KHNPDCDRAIsPEm Resource

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Sent: Monday, February 01, 2016 9:29 AM
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Cc: Haider, Syed; Segala, John; Umana, Jessica; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 385-8465 (6.2.1.4 Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures Inside Containment)
Attachments: APR1400 DC RAI 385 SCVB 8465.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, 60 days to respond to this RAI. We may adjust the schedule accordingly.

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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REQUEST FOR ADDITIONAL INFORMATION 385-8465

Issue Date: 02/01/2016
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 06.02.01.04 - Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures
Application Section: 6.2.1.4 Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures Inside Containment

QUESTIONS

06.02.01.04-4

Conservatisms in the Limiting MSLB/MFLB M&E Release Calculations from the Containment Perspective

General Design Criterion (GDC) 50 requires analyses of the most severe consequences for the spectrum of postulated secondary pipe breaks sizes, locations, and single failures. Standard Review Plan (SRP) Section 6.2.1.4, "Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures," lays out several acceptance criteria to ensure that the containment mass and energy (M&E) release calculations are performed for the worst design basis accident (DBA). The staff seeks information on the conservative treatment of M&E release calculations for the limiting main steamline break (MSLB) and main feedwater line break (MFLB) analyses from the containment response standpoint, such that the post-accident containment pressure and temperature are maximized. The applicant is also requested to update the APR1400 DCD or the KHNP Technical Report (TeR) APR1400-Z-A-NR-14007-P/NP (LOCA Mass and Energy Release Methodology) to document the explanations. (The regulatory basis identified in the above is applicable to all subsequent questions in this RAI.)

SRP Section 6.2.1.4 specifies that single-failure analyses should be performed for both MSLBs and MFLBs. DCD Tier 2, Table 6.2.1-1, "Spectrum of Postulated Accidents," describes five loss of coolant accident (LOCA) and ten MSLB cases analyzed to identify the most severe DBA to meet the requirements of GDC 50, 16, and 38. However, no information is provided in either DCD Tier 2, Chapter 6 or in KHNP Technical Report (TeR) APR1400-Z-A-NR-14007-P/NP, "LOCA Mass and Energy Release Methodology," (Reference 3) about the MFLB analysis or results. DCD Tier 2, Table 6.2.1-37, "Stored Energy Sources," reports data only for LOCAs and MSLBs, but does not include any MFLB data. The applicant is requested to describe their MFLB analyses in the DCD or TeR, or justify why they were not considered in the break spectrum analysis and that it did not affect the conservatism in the limiting secondary pipe rupture DBA.

06.02.01.04-5

SRP Section 6.2.1.4 Acceptance Criterion No. 2A specifies that mass release rates for the secondary-system pipe rupture should be calculated using the Moody model for saturated conditions or a model that is demonstrated to be equally conservative. DCD Tier 2, Section 6.2.1.4.4 briefly mentions that the break flow rate for secondary pipe ruptures is calculated using the Moody critical flow model for zero flow resistance. No further information is provided in either the DCD or in the TeR (Reference 3) about the application of the Moody's model. The applicant is asked to justify how Moody's critical flow model was used conservatively for

secondary system pipe break analysis and provide more details on the assumptions, e.g., about the fluid phase; and about the empiricism used in the model, e.g., Moody flowrate multiplier.

06.02.01.04-6

SRP Section 6.2.1.4 Acceptance Criterion No. 2B specifies that the calculations of heat transfer to the water in the affected steam generator (SG) should be based on nucleate boiling heat transfer. DCD Tier 2, Section 6.2.1.3 (Mass and Energy Release Analyses for Postulated Loss-of Coolant Accidents) does mention that a nucleate boiling heat transfer coefficient is used to model the heat transfer from the SG tubes to the primary coolant, for the M&E release analysis for postulated LOCAs. However, no such information is provided in DCD Tier 2, Section 6.2.1.4 for secondary system pipe rupture or in the TeR, so it is not clear whether the statement made in DCD Tier 2, Section 6.2.1.3 applied to LOCA only or would also apply to MSLB. The applicant is request to provide information about the heat transfer correlation used and justify it to be conservative.

06.02.01.04-7

The SGN-III computer code is used for the secondary system pipe break analysis. However, the DCD or TeR do not comment on the acceptability of the SGN-III code for this application, which needs to be established. The applicant should document whether the SGN-III computer codes has been validated against pertinent experimental data. The applicant is also suggested to update the title of the KHNP Technical Report APR1400-Z-A-NR-14007-P/NP, i.e., "LOCA Mass and Energy Release Methodology," as it also covers the mass and energy release methodology for both LOCA and secondary pipe ruptures, e.g., MSLBs.

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.


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