Response to

Request for Additional Information No. 236 (2589), Supplement 1, Revision 0

6/12/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 19 - Probabilistic Risk Assessment and Severe Accident Evaluation
Application Section: 19

QUESTIONS for PRA Licensing, Operations Support and Maintenance Branch 2 (ESBWR/ABWR Projects) (SPLB)

Question 19-313:

A New section on risk metrics (Section 4.1) is included in the "AREVA NP Environmental Report Standard Design Certification," ANP-10290, draft Revision 1, wherein the core damage frequency (CDF) is used as the primary risk metric to characterize the frequency of occurrence of a severe accident. The actual radiological risk, as calculated in the U.S. EPR Level 3 PRA, is used to quantify averted costs for offsite consequences. Also, as indicated through various RAI responses, AREVA has corrected the radionuclide core inventory to higher values. The offsite consequence results used in the SAMDA analysis indicate slight reduction in total offsite population dose, which contradicts the expected higher value, even if the release fractions were to remain unchanged. Accordingly:

1. Please provide the fraction of the total CDF that is captured among the release categories considered in the Level 3 PRA, as well as the values of the release category frequencies.
2. Please provide the corrected radionuclide core inventory and released fractions used in the level 3 PRA analysis.
3. For the SAMDA candidate development, the top 100 Level 1 cutsets were chosen, equating to approximately 50% of the total CDF. This may not be conservative, however, because this cutset list may not correspond to the top 100 cutsets contributing to the large release frequency (LRF). Please provide the list of the top 100 LRF cutsets, and indicate the fraction of the LRF these comprise. In addition, please list and describe any additional candidates identified from using the top 100 LRF cutsets instead of the top 100 CDF cutsets, and which of these additional candidates are categorized as "consider for further evaluation." If any do fall into that category, please explain how the Maximum Benefit Evaluation would be affected.
4. In response to RAI 19-238, the applicant indicated that the screening process for the "Vent MSSV's in containment" will be changed from "Not Applicable" to "Excessive Implementation Cost," in the revised report. But, this change was not included in this revision. This change would also affect the "Result and Summary" section. Please make this change in the next revision of the report.

Response to Question 19-313:

Response to Question 19-313, Part 1:

The total CDF is captured among the release categories considered in the Level 3 probabilistic risk assessment (PRA). The total CDF is 5.3E-07/year, which is the sum of the release category frequencies. Table 19-313-1 provides the release category frequency vector used in the Level 3 PRA.

Response to Question 19-313, Part 2:

Radionuclide Core Inventory used in Level 3 PRA

The core inventory used in the modular accident analysis program (MAAP) model was updated to include the entire core inventory. The original U.S. EPR MAAP model used the masses of only the radioactive portion of the core inventory. To correct the core inventory used in the U.S. EPR MAAP model, an additional ORIGEN-2 model was developed and executed. This

ORIGEN-2 run provided the core inventory of fission products and actinides on an elemental mass basis. The elemental masses (which include both radioactive and non-radioactive isotopes) were used as input to the updated U.S. EPR MAAP model. The ORIGEN-2 run also provided the activity inventory (in curies). The activity inventory from the ORIGEN-2 run was compared to the previous ORIGEN-2 run activity inventory and the activity inventories were found to be identical.

The Level 3 PRA used the revised results of the updated U.S. EPR MAAP model runs to determine the mass fraction released to the environment for each radioisotope group, the core uncovery time, and release duration. However, the input of the core inventory to MACCS2 was unchanged because the radioisotope core inventory (in curies) did not change as a result of modifying the MAAP model core inventory. Table 19-313-2 provides the core inventory used in MACCS2.

Table 19-313-2 shows that the MAAP model uses the total elemental mass, while MACCS2 uses the core inventory for each radioisotope.

Release Fractions

Table 19-313-3 provides the release fractions from each release category used in the Level 3 PRA.

Response to Question 19-313, Part 3:

In addition to the top 100 CDF cutsets, the top 100 large release frequency (LRF) cutsets are evaluated to identify plant-specific modifications that could reduce the likelihood of the dominant containment challenges. The top 100 LRF cutsets are provided in Appendix A of this response.

The model used for this evaluation was developed in the Response to RAI 22, Supplement 3, Question 19-160. This model is the U.S. EPR FSAR Level 2 PRA model with the following LRF sequence removed: main steam line break (MSLB) inside of containment leading to an overcooling event, resulting in overpressure failure of the containment. This sequence did not lead to core damage in the Response to RAI 22, Supplement 3, Question 19-160. Removing this sequence addresses the staff's concern that the overly conservative treatment of that event would artificially reduce the relative importance of other failure modes.

The total U.S. EPR LRF, once the MSLB contribution has been removed, is approximately 1.4E-08/year. The top 100 LRF cutsets shown in Appendix A include all cutsets contributing greater than one percent to that total. The top 100 LRF cutsets equate to approximately 7E-09/year, or 50 percent of the total LRF. The individual contribution of the total LRF for the 101st cutset is 0.10 percent.

Examination of the top 100 LRF cutsets yielded no additional severe accident mitigation design alternatives (SAMDA) candidates beyond those initially identified in ANP-10290, Revision 1, "AREVA NP Environmental Report Standard Design Certification," Table 3-1 . This is due to the comprehensive nature of the original SAMDA analysis, as it identified enhancements related to containment phenomena and containment bypass.

When the contribution from the containment failure due to an MSLB inside containment is removed, the Level 2 results for internal events, fire, and flooding are consistent.

Four containment failure mechanisms are found in the top 100 LRF cutsets:

- Early containment failure due to hydrogen flame acceleration.
- Steam generator tube rupture (SGTR) (pressure-induced or creep-induced).
- Interfacing system loss of coolant accidents (LOCAs).
- Containment isolation failures.

These phenomena are compared to the list of existing SAMDA candidates to evaluate if additional SAMDAs need to be considered.

Hydrogen Flame Acceleration

Containment failure due to hydrogen flame acceleration appears in more than 50 of the top 100 LRF cutsets. It is a dominant contributor to LRF, contributing approximately 40 percent to internal event LRF (see the Response to RAI 22, Supplement 3, Table 19-160-6), and approximately 80 percent to flood and fire LRF (see U.S. EPR FSAR Tier 2, Table 19.1-54 and Table 19.1-79).

The following SAMDA candidates from ANP-10290, Revision 1, Table 3-1 apply to containment failures due to hydrogen phenomena:

- Provide post-accident containment inerting capability (CP-07).
- Install an independent power supply to the hydrogen control system using either new batteries, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies, such as the security system diesel (CP-19).
- Install a passive hydrogen control system (CP-20).

SGTR

Containment bypass due to SGTR appears in approximately 40 of the top 100 LRF cutsets.

