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.:	**385-8465**
SRP Section:	**06.02.01.04 - Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures**
Application Section:	**6.2.1.4**
Date of RAI Issue:	**02/01/2016**

Question No. 06.02.01.04-8

There is one main steam isolation valve (MSIV) in each main steam line and two main feedwater isolation valves (MFIVs) in each feedwater line. The closure of the MSIVs and the MFIVs by the engineered safety feature actuation system (ESFAS) is considered in the M&E analysis. Following closure of the MFIVs, there is an inventory of feedwater between the MFIVs and the affected SG. In addition to the energy sources identified and met in SRP Section 6.2.1.4 Acceptance Criterion No. 1, SRP Section 6.2.1.4 Acceptance Criterion No. 2C asks to also account for the water contained in the affected SG's feedwater line, and steam in the affected SG, for conservatism. As the affected SG depressurizes, this inventory starts to boil. As steam in the line expands, the feedwater inventory is pushed into the SG and is boiled off by primary-to secondary heat transfer. It appears that the applicant has accounted for the water contained in the affected SG's feedwater line. However, the DCD does not mention whether the energy stored in the steam in the affected SG is also accounted for in the M&E release calculations for the secondary system pipe ruptures. It needs to be clarified in the DCD.

Response

The initial steam energy stored in the affected steam generator is taken into account for the MSLB analysis and it is conservatively calculated using the SGNIII code.

The initial SG steam and liquid mass are considered as follows:

TS

To maximize the mass and energy release, the maximum steam line volumes have been considered in the MSLB analysis and described in the DCD Section 6.2.1.4 as follows:

> "The total volume of fluid for two steam lines between the MSIVs and a steam generator is assumed to be the maximum in the analysis. The total volume of fluid between the MSIVs and the turbine stop valves is also assumed to be the maximum in the analysis."

DCD Tier 2, Section 6.2.1.4 will be revised to state that the energy stored in the steam and liquid in the affected steam generator is accounted for the mass and energy release calculations for the secondary system pipe ruptures.

Impact on DCD

DCD Section 6.2.1.4 will be revised as indicated in the attachment associated with 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 Environment Report.

The total volume of fluid for two steam lines between the MSIVs and a steam generator is assumed to be the maximum in the analysis. The total volume of fluid between the MSIVs and the turbine stop valves is also assumed to be the maximum in the analysis.

There are two M The analysis credits the energy stored in the steam and liquid in the affected steam generator. veen the upstream MFIV and each steam generator is assumed to be the maximum. The flashing of this fluid into the affected steam generator and then into the containment is considered in the analysis. These assumed volumes conservatively exceed the actual design values of the APR1400 volumes.

The sources of energy considered in the MSLB analysis include the stored energy in the (1) affected steam generator's metal, including the steam generator tube, (2) water in the affected steam generator, (3) feedwater transferred to the affected steam generator before the closure of the MFIV, and (4) steam from the unaffected steam generator before the closure of the MSIV. The energy sources that are considered also include the energy transferred from the primary coolant to the water in the affected steam generator during blowdown.

6.2.1.4.1 Mass and Energy Release Data

Mass and energy release data for the MSLB cases listed in Table 6.2.1-1 are given in Tables 6.2.1-9 through 6.2.1-18.

6.2.1.4.2 Single Failure Analysis

Non-class 1E electric power is conservatively assumed to be available because it allows the continuation of reactor coolant pump operation, which maximizes the rate of heat transfer to the affected steam generator, which maximizes the rate of an M&E release. With the availability of Non-class 1E electric power, a postulated diesel generator failure is unnecessary.

There is an MSIV in each main steam line. The MSIVs are designed to close based on a conservative calculation that maximizes the dynamic pressure loading on the valve for all possible flow rates and qualities. Each valve has dual control circuits to provide reasonable assurance of closure even with a single failure in the control system. Each