

Table 19.1-110—Level 2 Low Power Shutdown Plant Operating States Definition

Plant State	CA	CB	D	E
RCS status	Closed	Closed	Open	Open
Containment status	Open	Open	Closed	Open
RCS Inventory	Normal	Mid-loop	Mid-loop	Cavity flooded
Corresponding Level 1 POSs	CAd & CAu	CBd & CBu	Dd & Du	E
Decay heat (MW)	37.2 & 13.2	23.7 & 13.2	18.5 & 13.2	17.3

Table 19.1-111—Level 2 Low Power Shutdown Core Damage End States Definition

CDES	Description
TR(C)	Core damage transient sequences where the RCS system was not depressurized in POSs CA and CB
TR(D)	Core damage transient sequences with the RCS system depressurized in POS D
LL(CA)	Core damage large LOCA sequences with depressurized RCS in POS CA
LL(CB)	Core damage large LOCA sequences with depressurized RCS in POS CB
LL(D)	Core damage large LOCA sequences with depressurized RCS in POS D
LL(E)	Core damage large LOCA sequences with depressurized RCS in POS E
SL(CA)	Core damage small LOCA sequences where the RCS system was not depressurized in POS CA
SL(CB)	Core damage small LOCA sequences where the RCS system was not depressurized in POS CB
SL(D)	Core damage small LOCA sequences with the RCS system depressurized in POS D
SL(E)	Core damage small LOCA sequences with the RCS system depressurized in POS E
SS(CA)	Core damage seal LOCA sequences where the RCS system was not depressurized in POS CA.
IS	Core damage Interfacing System LOCA sequences

Table 19.1-112—Level 2 Low Power Shutdown Containment Isolation

Valve ID	System	Fraction of time open at Power	Fraction of time open at shutdown
JMM10AA006	Leak-Off	0	0.01
JMM10AA007	Leak-Off	0	0.01
KLA10AA001	Containment Ventilation	0.05	1
KLA10AA003	Containment Ventilation	0.05	1
KLA20AA001	Containment Ventilation	0.05	1
KLA20AA003	Containment Ventilation	0.05	1
KLA30AA002	Containment Ventilation	0	1
KLA30AA003	Containment Ventilation	0	1
KLA40AA001	Containment Ventilation	0	1
KLA40AA002	Containment Ventilation	0	1
KPL84AA002	Gaseous Waste Processing	1	1
KPL84AA003	Gaseous Waste Processing	1	1
KPL85AA003	Gaseous Waste Processing	0.1 ¹	0.1
KPL85AA004	Gaseous Waste Processing	0.1	0.1
KTA10AA018	NI Drain and Vent	0.01	1
KTA10AA017	NI Drain and Vent	0.01	1
KTC10AA005	NI Drain and Vent	0.01	0.1
KTC10AA006	NI Drain and Vent	0.01	0.1
KTC10AA010	NI Drain and Vent	0.01	0.1
KTC10AA029	NI Drain and Vent	0.01	0.1
KTD10AA015	NI Drain and Vent	0.01	0.1
KTD10AA024	NI Drain and Vent	0.01	0.1

Note:

1. For the KPL85 line, the factor corresponds to the probability of catastrophic failure of the system given a failure of isolation.

Table 19.1-113—Level 2 Low Power Shutdown Source Term for Plant State CA
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Release Category	Plant State Ca								
	Release Fraction								
	XE/KR	I	Cs	Te	Sr	Ru	La	Ce	Ba
RC101	6.12E-03	5.77E-05	4.77E-05	1.04E-04	5.39E-06	1.34E-05	2.37E-07	3.10E-06	7.63E-06
RC201	1.00E+00	4.95E-02	4.13E-02	8.78E-02	1.46E-03	1.70E-02	1.81E-04	3.21E-03	5.77E-03
RC202	9.76E-01	3.89E-02	2.73E-02	7.70E-02	1.36E-03	1.57E-02	1.68E-04	2.98E-03	5.36E-03
RC203	1.00E+00	4.95E-02	4.13E-02	8.78E-02	1.46E-03	1.70E-02	1.81E-04	3.21E-03	5.77E-03
RC204	9.92E-01	1.46E-02	1.82E-02	5.82E-02	1.18E-03	1.44E-02	1.64E-04	2.87E-03	4.59E-03
RC205	1.00E+00	4.95E-02	4.13E-02	8.78E-02	1.46E-03	1.70E-02	1.81E-04	3.21E-03	5.77E-03
RC206	5.81E-01	6.79E-03	6.13E-03	9.58E-03	9.70E-04	7.04E-03	2.25E-05	9.36E-05	2.61E-03
RC301	1.00E+00	1.59E-02	1.86E-02	4.37E-02	1.14E-03	1.38E-02	1.61E-04	2.84E-03	4.20E-03
RC302	1.00E+00	4.95E-02	4.13E-02	8.78E-02	1.46E-03	1.70E-02	1.81E-04	3.21E-03	5.77E-03
RC303	9.88E-01	1.58E-02	1.67E-02	5.80E-02	1.35E-03	1.57E-02	1.67E-04	2.97E-03	5.29E-03
RC304	1.00E+00	4.95E-02	4.13E-02	8.78E-02	1.46E-03	1.70E-02	1.81E-04	3.21E-03	5.77E-03
RC401	1.00E+00	1.05E-02	2.41E-02	1.80E-02	4.36E-03	6.61E-03	7.91E-05	4.42E-04	7.23E-03
RC402	1.00E+00	2.22E-02	5.94E-02	3.51E-02	5.89E-03	9.30E-03	1.12E-04	6.41E-04	1.01E-02
RC403	9.89E-01	8.78E-03	2.16E-02	1.38E-02	4.34E-03	6.59E-03	7.90E-05	4.48E-04	7.21E-03
RC404	1.00E+00	2.22E-02	5.94E-02	3.51E-02	5.89E-03	9.30E-03	1.12E-04	6.41E-04	1.01E-02
RC501	9.98E-01	4.66E-05	4.22E-05	5.59E-03	8.26E-06	5.44E-05	2.07E-07	1.42E-06	1.34E-05
RC502	1.00E+00	4.00E-04	7.32E-04	6.21E-02	8.27E-06	5.44E-05	2.07E-07	1.42E-06	2.13E-05
RC503	1.00E+00	7.10E-05	5.84E-05	9.09E-05	8.27E-06	5.44E-05	2.07E-07	1.42E-06	2.13E-05
RC504	1.00E+00	4.00E-04	7.32E-04	6.21E-02	8.27E-06	5.44E-05	2.07E-07	1.42E-06	2.13E-05
RC602	1.00E+00	4.00E-04	7.32E-04	6.21E-02	8.27E-06	5.44E-05	2.07E-07	1.42E-06	2.13E-05

Table 19.1-113—Level 2 Low Power Shutdown Source Term for Plant State CA
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Release Category	Plant State Ca								
	Release Fraction								
	XE/KR	I	Cs	Te	Sr	Ru	La	Ce	Ba
RC702	1.00E+00	9.17E-01	9.09E-01	8.98E-01	8.33E-02	5.50E-01	3.34E-03	1.26E-02	3.23E-01
RC802	8.44E-01	7.66E-01	7.73E-01	7.65E-01	4.95E-02	3.24E-01	1.58E-03	1.11E-02	1.64E-01

Table 19.1-114—Level 2 Low Power Shutdown Source Term for Plant State CB
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Release Category	Plant State Cb								
	Release Fraction								
	XE/KR	I	Cs	Te	Sr	Ru	La	Ce	Ba
RC101	7.68E-03	1.0E-04	6.2E-05	1.0E-04	2.8E-06	1.0E-05	2.2E-07	2.8E-06	5.5E-06
RC201	1.00E+00	8.9E-02	5.5E-02	1.1E-01	2.3E-03	1.0E-02	2.1E-04	3.2E-03	4.5E-03
RC202	9.76E-01	7.0E-02	3.6E-02	9.8E-02	2.1E-03	9.4E-03	1.9E-04	3.0E-03	4.2E-03
RC203	1.00E+00	8.9E-02	5.5E-02	1.1E-01	2.3E-03	1.0E-02	2.1E-04	3.2E-03	4.5E-03
RC204	9.92E-01	2.6E-02	2.4E-02	7.4E-02	1.9E-03	8.6E-03	1.9E-04	2.9E-03	3.6E-03
RC205	1.00E+00	8.9E-02	5.5E-02	1.1E-01	2.3E-03	1.0E-02	2.1E-04	3.2E-03	4.5E-03
RC206	5.81E-01	6.8E-03	6.1E-03	9.6E-03	9.7E-04	7.0E-03	2.3E-05	9.4E-05	2.6E-03
RC301	1.00E+00	2.9E-02	2.5E-02	2.5E-02	1.8E-03	8.3E-03	1.9E-04	2.9E-03	3.3E-03
RC302	1.00E+00	8.9E-02	5.5E-02	1.1E-01	2.3E-03	1.0E-02	2.1E-04	3.2E-03	4.5E-03
RC303	9.88E-01	2.8E-02	2.2E-02	2.8E-02	2.1E-03	9.4E-03	1.9E-04	3.0E-03	4.2E-03
RC304	1.00E+00	8.9E-02	5.5E-02	1.1E-01	2.3E-03	1.0E-02	2.1E-04	3.2E-03	4.5E-03
RC401	1.00E+00	1.0E-02	2.4E-02	1.8E-02	4.4E-03	6.6E-03	7.9E-05	4.4E-04	7.2E-03
RC402	1.00E+00	2.2E-02	5.9E-02	3.5E-02	5.9E-03	9.3E-03	1.1E-04	6.4E-04	1.0E-02
RC403	9.89E-01	8.8E-03	2.2E-02	7.1E-01	4.3E-03	6.6E-03	7.9E-05	4.5E-04	7.2E-03
RC404	1.00E+00	2.2E-02	5.9E-02	3.5E-02	5.9E-03	9.3E-03	1.1E-04	6.4E-04	1.0E-02
RC501	9.98E-01	4.7E-05	4.2E-05	4.3E-04	8.3E-06	5.4E-05	2.1E-07	1.4E-06	1.3E-05
RC502	1.00E+00	4.0E-04	7.3E-04	6.2E-02	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05
RC503	1.00E+00	7.1E-05	5.8E-05	5.7E-05	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05
RC504	1.00E+00	4.0E-04	7.3E-04	6.2E-02	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05
RC602	1.00E+00	4.0E-04	7.3E-04	6.2E-02	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05

Table 19.1-114—Level 2 Low Power Shutdown Source Term for Plant State CB
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Release Category	Plant State Cb								
	Release Fraction								
	XE/KR	I	Cs	Te	Sr	Ru	La	Ce	Ba
RC702	1.00E+00	9.2E-01	9.1E-01	9.0E-01	8.3E-02	5.5E-01	3.3E-03	1.3E-02	3.2E-01
RC802	8.44E-01	7.7E-01	7.7E-01	7.6E-01	4.9E-02	3.2E-01	1.6E-03	1.1E-02	1.6E-01

Table 19.1-115—Level 2 Low Power Shutdown Source Term for Plant States D and E

Release Category	Plant States D and E								
	Release Fraction								
	XE/KR	I	Cs	Te	Sr	Ru	La	Ce	Ba
RC101	7.7E-03	1.0E-03	9.9E-04	7.3E-04	8.4E-05	2.0E-04	7.8E-06	9.8E-05	1.1E-04
RC201	1.00E+00	8.9E-01	8.8E-01	7.8E-01	6.9E-02	1.9E-01	7.3E-03	1.1E-01	9.5E-02
RC202	9.8E-01	7.0E-01	5.8E-01	6.8E-01	6.4E-02	1.8E-01	6.8E-03	1.1E-01	8.9E-02
RC203	1.00E+00	8.9E-01	8.8E-01	7.8E-01	6.9E-02	1.9E-01	7.3E-03	1.1E-01	9.5E-02
RC204	9.9E-01	2.6E-01	3.9E-01	5.2E-01	5.6E-02	1.6E-01	6.6E-03	1.0E-01	7.6E-02
RC205	1.00E+00	8.9E-01	8.8E-01	7.8E-01	6.9E-02	1.9E-01	7.3E-03	1.1E-01	9.5E-02
RC206	5.8E-01	6.8E-02	9.8E-02	1.1E-01	2.9E-02	1.3E-01	7.9E-04	3.3E-03	5.5E-02
RC302	1.00E+00	8.9E-01	8.8E-01	7.8E-01	6.9E-02	1.9E-01	7.3E-03	1.1E-01	9.5E-02
RC501	1.00E+00	4.7E-05	4.2E-05	4.3E-04	8.3E-06	5.4E-05	2.1E-07	1.4E-06	1.3E-05
RC502	1.00E+00	4.0E-04	7.3E-04	6.2E-02	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05
RC503	1.00E+00	7.1E-05	5.8E-05	5.7E-05	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05
RC504	1.00E+00	4.0E-04	7.3E-04	6.2E-02	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05
RC602	1.00E+00	4.0E-04	7.3E-04	6.2E-02	8.3E-06	5.4E-05	2.1E-07	1.4E-06	2.1E-05
RC802	8.4E-01	7.7E-01	7.7E-01	7.6E-01	4.9E-02	3.2E-01	1.6E-03	1.1E-02	1.6E-01

