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.:	**290-8336**
SRP Section:	**06.02.01.03 – Mass and Energy Release Analysis for Postulated Loss-of-Coolant Accidents (LOCAs)**
Application Section:	**6.2.1.3**
Date of RAI Issue:	**11/03/2015**

Question No. 06.02.01.03-1

Break Spectrum Analysis for Hot Leg Break LOCA

General Design Criterion 50, “Containment design basis” and Appendix K to 10 CFR Part 50, “ECCS Evaluation Models” require that the selected combination of power distribution shape and peaking factor should be the one that results in the most severe calculated consequences for the spectrum of postulated breaks and single failures that are analyzed. NUREG-0800, SRP Section 6.2.1.3, “Mass and Energy Release Analysis for Postulated Loss-of-Coolant Accidents (LOCAs)” suggests that containment design basis calculations should be performed for a spectrum of possible pipe break sizes and locations to assure that the worst case has been identified. Table 3-1, “Containment P/T with 1 Percent Metal-Water Reaction”, in the Technical Report (TeR) APR1400-Z-A-NR-14007-P, Rev.0, identifies the double-ended discharge leg slot break (DEDLSB) with maximum safety injection (SI) flow to be the most severe LOCA. The staff is concerned that the APR1400 methodology does not satisfy the required break spectrum analysis (small, medium, and large breaks) to identify the most limiting LOCA. This requirement appears to have been interpreted only in terms of hot leg and cold leg breaks as opposed to the break flow areas ranging from small slot to double-ended (DE) guillotine break. In this regard, the applicant is requested to address the following two questions and update the APR1400 DCD and TeR accordingly.

(1) This analysis follows the traditional assumption of a hot leg piping slot break of the same flow area as that of a double-ended guillotine piping rupture. However, the TeR does not report any double-ended (DE) guillotine break analysis results. The applicant is requested to demonstrate that a limiting double-ended (DE) guillotine break would result in less severe thermal-hydraulic conditions in the containment than in the limiting DEDLSB with maximum SI flow, or justify why such an analysis is not warranted.

(2) Table 3-1 in the TeR shows that the double-ended hot leg slot break (DEHLSB) results in

the lowest peak pressure compared to all four cold leg breaks. It is not documented in the DCD or the TeR whether the DEHLSB was assumed to be the limiting break size for a hot leg LOCA or it was obtained from a break spectrum analysis. The applicant is requested to demonstrate that the mass and energy release and subsequent containment thermal-hydraulic response analyses for DEHLSB are most conservative across the possible hot break spectrum, including smaller slot break sizes.

Response

(1) The hot leg guillotine break case is newly analyzed with the assumption of the double-ended break area. The blowdown mass and energy (M/E) release data of the guillotine break case is calculated and compared with those of the hot leg slot break case of APR1400 DCD Section 6.2.1.3. The comparison is presented in Figure 1 and Table 1 and shows that the hot leg guillotine break case has slightly more severe results than the hot leg slot break case. Even though the DEHLGB case is more severe than the DEHLSB case, the peak pressure of the DEHLGB is less than that of the limiting LOCA case (DEDLSB) in the APR1400 DCD Table 6.2.1-19.

In order to justify the limiting LOCA case, the blowdown M/E data of the double-ended discharge leg guillotine break (DEDLGB) case is newly calculated and compared with the DEDLSB case of APR1400 DCD Section 6.2.1.3 in Figure 2 and Table 2. This comparison of M/E data shows that the DEDLSB case of APR1400 DCD Section 6.2.1.3 is clearly more severe than the DEDLGB case even though the containment peak pressures are not compared. Thus, the DEDLSB case in APR1400 DCD is still valid as the limiting LOCA case.