Initiating events “SGTR” and “induced SGTR” (i.e., pressure-induced tube ruptures prior to core damage) contribute to LRF, making up almost half of the internal event LRF (see the Response to RAI 22, Supplement 3, Table 19-160-5)

The following SAMDA candidates from ANP-10290, Revision 1,Table 3-1 apply to containment bypass due to SGTR:

- Institute maintenance practice to perform a 100 percent inspection of steam generator (SG) tubes during each refueling outage (CB-09).
- Replace SG with a new design (CB-10).
- Increase the pressure capacity of the secondary side so that a SGTR would not cause the relief values to lift (CB-11).
- Provide improved instrumentation to detect SGTRs, such as Nitrogen-16 monitors (CB-14).

- Route the discharge from the main steam safety valves (MSSVs) through a structure where a water spray would condense the steam and remove most of the fission products (CB-15).
- Install a reliable (closed loop) SG shell-side heat removal system that relies on natural circulation and stored water sources (CB-16).
- Revise emergency operating procedures (EOPs) to direct isolation of a faulted SG (CB-17).
- Direct SG flooding after an SGTR, prior to core damage (CB-18).
- Vent MSSVs in containment (CB-19).

Creep-induced SGTRs during severe accident sequences at high pressure contribute approximately 17 percent to LRF (see U.S. EPR FSAR Tier 2, Table 19.1-50 and Table 19.1-75). The following SAMDA candidates from ANP-10290, Revision 1, Table 3-1 specifically address reducing primary system pressure during severe accident sequences, which is the preferred method for arresting the mechanism of induced SGTR during high pressure core damage sequences:

- Install a redundant spray system to depressurize the primary system during an SGTR (CB-12).
- Proceduralize use of pressurizer vent valves during SGTR sequences (CB-13).

Interfacing System LOCA

Interfacing system loss of coolant accidents (ISLOCAs) appear in four of the top 100 LRF cutsets and are a small contributor to LRF (approximately three percent of the internal events LRF, see the Response to RAI 22, Supplement 3, Table 19-160-2).

The following SAMDA candidates from ANP-10290, Revision 1, Table 3-1 address the issues associated with interfacing system LOCA:

- Install additional pressure or leak monitoring instruments for detection of ISLOCAs (CB-01).
- Increase leak testing of valves in ISLOCA paths (CB-03).
- Locate residual heat removal (RHR) inside containment (CB-05).
- Ensure that ISLOCA releases are scrubbed by plugging drains in potential break areas so that break points will be covered with water (CB-06).
- Revise EOPs to improve ISLOCA identification (CB-07).
- Improve operator training on ISLOCA coping (CB-08).
- Install relief valves in the component cooling water system (CCWS) (CB-20).

Containment Isolation Failure

Containment isolation failures appear in four of the top 100 LRF cutsets and are a contributor to LRF. The Response to RAI 22, Supplement 3, Table 19-160-2 and U.S. EPR FSAR Tier 2, Table 19.1-50 and Table 19.1-75 show the containment isolation failures account for about eight percent of LRF for internal events, five percent of LRF from flooding events, and two percent of LRF for fire events.

The following SAMDA candidates from ANP-10290, Revision 1, Table 3-1 address containment isolation failure:

- Add redundant and diverse limit switches to each containment isolation valve (CIV) (CB-02).
- Install self-actuating CIVs (CB-04).

No additional SAMDA candidates were identified.

Conclusion

When evaluating the top 100 LRF cutsets, no additional SAMDA candidates were identified. Therefore, the list of SAMDA candidates provided in ANP-10290, Revision 1, Table 3-1 is a comprehensive list of SAMDA candidates for the U.S. EPR.

The reference to ANP-10290 will change from Revision 0 to Revision 1 in U.S. EPR FSAR Tier 2, Section 19.2.7 and U.S. EPR FSAR Tier 2, Table 1.6-1.

Response to Question 19-313 Part 4:

The screening for the SAMDA candidate, “Vent MSSVs in containment,” will be revised from “not applicable” to “excessive implementation cost” in ANP-10290, Revision 1.

U.S. EPR FSAR Tier 2, Section 19.2.6.4 will be revised to reflect this change in SAMDA candidate categorization.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 19.2.6.4, Section 19.2.7, and Table 1.6-1 will be revised as described in the response and as indicated on the enclosed markup.

Table 19-313-1—Release Category Frequency Vector

Release Category	Frequency
RC101	3.43E-07
RC201	4.98E-10
RC202	3.97E-14
RC203	1.92E-12
RC204	2.78E-11
RC205	4.08E-10
RC206	1.65E-08
RC301	1.67E-12
RC302	2.18E-11
RC303	2.30E-09
RC304	1.75E-08
RC401	1.38E-11
RC402	2.75E-10
RC403	6.82E-10
RC404	1.34E-08
RC501	5.92E-13
RC502	2.87E-10
RC503	6.01E-10
RC504	1.19E-07
RC602	6.50E-10
RC701	1.02E-08
RC702	5.38E-09
RC802	2.64E-10
Total	**5.3E-07**

Table 19-313-2—U.S. EPR Core Inventory in Curies and Becquerels

Radioisotope	Bounding Core Inventory (curies)	Bounding Core Inventory (becquerels)	Radioisotope	Bounding Core Inventory (curies)	Bounding Core Inventory (becquerels)
Kr-85	2.10E+06	**7.77E+16**	Te-132	1.98E+08	**7.33E+18**
Kr-85m	4.50E+07	**1.66E+18**	I-131	1.39E+08	**5.14E+18**
Kr-87	9.02E+07	**3.34E+18**	I-132	2.01E+08	**7.44E+18**
Kr-88	1.29E+08	**4.77E+18**	I-133	2.90E+08	**1.07E+19**
Rb-86	5.80E+05	**2.15E+16**	I-134	3.18E+08	**1.18E+19**
Sr-89	1.61E+08	**5.96E+18**	I-135	2.69E+08	**9.95E+18**
Sr-90	1.69E+07	**6.25E+17**	Xe-133	2.89E+08	**1.07E+19**
Sr-91	2.07E+08	**7.66E+18**	Xe-135	9.26E+07	**3.43E+18**
Sr-92	2.14E+08	**7.92E+18**	Cs-134	6.48E+07	**2.40E+18**
Y-90	1.79E+07	**6.62E+17**	Cs-136	1.61E+07	**5.96E+17**
Y-91	1.96E+08	**7.25E+18**	Cs-137	2.47E+07	**9.14E+17**
Y-92	2.14E+08	**7.92E+18**	Ba-139	2.62E+08	**9.69E+18**
Y-93	2.34E+08	**8.66E+18**	Ba-140	2.52E+08	**9.32E+18**
Zr-95	2.29E+08	**8.47E+18**	La-140	2.54E+08	**9.40E+18**
Zr-97	2.43E+08	**8.99E+18**	La-141	2.41E+08	**8.92E+18**
Nb-95	2.29E+08	**8.47E+18**	La-142	2.35E+08	**8.69E+18**
Mo-99	2.59E+08	**9.58E+18**	Ce-141	2.24E+08	**8.29E+18**
Tc-99m	2.27E+08	**8.40E+18**	Ce143	2.28E+08	**8.44E+18**
Ru-103	2.42E+08	**8.95E+18**	Ce-144	1.70E+08	**6.29E+18**
Ru-105	1.96E+08	**7.25E+18**	Pr-143	2.26E+08	**8.36E+18**
Ru-106	1.43E+08	**5.29E+18**	Nd-147	9.44E+07	**3.49E+18**
Rh-105	1.75E+08	**6.47E+18**	Np-239	3.82E+09	**1.41E+20**
Sb-127	1.80E+07	**6.66E+17**	Pu-238	1.46E+06	**5.40E+16**
Sb-129	4.85E+07	**1.79E+18**	Pu-239	6.14E+04	**2.27E+15**
Te-127	1.79E+07	**6.62E+17**	Pu-240	1.40E+05	**5.18E+15**
Te-127m	2.43E+06	**8.99E+16**	Pu-241	2.53E+07	**9.36E+17**
Te-129	4.78E+07	**1.77E+18**	Am-241	2.88E+04	**1.07E+15**
Te-129m	7.08E+06	**2.62E+17**	Cm-242	1.31E+07	**4.85E+17**
Te-131m	2.04E+07	**7.55E+17**	Cm-244	6.94E+06	**2.57E+17**