Table 19.1-116—U.S. EPR Large Release Category Results - Level 2 Shutdown
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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	7.88E-10	9.85%	0.0132
RC202	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex vessel, with containment spray	5.74E-12	0.07%	0.0001
RC203	Containment fails before vessel breach due to isolation failure, melt released from vessel, with MCCI, melt not flooded ex vessel, without containment spray	4.09E-09	51.21%	0.0687
RC204	Containment fails before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex vessel with containment spray	8.62E-10	10.79%	0.0145
RC205	Containment failures before vessel breach due to isolation failure, melt released from vessel, without MCCI, melt flooded ex vessel without containment spray	2.52E-10	3.15%	0.0042
RC206	Small containment failure due to failure to isolate 2" or smaller lines	3.67E-09	n/a	0.0616
RC301	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex vessel, with containment spray	9.50E-14	0.00%	0.0
RC302	Containment fails before vessel breach due to containment rupture, with MCCI, melt not flooded ex vessel, without containment spray	3.43E-13	0.00%	0.0
RC303	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex vessel, with containment spray	5.36E-11	0.67%	0.0009

Table 19.1-116—U.S. EPR Large Release Category Results - Level 2 Shutdown
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Shutdown Release Category	Description	Shutdown RC Frequency	Contribution to Shutdown LRF	Conditional Containment Failure Probability
RC304	Containment fails before vessel breach due to containment rupture, without MCCI, melt flooded ex vessel, without containment spray	1.02E-11	0.13%	0.0002
RC401	Containment failures after breach and up through debris quench due to containment rupture, with MCCI, without debris flooding, with containment spray	3.41E-13	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	1.88E-13	0.00%	0.0
RC403	Containment failures after breach and up through debris quench due to containment rupture, without MCCI, with debris flooding, with containment spray	1.32E-11	0.17%	0.0002
RC404	Containment failures after breach and up through debris quench due to containment rupture, without MCCI, with debris flooding, without containment spray	1.08E-11	0.13%	0.0002
RC501	Long term containment failure after debris quench due to rupture, with MCCI, without debris flooding, with containment spray	4.76E-14	n/a	0.0
RC502	Long term containment failure after debris quench due to rupture, with MCCI, without debris flooding, without containment spray	2.96E-11	n/a	0.0005
RC503	Long term containment failure after debris quench due to rupture, without MCCI, with debris flooding, with containment spray	4.81E-11	n/a	0.0008

**Table 19.1-116—U.S. EPR Large Release Category Results - Level 2
Shutdown
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Shutdown Release Category	Description	Shutdown RC Frequency	Contribution to Shutdown LRF	Conditional Containment Failure Probability
RC504	Long term containment failure after debris quench due to rupture, without MCCI, with debris flooding, without containment spray	4.66E-11	n/a	0.0008
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	2.91E-09	n/a	0.0488
RC701	Steam Generator Tube Rupture with Fission Product Scrubbing	0.00E+00	n/a	0.0
RC702	Steam Generator Tube Rupture without Fission Product Scrubbing	1.40E-12	0.02%	0.0
RC801	Interfacing System LOCA with Fission Product Scrubbing	0.00E+00	n/a	0.0
RC802	Interfacing System LOCA without Fission Product Scrubbing but with building deposition credited	1.90E-09	23.80%	0.0319
Total Shutdown LRF:		8.00E-09	100.00%	0.1341
RS Total Shutdown LRF:		7.88E-09		

Table 19.1-117—U.S. EPR Large Release Frequency for each POS - Level 2 Shutdown

Statistics	State					
	All	C (All)	CA	CB	D	E
Shutdown CDF	6.0E-08	4.5E-08	1.8E-08	2.7E-08	1.3E-08	1.7E-09
Shutdown LRF	7.9E-09	4.9E-09	1.9E-09	3.0E-09	1.3E-09	1.7E-09
Conditional Containment Failure Probability	0.13	0.11	0.11	0.11	0.10	1.00

Table 19.1-118—U.S. EPR Large Release Frequency for each Initiating Event - Level 2 Shutdown
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Initiator	Description	LRF per Initiator (1/yr)	LRF per Initiator (%)
LOCA-L CAD	LOCA-Large During Shutdown State CAd	3.5E-15	0.0%
LOCA-L CAU	LOCA-Large During Shutdown State CAu	1.2E-15	0.0%
LOCA-L CBD	LOCA-Large During Shutdown State CBd	3.5E-15	0.0%
LOCA-L CBU	LOCA-Large During Shutdown State CBu	1.8E-15	0.0%
LOCA-L DD	LOCA-Large During Shutdown State Dd	3.1E-13	0.0%
LOCA-L DU	LOCA-Large During Shutdown State Du	6.8E-13	0.0%
LOCA-L E	LOCA-Large During Shutdown State E	8.3E-11	1.1%
LOCA-S CAD	LOCA-Small During Shutdown State CAd	4.4E-11	0.6%
LOCA-S CAU	LOCA-Small During Shutdown State CAu	1.5E-11	0.2%
LOCA-S CBD	LOCA-Small During Shutdown State CBd	3.0E-11	0.4%
LOCA-S CBU	LOCA-Small During Shutdown State CBu	1.2E-11	0.2%
LOCA-S DD	LOCA-Small During Shutdown State Dd	2.5E-12	0.0%
LOCA-S DU	LOCA-Small During Shutdown State Du	5.1E-12	0.1%
LOCA-S E	LOCA-Small During Shutdown State E	7.5E-10	9.5%
RHR CAD	RHR in Power State CAd	8.8E-10	11.1%
RHR CAU	RHR in Power State CAu	5.9E-10	7.4%
RHR CBD	RHR in Power State CBd	1.0E-09	12.6%
RHR CBU	RHR in Power State CBu	7.4E-10	9.4%
RHR DD	RHR in Power State Dd	1.8E-10	2.3%
RHR DU	RHR in Power State Du	5.6E-10	7.1%
RHR ISLOCA CAD	RHR ISLOCA During Shutdown State CAd	2.8E-10	3.5%
RHR ISLOCA CAU	RHR ISLOCA During Shutdown State CAu	9.2E-11	1.2%
RHR ISLOCA CBD	RHR ISLOCA During Shutdown State CBd	2.8E-10	3.5%
RHR ISLOCA CBU	RHR ISLOCA During Shutdown State CBu	1.4E-10	1.7%
RHR ISLOCA DD	RHR ISLOCA During Shutdown State Dd	6.9E-11	0.9%
RHR ISLOCA DU	RHR ISLOCA During Shutdown State Du	1.4E-10	1.7%
RHR ISLOCA E	RHR ISLOCA During Shutdown State E	9.2E-10	11.6%
ULD CBD	Uncontrolled Level Drop in Shutdown State CBd	7.8E-10	9.9%
ULD CBU	Uncontrolled Level Drop in Shutdown State CBu	7.1E-13	0.0%
ULD DD	Uncontrolled Level Drop in Shutdown State Dd	1.0E-13	0.0%

Table 19.1-118—U.S. EPR Large Release Frequency for each Initiating Event - Level 2 Shutdown
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Initiator	Description	LRF per Initiator (1/yr)	LRF per Initiator (%)
ULD DU	Uncontrolled Level Drop in Shutdown State Du	3.2E-10	4.0%
LRF	Large Release Frequency	7.9E-09	100.0%

**Table 19.1-119—U.S. EPR Release Category Frequencies for each POS - Level 2 Shutdown
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Release Category Frequency (1/yr) (Bolded are LRF)	State					
	ALL	C	CA	CB	D	E
RC101	4.49E-08	5.20E-08	5.67E-08	5.50E-08	5.43E-08	5.78E-08
RC201	7.88E-10	7.88E-10	3.31E-10	4.57E-10	0.00E+00	0.00E+00
RC202	5.74E-12	2.95E-12	1.19E-12	1.77E-12	7.76E-13	2.01E-12
RC203	4.09E-09	2.94E-09	1.03E-09	1.91E-09	9.51E-10	2.02E-10
RC204	8.62E-10	1.31E-10	7.35E-11	5.75E-11	1.05E-10	6.26E-10
RC205	2.52E-10	1.37E-10	6.29E-11	7.44E-11	2.80E-11	8.66E-11
RC206	3.67E-09	2.68E-09	1.02E-09	1.66E-09	9.95E-10	0.00E+00
RC301	9.50E-14	9.50E-14	1.66E-14	7.83E-14	0.00E+00	0.00E+00
RC302	3.43E-13	2.74E-13	9.88E-14	1.75E-13	6.44E-14	4.39E-15
RC303	5.36E-11	5.36E-11	2.04E-11	3.32E-11	0.00E+00	0.00E+00
RC304	1.02E-11	1.02E-11	3.91E-12	6.26E-12	0.00E+00	0.00E+00
RC401	3.41E-13	3.41E-13	6.09E-14	2.80E-13	0.00E+00	0.00E+00
RC402	1.88E-13	1.88E-13	4.64E-14	1.42E-13	0.00E+00	0.00E+00
RC403	1.32E-11	1.32E-11	4.26E-12	8.98E-12	0.00E+00	0.00E+00
RC404	1.08E-11	1.08E-11	3.47E-12	7.28E-12	0.00E+00	0.00E+00
RC501	4.76E-14	3.90E-15	1.26E-15	2.65E-15	4.37E-14	0.00E+00
RC502	2.96E-11	1.19E-13	2.70E-14	9.25E-14	2.95E-11	0.00E+00
RC503	4.81E-11	3.84E-12	1.25E-12	2.59E-12	4.42E-11	0.00E+00
RC504	4.66E-11	2.41E-11	1.16E-11	1.25E-11	2.25E-11	0.00E+00
RC601	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RC602	2.91E-09	1.30E-11	2.68E-12	1.03E-11	2.90E-09	0.00E+00

Table 19.1-119—U.S. EPR Release Category Frequencies for each POS - Level 2 Shutdown
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Release Category Frequency (1/yr) (Bolded are LRF)	State					
	ALL	C	CA	CB	D	E
RC701	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RC702	1.40E-12	1.40E-12	5.80E-13	8.16E-13	0.00E+00	0.00E+00
RC801	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RC802	1.90E-09	7.79E-10	3.67E-10	4.13E-10	2.06E-10	9.18E-10

**Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1a	RC201	2, 3, 4, 9	1.21E-10	1.5%	IE SD RHR CBD	Initiator - RHR in Power State CBD	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all 1E 2hr Batteries results in failure of all EDGs. Failure of all EDGs and inability to connect SBODGs due to the loss of the batteries results in total loss of divisional power.
					BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • Depressurization is successful with power supply from the non-safety electrical buses • Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 • In-vessel recovery is successful after power recovery leading to RC201
					L2PH INVREC(T-DEP)=Y	In-vessel recovery success - hot leg rupture or operator depressurization during transient CDES	
P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)						

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1b	RC201	5, 7, 8	7.21E-11	0.9%	IE SD RHR CBD	Initiator - RHR in Power State Cbd	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all 1E 2hr Batteries results in failure of all EDGs. Failure of all EDGs and inability to connect SBODGs due to the loss of the batteries results in total loss of divisional power.
					BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • Depressurization is successful with power supply from the non-safety electrical buses • Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4
					L2PH INVREC(LOOP)=Y	In-vessel recovery, phenomenological success given sufficient injection. LOOP	
P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	<ul style="list-style-type: none"> • In-vessel recovery is successful after power recovery leading to RC201 					

**Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
2	RC201	1, 6	5.76E-11	0.7%	IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	Level 1: ULD initiator caused by the failure of LPRS valves and operator fails to isolate.
					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)	
					L2PH INVREC(S-DEP)=Y	In-vessel recovery success - hot leg rupture or operator depressurization during seal/small LOCA DES	Level 2: <ul style="list-style-type: none"> • Depressurization is successful • Large containment isolation failure due to the open hatch and failure of the operator close in 1 hour • In-vessel recovery is successful following a seal LOCA leading to RC201
OPF-L2-HTCH-1H	Operator fails to close the equipment hatch in less than 1hr when power is available.						