Table 1. Comparison of M/E results of DEHLSB and DEHLGB

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Table 2. Comparison of M/E results of DEDLSB and DEDLGB

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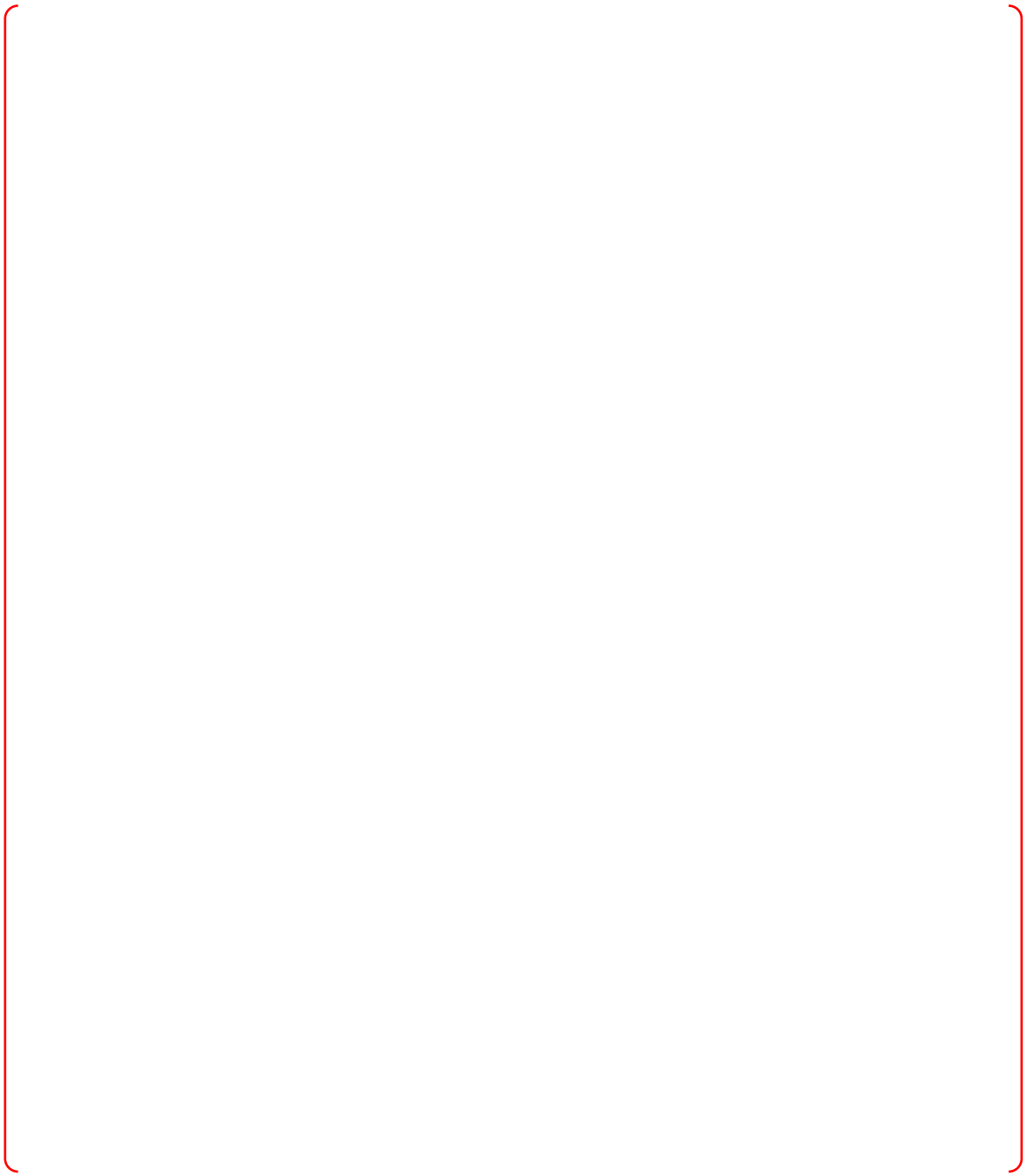