Table 19-313-3—MAAP Release Fractions (3 Sheets)

	ST1.8		ST1.8a		ST1.8b		ST1.8c		ST1.8f
Release Category	RC304	RC205	RC303	RC204	RC203	RC302	RC202	RC301	RC206
FREL(1)	9.78E-01	9.78E-01	9.47E-01	9.47E-01	8.87E-01	8.87E-01	7.93E-01	7.93E-01	1.85E-01
FREL(2)	5.71E-02	5.71E-02	2.76E-02	2.76E-02	5.31E-02	5.31E-02	2.35E-02	2.35E-02	5.61E-03
FREL(3)	2.89E-02	2.89E-02	1.57E-02	1.57E-02	2.40E-02	2.40E-02	1.20E-02	1.20E-02	7.65E-03
FREL(4)	4.05E-03	4.05E-03	1.68E-04	1.68E-04	1.37E-04	1.37E-04	2.44E-04	2.44E-04	1.24E-03
FREL(5)	9.81E-03	9.81E-03	5.33E-03	5.33E-03	6.75E-03	6.75E-03	3.44E-03	3.44E-03	7.25E-03
FREL(6)	3.63E-02	3.63E-02	1.64E-02	1.64E-02	2.80E-02	2.80E-02	1.46E-02	1.46E-02	4.98E-03
FREL(7)	6.08E-03	6.08E-03	3.17E-03	3.17E-03	2.21E-03	2.21E-03	2.38E-03	2.38E-03	4.20E-03
FREL(8)	2.96E-04	2.96E-04	1.45E-05	1.45E-05	1.50E-05	1.50E-05	1.87E-05	1.87E-05	5.49E-05
FREL(9)	5.32E-04	5.32E-04	6.21E-05	6.21E-05	2.36E-04	2.36E-04	6.79E-05	6.79E-05	1.80E-04
FREL(10)	9.33E-02	9.33E-02	3.59E-02	3.59E-02	1.58E-01	1.58E-01	1.99E-02	1.99E-02	8.99E-03
FREL(11)	4.44E-08	4.44E-08	2.43E-08	2.43E-08	8.53E-06	8.53E-06	1.46E-08	1.46E-08	5.13E-07
FREL(12)	1.17E-07	1.17E-07	6.46E-08	6.46E-08	2.63E-05	2.63E-05	1.62E-07	1.62E-07	3.42E-07

Table 19-313-3—MAAP Release Fractions (3 Sheets)

	ST1.10			ST1.10a			ST1.10b	
Release Category	RC503	RC504	RC101	RC501	RC502	RC602	RC402	RC404
FREL(1)	1.00E+00	1.00E+00	1.90E-03	9.93E-01	9.93E-01	9.93E-01	9.73E-01	9.73E-01
FREL(2)	4.09E-04	4.09E-04	2.42E-05	7.73E-04	7.73E-04	7.73E-04	2.03E-02	2.03E-02
FREL(3)	5.12E-05	5.12E-05	3.61E-05	5.29E-05	5.29E-05	5.29E-05	7.30E-03	7.30E-03
FREL(4)	8.45E-06	8.45E-06	8.45E-06	7.38E-06	7.38E-06	7.38E-06	3.82E-03	3.82E-03
FREL(5)	4.43E-05	4.43E-05	4.43E-05	4.36E-05	4.36E-05	4.36E-05	2.05E-03	2.05E-03
FREL(6)	6.94E-05	6.94E-05	2.00E-05	4.04E-04	4.04E-04	4.04E-04	1.04E-02	1.04E-02
FREL(7)	2.40E-05	2.40E-05	2.40E-05	2.42E-05	2.42E-05	2.42E-05	7.34E-03	7.34E-03
FREL(8)	2.83E-07	2.83E-07	2.83E-07	2.16E-07	2.16E-07	2.16E-07	1.14E-04	1.14E-04
FREL(9)	7.32E-07	7.32E-07	7.32E-07	7.03E-07	7.03E-07	7.03E-07	4.93E-04	4.93E-04
FREL(10)	6.13E-04	6.13E-04	5.25E-05	1.73E-02	1.73E-02	1.73E-02	1.23E-02	1.23E-02
FREL(11)	8.76E-06	8.76E-06	2.44E-08	1.11E-05	1.11E-05	1.11E-05	1.83E-05	1.83E-05
FREL(12)	2.45E-09	2.45E-09	2.45E-09	5.98E-09	5.98E-09	5.98E-09	1.22E-05	1.22E-05

Table 19-313-3—MAAP Release Fractions (3 Sheets)

	ST1.10c		ST1.11	ST2.3		ST3.2a
Release Category	RC401	RC403	RC201	RC702	RC701	RC802
FREL(1)	7.97E-01	7.97E-01	3.63E-01	1.09E-01	1.09E-01	9.76E-01
FREL(2)	4.57E-03	4.57E-03	1.03E-01	8.42E-02	4.21E-03	7.06E-01
FREL(3)	2.32E-03	2.32E-03	7.64E-03	1.15E-01	5.74E-03	6.43E-01
FREL(4)	2.70E-03	2.70E-03	7.85E-05	1.20E-02	6.00E-04	1.25E-01
FREL(5)	1.47E-03	1.47E-03	1.06E-03	9.60E-02	4.80E-03	5.69E-01
FREL(6)	2.34E-03	2.34E-03	9.55E-02	8.70E-02	4.35E-03	6.93E-01
FREL(7)	5.21E-03	5.21E-03	4.13E-04	5.45E-02	2.72E-03	3.80E-01
FREL(8)	7.99E-05	7.99E-05	3.37E-06	4.49E-04	2.25E-05	3.85E-03
FREL(9)	3.35E-04	3.35E-04	1.72E-05	2.24E-03	1.12E-04	2.22E-02
FREL(10)	3.36E-03	3.36E-03	9.58E-03	1.39E-01	6.94E-03	6.42E-01
FREL(11)	9.76E-07	9.76E-07	0.00E+00	4.51E-06	2.25E-07	2.09E-05
FREL(12)	6.14E-06	6.14E-06	0.00E+00	1.06E-06	5.30E-08	1.36E-05