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
3	RC201	10	1.46E-11	0.2%	IE SD RHR CBD	Initiator - RHR in Power State Cbd	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all EDGs. Failure of all EDGs results in failure of CCW. The additional failure of SBODG 50 results in the failure of EFW and long-term cooling.
					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	
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • Depressurization is successful with power supply from the non-safety electrical buses • Large containment isolation failure due to the open hatch and failure of the operator close in 2 hours with power available • In-vessel recovery is successful after power recovery leading to RC201
					L2PH INVREC(T-DEP)=Y	In-vessel recover success - hot leg rupture or operator depressurization during transient CDES	
OPF-L2-HTCH-2H	Operator fails to close the equipment hatch in 2 hrs when power is available.						

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC202	1	3.60E-13	0.0%	IE SD LOCA-S E	Initiator - LOCA- Small During Shutdown State E	Level 1: Small LOCA in cold leg injection line 1 and common cause failure of common cold leg injection vales results in loss of all injection.
					JNG13AA005CFO_D-234	CCF to Open LHSI/ MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					SLOCA24	Small LOCA - 24 Hour	
					L2PH CCI	Level 2 phenomena: significant MCCI, no system failures	Level 2: <ul style="list-style-type: none"> ● Large containment isolation failure because the hatch is open in POS E and cannot be closed ● Residual MCCI with successful debris flooding ● SAHRS sprays are successful ● no ex-vessel steam explosion
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC203	1	1.86E-10	2.4%	IE SD LOCA-S E	Initiator - LOCA- Small During Shutdown State E	Level 1: Small LOCA in cold leg injection line 1 and common cause failure of common suction strainers results in loss of all injection.
					JNK10AT001SPG_P- ALL	CCF of IRWST Sump Strainers - Plugged	
					SLOCA24	Small LOCA - 24 Hour	
					L2PH CCI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	Level 2: <ul style="list-style-type: none"> ● Large containment isolation failure because the hatch is open in POS E and cannot be closed ● Significant MCCI with failure of debris flooding due to common cause of the IRWST strainers ● no ex-vessel steam explosion ● SAHRS sprays are failed due to common cause of the IRWST strainers
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	

**Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
2	RC203	2, 3, 4, 5, 24, 26, 27, 28	5.19E-10	6.6%	IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	Level 1: ULD initiator caused by operator failing to stop drain down. Common cause failure of HVAC exhaust fans in Safeguard Buildings 1 & 4 causes failure of running CCWS pumps. Operator failure to switch to standby CCWS pumps causes total loss of HVAC.
					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 Drain down at Mid-Loop (SHUTDOWN)	
					SAC01AN001EFR_B-ALL	CCF to Run Normal Air Supply Fans (Trains 1 & 4)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CGI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	Level 2: <ul style="list-style-type: none"> • Depressurization is failed due to the loss of electrical Divisions 1 and 4 • Large containment isolation failure due to the open hatch and failure of the operator to close in 1 hour with power unavailable • no creep induced SGTR • Significant MCCI with failure of debris flooding due to failure to open the MOVs on the passive flooding lines • no pit overpressure failure in cases without circumferential break of the vessel • SAHRS sprays are failed due to common cause of the IRWST strainers
					L2PH ISGTR-SS,SL=N	No ISGTR in SL, SS cases with secondary pressurized	
					L2PH PF-VF NO-CBV=N	Level 2 phenomena. Pit overpressure failure (not CBV case)	
					OPF-L2-HTCH-1H NP	Operator fails to close the equipment hatch manually in less than 1hr P=1	
					PROB HLR=N SD	Induced HLR for all CDES	

**Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
3	RC203	6, 7, 23, 25	2.60E-10	3.3%	IE SD ULD DU D	Initiator - Uncontrolled Level Drop in Shutdown State Du (Demand)	Level 1: ULD initiator caused by operator failing to stop drain down. Common cause failure of HVAC exhaust fans in Safeguard Buildings 1 & 4 causes failure of running CCWS pumps. Operator failure to switch to standby CCWS pumps causes total loss of HVAC.
					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 Drain down at Mid-Loop (SHUTDOWN)	
					SAC01AN001EFR_B-ALL	CCF to Run Normal Air Supply Fans (Trains 1 & 4)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CCI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	Level 2: <ul style="list-style-type: none"> Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 Significant MCCI with failure of debris flooding due to failure to open the MOVs on the passive flooding lines no ex-vessel steam explosion SAHRS sprays are failed due to common cause of the IRWST strainers
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	
					P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
4	RC203	8, 9, 10, 11, 13, 14, 16, 18, 19, 20, 21, 22, 32, 33, 34, 36, 38, 39, 40, 42, 43, 45, 46, 47, 48, 49, 50	9.21E-10	11.7%	IE SD RHR CBD	Initiator - RHR in Power State Cbd	Level 1: RHR initiator caused by common cause failure of Safeguard Buildings 1 & 4 supply fans which cause the loss of the running CCWS pumps plus operator failure to switch to standby CCWS pumps resulting in total loss of HVAC.
					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	
					SAC01AN001EFR_B-ALL	CCF to Run Normal Air Supply Fans (Trains 1 & 4)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CGI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	Level 2: <ul style="list-style-type: none"> • Depressurization is failed due to the loss of electrical Divisions 1 and 4 • Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 • no creep induced SGTR • Significant MCCI with failure of debris flooding due to failure to open the MOVs on the passive flooding lines • no pit overpressure failure in cases without circumferential break of the vessel • SAHRS sprays are failed due to common cause of the IRWST strainers
					L2PH ISGTR-TR=N	Induced SGTR. Transients, secondary not depressurized	
					L2PH PF-VF NO-CBV=N	Level 2 phenomena. Pit overpressure failure (not CBV case)	
					P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	
					PROB HLR=N SD	Induced HLR for all CDES	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
6	RC203	12, 15, 17, 29, 30, 31, 35, 37, 41, 44	2.97E-10	3.8%	IE SD RHR DU	Initiator - RHR in Power State Du	Level 1: RHR initiator caused by common cause failure of Safeguard Buildings 1 & 4 supply fans which cause the loss of the running CCWS pumps plus operator failure to switch to standby CCWS pumps resulting in total loss of HVAC.
					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	
					SAC01AN001EFR_B-ALL	CCF to Run Normal Air Supply Fans (Trains 1 & 4)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CCI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	Level 2: <ul style="list-style-type: none"> Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 Significant MCCI with failure of debris flooding due to failure to open the MOVs on the passive flooding lines no ex-vessel steam explosion SAHRS sprays are failed due to common cause of the IRWST strainers
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	
					P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1a	RC204	1, 2, 3	5.40E-10	6.9%	IE SD LOCA-S E	Initiator - LOCA- Small During Shutdown State E	Level 1: Small LOCA in cold leg injection line 1 and common cause failure of common cold leg injection vales results in loss of all injection.
					JNG13AA005CFO_D-234	CCF to Open LHSI/ MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					SLOCA24	Small LOCA - 24 Hour	
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	Level 2: <ul style="list-style-type: none"> ● Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 ● Significant MCCI with failure of debris flooding due to failure to open the MOVs on the passive flooding lines ● no ex-vessel steam explosion ● SAHRS sprays are failed due to common cause of the IRWST strainers
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	

**Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1b	RC204	6, 7, 12, 13, 16, 17	3.35E-11	0.4%	IE SD LOCA-L E	Initiator - LOCA-Large During Shutdown State E	Level 1: LOCA initiator caused by failure of LHSI IRWST suction valve and operator failure to isolate. Common cause failure of common cold leg injection vales results in loss of all injection.
					JNG13AA005CFO_D-234	CCF to Open LHSI/MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					JNG20AA001EOP	LHSI, LHSI Pump 20 Suction from IRWST MOV JNG20AA001, Fails to Remain Closed (SO)	
					OPF-ISOIRWSTFD-E	Operator Fails to Isolate RHR Suction to IRWST (Valve JNGX0AA001) in State E	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	Level 2: <ul style="list-style-type: none"> • Large containment isolation failure because the hatch is open in POS E and cannot be closed • No MCCI with debris flooded following successful opening of the MOVs on the passive flooding lines • no ex-vessel steam explosion • SAHRS sprays are successful
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1c	RC204	8, 9, 10, 11	1.61E-11	0.2%	IE SD LOCA-L E	Initiator - LOCA-Large During Shutdown State E	Level 1: LOCA initiator caused by failure of LHSI IRWST suction valve and operator failure to isolate. Common cause failure of MHSI pumps and failure of operator to align and start LHSI pumps results in loss of all injection.
					JND10AP001EFR_D-234	CCF of MHSI Pumps to Run	
					JNG20AA001EOP	LHSI, LHSI Pump 20 Suction from IRWST MOV JNG20AA001, Fails to Remain Closed (SO)	
					OPD-LHSILO-X-MED	Operator fails to align/start LHSI pump for LOCA in POS_ -medium dependency	
					OPF-ISOIRWSTFD-E	Operator Fails to Isolate RHR Suction to IRWST (Valve JNGX0AA001) in State E	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	Level 2: <ul style="list-style-type: none"> Large containment isolation failure because the hatch is open in POS E and cannot be closed No MCCI with debris flooded following successful opening of the MOVs on the passive flooding lines no ex-vessel steam explosion SAHRS sprays are successful
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	
2	RC204	4, 5, 18, 19	6.28E-11	0.8%	IE SD RHR DU	Initiator - RHR in Power State Du	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all 1E 2hr Batteries results in failure of all EDGs. Failure of all EDGs and inability to connect SBODGs due to the loss of the batteries results in total loss of divisional power.
					BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • Depressurization is successful with power supply from the non-safety electrical buses • Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 • SAHRS sprays successful following power recovery within 7 hours • no ex-vessel steam explosion
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	
					P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
3	RC204	14, 15, 20	9.26E-12	0.1%	IE SD RHR CBD	Initiator - RHR in Power State CBd	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all EDGs. Failure to connect SBODGs results in a total loss of HVAC
					OPD-SAC-2H-MED	Operator fails to start local room, cooling - medium dependency	
					OPF-XTLDSBO-2H	Operator Fails to Connect and Load SBO DGs	
					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	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • Depressurization is failed due to the loss of electrical Divisions 1 and 4 • Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 • no creep induced SGTR • No MCCI with debris flooded following successful opening of the MOVs on the passive flooding lines • no pit overpressure failure in cases without circumferential break of the vessel • SAHRS sprays are successful following power recovery within 7 hours
					L2PH ISGTR-TR=N	Induced SGTR. Transients, secondary not depressurized	
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	
					L2PH PF-VF NO-CBV=N	Level 2 phenomena. Pit overpressure failure (not CBV case)	
					P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	
					PROB HLR=N SD	Induced HLR for all CDES	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC205	4, 6, 10	5.67E-11	0.7%	IE SD LOCA-S E	Initiator - LOCA- Small During Shutdown State E	Level 1: Small LOCA in cold leg injection line 1 and common cause failure of common cold leg injection vales results in loss of all injection.
					JNG13AA005CFO_D-234	CCF to Open LHSI/ MHSI Common Injection Check Valves (SIS First Isolation Valves)	
					SLOCA24	Small LOCA - 24 Hour	
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	Level 2: <ul style="list-style-type: none"> • Large containment isolation failure because the hatch is open in POS E and cannot be closed • No MCCI with debris flooded following successful opening of the MOVs on the passive flooding lines • no pit overpressure ex-vessel steam explosion • SAHRS sprays are failed due to preventive maintenance
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	
					SAHR PM4	SAHR Train Unavailable due to Preventive Maintenance	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
2A	RC205	5	4.33E-12	0.1%	IE SD RHR DU	Initiator - RHR in Power State Du	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all 1E 2hr Batteries results in failure of all EDGs. Failure of all EDGs and inability to connect SBODGs due to the loss of the batteries results in total loss of divisional power.
					BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • Large containment isolation failure due to the primary drain lines being open and failure to close them following loss of electrical Divisions 1 and 4 • No MCCI with debris flooded following successful opening of the MOVs on the passive flooding lines • no pit overpressure in cases without ex-vessel steam explosion • SAHRS sprays are failed due to the loss of the dedicated cooling chain
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	
					P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	
					SA-ESWS UHS4 SBO	Failure of SA-ESWS/UHS4 in SBO Conditions	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
2B	RC205	7	2.85E-12	0.0%	IE SD RHR DU	Initiator - RHR in Power State Du	<p>Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all 1E 2hr Batteries results in failure of all EDGs. Failure of all EDGs and inability to connect SBODGs due to the loss of the batteries results in total loss of divisional power.</p>
					BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					L2 REC OSP 2-7H SD	Non-Recovery of OSP after 7 hours in Shutdown. Dependent on non-recovery in 1 hour	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2 REC OSP 7-31H SD	Non-Recovery of OSP after 31 hours (24 h value) in SD. Dependent on non-recovery in 7h.	
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	
					L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	
					P KTA10 17/18 OP-S	Probability that Primary Drain Line KTA10 is Open (S/D)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
3	RC205	8, 9	4.00E-12	0.1%	IE SD RHR CAD	Initiator - RHR in Power State CAD	Level 1: RHR initiator due to common cause failure of all ESWS pumps which results in the loss of all CCW and all RHR heat removal capabilities. Transient Induced LOCA occurs with a probability of 0.2. Loss of CH2 and QKA40 Chiller results in the loss of HVAC to Safeguard Building 4 disabling bleed ability.
					CONF CH1 TO TB	Configuration 1: CH1 Supplying All RCP TB. Maintenance on CCW 3 Only.	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	
					PEB10AP001EFRS_D-ALL	CCF of the ESWS Pumps to Run (Shutdown)	
					PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling	
					QKA40GH001_FS	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Start on Demand	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	Level 2: <ul style="list-style-type: none"> • Large containment isolation failure due to the open hatch and failure of the operator to close in 40 minutes with power unavailable • No MCCI with debris flooded following successful opening of the MOVs on the passive flooding lines • no pit overpressure in cases without circumferential break of the vessel • SAHRS sprays are failed due to the loss of electrical power Division 4
					L2PH PF-VF NO-CBV=N	Level 2 phenomena. Pit overpressure failure (not CBV case)	
					OPF-L2-HTCH-40M NP	Operator fails to close the equipment hatch manually in less than 40 min P=1	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC301	1	1.37E-14	0.0%	IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	Level 1: ULD initiator due to failure of LPRS valves and operator fails to isolate.
					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 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CCI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	Level 2: <ul style="list-style-type: none"> • High pressure sequence • Very early containment failure due to hydrogen flame acceleration loads • Extensive MCCI with failed basemat flooding due to failure of operator to open the MOVs on basemat flooding • No pit overpressure failure in cases without circumferential breach of the vessel • Operator failures to open the MOVs on the passive flooding lines and failure to start LHSI in-vessel cooling - Successful SAHRS sprays
					L2PH PF-VF NO-CBV=N	Level 2 phenomena. Pit overpressure failure (not CBV case)	
					L2PS VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)	
					OPD-L2-DEPRESS-4H	Operator Fails to Open Sufficient RCS Depressurization Valves (Shutdown)	
					OPD-L2-DEPRESS-LOW	Operator fails to open PDS to depressurize RCS - low dependency	
					OPD-L2-SAHRSPF-HIGH	Operator fails to open MOVs to enable passive cooling -high dependency	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC302	1	1.17E-14	0.0%	IE SD RHR CBD	Initiator - RHR in Power State Cbd	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all EDGs. Failure of all EDGs results in failure of CCW. The additional failure of SBODG 50 results in the failure of EFW and long-term cooling.
					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	
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> ● Low pressure sequence ● Very early containment failure due to in-vessel steam explosion
L2PH STM EXP INV LP	Level 2 phenomena: containment failure due to in-vessel steam explosion. Low pressure CET sequences.	<ul style="list-style-type: none"> ● Extensive MCCI with failed basemat flooding due to failure to open the MOVs on the passive flooding lines ● SAHRS is not credited in this sequence 					

