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.: **199-8223**

SRP Section: **03.08.01 – Concrete Containment**

Application Section: **03.08.01**

Date of RAI Issue: **09/08/2015**

Question No. 03.08.01-10

According to 10 CFR 52.47(a)(23), applications for light-water reactor (LWR) designs shall include a description and analysis of design features for the prevention and mitigation of severe accidents. Standard Review Plan (SRP) 3.8.1, Section II.4.K and Regulatory Guide (RG) 1.216, "Containment Structural Integrity Evaluation for Internal Pressure Loadings Above Design-Basis Pressure," provide guidance for demonstrating the structural integrity of the containment in accordance with the requirements in 10 CFR 52.47(a)(23). In accordance with RG 1.206 and RG 1.216, the description of the evaluation for containment pressure integrity under the more likely severe accident challenges is normally described in Section 19 of the applicant's DCD. DCD Section 19.2.3.1.2, "Containment Pressure Limits" states that the containment structural integrity evaluation is described in Subsection 3.8.1.4.12.

The staff reviewed Section 3.8.1.4.12, "Severe Accident Capability," of the DCD and noted that additional information is needed in order for the staff to complete its safety review of the containment. The staff noted that information such as a description of the severe accidents that are being evaluated, the loads that are selected, the mathematical models that are being used, analysis approach and results are not included in the application. Regulatory Guide 1.216, Position 3, "Commission's Severe Accident Performance Goal," describes the methods acceptable for demonstrating that the containment can maintain its role as a reliable, leak-tight barrier for approximately 24 hours following the onset of core damage. In accordance with 52.47(a)(23), SRP 3.8.1 and RG 1.216, the applicant is requested to provide a description of its severe accident analysis approach in Section 3.8.1.4.12 of the DCD, and explain how it compares to the approach described in Regulatory Guide 1.216, Position 3.

Response – (Rev.1)

This response is limited to Regulatory Guide (RG) 1.216, Position 3, "Commission's Severe Accident Performance Goal".

For a description of how the application conforms to the guidance of RG 1.216, Position 1, “Containment Structural Integrity Evaluation for Internal Pressure Loadings Above Design-Basis Pressure,” please refer to the revised response to RAI 129-8085, Question No. 03.08.01-5. In the response to RAI 129-8085, Question No. 03.08.01-5, the ultimate pressure capacity (UPC) of the prestressed concrete containment is described. The description includes discussions regarding the finite element (FE) model, FE analysis method, and the acceptance criteria of RG 1.216, Position 1.

For a description of how the application conforms to the guidance of RG 1.216, Position 2, “Combustible Gas Control Inside Containment,” please refer to the response to RAI 199-8223, Question No. 03.08.01-8. In the response to RAI 199-8223, Question No. 03.08.01-8, the safety of containment under the combustible gas load (P_s) condition is described. The description includes discussion regarding the FE model, FE analysis method, and the acceptance criteria in RG 1.216, Position 2. The detailed description of the combustible gas load is also found in the revised response to RAI 129-8085, Question No. 03.08.01-1(c). In order to avoid confusion, the title of Subsection 3.8.1.4.12 in DCD Tier 2 was changed from “Severe Accident Capability” to “Combustible Gas Control Inside Containment” in RAI 199-8223, Question No. 03.08.01-8.

Discussion regarding RG 1.216, Position 3, is as follows.

Regarding RG 1.216 Regulatory Position 3.1 a, selection of accident sequences based on Level 1 probabilistic risk assessment (PRA) study is made in the following way. The more likely severe accident sequences to be analyzed for the containment performance are selected using a combination of deterministic and probabilistic approaches.

The 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). These ten sequences are account for 87.6% of the cumulative CDF. The applicant believes this to be an acceptable approach to identifying the more likely severe accident challenges since the probabilistic sequences and the dominant sequences from the deterministic approach are included. Details regarding the identification of the more likely severe accident challenges are given in Section 3.1.2 of “Containment Performance Analysis”, 1-035-N389-501, Rev. 04, which has been provided in the ERR.

Regarding RG 1.216 Regulatory Position 3.1 b, the selected sequences are analyzed with cavity flooding system (CFS) and emergency containment spray backup system (ECSBS) availability by using MAAP4.0.8. The pressure response for each sequence is summarized the following: the SBO event peak pressure was 98.70 psia and peak temperature was 325°F (Table A-2, p. 239 in calculation note 1-035-N389-501, Rev.4); for the LLOCA event, 112 psia and 332°F (Table A-2, p. 239 in calculation note 1-035-N389-501, Rev.4); for the LOFW event, 105 psia and 330°F (Table A-2, p. 239 in calculation note 1-035-N389-501, Rev.4), respectively.

Consequently, the MAAP study for the selected more likely severe accident sequences indicates that the pressure build-up inside the containment is bounded by the peak pressure of 112 psia (LLOCA) during the 24-hour period following the onset of core damage. A constant temperature of 350°F, which bounds the transient response to a LLOCA, is conservatively employed as the temperature loading.

Because 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, as illustrated the pressure curves of the three sequences, 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.

Impact on DCD

There is no impact on the DCD. The response to RAI 199-8223, Question No. 03.08.01-8 provides changes to the DCD as discussed in this response.

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 Environmental Report.