Table 19.1-81—U.S. EPR Risk-Significant Equipment based on FV Importance - Level 2 Internal Fires
Sheet 1 of 3

Rank	System	Component ID	Component Description	FV	RAW
1	ELEC	31BRA	ELEC, 480V MCC 31BRA	0.306	2,240.0
2	ESWS	30PEB30AP001	ESWS, Train 3 Motor Driven Pump PEB30AP001	0.278	8.2
3	ESWS	30PEB20AP001	ESWS, Train 2 Motor Driven Pump PEB20AP001	0.167	8.9
4	SIS/RHR	30JNG13AA005	LHSI, MHSI/LHSI Train 1 First SIS Isolation Check Valve JNG13AA005	0.095	40.2
5	ELEC	30XKA30	ELEC, Emergency Diesel Generator XKA30	0.090	2.6
6	SIS/RHR	30JNG23AA005	LHSI, MHSI/LHSI Train 2 First SIS Isolation Check Valve JNG23AA005	0.064	3.2
7	SIS/RHR	30JND10AP001	MHSI, Train 1 Motor Driven Pump JND10AP001	0.061	2.9
8	ESWS	30PEB20AA005	ESWS, Train 2 Pump Discharge Isolation MOV PEB20AA005	0.042	8.7
9	UHS	30PED20AA010	UHS, Cooling Tower Train 2 Spray MOV PED20AA010	0.042	8.7
10	CCWS	30KAA10AP001	CCWS, Train 1 Motor Driven Pump KAA10AP001	0.041	363.0
11	SIS/RHR	30JNG10AP001	LHSI, Train 1 Motor Driven Pump JNG10AP001	0.038	4.3
12	IRWST	30JNK10AT001	IRWST, SIS Sump Strainer to MHSI/LHSI Train 1 Pumps JNK10AT001	0.038	60.7
13	ELEC	32BRA	ELEC, 480V MCC 32BRA	0.037	274.0
14	ESWS	30PEB30AA005	ESWS, Train 3 Pump Discharge Isolation MOV PEB30AA005	0.037	7.9
15	UHS	30PED30AA010	UHS, Cooling Tower Train 3 Spray MOV PED30AA010	0.037	7.9
16	ESWS	30PEB10AP001	ESWS, Train 1 Motor Driven Pump PEB10AP001	0.035	366.0
17	SIS/RHR	30JNG33AA005	LHSI, MHSI/LHSI Train 3 First SIS Isolation Check Valve JNG33AA005	0.034	1.0
18	IRWST	30JNK10AT002	IRWST, SIS Sump Strainer to MHSI/LHSI Train 2 Pumps JNK10AT002	0.032	2.0
19	SIS/RHR	30JNG43AA005	LHSI, MHSI/LHSI Train 4 First SIS Isolation Check Valve JNG43AA005	0.032	1.0
20	SIS/RHR	30JNG10AA006	LHSI, LHSI CL1 Discharge Manual CHECK Valve JNG10AA006	0.028	4.5
21	CCWS	30KAA20AP001	CCWS, Train 2 Motor Driven Pump KAA20AP001	0.028	8.1
22	EFWS	30LAS21AP001	EFWS, Train 2 Motor Driven Pump LAS21AP001	0.026	2.1

Table 19.1-81—U.S. EPR Risk-Significant Equipment based on FV Importance - Level 2 Internal Fires
Sheet 2 of 3

Rank	System	Component ID	Component Description	FV	RAW
23	UHS	30PED10AN002	UHS, Cooling Tower Train 1 Cooling Fan PED10AN002	0.025	6.1
24	EFWS	30LAS11AP001	EFWS, Train 1 Motor Driven Pump LAS11AP001	0.025	2.0
25	CCWS	30KAA30AP001	CCWS, Train 3 Motor Driven Pump KAA30AP001	0.025	7.1
26	CCWS	30KAA12AA005	CCWS, Train 1 to LHSI HTX 10 Cooling MOV KAA12AA005	0.024	5.3
27	IRWST	30JNK11AT001	IRWST, SIS Sump Strainer to MHSI/LHSI Train 4 Pumps JNK11AT001	0.022	1.0
28	IRWST	30JNK11AT002	IRWST, SIS Sump Strainer to MHSI/LHSI Train 3 Pumps JNK11AT002	0.022	1.0
29	IRWST	30JNK10AT003	IRWST, CVCS Sump Strainer JNK10AT003	0.022	1.3
30	IRWST	30JNK11AT003	IRWST, SAHR Sump Strainer JNK11AT003	0.022	1.0
31	MSS	30LBA23AA001	MSS, Train 2 MSRIV LBA23AA001	0.021	4.6
32	MSS	30LBA33AA001	MSS, Train 3 MSRIV LBA33AA001	0.020	4.6
33	MSS	30LBA13AA001	MSS, Train 1 MSRIV LBA13AA001	0.019	4.6
34	MSS	30LBA43AA001	MSS, Train 4 MSRIV LBA43AA001	0.019	4.6
35	SIS/RHR	30JND10AA003	MHSI, MHSI Pump 10 Discharge Manual CHECK Valve JND10AA003	0.015	2.8
36	HVAC	30SAC05AA003	SAC, Maintenance Division Outside Air Supply Damper SAC05AA003	0.014	1.2
37	SCWS	30QKA40GH001	SCWS, Train 4 Chiller Unit QKA40GH001	0.014	1.7
38	ELEC	30XKA10	ELEC, Emergency Diesel Generator XKA10	0.011	1.1
39	EFWS	30LAS31AP001	EFWS, Train 3 Motor Driven Pump LAS31AP001	0.010	1.0
40	SIS/RHR	30JNA10AA101	RHR, LHSI Train 1 HTX Bypass MOV JNA10AA101	0.010	4.3
41	SIS/RHR	30JNG20AA006	LHSI, LHSI CL2 Discharge Manual CHECK Valve JNG20AA006	0.010	2.2
42	MSS	30LBA22AA191	MSS, Train 2 Main Steam Safety Relief Valve LBA22AA191	0.010	4.2
43	MSS	30LBA21AA191	MSS, Train 2 Main Steam Safety Relief Valve LBA21AA191	0.010	4.2
44	MSS	30LBA31AA191	MSS, Train 3 Main Steam Safety Relief Valve LBA31AA191	0.010	4.2
45	MSS	30LBA32AA191	MSS, Train 3 Main Steam Safety Relief Valve LBA32AA191	0.010	4.2

Table 19.1-81—U.S. EPR Risk-Significant Equipment based on FV Importance - Level 2 Internal Fires
Sheet 3 of 3

Rank	System	Component ID	Component Description	FV	RAW
46	MSS	30LBA11AA191	MSS, Train 1 Main Steam Safety Relief Valve LBA11AA191	0.010	4.2
47	MSS	30LBA12AA191	MSS, Train 1 Main Steam Safety Relief Valve LBA12AA191	0.010	4.2
48	MSS	30LBA41AA191	MSS, Train 4 Main Steam Safety Relief Valve LBA41AA191	0.010	4.2
49	MSS	30LBA42AA191	MSS, Train 4 Main Steam Safety Relief Valve LBA42AA191	0.010	4.2
50	EFWS	30LAS41AP001	EFWS, Train 4 Motor Driven Pump LAS41AP001	0.009	1.0
51	CCWS	30KAA22AA005	CCWS, Train 2 to LHSI HTX 20 Cooling MOV KAA22AA005	0.008	2.1
52	SIS/RHR	30JNG10AC001	LHSI, LHSI Train 1 HTX JNG10AC001	0.008	335.0
53	ELEC	31BDD	ELEC, 6.9kV SWGR 31BDD	0.008	333.0
54	ELEC	31BMD	ELEC, 480V Load Center 31BMD	0.008	333.0
55	ELEC	31BMT04	ELEC, 6.9kV-480V Transformer 31BMT04	0.008	333.0
56	ELEC	1BRU011BRA	ELEC, Inverter 31BRU01 to 480V MCC 31BRA Circuit Breaker	0.008	1,110.0
57	ELEC	30XKA20	ELEC, Emergency Diesel Generator XKA20	0.007	1.1
58	UHS	30PED20AN001	UHS, Cooling Tower Train 2 Cooling Fan PED20AN001	0.007	2.4
59	UHS	30PED20AN002	UHS, Cooling Tower Train 2 Cooling Fan PED20AN002	0.007	2.4
60	SCWS	30QKA20GH001	SCWS, Train 2 Chiller Unit QKA20GH001	0.007	1.3
61	CCWS	30KAA22AA013	CCWS, Train 2 LHSI Pump Seal Cooler MOV KAA22AA013	0.006	2.1
62	HVAC	30SAC01AN001	SAC, Normal Air Supply Fan SAC01AN001	0.006	16.6
63	HVAC	30SAC31AN001	SAC, Normal Air Exhaust Fan SAC31AN001	0.006	16.6

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
Sheet 1 of 9

Rank	System	Component ID	Component Description	RAW	FV
1	ELEC	31BRA	ELEC, 480V MCC 31BRA	2,240.0	0.306
2	ELEC	1BRU011BRA	ELEC, Inverter 31BRU01 to 480V MCC 31BRA Circuit Breaker	1,110.0	0.008
3	ESWS	30PEB10AP001	ESWS, Train 1 Motor Driven Pump PEB10AP001	366.0	0.035
4	CCWS	30KAA10AP001	CCWS, Train 1 Motor Driven Pump KAA10AP001	363.0	0.041
5	SIS/RHR	30JNG10AC001	LHSI, LHSI Train 1 HTX JNG10AC001	335.0	0.008
6	ELEC	31BDD	ELEC, 6.9kV SWGR 31BDD	333.0	0.008
7	ELEC	31BMD	ELEC, 480V Load Center 31BMD	333.0	0.008
8	ELEC	31BMT04	ELEC, 6.9kV-480V Transformer 31BMT04	333.0	0.008
9	CCWS	30KAA10BB001	CCWS, Train 1 Surge Tank KAA10BB001	307.0	0.004
10	CCWS	30KAA10AA112	CCWS, Train 1 Heat Exchanger Bypass MOV KAA10AA112	294.0	0.003
11	ESWS	30PEB10AA002	ESWS, Train 1 Pump Recirc MOV PEB10AA002	294.0	0.003
12	ESWS	30PEB10AA005	ESWS, Train 1 Pump Discharge Isolation MOV, PEB10AA005	294.0	0.002
13	UHS	30PED10AA010	UHS, Cooling Tower Train 1 Spray MOV PED10AA010	294.0	0.002
14	UHS	30PED10AA011	UHS, Cooling Tower Train 1 Bypass Line MOV PED10AA011	294.0	0.003
15	ELEC	1BDA_1BDD1	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDD Circuit Breaker	275.0	0.002
16	ELEC	1BDA_1BDD2	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDD Circuit Breaker	275.0	0.002
17	ELEC	1BDD1BMT04	ELEC, 6.9kV SWGR 31BDD to Transformer 31BMT04 Circuit Breaker	275.0	0.002
18	ELEC	1BMT041BMD	ELEC, Transformer 31BMT04 to 480V Load Center 31BMD Circuit Breaker	275.0	0.002
19	CCWS	30KAA10AC001	CCWS, Train 1 HTX 10 KAA10AC001	275.0	0.002
20	ELEC	32BRA	ELEC, 480V MCC 32BRA	274.0	0.037
21	CCWS	30KAA10AA004	CCWS, Train 1 Discharge from CCW HTX 10 Check Valve KAA10AA004	238.0	0.001
22	ESWS	30PEB10AA204	ESWS, Train 1 Pump Discharge Check Valve PEB10AA204	238.0	0.001

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
Sheet 2 of 9

Rank	System	Component ID	Component Description	RAW	FV
23	ELEC	31BDA	ELEC, 6.9kV Switchgear 31BDA	176.0	0.004
24	ELEC	31BDC	ELEC, 6.9kV SWGR 31BDC	150.0	0.004
25	ELEC	2BRU012BRA	ELEC, Inverter 32BRU01 to 480V MCC 32BRA Circuit Breaker	130.0	0.001
26	ELEC	31BDB	ELEC, 6.9kV SWGR 31BDB	119.0	0.003
27	ELEC	31BMB	ELEC, 480V Load Center 31BMB	119.0	0.003
28	ELEC	31BMT02	ELEC, 6.9kV-480V Transformer 31BMT02	119.0	0.003
29	ELEC	1BDA_1BDC1	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	104.0	0.001
30	ELEC	1BDA_1BDC2	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	104.0	0.001
31	ELEC	1BDB1BMT02	ELEC, 6.9kV SWGR 31BDB to Transformer 31BMT02 Circuit Breaker	76.8	0.001
32	ELEC	1BDC_1BDB1	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	76.8	0.001
33	ELEC	1BDC_1BDB2	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	76.8	0.001
34	ELEC	1BMT021BMB	ELEC, Transformer 31BMT02 to 480V Load Center 31BMB Circuit Breaker	76.8	0.001
35	IRWST	30JNK10AT001	IRWST, SIS Sump Strainer to MHSI/LHSI Train 1 Pumps JNK10AT001	60.7	0.038
36	ELEC	32BDA	ELEC, 6.9kV SWGR 32BDA	50.4	0.001
37	ELEC	31BNB02	ELEC, 480V MCC 31BNB02	48.7	0.001
38	ELEC	31BNT01	ELEC, Constant Voltage Transformer 31BNT01	48.7	0.001
39	SIS/RHR	30JNG13AA005	LHSI, MHSI/LHSI Train 1 First SIS Isolation Check Valve JNG13AA005	40.2	0.095
40	ELEC	31BUC	ELEC, 1E 250V DC Switchboard 31BUC	38.2	0.001
41	ELEC	31BRW10BUW11	ELEC, 24V DC I&C Power Rack 31BRW10/ 31BUW11	37.8	0.001
42	ELEC	32BRW32BUW33	ELEC, 24V DC I&C Power Rack 32BRW32/ 32BUW33	37.8	0.001
43	IRWST	30JNK10AA001	IRWST, SIS Sump to MHSI/LHSI Train 1 Pumps Suction MOV JNK10AA001	35.0	0.000
44	ELEC	1BMB1BNT01	ELEC, 480V Load Center 31BMB to Transformer 31BNT01 Circuit Breaker	29.5	0.000

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
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Rank	System	Component ID	Component Description	RAW	FV
45	ELEC	1BNT011BNB02	ELEC, Transformer 31BNT01 to 480V MCC 31BNB02 Circuit Breaker	29.5	0.000
46	ELEC	32BDB	ELEC, 6.9kV SWGR 32BDB	22.4	0.001
47	ELEC	32BMB	ELEC, 480V Load Center 32BMB	22.4	0.001
48	ELEC	32BMT02	ELEC, 6.9kV-480V Transformer 32BMT02	22.4	0.001
49	ELEC	2BDA_2BDB1	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	20.0	0.000
50	ELEC	2BDA_2BDB2	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	20.0	0.000
51	ELEC	2BDB2BMT02	ELEC, 6.9kV SWGR 32BDB to Transformer 32BMT02 Circuit Breaker	20.0	0.000
52	ELEC	2BMT022BMB	ELEC, Transformer 32BMT02 to 480V Load Center 32BMB Circuit Breaker	20.0	0.000
53	HVAC	30SAC01AN001	SAC, Normal Air Supply Fan SAC01AN001	16.6	0.006
54	HVAC	30SAC31AN001	SAC, Normal Air Exhaust Fan SAC31AN001	16.6	0.006
55	SCWS	30QKC10AA101	SCWS, Return from SAC Div 1 MOV QKC10AA101	12.5	0.001
56	HVAC	30SAC01AA004	SAC, Div 1 Recirculation Motor Operated Damper SAC01AA004	12.5	0.001
57	ELEC	31BTD01	ELEC, 250V 1E 2-hr Battery 31BTD01	10.3	0.005
58	ESWS	30PEB20AP001	ESWS, Train 2 Motor Driven Pump PEB20AP001	8.9	0.167
59	ESWS	30PEB20AA005	ESWS, Train 2 Pump Discharge Isolation MOV PEB20AA005	8.7	0.042
60	UHS	30PED20AA010	UHS, Cooling Tower Train 2 Spray MOV PED20AA010	8.7	0.042
61	ESWS	30PEB30AP001	ESWS, Train 3 Motor Driven Pump PEB30AP001	8.2	0.278
62	CCWS	30KAA20AP001	CCWS, Train 2 Motor Driven Pump KAA20AP001	8.1	0.028
63	ESWS	30PEB30AA005	ESWS, Train 3 Pump Discharge Isolation MOV PEB30AA005	7.9	0.037
64	UHS	30PED30AA010	UHS, Cooling Tower Train 3 Spray MOV PED30AA010	7.9	0.037
65	HVAC	30SAC01AA003	SAC, Normal Air Inlet Motor Operated Damper SAC01AA003	7.2	0.001

**Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
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Rank	System	Component ID	Component Description	RAW	FV
66	HVAC	30SAC31AA002	SAC, Normal Air Exhaust Motor Operated Damper SAC31AA002	7.2	0.000
67	ELEC	BDT01	ELEC, Aux Transformer 30BDT01	7.2	0.000
68	CCWS	30KAA30AP001	CCWS, Train 3 Motor Driven Pump KAA30AP001	7.1	0.025
69	ELEC	33BUC	ELEC, 1E 250V DC Switchboard 33BUC	7.0	0.000
70	HVAC	30SAC01AA005	SAC, Normal Air Inlet Supply Fan Discharge Check Damper SAC01AA005	6.4	0.000
71	HVAC	30SAC31AA003	SAC, Normal Air Exhaust Supply Fan Discharge Check Damper SAC31AA003	6.4	0.000
72	ELEC	BDT01_1BDA	ELEC, Aux Transformer 30BDT01 to 6.9kV SWGR 31BDA Circuit Breaker	6.3	0.000
73	UHS	30PED10AN002	UHS, Cooling Tower Train 1 Cooling Fan PED10AN002	6.1	0.025
74	UHS	30PED10AN001	UHS, Cooling Tower Train 1 Cooling Fan PED10AN001	5.4	0.003
75	CCWS	30KAA12AA005	CCWS, Train 1 to LHSI HTX 10 Cooling MOV KAA12AA005	5.3	0.024
76	CCWS	30KAB30AA191	CCWS, RCP Thermal Barrier to CCWS CH1 Return Safety Valve KAB30AA191	4.9	0.000
77	CCWS	30KAB10AA192	CCWS, CCWS CH1 Return Safety Valve KAB10AA192	4.8	0.000
78	CCWS	30KAB10AA193	CCWS, FPCS Train 1 Cooling Header Safety Valve KAB10AA193	4.8	0.000
79	CCWS	30KAB60AA191	CCWS, CVCS HP Cooler 1 Return Safety Valve KAB60AA191	4.8	0.000
80	MSS	30LBA13AA001	MSS, Train 1 MSRIV LBA13AA001	4.6	0.019
81	MSS	30LBA23AA001	MSS, Train 2 MSRIV LBA23AA001	4.6	0.021
82	MSS	30LBA33AA001	MSS, Train 3 MSRIV LBA33AA001	4.6	0.020
83	MSS	30LBA43AA001	MSS, Train 4 MSRIV LBA43AA001	4.6	0.019
84	CCWS	30KAA20AA005	CCWS, Discharge from CCW HTX 20 Manual Valve KAA20AA005	4.5	0.001
85	CCWS	30KAA20AA007	CCWS, Pump 20 Cooling Manual Valve KAA20AA007	4.5	0.001
86	CCWS	30KAA20AA008	CCWS, Pump 20 Cooling Manual Valve KAA20AA008	4.5	0.001

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
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Rank	System	Component ID	Component Description	RAW	FV
87	CCWS	30KAA20AA011	CCWS, Pump 20 Suction from CCST Manual Valve KAA20AA011	4.5	0.001
88	CCWS	30KAA20AA015	CCWS, Pump 20 Suction Manual Valve KAA20AA015	4.5	0.001
89	CCWS	30KAA20AA018	CCWS, Pump 20 Discharge Manual Valve KAA20AA018	4.5	0.001
90	CCWS	30KAA20AA140	CCWS, Pump 20 Cooling Manual Valve KAA20AA140	4.5	0.001
91	ESWS	30PEB20AA007	ESWS, Train 2 Manual Valve PEB20AA007	4.5	0.001
92	ESWS	30PEB20AA009	ESWS, Train 2 Manual Valve PEB20AA009	4.5	0.001
93	ESWS	30PEB20AA027	ESWS, Train 2 Manual Valve PEB20AA027	4.5	0.001
94	ESWS	30PEB20AA029	ESWS, Train 2 Manual Valve PEB20AA029	4.5	0.001
95	SIS/RHR	30JNG10AA006	LHSI, LHSI CL1 Discharge Manual CHECK Valve JNG10AA006	4.5	0.028
96	SCWS	30QKA10AA102	SCWS, Train 1 Discharge Xtie MOV QKA10AA102	4.5	0.000
97	SCWS	30QKA10AA103	SCWS, Train 1 Suction Xtie MOV QKA10AA103	4.5	0.000
98	SCWS	30QKA20AA102	SCWS, Train 2 Discharge Xtie MOV QKA20AA102	4.5	0.000
99	SCWS	30QKA20AA103	SCWS, Train 2 Suction Xtie MOV QKA20AA103	4.5	0.000
100	SIS/RHR	30JNA10AA101	RHR, LHSI Train 1 HTX Bypass MOV JNA10AA101	4.3	0.010
101	SIS/RHR	30JNG10AP001	LHSI, Train 1 Motor Driven Pump JNG10AP001	4.3	0.038
102	MSS	30LBA11AA191	MSS, Train 1 Main Steam Safety Relief Valve LBA11AA191	4.2	0.010
103	MSS	30LBA12AA191	MSS, Train 1 Main Steam Safety Relief Valve LBA12AA191	4.2	0.010
104	MSS	30LBA21AA191	MSS, Train 2 Main Steam Safety Relief Valve LBA21AA191	4.2	0.010
105	MSS	30LBA22AA191	MSS, Train 2 Main Steam Safety Relief Valve LBA22AA191	4.2	0.010
106	MSS	30LBA31AA191	MSS, Train 3 Main Steam Safety Relief Valve LBA31AA191	4.2	0.010
107	MSS	30LBA32AA191	MSS, Train 3 Main Steam Safety Relief Valve LBA32AA191	4.2	0.010

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
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Rank	System	Component ID	Component Description	RAW	FV
108	MSS	30LBA41AA191	MSS, Train 4 Main Steam Safety Relief Valve LBA41AA191	4.2	0.010
109	MSS	30LBA42AA191	MSS, Train 4 Main Steam Safety Relief Valve LBA42AA191	4.2	0.010
110	ELEC	31BRU01	ELEC, Inverter 31BRU01	4.0	0.001
111	ELEC	34BDA	ELEC, 6.9kV SWGR 34BDA	3.6	0.000
112	CCWS	30KAA30AA005	CCWS, Discharge from CCW HTX 30 Manual Valve KAA30AA005	3.6	0.001
113	CCWS	30KAA30AA007	CCWS, Pump 30 Cooling Manual Valve KAA30AA007	3.6	0.001
114	CCWS	30KAA30AA008	CCWS, Pump 30 Cooling Manual Valve KAA30AA008	3.6	0.001
115	CCWS	30KAA30AA011	CCWS, Pump 30 Suction from CCST Manual Valve KAA30AA011	3.6	0.001
116	CCWS	30KAA30AA015	CCWS, Pump 30 Suction Manual Valve KAA30AA015	3.6	0.001
117	CCWS	30KAA30AA018	CCWS, Pump 30 Discharge Manual Valve KAA30AA018	3.6	0.001
118	CCWS	30KAA30AA140	CCWS, Pump 30 Cooling Manual Valve KAA30AA140	3.6	0.001
119	ESWS	30PEB30AA007	ESWS, Train 3 Manual Valve PEB30AA007	3.6	0.001
120	ESWS	30PEB30AA009	ESWS, Train 3 Manual Valve PEB30AA009	3.6	0.001
121	ESWS	30PEB30AA027	ESWS, Train 2 Manual Valve PEB30AA027	3.6	0.001
122	ESWS	30PEB30AA029	ESWS, Train 2 Manual Valve PEB30AA029	3.6	0.001
123	ELEC	34BDC	ELEC, 6.9kV SWGR 34BDC	3.4	0.000
124	ELEC	34BDB	ELEC, 6.9kV SWGR 34BDB	3.4	0.000
125	ELEC	34BMB	ELEC, 480V Load Center 34BMB	3.4	0.000
126	ELEC	34BMT02	ELEC, 6.9kV-480V Transformer 34BMT02	3.4	0.000
127	RCS	30JEF10CP801	PZR pressure (NR) sensor	3.3	0.000
128	RCS	30JEF10CP803	PZR pressure (NR) sensor	3.3	0.000
129	RCS	30JEF10CP805	PZR pressure (NR) sensor	3.3	0.000
130	ELEC	33BTD01	ELEC, 250V 1E 2-hr Battery 33BTD01	3.3	0.002
131	GWPS	30KPL84AA007	GWPS, Inflow line inboard check valve KPL84AA007	3.3	0.000