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC303	1	4.55E-12	0.1%	IE SD RHR CBD	Initiator - RHR in Power State Cbd	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all EDGs. Failure of all EDGs results in failure of CCW. The additional failure of SBODG 50 results in the failure of EFW and long-term cooling.
					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	
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • High pressure sequence • Very early containment failure due to hydrogen flame acceleration loads • Successful in-vessel recovery following power recovery • Successful SAHRS sprays following power recovery within 7 hours
					L2PH INVREC(T-DEP)=Y	In-vessel recovery success - hot leg rupture or operator depressurization during transient CDES	
L2PS VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)						

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC304	1	4.55E-13	0.0%	IE SD RHR CBD	Initiator - RHR in Power State CBd	Level 1: RHR initiator caused by a LOOP event while shutdown and common cause failure of all EDGs. Failure of all EDGs results in failure of CCW. The additional failure of SBODG 50 results in the failure of EFW and long-term cooling.
					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 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • High pressure sequence • Very early containment failure due to hydrogen flame acceleration loads • Successful in-vessel recovery following power recovery • Failed SAHRS sprays due to dedicated cooling chain failure
					L2PH INVREC(T-DEP)=Y	In-vessel recovery success - hot leg rupture or operator depressurization during transient CDES	
					L2PS VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)	
					SA-ESWS UHS4 SBO	Failure of SA-ESWS/UHS4 in SBO Conditions	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC401	1	4.40E-14	0.0%	IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	Level 1: ULD initiator due to a failure of LPRS valves and operator fails to isolate.
					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 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CBV HP	Complete circumferential rupture of vessel (gives vessel rocket in HP sequences)	Level 2: <ul style="list-style-type: none"> • High pressure sequence failure of the operator to depressurize • Early failure of containment at the time of vessel failure due to vessel rocketing • No pit overpressure failure with complete circumferential failure of the vessel • Significant MCCI due to failure of the operator to open the MOVs on the passive flooding lines • Successful SAHRS sprays
					L2PH CCI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	
					L2PH PF-VF CBV=N	Pit overpressure at high pressure vessel failure fails melt plug given CBV occurs	
					OPD-L2-DEPRESS-4H	Operator Fails to Open Sufficient RCS Depressurization Valves (Shutdown)	
					OPD-L2-DEPRESS-LOW	Operator fails to open PDS to depressurize RCS - low dependency	
					OPD-L2-SAHRSPF-HIGH	Operator fails to open MOVs to enable passive cooling -high dependency	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC402	1	2.39E-15	0.0%	IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	Level 1: ULD initiator caused by operator failing to stop drain down. Common cause failure of IRWST sump strainers causes failure of MHSI. HVAC failure in Safeguard Building 4 prevents isolation of LPRS and opening up of PDVs.
					JNK10AT001SPG_P-ALL	CCF of IRWST Sump Strainers - Plugged	
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	
					OPF-ULD	Operator Fails to Stop Drain down at Mid-Loop (SHUTDOWN)	
					SAC34AN001EFR	SAC, Normal Air Exhaust Fan SAC34AN001, Fails to Run	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CBV HP	Complete circumferential rupture of vessel (gives vessel rocket in HP sequences)	Level 2: <ul style="list-style-type: none"> • High pressure sequence failure due to loss of electrical Division 4 • Early failure of containment at the time of vessel failure due to vessel rocketing • No pit overpressure failure with complete circumferential failure of the vessel • Significant MCCI following failure to open the MOVs on the passive flooding lines • Failure of SAHRS sprays due to loss of electrical Division 4
					L2PH CCI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	
					L2PH PF-VF CBV=N	Pit overpressure at high pressure vessel failure fails melt plug given CBV occurs	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC403	1	4.15E-13	0.0%	IE SD RHR CBD	Initiator - RHR in Power State CBd	Level 1: RHR initiator caused by LOOP event during shutdown with common cause failure of EDGs 1, 2 and 3 and failure of operator failure connect SBODGs to allow alignment of RHR train 4. Failure of HVAC in Safeguard Buildings 1 & 2 results in failure of EFW and bleed.
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	
					OPF-XTLDSBO-NSC	Operator Fails to Connect and Load SBO DGs During Non-SBO Conditions	
					SD LOOP24+REC	Loss Of Offsite Power During Shutdown and Failure of Recovery Within 1 Hour	
					XKA10____DFR_D-123	CCF of EDGs to Run	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2 REC=Y OSP 2-7H S	Offsite power recovered between 2 and 7 hours (Shutdown)	Level 2: <ul style="list-style-type: none"> • High pressure sequence failure due to loss of electrical Division 1 • Early failure of containment at the time of vessel failure due to vessel rocketing • No pit overpressure failure with complete circumferential failure of the vessel • No MCCI following successful opening of the MOVs on the passive flooding lines • Successful SAHRS sprays following power recovery
					L2PH CBV HP	Complete circumferential rupture of vessel (gives vessel rocket in HP sequences)	
					L2PH ISGTR-TR=N	Induced SGTR. Transients, secondary not depressurized	
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	
					L2PH PF-VF CBV=N	Pit overpressure at high pressure vessel failure fails melt plug given CBV occurs	
					PROB HLR=N SD	Induced HLR for all CDES	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC404	1	3.84E-14	0.0%	IE SD RHR CBD	Initiator - RHR in Power State CBd	Level 1: RHR initiator caused by common cause failure of ESWS pumps to start. Failure of QKA10 chiller and loss of CH1 due to ESWS failure results in loss of HVAC in Safeguard Buildings 1 & 2. Loss of HVAC causes failure of EFW and bleed functions.
					OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	
					PEB10AP001EFRS_D-ALL	CCF of the ESWS Pumps to Run (Shutdown)	
					QKA10GH001_FR	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Run	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PH CBV HP	Complete circumferential rupture of vessel (gives vessel rocket in HP sequences)	Level 2: <ul style="list-style-type: none"> • High pressure sequence failure due to loss of electrical Division 1 • Early failure of containment at the time of vessel failure due to vessel rocketing • No pit overpressure failure with complete circumferential failure of the vessel • No creep induced SGTR • No MCCI following successful opening of the MOVs on the passive flooding lines • Failure of SAHRS sprays due to the loss of electrical Division 1
					L2PH ISGTR-TR=N	Induced SGTR. Transients, secondary not depressurized	
					L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	
					L2PH PF-VF CBV=N	Pit overpressure at high pressure vessel failure fails melt plug given CBV occurs	
					PROB HLR=N SD	Induced HLR for all CDES	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
1	RC702	1	4.80E-15	0.0%	IE SD ULD CBD D	Initiator - Uncontrolled Level Drop in Shutdown State CBd (Demand)	Level 1: ULD initiator caused by operator failing to stop drain down. Common cause failure of HVAC exhaust fans in Safeguard Buildings 1 & 4 causes failure of running CCWS pumps. Operator failure to switch to standby CCWS pumps causes total loss of HVAC.
					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 Drain down at Mid-Loop (SHUTDOWN)	
					SAC31AN001EFR_B-ALL	CCF to Run Normal Air Exhaust Fans (Trains 1 & 4)	

Table 19.1-120—U.S. EPR Important Cutset Groups - Level 2 Shutdown
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Group	Release Category	Cutsets	Freq/yr	Contribution to LRF (%)	Event Identifier	Event Description	Sequence of events that lead to CD and to Containment Failure
					L2PHS ISGTR-SL2D=Y	Induced SGTR occurs. 2" LOCAs, secondary depressurized. Shutdown state C	Level 2: <ul style="list-style-type: none"> containment bypass following creep induced SGTR after a small LOCA and a depressurized secondary side
					LBA13AA001PFC	MSS, Train 1 MSRIV LBA13AA001, Fails to Close on Demand	
1	RC802	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	1.52E-09	19.3%	IE SD RHR ISLOCA E	RHR ISLOCA During Shutdown State E	Level 1: ISLOCA caused by a RHR Pipe break and failure to isolate.
					OPF-ISORHRBRK	Operator Fails to Isolate RHR Pipe Break (SHUTDOWN)	
					PAS	Process Automation System (PAS) Fails (Estimate)	
					RHR TR3 PIPE BRK	Pipe Break in RHR Train 3	
					L2CP ISL BL NO WATER	Level 2 conditional probability: break location not under water (ISL)	Level 2: <ul style="list-style-type: none"> Containment bypass following ISLOCA initiator with unscrubbed releases