Response to
Request for Additional Information No. 236, Supplement 1

Question 19-313

Appendix A

Top 100 LRF Cutsets

Statistic Description	Value
Analysis Case type	MCS Analysis Case
Analysis Case ID	#LARGE RELEASE
Description	large releases - level 2
Type of calculation	F
Min cut upper bound	1.3781E-08
1st order approximation	1.3782E-08
2nd order approximation	N/A
3rd order approximation	N/A
Cutoff error	5.2334E-10
Module MCS cutoff error	0.0000E+00
Demodularization cutoff error	5.2334E-10
Used cutoff for module MCS	0.0000E+00
Used cutoff for demodularization	1.4188E-14
Date & time	2008-10-07 16:37:56
BC Set used	
Cutoff type	Probabilistic
Input absolute cutoff value	1.0000E-20
Input relative cutoff value	1.0000E-06
Approximation	
Include CCF	No
Negated Event handling	Ignore ET success
Max no. of module MCS saved	0
Max no. of Basic Event MCS saved	100000
Gates	0
Basic Events	1948
CCF Events	1206
Modules	0
Gates in modularized tree	0
Primary Events in modularized tree	0
No. of boolean cutsets	0.00000E+0
No. of boolean cutsets in mod. tree	0.00000E+0
No. of module MCS > cutoff	0
No. of basic MCS evaluated	0.00000E+0
No. of basic MCS > cutoff	49669
No. of module MCS saved (binary)	0
No. of Basic Event MCS saved (binary)	54773
Run time (s)	0.00
MCS generation time (s)	0.00

Minimal Cutsets

Top Event frequency F = 1.378E-08

No.	Freq.	%	Event	Description
1	1.212E-09	8.79	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours
2	5.120E-10	3.72	IE FLD-ANN ALL	Initiator - Flood in the RB Annulus (Contained)
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			PROB ANNULUS	Probability that the connection boxes will withstand a flood in the Annulus
3	4.202E-10	3.05	IE FIRE-MS-VR	Initiator - Fire in One of Two MF/MS Valve Rooms With Spurious Opening of 1 MSRIV
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			MSIV TR3 ISO-FIRE	MSIV 3 Fails to Isolate Due to Fire in MS/FW Valve Room
			MSIV TR4 ISO-FIRE	MSIV 4 Fails to Isolate Due to Fire in MS/FW Valve Room
			OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours
4	4.032E-10	2.93	IE FIRE-MCR	Initiator - Fire in the Main Control Room
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPE-MCR-RSS-90M	Operator Fails to Transfer to the RSS in 90 Mins Given A MCR Fire
5	1.710E-10	1.24	IE FIRE-SAB-MECH	Initiator - Fire in the Pump Room of Any Safeguard Building
			L2CP SS2"DIAM	Level 2 conditional probability: Seal LOCA has 2" diameter
			L2PH ISGTR-SS2D=Y	Induced SGTR. 2" LOCA, secondary depressurized
			OPE-FCD-40M=Y	
			OPF-RCP-10M	Operator Fails to Trip RCPs on a Loss of Seal Injection
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
6	1.574E-10	1.14	IE SGTR	Initiator - Steam Generator Tube Rupture
			EFWS PM4	EFWS Train 4 Unavailable due to Preventive Maintenance
			LBA40AA002PFC	MSS, Train 4 Main Steam Isolation Valve LBA40AA002, Fails to Close on Demand
			OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours
7	1.355E-10	0.98	IE SGTR	Initiator - Steam Generator Tube Rupture
			EFWS PM4	EFWS Train 4 Unavailable due to Preventive Maintenance
			LBA43AA101EFC	MSS, Train 4 MSRCV LBA43AA101, Fails to Close on Demand
			OPD-RHR4H/SGTR1H	Dependency (MED) Between Operator Actions for Stabilizing SGTR and Initiating RHR
			OPF-SGTR-1H	Operator Fails to Isolate SGTR and Initiate Cooldown

No.	Freq.	%	Event	Description
8	1.284E-10	0.93	IE ISL-CVCS HPTR	Initiator - ISLOCA - Tube Rupture High Pressure Letdown Cooler
			L2CP ISL BL NO WATER	Level 2 conditional probability: break location not under water (ISL)
			OPD-RHR4H/ISLOCA	Dependency (MED) Between Operator Actions for Isolating ISLOCA and Initiating RHR
9	1.259E-10	0.91	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Start
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
10	1.186E-10	0.86	IE FIRE-SAB-MECH	Initiator - Fire in the Pump Room of Any Safeguard Building
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
11	1.185E-10	0.86	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance
12	1.185E-10	0.86	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA40GH001_FS	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Start on Demand
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance

No.	Freq.	%	Event	Description
13	1.140E-10	0.83	IE FIRE-SAB-MECH	Initiator - Fire in the Pump Room of Any Safeguard Building
			L2CP SS2"DIAM	Level 2 conditional probability: Seal LOCA has 2" diameter
			L2PH ISGTR-SS2D=Y	Induced SGTR. 2" LOCA, secondary depressurized
			OPE-FCD-40M=Y	
			OPF-RCP-30M	Operator Fails to Trip RCPs on a Loss of Bearing Cooling
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
14	1.065E-10	0.77	IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LBA13AA001PFO_D-ALL	CCF to Open Main Steam Relief Isolation Valves
			OPE-FB-40M	Operator Fails to Initiate Feed & Bleed for SLOCA
15	8.599E-11	0.62	IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)
			JNG13AA005CFO_D-ALL	CCF to Open LHSI/MHSI Common Injection Check Valves
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPE-FCD-40M=Y	
16	8.581E-11	0.62	IE SGTR	Initiator - Steam Generator Tube Rupture
			BRW70BUW71OFL	ELEC, 24V DC I&C Power Rack 34BRW70/34BUW71, Fails During Operation
			OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours
17	8.538E-11	0.62	IE FIRE-SAB14-AC	Initiator - Fire in Switchgear Room of Safeguard Building 1 (or 4)
			31BRA_____RFR	ELEC, 480V AC to 24V DC Rectifier for MCC 31BRA Control Power, Fails to Run
			CVCS VCT	CVCS Switchover to IRWST May Not Be Required
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPE-FB-40M=Y	
			PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling
18	8.538E-11	0.62	IE FIRE-SAB14-AC	Initiator - Fire in Switchgear Room of Safeguard Building 1 (or 4)
			32BRA_____RFR	ELEC, 480V AC to 24V DC Rectifier for MCC 32BRA Control Power, Fails to Run
			CVCS VCT	CVCS Switchover to IRWST May Not Be Required
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPE-FB-40M=Y	
			PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling
19	6.844E-11	0.50	IE SGTR	Initiator - Steam Generator Tube Rupture
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
			XKA30_____DFR	ELEC, Emergency Diesel Generator XKA30, Fails to Run