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
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Rank	System	Component ID	Component Description	RAW	FV
132	GWPS	30KPL84AA013	GWPS, Inflow line inboard check valve KPL84AA013	3.3	0.000
133	CCWS	30KAA20AA004	CCWS, Train 2 Discharge from CCW HTX 20 Check Valve KAA20AA004	3.2	0.000
134	ESWS	30PEB20AA204	ESWS, Train 2 Pump Discharge Check Valve, PEB20AA204	3.2	0.000
135	SIS/RHR	30JNG23AA005	LHSI, MHSI/LHSI Train 2 First SIS Isolation Check Valve JNG23AA005	3.2	0.064
136	ELEC	33BNB02	ELEC, 480V MCC 33BNB02	3.0	0.000
137	CCWS	30KAA10AP006A	CCWS, Hydraulic Valve KAA10AA006 Hydraulic Pump KAA10AP006A	2.9	0.001
138	CCWS	30KAA10AP010A	CCWS, Hydraulic Valve KAA10AA010 Hydraulic Pump KAA10AP010A	2.9	0.001
139	SIS/RHR	30JND10AP001	MHSI, Train 1 Motor Driven Pump JND10AP001	2.9	0.061
140	ELEC	4BDA_4BDC1	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	2.9	0.000
141	ELEC	4BDA_4BDC2	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	2.9	0.000
142	ELEC	4BDB4BMT02	ELEC, 6.9kV SWGR 34BDB to Transformer 34BMT02 Circuit Breaker	2.9	0.000
143	ELEC	4BDC_4BDB1	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	2.9	0.000
144	ELEC	4BDC_4BDB2	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	2.9	0.000
145	ELEC	4BMT024BMB	ELEC, Transformer 34BMT02 to 480V Load Center 34BMB Circuit Breaker	2.9	0.000
146	SIS/RHR	30JND10AA003	MHSI, MHSI Pump 10 Discharge Manual CHECK Valve JND10AA003	2.8	0.015
147	ELEC	33BRW52BUW53	ELEC, 24V DC I&C Power Rack BRW52/ BUW53	2.7	0.000
148	ELEC	32BNB02	ELEC, 480V MCC 32BNB02	2.7	0.000
149	ELEC	30XKA30	ELEC, Emergency Diesel Generator XKA30	2.6	0.090
150	CCWS	30KAA10AA006	CCWS, Train 1 Discharge to Common Header 1 Hydraulic Valve KAA10AA006	2.6	0.000
151	CCWS	30KAA10AA010	CCWS, Train 1 Return from Common Header 1 Hydraulic Valve KAA10AA010	2.6	0.000

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
Sheet 8 of 9

Rank	System	Component ID	Component Description	RAW	FV
152	HVAC	30SAC04AN001	SAC, Normal Air Supply Fan SAC04AN001	2.6	0.001
153	HVAC	30SAC34AN001	SAC, Normal Air Exhaust Fan SAC34AN001	2.6	0.001
154	SCWS	30QKA10GH001	SCWS, Train 1 Chiller Unit QKA10GH001	2.5	0.002
155	UHS	30PED20AN001	UHS, Cooling Tower Train 2 Cooling Fan PED20AN001	2.4	0.007
156	UHS	30PED20AN002	UHS, Cooling Tower Train 2 Cooling Fan PED20AN002	2.4	0.007
157	ELEC	33BDA	ELEC, 6.9kV SWGR 33BDA	2.4	0.000
158	ELEC	33BDB	ELEC, 6.9kV SWGR 33BDB	2.3	0.000
159	ELEC	33BMB	ELEC, 480V Load Center 33BMB	2.3	0.000
160	ELEC	33BMT02	ELEC, 6.9kV-480V Transformer 33BMT02	2.3	0.000
161	ELEC	34BNB02	ELEC, 480V MCC 34BNB02	2.3	0.000
162	ELEC	34BNT01	ELEC, Constant Voltage Transformer 34BNT01	2.3	0.000
163	CCWS	30KAA30AA004	CCWS, Train 3 Discharge from CCW HTX 30 Check Valve KAA30AA004	2.3	0.000
164	ESWS	30PEB30AA204	ESWS, Train 3 Pump Discharge Check Valve, PEB30AA204	2.3	0.000
165	SIS/RHR	30JNG20AA006	LHSI, LHSI CL2 Discharge Manual CHECK Valve JNG20AA006	2.2	0.010
166	ELEC	31BRU0101	ELEC, Inverter 31BRU01 Static Switch 31BRU0101	2.2	0.000
167	ELEC	32BNT04	ELEC, Voltage Regulating Transformer 32BNT04	2.2	0.000
168	SCWS	30QKC40AA101	SCWS, Return from SAC Div 4 MOV QKC40AA101	2.2	0.000
169	HVAC	30SAC04AA004	SAC, Div 4 Recirculation Motor Operated Damper SAC04AA004	2.2	0.000
170	ELEC	33BNT01	ELEC, Constant Voltage Transformer 33BNT01	2.2	0.000
171	SIS/RHR	30JNG20AC001	LHSI, LHSI Train 2 HTX JNG20AC001	2.2	0.000
172	ELEC	32BDD	ELEC, 6.9kV SWGR 32BDD	2.2	0.000
173	ELEC	32BMD	ELEC, 480V Load Center 32BMD	2.2	0.000
174	ELEC	32BMT04	ELEC, 6.9kV-480V Transformer 32BMT04	2.2	0.000
175	CCWS	30KAA22AA005	CCWS, Train 2 to LHSI HTX 20 Cooling MOV KAA22AA005	2.1	0.008

Table 19.1-82—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 2 Internal Fires
Sheet 9 of 9

Rank	System	Component ID	Component Description	RAW	FV
176	CCWS	30KAA22AA013	CCWS, Train 2 LHSI Pump Seal Cooler MOV KAA22AA013	2.1	0.006
177	EFWS	30LAS21AP001	EFWS, Train 2 Motor Driven Pump LAS21AP001	2.1	0.026
178	EFWS	30LAS11AP001	EFWS, Train 1 Motor Driven Pump LAS11AP001	2.0	0.025

Table 19.1-83—U.S. EPR Risk-Significant Human Actions based on FV Importance-Level 2 Internal Fires

Rank	ID	Description	Nominal Value	FV	RAW
1	OPF-RCP-30M	Operator Fails to Trip RCPs on a Loss of Bearing Cooling	4.0E-02	0.253	7.0
2	OPE-MCR-RSS-90M	Operator Fails to Transfer to the RSS in 90 Mins Given A MCR Fire	7.0E-05	0.051	733.0
3	OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	1.2E-02	0.046	4.8
4	OPF-RCP-10M	Operator Fails to Trip RCPs on a Loss of Seal Injection	6.0E-02	0.022	1.3
5	OPF-CCWS TR SO	Operator Fails to Switch CH Supply to Standby CCW Train Before A Loss of the Running Train	1.6E-01	0.015	1.1
6	OPE-FB-40M	Operator Fails to Initiate Feed & Bleed for SLOCA	2.8E-02	0.013	1.4
7	OPF-XTIE BC	Operator Fails to Align Backup Battery Charger to BUC Bus	5.0E-01	0.010	1.0
8	OPF-BRA MAN	Operator Fails to Manually Align and Power Bus Through Maintenance Tie	5.0E-01	0.009	1.0

Table 19.1-84—U.S. EPR Risk-Significant Human Actions based on RAW Importance-Level 2 Internal Fires

Rank	ID	Description	Nominal Value	RAW	FV
1	OPE-MCR-RSS-90M	Operator Fails to Transfer to the RSS in 90 Mins Given A MCR Fire	7.0E-05	733.0	0.051
2	OPF-EFW-6H	Operator Fails to Manually Align EFW Tanks Within 6 Hrs	2.0E-05	19.7	0.000
3	OPE-RHR-L12H	Operator Fails to Initiate RHR (Longer than 12 Hours)	5.5E-05	14.2	0.001
4	OPF-RCP-30M	Operator Fails to Trip RCPs on a Loss of Bearing Cooling	4.0E-02	7.0	0.253
5	OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	1.2E-02	4.8	0.046
6	OPF-SAC-1H	Operator Fails to Start Maintenance HVAC Trains After Failure of Normal SAC Safety Train	1.1E-04	3.2	0.000

Table 19.1-85—U.S. EPR Risk-Significant Common Cause Events based on RAW Importance - Level 2 Internal Fires
Sheet 1 of 2

Rank	System	ID	Description	Nominal Value	RAW
1	CCWS	JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	5.7E-06	3,460.0
2	SIS/RHR	JNG13AA005CFO_D-ALL	CCF to Open LHSI/MHSI Common Injection Check Valves (SIS First Isolation Valves)	4.1E-06	3,430.0
3	ELEC	BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand	1.6E-07	2,160.0
4	UHS	PED10AN002EFS_F-ALL	CCF to Start Standby Cooling Tower Fans (At Power)	3.3E-05	1,360.0
5	UHS	PED10AN002EFR_F-ALL	CCF to Run Standby Cooling Tower Fans (At Power)	1.9E-06	1,250.0
6	HVAC	SAC01AN001EFR_B-ALL	CCF to Run Normal Air Supply Fans (Trains 1 & 4)	5.1E-06	429.0
7	HVAC	SAC31AN001EFR_B-ALL	CCF to Run Normal Air Exhaust Fans (Trains 1 & 4)	5.1E-06	429.0
8	EFWS	LAS11AP001EFS_D-ALL	CCF of EFWS Pumps to Start	1.0E-05	373.0
9	EFWS	LAS11AP001EFR_D-ALL	CCF of EFWS Pumps to Run	7.7E-06	355.0
10	ESWS	PEB10AP001EFR_B-ALL	CCF of ESWS Pumps 1 and 4 to Run (Normally Running)	1.9E-06	206.0
11	CCWS	KAA10AP001EFR_B-ALL	CCF of CCWS Pumps 1 and 4 to Run (Normally Running)	9.6E-07	183.0
12	ESWS	PEB20AP001EFS_B-ALL	CCF of ESWS Pumps 2 and 3 to Start (Standby)	8.1E-05	116.0
13	CCWS	KAA20AP001EFS_B-ALL	CCF of CCWS Pumps 2 and 3 to Start (Standby)	5.5E-05	112.0
14	MSS	LBA13AA001PFO_D-ALL	CCF to Open Main Steam Relief Isolation Valves	4.6E-05	79.4
15	MSS	MSRIVSCPFO_P-ALL	CCF to Open Main Steam Relief Isolation Steam Operated Pistion Valve Pilot Valves	3.7E-06	74.0
16	MSS	MSRIVSOOFO_P-ALL	CCF to Open Main Steam Relief Isolation Solenoid Pilot Valves	1.9E-06	72.7

Table 19.1-85—U.S. EPR Risk-Significant Common Cause Events based on RAW Importance - Level 2 Internal Fires
Sheet 2 of 2

Rank	System	ID	Description	Nominal Value	RAW
17	CCWS	KAA12AA005EFO_D-ALL	CCF to Open CCWS to LHSI HTX Cooling MOV	2.2E-05	58.1
18	ESWS	PEB20AP001EFR_B-ALL	CCF of ESWS Pumps 2 and 3 to Run (Standby)	1.9E-06	31.7
19	ELEC	XKA10_____DFR_D-ALL	CCF of EDGs to Run	1.0E-04	20.4

Table 19.1-86—U.S. EPR Risk-Significant I&C Common Cause Events based on RAW Importance - Level 2 Internal Fires

Rank	ID	Description	Nominal Value	RAW
1	SG LVL CCG	Common Cause Failure of the SG Level Sensors (32)	4.9E-08	5,540.0
2	SAS CCF-ALL	CCF of SAS Divisions	5.0E-07	297.0
3	EFW FLOW CCF-ALL	CCF of EFW pump discharge flow sensors	2.7E-06	274.0
4	I/O MOD CCF	I/O Module Common Cause Failure	6.5E-06	246.0
5	ALU/APU NS-ALL	CCF of ALU and APU Protection System Computer Processors (Non-Self-Monitored)	3.3E-07	217.0
6	CL-PS-B-SWCCF	CCF of Protection System Diversity Group B Application Software	1.0E-05	76.3
7	CL-TXS-OSCCF	CCF of TXS Operating System or Other Common Software	1.0E-07	62.6
8	ALU/APU SM-ALL	CCF of ALU and APU Protection System Computer Processors (Self-Monitored)	9.0E-08	62.4

Table 19.1-87—Plant Operating States (POS)
Sheet 1 of 2

POS	Description	RCS Conditions				Transition Boundaries
		T (F)	P(psia)	Integrity	Level	
A	Power Operation	Nominal	Nominal	Closed	Normal	Reactor is Critical (all rods are not in)
B	Hot Standby	Nominal to 248	Nominal to 460	Closed	Normal	From 0% power (all rods in) until RHR operation (<248°F and 460 psia)
CA_{d1}	RHR: RCS Normal Level with 2 RHR and SG (shutting down)	248 to 212	460 to 380	Closed	Normal	From start of RHR operation until 4 RHR in operation
CA_{d2}	RHR: RCS Solid with 4 RHR and SG (shutting down)	212 to 131	380	Closed	PZR 90% to Solid	From 4 RHR operation till all RCPs stopped at 131°F (Secondary cooling with SG stopped earlier)
CA_{d3}	RHR: RCS Solid 4 RHR (shutting down)	131	380 to Atm	Closed	PZR Solid	From 131°F (no RCPs running) until start of drain down
CB_d	RHR: Mid-loop w/ RPV head on (shutting down)	131	Atm	Vent	Mid-loop	From start of drain down until RPV head off
D_d	RHR: Mid-loop w/ RPV head off (shutting down)	131	Atm	RPV head off	Mid-loop	From RPV head off until cavity is flooded
E	Cavity Flooded (fuel off load)	131	Atm	RPV head off	Cavity	From cavity is flooded until fuel in SFP with gates/transfer tube closed
F	Core Off-load					Fuel is in SFP with gates/ transfer tube closed
E	Cavity Flooded (fuel load)	131	Atm	RPV head off	Cavity	From opening of transfer tube/gates until start of draining the cavity
D_u	RHR: Mid-loop w/ RPV head off (starting up after refueling)	131	Atm	RPV head off	Mid-loop	From start of cavity draining until RPV head on
CB_u	RHR: Mid-loop w/ RPV head on (starting up after refueling)	131	Atm	Vent	Mid-loop	From RPV head on till level in the pressurizer

Table 19.1-87—Plant Operating States (POS)
Sheet 2 of 2

POS	Description	RCS Conditions				Transition Boundaries
		T (F)	P(psia)	Integrity	Level	
CA_u	RHR: RCS Normal Level (starting up after refueling)	131 to 248	Atm to 460	Closed	Normal	From level in the pressurizer until RHR is secured
B	Startup	248 to Nominal	460 to Nominal	Closed	Normal	From RHR secured until criticality
A	Power Operation	Nominal	Nominal	Closed	Normal	Reactor is Critical

Table 19.1-88—LPSD Initiating Event List

Initiating Event		Basis
Loss of RHR		
IE RHR CAd	Loss of 4 running RHR trains	Fault Tree Analysis
IE RHR CBd	Loss of 3 running/1 Stand-by RHR trains	
IE RHR Dd	Loss of 3 running/1 Stand-by RHR trains	
IE RHR Du	Loss of 2 running/2 Stand-by RHR trains	
IE RHR CBu	Loss of 2 running/2 Stand-by RHR trains	
IE RHR CAu	Loss of 2 running/2 Stand-by RHR trains	
Loss of Inventory		
IE LOCA-S, L CAd	Flow diversions and leaks in POS CAd	Generic SLOCA Frequency, Flow Diversion Analysis, Fault Tree Analysis
IE LOCA-S, L CBd	Flow diversions and leaks in POS CBd	
IE LOCA-S, L Dd	Flow diversions and leaks in POS Dd	
IE LOCA-S, L E	Flow diversions and leaks in POS E	
IE LOCA-S, L Du	Flow diversions and leaks in POS Du	
IE LOCA-S, L CBu	Flow diversions and leaks in POS CBu	
IE LOCA-S, L CAu	Flow diversions and leaks in POS CAu	
IE ULD CBd	Uncontrolled Level drop during POS CBd	Fault Tree Analysis
IE ULD Dd	Uncontrolled Level drop during POS Dd	
IE ULD Du	Uncontrolled Level drop during POS Du	
IE ULD CBu	Uncontrolled Level drop during POS CBu	
IE RHR ISLOCA CAd	RHR LOCA Outside Containment in POS CAd	Pipe Break Frequency and Operator Recovery
IE RHR ISLOCA CBd	RHR LOCA Outside Containment in POS CBd	
IE RHR ISLOCA Dd	RHR LOCA Outside Containment in POS Dd	
IE RHR ISLOCA E	RHR LOCA Outside Containment in POS E	
IE RHR ISLOCA Du	RHR LOCA Outside Containment in POS Du	
IE RHR ISLOCA CBu	RHR LOCA Outside Containment in POS CBu	
IE RHR ISLOCA CAu	RHR LOCA Outside Containment in POS CAu	

Table 19.1-89—System Availability During Shutdown
Sheet 1 of 2

		LHSI/RHR Availability				Secondary Cooling Availability		SIS				
POS	Description	Trains Avail	RHR Run	RHR Stdby	LHSI Stdby	SG with MSRT	EFW	Signal	MHSI	SAHR	Hatch	Comment
CA_d	RHR Heat Removal with Level in PZR (shutting down)	4	4	0	0	2	2 (Trains 1 and 2 w/ P13)	Low delta Psat	4	1	Open	MSRT set at 148 psia
CB_d	RHR Heat Removal at mid-LOOP with RPV Head On (shutting down)	4	3	0	1 (Train 4)	2	2 (Trains 1 and 2 w/ P13)	Low Loop Level	4	1	Open	MSRT set at 148 psia
D_d	RHR Heat Removal at mid-LOOP with RPV Head Off (shutting down)	4	3	0	1 (Train 4)	NA	NA	Low Loop Level	4	NA	Closed	
E	Reactor Cavity Flooded (fuel off load)	3	2 (Train 2 & 3)	0	1 (Train 4)	NA	NA	Low Loop Level	3	NA	Open	
F	Core Off-load	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
E	Reactor Cavity Flooded (fuel load)	3	2 (Train 2 & 3)	0	1 (Train 4)	NA	NA	Low Loop Level	3	NA	Open	
D_u	RHR Heat Removal at mid-LOOP with RPV Head OFF (starting up after refueling)	4	2 (Train 2 & 3)	1 (Train 1)	1 (Train 4)	NA	NA	Low Loop Level	4	NA	Closed	

Table 19.1-89—System Availability During Shutdown
Sheet 2 of 2

POS	Description	LHSI/RHR Availability				Secondary Cooling Availability		SIS		SAHR	Hatch	Comment
		Trains Avail	RHR Run	RHR Stdby	LHSI Stdby	SG with MSRT	EFW	Signal	MHSI			
CB_u	RHR: Mid-loop w/ RPV head on (starting up after refueling)	4	2 (Train 2 & 3)	1 (Train 1)	1 (Train 4)	2	2	Low Loop Level	4	1	Open	MSRT set at 148 psia
CA_u	RHR: RCS Normal Level (starting up after refueling)	4	2 (Train 2 & 3)	1 (Train 1)	1 (Train 4)	2 to 4	2 to 4	Low delta Psat	4	1	Open	MSRT set at 148 psia

Table 19.1-90—U.S. EPR Significant Initiating Events Contributions - Level 1 Shutdown (Contributing more than 1% to SD CDF)

IE	Description	IE Frequency (1/yr)	CDF (1/yr)	Contribution
SD RHR CBD	SD Loss of RHR in State CBd	1.8E-06	8.4E-09	13.9%
SD RHR CAD	SD Loss of RHR in State CAd	1.3E-06	6.3E-09	10.5%
SD RHR CBU	SD Loss of RHR in State CBu	1.4E-06	6.3E-09	10.5%
SD LOCA-S CAD	SD LOCA-Small in State CAd	4.4E-04	4.6E-09	7.6%
SD LOCA-S CBD	SD LOCA-Small in State CBd	4.4E-04	4.5E-09	7.4%
SD RHR CAU	SD Loss of RHR in State CAu	9.8E-07	4.4E-09	7.3%
SD ULD CBD D	SD Uncontrolled Level Drop in State CBd (Demand)	1.3E-02	4.2E-09	7.1%
SD ULD DU D	SD Uncontrolled Level Drop in State Du (Demand)	1.3E-02	4.2E-09	6.9%
SD RHR DU	SD Loss of RHR in State Du	1.5E-06	3.9E-09	6.4%
SD LOCA-S CBU	SD LOCA-Small in State CBu	2.2E-04	2.2E-09	3.7%
SD LOCA-S DU	SD LOCA-Small in State Du	2.2E-04	2.2E-09	3.6%
SD LOCA-S CAU	SD LOCA-Small in State CAu	1.5E-04	1.5E-09	2.6%
SD RHR DD	SD Loss of RHR in State Dd	2.4E-06	1.3E-09	2.2%
SD LOCA-S DD	SD LOCA-Small in State Dd	1.1E-04	1.1E-09	1.8%
SD RHR ISLOCA E	SD RHR ISLOCA in State E	9.2E-10	9.2E-10	1.5%
SD LOCA-S E	SD LOCA-Small in State E	3.3E-05	7.5E-10	1.2%
SD LOCA-L CAD	SD LOCA-Large in State CAd	6.5E-05	6.8E-10	1.1%
SD LOCA-L CBD	SD LOCA-Large in State CBd	6.5E-05	6.4E-10	1.1%
		Total:	6.0E-08	
		Total RS:	6.0E-08	

Table 19.1-91—U.S. EPR Shutdown State (POS) Contributions - Level 1 Shutdown

Shutdown State (POS)	Description	Estimated POS Duration (days)	CDF (1/yr)	CDF (1/day)	Contribution (SD Total)
CAD	RHR Heat Removal with Level in PZR - Shutting Down	1.5	1.2E-08	7.8E-09	19.6%
CBD	RHR Heat Removal at mid-LOOP with RPV Head On - Shutting Down	2	1.8E-08	8.9E-09	29.9%
DD	RHR Heat Removal at mid-LOOP with RPV Head Off - Shutting Down	0.5	2.6E-09	5.2E-09	4.4%
E	Reactor cavity Flooded	10	1.7E-09	1.7E-10	2.9%
DU	RHR Heat Removal at mid-LOOP with RPV Head Off - Starting Up	1.5	1.1E-08	7.1E-09	17.8%
CBU	RHR Heat Removal at mid-LOOP with RPV Head On - Starting Up	1.5	8.9E-09	5.9E-09	14.9%
CAU	RHR Heat Removal with Level in PZR - Starting Up	1	6.2E-09	6.2E-09	10.4%
Total SD CDF:		18 (+ POS F)	6.0E-08	4.1E-08	100.0%

