KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Wednesday, December 02, 2015 2:48 PM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Erin Wisler
Cc: Haider, Syed; McKirgan, John; Umana, Jessica; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 324-8362 (6.2.1.4 Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures Inside Containment)
Attachments: APR1400 DC RAI 324 SCVB 8362.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, 45 days to respond to RAI questions 06.02.01.04-1 and 06.02.01.04-2. We may adjust the schedule accordingly.

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

Thank you,

Jeff Ciocco
New Nuclear Reactor Licensing
301.415.6391
jeff.ciocco@nrc.gov

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
Email Number: 373

Mail Envelope Properties (165334ce48434014a384c224c75c9bfa)

Subject: APR1400 Design Certification Application RAI 324-8362 (6.2.1.4 Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures Inside Containment)
Sent Date: 12/2/2015 2:48:17 PM
Received Date: 12/2/2015 2:48:20 PM
From: Ciocco, Jeff

Created By: Jeff.Ciocco@nrc.gov

Recipients:
"Haider, Syed" <Syed.Haider@nrc.gov>
Tracking Status: None
"McKirgan, John" <John.McKirgan@nrc.gov>
Tracking Status: None
"Umana, Jessica" <Jessica.Umana@nrc.gov>
Tracking Status: None
"Lee, Samuel" <Samuel.Lee@nrc.gov>
Tracking Status: None
"apr1400rai@khnp.co.kr" <apr1400rai@khnp.co.kr>
Tracking Status: None
"KHNPDCDRAIsPEm Resource" <KHNPDCDRAIsPEm.Resource@nrc.gov>
Tracking Status: None
"Harry (Hyun Seung) Chang" <hyunseung.chang@gmail.com>
Tracking Status: None
"Andy Jiyong Oh" <jiyong.oh5@gmail.com>
Tracking Status: None
"Erin Wisler " <erin.wisler@aecom.com>
Tracking Status: None

Post Office: HQPWMSMRS07.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	645	12/2/2015 2:48:20 PM
image001.jpg	5040	
APR1400 DC RAI 324 SCVB 8362.pdf	115960	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

REQUEST FOR ADDITIONAL INFORMATION 324-8362

Issue Date: 12/02/2015
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

06.02.01.04-1

Containment Initial and Boundary Conditions for the MSLB Analyses

General Design Criteria (GDC) 50, "Containment design basis", and GDC 16, "Containment design", of Appendix A to 10 CFR Part 50 require, in part, that the reactor containment structure and associated heat removal system shall be designed with sufficient margin to accommodate the calculated pressure and temperature conditions resulting from any loss-of-coolant accident (LOCA). NUREG-0800, SRP Section 6.2.1.1A, Acceptance Criterion No. 1 specifies that the containment design pressure should provide at least a 10% margin above the accepted peak calculated containment pressure following a loss-of-coolant accident, a main steam line break (MSLB), or a main feedwater line break (MFLB), to satisfy the GDC 16 and 50 requirements for sufficient design margin. In addition, ANSI/ANS 56.4-1983, which has established detailed guidelines for containment response to design basis accidents (DBAs), specifies that initial conditions should be chosen to yield a conservatively high peak containment atmosphere pressure and temperature. These guidance documents ensure sufficient conservatism in the mass and energy release analysis for the postulated primary and secondary system pipe ruptures during the DBA such that the reactor containment structure and heat removal system design can accommodate the calculated peak pressure and temperature conditions.

In this backdrop, the staff seeks the following additional information to gain safety insights into the initial and boundary conditions the applicant used for the limiting MSLB analysis for the containment. The applicant is also requested to update the APR1400 DCD and/or the Technical Report (TeR), "LOCA Mass and Energy Release Methodology", APR1400-Z-A-NR-14007-P, Rev.0, to appropriately document the respective explanations.

Following the acceptance criteria, the limiting single failure MSLB analysis is based on two assumptions: (1) maximizing the flow of saturated and superheated steam out of the break; and (2) minimizing the rate of heat removal from the containment atmosphere. Since the APR1400 containment response analysis does not credit any fan coolers, the latter assumption is accomplished by not crediting the containment spray system (CSS). The former assumption can be based on any one of the several possible single failures including the failure of condensate booster pump to trip, FRV (Feedwater Regulating Valve) to close, or MSIV (Main Steam Isolation Valve) to shut. The APR1400 MSLB analysis has considered the CSS and MSIV single failures to see which one is conservative. The applicant is requested to clarify whether the single failure of the feedwater regulating valve to close was also examined. The staff is concerned that during the time the feedwater bypass valve takes to shut the flow, considerable amount of feedwater may enter the steam generator, gain heat from the hot primary-side, and the resulting additional steam would enter the containment to further increase the containment peak pressure and, especially, the peak temperature. Please demonstrate that the current limiting MSLB analysis is bounding for all possible single failures.

06.02.01.04-2

Double-ended pipe breaks could be of the guillotine type or the slot type breaks. Typically, double-ended slot breaks and double-ended guillotine breaks are most severe pipe breaks for LOCA and MSLB, respectively. Please clarify the type of break (guillotine versus slot) that was used in the analysis of APR1400 to produce the MSLB mass and energy release for the containment, and explain how it was concluded to be the most conservative secondary pipe rupture.

06.02.01.04-3

Active safety systems are always associated with time delay for actuation. Longer time delays reduce the effectiveness of such systems and are thus more conservative. For the CSS, the time delay consists of the time for the emergency diesel generators (EDGs) to start, the spray pump to reach the nominal speed, the spray regulating valve to reach the full stroke, and the drained spray piping and spray header to fill. Section A.3.1 of the TeR specifies that due to the availability of offsite power "*unlike the LOCA analysis that assumes a 20-second delay on CS initiation for EDG startup, the MSLB analysis assumes no CS initiation time delay*." Please clarify whether the delay for CS flow entering the vapor space during an MSLB is 110 – 20 = 90 seconds as the above statement may be interpreted as no CS time delay. The 110 seconds is obtained from Section A.2.3.4 that states "*The CS pump starts automatically from a high-high containment pressure setpoint with a time delay of 110 seconds based on EDG startup (20 seconds) and CS piping fill-up (90 seconds). The delay time for CS piping fill-up includes EDG pump loading (20 seconds), pump startup (3 seconds), system pipe filling (58 seconds), signal delay (2 seconds), and 7 seconds for contingency*."