Table 19.1-121—U.S. EPR CDES Contribution to the LRF - Level 2 Shutdown

CDES	Description	LRF (1/yr)	Contribution (Total)
IS	Core damage Interfacing System LOCA sequences	1.9E-09	24.2%
LL(CA)	Core damage large LOCA sequences with depressurized RCS in POS CA	4.7E-15	0.0%
LL(CB)	Core damage large LOCA sequences with depressurized RCS in POS CB	5.3E-15	0.0%
LL(D)	Core damage large LOCA sequences with depressurized RCS in POS D	9.9E-13	0.0%
LL(E)	Core damage large LOCA sequences with depressurized RCS in POS E	8.3E-11	1.1%
SL(CA)	Core damage small LOCA sequences where the RCS system was not depressurized in POS CA	5.9E-11	0.8%
SL(CB)	Core damage small LOCA sequences where the RCS system was not depressurized in POS CB	8.2E-10	10.4%
SL(D)	Core damage small LOCA sequences with the RCS system depressurized in POS D	3.2E-10	4.1%
SL(E)	Core damage small LOCA sequences with the RCS system depressurized in POS E	7.5E-10	9.5%
SS(CA)	Core damage seal LOCA sequences where the RCS system was not depressurized in POS CA.	2.5E-10	3.2%
TR(C)	Core damage transient sequences where the RCS system was not depressurized in POSs CA and CB	2.9E-09	37.3%
TR(D)	Core damage transient sequences with the RCS system depressurized in POS D	7.4E-10	9.4%
Total		7.9E-09	100%

Table 19.1-122—U.S. EPR Risk-Significant Phenomena based on FV Importance - Level 2 Shutdown

Rank	ID	Description	Nominal Value	FV	RAW
1	L2PH CCI-DRY	Significant MCCI occurs, debris not flooded. P = 1.0	1.0E+00	0.520	1.0
2	L2PH PF-VF NO-CBV=N	Level 2 phenomena. Pit overpressure failure (not CBV case)	1.0E+00	0.406	1.0
3	L2PH ISGTR-TR=N	Induced SGTR. Transients, secondary not depressurized	1.0E+00	0.280	1.0
4	L2PH STMEXP EXV=N	Level 2 Phenomena: Steam explosion avoided in dry pit sequences	1.0E+00	0.241	1.0
5	L2PH NO CCI	Level 2 phenomena: NO MCCI, no system failures	1.0E+00	0.131	1.0
6	L2PH ISGTR-SS,SL=N	No ISGTR in SL, SS cases with secondary pressurized	1.0E+00	0.106	1.0
7	L2PH INVREC(T-DEP)=Y	In-vessel recovery success - hot leg rupture or operator depressurization during transient CDES	7.0E-01	0.051	1.0
8	L2PH INVREC(LOOP)=Y	In-vessel recovery, phenomenological success given sufficient injection. LOOP	5.0E-01	0.039	1.0
9	L2PH INVREC(S-DEP)=Y	In-vessel recovery success - hot leg rupture or operator depressurization during seal/small LOCA DES	5.0E-01	0.017	1.0
10	L2PS VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)	3.1E-03	0.007	3.3
11	L2PHS ISGTR-TRD=N	Induced SGTR. Transient, secondary depressurized. Shutdown state C	9.9E-01	0.007	1.0

Table 19.1-123—U.S. EPR Risk-Significant Phenomena based on RAW Importance - Level 2 Shutdown

Rank	ID	Description	Nominal Value	RAW	FV
1	L2PH STM EXP INV LP	Level 2 phenomena: containment failure due to in-vessel steam explosion. Low pressure CET sequences.	5.6E-06	6.8	0.000
2	L2PS VEGF-H2DEF H	V early CF due to hydrogen deflagration. High pressure CDES, in-vessel - PRV cycling phase	3.0E-05	3.3	0.000
3	L2PS VEGF-FA(H)	Very early containment failure due to H2 Flame Acceleration (High pressure sequences)	3.1E-03	3.3	0.007

**Table 19.1-124—U.S. EPR Risk Significant Level 2 Human Actions based on either FV or RAW Importance - Level 2 Shutdown
Sheet 1 of 2**

ID	Description	Nominal Value	FV	RAW
OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally	1.2E-02	0.405	34.6
OPF-CCWS TR SO	Operator Fails to Switch CH Supply to Standby CCW Train Before A Loss of the Running Train	1.6E-01	0.300	2.6
OPF-ISORHRBRK	Operator Fails to Isolate RHR Pipe Break (SHUTDOWN)	1.1E-01	0.181	2.5
OPF-SAC-1H	Operator Fails to Start Maintenance HVAC Trains After Failure of Normal SAC Safety Train	1.1E-04	0.129	1,170.0
OPD-SAC-2H-HIGH	Operator fails to start local room cooling - high dependency	5.0E-01	0.129	1.1
OPF-ULD	Operator Fails to Stop Draindown at Mid-Loop (SHUTDOWN)	1.0E-02	0.099	10.8
OPF-L2-HTCH-1H NP	Operator fails to close the equipment hatch manually in less than 1hr P=1	1.0E+00	0.047	1.0
OPF-L2-HTCH-2H NP	Operator fails to close the equipment hatch in 2 hrs when no power is available.	8.0E-02	0.044	1.5
OPF-QKA-FTI	Operator Fails to Isolate QKA Xtie When Required	1.0E-01	0.022	1.2
OPF-L2-HTCH-40M NP	Operator fails to close the equipment hatch manually in less than 40 min P=1	1.0E+00	0.022	1.0
OPF-XTLDSBO-NSC	Operator Fails to Connect and Load SBO DGs During Non-SBO Conditions	1.0E-01	0.018	1.2
OPF-L2-HTCH-2H	Operator fails to close the equipment hatch in 2 hrs when power is available.	1.0E-02	0.017	2.7
OPE-ISOCSLPRS	Operator Fails to Isolate the CVCS Low Pressure Reducing Station (SHUTDOWN)	2.0E-05	0.011	564.0
OPF-ISOIRWSTFD-E	Operator Fails to Isolate RHR Suction to IRWST (Valve JNGX0AA001) in State E	1.1E-02	0.011	2.0

**Table 19.1-124—U.S. EPR Risk Significant Level 2 Human Actions based on either FV or RAW Importance -
Level 2 Shutdown
Sheet 2 of 2**

ID	Description	Nominal Value	FV	RAW
OPF-L2-HTCH-1H	Operator fails to close the equipment hatch in less than 1hr when power is available.	6.0E-02	0.011	1.2
OPF-ISORHRSVFD-CA	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State CA	1.0E+00	0.007	1.0
OPF-ISORHRSVFD-CB	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State CB	1.0E+00	0.005	1.0
OPF-XTLDSBO-2H	Operator Fails to Connect and Load SBO DGs	6.0E-04	0.0045	8.6
OPF-ISORHRSVFD-E	Operator Fails to Isolate RHR Safety Valve to IRWST (Valve JNAX0AA191) in State E	1.1E-04	0.000	5.2
OPF-ISORHRFD-E	Operator Fails to Isolate Other RHR Flow Diversion (LOCA) in State E	1.1E-04	0.000	3.0

Table 19.1-125—U.S. EPR Risk Significant Components based on FV Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 1 of 3

Rank	System	Component ID	Component Description	FV	RAW
1	SCWS	30QKA40GH001	SCWS, Train 4 Chiller Unit QKA40GH001	0.220	8.4
2	SCWS	30QKA10GH001	SCWS, Train 1 Chiller Unit QKA10GH001	0.180	20.9
3	SCWS	30QKA20GH001	SCWS, Train 2 Chiller Unit QKA20GH001	0.110	6.9
4	SCWS	30QKA30GH001	SCWS, Train 3 Chiller Unit QKA30GH001	0.080	9.2
5	SIS/RHR	30JNG23AA005	LHSI, MHSI/LHSI Train 2 First SIS Isolation Check Valve JNG23AA005	0.070	1.6
6	SIS/RHR	30JNG33AA005	LHSI, MHSI/LHSI Train 3 First SIS Isolation Check Valve JNG33AA005	0.070	1.5
7	SIS/RHR	30JNG43AA005	LHSI, MHSI/LHSI Train 4 First SIS Isolation Check Valve JNG43AA005	0.070	1.2
8	ELEC	30XKA30	ELEC, Emergency Diesel Generator XKA30	0.070	1.3
9	ELEC	30XKA20	ELEC, Emergency Diesel Generator XKA20	0.070	1.3
10	ELEC	30XKA40	ELEC, Emergency Diesel Generator XKA40	0.060	1.2
11	ELEC	30XKA10	ELEC, Emergency Diesel Generator XKA10	0.060	1.2
12	ELEC	34BTD01	ELEC, 250V 1E 2-hr Battery 34BTD01	0.060	7.6
13	ELEC	31BTD01	ELEC, 250V 1E 2-hr Battery 31BTD01	0.060	3.6
14	ELEC	32BTD01	ELEC, 250V 1E 2-hr Battery 32BTD01	0.050	6.2
15	ELEC	33BTD01	ELEC, 250V 1E 2-hr Battery 33BTD01	0.050	1.8
16	SCWS	30QKA40AA101	SCWS, Train 4 Chiller By-pass MOV QKA40AA101	0.040	8.3
17	CVCS	30KBA14AA106	CVCS, CVCS Low Power Reducing Station MOV KBA14AA106	0.030	IE
18	ELEC	30XKA50	ELEC, SBO Diesel Generator XKA50	0.030	1.5
19	SCWS	30QKA20AA101	SCWS, Train 2 Chiller By-pass MOV QKA20AA101	0.030	6.8

**Table 19.1-125—U.S. EPR Risk Significant Components based on FV Importance Measure Related to Level 2
Specific Importance - Level 2 Shutdown
Sheet 2 of 3**

Rank	System	Component ID	Component Description	FV	RAW
20	IRWST	30JNK10AT002	IRWST, SIS Sump Strainer to MHSI/LHSI Train 2 Pumps JNK10AT002	0.030	1.2
21	IRWST	30JNK11AT002	IRWST, SIS Sump Strainer to MHSI/LHSI Train 3 Pumps JNK11AT002	0.030	1.1
22	IRWST	30JNK11AT001	IRWST, SIS Sump Strainer to MHSI/LHSI Train 4 Pumps JNK11AT001	0.030	1.1
23	IRWST	30JNK10AT001	IRWST, SIS Sump Strainer to MHSI/LHSI Train 1 Pumps JNK10AT001	0.030	1.1
24	IRWST	30JNK11AT003	IRWST, SAHR Sump Strainer JNK11AT003	0.030	1.0
25	IRWST	30JNK10AT003	IRWST, CVCS Sump Strainer JNK10AT003	0.030	1.0
26	SIS/RHR	30JNA20AA002	RHR, LHSI Pump 20 Hot Leg Suction from RCS MOV JNA20AA002	0.020	5.3
27	SIS/RHR	30JNA30AA002	RHR, LHSI Pump 30 Hot Leg Suction from RCS MOV JNA30AA002	0.020	5.3
28	SIS/RHR	30JNA20AA001	RHR, LHSI Pump 20 Hot Leg Suction from RCS MOV JNA20AA001	0.020	IE
29	SIS/RHR	30JNA30AA001	RHR, LHSI Pump 30 Hot Leg Suction from RCS MOV JNA30AA001	0.020	IE
30	ELEC	30XKA80	ELEC, SBO Diesel Generator XKA80	0.020	1.3
31	SIS/RHR	30JNG13AA005	LHSI, MHSI/LHSI Train 1 First SIS Isolation Check Valve JNG13AA005	0.020	1.3
32	CCWS	30KAA32AA101	CCWS, Common Header 2 QKA30 Chiller Return 3-Way MOV KAA32AA101	0.010	10.1
33	HVAC	30SAC04AN001	SAC, Normal Air Supply Fan SAC04AN001	0.010	30.5
34	HVAC	30SAC34AN001	SAC, Normal Air Exhaust Fan SAC34AN001	0.010	30.5

Table 19.1-125—U.S. EPR Risk Significant Components based on FV Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 3 of 3