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
Sheet 1 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
LOCA Sequences in Shutdown							
1	8-10, 13-20, 33, 34, 50-52	8.14E-10 - 2.03E-10	14.7	14.7	**Sequences:** **LOCA C S-24: MHSI, LHSI** **LOCA D S-3: MHSI, LHSI**		
					IE SD LOCA-S CBD	Initiator - LOCA-Small During Shutdown State CBd	A SLOCA IE is caused by a premature opening of an RHR/LHSI safety valve and an operator failure to isolate flow diversion; MHSI/LHSI injection fails due to a CC failure of common IRWST suction strainers.
					JNA20AA191SPO	RHR, LHSI Train 2 Safety Valve JNA20AA191, Premature Opening	
					JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	
					OPF-ISORHRSVFD-CB	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State CB	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
Sheet 2 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
2	21-23, 25-32, 40, 41, 66-68	5.89E-10 - 1.47E-10	10.6	25.3	**Sequences:** **LOCA C S-24: MHSI, LHSI** **LOCA D S-3: MHSI, LHSI**		
					IE SD LOCA-S CBD	Initiator - LOCA-Small During Shutdown State CBd	A SLOCA IE is caused by a premature opening of an RHR/LHSI safety valve and an operator failure to isolate flow diversion; MHSI/LHSI injection fails due to a CC failure of common cold leg injection check valves.
					JNA10AA191SPO	RHR, LHSI Train 1 Safety Valve JNA10AA191, Premature Opening	
					JNG13AA005CFO_D-ALL	CCF to Open LHSI/ MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					OPF-ISORHRSVFD-CB	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State CB	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
Sheet 3 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
3	35, 74	3.60E-10 - 1.35E-10	0.8	26.1	**Sequence: LOCA E S-3: MHSI, LHSI**		
					IE SD LOCA-S E	Initiator - LOCA-Small During Shutdown State E	A SLOCA IE is caused by a SLOCA on a cold leg injection line; MHSI/ LHSI injection fails due to a CC failure of three common cold leg injection check valves (Div 1 is assumed out for maintenance).
					JNG13AA005CFO_D-234	CCF to Open LHSI/ MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					SLOCA24	Small LOCA - 24 Hour	
4	96-98	9.49E-11	0.5	26.6	**Sequence: LOCA C L-5: MHSI, LHSI**		
					IE SD LOCA-L CBD	Initiator - LOCA-Large During Shutdown State CBd	A LLOCA IE is caused by a spurious opening of an IRWST suction valve and an operator failure to isolate flow diversion; MHSI/LHSI injection fails due to a CC failure of common IRWST suction strainers.
					JNG20AA001EOP	LHSI, LHSI Pump 20 Suction from IRWST MOV JNG20AA001, Fails to Remain Closed (SO)	
					JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	
					OPF-ISOIRWSTFD-CB	Operator Fails to Isolate RHR Suction to IRWST (Valve JNGX0AA001) in State CB	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
5	58	1.86E-10	0.3	26.9	**Sequence: LOCA E S-3: MHSI, LHSI**		
					IE SD LOCA-S E	Initiator - LOCA-Small During Shutdown State E	A SLOCA IE is caused by a small break on a cold leg injection line; MHSI/ LHSI injection fails due to a CC failure of common IRWST suction strainers.
					JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	
					SLOCA24	Small LOCA - 24 Hour	
Loss of RHR Sequences in Shutdown							
6	1-3, 5, 45, 55, 59, 60, 61, 64, 69, 70, 75-77, 82, 83, 88, 91	2.54E-09 - 9.74E-11	16.5	43.4	**Sequence: RHR C-12: EFW, MHSI FB, LTC**		
					IE SD RHR CBD	Initiator - RHR in Power State CBd	A loss of RHR IE is caused by a LOOP during the CBD state and a CC failure of all EDGs; failure of SBO DG Division 1 disables all EFW (only SG1 & 2 are assumed to be available in the CBD state); a loss of CCW (not supplied from SBO DGs) disables MHSI and RHR heat exchangers; a loss of Division 1 disables SAHR suction, failing LTC function
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					XKA10_____DFR_D-ALL	CCF of EDGs to Run	
					XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 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	4, 24	1.35E-09 - 4.50E-10	3.0	46.4	**Sequence: RHR D-3: MHSI, LHSI**		
					IE SD RHR DU	Initiator - RHR in Power State Du	A loss of RHR IE is caused by a LOOP during the DU state and a CC failure of common cold leg injection valves. This also results in the loss of all injection (MHSI/ LHSI).
					JNG13AA005CFO_D-ALL	CCF to Open LHSI/ MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
8	42, 48, 49, 71	2.87E-10 - 1.43E-10	1.4	47.9	**Sequence: RHR C-12: EFW, MHSI FB, LTC**		
					IE SD RHR CBD	Initiator - RHR in Power State CBd	A loss of RHR IE is caused by a LOOP during the CBD state. CCF of PS fails start of all EDGs and EFW. CCW and RHR heat exchangers do not function in SBO conditions. Failure of SAHR UHS disables LTC.
					I/O MOD CCF	I/O Module Common Cause Failure	
					SA-ESWS UHS4 SBO	Failure of SA-ESWS/ UHS4 in SBO Conditions	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 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	
9	62, 63, 78-81	1.59E-10 - 1.19E-10	1.3	49.2	**Sequence: RHR C-12: EFW, MHSI FB, LTC**		
					IE SD RHR CBD	Initiator - RHR in Power State CBd	A loss of RHR IE is caused by a LOOP during the CBD state. CCF of PS fails start of all EDGs and EFW. CCW and RHR heat exchangers do not function in SBO conditions. Failure of one SBO DG fails SAHR and disables LTC.
					I/O MOD CCF	I/O Module Common Cause Failure	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 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	65, 84-86	1.49E-10 - 1.12E-10	0.8	50.0	**Sequences:** **RHR C-10: EFW, LTC** **RHR D-3: MHSI, LHSI**		
					IE SD RHR CBD	Initiator - RHR in Power State CBd	A loss of RHR IE is caused by a LOOP during the CBD or D state. It is followed by a CC failure of three safety batteries to start on demand, disabling three divisions. Only Div. 4 is available. EFW is failed because only SG1 & SG2 are credited. RHR 4 is failed because it is aligned in the SI injection mode and needs Div. 3 & 4 to be realigned to the RHR cooling mode. All cooling is lost.
					BTD01_BAT__ST_D-123	CCF of Safety Related Batteries on Demand	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 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	99, 100	8.93E-11	0.3	50.3	**Sequence: RHR C-14: EFW, PBL**		
					IE SD RHR CBD	Initiator - RHR in Power State CBd	A loss of RHR IE is caused by a loss of HVAC during the CBD state. A loss of HVAC is caused by a CC failure of two running SAC fans, failing Div. 1 & 4 cooling. Failure to switch CH2 supply to the standby CCW3 train before a HVAC related loss of the running CCW4, results in losses of CCW cooled QKA chillers in Div. 2 & 3. Operator failures to recover lead to a total loss of ventilation.
					OPD-SAC-2H-HIGH	Operator fails to start local room cooling - high dependency	
					OPF-CCWS TR SO	Operator Fails to Switch CH Supply to Standby CCW Train Before A Loss of the Running Train	
					OPF-SAC-1H	Operator Fails to Start Maintenance HVAC Trains After Failure of Normal SAC Safety Train	
					SAC31AN001EFR_B-ALL	CCF to Run Normal Air Exhaust Fans (Trains 1 & 4)	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
12	89, 90	1.01E-10	0.3	50.7	**Sequence: RHR D-3: MHSI, LHSI**		
					IE SD RHR DU	Initiator - RHR in Power State Du	A loss of RHR IE is caused by a LOOP during the DU state. A CC failure of 3 common cold leg injection valves and loss of the remaining pump due to the failure of a EDG, results in loss of MHSI/LHSI injection.
					JNG13AA005CFO_D-124	CCF to Open LHSI/ MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					XKA30_____DFR	ELEC, Emergency Diesel Generator XKA30, Fails to Run	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
13	87	1.05E-10	0.2	50.8	**Sequence: RHR D-3: MHSI, LHSI**		
					IE SD RHR DU	Initiator - RHR in Power State Du	A loss of RHR IE is caused by a LOOP during the DU state. A CC failure of all EDGs and failure of both SBO DGs results is a total station blackout (loss of all AC power).
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					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 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 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	
Uncontrolled Level Drop Sequences in Shutdown							
14	6, 7, 46, 47	1.23E-09 - 2.36E-10	4.9	55.8	**Sequences:** **ULD CB-3: ISO LPRS, OP ISO LPRS** **ULD D-3: ISO LPRS, OP ISO LPRS**		
					IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	An uncontrolled level drop IE is caused by CC failure of CVCS LP reducing station MOVs to close, this also fails a second chance to isolate, the mitigating systems are available, but a long term operator failure to isolate, leads to a slow RCS drain outside containment.
					KBA14AA004EFC_B-ALL	CCF to Close CVCS Low Pressure Reducing Station MOVs	
					OPE-ISOCSLPRS	Operator Fails to Isolate the CVCS Low Pressure Reducing Station (SHUTDOWN)	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
Sheet 12 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
15	11, 12	6.88E-10	2.3	58.1	**Sequences:** **ULD CB-3: ISO LPRS, OP ISO LPRS** **ULD D-3: ISO LPRS, OP ISO LPRS**		
					IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	An uncontrolled level drop IE is caused by the operator failure to stop the RCS drain down. The failure of CVCS LP reducing station MOV to close fails a second chance to isolate, the mitigating systems are available, but a long term operator failure to isolate, leads to a slow RCS drain outside containment.
					KBA14AA004EFC	CVCS, Low Pressure Reducing Station Isolation MOV KBA14AA004, Fails to Close on Demand	
					OPE-ISOCSLPRS	Operator Fails to Isolate the CVCS Low Pressure Reducing Station (SHUTDOWN)	
					OPF-ULD	Operator Fails to Stop Draindown at Mid-Loop (SHUTDOWN)	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events) Sheet 13 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
16	36, 37	3.48E-10	1.2	59.2	**Sequences: ULD CB-31: ISO LPRS, MHSI, LHSI ULD D-6: ISO LPRS, MHSI, LHSI**		
					IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	An uncontrolled level drop IE is caused by CC failure of CVCS LP reducing station MOVs to close, this also fails a second chance to isolate. MHSI/LHSI injection fails due to the CC failure of the common IRWST suction strainers.
					JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	
					KBA14AA004EFC_B-ALL	CCF to Close CVCS Low Pressure Reducing Station MOVs	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
Sheet 14 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
17	53, 54	2.00E-10	0.7	59.9	**Sequences:** **ULD CB-3: ISO LPRS, OP ISO LPRS** **ULD D-3: ISO LPRS, OP ISO LPRS**		
					IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	An uncontrolled level drop IE is caused by the operator failure to stop the RCS drain down. The failure of PAS prevents a second chance to isolate, the mitigating systems are available, but a long term operator failure to isolate, leads to a slow RCS drain outside containment.
					OPE-ISOCSLPRS	Operator Fails to Isolate the CVCS Low Pressure Reducing Station (SHUTDOWN)	
					OPF-ULD	Operator Fails to Stop Draindown at Mid-Loop (SHUTDOWN)	
					PAS	Process Automation System (PAS) Fails (Estimate)	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
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Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
18	56, 57	1.94E-10	0.7	60.6	**Sequences:** **ULD CB-31: ISO LPRS, MHSI, LHSI** **ULD D-6: ISO LPRS, MHSI, LHSI**		
					IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	An uncontrolled level drop IE is caused by the operator failure to stop the RCS drain down. The failure of CVCS LP reducing station MOV to close fails a second chance to isolate, MHSI/ LHSI fails due to the CC failure of common IRWST suction strainers.
					JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	
					KBA14AA004EFC	CVCS, Low Pressure Reducing Station Isolation MOV KBA14AA004, Fails to Close on Demand	
					OPF-ULD	Operator Fails to Stop Draindown at Mid-Loop (SHUTDOWN)	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
Sheet 16 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%) Group	Contribution to CDF (%) Cumulative	Sequence Type and a Representative Cutset: Event Identifier	Sequence Type and a Representative Cutset: Event Description	Sequence Description
19	92-95	9.66E-11	0.6	61.2	**Sequences:** **ULD CB-32: ISO LPRS, MHSI, PBL** **ULD D-6: ISO LPRS, MHSI, LHSI**		
					IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	An uncontrolled level drop IE is caused by a loss of HVAC (failure of CVCS LP reducing station MOVs to close) and the operator failure to stop the RCS drain down. A loss of HVAC is caused by a CC failure of two running SAC fans, failing Div. 1 & 4 cooling. Failure to switch CH2 supply to the standby CCW3 train before a HVAC related loss of the running CCW4, results in losses of CCW cooled QKA chillers in Div. 2 & 3. Operator failure to recover leads to a total loss of ventilation.
					OPF-CCWS TR SO	Operator Fails to Switch CH Supply to Standby CCW Train Before A Loss of the Running Train	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	
					OPF-ULD	Operator Fails to Stop Draindown at Mid-Loop (SHUTDOWN)	
					SAC01AN001EFR_B-ALL	CCF to Run Normal Air Supply Fans (Trains 1 & 4)	

Table 19.1-92—U.S. EPR Important Cutset Groups - Level 1 Shutdown (Top 100 Events)
Sheet 17 of 17

Group No	Cutset Numbers	Cutset Frequencies	Contribution to CDF (%)		Sequence Type and a Representative Cutset		Sequence Description
			Group	Cumulative	Event Identifier	Event Description	
ISLOCA Sequences in Shutdown							
20	38, 39	3.43E-10	1.2	62.4	**Sequence: RHR ISLOCA E-2: RHR ISLOCA**		
					IE SD RHR ISLOCA E	RHR ISLOCA During Shutdown State E	A ISLOCA IE is caused by a pipe break in one RHR train, a failure of PAS disables automatic isolation and operator failure to isolate leads to unisolated LOCA outside containment.
					OPF-ISORHRBRK	Operator Fails to Isolate RHR Pipe Break (SHUTDOWN)	
					PAS	Process Automation System (PAS) Fails (Estimate)	
					RHR TR2 PIPE BRK	Pipe Break in RHR Train 2	

Table 19.1-93—U.S. EPR Risk-Significant Components based on FV Importance - Level 1 Shutdown
Sheet 1 of 2

Rank	System US	Component ID	Component Description	FV	RAW
1	ELEC	30XKA20	ELEC, Emergency Diesel Generator XKA20	0.276	2.1
2	ELEC	30XKA30	ELEC, Emergency Diesel Generator XKA30	0.271	2.0
3	ELEC	30XKA10	ELEC, Emergency Diesel Generator XKA10	0.266	1.9
4	ELEC	30XKA50	ELEC, SBO Diesel Generator XKA50	0.255	5.0
5	ELEC	30XKA40	ELEC, Emergency Diesel Generator XKA40	0.254	1.7
6	SIS/RHR	30JNG43AA005	LHSI, MHSI/LHSI Train 4 First SIS Isolation Check Valve JNG43AA005	0.204	3.1
7	IRWST	30JNK11AT001	IRWST, SIS Sump Strainer to MHSI/LHSI Train 4 Pumps JNK11AT001	0.201	1.7
8	IRWST	30JNK10AT002	IRWST, SIS Sump Strainer to MHSI/LHSI Train 2 Pumps JNK10AT002	0.201	1.3
9	IRWST	30JNK11AT002	IRWST, SIS Sump Strainer to MHSI/LHSI Train 3 Pumps JNK11AT002	0.201	1.3
10	IRWST	30JNK10AT001	IRWST, SIS Sump Strainer to MHSI/LHSI Train 1 Pumps JNK10AT001	0.200	1.7
11	IRWST	30JNK11AT003	IRWST, SAHR Sump Strainer JNK11AT003	0.200	1.3
12	IRWST	30JNK10AT003	IRWST, CVCS Sump Strainer JNK10AT003	0.200	-
13	SIS/RHR	30JNG33AA005	LHSI, MHSI/LHSI Train 3 First SIS Isolation Check Valve JNG33AA005	0.198	3.7
14	SIS/RHR	30JNG23AA005	LHSI, MHSI/LHSI Train 2 First SIS Isolation Check Valve JNG23AA005	0.197	3.7
15	SIS/RHR	30JNG13AA005	LHSI, MHSI/LHSI Train 1 First SIS Isolation Check Valve JNG13AA005	0.197	2.9
16	SIS/RHR	30JNA30AA191	RHR, LHSI Train 3 Safety Valve JNA30AA191	0.098	IE
17	SIS/RHR	30JNA20AA191	RHR, LHSI Train 2 Safety Valve JNA20AA191	0.098	IE
18	SIS/RHR	30JNA10AA191	RHR, LHSI Train 1 Safety Valve JNA10AA191	0.049	IE
19	CVCS	30KBA14AA004	CVCS, Low Pressure Reducing Station Isolation MOV KBA14AA004	0.046	IE
20	ELEC	30XKA80	ELEC, SBO Diesel Generator XKA80	0.034	1.4
21	SCWS	30QKA40GH001	SCWS, Train 4 Chiller Unit QKA40GH001	0.032	3.0
22	SCWS	30QKA10GH001	SCWS, Train 1 Chiller Unit QKA10GH001	0.029	7.3
23	ELEC	33BTD01	ELEC, 250V 1E 2-hr Battery 33BTD01	0.022	13.0
24	ELEC	31BTD01	ELEC, 250V 1E 2-hr Battery 31BTD01	0.022	11.8

Table 19.1-93—U.S. EPR Risk-Significant Components based on FV Importance - Level 1 Shutdown
Sheet 2 of 2

Rank	System US	Component ID	Component Description	FV	RAW
25	CVCS	30KBA14AA106	CVCS, CVCS Low Power Reducing Station MOV KBA14AA106	0.020	IE
26	SIS/RHR	30JNA40AA191	RHR, LHSI Train 4 Safety Valve JNA40AA191	0.019	IE
27	ELEC	32BTD01	ELEC, 250V 1E 2-hr Battery 32BTD01	0.017	2.4
28	SIS/RHR	30JNG20AA001	LHSI, LHSI Pump 20 Suction from IRWST MOV JNG20AA001	0.015	IE
29	SIS/RHR	30JNG30AA001	LHSI, LHSI Pump 30 Suction from IRWST MOV JNG30AA001	0.015	IE
30	SCWS	30QKA20GH001	SCWS, Train 2 Chiller Unit QKA20GH001	0.014	1.9
31	EFWS	30LAS11AP001	EFWS, Train 1 Motor Driven Pump LAS11AP001	0.012	1.9
32	SCWS	30QKA40AA101	SCWS, Train 4 Chiller By-pass MOV QKA40AA101	0.010	2.9
33	SIS/RHR	30JNA30AA101	RHR, LHSI Train 3 HTX Bypass MOV JNA30AA101	0.009	3.7
34	SIS/RHR	30JNG10AA001	LHSI, LHSI Pump 10 Suction from IRWST MOV JNG10AA001	0.009	IE
35	SCWS	30QKA30GH001	SCWS, Train 3 Chiller Unit QKA30GH001	0.008	1.7
36	SIS/RHR	30JNG40AP001	LHSI, Train 4 Motor Driven Pump JNG40AP001	0.008	2.2
37	ELEC	34BTD01	ELEC, 250V 1E 2-hr Battery 34BTD01	0.008	2.4
38	SIS/RHR	30JNG30AP001	LHSI, Train 3 Motor Driven Pump JNG30AP001	0.007	2.7
39	SIS/RHR	30JNG10AP001	LHSI, Train 1 Motor Driven Pump JNG10AP001	0.007	2.0
40	SIS/RHR	30JNG20AP001	LHSI, Train 2 Motor Driven Pump JNG20AP001	0.007	2.4
41	SIS/RHR	30JNA20AA101	RHR, LHSI Train 2 HTX Bypass MOV JNA20AA101	0.006	2.8
42	ELEC	32BRU03	ELEC, Inverter 32BRU03	0.006	15.0
43	ELEC	BDT02_2BDA	ELEC, Aux Transformer 30BDT02 to 6.9kV SWGR 32BDA Circuit Breaker	0.005	1.7
44	ELEC	BDT01_3BDA	ELEC, Aux Transformer 30BDT01 to 6.9kV SWGR 33BDA Circuit Breaker	0.005	1.6
45	ESWS	30PEB20AP001	ESWS, Train 2 Motor Driven Pump PEB20AP001	0.005	4.8

NOTE:

1. IE-NA denotes a component whose failure also leads to an initiating event, hence, the calculated RAW value is not valid; it is produced due to software limitations.

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
Sheet 1 of 8

Rank	System US	Comp ID	Component Description	RAW	FV
1	SCWS	30QKA10AA102	SCWS, Train 1 Discharge Xtie MOV QKA10AA102	42.6	0.000
2	SCWS	30QKA10AA103	SCWS, Train 1 Suction Xtie MOV QKA10AA103	42.6	0.000
3	SCWS	30QKA20AA102	SCWS, Train 2 Discharge Xtie MOV QKA20AA102	42.6	0.000
4	SCWS	30QKA20AA103	SCWS, Train 2 Suction Xtie MOV QKA20AA103	42.6	0.000
5	ELEC	33BRW50BUW51	ELEC, 24V DC I&C Power Rack 33BRW50/ 33BUW51	41.1	0.001
6	ELEC	32BUD	ELEC, Non 1E 250V DC Switchboard 32BUD	18.0	0.000
7	ELEC	32BRU03	ELEC, Inverter 32BRU03	15.0	0.006
8	ELEC	34BRB	ELEC, 480V MCC 34BRB	14.8	0.002
9	ELEC	31BDC	ELEC, 6.9kV SWGR 31BDC	14.7	0.000
10	ELEC	32BRC	ELEC, 480V MCC 32BRC	14.5	0.000
11	ELEC	32BRU0301	ELEC, Inverter 32BRU03 Static Switch 32BRU0301	14.5	0.000
12	ELEC	2BRC_4BRB1	ELEC, 480V MCC 32BRC to 480V MCC 34BRB Circuit Breaker	14.4	0.000
13	ELEC	2BRC_4BRB2	ELEC, 480V MCC 32BRC to 480V MCC 34BRB Circuit Breaker	14.4	0.000
14	ELEC	2BRU032BRC	ELEC, Inverter 32BRU03 to 480V MCC 32BRC Circuit Breaker	14.4	0.000
15	ELEC	2BUD2BRU03	ELEC, 250V Pnl 32BUD to Inverter 32BRU03 Circuit Breaker	14.4	0.000
16	ELEC	31BDB	ELEC, 6.9kV SWGR 31BDB	14.4	0.000
17	ELEC	31BMB	ELEC, 480V Load Center 31BMB	14.4	0.000
18	ELEC	31BMT02	ELEC, 6.9kV-480V Transformer 31BMT02	14.4	0.000
19	ELEC	31BNB02	ELEC, 480V MCC 31BNB02	14.0	0.001
20	ELEC	31BNT01	ELEC, Constant Voltage Transformer 31BNT01	14.0	0.000
21	ELEC	33BTD01	ELEC, 250V 1E 2-hr Battery 33BTD01	13.0	0.022
22	ELEC	31BTD01	ELEC, 250V 1E 2-hr Battery 31BTD01	11.8	0.022
23	ELEC	33BUC	ELEC, 1E 250V DC Switchboard 33BUC	9.6	0.000
24	ELEC	31BUC	ELEC, 1E 250V DC Switchboard 31BUC	9.3	0.000
25	ELEC	31BDA	ELEC, 6.9kV Switchgear 31BDA	9.1	0.000

