
REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.: 434-8352
SRP Section: SRP 19
Application Section: 19.1
Date of RAI Issue: 03/08/2015

Question No. 19-94

10 CFR 52.47(a)(27) states that a design certification (DC) application must contain an FSAR that includes a description of the design-specific PRA and its results. As discussed in Standard Review Plan (SRP) Chapter 19.0, draft Revision 3, Section I "Areas of Review," the NRC expects that, generally, the information that it needs to perform its review of an application from a PRA perspective is that information contained in the applicant's FSAR Chapter 19. The staff should issue a request for additional information (RAI) and conduct audits of the complete PRA (e.g., models, analyses, data, and codes) to obtain clarifying information as needed. The staff will document any NRC audits performed in audit reports so that they may be referenced in the staff's safety evaluation report (SER).

During the review of APR1400 DCD, Revision 0, and the regulatory audit (conducted from April 15, 2015 through October 15, 2015) of PRA, severe accident (SA) evaluation, and reliability assurance program (RAP), the staff has found inconsistencies with information in the DCD and audited documents and discussed these concerns at public meetings and teleconferences. In its responses, KHNP committed to revise the APR 1400 PRA notebook(s) to be consistent with the information provided in the DCD. These actions are documented in the PRA/SA/RAP tracking list (ADAMS ML15292A030), which contains proprietary information.

Therefore, in order for the staff to complete its review of the APR1400 DC application and to reach a reasonable assurance finding, the staff requests that KHNP revise the PRA notebooks or DCD, as committed during the PRA/SA/RAP regulatory audit, for the following tracking list items:

- a) PRA-140 - The Level 2 At-power internal flooding information.
- b) PRA-190 - The hydrogen control system notebook regarding the operations of passive autocatalytic recombiners during Modes 1 through 6.
- c) PRA-218 - Notebook "APR1400-K-P-NR-013602-P," Event 5 branch split fraction.

- d) PRA-219 - The core damage frequency (CDF) and large release frequency (LRF) values in notebook APR1400-K-P-NR-013604-P.

Response - (Rev. 1)

- a) The results of at-power Level 2 internal flooding are included in Full Power Level 2 PRA - Quantification Notebook (APR1400-K-P-NR-013604-P, Rev.0A). However the current results are revised because it included outdated information (See Attachment 1).

Note: Attachment 1 is placed in the electronic reading room.

- b) DCD Section 16 did not include the TS item for PARs, so Section 4.3 of the Full Power Level 1 PRA - Hydrogen Control System Notebook (APR1400-K-P-NR-013223-P, Rev. 0) is revised (See Attachment 2).

Note: Attachment 2 (APR1400-K-P-NR-013223-P, Rev. 0A) is placed in the electronic reading room.

- c) The correct value is 9.786E-01, and the CET /DET Analysis notebook (APR1400-K-P-013602-P, Rev. 0) is revised to reflect the correct value (See Attachment 3).

Note: Attachment 3 (APR1400-K-P-NR-013602-P, Rev. 0A) is placed in the electronic reading room.

- d) The total PDS frequencies for Internal Flooding Events and Internal Fire Events are 4.24E-7/ry and 2.06E-6/ry and the LRF for Internal Flooding Events and Internal Fire Events are 3.07E-08/ry and 1.68E-07/yr in Full Power Level 2 PRA-Quantification Notebook (APR1400-K-P-NR-013604-P, Rev.0).

- e) The PDS frequencies for Internal Flooding Events and Internal Fire Events were not included in DCD 19.1. And the LRF for Internal Flooding Events and Internal Fire Events are 1.7E-8/yr (Section 19.1.5.3.2) and 1.7E-7/yr (19.1.5.2.2) in DCD 19.1.

The summary of results is as follows;

	Large Release Frequency (LRF)	
	Level 2 PRA Notebook (APR1400-K-P-NR-013606-P)	DCD 19.1
Internal Events PRA	1.11E-07	1.1E-07 (19.1.4.2.2.1)
Internal Fire PRA	1.68E-07	1.7E-7 (19.1.5.2.2)
Internal Flooding PRA	3.07E-8	1.7E-8 (19.1.5.3.2)

The LRF for Internal Flooding Events in DCD 19.1.5.3.2 is the correct values, thus the LRF for Internal Flooding Events in the Full Power Level 2 PRA-Quantification Notebook (APR1400-K-P-NR-013604-P, Rev.0) should be revised (See Attachment 1).

Note: Attachment 1 (APR1400-K-P-NR-013604-P, Rev.0A) is placed in the electronic reading room.

In addition, Table 19.1-27 (Frequency of PDS and Dominant PDS ET sequences) in DCD 19.1 Rev.0 is incorrect and needs to be corrected. It will be revised to address the information of each relevant Level 1 core damage sequence for each PDS ET sequence (See Attachment 4).