Rank	System	Component ID	Component Description	FV	RAW
35	HVAC	30SAC01AN001	SAC, Normal Air Supply Fan SAC01AN001	0.010	25.9
36	HVAC	30SAC31AN001	SAC, Normal Air Exhaust Fan SAC31AN001	0.010	25.9
37	SCWS	30QKA40AP107	SCWS, Train 4 Motor Driven Safety Chiller Pump QKA40AP107	0.010	2.2
38	SIS/RHR	30JND20AP001	MHSI, Train 2 Motor Driven Pump JND20AP001	0.010	1.1
39	CCWS	30KAA22AA101	CCWS, Common Header 1 QKA20 Chiller Return 3-Way MOV KAA22AA101	0.010	6.6
40	SCWS	30QKA20AP107	SCWS, Train 2 Motor Driven Safety Chiller Pump QKA20AP107	0.010	1.9
41	SIS/RHR	30JND30AP001	MHSI, Train 3 Motor Driven Pump JND30AP001	0.010	1.0
42	SIS/RHR	30JND10AP001	MHSI, Train 1 Motor Driven Pump JND10AP001	0.010	1.1
43	SCWS	30QKA10AP107	SCWS, Train 1 Motor Driven Safety Chiller Pump QKA10AP107	0.010	2.9
44	SIS/RHR	30JND40AP001	MHSI, Train 4 Motor Driven Pump JND40AP001	0.010	1.0
45	SCWS	30QKA30AP107	SCWS, Train 3 Motor Driven Safety Chiller Pump QKA30AP107	0.010	2.1
46	SIS/RHR	30JNA10AA002	RHR, LHSI Pump 10 Hot Leg Suction from RCS MOV JNA10AA002	0.010	2.0
47	SIS/RHR	30JNG20AA001	LHSI, LHSI Pump 20 Suction from IRWST MOV JNG20AA001	0.010	IE
48	SIS/RHR	30JNG30AA001	LHSI, LHSI Pump 30 Suction from IRWST MOV JNG30AA001	0.010	IE
49	SIS/RHR	30JNA30AA191	RHR, LHSI Train 3 Safety Valve JNA30AA191	0.010	IE
50	SIS/RHR	30JNA10AA001	RHR, LHSI Pump 10 Hot Leg Suction from RCS MOV JNA10AA001	0.010	IE

Note:

1. IE denotes a component whose failure also leads to an initiating event, hence the calculated RAW value is not valid.

Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 1 of 11

Rank	System	Component ID	Component Description	RAW	FV
1	SCWS	30QKA10AA102	SCWS, Train 1 Discharge Xtie MOV QKA10AA102	268.9	0.000
2	SCWS	30QKA10AA103	SCWS, Train 1 Suction Xtie MOV QKA10AA103	268.9	0.000
3	SCWS	30QKA20AA102	SCWS, Train 2 Discharge Xtie MOV QKA20AA102	268.9	0.000
4	SCWS	30QKA20AA103	SCWS, Train 2 Suction Xtie MOV QKA20AA103	268.9	0.000
5	SCWS	30QKA30AA102	SCWS, Train 3 Discharge Xtie MOV QKA30AA102	86.9	0.000
6	SCWS	30QKA30AA103	SCWS, Train 3 Suction Xtie MOV QKA30AA103	86.9	0.000
7	SCWS	30QKA40AA102	SCWS, Train 4 Discharge Xtie MOV QKA40AA102	86.9	0.000
8	SCWS	30QKA40AA103	SCWS, Train 4 Suction Xtie MOV QKA40AA103	86.9	0.000
9	ELEC	33BRW50BUW51	ELEC, 24V DC I&C Power Rack 33BRW50/33BUW51	47.9	0.000
10	HVAC	30SAC04AN001	SAC, Normal Air Supply Fan SAC04AN001	30.5	0.010
11	HVAC	30SAC34AN001	SAC, Normal Air Exhaust Fan SAC34AN001	30.5	0.010
12	SCWS	30QKC40AA101	SCWS, Return from SAC Div 4 MOV QKC40AA101	26.8	0.000
13	HVAC	30SAC04AA004	SAC, Div 4 Recirculation Motor Operated Damper SAC04AA004	26.8	0.000
14	HVAC	30SAC01AN001	SAC, Normal Air Supply Fan SAC01AN001	25.9	0.010
15	HVAC	30SAC31AN001	SAC, Normal Air Exhaust Fan SAC31AN001	25.9	0.010
16	SCWS	30QKC10AA101	SCWS, Return from SAC Div 1 MOV QKC10AA101	22.2	0.000
17	HVAC	30SAC01AA004	SAC, Div 1 Recirculation Motor Operated Damper SAC01AA004	22.2	0.000
18	SCWS	30QKA10GH001	SCWS, Train 1 Chiller Unit QKA10GH001	20.9	0.180
19	ELEC	31BNB02	ELEC, 480V MCC 31BNB02	17.0	0.000

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 2 of 11**

Rank	System	Component ID	Component Description	RAW	FV
20	HVAC	30SAC04AA003	SAC, Normal Air Inlet Motor Operated Damper SAC04AA003	16.2	0.000
21	HVAC	30SAC34AA002	SAC, Normal Air Exhaust Motor Operated Damper SAC34AA002	16.2	0.000
22	HVAC	30SAC04AA005	SAC, Normal Air Inlet Supply Fan Discharge Check Damper SAC04AA005	15.2	0.000
23	HVAC	30SAC34AA003	SAC, Normal Air Exhaust Supply Fan Discharge Check Damper SAC34AA003	15.2	0.000
24	SCWS	30QKA10AA101	SCWS, Train 1 Chiller By-pass MOV QKA10AA101	15.1	0.000
25	ELEC	31BDA	ELEC, 6.9kV Switchgear 31BDA	13.4	0.000
26	ELEC	31BDC	ELEC, 6.9kV SWGR 31BDC	13.4	0.000
27	ELEC	31BDB	ELEC, 6.9kV SWGR 31BDB	13.0	0.000
28	ELEC	31BMB	ELEC, 480V Load Center 31BMB	13.0	0.000
29	ELEC	31BMT02	ELEC, 6.9kV-480V Transformer 31BMT02	13.0	0.000
30	ELEC	31BNT01	ELEC, Constant Voltage Transformer 31BNT01	12.8	0.000
31	HVAC	30SAC01AA003	SAC, Normal Air Inlet Motor Operated Damper SAC01AA003	11.8	0.000
32	HVAC	30SAC31AA002	SAC, Normal Air Exhaust Motor Operated Damper SAC31AA002	11.8	0.000
33	ELEC	31BMC	ELEC, 480V Load Center 31BMC	11.3	0.000
34	ELEC	31BMT03	ELEC, 6.9kV-480V Transformer 31BMT03	11.3	0.000
35	ELEC	31BNC01	ELEC, 480V MCC 31BNC01	11.3	0.000
36	ELEC	33BNB02	ELEC, 480V MCC 33BNB02	11.1	0.000

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 3 of 11**

Rank	System	Component ID	Component Description	RAW	FV
37	HVAC	30SAC01AA005	SAC, Normal Air Inlet Supply Fan Discharge Check Damper SAC01AA005	10.8	0.000
38	HVAC	30SAC31AA003	SAC, Normal Air Exhaust Supply Fan Discharge Check Damper SAC31AA003	10.8	0.000
39	CCWS	30KAA32AA101	CCWS, Common Header 2 QKA30 Chiller Return 3-Way MOV KAA32AA101	10.1	0.010
40	ELEC	32BNB02	ELEC, 480V MCC 32BNB02	10.0	0.000
41	ELEC	34BDA	ELEC, 6.9kV SWGR 34BDA	9.6	0.000
42	ELEC	34BDC	ELEC, 6.9kV SWGR 34BDC	9.4	0.000
43	ELEC	34BDB	ELEC, 6.9kV SWGR 34BDB	9.3	0.000
44	ELEC	34BMB	ELEC, 480V Load Center 34BMB	9.3	0.000
45	ELEC	34BMT02	ELEC, 6.9kV-480V Transformer 34BMT02	9.3	0.000
46	ELEC	BDT01	ELEC, Aux Transformer 30BDT01	9.3	0.000
47	SCWS	30QKA30GH001	SCWS, Train 3 Chiller Unit QKA30GH001	9.2	0.080
48	ELEC	33BDA	ELEC, 6.9kV SWGR 33BDA	9.0	0.000
49	ELEC	32BDA	ELEC, 6.9kV SWGR 32BDA	9.0	0.000
50	ELEC	33BDB	ELEC, 6.9kV SWGR 33BDB	8.9	0.000
51	ELEC	33BMB	ELEC, 480V Load Center 33BMB	8.9	0.000
52	ELEC	33BMT02	ELEC, 6.9kV-480V Transformer 33BMT02	8.9	0.000
53	ELEC	32BDB	ELEC, 6.9kV SWGR 32BDB	8.9	0.000
54	ELEC	32BMB	ELEC, 480V Load Center 32BMB	8.9	0.000
55	ELEC	32BMT02	ELEC, 6.9kV-480V Transformer 32BMT02	8.9	0.000

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 4 of 11**

Rank	System	Component ID	Component Description	RAW	FV
56	ELEC	2BDA_2BDB1	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	8.4	0.000
57	ELEC	2BDA_2BDB2	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	8.4	0.000
58	ELEC	2BDB2BMT02	ELEC, 6.9kV SWGR 32BDB to Transformer 32BMT02 Circuit Breaker	8.4	0.000
59	ELEC	2BMT022BMB	ELEC, Transformer 32BMT02 to 480V Load Center 32BMB Circuit Breaker	8.4	0.000
60	SCWS	30QKA40GH001	SCWS, Train 4 Chiller Unit QKA40GH001	8.4	0.220
61	ELEC	2BMB2BNT01	ELEC, 480 Load Center 32BMB to Transformer 32BNT01 Circuit Breaker	8.3	0.000
62	ELEC	2BNT012BNB02	ELEC, Transformer 32BNT01 to 480V MCC 32BNB02 Circuit Breaker	8.3	0.000
63	SCWS	30QKA40AA101	SCWS, Train 4 Chiller By-pass MOV QKA40AA101	8.3	0.040
64	ELEC	33BNT01	ELEC, Constant Voltage Transformer 33BNT01	8.1	0.000
65	ELEC	4BDA_4BDC1	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	8.0	0.000
66	ELEC	4BDA_4BDC2	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	8.0	0.000
67	ELEC	4BDB4BMT02	ELEC, 6.9kV SWGR 34BDB to Transformer 34BMT02 Circuit Breaker	8.0	0.000
68	ELEC	4BDC_4BDB1	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	8.0	0.000
69	ELEC	4BDC_4BDB2	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	8.0	0.000

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
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Rank	System	Component ID	Component Description	RAW	FV
70	ELEC	4BMT024BMB	ELEC, Transformer 34BMT02 to 480V Load Center 34BMB Circuit Breaker	8.0	0.000
71	ELEC	34BTD01	ELEC, 250V 1E 2-hr Battery 34BTD01	7.6	0.060
72	ELEC	1BDB1BMT02	ELEC, 6.9kV SWGR 31BDB to Transformer 31BMT02 Circuit Breaker	7.3	0.000
73	ELEC	1BDC_1BDB1	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	7.3	0.000
74	ELEC	1BDC_1BDB2	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	7.3	0.000
75	ELEC	1BMT021BMB	ELEC, Transformer 31BMT02 to 480V Load Center 31BMB Circuit Breaker	7.3	0.000
76	ELEC	1BMB1BNT01	ELEC, 480V Load Center 31BMB to Transformer 31BNT01 Circuit Breaker	7.2	0.000
77	ELEC	1BNT011BNB02	ELEC, Transformer 31BNT01 to 480V MCC 31BNB02 Circuit Breaker	7.2	0.000
78	ELEC	1BDA_1BDC1	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	7.2	0.000
79	ELEC	1BDA_1BDC2	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	7.2	0.000
80	SCWS	30QKA20GH001	SCWS, Train 2 Chiller Unit QKA20GH001	6.9	0.110
81	ELEC	34BNB02	ELEC, 480V MCC 34BNB02	6.9	0.000
82	SCWS	30QKA20AA101	SCWS, Train 2 Chiller By-pass MOV QKA20AA101	6.8	0.030
83	ELEC	3BDA_3BDB1	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDB Circuit Breaker	6.7	0.000