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
Sheet 2 of 8

Rank	System US	Comp ID	Component Description	RAW	FV
26	SCWS	30QKA30AA102	SCWS, Train 3 Discharge Xtie MOV QKA30AA102	8.7	0.000
27	SCWS	30QKA30AA103	SCWS, Train 3 Suction Xtie MOV QKA30AA103	8.7	0.000
28	SCWS	30QKA40AA102	SCWS, Train 4 Discharge Xtie MOV QKA40AA102	8.7	0.000
29	SCWS	30QKA40AA103	SCWS, Train 4 Suction Xtie MOV QKA40AA103	8.7	0.000
30	ELEC	1BDB1BMT02	ELEC, 6.9kV SWGR 31BDB to Transformer 31BMT02 Circuit Breaker	8.6	0.000
31	ELEC	1BDC_1BDB1	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	8.6	0.000
32	ELEC	1BDC_1BDB2	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	8.6	0.000
33	ELEC	1BMT021BMB	ELEC, Transformer 31BMT02 to 480V Load Center 31BMB Circuit Breaker	8.6	0.000
34	ELEC	33BDA	ELEC, 6.9kV SWGR 33BDA	8.6	0.000
35	ELEC	1BMB1BNT01	ELEC, 480V Load Center 31BMB to Transformer 31BNT01 Circuit Breaker	8.5	0.000
36	ELEC	1BNT011BNB02	ELEC, Transformer 31BNT01 to 480V MCC 31BNB02 Circuit Breaker	8.5	0.000
37	SCWS	30QKA10GH001	SCWS, Train 1 Chiller Unit QKA10GH001	7.3	0.029
38	ELEC	31BUD	ELEC, Non 1E 250V DC Switchboard 31BUD	7.2	0.000
39	ELEC	33BDB	ELEC, 6.9kV SWGR 33BDB	6.0	0.000
40	ELEC	33BMB	ELEC, 480V Load Center 33BMB	6.0	0.000
41	ELEC	33BMT02	ELEC, 6.9kV-480V Transformer 33BMT02	6.0	0.000
42	ELEC	31BRW12BUW13	ELEC, 24V DC I&C Power Rack 31BRW12/ 31BUW13	5.8	0.000
43	ELEC	32BDA	ELEC, 6.9kV SWGR 32BDA	5.7	0.000
44	HVAC	30SAC01AN001	SAC, Normal Air Supply Fan SAC01AN001	5.3	0.002
45	HVAC	30SAC31AN001	SAC, Normal Air Exhaust Fan SAC31AN001	5.3	0.002
46	CCWS	30KAA30AP001	CCWS, Train 3 Motor Driven Pump KAA30AP001	5.1	0.004
47	ELEC	30XKA50	ELEC, SBO Diesel Generator XKA50	5.0	0.255
48	CCWS	30KAA20AP001	CCWS, Train 2 Motor Driven Pump KAA20AP001	4.9	0.004

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
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Rank	System US	Comp ID	Component Description	RAW	FV
49	ESWS	30PEB20AP001	ESWS, Train 2 Motor Driven Pump PEB20AP001	4.8	0.005
50	ESWS	30PEB30AP001	ESWS, Train 3 Motor Driven Pump PEB30AP001	4.8	0.005
51	ELEC	31BTB01	ELEC, 250V Non 1E 12-hr Battery 31BTB01	4.8	0.001
52	ELEC	30XKA50_1BBH	ELEC, SBO DG XKA50 to 6.9kV SWGR 31BBH Circuit Breaker	4.7	0.002
53	ELEC	1BBH_1BDC1	ELEC, 6.9kV SWGR 31BBH to 6.9kV SWGR 31BDC Circuit Breaker	4.7	0.002
54	ELEC	1BBH_1BDC2	ELEC, 6.9kV SWGR 31BBH to 6.9kV SWGR 31BDC Circuit Breaker	4.7	0.002
55	ELEC	1BDA_1BDC2	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	4.7	0.002
56	ELEC	1BBT081BBH	ELEC, Transformer 31BBT08 to 6.9kV SWGR 31BBH Circuit Breaker	4.7	0.002
57	SIS/RHR	30JNG30AC001	LHSI, LHSI Train 3 HTX JNG30AC001	4.7	0.000
58	ELEC	33BDD	ELEC, 6.9kV SWGR 33BDD	4.7	0.000
59	ELEC	33BMD	ELEC, 480V Load Center 31BMD	4.7	0.000
60	ELEC	33BMT04	ELEC, 6.9kV-480V Transformer 33BMT04	4.7	0.000
61	SCWS	30QKA10AA101	SCWS, Train 1 Chiller By-pass MOV QKA10AA101	4.6	0.000
62	SIS/RHR	30JNG20AC001	LHSI, LHSI Train 2 HTX JNG20AC001	4.6	0.000
63	ELEC	32BDD	ELEC, 6.9kV SWGR 32BDD	4.6	0.000
64	ELEC	32BMD	ELEC, 480V Load Center 32BMD	4.6	0.000
65	ELEC	32BMT04	ELEC, 6.9kV-480V Transformer 32BMT04	4.6	0.000
66	CCWS	30KAA30BB001	CCWS, Train 3 Surge Tank KAA30BB001	4.3	0.000
67	SIS/RHR	30JND30AA003	MHSI, MHSI Pump 30 Discharge Manual CHECK Valve JND30AA003	4.3	0.000
68	CCWS	30KAA20BB001	CCWS, Train 2 Surge Tank KAA20BB001	4.2	0.000
69	ELEC	31BBH	ELEC, 6.9kV SWGR 31BBH	4.2	0.000
70	ELEC	31BRV31BUV	ELEC, 24V DC I&C Power Rack 31BRV/31BUV	4.2	0.000
71	SIS/RHR	30JND20AA003	MHSI, MHSI Pump 20 Discharge Manual CHECK Valve JND20AA003	4.2	0.000
72	ELEC	32BNB02	ELEC, 480V MCC 32BNB02	4.1	0.000
73	SIS/RHR	30JNG20AA003	LHSI, LHSI Train 2 to Radial Miniflow Motor Operated Check Valve JNG20AA003	4.1	0.000

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
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Rank	System US	Comp ID	Component Description	RAW	FV
74	SIS/RHR	30JNG30AA003	LHSI, LHSI Train 3 to Radial Miniflow Motor Operated Check Valve JNG30AA003	4.1	0.000
75	ELEC	BDT01	ELEC, Aux Transformer 30BDT01	4.0	0.000
76	CCWS	30KAA20AA112	CCWS, Train 2 Heat Exchanger Bypass MOV KAA20AA112	4.0	0.000
77	CCWS	30KAA30AA112	CCWS, Train 3 Heat Exchanger Bypass MOV KAA30AA112	4.0	0.000
78	SIS/RHR	30JNG20AA004	LHSI, Train 2 Min Flow MOCV JNG20AA004	3.9	0.000
79	SIS/RHR	30JNG30AA004	LHSI, Train 3 Min Flow MOCV JNG30AA004	3.9	0.000
80	ELEC	2BDA_2BDD1	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDD Circuit Breaker	3.8	0.000
81	ELEC	2BDA_2BDD2	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDD Circuit Breaker	3.8	0.000
82	ELEC	2BDD2BMT04	ELEC, 6.9kV SWGR 32BDD to Transformer 32BMT04 Circuit Breaker	3.8	0.000
83	ELEC	2BMT042BMD	ELEC, Transformer 32BMT04 to 480V Load Center 32BMD Circuit Breaker	3.8	0.000
84	CCWS	30KAA20AC001	CCWS, Train 2 HTX 20 KAA20AC001	3.8	0.000
85	CCWS	30KAA30AC001	CCWS, Train 3 HTX 30 KAA30AC001	3.8	0.000
86	ELEC	3BDA_3BDD1	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDD Circuit Breaker	3.8	0.000
87	ELEC	3BDA_3BDD2	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDD Circuit Breaker	3.8	0.000
88	ELEC	3BDD3BMT04	ELEC, 6.9kV SWGR 33BDD to Transformer 33BMT04 Circuit Breaker	3.8	0.000
89	ELEC	3BMT043BMD	ELEC, Transformer 33BMT04 to 480V Load Center 33BMD Circuit Breaker	3.8	0.000
90	HVAC	30SAC04AN001	SAC, Normal Air Supply Fan SAC04AN001	3.8	0.001
91	HVAC	30SAC34AN001	SAC, Normal Air Exhaust Fan SAC34AN001	3.8	0.001
92	SIS/RHR	30JNA30AA101	RHR, LHSI Train 3 HTX Bypass MOV JNA30AA101	3.7	0.009
93	SIS/RHR	30JNG23AA005	LHSI, MHSI/LHSI Train 2 First SIS Isolation Check Valve JNG23AA005	3.7	0.197
94	SIS/RHR	30JNG33AA005	LHSI, MHSI/LHSI Train 3 First SIS Isolation Check Valve JNG33AA005	3.7	0.198

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
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Rank	System US	Comp ID	Component Description	RAW	FV
95	CCWS	30KAA20AA004	CCWS, Train 2 Discharge from CCW HTX 20 Check Valve KAA20AA004	3.7	0.000
96	CCWS	30KAA30AA004	CCWS, Train 3 Discharge from CCW HTX 30 Check Valve KAA30AA004	3.7	0.000
97	ESWS	30PEB20AA002	ESWS, Train 2 Pump Recirc MOV PEB20AA002	3.7	0.000
98	ESWS	30PEB20AA005	ESWS, Train 2 Pump Discharge Isolation MOV PEB20AA005	3.7	0.000
99	ESWS	30PEB30AA002	ESWS, Train 3 Pump Recirc MOV PEB30AA002	3.7	0.000
100	ESWS	30PEB30AA005	ESWS, Train 3 Pump Discharge Isolation MOV PEB30AA005	3.7	0.000
101	UHS	30PED20AA010	UHS, Cooling Tower Train 2 Spray MOV PED20AA010	3.7	0.000
102	UHS	30PED20AA011	UHS, Cooling Tower Train 2 Bypass Line MOV PED20AA011	3.7	0.000
103	UHS	30PED30AA010	UHS, Cooling Tower Train 3 Spray MOV PED30AA010	3.7	0.000
104	UHS	30PED30AA011	UHS, Cooling Tower Train 3 Bypass Line MOV PED30AA011	3.7	0.000
105	ESWS	30PEB20AA204	ESWS, Train 2 Pump Discharge Check Valve, PEB20AA204	3.6	0.000
106	ESWS	30PEB30AA204	ESWS, Train 3 Pump Discharge Check Valve, PEB30AA204	3.6	0.000
107	ELEC	33BNB02	ELEC, 480V MCC 33BNB02	3.4	0.000
108	ELEC	32BDB	ELEC, 6.9kV SWGR 32BDB	3.4	0.000
109	ELEC	32BMB	ELEC, 480V Load Center 32BMB	3.4	0.000
110	ELEC	32BMT02	ELEC, 6.9kV-480V Transformer 32BMT02	3.4	0.000
111	SCWS	30QKC10AA101	SCWS, Return from SAC Div 1 MOV QKC10AA101	3.3	0.000
112	HVAC	30SAC01AA004	SAC, Div 1 Recirculation Motor Operated Damper SAC01AA004	3.3	0.000
113	ELEC	34BUC	ELEC, 1E 250V DC Switchboard 34BUC	3.1	0.000
114	ELEC	1BDA_1BDC1	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	3.1	0.000
115	ELEC	32BNT01	ELEC, Constant Voltage Transformer 32BNT01	3.1	0.000

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
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Rank	System US	Comp ID	Component Description	RAW	FV
116	SIS/RHR	30JNG43AA005	LHSI, MHSI/LHSI Train 4 First SIS Isolation Check Valve JNG43AA005	3.1	0.204
117	SCWS	30QKA40GH001	SCWS, Train 4 Chiller Unit QKA40GH001	3.0	0.032
118	SCWS	30QKA40AA101	SCWS, Train 4 Chiller By-pass MOV QKA40AA101	2.9	0.010
119	SIS/RHR	30JNG13AA005	LHSI, MHSI/LHSI Train 1 First SIS Isolation Check Valve JNG13AA005	2.9	0.197
120	ELEC	33BNT01	ELEC, Constant Voltage Transformer 33BNT01	2.8	0.000
121	SIS/RHR	30JNA20AA101	RHR, LHSI Train 2 HTX Bypass MOV JNA20AA101	2.8	0.006
122	ELEC	34BDA	ELEC, 6.9kV SWGR 34BDA	2.8	0.000
123	SIS/RHR	30JNG30AP001	LHSI, Train 3 Motor Driven Pump JNG30AP001	2.7	0.007
124	ELEC	3BDA_3BDB1	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDB Circuit Breaker	2.7	0.000
125	ELEC	3BDA_3BDB2	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDB Circuit Breaker	2.7	0.000
126	ELEC	3BDB3BMT02	ELEC, 6.9kV SWGR 33BDB to Transformer 33BMT02 Circuit Breaker	2.7	0.000
127	ELEC	3BMT023BMB	ELEC, Transformer 33BMT02 to 480V Load Center 33BMB Circuit Breaker	2.7	0.000
128	ELEC	32BRW30BUW31	ELEC, 24V DC I&C Power Rack 32BRW30/ 32BUW31	2.7	0.000
129	ELEC	34BDB	ELEC, 6.9kV SWGR 34BDB	2.7	0.000
130	ELEC	34BDC	ELEC, 6.9kV SWGR 34BDC	2.7	0.000
131	ELEC	34BMB	ELEC, 480V Load Center 34BMB	2.7	0.000
132	ELEC	34BMT02	ELEC, 6.9kV-480V Transformer 34BMT02	2.7	0.000
133	SIS/RHR	30JNG30AA102	LHSI, LHSI Pump 30 Control MOV JNG30AA102	2.7	0.002
134	ELEC	31BMC	ELEC, 480V Load Center 31BMC	2.7	0.000
135	ELEC	31BMT03	ELEC, 6.9kV-480V Transformer 31BMT03	2.7	0.000
136	ELEC	31BNC01	ELEC, 480V MCC 31BNC01	2.7	0.000
137	SCWS	30QKC40AA101	SCWS, Return from SAC Div 4 MOV QKC40AA101	2.6	0.000
138	HVAC	30SAC04AA004	SAC, Div 4 Recirculation Motor Operated Damper SAC04AA004	2.6	0.000

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
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Rank	System US	Comp ID	Component Description	RAW	FV
139	SIS/RHR	30JNG20AP001	LHSI, Train 2 Motor Driven Pump JNG20AP001	2.4	0.007
140	ELEC	34BNB02	ELEC, 480V MCC 34BNB02	2.4	0.000
141	ELEC	34BNT01	ELEC, Constant Voltage Transformer 34BNT01	2.4	0.000
142	ELEC	34BTD01	ELEC, 250V 1E 2-hr Battery 34BTD01	2.4	0.008
143	ELEC	32BTD01	ELEC, 250V 1E 2-hr Battery 32BTD01	2.4	0.017
144	ELEC	34BNC01	ELEC, 480V MCC 34BNC01	2.3	0.000
145	RCS	30JEF-PSRV	PZR, Pressurizer Safety Relief Valve	2.2	0.004
146	SIS/RHR	30JNG40AP001	LHSI, Train 4 Motor Driven Pump JNG40AP001	2.2	0.008
147	SIS/RHR	30JNA40AA101	RHR, LHSI Train 4 HTX Bypass MOV JNA40AA101	2.2	0.004
148	SIS/RHR	30JND10AA003	MHSI, MHSI Pump 10 Discharge Manual CHECK Valve JND10AA003	2.1	0.000
149	ELEC	32BUC	ELEC, 1E 250V DC Switchboard 32BUC	2.1	0.000
150	ELEC	2BDA_2BDB1	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	2.1	0.000
151	ELEC	2BDA_2BDB2	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	2.1	0.000
152	ELEC	2BDB2BMT02	ELEC, 6.9kV SWGR 32BDB to Transformer 32BMT02 Circuit Breaker	2.1	0.000
153	ELEC	2BMB2BNT01	ELEC, 480 Load Center 32BMB to Transformer 32BNT01 Circuit Breaker	2.1	0.000
154	ELEC	2BMT022BMB	ELEC, Transformer 32BMT02 to 480V Load Center 32BMB Circuit Breaker	2.1	0.000
155	ELEC	2BNT012BNB02	ELEC, Transformer 32BNT01 to 480V MCC 32BNB02 Circuit Breaker	2.1	0.000
156	ELEC	3BMB3BNT01	ELEC, 480V Load Center 33BMB to Transformer 33BNT01 Circuit Breaker	2.1	0.000
157	ELEC	3BNT013BNB02	ELEC, Transformer 33BNT01 to 480V MCC 33BNB02 Circuit Breaker	2.1	0.000
158	ELEC	34BMC	ELEC, 480V Load Center 34BMC	2.1	0.000
159	ELEC	34BMT03	ELEC, 6.9kV-480V Transformer 34BMT03	2.1	0.000
160	SIS/RHR	30JNG40AC001	LHSI, LHSI Train 4 HTX JNG40AC001	2.1	0.000
161	SIS/RHR	30JNG10AA003	LHSI, LHSI Train 1 to Radial Miniflow Motor Operated Check Valve JNG10AA003	2.1	0.000

Table 19.1-94—U.S. EPR Risk-Significant Equipment based on RAW Importance - Level 1 Shutdown
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Rank	System US	Comp ID	Component Description	RAW	FV
162	SIS/RHR	30JNG20AA102	LHSI, LHSI Pump 20 Control MOV JNG20AA102	2.1	0.002
163	ELEC	30XKA20	ELEC, Emergency Diesel Generator XKA20	2.1	0.276
164	SIS/RHR	30JNG10AC001	LHSI, LHSI Train 1 HTX JNG10AC001	2.0	0.000

Table 19.1-95—U.S. EPR Risk-Significant Human Actions at Shutdown based on FV Importance - Level 1 Shutdown

Rank	Basic Event	Description	Nominal Value	FV	RAW
1	OPF-ISORHRSVFD-CB	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State CB	1.0E+00	0.109	1.0
2	OPF-ISORHRSVFD-CA	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State CA	1.0E+00	0.101	1.0
3	OPE-ISOCSLPRS	Operator Fails to Isolate the CVCS Low Pressure Reducing Station (SHUTDOWN)	2.0E-05	0.088	4,375.5
4	OPF-ULD	Operator Fails to Stop Draindown at Mid-Loop (SHUTDOWN)	1.0E-02	0.059	IE
5	OPF-ISORHRSVFD-D	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State D	1.0E+00	0.054	1.0
6	OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	1.2E-02	0.052	5.3
7	OPF-XTLDSBO-NSC	Operator Fails to Connect and Load SBO DGs During Non-SBO Conditions	1.0E-01	0.047	1.4
8	OPF-CCWS TR SO	Operator Fails to Switch CH Supply to Standby CCW Train Before A Loss of the Running Train	1.6E-01	0.029	1.2
9	OPF-ISORHRBRK	Operator Fails to Isolate RHR Pipe Break (SHUTDOWN)	1.1E-01	0.024	1.2
10	OPF-ISOIRWSTFD-CB	Operator Fails to Isolate RHR Suction to IRWST (Valve JNGX0AA001) in State CB	1.0E+00	0.016	1.0
11	OPF-ISOIRWSTFD-CA	Operator Fails to Isolate RHR Suction to IRWST (Valve JNGX0AA001) in State CA	1.0E+00	0.015	1.0
12	OPD-SAC-2H-HIGH	Operator fails to start local room cooling - high dependency	5.0E-01	0.013	1.0
13	OPF-SAC-1H	Operator Fails to Start Maintenance HVAC Trains After Failure of Normal SAC Safety Train	1.1E-04	0.013	118.4
14	OPF-ISOIRWSTFD-D	Operator Fails to Isolate RHR Suction to IRWST (Valve JNGX0AA001) in State D	1.0E+00	0.008	1.0

Table 19.1-96—U.S. EPR Risk-Significant Human Actions based on RAW Importance - Level 1 Shutdown

Rank	Basic Event	Description	Nominal Value	RAW	FV
1	OPE-ISOCSLPRS	Operator Fails to Isolate the CVCS Low Pressure Reducing Station (SHUTDOWN)	2.0E-05	4,375.5	0.088
2	OPF-SAC-1H	Operator Fails to Start Maintenance HVAC Trains After Failure of Normal SAC Safety Train	1.1E-04	118.4	0.013
3	OPF-LHSIRHR-DU	Operator Fails to Align and Start LHSI Pump in DU, Given a Loss of RHR	2.0E-04	10.6	0.002
4	OPF-XTLDSBO-2H	Operator Fails to Connect and Load SBO DGs	6.0E-04	5.8	0.003
5	OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	1.2E-02	5.3	0.052
6	OPF-LHSIRHR-DD	Operator Fails to Align and Start LHSI Pump in DD, Given a Loss of RHR	2.0E-04	4.3	0.001
7	OPF-RHRLOCA-CAD	Operator Fails to Start RHR in CAd (LOCA Initiator)	2.0E-03	2.2	0.002
8	OPF-RHRLOCA-CBD	Operator Fails to Start RHR in CBd (LOCA Initiator)	1.1E-03	2.2	0.001

Table 19.1-97—U.S. EPR Risk-Significant Common Cause Events based on RAW Importance - Level 1 Shutdown

Rank	System	ID	Description	Nominal Value	RAW
1	SIS/RHRS	JNG13AA005CFO_D-ALL	CCF to Open LHSI/MHSI Common Injection Check Valves (SIS First Isolation Valves)	4.1E-06	43,981.0
2	IRWST	JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	5.7E-06	35,303.0
3	ELEC	BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand	1.6E-07	29,564.0
4	HVAC	SAC01/31AN001EFR_B-ALL	CCF to Run Normal Air Supply/Exhaust Fans (Trains 1 & 4)	5.1E-06	2,316.1
5	ELEC	XKA10_____DFR/FS_D-ALL	CCF of EDGs to Run/Start	1.0E-04	1,677.9
6	ESWS	PEB10AP001EFSS_D-ALL	CCF of the ESWS Pumps to Start (Shutdown)	6.5E-06	1,647.2
7	SCWS	QKA10GH001_FR_B-ALL	CCF of the Running SCWS Chiller Units to Run	2.2E-05	780.6
8	SIS/RHRS	JNG10AP001EFS_D-ALL	CCF of LHSI Pumps to Start	1.7E-06	519.1
9	SIS/RHRS	JNG10AA006CFO_D-ALL	CCF to Open LHSI Check Valves (SIS Second Isolation Valves)	2.3E-07	360.5
10	HVAC	SAC01/31AA005/003CFO_D-ALL	CCF to Open Normal SAC Supply/Exhaust Fan Discharge Check Dampers	4.5E-07	352.3
11	SIS/RHRS	JND10AP001EFR/FS_D-ALL	CCF of MHSI Pumps to Run/Start	3.0E-05	61.9
12	ESWS	PED10AN001EFRS_D-ALL	CCF to Run Normally Running Cooling Tower Fans (Shutdown)	1.9E-06	61.0
13	HVAC	SAC01/31AN001EFS_B-ALL	CCF to Start Normal Air Supply/Exhaust Fans (Trains 1 & 4)	1.4E-05	57.6
14	SCWS	QKA20GH001_FS/FR_B-ALL	CCF of the Standby SCWS Chiller Units to Start/Run	1.5E-04	44.2
15	CCWS	KAA10AP001EFSS_D-ALL	CCF of the CCWS Pumps to Run (Shutdown)	7.4E-06	29.2
16	SIS/RHRS	JNG10AA001EFO_D-ALL	CCF to Open LHSI Pump Suction from IRWST MOVs	1.1E-05	24.1

Table 19.1-98—U.S. EPR Risk-Significant Common Cause I&C Events based on RAW Importance - Level 1 Shutdown

Rank	ID	Description	Nominal Value	RAW
1	I/O MOD CCF	I/O Module Common Cause Failure	6.5E-06	5,675.3
2	ALU/APU NS-ALL	CCF of ALU and APU Protection System Computer Processors (Non-Self-Monitored)	3.3E-07	5,566.4
3	CL-TXS-OSCCF	CCF of TXS Operating System or Other Common Software	1.0E-07	5,329.9
4	ALU/APU SM-ALL	CCF of ALU and APU Protection System Computer Processors (Self-Monitored)	9.0E-08	5,318.4
5	SAS CCF-ALL	CCF of SAS Divisions	5.0E-07	2,503.2
6	CL-PS-EDG-SWCCF	CCF of EDG Start Function in PS Diversity Groups A&B Software	1.0E-05	1,655.5
7	BUS UV CCF-ALL	CCF of 6.9KV bus undervoltage sensors	4.3E-06	1,643.9
8	CL-PS-B-SWCCF	CCF of Protection System Diversity Group B Application Software	1.0E-05	60.4
9	PAS	Process Automation System (PAS) Fails (Estimate)	1.0E-03	38.4
10	HL LVL CCF-ALL	CCF of hotleg loop level	1.3E-06	35.5
11	HL TEMP CCF-ALL	CCF of hotleg WR temperature sensors	4.3E-06	21.9
12	HL PRES CCF-ALL	CCF of hotleg WR pressure sensors	6.7E-07	20.3
13	RCS TEMP CCG	Common Cause Failure of the RCP Temperature Sensors (12)	1.6E-07	20.3

