned the IS CDES (IS LOCA). A header is included to assess whether or not the break location is scrubbed due to an overlying water pool. Note that an assessment performed concluded that a conditional probability of 1.0 of no overlying water pool for scrubbing had to be used for IS LOCA sequences for the U.S. EPR.	Table 19.1.C-2 Figure 19.1.C-2
##CET LIMITED CD	This CET is used for sequences which are identified as being limited core damage cases in the CDES link trees. In these cases as in-vessel arrest of the core damage process and in-vessel retention are assured, the only relevant question is whether or not the containment is isolated.	Table 19.1.C-3 Figure 19.1.C-3
#CET LO PRESSURE	Entry to this CET is via transfers from CET1 HI PRESSURE or directly for low pressure CDES. This CET models the remaining applicable phenomena for low pressure sequences (these being those that are low at core damage or become low in the CET1 HI PRESSURE).	Table 19.1.C-4 Figure 19.1.C-4
#CET SGTR	This CET simply passes the incoming sequences through to RC702 (unscrubbed SGTR).	Table 19.1.C-5 Figure 19.1.C-5
#CET SGTR FW	This CET simply passes the incoming sequences through to RC701 (scrubbed SGTR).	Table 19.1.C-6 Figure 19.1.C-6

Table 19.1-18—Description of Level 2 Containment Event Trees
Sheet 2 of 2

CET ID	Description of CET	Figures and Tables presenting further details
#CET1 HI PRESSURE	This CET is the initial entry point to the CET model for CDES which are initially at high pressure. This CET asks questions corresponding to phenomena occurring during the initial in-vessel phase (timeframe 1, excluding containment isolation, which is addressed in CET2 HI PRESSURE) of the severe accident. Depressurization performed by the operators, depressurization due to an induced hot leg rupture and induced steam generator tube rupture are assessed. For small LOCAs the proportion of these sequences remaining at high pressure (at the time of vessel failure) is also assessed; in the current model it is conservatively assumed that 100% of these sequences remain at high pressure. The outcomes of this initial tree are either release category RC702 (unscrubbed SGTR) or a transfer to the low pressure CET (for sequences depressurized by a hot leg rupture or operator depressurization) or a transfer to the 2nd stage high pressure CET (sequences without depressurization or induced SGTR).	Table 19.1.C-7 Figure 19.1.C-7
#CET2 HI PRESSURE	Entry to this CET is via transfers from CET1 HI PRESSURE. This CET models the remaining applicable phenomena for high pressure sequences (which have not depressurized due to the phenomena addressed in #CET1 HI PRESSURE).	Table 19.1.C-8 Figure 19.1.C-8

Table 19.1-19—Release Category Definitions
Sheet 1 of 2

Release Category	Description
RC101	No containment failure
RC201	Containment fails before vessel breach due to isolation failure, melt retained in vessel
RC202	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex vessel, with containment spray
RC203	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex vessel, without containment spray
RC204	Containment fails before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex vessel with containment spray
RC205	Containment failures before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex vessel without containment spray
RC206	Small containment failure due to failure to isolate 2” or smaller lines
RC301	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex vessel, with containment spray
RC302	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex vessel, without containment spray
RC303	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex vessel, with containment spray
RC304	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex vessel, without containment spray
RC401	Containment failures after breach and up through debris quench due to containment rupture, with MCCI, without debris flooding, with containment spray
RC402	Containment failures after breach and up through debris quench due to containment rupture, with MCCI, without debris flooding, without containment spray
RC403	Containment failures after breach and up through debris quench due to containment rupture, without MCCI, with debris flooding, with containment spray
RC404	Containment failures after breach and up through debris quench due to containment rupture, without MCCI, with debris flooding, without containment spray
RC501	Long term containment failure after debris quench due to rupture, with MCCI, without debris flooding, with containment spray
RC502	Long term containment failure after debris quench due to rupture, with MCCI, without debris flooding, without containment spray
RC503	Long term containment failure after debris quench due to rupture, without MCCI, with debris flooding, with containment spray
RC504	Long term containment failure after debris quench due to rupture, without MCCI, with debris flooding, without containment spray