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 6 of 11**

Rank	System	Component ID	Component Description	RAW	FV
84	ELEC	3BDA_3BDB2	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDB Circuit Breaker	6.7	0.000
85	ELEC	3BDB3BMT02	ELEC, 6.9kV SWGR 33BDB to Transformer 33BMT02 Circuit Breaker	6.7	0.000
86	ELEC	3BMT023BMB	ELEC, Transformer 33BMT02 to 480V Load Center 33BMB Circuit Breaker	6.7	0.000
87	ELEC	34BUC	ELEC, 1E 250V DC Switchboard 34BUC	6.7	0.000
88	CCWS	30KAA22AA101	CCWS, Common Header 1 QKA20 Chiller Return 3-Way MOV KAA22AA101	6.6	0.010
89	ELEC	34BNC01	ELEC, 480V MCC 34BNC01	6.5	0.000
90	ELEC	3BMB3BNT01	ELEC, 480V Load Center 33BMB to Transformer 33BNT01 Circuit Breaker	6.4	0.000
91	ELEC	3BNT013BNB02	ELEC, Transformer 33BNT01 to 480V MCC 33BNB02 Circuit Breaker	6.4	0.000
92	SCWS	30QKA30AA101	SCWS, Train 3 Chiller By-pass MOV QKA30AA101	6.3	0.000
93	ELEC	32BTD01	ELEC, 250V 1E 2-hr Battery 32BTD01	6.2	0.050
94	ELEC	1BDC1BMT03	ELEC, 6.9kV SWGR 31BDC to Transformer 31BMT03 Circuit Breaker	6.1	0.000
95	ELEC	1BMT031BMC	ELEC, Transformer 31BMT03 to 480V Load Center 31BMC Circuit Breaker	6.1	0.000
96	ELEC	31BMC1BNC01	ELEC AC, 480V Bus 31BMC to 480V MCC 31BNC01 Circuit Breaker	6.1	0.000
97	CCWS	30KAB20AA192	CCWS, CCWS CH2 Return Safety Valve KAB20AA192	6.1	0.000

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 7 of 11**

Rank	System	Component ID	Component Description	RAW	FV
98	CCWS	30KAB20AA193	CCWS, FPCS Train 2 Cooling Header Safety Valve KAB20AA193	6.1	0.000
99	CCWS	30KAB30AA192	CCWS, RCP Thermal Barrier to CCWS CH2 Return Safety Valve KAB30AA192	6.1	0.000
100	CCWS	30KAB70AA191	CCWS, CVCS HP Cooler 2 Return Safety Valve KAB60AA191	6.1	0.000
101	ELEC	34BNT01	ELEC, Constant Voltage Transformer 34BNT01	5.8	0.000
102	ELEC	32BNA02	ELEC, 480V MCC 32BNA02	5.6	0.000
103	CCWS	30KAB10AA192	CCWS, CCWS CH1 Return Safety Valve KAB10AA192	5.5	0.000
104	CCWS	30KAB10AA193	CCWS, FPCS Train 1 Cooling Header Safety Valve KAB10AA193	5.5	0.000
105	CCWS	30KAB30AA191	CCWS, RCP Thermal Barrier to CCWS CH1 Return Safety Valve KAB30AA191	5.5	0.000
106	CCWS	30KAB60AA191	CCWS, CVCS HP Cooler 1 Return Safety Valve KAB60AA191	5.5	0.000
107	ELEC	34BMC	ELEC, 480V Load Center 34BMC	5.4	0.000
108	ELEC	34BMT03	ELEC, 6.9kV-480V Transformer 34BMT03	5.4	0.000
109	ELEC	31BRA	ELEC, 480V MCC 31BRA	5.4	0.000
110	ELEC	32BNT01	ELEC, Constant Voltage Transformer 32BNT01	5.4	0.000
111	ELEC	34BRW72BUW73	ELEC, 24V DC I&C Power Rack 34BRW72/34BUW73	5.4	0.000
112	SIS/RHR	30JNA20AA002	RHR, LHSI Pump 20 Hot Leg Suction from RCS MOV JNA20AA002	5.3	0.020
113	SIS/RHR	30JNA30AA002	RHR, LHSI Pump 30 Hot Leg Suction from RCS MOV JNA30AA002	5.3	0.020

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 8 of 11**

Rank	System	Component ID	Component Description	RAW	FV
114	ELEC	34BRA	ELEC, 480V MCC 34BRA	5.2	0.000
115	SIS/RHR	30JNA20AA001	RHR, LHSI Pump 20 Hot Leg Suction from RCS MOV JNA20AA001	5.1	0.020
116	SIS/RHR	30JNA30AA001	RHR, LHSI Pump 30 Hot Leg Suction from RCS MOV JNA30AA001	5.1	0.020
117	ELEC	4BMB4BNT01	ELEC, 480V Load Center 34BMB to Transformer 34BNT01 Circuit Breaker	5.1	0.000
118	ELEC	4BNT014BNB02	ELEC, Transformer 34BNT01 to 480V MCC 34BNB02 Circuit Breaker	5.1	0.000
119	ELEC	31BRW12BUW13	ELEC, 24V DC I&C Power Rack 31BRW12/31BUW13	5.0	0.000
120	ELEC	32BUC	ELEC, 1E 250V DC Switchboard 32BUC	4.8	0.000
121	ELEC	4BDC4BMT03	ELEC, 6.9kV SWGR 34BDB to Transformer 34BMT03 Circuit Breaker	4.8	0.000
122	ELEC	4BMT034BMC	ELEC, Transformer 34BMT03 to 480V Load Center 34BMC Circuit Breaker	4.8	0.000
123	ELEC	34BMC4BNC011	ELEC, 480V Bus 34BMC to 480V MCC 34BNC01 Circuit Breaker	4.8	0.000
124	ELEC	34BNB01	ELEC, 480V MCC 34BNB01	4.8	0.000
125	ELEC	32BRW30BUW31	ELEC, 24V DC I&C Power Rack 32BRW30/32BUW31	4.7	0.000
126	ELEC	32BNT04	ELEC, Voltage Regulating Transformer 32BNT04	4.7	0.000
127	ELEC	32BMT03	ELEC, 6.9kV-480V Transformer 32BMT03	4.7	0.000
128	ELEC	32BUD	ELEC, Non 1E 250V DC Switchboard 32BUD	4.5	0.000
129	SIS/RHR	30JND30AA003	MHSI, MHSI Pump 30 Discharge Manual CHECK Valve JND30AA003	4.4	0.000

Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
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Rank	System	Component ID	Component Description	RAW	FV
130	SIS/RHR	30JND20AA003	MHSI, MHSI Pump 20 Discharge Manual CHECK Valve JND20AA003	4.4	0.000
131	SIS/RHR	30JNG20AA003	LHSI, LHSI Train 2 to Radial Miniflow Motor Operated Check Valve JNG20AA003	4.3	0.000
132	SIS/RHR	30JNG20AA004	LHSI, Train 2 Min Flow MOCV JNG20AA004	4.3	0.000
133	SIS/RHR	30JNG30AA003	LHSI, LHSI Train 3 to Radial Miniflow Motor Operated Check Valve JNG30AA003	4.3	0.000
134	SIS/RHR	30JNG30AA004	LHSI, Train 3 Min Flow MOCV JNG30AA004	4.3	0.000
135	ELEC	32BDA2BMT03	ELEC, 6.9kV SWGR 32BDA to Transformer 32BMT03 Circuit Breaker	4.2	0.000
136	ELEC	32BMT032BNA02	ELEC, Transformer 32BMT03 to 480V MCC 32BNA02 Circuit Breaker	4.2	0.000
137	ELEC	4BMB4BNB01	ELEC, 480V Load Center 34BMB to 480V MCC 34BNB01 Circuit Breaker	4.0	0.000
138	ELEC	33BMT03	ELEC, 6.9kV-480V Transformer 33BMT03	4.0	0.000
139	ELEC	33BNA02	ELEC, 480V MCC 33BNA02	4.0	0.000
140	ELEC	31BTD01	ELEC, 250V 1E 2-hr Battery 31BTD01	3.6	0.060
141	ELEC	32BTB01	ELEC, 250V Non 1E 12-hr Battery 32BTB01	3.5	0.000
142	ELEC	1BRU011BRA	ELEC, Inverter 31BRU01 to 480V MCC 31BRA Circuit Breaker	3.0	0.000
143	ELEC	4BRU014BRA	ELEC, Inverter 34BRU01 to 480V MCC 34BRA Circuit Breaker	3.0	0.000
144	ELEC	32BRU03	ELEC, Inverter 32BRU03	2.9	0.000
145	SCWS	30QKA10AP107	SCWS, Train 1 Motor Driven Safety Chiller Pump QKA10AP107	2.9	0.010

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 10 of 11**

Rank	System	Component ID	Component Description	RAW	FV
146	SCWS	30QKA10AP108	SCWS, Train 1 Motor Driven Safety Chiller Pump QKA10AP108	2.9	0.000
147	ELEC	31BTB01	ELEC, 250V Non 1E 12-hr Battery 31BTB01	2.6	0.000
148	ELEC	34BRB	ELEC, 480V MCC 34BRB	2.5	0.000
149	ELEC	31BUC	ELEC, 1E 250V DC Switchboard 31BUC	2.5	0.000
150	ELEC	33BDA3BMT03	ELEC, 6.9kV SWGR 33BDA to Transformer 33BMT03 Circuit Breaker	2.3	0.000
151	ELEC	33BMT033BNA02	ELEC, Transformer 33BMT03 to 480V MCC 33BNA02 Circuit Breaker	2.3	0.000
152	ELEC	32BRC	ELEC, 480V MCC 32BRC	2.3	0.000
153	ELEC	32BRU0301	ELEC, Inverter 32BRU03 Static Switch 32BRU0301	2.3	0.000
154	ELEC	31BUD	ELEC, Non 1E 250V DC Switchboard 31BUD	2.3	0.000
155	SIS/RHR	30JNA30AA101	RHR, LHSI Train 3 HTX Bypass MOV JNA30AA101	2.3	0.000
156	HVAC	30SAC03AN001	SAC, Normal Air Supply Fan SAC03AN001	2.3	0.000
157	HVAC	30SAC33AN001	SAC, Normal Air Exhaust Fan SAC33AN001	2.3	0.000
158	SCWS	30QKA40AP107	SCWS, Train 4 Motor Driven Safety Chiller Pump QKA40AP107	2.2	0.010
159	SCWS	30QKA40AP108	SCWS, Train 4 Motor Driven Safety Chiller Pump QKA40AP108	2.2	0.000
160	CVCS	30KBA14AA004	CVCS, Low Pressure Reducing Station Isolation MOV KBA14AA004	2.1	0.000
161	SCWS	30QKA30AP107	SCWS, Train 3 Motor Driven Safety Chiller Pump QKA30AP107	2.1	0.010

**Table 19.1-126—U.S. EPR Risk Significant Components based on RAW Importance Measure Related to Level 2 Specific Importance - Level 2 Shutdown
Sheet 11 of 11**

Rank	System	Component ID	Component Description	RAW	FV
162	SCWS	30QKA30AP108	SCWS, Train 3 Motor Driven Safety Chiller Pump QKA30AP108	2.1	0.000
163	ELEC	2BRU032BRC	ELEC, Inverter 32BRU03 to 480V MCC 32BRC Circuit Breaker	2.1	0.000
164	ELEC	2BUD2BRU03	ELEC, 250V Pnl 32BUD to Inverter 32BRU03 Circuit Breaker	2.1	0.000
165	ELEC	2BRC_4BRB1	ELEC, 480V MCC 32BRC to 480V MCC 34BRB Circuit Breaker	2.1	0.000
166	ELEC	2BRC_4BRB2	ELEC, 480V MCC 32BRC to 480V MCC 34BRB Circuit Breaker	2.1	0.000
167	ELEC	32BRA	ELEC, 480V MCC 32BRA	2.0	0.000

**Table 19.1-127—U.S. EPR Important Sequences – Level 1 Internal Events
(Contributing more than 1% to the Total CDF)
Sheet 1 of 3**

Event Tree	Seq. Num	RS Sequence ID	Seq. Freq (1/yr)	Description	Corresponding Cutsets	
					Table Number	Group Number
LOOP	48	LOOP-EDG-REC LOOP-EFW-MHSI FB-LTC	2.8E-08	A LOOP event, no recovery of OSP in 2 hours; with a failure of all EDGs (SBO conditions). Followed by a EFW system failure and failure of MHSI/LHSI for feed and bleed function and IRWST long-term cooling.	19.1-7	1
LOOP	50	LOOP-EDG-REC LOOP-EFW-MHSI FB-LHSI	2.5E-08	A LOOP event, no recovery of OSP in 2 hours; with a failure of all EDGs (SBO conditions). Followed by a EFW system failure and failure of MHSI/LHSI for feed and bleed function.	19.1-7	3
SGTR	15	SGTR-SG ISO-RHR	2.4E-08	A SGTR event with failure to isolate affected SG; followed by a failure of RHR.	–	–
LOOP	53	LOOP-EDG-REC LOOP-SBO	2.1E-08	A LOOP event, no recovery of OSP in 2 hours; with a failure of all EDGs and both SBO DGs leading to a total blackout.	19.1-7	2
LOOP	11	LOOP-REC LOOP- EFW-LTC	1.7E-08	A LOOP event, no recovery of OSP in 2 hours; followed by failures of EFW system and IRWST long-term cooling, required for feed and bleed.	19.1-7	5
LOOP	38	LOOP-MSR	1.6E-08	A LOOP event followed by loss of all steam relief capabilities.	–	–
SLOCA	15	SLOCA-MHSI- LHSI	1.5E-08	A SLOCA event followed by failure of MHSI/LHSI for feed and bleed function.	19.1-7	6, 8
SLOCA	2	SLOCA-LTC	1.5E-08	A SLOCA event followed by failure of IRWST long-term cooling.	19.1-7	7