Table 19.1-99—U.S. EPR Risk-Significant PRA Parameters - Level 1 Shutdown

Rank	ID	Description	Nominal Value	FV	RAW
PRA Modeling Parameters					
1	SA-ESWS UHS4 SBO	Failure of SA-ESWS/UHS4 in SBO Conditions	1.0E-01	0.027	1.2
2	RHR TR3 PIPE BRK	Pipe Break in RHR Train 3	3.1E-07	0.014	44,176.0
3	RHR TR2 PIPE BRK	Pipe Break in RHR Train 2	3.1E-07	0.014	44,136.0
4	JEF-PSRV-FRC	PZR, Pressurizer Safety Relief Valve Fails to Reclose or to Reseat	3.0E-03	0.004	2.2
5	RHR TR1 PIPE BRK	Pipe Break in RHR Train 1	3.1E-07	0.003	9,764.6
6	RHR TR4 PIPE BRK	Pipe Break in RHR Train 4	3.1E-07	0.001	3,669.9
7	XKA LOADS-ALL	CCF of SWGR Loads to Disconnect	1.4E-06	0.000	84.8
Offsite Power Related Events					
1	SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	2.2E-04	0.443	2,014.6

Table 19.1-100—U.S. EPR LEVEL 1 Internal Events Sensitivity Studies - Level 1 Shutdown

Sensitivity Case Group	Case #	Sensitivity Case Description	SC CDF (1/yr)	Delta CDF (%)
0	0	Base Case (Shutdown CDF)	6.0E-08	0%
1		**Common Cause Assumption**		
	1b	EDGs & SBODGs in the same CC group	2.4E-07	297%
2		**Assumptions on Electrical Dependencies**		
	2a	UHS 4 assumed unavailable during SBO Conditions (no credit for SBO x-tie for dedicated ESW)	7.24E-08	21%
3		**Assumptions on HVAC Recoveries**		
	3a	Room heat-up was not considered	5.6E-08	-6%
	3b	Operator recovery of HVAC not credited	3.8E-07	540%
4		**Sensitivity to HEPs Values**		
	4a	All HEPs Set to 5% Value	4.5E-08	-25%
	4b	All HEPs Set to 95% Value	1.3E-07	116%
5		**UHS Requirement in Shutdown**		
	5	UHS Fans not required	6.0E-08	0%
6		**Assumptions on Preventive Maintenance**		
	6	Train 1 in preventive maintenance during shutdown states CBU and DU	1.4E-06	2267%
		I&C Software and Hardware Common Cause		
	7a	Increase I&C CC parameters by factor of 10; include operator dependency	7.0E-08	17%
	7b	Increase I&C CC parameters by factor of 100	2.0E-07	229%
		Design Change after the PRA Model Freeze		
		Design Change to RCP seal valves: type (SOV to MOV) and electrical supply (12 hr NUPS to 2 hr EUPS)	6.0E-8	0%

Table 19.1-101—Level 2 Low Power Shutdown Plant Operating States Release Categories

Release Category	RC Freq for State C	RC % of LRF in State C	RC Freq for State D	RC % of LRF in State D	RC Freq for State E	RC % of LRF in State E
RC201	7.88E-10	16.18%	0.00E+00	0.00%	0.00E+00	0.00%
RC202	2.95E-12	0.06%	7.76E-13	0.06%	2.01E-12	0.11%
RC203	2.94E-09	60.40%	9.51E-10	73.66%	2.02E-10	11.03%
RC204	1.31E-10	2.69%	1.05E-10	8.15%	6.26E-10	34.13%
RC205	1.37E-10	2.82%	2.80E-11	2.17%	8.66E-11	4.72%
RC301	9.50E-14	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
RC302	2.74E-13	0.01%	6.44E-14	0.00%	4.39E-15	0.00%
RC303	5.36E-11	1.10%	0.00E+00	0.00%	0.00E+00	0.00%
RC304	1.02E-11	0.21%	0.00E+00	0.00%	0.00E+00	0.00%
RC401	3.41E-13	0.01%	0.00E+00	0.00%	0.00E+00	0.00%
RC402	1.88E-13	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
RC403	1.32E-11	0.27%	0.00E+00	0.00%	0.00E+00	0.00%
RC404	1.08E-11	0.22%	0.00E+00	0.00%	0.00E+00	0.00%
RC702	1.40E-12	0.03%	0.00E+00	0.00%	0.00E+00	0.00%
RC802	7.79E-10	16.00%	2.06E-10	15.96%	9.18E-10	50.02%
	4.87E-09		1.29E-09		1.83E-09	

Table 19.1-102—U.S. EPR Design Features Contributing to Low Risk
Sheet 1 of 7

No	U.S. EPR Design Feature Description	Disposition
1	**High level of redundancy and independence for safety systems** The U.S. EPR design incorporates four trains of most safety systems, and provides for significant separation: ● Four trains of the safety injection systems (LHSI, MHSI, and accumulators). ● Four trains of emergency feedwater (EFW), supplying four steam generators. Each train has an EFW water storage tank for its suction source. ● Four safety trains of support systems (cooling trains, building HVAC, and electric power).	Tier 1, Section 2.2.3; Tier 2, Section 6.3 Tier 1, Section 2.2.4; Tier 2, Section 10.4.9.2.1 Cooling Trains: Tier 2, Section 9.2.2; Tier 2, Section 9.2.1.2 HVAC: Tier 1, Section 2.6.6; Tier 2, Section 9.4.5 Electrical power: Tier 1, Section 2.5.1; Tier 2, Section 8.1.2
2	**Physical separation of safety systems** In addition to being highly redundant, the four trains of safety systems are physically separated by being located in different safeguard buildings. This significantly reduces the potential for core-damage accidents due to internal flooding, internal fires, or external events for which spatial considerations are important.	Tier 1, Section 2.1.1; Tier 2, Section 3.8.4; Tier 2, Section 6.3.2.6
3	**In-containment refueling water storage tank (IRWST)** The design of the IRWST eliminates some failure modes that have been important for current-generation plants: ● Use of the IRWST eliminates the need to change system alignment by switching suction sources for safety injection following a LOCA. The failure to accomplish this switchover has been an important contributor to failure of long term safety injection for many current-generation PWRs. ● Eliminating the need for switchover also obviates the need to isolate the suction path used during the injection phase. For some current-generation PWRs, failure to isolate this path has been assessed to result in inadequate NPSH for the safety injection paths, and may create a release path after the recirculation path is opened. ● The reactor containment building affords the IRWST better protection against some types of external events than is the case for equivalent tanks at current-generation plants.	Tier 1, Section 2.2.2; Tier 2, Section 6.3.2.2.2

Table 19.1-102—U.S. EPR Design Features Contributing to Low Risk
Sheet 2 of 7

No	U.S. EPR Design Feature Description	Disposition
4	**High level of redundancy and independence for onsite power supply system** The U.S. EPR design includes both emergency diesel-generators (EDGs) and station blackout diesel generators that serve as an alternate AC source. These onsite power sources have the following features:	
	• There are four EDGs, one supporting each safety division. This provides substantial redundancy to maintain the function of safety systems following a loss of offsite power.	Tier 1, Section 2.5.4; Tier 2, Section 8.3.1.1.5
	• There are two backup SBO diesel-generators for AAC. The SBO diesel-generators are diverse from the EDGs in design, cooling, actuation and control, fuel oil supply and operating environment. This affords significant defense against potential common-cause failures that might affect all of the diesel generators.	Tier 1, Section 2.5.3; Tier 2, Section 8.4.1
	• The SBO diesel-generators can be aligned to back up two divisions of the safety loads if the EDGs are unavailable, and can be used to support systems provided to mitigate severe-accident conditions.	Tier 1, Section 2.5.3; Tier 2, Section 8.4.1
5	**Reliability of normal AC power supplies** Among the provisions incorporated into the design of the U.S. EPR to provide for improved reliability of the normal supply of AC power, reducing the demand for emergency power from the diesel-generators, are the following:	
	• The design includes the capability to withstand a full load rejection without tripping the reactor. In the event of a load rejection, the reactor and turbine would automatically run back to a power level sufficient to allow the main generator to continue to supply the plant auxiliary loads. This design would reduce the potential for reactor trip and challenge to onsite emergency power systems for grid-centered loss of power events.	Tier 2, Section 8.3.1.1; Tier 2, Section 7.7.2.3.4; Tier 2, Section 10.2.2.7; Tier 2, Section 14.2.12.21.4
	• During normal operation, two auxiliary transformers supply power directly from the switchyard to all four safety-related switchgear divisions. An additional two transformers supply the non-safety-related switchgear. Since the main generator does not normally supply auxiliary loads in this configuration, a reactor trip does not create a demand for fast transfer to an offsite power source. Moreover, there are redundant feeds for each switchgear (safety-related and non-safety-related), so that loss of an individual auxiliary transformer will not affect the continued supply of offsite power to plant loads.	Tier 1, Section 2.5.5; Tier 2, Section 8.2.1.1; COLA Item 8.1-1; COLA Item 8.2-1; COLA Item 8.2-3

Table 19.1-102—U.S. EPR Design Features Contributing to Low Risk
Sheet 3 of 7

No	U.S. EPR Design Feature Description	Disposition
6	**Provisions to limit the impact of sequences involving failure to scram** The extra borating system (EBS) provides manual injection capability of highly borated water into the reactor pressure vessel (RPV) in the event that the reactor shutdown system does not function properly. EBS is a two-train system which further reduces the potential contribution of accidents involving a failure to scram	Tier 1, Section 2.2.7; Tier 2, Section 6.8
7	**Reduced potential for a small LOCA due to failure of reactor coolant pump (RCP) seals** The potential for RCS leakage or small LOCA (SLOCA) due to failure of reactor coolant pump (RCP) shaft seals has been an important risk contributor for many PWRs. The U.S. EPR design includes a stand still seal for each RCP. The stand still seal is a pneumatic, “metal-to-metal” seal that serves as a back-up seal, and is independent of the normal shaft seal. The stand still seal system reduces the risk of a LOCA event as a result of postulated RCP seal degradation.	Tier 2, Section 5.4.1.2.1
8	**Reduced potential for release pathway following a steam generator tube rupture (SGTR)** Among the features of the MHSI system is the provision for a shutoff head below the setpoints for the main steam safety valves (MSSV). In the event of an SGTR, the lower MHSI shutoff head limits the pressure differential that forces reactor coolant through the broken tube. The lower MHSI pressure will not challenge the associated MSSV to open (with possible failure to re-close). This reduces the potential for a release pathway from the RCS through the MSSV.	Tier 2, Table 6.3-3; Tier 2, Table 10.3-2; Tier 2, Section 15.6.3.1.1; Tier 1, Table 2.8.2-3
9	**A state-of-the-art digital instrumentation and control (I&C) system**	
	The U.S. EPR uses state-of-the-art digital systems for I&C functions. The reliability of these systems enhances the automatic initiation of functions important to maintaining core cooling, including the following: • Reactor shutdown, • Emergency feedwater, and • Safety injection	Tier 1, Section 2.4.1; Tier 2, Section 7.1.1.4.1
	The human-system interface implemented through a fully computerized control room also optimizes the information available to the operators.	Tier 2, Section 7.1.1.1

Table 19.1-102—U.S. EPR Design Features Contributing to Low Risk
Sheet 4 of 7

No	U.S. EPR Design Feature Description	Disposition
	Because of the level of redundancy of such systems, concerns regarding the potential for common-cause failures must be addressed. A number of important measures have been taken to limit the potential for CCFs for the digital I&C systems of the U.S. EPR, including the following: ● The Protection System employs subsystems called diversity groups to accomplish essential actuations. These subsystems are functionally diverse and independent. The diversity results from the use of different application programs and different parameter/sensor inputs. No information is shared between diversity groups via network connections. ● The outputs of the protective system (PS) are connected to diverse reactor trip devices. ● The ESF functions are also divided between the diverse subsystems to obtain maximum functional diversity. In addition to the functional diversity provided by the subsystems within the PS and the diversity of the reactor trip devices, there is additional defense-in-depth provided in the I&C architecture. This includes the following:	Tier 2, Section 7.1.1.4.1; Tier 2, Section 7.2.1.1
	● Trip reduction features of the RCSL and PAS systems, which provide control, surveillance, and limitation functions to reduce reactor trips and PS challenges. Among these features is the automatic power reduction that is not credited in the PRA.	Tier 2, Section 7.1.1.4.5; Tier 2, Section 7.1.1.4.6
	● Backup trip and actuation functions are performed by the DAS.	Tier 2, Section 7.4.1.1
	The potential for software CCFs is minimized by such measures as the following: ● High quality software design tools. ● A deterministic operating system. ● Built in monitoring and testing. ● Built in functional diversity.	Tier 2, Section 7.1.1.1; Tier 2, Section 7.1.1.2
10	**Diversity of some elements of HVAC** Diversity is incorporated into the design of the safety chilled water system through the use of air cooling for the refrigeration units in Divisions 1 and 4, and CCW cooling for the refrigeration units of Divisions 2 and 3.	Tier 2, Section 9.2.8.2.2; Tier 2, Section 9.2.8.4

Table 19.1-102—U.S. EPR Design Features Contributing to Low Risk
Sheet 5 of 7

No	U.S. EPR Design Feature Description	Disposition
11	**A large, robust containment** The U.S. EPR has a containment that can withstand a variety of challenges, including the following:	
	• The containment has a free volume of about 2.8 x 10^6 ft^3, and a design pressure of 62 psig. This volume and relatively high design pressure provide significant capacity to accommodate the loadings due to a LOCA, a main steam-line break inside containment, or severe-accident phenomena.	Tier 2, Section 6.2.1.1.2; Tire 2, Section 6.2.1.5.3
	• The containment is also designed to maintain its integrity when challenged by external forces, including the impact from aircraft and the loadings from seismic events.	Tier 1, Section 2.1.1; Tier 2, Section 6.2.1.1.1
12	**Primary depressurization system (PDS)**	
	The U.S. EPR is equipped with a PDS that goes well beyond the capabilities for depressurization in current-generation PWRs to address the potential for accidents that might progress with the RCS at high pressure. This system is comprised of two trains with four primary depressurization system valves, independent of three pressurizer safety valves, that can provide the following benefits:	Tier 2, Section 19.2.3.3.4
	• The PDSVs can be used to provide a bleed path independent of the PSVs to support feed-and-bleed cooling in the event of a total loss of feedwater to the steam generators. This feature of the system further reduces the potential for occurrence of a core-damage accident.	Tier 2, Section 19.2.2.6
	• In the event of a severe accident, the primary purpose of the PDSVs is to prevent the progression from taking place with the RCS at high pressure. Depressurization of the RCS limits the potential for induced failures of the RCS due to the generation of high-temperature gases. This is of particular interest because it further reduces the potential for induced failure of tubes in the steam generators; such failure could create the possibility of a path for radionuclide release that would bypass the containment boundary.	Tier 2, Section 19.1.4.2.1.2
	• Depressurization of the RCS also limits the dispersion of core debris to the containment atmosphere, essentially eliminating the possibility of direct containment heating.	Tier 2, Section 19.2.3.3.4
13	**Provisions to control combustible gases** The containment is equipped with passive autocatalytic recombiners. These recombiners prevent the buildup of hydrogen concentration so as to limit the size of any hydrogen deflagration and prevent hydrogen detonation.	Tier 1, Section 2.3.1; Tier 2, Section 6.2.5.2.1

Table 19.1-102—U.S. EPR Design Features Contributing to Low Risk
Sheet 6 of 7

No	U.S. EPR Design Feature Description	Disposition
14	**Core-melt retention system** A combination of passive and active devices allows gravity driven water from the IRWST to flood the corium spreading area to remove heat from below the core debris via the cooling water channels. This design limits the potential for core-concrete interactions that could cause pressurization of the containment via the generation of non-condensable gases.	Tier 2, Section 19.2.3.3.3.1; Tier 2, Section 19.2.3.3.3.2
15	**Severe-accident heat removal system** The severe accident heat removal system (SAHRS) provides a means for removing heat from containment following a severe accident. Feature of the SAHRS that play an important role in the Level 2 PRA include the following: ● The system supports passive cooling of the molten core debris via the core-melt retention system. ● The system includes a containment spray mode that enhances scrubbing of fission products from the containment atmosphere. ● The system provides for active recirculation of cooling water for the molten core debris. ● Active elements of the SAHRS rely on the SBO diesel generators, providing a degree of diversity and independence from the safety systems involved in core cooling. In addition to containment heat removal credited in Level 2, the SAHRS is also credited in some Level 1 sequences for cooling IRWST if the heat removal function of LHSI fails. The demands/ challenges to the SAHRS are relatively low in frequency due to the four train reliability of LHSI heat removal and overall low CDF. The SAHRS is a single train, which has a dedicated CCW and ESW cooling capability. The system is manually initiated.	Tier 1, Section 2.3.3; Tier 2, Section 19.2.3.3.3.2
16	**Main steam relief trains for reliable heat removal** Each main steam line is equipped with a MSRT. To provide for both reliable operation and limited potential for spurious operation, each MSRT is equipped with four solenoid valves.	Tier 2, Section 10.3.2.2

Table 19.1-102—U.S. EPR Design Features Contributing to Low Risk
Sheet 7 of 7

No	U.S. EPR Design Feature Description	Disposition
17	**The remote shutdown workstation is in a fire and flood area separate from the main control room.** Although a main control room fire may defeat manual actuation of equipment from the main control room, it will not affect the automatic functioning of safe shutdown equipment via the PS or manual operation from the remote shutdown station. Sufficient instrumentation and control is provided at the remote shutdown station to bring the plant to safe shutdown conditions in case the control room must be evacuated. There are no differences between the main control room and remote shutdown workstation controls and monitoring that would be expected to affect safety system redundancy and reliability. The following applies toward transferring control from the MCR to the RSS: ● The transfer must be in a different fire area than the MCR and within reasonable walking distance from the MCR. ● The transfer must disable the MCR control and provide transfer to the RSS controls without loss of control capability.	Tier 2, Section 3.4.3.4; Tier 2, Section 9.5.1.2.1; Tier 2, Section 7.4.1.3; Tier 2, Section 7.4.2.3
18	**MCR & RSS ventilation systems** The main control room has its own ventilation system, and is pressurized. This prevents smoke, hot gases, or fire suppressants originating in areas outside the control room from entering the control room via the ventilation system. The ventilation system for the remote shutdown workstation is independent of the ventilation system for the main control room.	Tier 2, Section 6.4.2.4; Tier 2, Section 9.4.1.3
19	**Seismic margins analysis** The plant level HCLPF is ≥ 1.67 SSE, where the SSE is defined by the Certified Design Response Spectra (CSDRS), and there are no spatial seismic interaction issues. Differences between the as-built plant and the design used as the basis for the U.S. EPR FSAR seismic margins analysis will be reviewed.	COL Item 19.1-6; COL Item 19.1-9
20	**Instrumentation through RPV top head** The U.S. EPR location of the RPV instrumentation which is through RPV top head not lower head, reduces likelihood of LOCA during maintenance	Tier 2, Section 5.3.3.1.1; Tier 2, Section 5.3.3.1.3

Table 19.1-103—U.S. EPR Level 1 Top Initiating Event Contributions to the Total CDF at Power (Contributing more than 1% to Total CDF) Rank
Sheet 1 of 2

	Initiating Event	Description	CDF	Contribution	Cumulative Contribution
1	FIRE-SAB14-ELEC	Fire in Switchgear Room of Safeguard Building 1 (or 4)	1.3E-07	23.6%	23.6%
2	LOOP - SBO	Loss of Offsite Power - SBO Conditions	7.2E-08	12.5%	36.1%
3	LOOP - General	Loss of Offsite Power - General	4.0E-08	7.0%	43.1%
4	SLOCA	Small LOCA (0.6 to 3-Inch Diameter)	3.9E-08	6.9%	50.0%
5	LOCCW	Loss Component Cooling Water Common Headers	3.6E-08	6.3%	56.3%
6	FLD-SAB14 FB	Flood in Safeguard Building 1 or 4 (Pump Room) Including Fuel Building	3.2E-08	5.7%	62.0%
7	SGTR	Steam Generator Tube Rupture	2.6E-08	4.6%	66.6%
8	FIRE-MCR	Fire in the Main Control Room	2.6E-08	4.5%	71.0%
9	GT	General Transient (Includes Turbine Trip and Reactor Trip)	2.0E-08	3.5%	74.6%
10	FLD-SIS	Flood Due to SIS Pipe Break	1.6E-08	2.7%	77.3%
11	LOOP - Seal LOCA	Loss of Offsite Power - With Seal LOCA	1.4E-08	2.5%	79.9%
12	LOOP - SBO Seal LOCA	Loss of Offsite Power - SBO Conditions with Seal LOCA	1.3E-08	2.3%	82.1%
13	FIRE-SAB-MECH	Fire in the Pump Room of Any Safeguard Building	1.2E-08	2.0%	84.2%
14	BDA	Loss of 6.9kV Power from Bus BDA	1.1E-08	2.0%	86.1%
15	FLD-ANN	Flood in the RB Annulus (FWDS Pipe Break)	1.1E-08	1.9%	88.1%
16	ATWS	Anticipated Transient Without Scram	8.9E-09	1.6%	89.7%
17	IND SGTR	Induced SGTR	8.5E-09	1.5%	91.1%

Table 19.1-103—U.S. EPR Level 1 Top Initiating Event Contributions to the Total CDF at Power (Contributing more than 1% to Total CDF) Rank Sheet 2 of 2

	Initiating Event	Description	CDF	Contribution	Cumulative Contribution
18	FIRE-MS-VR	Fire in One of the Two MF/ MS Valve Rooms With Spurious Opening of 1 MSRIV	8.3E-09	1.5%	92.6%
19	FIRE-SWGR	Fire in the Switchgear Building	7.8E-09	1.4%	94.0%
20	LOMFW	Total Loss of Main Feedwater	7.4E-09	1.3%	95.2%
Total Pwr:			4.9E-07		

Table 19.1-104—U.S. EPR Level 1 Total Events Sensitivity Studies
Sheet 1 of 3

Sensitivity Case Group	Case #	Sensitivity Case Description	SC CDF (1/yr)	Delta CDF (%)
0	0	Base Case (Total CDF)	5.4E-07	0%
1	**Common Cause Assumption**			
	1b	EDGs & SBODGs in the same CC group	1.6E-06	187%
2	**LOOP Assumptions**			
	2a	No Credit was given for LOOP recoveries (DG MT also set back to 24 hours)	1.2E-06	124%
	2b	DG Mission Time set to 24 hours	7.7E-07	42%
	2c	SBO DG Mission Time set to 18 hours	5.3E-07	-3.5%
	2d	Consequential LOOP events were not considered	5.1E-07	-7%
3	**Assumptions on Electrical Dependencies**			
	3a	MSRT Realignment to One Power Train per Train	5.2E-07	-4.5%
	3b	For CVCS seal injection, assume that a switchover from the VCT to the IRWST is always required (Div1 & Div4 required)	7.6E-06	39%
	3c	UHS 4 assumed unavailable during SBO Conditions (no credit for SBO x-tie for dedicated ESW)	5.7E-07	5%
4	**Assumptions on HVAC Recoveries**			
	4a	Room heat-up was not considered	5.1E-07	-6%
	4b	Operator recovery of HVAC not credited	6.5E-06	1083%
5	**Sensitivity to HEPs Values**			
	5a	All HEPs Set to 5% Value	3.3E-07	-40%
	5b	All HEPs Set to 95% Value	1.8E-06	228%

