Staff feedback on RAI 199-8223; Q 03.08.01-10

In RAI 8223, Question 03.08.01-10, the staff requested the applicant to provide a description of its severe accident analysis approach and explain how the approach compares to the Position 3 of RG 1.216.

For Position 3.1 a, the applicant's draft response, dated April 28, 2016, states that "[t]he top ten dominant sequences contributing to the core damage frequency (CDF) are selected from the Level 1 PRA results at the time of performing the analysis. Accident initiators for these sequences include: station blackout (SBO), large break LOCA (LLOCA), small break LOCA (SLOCA), loss of feedwater (LOFW), and steam generator tube rupture (SGTR)." The staff finds that the sequences selected by the applicant are inconsistent with APR1400 DCD, Tier 2, Rev. 0, Table 19.1-18, "Level 1 Internal Events Top Accident Sequences," and the following in Section 19.1.4.1.2.3: "The accident sequences are dominated by loss of offsite power (LOOP), station blackout (SBO), loss of component cooling water (LOCCW), and loss of essential service water (LOESW). The applicant is requested to clarify the term "the Level 1 PRA results at the time of performing the analysis."

[KHNP Response]
At the starting time of the severe accident analysis including the containment performance, the draft result of CDF ranking table was only available. The top ten sequences used for the containment performance analysis from this draft ranking was given in p. 238, Table A-1 in Calculation Note "Containment Performance Analysis, Rev.4 (1-035-N389-501)" denoted as R1_XX to R10_XX, as below.

Table A-1. Sequences

No.	Sequence Name
1	SBO-C01-NoECSBS-MCCI
2	SBO-C03-NoECSBS-MCCI
3	LLOCA-C04-NoECSBS-MCCI
4	SLOCA-C06-NoECSBS-MCCI
5	LOFW-C08-NoECSBS-MCCI
6	SGTR-C10-NoECSBS-MCCI
7	SBO-C01-ECSBS-M-MCCI
8	LLOCA-C04-ECSBS-M-MCCI
9	LOFW-C08-ECSBS-M-MCCI
10	R1_TLOES-003-MCCI
11	R2_MLOCA003-MCCI
12	R3_LOOP-004-MCCI
13	R4_SBO-002-MCCI
14	R5_SBO-005-MCCI
15	R6_SLOCA008-MCCI
16	R7_PR-A-SL_007-MCCI
17	R8_MLOCA002-MCCI
18	R9_SBO-006-MCCI
19	R10_SGTR10-MCCI

The top accident sequences given in DCD, Tier 2, Rev. 0, Table 19.1-18 is determined after the containment performance analysis completion. Therefore the sequence frequency and the rank between two tables are not identical to each other.
However, the present conclusion on the containment performance regarding Position 3 is still valid because

i) the sequence groups which have a dominant contribution to total CDF – SBO+LOOP, LOCCW, MLOCA, LOCCW, SLOCA, and SGTR– are comparable with each other,
ii) nine sequences with five initiator type (SBO, LLOCA, SLOCA, LOFW, and SGTR) based on deterministic viewpoint were additionally taken into account in the scenario selection. These sequences represent the entire spectrum of severe accident conditions important to containment pressurization. Other PRA accident sequences can be either represented or bounded by these analyzed sequences such that analysis of that specific sequence is not necessary. For example, TLOES_003 (Rank 1 in draft CDF table and Rank 17 in CDF table in DCD) and LOOP_004 (Rank 3/ Rank 9) sequences can be represented by the analyzed TLOFW sequence. Accident definitions for TLOESW, LOOP, and TLOFW are similar in that all (Motor-driven and turbine-driven) auxiliary feedwater, safety injection pumps, charging pump are unavailable. Vessel failure times for these sequences are in a similar range between 5.5 to 6.7 hours. Hence, containment performance results for these sequences would be similar,
and iii) peak pressure of the more likely severe accident sequences is still lower than the severe accident load (123.7 psia) used for FLC, in addition the maximum strain of steel liner under the 123.7 psia load condition is also very lower than that of failure criteria.

For Position 3.1 b, the applicant identified peak pressure and temperature loadings which occur during the 24-hour period following the onset of core damage for more likely severe accident challenges. The applicant concluded that "[b]ecause the maximum pressure and temperature which occur after the initial 24-hours after the onset of core damage are enveloped by the maximum pressure and temperature during the initial 24-hour period . . . the containment is capable of providing a barrier against the uncontrolled release of fission products for the more likely severe accident challenges, in accordance with RG 1.216 Regulatory Position 3.2 a." Pending resolution of the staff's concern stated in the previous paragraph, the staff finds that the applicant's approach is consistent with RG 1.216 Regulatory Position 3, and therefore, acceptable.

[KHNP response]
No response.