Figure 1. Comparison of M/E results of DEHLSB and DEHLGB

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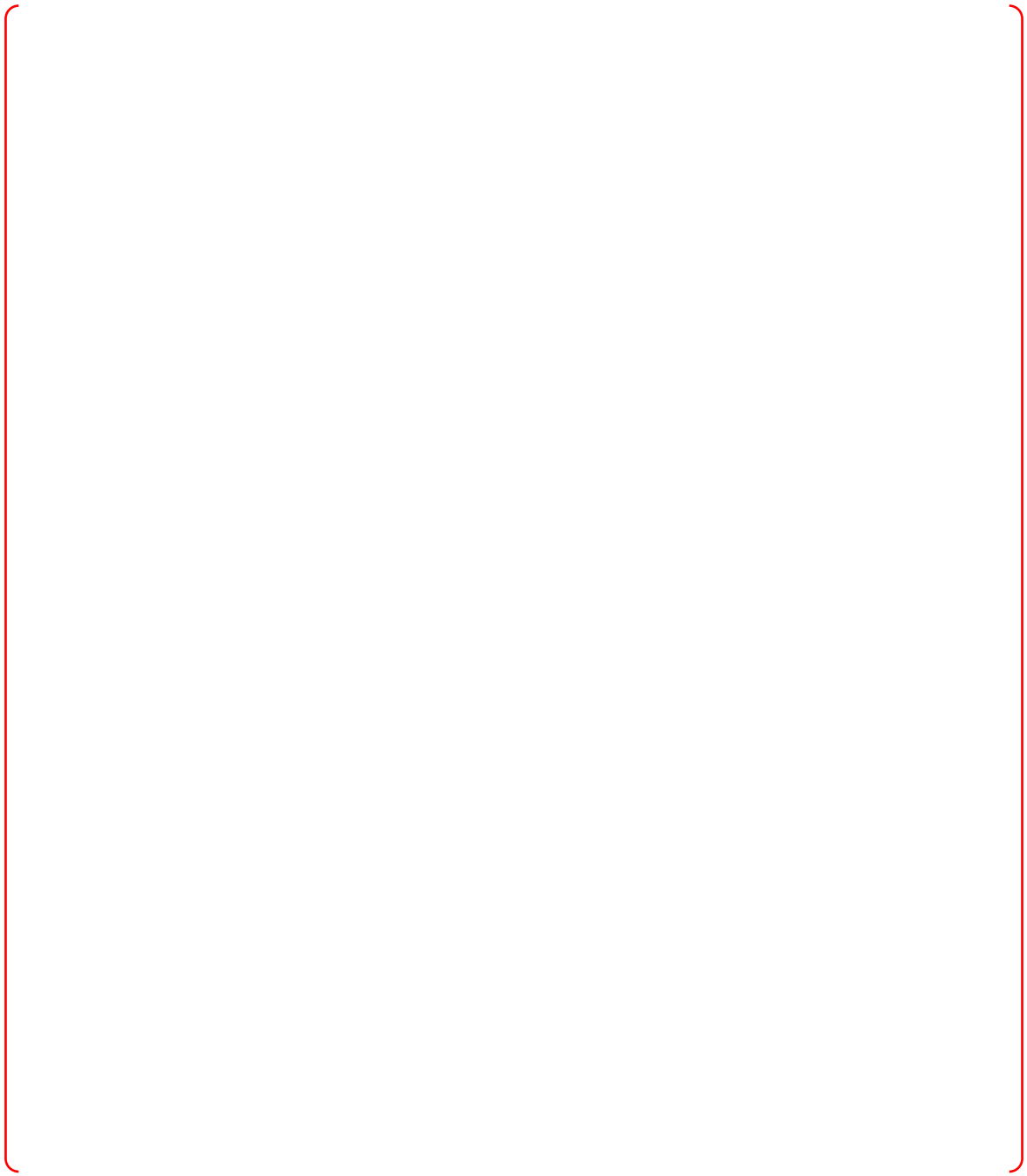

Figure 2. Comparison of M/E results of DEHLSB and DEHLGB

(2) For the break area spectrum analysis of the double-ended hot leg slot break (DEHLSB), two cases with 0.8 DEHLSB area and 0.6 DEHLSB area are analyzed. The calculated mass and energy releases are compared with those of the DEHLSB case in the APR1400 DCD and presented in Figure 3. The subsequent containment thermal-hydraulic responses are presented in Table 3. The comparison of the results shows that the double-ended hot leg break case as in the APR1400 DCD is most conservative in the break spectrum analysis.