Table 19.1-104—U.S. EPR Level 1 Total Events Sensitivity Studies
Sheet 2 of 3

Sensitivity Case Group	Case #	Sensitivity Case Description	SC CDF (1/yr)	Delta CDF (%)
6		**Assumptions on Probabilities of an RCP LOCA**		
	6a	RCP Seal LOCA Probability - 1.0	9.1E-07	66%
	6b	RCP Seal LOCA Probability - 0.5	6.8E-07	24%
	6c	RCP Seal LOCA Probability - 0.1	5.0E-07	-7.5%
7		**Assumptions on Long Term Cooling Mission Time**		
	7a	SAHR Mission Time set to 36 hours	5.5E-07	0%
	7b	SAHR Mission Time set to 72 hours	5.5E-07	0%
8		**Preventive Maintenance Assumptions**		
	8a	Train 2 assumed to be in PM for all year	7.4E-07	35%
	8b	W/o Preventive Maintenance	2.7E-07	-51%
9		**I&C Software and Hardware Common Cause**		
	9a	Increase I&C CC parameters by factor of 10; include operator dependency	9.3E-07	70%
	9b	Increase I&C CC parameters by factor of 100	1.4E-06	156%
10		**Location of CCW Switchover Valves**		
	10	Flood in SAB14 doesn't disable CCWS SO	5.3E-07	-4%
11		**Physical Separation of Non-safety Cables**		
	11	Fire in CSR kills Safety Train 4 and all Non-Safety Divisions	5.5E-07	0%
12		**Simultaneous Hot Shorts not Considered**		
	12	Simultaneous hot shorts not considered, therefore no inadvertent valve openings for PZR cubicle or MFW/MS valve room fire	5.4E-07	-1%
13		**Assumptions on MS isolation, given a Fire in MFW/MS Valve Room**		
	13a	MSIV3 & MSIV4 isolation not credited for a fire in MFW/MS valve room	6.9E-07	26%

Table 19.1-104—U.S. EPR Level 1 Total Events Sensitivity Studies
Sheet 3 of 3

Sensitivity Case Group	Case #	Sensitivity Case Description	SC CDF (1/yr)	Delta CDF (%)
	13b	MSIV3 and MSIV4 assumed not to be separated by a fire barrier, for a fire in MFW/MS Valve Room	5.4E-07	-1%
14	**Design Change after the PRA Model Freeze**			
	14	Design Change to RCP seal valves: type (SOV to MOV) and electrical supply (12 hr NUPS to 2 hr EUPS)	5.6E-07	3%
15	**Combination of Different Cases**			
	15	Combination of Cases 1b, 2b, 3a, 3b, 5b, 6a	7.0E-06	1777%

Table 19.1-105—U.S. EPR Release Category Contributions to Total LRF from at Power Internal Events, Fire and Flooding Sheet 1 of 3

Shutdown Release Category	Description	Shutdown RC Frequency	Contribution to Shutdown LRF	Conditional Containment Failure Probability
RC201	Containment fails before vessel breach due to isolation failure, melt retained in vessel	5.50E-10	1.82%	0.0011
RC202	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex vessel, with containment spray	1.08E-11	0.04%	0.0
RC203	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex vessel, without containment spray	1.56E-09	5.18%	0.0032
RC204	Containment fails before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex vessel with containment spray	9.73E-10	3.22%	0.0020
RC205	Containment failures before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex vessel without containment spray	2.55E-09	8.43%	0.0052
RC206	Small containment failure due to failure to isolate 2” or smaller lines	4.62E-08	n/a	0.0952
RC301	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex vessel, with containment spray	6.63E-13	0.00%	0.0
RC302	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex vessel, without containment spray	1.05E-11	0.03%	0.0

Table 19.1-105—U.S. EPR Release Category Contributions to Total LRF from at Power Internal Events, Fire and Flooding
Sheet 2 of 3

Shutdown Release Category	Description	Shutdown RC Frequency	Contribution to Shutdown LRF	Conditional Containment Failure Probability
RC303	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex vessel, with containment spray	7.65E-11	0.25%	0.0002
RC304	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex vessel, without containment spray	5.34E-10	1.77%	0.0011
RC401	Containment failures after breach and up through debris quench due to containment rupture, with MCCI, without debris flooding, with containment spray	1.09E-12	0.00%	0.0
RC402	Containment failures after breach and up through debris quench due to containment rupture, with MCCI, without debris flooding, without containment spray	2.35E-11	0.08%	0.0
RC403	Containment failures after breach and up through debris quench due to containment rupture, without MCCI, with debris flooding, with containment spray	9.88E-11	0.33%	0.0002
RC404	Containment failures after breach and up through debris quench due to containment rupture, without MCCI, with debris flooding, without containment spray	1.11E-09	3.66%	0.0023
RC501	Long term containment failure after debris quench due to rupture, with MCCI, without debris flooding, with containment spray	1.57E-12	n/a	0.0000
RC502	Long term containment failure after debris quench due to rupture, with MCCI, without debris flooding, without containment spray	2.84E-10	n/a	0.0006

Table 19.1-105—U.S. EPR Release Category Contributions to Total LRF from at Power Internal Events, Fire and Flooding
Sheet 3 of 3

Shutdown Release Category	Description	Shutdown RC Frequency	Contribution to Shutdown LRF	Conditional Containment Failure Probability
RC503	Long term containment failure after debris quench due to rupture, without MCCI, with debris flooding, with containment spray	1.24E-09	n/a	0.0026
RC504	Long term containment failure after debris quench due to rupture, without MCCI, with debris flooding, without containment spray	2.93E-08	n/a	0.0604
RC601	Long term containment failure due to basemat failure, without debris flooding, with containment sprays	0.00E+00	n/a	0.0
RC602	Long term containment failure due to basemat failure, without debris flooding, without containment spray	2.65E-08	n/a	0.0546
RC701	Steam Generator Tube Rupture with Fission Product Scrubbing	2.825E-08	n/a	0.0582
RC702	Steam Generator Tube Rupture without Fission Product Scrubbing	1.46E-08	48.41%	0.0301
RC801	Interfacing System LOCA with Fission Product Scrubbing	7.817E-09	n/a	0.0161
RC802	Interfacing System LOCA without Fission Product Scrubbing but with building deposition credited	8.09E-09	26.78%	0.0167
Total Power LRF:		3.02E-08	100.00%	0.0622
RS Total Power LRF:		3.01E-08		

Table 19.1-106—SSC HCLPF Capacities
Sheet 1 of 7

SSC as a Function of Event Tree Node[2]	HCLPF (g) (pga)
Structures	
Reactor Containment Building	1.12
Reactor Shield Building	0.85
Reactor Building Internal Structure	0.73
Safeguard Building 1	0.54
Safeguard Building 4	0.59
Safeguard Buildings 2 & 3	0.57
Emergency Power Generating Buildings	0.75
Essential Service Water Pump Building (and Cooling Tower Structure)	0.62
Fuel Building	–
Vent Stack	0.54
Reactor Coolant System, Control Rods & Reactor Internals	
Reactor Vessel & Supports	0.5
Reactor Internals (do not prevent rod drop)	
Core Assemblies (do not prevent rod drop)	
Control Rod Drives (e.g., Guide Tubes)	
Steam Generators & Supports	
Reactor Coolant Pumps & Supports	
Pressurizer & Supports	
Pressurizer Relief Valves (JEF10AA191 including SOV JEF10AA717)	
Pressurizer Vent MOVs (JEF10AA501 and 502)	
Piping, Manual Valves, Check Valves	
Steam Generator Tubes including Tube to Tube Sheet Weld	
Low Pressure Reducing Station Letdown Isolation Valves (KBA14AA004 and 106)	

Table 19.1-106—SSC HCLPF Capacities
Sheet 2 of 7

SSC as a Function of Event Tree Node[2]	HCLPF (g) (pga)
Secondary Coolant System	
Feedwater Piping downstream of FWIV	0.5
Main Steam Piping upstream of MSIV	
MSIVs (LBA10AA002 and SOVs LBA10AA712)	
FWIVs MOVs (LAB60AA002)	
High Range FWIVs Hydraulic-Pneumatic) (LAB60AA001 and associated SOVs,)	
Low Range Feedwater Control Valves (LAB64AA102)	
MSRVs Control MOV (LBA13AA101)	
MSRIVs Steam-Operated (LBA13AA001 and associated SOVs)	
MSSVs (LBA11AA191)	
Emergency Feedwater System	
Pumps (LAS11AP001)	0.5
Isolation MOVs (LAR11AA006)	
Flow Control Valves (LAR11AA105)	
Limitation Control Valves (LAR11AA103)	
Piping, Manual Valves, Check Valves	
Medium Head Safety Injection	
Pumps (JND10AP001)	0.5
MOVs (JND10AA002 / 004 / 005)	
IRWST	
Piping, Manual Valves, Check Valves, Motor-Operated Check Valve	
Safety Injection Accumulators	
Accumulator (JNG13BB001)	0.5
Piping, MOV, Manual Valves, Check Valves	

Table 19.1-106—SSC HCLPF Capacities
Sheet 3 of 7

SSC as a Function of Event Tree Node[2]	HCLPF (g) (pga)
Low Head Safety Injection / Residual Heat Removal	
Pumps (JNG10AP001)	0.5
Heat Exchangers (JNG10AC001)	
CCWS LHSI HX Supply Valve (KAA12AA005)	
MOVs (i.e. JNG, JNA10AA001, JNA10AA003, JNA10AA101)	
IRWST	
RHR system coolant purification isolation valves to the CVCS (JNA30AA004, JNA30AA103; JNA40A004, JNA40AA103)	
Piping, Safety, Manual & Check Valves, Motor-Operated Check Valve	
Extra Borating System	
Pumps (JDH10AP001 and JDH40AP001)	0.5
MOVs (i.e., JDH10AA006/008/015)	
Piping, Safety, Manual & Check Valves	
EBS Boric Acid Tanks	
Building Ventilation (e.g., Fans, Dampers, Ducts, Coolers, Filters)	
Component Cooling Water	
Pumps (KAA10AP001)	0.5
Heat Exchangers (KAA10AC001)	
MOVs (i.e., KAA10AA112, KAA12AA005/013)	
Common Header Supply and Return Valves (KAA10AA006/010/032/ 033)	
Piping, Safety, Manual & Check Valves	
NAB Isolation Valves (KAB50AA001,002and 004; KAB80AA015,016 and 019)	
Essential Service Water	
ESWS Pumps (PEB10AP001	0.5
MOVs (PEB10AA005)	
Cooling Tower Fans & Equipment	
Piping, Manual Valves, Check Valves, Filters and Strainers	
Building Ventilation (e.g., Fans, Dampers, Ducts, Coolers, Filters)	

Table 19.1-106—SSC HCLPF Capacities
Sheet 4 of 7

SSC as a Function of Event Tree Node[2]	HCLPF (g) (pga)
Emergency Diesels	
Diesel Generator and Controls (XJA10)	0.5
Fuel Oil Day Tanks	
Fuel Oil Storage Tanks	
Air Start Compressors (XJX10AN001)	
Air Start Receivers	
Diesel Heat Exchangers	
Building Ventilation (e.g., Fans, Dampers, Ducts, Coolers, Filters)	
Safeguards Building Ventilation	
Supply Fans (SAC01AN001)	0.5
Exhaust Fans (SAC31AN001)	
Chillers (QKA10AH112)	
Pumps (QKA10AP107)	
Motor-Operated Dampers (e.g., SAC31AA002)	
Piping, Ducting, Manual and Check Dampers (Valves QKA)	
EFW Ventilation Chiller (SAC01AH001)	
Control Room Emergency Ventilation	
Pre, HEPA, Carbon filters SAB11AT001, 2, 3, 4	0.5
Fan (SAB11AN001)	
Chiller Cooling Coil (SAB01AC001)	
Fan (SAB01AN001)	
HEPA Filter (SAB01AT005)	
Fuel Pool Cooling	
Pumps (FAK11AP001, FAK12AP001, FAK21AP001, FAK22AP001)	0.5
Heat Exchangers (FAK10AC001, FAK20AC001)	
MOVs (FAK10AA601, FAK10AA001)	
Piping, Manual Valves, Check Valves	
Building Ventilation (e.g., Fans, Dampers, Ducts, Coolers, Filters)	

Table 19.1-106—SSC HCLPF Capacities
Sheet 5 of 7

SSC as a Function of Event Tree Node[2]	HCLPF (g) (pga)
Emergency AC & DC	
Electrical Change 6.9kv switchgear (31BDA, BDB, BDC, BDD)	0.5
Transformers (31BMT01, 02, 03, 04)	
Transformer, Voltage-Regulated (31BNT01)	
480 V Load Center (31BMB, BMC, BMD)	
480 V MCC (31BNB01, 31BNB02, 31BNB03, 31BNA01, 31BNA02, 31BNC01, 31BND01)	
480 V Uninterruptible MCC (31BRA)	
Electrical Panel Boards (e.g., 120V AC Panelboards Associated with Equipment Credited in the SMA)	
Batteries & Racks (31BTD01)	
Chargers (31BTP01, BTP02)	
Inverters with Electronic Bypass Switch in Same Cabinet (31BRU01)	
AC/DC Converters & DC power supplies (BRV, BRW)	
EDG Breaker (Qualified as Part of Cabinet)	
Cable Trays (Associated with Equipment Credited in the SMA)	
Miscellaneous Equipment	
Containment Penetrations (e.g., Piping, Hatches)	0.5g
Reactor Cavity, Seal and Pools	
Fuel Transfer Tube	
Refuel Gates	
Refuel Machine[1]	
Polar Crane[1]	
Control Room & Ceiling	
Cable Duct & Shaft	
Nuclear Auxiliary Building[1]	

Table 19.1-106—SSC HCLPF Capacities
Sheet 6 of 7

SSC as a Function of Event Tree Node[2]	HCLPF (g) (pga)
I&C / Relays / Sensor & Transmitters	
Steam Generator Level (JEA10CL809/10/11/12)	0.5
Steam Generator Pressure (LBA10CP811/21/31/41)	
Pressurizer Pressure (JEF10CP801/03/05/07)	
Pressurizer Level (JEF10CL802/04/06/08)	
Steamline Activity (30LBA10CR811)	
EFW Pump Flow (LAR11CF801)	
RCP Speed	
Cold Leg Temperature Elements (JEB10CT811)	
Hot Leg Temperature Elements (JEB10CT805)	
RCS Loop Level	
Self-Powered Neutron Sensor	
RCCA Rod Position Reactor Trip Check Back (CRDM)	
Reactor Protection Cabinets, Racks, Modules, Fiber Optics (TXS)	
Reactor Trip Cabinets (Breakers, Contactors) (TXS)	
PACS Cabinets (ESF, Priority Module Actuators, Solid State Modules) (TXS)	
SAS Cabinets (EFW, RHR Controls) (TXS)	
RCSL Cabinets (Reactor Control) (TXS)	
SICS (Backup to PICS – Solid State Display) (TXS)	
Incore Instrumentation and Cabinets (TXS)	
Excore Instrumentation and Cabinets (TXS)	
Rodpilot Cabinets (TXS)	
Radiation Monitoring Sensors, Skids, Cabinets (TXS, T3000)	
Instrumentation (Operator Support Other than Above Sensors)	
LHSI Heat Exchanger Temperature (JNG10CT001 and 002)	
ESWS Flow Rate (PEB10CF001)	
CCWS Flow Rate (KAA10CF023)	
CCWS Temperature (KAA10CT092/93)	
CCWS / ESWS Start (KAA10EC001)	
EFW Flow to Steam Generator (LAR11CF802)	
EFW Pool Level (LAR10CL001)	

Table 19.1-106—SSC HCLPF Capacities
Sheet 7 of 7

SSC as a Function of Event Tree Node[2]	HCLPF (g) (pga)
Containment Systems and Containment Isolation (CI) Valves	
Core Melt Retention Structure	0.5
Passive flooding line to the core melt stabilization system (CMSS) up to and including MOV JMQ42AA004/006	
Combustible Gas Control (Including the Passive Autocatalytic Recombiners)	
Ventilation (KLA10AA001, 003 etc including SOVs)	
Gaseous Waste (e.g., KPL84AA002, and 003)	
Reactor Building Primary Drain (e.g., KTA10AA017 and 018)	
Containment Area Sump, Floor Drain (e.g., KTC10AA005 and 006)	
Leakage Monitoring (e.g., JMM10AA006 and 007)	
Letdown Isolation Valves (e.g., KBA14AA002 and 003)	
Steam Generator Blowdown (LCQ10AA003, LCQ51AA002 and 003, LCQ52AA001 and 002)	

Notes:

1. The HCLPF capacity of this SSC is the capacity to not disable the safety functions of SSC credited in the PRA-based SMA. This SSC is not credited in the PRA-based SMA.

2. Train 1 Component IDs are listed as representative.

Table 19.1-107—Deleted

Table 19.1-108—U.S. EPR PRA Based Insights
Sheet 1 of 6

No	U.S. EPR PRA Based Insight	Disposition
1	**Significance of AC power to the core-damage results** Despite the provisions made for the reliable supply of offsite and onsite AC power, the risk results indicate that losses of offsite power are among the dominant contributors to the frequency of core damage. Since the U.S. EPR employs active safety systems that derive their motive power from AC sources, this is to be expected. The CDF remains low because of the level of redundancy and diversity incorporated into the AC systems.	Tier 2, Section 19.1.4.1.2.2
2	**Modest contribution of SLOCA** Small LOCAs are less significant than are losses of offsite power. This is large part due to the four-train redundancy of the safety injection systems. The contribution from SLOCAs is, however, still important on a relative basis, because of the potential for common-cause failures of the systems needed to prevent core damage (e.g., IRWST strainers, common injection check valves, MHSI and actuation systems).	Tier 2, Section 19.1.4.1.2.2
3	**Sensitivity to human reliability** The Level 1 internal events CDF is sensitive to probabilities for human failure events. The U.S. EPR employs active safety systems, and in unlikely sequences of multiple trains failures, operators are credited to initiate recovery actions (e.g., loss of HVAC recovery, feed and bleed, recovery in SBO conditions, or fast cooldown function). The HRA is performed under assumptions that the operating procedures and guidelines will be well written and complete. This applies to operator training as well.	Tier 1, Section 3.04; Tier 2, Section 18.6
4	**EDGs and SBO DGs are assigned to different common-cause groups.** This PRA modeling assumption will be confirmed by assuring diversity between EDGs and SBO DGs (multiple diversities that could be accomplished be selecting different model, control power, heating, ventilation and air conditioning (HVAC), engine cooling, fuel systems, and location.	Tier 2, Section 8.4.1

Table 19.1-108—U.S. EPR PRA Based Insights
Sheet 2 of 6

No	U.S. EPR PRA Based Insight	Disposition
5	**High I&C system reliability** The fault-tolerant design of the TXS platform contributes to high I&C system reliability. Inherent in the modeling of the fault tolerant design is the "coverage" of the self-monitoring features, which determines for a given module the percentage of failure modes that are assumed to be repaired quickly (24 hours) versus the non-self-monitored failure modes that are detected by periodic surveillance tests. In addition, the TELEPERM XS platform has features, as described in the TELEPERM XS: A Digital Reactor Protection System Topical Report (EMF-2110(NP)(A) (Reference 54)), that are effective for limiting the propagation of postulated failures if they occur. These features help minimize the potential for common cause failure	Tier 2, Section 7.1.3.6.26; Tier 2, Section 7.1.3.6.16; Tier 2, Section 7.1.3.6.21; Tier 2, Table 1.8-2, Item 19.1-9; Tier 2, Section 7.1.1.2.1
6	**The priority module is not susceptible to CCF** PACS 100 percent combinatorial testing demonstrates that the priority modules in PACS are not subject to software-related CCF. In addition, the priority modules are not susceptible to hardware-related CCF because of the following: • The priority modules are subject to the TXS platform quality assurance standards and the TXS platform design process. • The functions on the priority module are implemented in solid state logic gate arrays, are non-user programmable, and require no post-installation service or maintenance. • The priority modules reside in a mild environment during design basis events, and are qualified for environmental, seismic, and EMI/RFI conditions. • The priority modules have physical separation and independence between redundant trains.	Tier 2, Section 7.1.1.2.1
7	**Risk of losing all instrumentation is negligible** The human machine interface (HMI) design includes both SICS and PICS systems for operator monitoring and controls. Consequently the risk of losing all instrumentation is negligible relative to the human error probability.	Tier 2, Section 7.1.1.3.1; Tier 2, Section 7.1.1.3.2
8	**Floods caused by a break in the ESWS are assumed to be contained below ground level of the affected SB.** Bases for this assumption are following: 1. The ESWS is automatically isolated if the building sump detects a large flooding event 2. Expansive time is needed to flood a building up to ground level, so operator isolation is likely to succeed if automatic isolation failed.	Tier 1, Section 2.1.1; Tier 2, Section 3.4.3.1; Tier 2, Section 3.4.3.4; Tier 2, Section 9.2.1.3.5; Tier 2, Section 9.3.3.3

Table 19.1-108—U.S. EPR PRA Based Insights
Sheet 3 of 6

No	U.S. EPR PRA Based Insight	Disposition
9	**Manual crosstie between EFW tanks credited for fire events on locations, but not credited for flooding events.** Four EFW tanks are required for the EFW system success in 24 hour mission time. Given a failure of any EFW train, a manual crosstie between EFW tanks is required after 6 hours. Given that both flood and fire events in any of the safeguard buildings are assumed to disable one train of EFW, crosstie is assumed to be required for the success of EFW function. This manual action is not credited for flooding events, but it is credited for fire events, given that is required in 6 hours when any fire is likely to be extinguished.	Tier 2, Section 3.4.3.4; Tier 2, Section 10.4.9.2.1
10	**Flooding event would not affect the electrical and I&C rooms of a safeguard building.** Flood paths are provided in the safeguard buildings, such that water from a break anywhere in the building would be stored in the lower elevation of the building. In particular, a flooding event would not affect the electrical and I&C rooms of a safeguard building. All electrical / I&C equipment is located above the maximum postulated flood level.	Tier 1, Section 2.1.1; Tier 2, Section 3.4.3.4
11	**Cable separation in the MCR Cable Spreading Area** Due to divisional separation measures in the MCR Cable Spreading Area, a fire in the cable spreading area is assumed to disable only one electrical safety division. Non-safety division cables are also assumed to be separated from the safety divisions.	Tier 2, Section 9.5.1.2.1
12	**Shutdown management guidelines** The shutdown guidelines as described in the Shutdown Management Guidelines, NUMARC 91-06, should be considered when developing the plant specific operations procedures.	Tier 2, Section 13.5.2; COLA Item 13.1-1; COLA Item 13.4-1; COLA Item 13.5-1
13	**Closing containment hatches and penetrations** Containment hatch will be closed in the LPSD mid-loop operation. The ability to close containment hatches and penetrations during Modes 5 & 6 prior to steaming to containment is important. It is assumed that procedures and training will be developed that encompass this item.	Tier 2, Section 13.5.2; COLA Item 13.1-1; COLA Item 13.4-1; COLA Item 13.5-1
14	**Low pressure reducing station auto isolation** In shutdown operation, low pressure reducing station auto isolation on low loop level is important to prevent possible RCS flow diversion through CVCS.	Tier 2, Section 9.3.4.2.2; Tier 2, Section 7.7.2.3.13
15	**Automatic level control at mid-loop** Automatic level control at mid-loop is important to reduces likelihood of RHR pumps cavitations.	Tier 2, Section 5.4.7.2.1; Tier 2, Section 7.7.2.2.3

Table 19.1-108—U.S. EPR PRA Based Insights
Sheet 4 of 6

No	U.S. EPR PRA Based Insight	Disposition
16	**In-containment refueling water storage tank/SD** As stated in Table 19.1-102 design feature #3, the design of the IRWST eliminates some failure modes that have been important for current-generation plants: in shutdown operation IRWST inside containment reduces impacts of RHR flow diversions which lead to LOCAs inside containment not outside.	Tier 2, Section 6.3.2.2.2
17	**RHR auto isolation on safeguards building sump level** In shutdown operation, RHR auto isolation and pump shutoff on a high safeguards building sump level, divisionally based, is an important protection from RHR LOCAs outside containment.	Tier 2, Section 5.4.7.2.1
18	**Automatic MHSI actuation** In shutdown operation, automatic MHSI actuation on a low RCS (hot leg) loop level or on a low dPsat (for cold shutdown) is important to mitigate losses of RHR, LOCAs and flow diversions.	Tier 2, Section 5.4.7.2; Tier 1, Table 2.4.1-3
19	**Sensitivity to human reliability in shutdown** Similarly to the Insight # 4, the shutdown CDF is sensitive to probabilities for human failure events. Important human actions in shutdown are operator isolations of various flow diversions; operator actions to control draindown in midloop and operator manual actuations of RHR/LHSI pumps. It is assumed that instrumentation to support above actions will be available (e.g. loop level and sump level indications and alarms) and that the written procedures covering the above actions will be implemented, and maintained.	Tier 2, Section 18.6
20	**An alternate decay heat removal path** An alternate decay heat removal path in shutdown, can be established by operator action to manually open PSV valves or primary depressurization valves and to initiate MHSI/LHSI injection.	Tier 2, Section 5.2.2; Tier 1, Section 2.2.1; Tier 2, Section 5.4.13; Tier 2, Section 19.2.3.3.4.1
21	**Physical separation of safety systems/SD** As stated in Table 19.1-102 design feature #2, complete physical separation of the U.S. EPR safety systems, significantly reduces the potential for core-damage accidents due to internal or external hazards in shutdown. It is assumed that this separation also makes it possible to implement controls during maintenance in shutdown to protect operating trains. It is also expected that the written procedures will be developed to cover Fire Protection Program implementation.	Tier 2, Section 5.4.7.2; Tier 2, Section 9.5.1.6