The Full Power Level 2 PRA - Quantification Notebook (APR1400-K-P-NR-013604-P, Rev.0), Full Power Level 1 PRA - Hydrogen Control System Notebook (of APR1400-K-P-NR-013223-P, Rev. 0) and CET/DET Analysis notebook (APR1400-K-P-013602-P, Rev. 0) will be revised as stated in the response.

Impact on DCD

The DCD will be revised as shown in Attachment 4.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environment Report.

APR1400 DCD TIER 2

Replace with "A"

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Table 19.1-27

Frequency of PDS and Dominant PDS ET Sequences

Rank	PDS No.	Frequency (/yr)	Fraction (%)	Cumulative (%)	Contribution	
					PDS ET Sequences	Fraction (%)
1	14	3.12E-07	29.2	29.2	SBO sequence 03 LOOP sequence 03	34.7 13.4
2	8	2.68 E-07	25.1	54.4	LOOP sequence 18 GTRN sequence 26	32.0 31.9
3	13	9.96 E-08	9.3	63.7	RVR sequence 01 LOOP sequence 08	30.7 16.4
4	98	7.55E-08	7.1	70.8	LOOP sequence 26 GTRN sequence 36	60.4 19.8
5	103	4.19E-08	3.9	74.7	ATWS sequence 73 ATWS sequence 60	93.1 6.9
6	2	3.77E-08	3.5	78.2	LSSB-D sequence 62 ATWS sequence 43	59.4 15.2
7	7	3.59E-08	3.4	81.6	MLOCA sequence 02 LLOCA sequence 02	99.7 0.3
8	9	3.51E-08	3.3	84.9	GRID-SBO sequence 03 LOOP sequence 19	39.3 29.5
9	1	3.37E-08	3.2	88.1	SGTR sequence 08 SGTR sequence 10	60.8 10.9
10	17	2.70E-08	2.5	90.6	SBO sequence 05 LOOP sequence 05	70.6 16.7
11	18	2.51E-08	2.4	93.0	SBO sequence 38 SBO sequence 105	67.3 24.0
12	106	1.13E-08	1.0	94.0	LOOP sequence 31 TLOCCW sequence 09 TLOESW sequence 09	35.3 30.9 30.9
13	100	8.63E-09	0.8	94.8	LOOP sequence 27 GRID-SBO sequence 11	71.5 28.4
14	35	5.95E-09	0.6	95.4	SBO sequence 57 SBO sequence 04	51.8 23.4

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Table 19.1-27

Frequency of PDS and Dominant PDS ET Sequences

Rank	PDS No.	Frequency (yr)	Fraction (%)	Cumulative (%)	Contribution		Relative Level 1 Sequences
					PDS ET Sequences	Fraction (%)	
1	14	4.02E-07	30.6	30.6	PLOCCW seq. 17 PLOESW seq. 17	26.9 15.5	PLOCCW seq. 07 PLOESW seq. 07
2	7	2.11E-07	16.1	46.7	MLOCA seq. 2 SBO seq. 21 LOOP seq. 3	52.1 29.8 13.6	MLOCA seq. 02 SBO seq. 04 LOOP seq. 03
3	8	1.54E-07	11.7	58.4	LOOP seq. 14 SGTR seq. 15	41.8 9.5	LOOP seq. 03 SGTR seq. 09
4	86	1.19E-07	9.1	67.5	LOOP seq. 22 GRID-LOOP seq. 22	82.5 5.9	LOOP seq. 05 GRID-LOOP seq. 05
5	93	1.15E-07	8.8	76.2	SBO seq. 70	100	SBO seq. 09
6	13	7.70E-08	5.9	82.1	RVR seq. 1 LOOP seq. 4	39.7 22.3	RVR seq. 01 LOOP seq. 04
7	91	4.71E-08	3.6	85.7	ATWS seq. 65 ATWS seq. 52	86.5 6.4	ATWS seq. 07 ATWS seq. 06
8	2	4.01E-08	3.1	88.7	LSSB-D seq. 54 ATWS seq. 38	65.7 14.6	LSSB-D seq. 19 ATWS seq. 04
9	9	3.47E-08	2.6	91.4	GRID-SBO seq. 21 SBO seq. 33	87.2 5.3	GRID-SBO seq. 03 SBO seq. 06
10	1	2.41E-08	1.8	93.2	SGTR seq. 9 SGTR seq. 4	65.3 16.4	SGTR seq. 6 SGTR seq. 4
11	69	1.80E-08	1.4	94.6	TLOCCW seq. 4 TLOESW seq. 4	44.9 44.9	TLOCCW seq. 2 TLOESW seq. 2
12	94	8.99E-09	0.7	95.3	TLOCCW seq. 9 TLOESW seq. 9	30.3 30.3	TLOCCW seq. 3 TLOESW seq. 3