No.	Freq.	%	Event	Description
20	6.570E-11	0.48	IE SGTR	Initiator - Steam Generator Tube Rupture
			LBA13AA001PFO_D-ALL	CCF to Open Main Steam Relief Isolation Valves
			OPE-FB-90M	Operator Fails to Initiate Feed & Bleed for Transient
21	6.291E-11	0.46	IE LOMFW	Initiator - Total Loss of Main Feedwater
			L2PH INVREC(NR)=N	In vessel recovery phenomenological failure. Default, non-recoverable cases
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			STUCK ROD	Stuck Control Rods
22	6.139E-11	0.45	IE SGTR	Initiator - Steam Generator Tube Rupture
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			SAC31AN001EFR_D-ALL	CCF to Run Normal Air Exhaust Fans
23	6.139E-11	0.45	IE SGTR	Initiator - Steam Generator Tube Rupture
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			SAC01AN001EFR_D-ALL	CCF to Run Normal Air Supply Fans
24	6.078E-11	0.44	IE LOOP	Initiator - Loss Of Offsite Power
			BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
25	6.013E-11	0.44	IE FIRE-SAB14-AC	Initiator - Fire in Switchgear Room of Safeguard Building 1 (or 4)
			CCWS/ESWS PM2	CCWS/ESWS Train 2 Pump Unavailable due to Preventive Maintenance
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LOOPFCSD+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for Fire IEs Leading to a Controlled Shutdn
			OPE-FB-40M=Y	
			OPF-XTDIV-NSC	Operator Fails to Xtie Division 1 to Division 2 or Division 4 to Divison 3 During Non-SBO Conditions
			PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling
26	5.822E-11	0.42	IE FIRE-SAB-MECH	Initiator - Fire in the Pump Room of Any Safeguard Building
			L2CP SS0.6"DIAM	Level 2 conditional probability: Seal LOCA has 0.6" diameter
			L2PH ISGTR-SS0.6D=Y	Induced SGTR occurs. 0.6" LOCAs, secondary side depressurised
			OPE-FCD-40M=Y	
			OPF-RCP-10M	Operator Fails to Trip RCPs on a Loss of Seal Injection
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
27	5.320E-11	0.39	IE LOC	Initiator - Loss of Main Condenser (Includes MSIV Closure etc.)
			L2PH INVREC(NR)=N	In vessel recovery phenomenological failure. Default, non-recoverable cases
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			STUCK ROD	Stuck Control Rods

No.	Freq.	%	Event	Description
28	5.180E-11	0.38	IE ISL-CVCS REDS	Initiator - ISLOCA - Spurious Opening of Reducing Station
			L2CP ISL BL NO WATER	Level 2 conditional probability: break location not under water (ISL)
			OPD-RHR4H/ISLOCA	Dependency (MED) Between Operator Actions for Isolating ISLOCA and Initiating RHR
29	4.959E-11	0.36	IE FLD-SAB14 FB	Initiator - Flood in Safeguard Building 1 or 4 (Pump Room) Including Fuel Building
			L2CP SS2"DIAM	Level 2 conditional probability: Seal LOCA has 2" diameter
			L2PH ISGTR-SS2D=Y	Induced SGTR. 2" LOCA, secondary depressurized
			OPE-FCD-40M=Y	
			OPF-RCP-10M	Operator Fails to Trip RCPs on a Loss of Seal Injection
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
30	4.674E-11	0.34	IE SGTR	Initiator - Steam Generator Tube Rupture
			LAS41AP001EFR	EFWS, Train 4 Motor Driven Pump LAS41AP001, Fails to Run
			LBA40AA002PFC	MSS, Train 4 Main Steam Isolation Valve LBA40AA002, Fails to Close on Demand
			OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours
31	4.666E-11	0.34	IE SGTR	Initiator - Steam Generator Tube Rupture
			CLH22EQ021LD21SM	Backplane (half of subrack SBG6) fails (self-monitored)
			OPD-RHR4H/SGTR4H	Dependency (LOW) Between Operator Actions for Isolating SG Blowdown Lines and Initiating RHR
			OPF-SGTR-4H	Operator Fails to Isolate Blowdown Line for SGTR
32	4.666E-11	0.34	IE SGTR	Initiator - Steam Generator Tube Rupture
			CLH22EQ011LD11SM	Backplane (half of subrack SBG6) fails (self-monitored)
			OPD-RHR4H/SGTR4H	Dependency (LOW) Between Operator Actions for Isolating SG Blowdown Lines and Initiating RHR
			OPF-SGTR-4H	Operator Fails to Isolate Blowdown Line for SGTR
33	4.585E-11	0.33	IE SGTR	Initiator - Steam Generator Tube Rupture
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-XTDIVSBO-2H	Operator Fails to Xtie Division 1 to Division 2 or Division 4 to Divison 3 During SBO Considitions
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
34	4.454E-11	0.32	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			LBA13AA001PFO_D-ALL	CCF to Open Main Steam Relief Isolation Valves
35	4.268E-11	0.31	IE FIRE-SAB-MECH	Initiator - Fire in the Pump Room of Any Safeguard Building
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LOOPFCSD+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for Fire IEs Leading to a Controlled Shutdn
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance

No.	Freq.	%	Event	Description
36	4.143E-11	0.30	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC OSP 2-7H	Offsite power not recovered between 2 and 7 hours
			L2 REC=Y OSP 7-31H	Offsite power recovered between 7 and 31 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Start
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
37	4.127E-11	0.30	IE GT	Initiator - General Transient (Includes Turbine Trip and Reactor Trip)
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Start
38	4.023E-11	0.29	IE SGTR	Initiator - Steam Generator Tube Rupture
			LAS41AP001EFR	EFWS, Train 4 Motor Driven Pump LAS41AP001, Fails to Run
			LBA43AA101EFC	MSS, Train 4 MSRCV LBA43AA101, Fails to Close on Demand
			OPD-RHR4H/SGTR1H	Dependency (MED) Between Operator Actions for Stabilizing SGTR and Initiating RHR
			OPF-SGTR-1H	Operator Fails to Isolate SGTR and Initiate Cooldown
39	4.009E-11	0.29	IE FIRE-SAB14-AC	Initiator - Fire in Switchgear Room of Safeguard Building 1 (or 4)
			EDG PM2	EDG Train 2 Unavailable due to Preventive Maintenance
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LOOPFCSD+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for Fire IEs Leading to a Controlled Shutdn
			OPE-FB-40M=Y	
			OPF-XTDIV-NSC	Operator Fails to Xtie Division 1 to Division 2 or Division 4 to Divison 3 During Non-SBO Conditions
			PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling
40	3.898E-11	0.28	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC OSP 2-7H	Offsite power not recovered between 2 and 7 hours
			L2 REC=Y OSP 7-31H	Offsite power recovered between 7 and 31 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA40GH001_FS	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Start on Demand
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance

No.	Freq.	%	Event	Description
41	3.898E-11	0.28	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC OSP 2-7H	Offsite power not recovered between 2 and 7 hours
			L2 REC=Y OSP 7-31H	Offsite power recovered between 7 and 31 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance
42	3.883E-11	0.28	IE GT	Initiator - General Transient (Includes Turbine Trip and Reactor Trip)
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance
43	3.883E-11	0.28	IE GT	Initiator - General Transient (Includes Turbine Trip and Reactor Trip)
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA40GH001_FS	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Start on Demand
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
44	3.882E-11	0.28	IE FIRE-SAB-MECH	Initiator - Fire in the Pump Room of Any Safeguard Building
			L2CP SS0.6"DIAM	Level 2 conditional probability: Seal LOCA has 0.6" diameter
			L2PH ISGTR-SS0.6D=Y	Induced SGTR occurs. 0.6" LOCAs, secondary side depressurised
			OPE-FCD-40M=Y	
			OPF-RCP-30M	Operator Fails to Trip RCPs on a Loss of Bearing Cooling
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
45	3.726E-11	0.27	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			LAS11AP001EFR_D-123	CCF of EFWS Pumps to Run
46	3.631E-11	0.26	IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			MSRIVSCPFO_P-ALL	CCF to Open Main Steam Relief Isolation Pneumatic Pilot Valves
			OPE-FB-40M	Operator Fails to Initiate Feed & Bleed for SLOCA

No.	Freq.	%	Event	Description
47	3.563E-11	0.26	IE SGTR	Initiator - Steam Generator Tube Rupture
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
			XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run
48	3.450E-11	0.25	IE ISL-SIS LHSI	Initiator - ISLOCA - Break in LHSI Cold Leg Inj. CV with LHSI Line Break in Respective SAB
			L2CP ISL BL NO WATER	Level 2 conditional probability: break location not under water (ISL)
49	3.450E-11	0.25	IE ISL-SIS MHSI	Initiator - ISLOCA - Break in MHSI Cold Leg Injection CV with MHSI Line Break in Respective SAB
			L2CP ISL BL NO WATER	Level 2 conditional probability: break location not under water (ISL)
50	3.438E-11	0.25	IE FLD-SAB14 FB	Initiator - Flood in Safeguard Building 1 or 4 (Pump Room) Including Fuel Building
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
51	3.422E-11	0.25	IE SGTR	Initiator - Steam Generator Tube Rupture
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			OPF-XTDIV-NSC	Operator Fails to Xtie Division 1 to Division 2 or Division 4 to Divison 3 During Non-SBO Conditions
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance
			XKA20_____DFR	ELEC, Emergency Diesel Generator XKA20, Fails to Run
52	3.332E-11	0.24	IE LBOP	Initiator - Loss of Balance of Plant - Closed Loop Cooling Water or Aux Cooling Water
			L2PH INVREC(NR)=N	In vessel recovery phenomenological failure. Default, non-recoverable cases
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			STUCK ROD	Stuck Control Rods
53	3.306E-11	0.24	IE FLD-SAB14 FB	Initiator - Flood in Safeguard Building 1 or 4 (Pump Room) Including Fuel Building
			L2CP SS2"DIAM	Level 2 conditional probability: Seal LOCA has 2" diameter
			L2PH ISGTR-SS2D=Y	Induced SGTR. 2" LOCA, secondary depressurized
			OPE-FCD-40M=Y	
			OPF-RCP-30M	Operator Fails to Trip RCPs on a Loss of Bearing Cooling
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance

No.	Freq.	%	Event	Description
54	3.283E-11	0.24	IE FIRE-MS-VR	Initiator - Fire in One of Two MF/MS Valve Rooms With Spurious Opening of 1 MSRIV
			L2PH VECF-FA(HL)	Very early flame acceleration loads fail containment following induced Hot Leg Rupture
			MSIV TR3 ISO-FIRE	MSIV 3 Fails to Isolate Due to Fire in MS/FW Valve Room
			MSIV TR4 ISO-FIRE	MSIV 4 Fails to Isolate Due to Fire in MS/FW Valve Room
			OPE-RHR-4H	Operator Fails to Initiate RHR Within 4 Hours
55	3.200E-11	0.23	IE FLD-ANN ALL	Initiator - Flood in the RB Annulus (Contained)
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			OPF-L2-CI-30M	Operators fails to initiate manual Containment Isolation Signal
			PROB ANNULUS	Probability that the connection boxes will withstand a flood in the Annulus
			PROB KLA10/20 OP	Probability that tje Containment Sweep Vent System Small Flow Lines are Open
56	3.074E-11	0.22	IE SGTR	Initiator - Steam Generator Tube Rupture
			LBA13AA001PFO_D-123	CCF to Open Main Steam Relief Isolation Valves
			OPE-FB-90M	Operator Fails to Initiate Feed & Bleed for Transient
57	2.951E-11	0.21	IE SGTR	Initiator - Steam Generator Tube Rupture
			LAS31AP001EFR	EFWS, Train 3 Motor Driven Pump LAS31AP001, Fails to Run
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
58	2.950E-11	0.21	IE SGTR	Initiator - Steam Generator Tube Rupture
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10AP107EFR_D-ALL	CCF of SCWS Pumps to Run
59	2.760E-11	0.20	IE FIRE-SAB14-AC	Initiator - Fire in Switchgear Room of Safeguard Building 1 (or 4)
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LOOPFCSD+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for Fire IEs Leading to a Controlled Shutdn
			OPE-FB-40M=Y	
			OPF-XTDIV-NSC	Operator Fails to Xtie Division 1 to Division 2 or Division 4 to Divison 3 During Non-SBO Conditions
			PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling
			XKA20_____DFR	ELEC, Emergency Diesel Generator XKA20, Fails to Run
60	2.656E-11	0.19	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			KAA12AA005EFO_D-ALL	CCF to Open CCWS to LHSI HTX Cooling MOV
61	2.620E-11	0.19	IE SGTR	Initiator - Steam Generator Tube Rupture
			EFWS PM1	EFWS Train 1 Unavailable due to Preventive Maintenance
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			XKA10_____DFR_D-ALL	CCF of EDGs to Run