Table 19.1-19—Release Category Definitions
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RC601	Long term containment failure due to basemat failure, without debris flooding, with containment sprays
RC602	Long term containment failure due to basemat failure, without debris flooding, without containment spray
RC701	Steam Generator Tube Rupture with Fission Product Scrubbing
RC702	Steam Generator Tube Rupture without Fission Product Scrubbing
RC801	Interfacing System LOCA with Fission Product Scrubbing
RC802	Interfacing System LOCA without Fission Product Scrubbing but with building deposition credited

Table 19.1-20—Source Terms for Each Release Category

Release Category	Fraction of initial core inventory released as a total for each fission product group								
	Xe/Kr	I	Cs	Te	Sr	Ru	La	Ce	Ba
RC101	8.8E-03	2.4E-05	2.0E-05	5.3E-05	8.5E-06	4.4E-05	2.8E-07	7.3E-07	2.4E-05
RC201	3.6E-01	1.0E-02	9.5E-02	9.6E-03	7.8E-05	1.1E-03	3.4E-06	1.7E-05	4.1E-04
RC202	7.9E-01	2.3E-02	1.5E-02	2.0E-02	2.4E-04	3.4E-03	1.9E-05	6.8E-05	2.4E-03
RC203	8.9E-01	5.3E-02	2.8E-02	1.6E-01	1.4E-04	6.8E-03	1.5E-05	2.4E-04	2.2E-03
RC204	9.5E-01	2.8E-02	1.6E-02	3.6E-02	1.7E-04	5.3E-03	1.4E-05	6.2E-05	3.2E-03
RC205	9.8E-01	5.7E-02	3.6E-02	9.3E-02	4.0E-03	9.8E-03	3.0E-04	5.3E-04	6.1E-03
RC206	1.9E-01	5.6E-03	5.0E-03	9.0E-03	1.2E-03	7.3E-03	5.5E-05	1.8E-04	4.2E-03
RC301	7.9E-01	2.3E-02	1.5E-02	2.0E-02	2.4E-04	3.4E-03	1.9E-05	6.8E-05	2.4E-03
RC302	8.9E-01	5.3E-02	2.8E-02	1.6E-01	1.4E-04	6.8E-03	1.5E-05	2.4E-04	2.2E-03
RC303	9.5E-01	2.8E-02	1.6E-02	3.6E-02	1.7E-04	5.3E-03	1.4E-05	6.2E-05	3.2E-03
RC304	9.8E-01	5.7E-02	3.6E-02	9.3E-02	4.0E-03	9.8E-03	3.0E-04	5.3E-04	6.1E-03
RC401	8.0E-01	4.6E-03	2.3E-03	3.4E-03	2.7E-03	1.5E-03	8.0E-05	3.4E-04	5.2E-03
RC402	9.7E-01	2.0E-02	1.0E-02	1.2E-02	3.8E-03	2.1E-03	1.1E-04	4.9E-04	7.3E-03
RC403	8.0E-01	4.6E-03	2.3E-03	3.4E-03	2.7E-03	1.5E-03	8.0E-05	3.4E-04	5.2E-03
RC404	9.7E-01	2.0E-02	1.0E-02	1.2E-02	3.8E-03	2.1E-03	1.1E-04	4.9E-04	7.3E-03
RC501	9.9E-01	7.7E-04	4.0E-04	1.7E-02	7.4E-06	4.4E-05	2.2E-07	7.0E-07	2.4E-05
RC502	9.9E-01	7.7E-04	4.0E-04	1.7E-02	7.4E-06	4.4E-05	2.2E-07	7.0E-07	2.4E-05
RC503	1.0E+0	4.1E-04	6.9E-05	6.1E-04	8.5E-06	4.4E-05	2.8E-07	7.3E-07	2.4E-05
RC504	1.0E+0	4.1E-04	6.9E-05	6.1E-04	8.5E-06	4.4E-05	2.8E-07	7.3E-07	2.4E-05
RC602	9.9E-01	7.7E-04	4.0E-04	1.7E-02	7.4E-06	4.4E-05	2.2E-07	7.0E-07	2.4E-05
RC701	1.1E-01	4.2E-03	4.4E-03	6.9E-03	6.0E-04	4.8E-03	2.2E-05	1.1E-04	2.7E-03
RC702	1.1E-01	8.4E-02	8.7E-02	1.4E-01	1.2E-02	9.6E-02	4.5E-04	2.2E-03	5.4E-02
RC802	9.8E-01	7.1E-01	6.9E-01	6.4E-01	1.3E-01	5.7E-01	3.9E-03	2.2E-02	3.8E-01

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