**Table 19.1-127—U.S. EPR Important Sequences – Level 1 Internal Events
(Contributing more than 1% to the Total CDF)
Sheet 2 of 3**

Event Tree	Seq. Num	RS Sequence ID	Seq. Freq (1/yr)	Description	Corresponding Cutsets	
					Table Number	Group Number
LOOP	17	LOOP-REC LOOP-EFW-PBL	1.3E-08	A LOOP event, no recovery of OSP in 2 hours; followed by failures of EFW system and pressure relief for feed and bleed function.	–	–
GT	17	GT-MFW-SSS-EFW-MHSI FB-LHSI	1.0E-08	A plant trip with MFW and SSS failures, followed by failures of EFW system and MHSI/LHSI for feed and bleed function.	19.1-7	14, 16
LOCCW	32	LOCCW-RCP LOCA-MHSI-LTC	1.0E-08	A LOCCW event followed by a seal LOCA and failures of MHSI for feed and bleed function and IRWST long-term cooling.	–	–
ATWS	11	ATWS-PSR	1.0E-08	An ATWS event, pressure relief was not credited for ATWS events w/o MFW	19.1-7	11, 12
LOOP	56	LOOP-RCP LOCA-REC LOOP-LTC	9.4E-09	A LOOP event, no recovery of OSP in 1 hours; followed by a seal LOCA and failure of IRWST long-term cooling.	–	–
LOCCW	21	LOCCW-RCP LOCA-LTC	7.4E-09	A LOCCW event followed by a seal LOCA and failure of IRWST long-term cooling.	19.1-7	21
LOCCW	18	LOCCW-MFW-SSS-EFW-PBL	7.3E-09	A LOCCW event with MFW and SSS failures, followed by failures of EFW system and pressure relief for feed and bleed function.	–	–
LOOP	29	LOOP-RCP LOCA-REC LOOP-EFW-PBL	6.9E-09	A LOOP event, no recovery of OSP in 1 hour; followed by a seal LOCA and failures of EFW system and pressure relief for feed and bleed function.	–	–

**Table 19.1-127—U.S. EPR Important Sequences – Level 1 Internal Events
(Contributing more than 1% to the Total CDF)
Sheet 3 of 3**

Event Tree	Seq. Num	RS Sequence ID	Seq. Freq (1/yr)	Description	Corresponding Cutsets	
					Table Number	Group Number
GT	15	GT-MFW-SSS- EFW-MSHI FB- LTC	6.4E-09	A plant trip with MFW and SSS failures, followed by failures of EFW system and MHSI for feed and bleed function and IRWST long-term cooling.	19.1-7	15
LOOP	21	LOOP-RCP LOCA- REC LOOP-LTC	5.7E-09	A LOOP event, no recovery of OSP in 1 hour; followed by a seal LOCA and failure of IRWST long-term cooling.	–	–
LOCCW	17	LOCCW-MFW- SSS-EFW-MHSI FB-LHSI	5.6E-09	A LOCCW event with MFW and SSS failures, followed by failures of EFW system and MHSI/LHSI for feed and bleed function.	–	–
BDA	21	BDA-RCP LOCA- LTC	5.0E-09	A BDA event, followed by a seal LOCA and failure of IRWST long-term cooling.	–	–

**Table 19.1-128—U.S. EPR Important Sequences – Level 1 Flooding Events
(Contributing more than 1% to the Total CDF)**

Event Tree	Seq. Num	RS Sequence ID	Seq. Freq (1/yr)	Description	Corresponding Cutsets	
					Table Number	Group Number
LOCCW (IE FLD-SAB14 FB)	21	IE FLD-SAB14 FB-RCP LOCA-LTC	2.7E-08	A flood in the pump room of SB 4 (or SB 1) extending to the FB, resulting in a seal LOCA, with failure of IRWST long-term cooling.	19.1-41	8
LOCCW (IE FLD-SIS)	34	IE FLD-SIS-RCP LOCA-MHSI-LHSI	1.3E-08	A flood in SB due to SIS piping break, followed by a seal LOCA, and failure of MHSI/LHSI injection.	19.1-41	–
FLD-ANN	5	IE FLD-ANN-AFS BRK-AFS ISO	6.3E-09	A flood in the annulus from a 1" pipe break and failure to isolate FWDS ring header.	19.1-41	–

Table 19.1-129—U.S. EPR Important Sequences – Level 1 Internal Fire Events (Contributing more than 1% to the Total CDF)

Event Tree	Seq. Num	RS Sequence ID	Seq. Freq (1/yr)	Description	Corresponding Cutsets	
					Table Number	Group Number
BDA (IE FIRE-SAB14-ELEC)	29	IE FIRE-SAB14-ELEC-RCP LOCA-EFW-PBL	7.5E-08	A fire in the electrical room of SB 4 (or SB 1), resulting in a seal LOCA, followed by a failure of EFW (dominated by a failure of PCD function), and a failure of pressure relief for feed and bleed function.	19.1-66	2, 3, 4, 5, 8
BDA (IE FIRE-SAB14-ELEC)	21	IE FIRE-SAB14-ELEC-RCP LOCA-LTC	5.6E-08	A fire in the electrical room of SB 4 (or SB 1), resulting in a seal LOCA, with a failure of IRWST long-term cooling.	19.1-66	6, 7, 9, 10
FIRE-MCR	2	IE FIRE-MCR-OP RSS	2.5E-08	A fire occurs in the MCR and the operators fail to evacuate and transfer control of the plant to the Remote Shutdown Station.	19.1-66	1
LBOP (IE FIRE-SWGR)	16	IE FIRE-SWGR-EFW-PBL	7.6E-09	A fire in the switchgear building fails all non-safety power, disabling MFW and SSS, failures of EFW and pressure relief for feed and bleed function.	19.1-66	14, 15
MSSV (IE FIRE MS-VR)	19	IE FIRE MS-VR-MSIV ISO(3)-RHR	6.6E-09	A fire in the MFW/MS valve room causing a spurious opening of one MSRIV, and a failure to isolate with MSIVs, leading to two steam generators blowing down; followed by a RHR system failure.	19.1-66	12

**Table 19.1-130—U.S. EPR Important Sequence(s) – Level 1 Shutdown
(Contributing more than 1% to the Total CDF)**

Event Tree	Seq. Num	RS Sequence ID	Seq. Freq (1/yr)	Description	Corresponding Cutsets	
					Table Number	Group Number
RHR C (IE SD RHR CBD)	12	IE SD RHR CBD-EFW- MHSI FB-LTC	5.9E-09	A Loss of RHR event in POS CBD, followed by failures of the EFW system and MHSI for feed and bleed function and IRWST long-term cooling.	19.1-92	6, 8, 9

**Table 19.1-131—Key Sources of Uncertainties
Sheet 1 of 3**

No.	PRA Category	Source of Uncertainty
1	ALL	<p>Completeness of Design: All available design and operating features have been considered; however, in the design certification phase it cannot be confirmed that all inputs to the PRA model will be consistent with an actual as-built plant and as-operated procedures.</p> <p>There is not enough detailed design information to model systems outside of nuclear island: for example, the normal heat sink, condenser, PAS, and SAS systems.</p>
2	ALL	<p>Model Asymmetry: Normal and alternate system alignments consistent with the actual procedures, practices and history of the plant are not available.</p>
3	ALL	<p>Changes related to Fukushima NTF Recommendations: Design changes incorporated to address the Fukushima Near Term Task Force (NTTF) recommendations have not been incorporated. Currently the events addressed in these initiatives (for example, a prolonged total station blackout) are assumed to lead to core damage. The newly developed FLEX strategies may lead to recoveries of some of these out-of-design-basis events. However, some of these strategies, may also impact the current mitigating equipment, resulting in new flow diversion paths, or affecting modeled power recoveries</p>
4	ALL	<p>Uncertainty Evaluation: Ability to include success criteria uncertainty and uncertainty in phenomenological codes is very limited. Also, grouping of the random parameters is conservative: for example, all MOVs are assumed to be sampled from the same distribution. Sampling based on the common cause groups will be more accurate (only DGs are separated based on the common cause groups).</p>
5	DATA	<p>Generic data: Equipment is not yet procured and generic data sources were used.</p>
6	DATA	<p>Test and Maintenance Unavailability: Test and maintenance requirements and practices are not available.</p>
7	HRA	<p>Unavailability of EOPs & Alarm Response Procedures: Plant-specific EOPs, as well as the General Emergency Operating Guidelines and the Technical Bases Document do not exist yet. The identification of post-accident human response actions was based on the existing operating plants with the symptom based procedures. Limited credit is given to recovery actions, especially outside MCR. Errors of commission and miscalibration were not considered.</p>
8	HRA	<p>Operator and Digital I&C Interaction: Very limited experience with computerized digital MCR is available, the same applies for information on operator performance when digital systems are lost</p>

**Table 19.1-131—Key Sources of Uncertainties
Sheet 2 of 3**

No.	PRA Category	Source of Uncertainty
9	I&C	Software CCF: There is large uncertainty in the values used for the probability of software CCF.
10	I&C	I&C impact on initiating event frequency: Initiating event frequencies are based on historical operating experience with the conventional fleet. The digital control systems are expected to improve initiating event frequency over historic experience; however the specific impact of digital I&C on initiating event frequency, either positive or negative, is not quantified.
11	SYSTEMS-HVAC	HVAC recovery: HVAC recovery evaluation is based on the estimates of heat load of the electrical equipment and equipment responses to high temperature
12	INTERNAL EVENTS - LOOP	LOOP and DG Recoveries: A simplified model is used to represent interaction between timings of LOOP and DGs recoveries
13	FLOOD	Flood Analysis: A simplified and conservative flood analysis is performed because no detailed information is available on equipment and piping layouts, or on flood response procedures.
14	FLOOD	Flood Frequency: Flood Frequency is based on the number of piping segments. Given that a detailed piping layout is not available there was no detailed information on length of the piping, or number of welds. Also, non-piping elements were not considered in the frequency calculations.
15	FIRE	Fire Analysis: A simplified and conservative fire analysis is performed because no detailed information is available on equipment and cable layouts, combustible loads, transient combustible procedures, design of fire protection system, fire response procedures, etc.
16	FIRE	Fire Frequencies: Fire Frequencies are based on RES/OERAB/S02-01; NUREG/CR-6850 frequencies were not used because information is not available on total plant equipment (no design information on areas outside of the nuclear island), general equipment and cable layout and transient combustibles.
17	SD	SD Schedule: SD schedule and procedures are not available. Many assumptions are made based on the relevant plant experience, for example it was assumed that containment hatch will be closed in mid-loop operation, that an use of the nozzle dams (and bypass on safety injection actuation) will be limited, and that applicable GL 88-17 (and others) guidance will be followed.
18	L2	Passive Equipment Performance: No good data is available on estimating passive fuse valve failure likelihood.
19	L2 - HRA	Interaction Between Operators and Emergency Response Centers: Level 2 HRA is performed without evaluation in details a complex interaction between operators and emergency response centers.

**Table 19.1-131—Key Sources of Uncertainties
Sheet 3 of 3**

No.	PRA Category	Source of Uncertainty
20	L2	LRF Definition: Feedback from L3 to L2.
21	L2	The scrubbing factor: The value of 0.5 used in the flood LRF model is based on piping count. This number is based on the maximum IRWST water released into the safeguard building following the break and the percentage of pipes that would be under water (i.e., 50%).
22	L2	The SGTR initiator scrubbing: Without emergency procedures available, the operator action to restart EFW to the faulted generator following SGTR for scrubbing purposes cannot be confirmed.
23	L2	MAAP runs: Results from MAAP runs depend on many input parameters including some not directly relevant to outputs used in the Level 2 PRA. It was noted that cliff edge effects and time step instability introduced, in some cases, variations in the results. The uncertainty distributions used in the Level 2 PRA account for that variability. It is noted that MAAP outlier results are investigated before being considered or revised.

Next File