No.	Freq.	%	Event	Description
62	2.620E-11	0.19	IE SGTR	Initiator - Steam Generator Tube Rupture
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			SBODG5 PM1	SBO-DG Train 1 Unavailable due to Preventive Maintenance
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
63	2.408E-11	0.17	IE SGTR	Initiator - Steam Generator Tube Rupture
			CCWS/ESWS PM3	CCWS/ESWS Train 3 Pump Unavailable due to Preventive Maintenance
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand
64	2.287E-11	0.17	IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)
			CL-PS-B-SWCCF	SW CCF of Protection System diversity group B
			OPD-L2-CIH	Dependent operator failure to close containment isolation valves
			OPE-FCD-40M	Operator Fails to Initiate Fast Cooldown for SLOCA
			PROB KLA10/20 OP	Probability that tje Containment Sweep Vent System Small Flow Lines are Open
65	2.239E-11	0.16	IE SGTR	Initiator - Steam Generator Tube Rupture
			MSRIVSCPFO_P-ALL	CCF to Open Main Steam Relief Isolation Pneumatic Pilot Valves
			OPE-FB-90M	Operator Fails to Initiate Feed & Bleed for Transient
66	2.224E-11	0.16	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			PED10AN002EFS_D-ALL	CCF to Start Standby Cooling Tower Fans
67	2.084E-11	0.15	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			LBA13AA001PFO_D-123	CCF to Open Main Steam Relief Isolation Valves
68	2.074E-11	0.15	IE LOOP	Initiator - Loss Of Offsite Power
			BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2CP SS2"DIAM	Level 2 conditional probability: Seal LOCA has 2" diameter
			L2PH ISGTR-SS2D=Y	Induced SGTR. 2" LOCA, secondary depressurized
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
69	2.067E-11	0.15	IE FIRE-SAB14-AC	Initiator - Fire in Switchgear Room of Safeguard Building 1 (or 4)
			CVCS VCT	CVCS Switchover to IRWST May Not Be Required
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			LBA13AA001PFO_D-ALL	CCF to Open Main Steam Relief Isolation Valves
			OPE-FB-40M=Y	
			PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling

No.	Freq.	%	Event	Description
70	2.007E-11	0.15	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
			XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run
			XKA80_____DFR	ELEC, SBO Diesel Generator XKA80, Fails to Run
71	2.000E-11	0.15	IE LOOP	Initiator - Loss Of Offsite Power
			BTD01_BAT__ST_D-ALL	CCF of Safety Related Batteries on Demand
			L2 REC OSP 2-7H	Offsite power not recovered between 2 and 7 hours
			L2 REC=Y OSP 7-31H	Offsite power recovered between 7 and 31 hours
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
72	1.955E-11	0.14	IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)
			KAA12AA005EFO_D-ALL	CCF to Open CCWS to LHSI HTX Cooling MOV
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			SAHR PM4	SAHR Train Unavailable due to Preventive Maintenance
73	1.913E-11	0.14	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand
			QKA40GH001_FS	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Start on Demand
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
74	1.812E-11	0.13	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FR_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Run
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours

No.	Freq.	%	Event	Description
75	1.809E-11	0.13	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC OSP 2-7H	Offsite power not recovered between 2 and 7 hours
			L2 REC OSP 7-31H	Offsite power not recovered between 7 and 31 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Start
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
76	1.705E-11	0.12	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FR	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Run
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance
77	1.705E-11	0.12	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA40GH001_FR	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Run
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
78	1.702E-11	0.12	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC OSP 2-7H	Offsite power not recovered between 2 and 7 hours
			L2 REC OSP 7-31H	Offsite power not recovered between 7 and 31 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA40GH001_FS	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Start on Demand
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance

No.	Freq.	%	Event	Description
79	1.702E-11	0.12	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC OSP 2-7H	Offsite power not recovered between 2 and 7 hours
			L2 REC OSP 7-31H	Offsite power not recovered between 7 and 31 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance
80	1.688E-11	0.12	IE FLD-SAB14 FB	Initiator - Flood in Safeguard Building 1 or 4 (Pump Room) Including Fuel Building
			L2CP SS0.6"DIAM	Level 2 conditional probability: Seal LOCA has 0.6" diameter
			L2PH ISGTR-SS0.6D=Y	Induced SGTR occurs. 0.6" LOCAs, secondary side depressurised
			OPE-FCD-40M=Y	
			OPF-RCP-10M	Operator Fails to Trip RCPs on a Loss of Seal Injection
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			PAS	Proccess Automation System (PAS) Fails (Estimate)
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
81	1.647E-11	0.12	IE SLBI	Initiator - Steam Break Inside Containment
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH ISGTR-TRD=N	No induced SGTR. Transients with secondary depressurized
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			SAC01AN001EFR_D-ALL	CCF to Run Normal Air Supply Fans
82	1.647E-11	0.12	IE SLBI	Initiator - Steam Break Inside Containment
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH ISGTR-TRD=N	No induced SGTR. Transients with secondary depressurized
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			SAC31AN001EFR_D-ALL	CCF to Run Normal Air Exhaust Fans
83	1.637E-11	0.12	IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			PED10AN002EFS_D-ALL	CCF to Start Standby Cooling Tower Fans
			SAHR PM4	SAHR Train Unavailable due to Preventive Maintenance
84	1.606E-11	0.12	IE SGTR	Initiator - Steam Generator Tube Rupture
			EDG PM3	EDG Train 3 Unavailable due to Preventive Maintenance
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand

No.	Freq.	%	Event	Description
85	1.606E-11	0.12	IE SGTR	Initiator - Steam Generator Tube Rupture
			EFWS PM3	EFWS Train 3 Unavailable due to Preventive Maintenance
			LOOPCON+REC	Consequential LOOP and Failure of Recovery Within 1 Hour for IEs Leading to Auto Scram
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FS	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Start on Demand
86	1.590E-11	0.12	IE LOOP	Initiator - Loss Of Offsite Power
			34BTD01_BATST	ELEC, 250V 1E 2-hr Battery 34BTD01, Fails on Demand
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
87	1.590E-11	0.12	IE LOOP	Initiator - Loss Of Offsite Power
			31BTD01_BATST	ELEC, 250V 1E 2-hr Battery 31BTD01, Fails on Demand
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance
88	1.518E-11	0.11	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			MSRIVSCPFO_P-ALL	CCF to Open Main Steam Relief Isolation Pneumatic Pilot Valves
89	1.476E-11	0.11	IE LOOP	Initiator - Loss Of Offsite Power
			EFWS PM1	EFWS Train 1 Unavailable due to Preventive Maintenance
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
			XKA80_____DFR	ELEC, SBO Diesel Generator XKA80, Fails to Run

