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.:	**318-8337**
SRP Section:	**15.06.05 – Loss of Coolant Accidents Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary**
Application Section:	**15.6.5**
Date of RAI Issue:	**11/24/2015**

Question No. 15.06.05-3

General Design Criterion (GDC) 35, "Emergency Core Cooling," in 10 CFR Part 50, Appendix A, mandates the requirements for the emergency core cooling system (ECCS) that need to be satisfied by conforming to the ECCS acceptance criteria for light-water reactors given in 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-water Nuclear Power Reactors." 10 CFR 50.46(b)(1) identifies the peak cladding temperature (PCT) requirement; and 10 CFR 50.46(b)(5) requires that after any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time to prevent the core from being uncovered. These requirements, along with 10 CFR 50.46(a)(1), specify the need to calculate the ECCS cooling performance using an acceptable evaluation model for a number of postulated loss-of-coolant accidents (LOCAs) of different sizes, locations, and other properties sufficient to provide assurance that the most severe LOCAs have been evaluated.

For the 18.6 cm^2 DVI line break, the two-phase level is shown to be about 2 meters above the top of the core when PCT occurs at approximately 1200 seconds (Figures 15.6.5-31E, 15.6.5-31F, and15.6.5-31H). The applicant is requested to explain whether the calculations showing the core covered by the two-phase level are sufficient proof that the core will remain cooled and will not undergo a PCT. Also explain how the core could be covered with a two-phase mixture and yet the cladding temperature be more than 100 K higher than the saturation temperature. In this backdrop, describe how the two-phase level in the core is defined and calculated for the figures presented in the DCD Section 15.6.5.

Response

The S1M based on References 1 and 2 ends the STRIKIN-II part [

]TS The exact HTC value is not important because impact of the exact transition time on the subsequent PARCH/EM calculation is not significant. Then PARCH/EM continues the calculations using the STRIKIN-II results at the end time. In another words, the value for Vector 6 of PARCH/EM is set at the time. The methodology describes the transition time as an earlier time between the time when [ ]TS However, since the exact time is not important, the HTC-based criterion works well and it serves the purpose better.

It appears that the analysis of 0.02 ft^2 DVI line break was not performed correctly in making the transition from STRIKIN-II to PARCH/EM. The transition time was 1184 seconds. The HTC plot (Figure 15.6.5-31F) indicates that the transition should occur around 700 seconds when the STRIKIN-II-calculated HTC drops below the PARCH/EM HTC of about [ ]TS

This caused the cladding heat-up near 1200 seconds (Figures 15.6.5-31E, 15.6.5- 31F, and15.6.5-31H). The pool boiling calculation with PARCH/EM would not calculate cladding heat-up while the top of the core is under the mixture level because the core HTC is in the order of 100 BTU/ft^2-°F-hr under this condition. The mixture level is calculated by evaluating the void fraction in the core using a pressure-dependent drift velocity model and a sectionalized core model as described in Section 2.2 on Page 2-11 of Reference 2.

The recalculation will be performed and Figures will be revised.

References

1. CENPD-137P, “Calculative Methods for the C-E Small Break LOCA Evaluation Model,” August 1974.
2. CENPD-137, Supplement 1-P, “Small Break Model,

Impact on DCD

There is an 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 Environment Report.