Table 19.1-108—U.S. EPR PRA Based Insights
Sheet 5 of 6

No	U.S. EPR PRA Based Insight	Disposition
22	**Seal Loca contribution to fire and flooding CDF** RCP seal LOCAs are identified as important contributors to both the internal fire and the internal flooding CDF. Loss of the cooling to the RCP motors and a failure to trip the effected pumps is especially important for the fires in safeguard building electrical rooms. It is important to have an independent breaker outside these rooms that could be tripped independently.	Tier 2, Section 19.1.5.2.2.8 Tier 2, Section 19.1.5.3.2.8; Tier 2, Section 9.2.2.2.1
23	**LRF release categories** LRF release categories include large containment isolation failures, very early containment failures (before vessel rupture), early containment failure (at the time of vessel rupture), and containment bypass (Steam Generator Tube Rupture and Interfacing System LOCA).	Tier 2, Section 19.1.4.2.2.1; Tier 2, Section 19.1.5.3.3; Tier 2, Section 19.1.5.2.3; Tier 2, Section 19.1.6.4.1
24	**Sequences contributing to the at power internal LRF** LRF is dominated by sequences entering from the Level 1 in which the containment function is already defeated (bypassed) or cannot be restored (isolation failure). These sequences are: (i) steam generator tube rupture core damage sequences from Level 1 in addition to creep induced ruptures occurring before core damage and failure of electrical divisions (mainly due to HVAC common cause failures) leading to failure of containment isolation. The most important systems for the internal events LRF belong to the HVAC and electrical system. The HVAC and electrical systems impact containment isolation, passive flooding and SAHRS).	Tier 2, Section 19.1.4.2.2.1; Tier 2, Section 19.1.4.2.2.8
25	**Sequences contributing to the at power fire LRF** In the absence of the specific challenges and bypasses of containment seen in the internal events analysis, the results for LRF for fire events are dominated by creep induced SGTR containment isolation failure and phenomenological challenges. Induced SGTR and containment isolation failure are due to a loss of electrical Division 4 from fire initiators and a concurrent loss of electrical Division 1. The loss of these two divisions disables the depressurization function (that prevents creep induced SGTR) and fails containment isolation.	Tier 2, Section 19.1.5.3.3; Tier 2, Section 19.1.5.3.3.7
26	**Sequences contributing to the at power flood LRF** Unlike for fire events, the flood LRF is dominated by bypass sequences resulting from SIS flood initiator in the safeguard building. This flood initiator disables SIS suction in all four trains by draining the IRWST into the safeguard building.	Tier 2, Section 19.1.5.2.3; Tier 2, Section 19.1.5.2.3.7

Table 19.1-108—U.S. EPR PRA Based Insights
Sheet 6 of 6

No	U.S. EPR PRA Based Insight	Disposition
27	**Sequences contributing to the shutdown LRF** Containment isolation failures are the largest contributors to the total shutdown LRF. The high contribution of containment isolation failures is expected for the shutdown events where there is less restriction on containment isolation and containment is open for outage activities. Release categories corresponding to phenomena challenging the containment integrity have a very small contribution to the shutdown LRF. Hydrogen loads are still an important challenge as some of the primary system hydrogen discharge occurs in areas not equipped with Passive Autocatalytic Recombiners (PARs).	Tier 2, Section 19.1.6.4.1; Tier 2, Section 19.1.6.4.5
28	**Importance of passive systems in the Level 2** Passive systems (gravity driven core melt cooling system and PARs) are used in the long term mitigation actions. Because of this timeframe they do not show any importance based on LRF importance measures. Reduced PARs availability has been considered as a result of damage from early phenomena in the containment. The range of PARs availability considered included 100%, 50% and 25%. Failure of the core cooling system including the spreading area does not lead to additional release categories in the LRF.	Tier 2, Section 19.1.5.2.3.7; Tier 2, Section 19.1.6.3.2.2
29	**Containment leak and rupture failure modes** Containment failure modes are separated into leak and rupture. The release categories and LRF reported represent the total failure from both.	Tier 2, Section 19.1.6.3.2.3

Table 19.1-109—U.S. EPR PRA General Assumptions
Sheet 1 of 21

No.	Category[1]	PRA General Assumptions[2]
1	Model	Because of the circular logic problem, failures of electrical supplies to the HVAC/CCW/ESW trains used in the electrical system fault trees are not considered. Because of that, some interdependencies between different HVAC divisions may not be completely captured in the PRA model.
2	IE	Initiating event frequencies are based on a full year at power and were not adjusted for time spent at shutdown. For the current estimated shutdown duration, an adjustment factor would be 0.95. This assumption will be evaluated when plant–specific shutdown information is available.
3	IE	Trains 1 and 4 are assumed to be running for CCW/ESW pumps. This assumption on the running CCW trains results in an inclusion of the HVAC dependency between two safety divisions, and presents a higher risk configuration. Trains 1 and 4 are assumed to be operating for 8760 hr/year in order to calculate the LOCCW/ESW initiating event frequencies. The all year mission time is also used for the system common cause events.
4	IE	In the U.S. EPR PRA, LOCAs are assumed to occur on RCS loop 4. For medium and large break LOCAs, any injection flow (MHSI, LHSI, or accumulators) into cold leg 4 is assumed to pass out the break and not to reach the reactor vessel and core. In addition, due to the effects of steam entrainment during large break LOCAs, flow into the vessel from LHSI injection into cold leg 1 is also assumed to be unavailable.
5	IE	Very small leaks are not considered in the LOCA analysis since the response to this event would be similar to that of a transient and are within the makeup capability of the CVCS.
6	IE	In modeling SLOCA events, if the MHSI system fails, it is assumed that operators would initiate a fast cooldown. However, if a partial cooldown function fails (therefore failing MHSI), it is assumed that operators will initiate feed and bleed. These modeling assumptions and timing of these sequences will be analyzed in more detail after operating procedures are available.
7	IE	Spurious operation of MHSI and LHSI (a spurious SIS signal) are screened out as initiating events because the pump's shutoff head is lower than the reactor coolant system (RCS) normal operating pressure and spurious operation is not likely to cause an initiating event.
8	IE	One or few MSIVs closure was not considered as an initiating event; it was assumed that the operators can open the MSIV bypass valves from the control room to support secondary cooling. Closure of all MSIVs is included in the loss of main condenser initiating event.

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No.	Category[1]	PRA General Assumptions[2]
9	IE	Initiating events due to a loss of HVAC to the SWGR rooms or the main control room (MCR) are not explicitly modeled. These events are assumed to have similar effects as for the loss of single division initiator, or fires in the SWGR rooms, or the MCR. Even for a complete loss of HVAC event, it is not expected that the loss of HVAC event would result in plant trip. There is a chance that the CCW pump in the building is initially running, but this pump likely has low dependence on HVAC considering the relatively low heat load in the building during normal operation and compensatory actions that could be taken. Even if the CCW pump failed due to loss of HVAC, it is unlikely that a plant trip would be required, as the standby CCW pump or common header supply MOV serving the same CCW common header would have to fail to require reactor trip.
10	IE	Human errors during maintenance are not considered as possible initiators. Human maintenance actions will be evaluated for possible initiators after the maintenance procedures and insights from maintenance practice are available.
11	IE	The MFW system is assumed to require the main condenser and main steam bypass for success. The capability of MFW to provide SG makeup with only the demineralized water system has not been confirmed, thus the PRA model conservatively neglects this possibility.
12	IE	Recovery of offsite power is considered for transient events in two hours and for RCP seal LOCA events in one hour. Possible recovery for other times is partially credited through modifying the EDG running mission time, which was reduced to 12 hours. SBO DGs mission time was not modified.
13	IE	The full load rejection capability feature is assumed to have a failure probability of 0.32. If the full load rejection capability successfully performs its intended function, the U.S. EPR design can withstand a grid-induced loss of offsite power without requiring a reactor trip. The plant will isolate itself from the grid, and continue at power with only the “house” load supplied by the main generator.
14	IE	Conservative simplifying assumptions are made when modeling ATWS events; possibility to relieve RCS pressure is not credited for any events which lead to a loss of FW (e.g., a loss of MFW or a loss of condenser). Exceptions are LOOP events, when the RCP are tripped instantly.
15	CC	Common mode failure of the water cooled-chillers and the air-cooled chillers is not modeled. It was judged that the air-cooled and water-cooled chillers are functionally diverse.
16	CC	Intersystem common cause failure is only considered between the six IRWST sump strainers associated with SIS and SAHRS. For these six components, common cause factors from a group of four components are used. Using this data has the effect of overestimating the probability of a common cause failure of all six sump strainers by a factor of three.

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No.	Category[1]	PRA General Assumptions[2]
17	CC	The I&C of the U.S. EPR has not been designed to the point where a formal software reliability analysis is feasible. Therefore, the common cause parameters assigned to I&C components are a rough approximation and are expected to be conservative.
18	CC	The most important common cause event based on RAW importance is the CCF of the safety-related batteries on demand because, in the case of a LOOP event, this event is assumed to lead directly to core damage.
19	PM	Maintenance unavailability in the PRA model is assumed to be a combination of preventive and corrective maintenance. The unavailability time due to preventive maintenance is assumed to be seven days per year. Preventive maintenance is only considered for systems where it is assumed that scheduled maintenance will normally be performed "at power". The unavailability time due to corrective maintenance is assumed to be less than 1 day for equipment with AOT < one week, 12 days for equipment with 120 days AOT, and 18 days for equipment with no AOT.
20	PM	Maintenance unavailability is assumed on a divisional basis; only one division is allowed to have one (or several) of its systems unavailable for maintenance at any given time. In addition: ● One EFW train cannot be in maintenance when SSS/DWS makeup water to feedwater tank supply for SSS is in maintenance. ● One SBO DG and one EDG cannot be out for maintenance at the same time.
21	PM	Maintenance assumptions are not included for operating electrical equipment. The basis for this assumption is discussed below: ● Each Class 1E DC bus has two separate battery chargers and only one of them is credited in the PRA analysis which allows for one battery charger to be unavailable for maintenance. ● It is assumed that maintenance unavailability of the battery and the UPS inverter will be small relative to the other failure modes that are included in the model, since preventive maintenance is assumed to be performed during shutdown modes and corrective maintenance is assumed to be negligible. ● The maintenance unavailability of a Class 1E AC or DC bus is also assumed to be negligible, given that preliminary design information suggests an eight hour AOT for Class 1E buses and a two hour AOT for the Class 1E dc buses.
22	HRA	The HRA is performed under the assumption that the operating procedures and emergency guidelines will be well written and complete and that the operators will be well trained. Conservative HRA methods are used because the detailed design for the human machine interface (HMI) and corresponding emergency operating guidelines are not completed.

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No.	Category[1]	PRA General Assumptions[2]
23	HRA	For the experience and training performance shaping factors (PSF), the specific qualifications of the operators are not known at this time and the base PSF reflects nominal conditions based on insufficient information. For certain operator actions, however, a PSF reflecting a higher than nominal level of training and experience was applied. This factor (0.5 x the nominal value) was applied, for example, to failure to initiate feed-and-bleed cooling or to initiate cooldown of the RCS because these are actions that are assumed to receive extensive attention in operator training and to be practiced many times on the simulator.
24	HRA	The deciding factor in the HRA is the time available for the diagnosis and action, measured from initiation of the event or a subsequent cue, until core damage is unavoidable (as determined by the MAAP analysis). The timing elements are analyzed in a cue-response time framework. However, the specific cues, their timing, and the decision criteria are preliminary at this time; therefore the cues discussed in the models are based on engineering judgment from the available MAAP runs and conceptual understanding of the emergency operating guidelines.
25	HRA	Dependencies between pre-initiator human errors are not considered in the PRA model due to lack of test and maintenance procedures. Instead, a zero dependency is assumed for maintenance or tests on redundant trains. It was assessed that maintenance or test actions, especially at power, could not be performed on redundant equipment concurrently and are likely to be separated in time.
26	HRA	In the ASEP method, it is proposed that a complete dependency should be assumed between the functional testing and the independent verification. In this application, this assumption was considered to be overly conservative, given that the functional testing and verification are likely to be performed in different time steps, with different crews (two different tasks). Instead, the ASEP method was modified and a medium dependency was considered between these two recovery actions.
27	HRA	Most components in the electrical system (inverters, buses and transformers required to operate post accident) are continuously operating and are continuously monitored. It is assumed that pre-startup checklists confirm appropriate equipment configuration prior to startup. The operation of the batteries is also frequently monitored, and the float charge verifies electrical continuity. Therefore, there are no pre-accident human errors included in the electrical fault trees to represent an inappropriate initial operating condition or alignment for these components.

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No.	Category[1]	PRA General Assumptions[2]
28	HRA	Different operator actions human error probabilities (HEPs) are estimated for the SBO conditions (LOOP and all EDGs not available) versus non-SBO conditions (LOOP and at least one EDG available). It was assumed that operators will have more clear direction about the crosstie of buses and equipment in clear SBO conditions when no emergency power is available (i.e., versus the partially powered situation). The PRA also assumes that in SBO conditions operators will perform actions as required to allow LHSI and SAHRS to function. This assumption will be evaluated when the operating procedures and guidelines are available.
29	HRA	Because of the limited amount of information available at this time, a simplified HRA approach is used for LPSD operator actions. A spreadsheet is created that provides generic HEPs for operator actions assigned to the five categories of PSF for time (inadequate, barely adequate, nominal, extra, and expansive) for both diagnosis and action. The other PSFs are assumed to be nominal. However, the spreadsheet allows the PSFs for stress, complexity, and experience/training to be adjusted by the user as needed. The spreadsheet is based on the methodology and formulae of the SPAR-H methodology as implemented by the EPRI HRA calculator.
30	HRA	The MCR design including human factors engineering (HFE) and the human system interface (HSI) information was unavailable input into the DC PRA. The HFE and HSI will become much more specific as the design progresses. PSFs that were unable to be assigned specifically, such as those for ergonomics will need to be assessed and existing PSFs may need to change when more information becomes available.
31	SYS	CVCS is not credited for an RCS injection function. CVCS is only credited for RCP seal injection. It is assumed that the CVCS supply from the volume control tank will be available for a majority of the events where CVCS is credited for RCP seal injection with an estimated failure probability of 0.1. This assumption will be evaluated when plant–specific information is available.

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No.	Category[1]	PRA General Assumptions[2]
32	SYS	If both means of thermal barrier cooling are lost (CVCS seal injection and CCW thermal barrier cooling), the applicable seal LOCA assumptions are summarized below: ● If the RCPs are not tripped within 10 minutes (either automatically or manually), a seal LOCA is assumed. ● If seal leak-off valves fail open on any of the four RCPs, the probability of a seal LOCA is estimated to be 0.2. ● If Standstill Seal System fails to engage the probability of a seal LOCA is estimated to be 0.2. ● The probability that the standstill seal fails to engage was estimated as 1E-03 per demand (this is a newly developed system for which historical failure data is not available). ● Additionally, If the RCP motor and thrust bearing cooling is lost and the RCPs are not tripped within 30 minutes (either automatically or manually), a seal LOCA is assumed.
33	SYS	The PRA conservatively assumes that a loss of ventilation (SAC) to the electrical and I&C rooms in the Safeguards Building results in the complete loss of function of the electrical and I&C equipment in the affected building, after about two hours. Recovery actions are credited. The above assumption is conservative because generally it is judged unlikely that an electrical bus would fail due to loss of HVAC. However, important electrical supplies such as the inverters and battery chargers could fail, and instrumentation and control cabinets may fail, effectively rendering the electrical buses incapable of performing their intended function. It is judged likely that when the final building heat loads are known, including size of the area, location of sensitive equipment, qualification of equipment, heat up rates, time to failure if applicable, recovery actions etc., this modeling can be relaxed.
34	SYS	The HVAC model makes conservative assumptions regarding the equipment required to provide adequate cooling. ● Both the supply fan and the recirculation\exhaust fan are assumed to be required. However, in reality either fan may be sufficient to maintain an environment conducive to equipment survival. ● Availability of chilled water to the SAC is assumed to be required. However, for most, or even all, of the year, availability of chilled water to the SAC system may not be required for equipment survivability; those areas requiring ventilation may only need fresh air with exhaust.

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No.	Category[1]	PRA General Assumptions[2]
35	SYS	The following location dependency on the ventilation is considered negligible: ● Emergency Diesel Generator Buildings. ● Service Water Pump Buildings. ● SIS pump rooms. ● Fuel Building. ● Main Steam & Feedwater Valve Compartments. ● Circulating Water Building. ● Turbine Building. ● Conventional Island Electrical Building.
36	SYS	The EFWS pump rooms are judged to require SAC room cooling (local unit coolers) although this may be conservative because the SAC system provides air movement through the room. These SAC unit coolers are included in the EFWS model. The SAC coolers require chilled water (QK) which is included in the model.
37	SYS	It was judged that loss of MCR ventilation (SAB) is a negligible contributor to plant risk. There are four 50% ventilation trains powered by the 4 emergency power supplies, and only trains 2 and 3 are dependent on essential service water and containment cooling water. Also, the operators can open the doors to obtain partial cooling from SAC. In the unlikely case that the heat up causes unacceptable temperatures in the MCR the operators can evacuate to the remote shutdown room.
38	SYS	The capacity of the safety UHS basins will provide adequate NPSH to the ESWS/UHS pumps for 72 hours; no makeup to the basin is required for or assumed in the PRA. There will be no failure modes based on the failure of makeup to the basin of any cooling tower.
39	SYS	An estimate of the heat removal capability of a single cooling tower fan shows that a UHS train one pump and one fan will supply sufficient cooling for all of the system's heat loads except for RHR heat exchanger cooling. In those sequences where RHR heat exchanger cooling is required, the model requires that one pump and both cooling tower fans are running.

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No.	Category[1]	PRA General Assumptions[2]
40	SYS	A 100% volume per day leakage rate was used to determine the size of the containment failure above which the release for a containment isolation failure was considered “large.” The results from MAAP runs performed for the Level 2 source term analysis were examined, and this resulted in the determination that: • Leakage from a 1” diameter or smaller break could be neglected, as the flow rated observed were less than 10% of the threshold value for “large” releases. • Leakage from a single 3” diameter break would fall below the criteria for “large” release. • Leakage from two or more 3” lines, as well as any single line greater than 2” in diameter should be considered as a “large” release.
41	SYS	The PRA model models passive flooding valves as having two failure modes. For IRWST cooling, these valves are modeled as undeveloped basic events, “Failure to Remain Closed” with an assumed failure rate of 1.00E-04. For basemat flooding in either the active or the passive mode, these valves are modeled as basic events, “Failure to Open and Remain Open” with an assumed failure rate of 1.00E-02.
42	I&C	Reactor trip fault trees specific to every initiating event are not developed. Instead, representative reactor trips are modeled with a typical set of challenged parameters. This assumption is based on the protection system (PS) being designed so that each postulated initiating event will challenge at least two different measured parameters for reactor trip that are implemented in the two PS subsystems..
43	I&C	The I&C design has measures to preclude spurious operation. The frequency of initiating events caused by spurious I&C actions is not modeled explicitly and is subsumed in the reactor trip and other applicable initiating events. This is a reasonable assumption because the frequency of spurious operation of the digital I&C is expected to be improved relative to the historical initiating event data base.
44	I&C	The signal conditioning for the PS (signal modifiers, multipliers, etc.) assumes typical arrangements because design details were unavailable.
45	I&C	The PICS and the SICS are assumed not to be vulnerable to common cause failures based on the diversity of the PICS and the SICS I&C platforms (described in Section 7.1). There is sufficient diversity in the human machine interface (HMI) and connected systems that a common cause failure (CCF) will not prevent operator response for accident mitigation or for severe accident mitigation.

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No.	Category[1]	PRA General Assumptions[2]
46	I&C	The system PAS contains controls for non-safety systems. The PRA contains simplified models of the non-safety control functions, where needed. The system DAS contains diverse backups for reactor trip and ESF actuations. The PRA contains simplified models of the diverse reactor trip and the diverse ESFAS actuations.
47	I&C	The system SAS contains controls for post-accident safety systems. The SAS model in the PRA is simplified because design details were unavailable.
48	I&C	The normal plant control systems (PAS and RCSL) have features to reduce the frequency and consequence of plant transients that may challenge the safety systems. This is accomplished both by the way that the control functions are distributed within the I&C system divisions and by the limitation I&C functions. In as much as the PRA uses historic operating experience for the initiating event frequencies, the impact of these features is not evaluated in the PRA. Credible failures of the non-safety related controls are assumed to lead to initiating events that are included in the PRA and/or bounded by the Chapter 15 safety analysis, and the frequencies of these events in the PRA are representative or conservative.
49	I&C	Instrument calibration errors are not evaluated for the design certification PRA. Digital I&C systems are not as susceptible to drift as analogous analog systems. Instrumentation calibration errors will be analyzed in more detail after maintenance procedures and insights from maintenance practices are available.
50	LPSD	RCS level and volume are treated conservatively during the RCS level transitions in outages. For example, whenever the reactor cavity is not flooded and RCS level is not in the pressurizer, mid-loop operation is assumed. The following further summarizes this conservatism: ● Whenever the pressurizer is being drained, this time is applied to mid-loop. ● Whenever the reactor cavity is being drained after refueling, this time is applied to mid-loop. ● When level is near the flange during RPV head removal and installation, this time is applied to mid-loop. ● When level is increased from mid-loop to fill the cavity or pressurizer, this time is applied to midloop.

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No.	Category[1]	PRA General Assumptions[2]
51	LPSD	The shutdown POS durations and schedule in the LPSD PRA are based on the following assumptions: ● 18-month refueling cycle. ● 94% plant availability. ● Normal refueling outage of 14 days. ● Forced outage rate of 5 days/year. The LPSD PRA model assumes that the RCS status as well as decay heat are constant during the time within the POS. The analysis considers an early entry time after shutdown for the start of a POS and then decay heat is not reduced during the POS. This is conservative during a shutdown to cold conditions (e.g., unplanned maintenance) when decay heat levels would be much lower over time than that assumed in POS CA or POS CB.
52	LPSD	Possible transient LOCA events through RPV and PZR vent are not considered. The PRZ vent is normally open during shutdown. The RPV vent is open during mid-loop and during plant startup after refueling. Given RCS temperatures and pressures, a loss of inventory in the form of steam was evaluated after a loss of RHR cooling. The pressurizer vent contains a flow restrictor, which significantly limits the flow well below the makeup capacity of the CVCS system. The RPV vent is a one-inch line, and it would take a large amount of time to uncover the core by venting steam through this line. The risk from this event is not considered significant because the operators have more than enough time to isolate the vent or to provide makeup to the RCS.
53	LPSD	Loss of decay heat removal initiators while the plant is in POS E are neglected because the time to boil and then boil-off to top of fuel is very long when the cavity is flooded.
54	LPSD	Risk from the pressurizer solid state was not considered. Inadvertent start of a reactor coolant pump or a MHSI pump could cause an overpressure event when the pressurizer is solid. The PSVs and RHR relief valves would protect the system from overpressure and the exposure time is small. To address the risk of such an event, the low frequency of occurrence must be combined with the low probability of pressure relief failure and the probability that over pressure actually fails the pressure boundary and causes a core damage event. Thus, overfill events that could lead to a low temperature overpressure event have been considered not likely and have not been identified as initiating events that could significantly contribute to risk.
55	LPSD	IRWST cooling is assumed not to be required when the RPV head is off. Makeup to the RPV for boil-off is required when heat removal is lost. It would take more than 3 days to boil-off the IRWST if it is assumed that the steam is not condensed in the containment and returned to the IRWST.

