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.:	**217-8217**
SRP Section:	**15.04.04-15.04.05 – Startup of an Inactive Loop or Recirculation Loop at an Incorrect Temperature, and Flow Controller Malfunction Causing an Increase in BWR Core Flow Rate**
Application Section:	**15.04.04**
Date of RAI Issue:	**09/16/2015**

Question No. 15.04.04-1

GDC 10 requires that the reactor coolant system (RCS) is designed with appropriate margin to ensure that specified acceptable fuel design limits are not exceeded during normal operations, including anticipated operational occurrences (AOOs). GDC 15 and 28 require that the RCS is designed with sufficient margin to ensure the pressure boundary will not be breached during normal operations, including AOOs.

As part of the review of the analysis for the startup of an inactive reactor coolant pump (SIRCP) event, presented in DCD Section 15.4.4, staff audited the calculation note that is the basis for the qualitative description provided in DCD Section 15.4.4. This calculation note, APR1400-F-A-TM-12035-P, lacked sufficient detail regarding the input parameters for staff to understand the basis for the selected values. Staff is requesting the following additional information:

1) Shutdown margin referenced Technical Specifications, but Technical Specifications references the Core Operating Limits Report (COLR). Explain how the values used in the safety analyses that reference the COLR are checked prior to loading fuel.

2) The analysis uses maximum primary to secondary temperature differences, but it is not clear why the values provided are conservative. Explain how the maximum primary to secondary temperature differences are bounding.

Response

1) The startup of an inactive reactor coolant pump (SIRCP) analysis provided in DCD Section 15.4.4 was performed based on Shin-Kori nuclear power plant (SKN) units 3&4, which is the same plant design as the APR1400. The shutdown margin value used in the SIRCP analysis is included in the Technical Specifications of SKN units 3&4 because the Core Operating Limits Report (COLR) is not applied to SKN units 3&4. But KHNP decided to move the shutdown

margin value in the Technical Specifications into the COLR during submission of the APR1400 design certification documents. That's why the shutdown margin value could not be found for the SIRCP event. KHNP has finalized the COLR and can make it available for the staff's review upon request.

The shutdown margin value is determined so as to have sufficient margin during the initial core design stage. Also the core loading pattern is decided to meet the shutdown margin value in the COLR during the reload core design stage. Therefore the shutdown margin value in the COLR is checked prior to loading fuel.

2) The maximum primary to secondary temperature differences are conservative for the startup of an inactive reactor coolant pump (SIRCP) event because the amount of reactivity added to the core is calculated by simply multiplying the primary to secondary temperature differences by an Isothermal Temperature Coefficient (ITC).

The maximum primary to secondary temperature differences are estimated based on assumed possible operating configurations in a conservative manner during the operating modes 3, 4, 5 and 6 which can maximize positive or negative temperature differences.

Maximum positive primary to secondary temperature differences

During modes 3 and 4, the maximum positive primary to secondary temperature difference is expected during a natural circulation cooldown (NCC) since the natural circulation flow is smaller than the forced circulated flow. The maximum positive difference is taken from an NCC analysis and temperature instrument uncertainty is included in this value for additional margin.

During mode 5, the maximum positive difference can be established at the start of mode 5 when the SGs are drained and refilled simultaneously with the minimum secondary water temperature.

During mode 6, the maximum positive difference is determined using the maximum primary temperature based on the primary refueling water temperature and the minimum secondary water temperature.

Maximum negative primary to secondary temperature differences

The maximum negative temperature differences are conservatively based on possible operating configurations in which the SGs are assumed to stay at an entry temperature into mode 3. Meanwhile the primary is cooled down to mode 6.

Impact on DCD

There is no impact on DCD.

Impact on PRA

There is no impact on PRA.

Impact on Technical Specifications

There is no impact on Technical Specifications.

Impact on Technical/Topical/Environmental Report

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