No.	Freq.	%	Event	Description
90	1.476E-11	0.11	IE LOOP	Initiator - Loss Of Offsite Power
			EFWS PM4	EFWS Train 4 Unavailable due to Preventive Maintenance
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
			XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run
91	1.476E-11	0.11	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SBODG8 PM4	SBO-DG Train 4 Unavailable due to Preventive Maintenance
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
			XKA50_____DFR	ELEC, SBO Diesel Generator XKA50, Fails to Run
92	1.476E-11	0.11	IE LOOP	Initiator - Loss Of Offsite Power
			L2 REC=Y OSP 2-7H	Offsite power recovered between 2 and 7 hours
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			REC OSP 2HR	Failure to Recover Offsite Power Within 2 Hours
			SBODG5 PM1	SBO-DG Train 1 Unavailable due to Preventive Maintenance
			XKA10_____DFR_D-ALL	CCF of EDGs to Run
			XKA80_____DFR	ELEC, SBO Diesel Generator XKA80, Fails to Run
93	1.435E-11	0.10	IE SLOCA	Initiator - Small LOCA (0.6 to 3-Inch Diameter)
			CL-PS-B-SWCCF	SW CCF of Protection System diversity group B
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPE-FCD-40M	Operator Fails to Initiate Fast Cooldown for SLOCA
94	1.417E-11	0.10	IE FIRE-SAB14-AC	Initiator - Fire in Switchgear Room of Safeguard Building 1 (or 4)
			CVCS VCT	CVCS Switchover to IRWST May Not Be Required
			KAA12AA005EFO_D-ALL	CCF to Open CCWS to LHSI HTX Cooling MOV
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			PROB SEAL LOCA	Probability of Seal LOCA Occurring Given a Loss of Seal Cooling
95	1.362E-11	0.10	IE FIRE-SWGR	Initiator - Fire in the Switchgear Building
			L2PH CPIHLR-TR,TP=Y	Induced hot leg rupture. Conditional probability given no ISGTR. TR, TRD, TP, TPD cases.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FR_B-ALL	CCF of the Air Cooled SCWS Chiller Units to Run
96	1.359E-11	0.10	IE IND SGTR	Initiator - Induced Steam Generator Tube Rupture
			LAS11AP001EFS_D-ALL	CCF of EFWS Pumps to Start

No.	Freq.	%	Event	Description
97	1.349E-11	0.10	IE FIRE-SWGR	Initiator - Fire in the Switchgear Building
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA10GH001_FR	SCWS, Train 1 Chiller Unit QKA10GH001, Fails to Run
			SAC03/QKA30 PM3	Normal SAC03/QKA30 Train Unavailable due to Preventive Maintenance
98	1.349E-11	0.10	IE FIRE-SWGR	Initiator - Fire in the Switchgear Building
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA40GH001_FR	SCWS, Train 4 Chiller Unit QKA40GH001, Fails to Run
			SAC02/QKA20 PM2	Normal SAC02/QKA20 Train Unavailable due to Preventive Maintenance
99	1.349E-11	0.10	IE FIRE-SWGR	Initiator - Fire in the Switchgear Building
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA30GH001_FR	SCWS, Train 3 Chiller Unit QKA30GH001, Fails to Run
			SAC01/QKA10 PM1	Normal SAC01/QKA10 Train Unavailable due to Preventive Maintenance
100	1.349E-11	0.10	IE FIRE-SWGR	Initiator - Fire in the Switchgear Building
			L2PH LOCA-DEPRESS=N	Level 2 phenomena. Small LOCA remains at high pressure.
			L2PH VECF-FA(H)	Very early containment failure due to H2 Flame Acceleration (Hi pressure sequences)
			OPF-SAC-2H	Operator Fails to Recover Room Cooling Locally
			QKA20GH001_FR	SCWS, Train 2 Chiller Unit QKA20GH001, Fails to Run
			SAC04/QKA40 PM4	Normal SAC04/QKA40 Train Unavailable due to Preventive Maintenance

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Table 1.6-1—Reports Referenced
Sheet 2 of 4

Report No. (See Notes 1, 2, and 3)	Title	Date Submitted to NRC	FSAR Section Number(s)
ANP-10285P ANP-10285NP	U.S. EPR Fuel Assembly Mechanical Design Topical Report	10/02/07	4
ANP-10286P ANP-10286NP	U.S. EPR Rod Ejection Accident Methodology Topical Report	11/20/07	4.3 and 15
ANP-10287P ANP-10287NP	Incore Trip Setpoint and Transient Methodology for U.S. EPR Topical Report	11/27/07	4, 6, 7, and 15
ANP-10288P ANP-10288NP	U.S. EPR Post-LOCA Boron Precipitation and Boron Dilution Technical Report	12/6/07	15
ANP-10290, Revision 1	AREVA NP Environmental Report Standard Design Certification	12/6/07	19.2
ANP-10291P ANP-10291NP	Small Break LOCA and Non-LOCA Sensitivity Studies and Methodology Technical Report	5/09	15
ANP-10292, Revision 1	U.S. EPR Conformance with Standard Review Plan (NUREG-0800) Technical Report	5/09	1.9
ANP-10293	U.S. EPR Design Features to Address GSI-191 Technical Report	2/08	15.6.5.4.3
ANP-10294, Revision 1	U.S. EPR Reactor Coolant Pump Motor Flywheel Structural Analysis Technical Report	3/09	5.4.1.6.6
ANP-10304	U.S. EPR Instrumentation and Control Diversity and Defense in Depth Methodology Technical Report	5/09	
BAW-10132-A	Analytical Methods Description – Reactor Coolant System Hydrodynamic Loadings During a Loss-of-Coolant Accident	7/20/79	App. 3C
BAW-10133P-A BAW-10133-A Revision 1, Addendum 1 and 2	Mark-C Fuel Assembly LOCA-Seismic Analysis	10/30/00	4.2
BAW-10147P-A, BAW-10147-A Revision 1	Fuel Rod Bowing in Babcock & Wilcox Fuel Designs	6/28/83	4.2, 4.4

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training enhancements that could offer a potential risk reduction at a fraction of the cost of safety-related modifications.

- Very Low Benefit: If a SAMDA is related to a non-risk-significant system for which change in reliability is known to have negligible impact on the risk profile, it is deemed to have a very low benefit and is not retained. There are two ways to determine the risk impact for the U.S. EPR:
  - A PRA Level 1 importance list is used to determine if a given system is risk significant for the U.S. EPR. If a SAMDA candidate is associated with a system that is not included on the importance list, it can be concluded that the design alternative would have a negligible impact on the risk profile, and it is not retained.
  - If a SAMDA candidate can be shown to have a minimal impact on CDF, it is not retained.
- Not Required for Design Certification: Evaluation of any potential procedural or surveillance action SAMDA enhancements are not appropriate until the plant design is finalized and the plant procedures are being developed. If a SAMDA candidate is related to any of these enhancements, it is not retained for this analysis.
- Considered for Further Evaluation: Following the screening process, if a particular SAMDA is not categorized by any of the preceding categories, the SAMDA is considered for further evaluation and is subject to a cost-benefit analysis.

19.2.6.4 Risk Reduction Potential of Design Improvements

A total of 167 SAMDAs developed from industry and U.S. EPR documents were evaluated in this analysis.

- Twenty-one candidate SAMDAs were Not Applicable to the U.S. EPR design.
- Sixty-seven candidate SAMDAs were Already Implemented in the U.S. EPR design either as suggested in the SAMDA or an equivalent replacement that fulfilled the intent of the SAMDA. These are summarized in Table 19.2-5—SAMDA Candidates - Already Implemented.
- Four candidate SAMDAs were Combined with another SAMDA because they had the same intent.

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- Twenty-~~three~~four candidate SAMDAs were categorized as Excessive Implementation Cost.
- One candidate SAMDA was categorized as Very Low Benefit.
- Fifty~~-one~~ candidate SAMDAs were categorized as Not Required for Design Certification because they were related to procedural and surveillances actions.

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