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No.	Category[1]	PRA General Assumptions[2]
56	LPSD	Preventive maintenance unavailabilities used in the full power PRA are not applicable during LPSD. At this stage, system/functions are conservatively assumed to either be available or unavailable, as defined below: ● Maintenance on the SG systems is assumed to be performed on two SGs that are assumed not available in states CAD and CBD. ● Maintenance on all other trains is assumed to occur in state E. One division is assumed out for maintenance during that state. ● PSVs maintenance is assumed to be performed after the RPV head is removed. ● Because of maintenance unavailability assumptions, the charging system is not credited, even though it is likely to be available in states CAD and CBD.
57	LPSD	The equipment hatch is considered open in shutdown POS Ca, Cb, E and closed in D. The possibility to close hatch is credited (except in POS E). The initial actions are performed inside the containment, therefore the habitability of the containment (local temperature) is considered to be the limiting criterion in determining the time available to close the hatch. The closing action is assumed to take 20 minutes if power is available, or 90 minutes (and 6 operators) if the power is not available. All containment isolation valves are considered to have equal or higher probabilities of being open compared to the full power. No containment isolation line is assumed to be closed during entire shutdown duration.
58	LPSD	In the shutdown PRA it was assumed that the control of transient combustibles and limitation of the maintenance activities would apply to the operating RHR train and supporting systems. Because of the physical separation between operating and standby trains, the impact of the possible degradation in the fire and flood barriers during shutdown is assumed to be not significant. Based on these judgments, the risk from fire and flood events during at-power operation is assumed to envelop the risk during shutdown.
59	Flood	Because of incomplete information on equipment and piping locations, it is assumed that a flood in any building will fail all equipment in the building.
60	Flood	U.S. EPR plant systems that transport fluid (water) through any area are considered potential flood sources. The maximum released volume is the full inventory contained in the system. If automatic make-up from another source exists, the inventory of the second source is also considered.
61	Flood	Pipe failure data is characterized by pipe diameter and system category. A pipe failure rate is defined for each pipe system category and is assumed to be constant over time. No distinction was made between running systems and standby systems.

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No.	Category[1]	PRA General Assumptions[2]
62	Flood	It is assumed that a component listed as “affected” could fail as soon as the water reaches its lowest electrical part. The height of water needed to fail components depends on the room considered. However, it is assumed that this height will always be higher than one foot (1’). Therefore, systems that are not capable of generating a flood level of more than 1’ at the lowest elevation of their flood area are screened out of this analysis.
63	Flood	It is assumed that a flood in SB 1 or SB 4 would propagate to the fuel building, and vice versa. The door that separates those buildings is supposed to withstand a three-foot water column; it is conservatively assumed that any flood will cause it to fail.
64	Flood	Floods caused by a break in a system with very large flooding potential (ESWS or DWS) are assumed to be contained below ground level of the affected buildings (SB or FB). This assumption is based on the ability to automatically isolate those systems upon high sump level. Moreover, the amount of time needed to flood a building up to ground level is lengthy which supports detection and isolation by the operator if automatic isolation failed. This manual isolation is credited because an alarm exists in the Control Room, and the operation can be performed with high reliability.
65	Flood	A flood in an SB is assumed to affect the CCW switchover valves. This is a conservative assumption, since those valves are located exactly at ground level, while all flooding events considered are contained below ground level. Failure of either Train 1 or 4 of CCW requires a switchover to be performed in order to ensure continuous supply to the CCW common header. This assumption results in asymmetrical results for SAB1/4 versus SAB2/3.
66	Flood	Pipe breaks in the EFWS are treated as flooding events with the potential to drain all four EFW tanks. It is assumed that the operators will not be able to crosstie this tank to the other EFW trains, and that DWS makeup to the tanks of the intact EFW trains will be required.
67	Flood	Since detailed design for the Turbine Building has not been generated, an attempt was made to perform flooding evaluation by applying conservative assumptions in cases where information was not available. It is assumed that all equipment required for secondary heat removal (e.g., MFW/SSS pumps) will be located on the lowest elevations of the Turbine Building and will fail as the result of flooding. As far as the flooding potential is concerned, the circulating water system connected to the conventional UHS is consider to be the bounding system, and it is assumed that it has the potential to flood the TB above ground level. Should that occur, and should communication exist between the TB and the SWGR building, it is assumed that this communication would be protected by a water-resistant door so that water would preferably flow outside. Therefore, the spreading of the TB flood to another building is not considered.

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No.	Category[1]	PRA General Assumptions[2]
68	Fire	Based on the spatial separation of safety trains in the U.S. EPR, a conservative internal fire analysis has been performed implying that the fires are analyzed for an entire fire area (FA) (i.e., a location separated by three-hour fire barriers), that the worst PRA scenario resulting from the failure of all SSC in the FA is modeled, and that the total area fire ignition frequency is applied to that scenario. Propagation between fire areas is not considered. When two FAs are essentially identical and a fire in one or the other would have the same effect on the plant operation, only one of the symmetrical PFAs is modeled; the ignition frequency and risk of each area is assumed to be equal.
69	Fire	Transient fires are not specifically considered in the analysis. It is assumed that they are enveloped in the used generic fire frequencies. For the FAs where component specific frequencies are used (transformer yard, MS/MFW valve room and containment), it was assumed that a transient contribution would be minimal.
70	Fire	If no detailed information about fire detection and suppression is available for a fire area, no suppression is credited. The exceptions are: 1. It is assumed that automatic fire suppression will be installed in the Turbine Building in the vicinity of the Turbine Generator oil and Hydrogen inventories which represent major combustible loads. A factor of 0.1 is used as a suppression failure probability 2. To account for the fact that the MCR is permanently manned, making visual detection and manual suppression more likely to succeed, a factor of 0.1 is used as a manual suppression failure probability.
71	Fire	A fire in any AC or DC switchgear room is assumed to disable all divisions. Even if the fire is localized, detection is likely to shut down the room ventilation. The temperature resulting from the fire and loss of ventilation is likely to exceed the equipment qualification limit.
72	Fire	The U.S. EPR RCPs will be fitted with an oil-collection system designed to prevent RCP oil leakage from reaching any ignition source. Because of this improved design, it is assumed that fire ignition due to RCP oil leakage reaching an ignition source does not occur.

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No.	Category[1]	PRA General Assumptions[2]
73	Fire	A fire in the MCR is assumed to disable the entirety of the MCR if it is not suppressed. This will happen if a fire affects either the functional capability of the MCR (destroying cables or workstations) or if it degrades the habitability to an extent where operators have to evacuate the control room. A corresponding operator action is associated with the entire process, including the decision to evacuate the MCR and the action of switching controls. It is assumed that once the operators resume control of the plant from the RSS, the status of the plant will be similar as that following a Loss of Balance of Plants (LBOP) since the fire in the MCR could result in a loss of control of secondary side balance of plant systems. Failure of the operators to transfer to the RSS is assumed to lead directly to core damage. The RSS is assumed to be available in all POS where fuel is loaded to the core. It is assumed that the time needed to transfer control from the MCR to the RSS will be approximately 15 minutes or less and that there will be a procedure for MCR evacuation, which will contain clear abandonment criteria and instructions for transfer of control to the RSS.
74	Fire	For the CSR and MCR, the generic room fire ignition frequency is modified by using the 0.5 correction factor to account for the fact that most of the cables routed through the CSR and MCR will be fiber optic cables that are not susceptible to ignition under any condition.
75	Fire	The consequences of the spurious opening of an MSRIV are dependent on the position of the MSIV, with higher consequences corresponding to an open MSIV. The MSIVs are designed to fail closed in the case that their associated SOVs are de-energized. However, hot shorts may still cause one or more MSIVs to remain open. It is conservatively assumed that if there is a fire in the valve room that causes a spurious opening of an MSRIV, it could affect MSIV on the same location, even though there is approximately 14 feet of spatial separation between the MSRIV and MSIV. Based on engineering judgment, it is assumed that a fire affecting an MSRIV would cause its associated MSIV to fail open with a probability of 0.5 and independently cause the other MSIV in the same Valve Room to fail open with a probability of 0.1. Since this modeling was finalized, fire barriers were added in each of the two main steam/main feedwater valve rooms to separate Division 1 from Division 2 and Division 3 from Division 4. This separation would prevent any fire impact on the second MSIV.
76	Fire	Detailed designs for the Turbine Building and the Switchgear Building were not available at the time of the fire risk evaluation. Therefore, it was conservatively assumed that both the TB and SWGR building are one contiguous fire area. Given that the type of communications that will exist between the Switchgear Building and the TB is not known, it was consider reasonable to assume that electrical penetrations and doors, if any, will have a fire rating of three hours.

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No.	Category[1]	PRA General Assumptions[2]
77	Fire	The entire Transformer Yard is considered a single fire area and is physically separated from other plant structures. Separation will be assured by non-rated exterior barriers and distance. These factors will prevent a fire in the Transformer Yard from propagating to other plant structures. In the fire risk evaluation, it is also assumed that fire protection features will be designed to prevent fire propagation between transformers.
77a	Fire	It is assumed that when the final number of fire ignition sources is known for each PRA fire area, the conclusion that fire ignition frequencies obtained using RES/OERAB/S02-01 are comparable to those obtained by using NUREG/CR-6850 will remain valid.
78	Seismic	When equipment is not seismically qualified by analysis or testing or anchorage design is not complete, the seismic analysis is based on the seismic design criteria and qualification methods normally followed in the nuclear industry.
79	Seismic	Seismic-induced LOOP, LOCA and ATWS events are assumed to dominate all potential initiating events. Equipment and structures that are not seismically qualified are not credited in the model. The key assumptions regarding system availability and operator response are given below: • Seismic-induced LOOP is assumed not to be recoverable. • Station Blackout (SBO) Diesels are assumed to fail as a result of a SSE. • All systems that depend on normal AC power such as main feedwater, main condenser, Startup and Shutdown System (SSS) pump, and their support systems are assumed to fail as a result of a SSE. • Operator actions in response to seismic events are not credited. • RCP seal injection with CVCS is assumed to be lost due to a seismic event. • CVCS makeup to the Reactor Pressure Vessel (RPV) and auxiliary pressurizer spray are assumed to fail as a result of a SSE. • Dedicated Relief Valves (DRV) are assumed to fail as a result of a SSE. • Severe Accident Heat Removal (SAHR) is assumed to fail as a result of a SSE.
80	Seismic	The PRA-based seismic margin assessment assumes that equipment will be installed as designed and that there are no potential spatial interaction concerns in the as-built configuration (e.g., adjacent cabinets are bolted together, collapse of non-seismically designed equipment or masonry wall onto safety-related equipment is precluded, and no likelihood of seismically-induced fire or flood impacting safety-related equipment).

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No.	Category[1]	PRA General Assumptions[2]
81	LPSD	Nozzle dams are not required during a plant shutdown, but may be used infrequently during mid-cycle maintenance, when full core off-load is not desirable. Appropriate RCS operating conditions will be considered in the specification of nozzle dams to provide reasonable assurance that nozzle dams will not fail. Plant procedures that cover reduced inventory operation will govern the installation of nozzle dams and the establishment of adequate venting to prevent pressurization of the RPV upper plenum due to a postulated loss of decay heat removal. Nozzle dams are the only U.S. EPR related temporary reactor coolant system boundary as specified by NUREG-1449 and NUREG-1512. Freeze seals are not expected to be used; they will not be part of the maintenance procedures for the U.S. EPR.
82	LPSD	The efficiency of the Passive Autocatalytic Recombiners (PAR) during shutdown is assumed to be nominal. Maintenance unavailability, if any, is assumed to be limited to a small fraction of the PARs and would not affect the overall efficiency of the system.
83	LPSD	The RCS vents identified in state CB are not considered large enough to prevent RCS repressurization in the case of loss of cooling; therefore RCS repressurization is assumed in the time to boil calculation.
84	I&C	The principles and methods for defense against software CCF in the Protection System, including operating system features that reduce failure triggers and limit failure propagation, and lifecycle processes for application software development, (described in EMF-2110(NP)(A) and referenced in Section 7.1.1.2) are comparable to industry standards of good practice described in IEC-62340, IEC-60880, and IEC-61508 for safety integrity level four (SIL-4) applications.
85	Data	Certain basic event probabilities (e.g., EFW pump fail to start) in the various models) are quantified using typical industry data from Europe/Germany. Since U.S. EPRTM components have not yet been procured (such that it is not possible to predict the specific U.S. EPRTM component failure rates), it is assumed that the European/German data is applicable to U.S. EPRTM for certain components. In the model, for some failure probabilities calculations, test intervals and repair times are assumed. European/German test intervals generally do not apply to the U.S. EPRTM. However, the calculated U.S. EPRTM failure probabilities were compared with the corresponding U.S. failure probabilities and the two values were determined to be in reasonable agreement. U.S. failure rates for component fail-to-start or fail-to-open type basic events are usually presented as failures per demand rather than as failures per hour, and the failure on demand probability is not directly proportional to the test interval. Since the U.S. EPRTM values are in reasonable agreement with typical U.S. industry data, it is concluded that the U.S. EPRTM data approach provides failure probabilities that are suitable for use in the U.S. EPRTM DC PRA.

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No.	Category[1]	PRA General Assumptions[2]
86	Model	PRA Model is not symmetric. For modeling simplification purpose, assumed configurations are as follow: 1. CCW10/ESW10 and CCW40/ESW40 are assumed to be initially running with CCW20/ESW20 and CCW30/ESW30 either in standby or unavailable due to maintenance. 2. QKA10 and QKA30 are assumed to be initially running with QKA20 and QKA40 either in standby or unavailable due to maintenance. 3. QNA chillers 21, 22 and 23 are assumed to be initially running with QNA chiller 24 either in standby or unavailable due to maintenance. 4. CVCS10 is assumed to be initially running with CVCS20 either in standby or unavailable due to maintenance. 5. For thermal barrier cooling, the two possible configurations are modeled, with a weight of 50 percent each. The selection of configuration is done in the model by creating two basic events, “CONF CH1 TO TB” and “CONF CH2 TO TB.” Each basic event has a probability of 0.5. The configuration basic events are also used to disallow preventative maintenance on the side of the common header aligned to the RCPTB. 6. UHS Fan 1 (PED10AN001 and PED40AN001) are assumed to be initially running and the other six fans (PED10AN001, PED30AN001, PED10AN002, PED20AN002, PED30AN002 and PED40AN002) are assumed to be initially in standby. 7. All breaks (LOCAs, SLBs, SGTRs) are assumed to occur in Loop/Division 4
87	CC	In accordance with the general U.S. EPRTM modeling approach, common-mode failure is not considered between components which are initially running and those that are initially in standby. Conservatively, common mode failure is considered between both initially running chillers and between both standby chillers despite the fact that both of these groups contain one air-cooled chiller and one water-cooled chiller such that these chillers have significant diversity in the mode of operation such that the probability of common-mode failure is significantly reduced relative to standard industry experience.
88	HVAC	It is assumed that if ventilation cooling is lost to division of HVAC (both the normally operating safety train and the non-class powered maintenance train), that equipment survivability could be maintained by the operator aligning portable fans or by simply opening doors. Considering typical industry survivability information and the room heat-up analysis this assumption is judged as acceptable. This action is included in the HVAC models as operator action OPF-SAC-2H. (Based on the room heat up analysis it was concluded that the operators will have at least 4 hours available to align the maintenance train of HVAC or to provide an alternate means of cooling).

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No.	Category[1]	PRA General Assumptions[2]
89	HVAC	The preferred division for the SAC maintenance trains is assumed to be Divisions 1 and 4. For example, if both SAC divisions 1 and 2 fail, the maintenance train is assumed to be aligned to Division 1. Similarly, if both Division 3 and 4 fail, the maintenance train is assumed to be aligned to Division 4. Since CCW and ESW 1 and 4 are assumed to be initially in operation (whereas significant maintenance unavailability is applied to the CCW\ESW divisions 3 and 4) it is expected that preference will be given to supporting in-service equipment.
90	HVAC	Intake and exhaust failure due to exterior environmental conditions (icing), or damper closure is not considered in the HVAC model. Intake or exhaust damper failure due to spurious or real fire protection actuation is also not considered in the HVAC model. These are judged to be reasonable as they are low probability scenarios and acceptable room cooling can be maintained with the system as normally most of the HVAC flow is recirculated from inside the building with only a small fraction of the air replaced with fresh air.
91	ESW	There are two UHS fans for each UHS, however a single fan is capable of handling the normal at-power operating UHS heat load (the major post-accident UHS heat load is the RHR heat exchangers, and when the RHR heat exchanger is in operation both UHS fans are required). Both fans must be lost to initiate a loss of ESWS initiating event.
92	SIS	Switchover to hot leg injection is performed to prevent boron precipitation in the event of a large break LOCA on a cold leg. In that scenario, the boron concentration in the region of the core will start increasing over time due to boiling and the absence of liquid flow exiting the core. Without hot leg injection the solubility limit will eventually be exceeded, resulting in boron precipitating in the core and causing a gradual degradation in heat transfer. The PRA did not model the switchover to hot leg injection following a large LOCA because it is judged that the core heatup would result in the dissolving of the precipitate prior to exceeding 1200°F in the core; thereby, terminating the blockage prior to any possible core damage.
93	EFW	Common cause failure of SAS is not considered as an EFW failure mode for decay heat removal. EFW flow through a flow control valve that fails on the minimum flow stop is 270 gpm. Therefore a CCF of SAS will still allow for adequate flow to the steam generators to prevent core damage. The Success Criteria notebook shows that feedwater flow of 348 gpm is sufficient to provide sufficient heat removal to prevent core damage.
94	RCP	Operator action “OPF-TB CH SO” considers operator action to switch RCP thermal barrier cooling to the alternate CCW header. It is applied to certain flooding events flooding events where it has been judged that adequate time is available to perform the action before thermal barrier cooling is lost from the in-service common header.

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No.	Category[1]	PRA General Assumptions[2]
95	RCP	For a fire in the electrical area of safeguards building 4, the progression of the fire is important to the consequence. A fire that begins in room 34UJK10 027, that fails the two RCP trip breakers located in Room 27, and subsequently spreads to Room 26 without failing power to the RCP is a potential fire risk problem (since it requires an RCP trip while simultaneously disabling the normal method of executing the RCP trip function). This sequence is estimated to be of low probability. The probability of this scenario is represented in the model as basic event "RCP-TRIP-FIRE" which is assigned a basic event probability of 0.20 to account for the low likelihood for this specific combination of events.
96	RCP	A loss of RCP motor cooling, with failure to trip the pump is conservatively assumed to result in a seal LOCA. Industry studies have concluded that it is unlikely that a loss of motor cooling would result in a seal LOCA. (Not a new assumption, but as a result of including the control power dependencies on the RCP trip breakers the assumption is more important in the updated model)
97	MFW	For events that consider both MFW and SSS for event mitigation, the common dependencies of the two systems are modeled in both the SSS and MFW fault trees. Therefore, the common MFW and SSS dependencies are specifically accounted for in the accident sequence quantification. However, for a Loss of Main Feedwater initiating event, only SSS is considered credited for event mitigation and there is a possibility that SSS could be disabled by the failures that resulted in loss of MFW. Therefore, for the Loss of Main Feedwater Initiating Event, it is necessary to account for the possibility that the loss of Main Feedwater initiating event also fails SSS. This dependency was accounted for by quantifying the MFW fault tree, and examining the cutsets to identify the loss of Main Feedwater cutsets which would fail both SSS and MFW. It was determined that 81% of loss of Main Feedwater events may potentially fail both MFW and SSS. Therefore, the basic event "CF LOMFW/SSS" is included in the SSS fault model with a basic event probability of 0.81 to account for the possibility that SSS may be rendered ineffective for a loss of MFW initiating event.
98	Electric	Prealignment of the alternate feed breakers is credited in the current model. For example, in the event that EDG 2 is out of service for an extended period, it is expected that plant procedures will direct operators to realign electrical bus 32BDB to 31BDA (was 31BDC in previous revision) so that in the event of a loss of offsite power (with successful operation of EDG #1) all four trains of dc power will remain operable beyond the 2 hour supply capacity of the diesel generators.

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No.	Category[1]	PRA General Assumptions[2]
99	LPSD	One train of RHR and cooling to its heat exchanger adequately removes decay heat in all cases, except when both: 1) The plant is in POS Dd, and 2) The CCW train cooling the RHR heat exchanger is also cooling the CCW common header. For this exception, one train of RHR is sufficient if QNA loads are removed from the CCW common header and in any case, two trains of RHR are sufficient.
100	HRA	It is assumed that the normally closed isolation valves on the ESWS side of the CCWS heat exchanger of the SAHRS dedicated cooling chain will be remotely operated. It is assumed that these will be operable from the MCR via PICS with backup on SICS. This includes valves 30PEB80 AA003, AA004, AA013, and AA014. This affects the HEPs involving starting of SAHRS, which assume that the SAHRS can be started during a severe accident without sending personnel into the plant.
101	SAHR	Under non-SBO condition, failure of the SAHR heat sink, SA-ESW is explicitly modeled. However, in SBO conditions failure of SA-ESWS/UHS 4 is modeled as an undeveloped event with a value of 0.1.
102	Flood	Flood from SIS piping larger than 2” is treated as a separate flooding scenario and postulated to drain the IRWST outside containment leading to suction failure for all four SIS trains. Smaller SIS piping breaks (less than 2”) are included in the FLD-SAB14 FB flood scenario.
103	Flood	Containment Annulus is structurally designed to withstand pressure if it were filled with water up to the 0.0’ level. No information about the structural capacity of the annulus with a flood above ground level is available at this time. However, the doors connecting the annulus area to safeguard buildings 2 and 3 are located at ground level and are designed for a 3 ft level flood. It is therefore reasonable to assume that the doors will fail before the concrete structure relieving the pressure on the walls. Flood scenarios above ground level are conservatively assumed to lead to both propagation to safeguard buildings 2 and 3 (resulting from doors failure) and to penetrations failure in the annulus resulting in a total loss of communication between the containment and the main control room.
104	Fire	The risk form fire in the annulus fire area is expected to be negligible. The risk from fires in this FA is expected to negligible. Although the Annulus contains safety-related cables for all four safety trains, the frequency of spontaneous cable ignition is reduced because the cables are IEEE qualified. In addition, spatial separation between the safety divisions and limited heat load form the cables in case of fire reduce the likelihood that more than one train will be affected. This assumption will be reevaluated when design inputs on the cable routing in annulus become available.

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No.	Category[1]	PRA General Assumptions[2]
105	L2	It is assumed that the procedures will direct the operator to start the EFW to the faulted steam generator following SGTR initiator. Upon onset of core damage, this action is credited to scrub radioactive releases upon onset of core damage from this initiator.
106	L2	It is assumed that the operator will start the SAHRS sprays before entering OSSA in cases where the containment pressure rises due to steam line break initiator and failure to isolate secondary feed water.
107	L2	In cases with large containment isolation failure, it is assumed that the operator would start the SAHRS sprays to scrub the radioactive releases upon onset of core damage.
108	L2	The flood initiator representing SIS break is considered an IS LOCA for LRF grouping.

Notes:

1.

Category	Description
Model	Modeling Assumption
IE	Initiating Event
CC	Common Cause
PM	Preventive Maintenance
HRA	Human Reliability Analysis
SYS	System Modeling
I&C	Instrumentation and Controls
LPSD	Low Power/ Shutdown Modeling
Flood	Flood Analysis
Fire	Fire Analysis
Seismic	Seismic Analysis

2. COL item 19.1-9 listed in Table 1.8-2—U.S. EPR Combined License Information Items is provided to confirm that assumptions used in the PRA remain valid for the as-to-be-operated plant.

Next File