Table 3. Containment Peak P/T Results of Hot Leg Slot Break Area Spectrum Analysis

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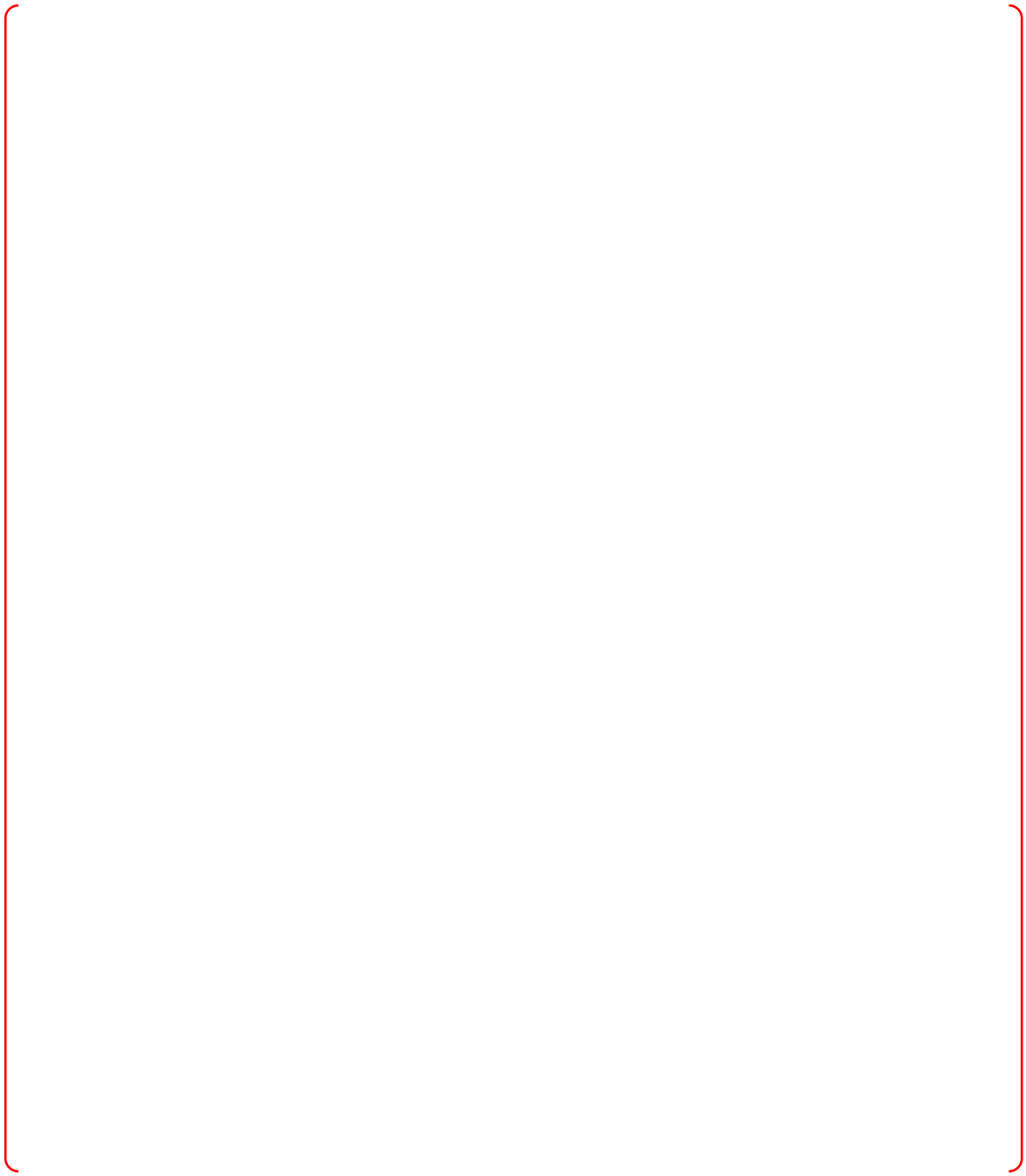

Figure 3 Comparison of M/E Results of Hot Leg Slot Break Area Spectrum Analysis

Impact on DCD

There is no impact on the DCD.

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 Reports