KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Thursday, December 03, 2015 10:55 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Erin Wisler
Cc: Haider, Syed; Segala, John; Umana, Jessica; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 327-8354 (06.02.01.01.A - PWR Dry Containments, Including Subatmospheric Containments)
Attachments: APR1400 DC RAI 327 SCVB 8354.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 06.02.01.01.A-5 and 06.02.01.01.A-6. We may adjust the schedule accordingly.

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

Thank you,

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United States Nuclear Regulatory Commission
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REQUEST FOR ADDITIONAL INFORMATION 327-8354

Issue Date: 12/03/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 06.02.01.01.A - PWR Dry Containments, Including Subatmospheric Containments
Application Section: 6.2.1.1 Containment Structure

QUESTIONS

06.02.01.01.A-4

Containment Initial and Boundary Conditions for the LOCA 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 LOCA, or a steam line or feedwater line break, 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, specifies that initial conditions should be chosen to yield a conservatively high peak containment atmosphere pressure and temperature. In selecting the initial dry primary containment atmospheric conditions and structural temperatures, consideration should be given to the competing effects of the initial air mass and the active and passive heat sink thermal capacities.

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 LOCA 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.

The initial containment atmosphere temperature is an important parameter such that its upper value constitutes a technical specification. The initial atmosphere temperature not only affects the containment response to a design basis LOCA but also other aspects of the accident such as the safety injection water temperature from safety injection tanks (SITs). As discussed in Appendix C of the TeR, "Case studies for modeling characteristics", and given in Table C-1A, the maximum containment temperature is 120 °F beyond which the limiting conditions for operation apply. An instrument uncertainty of 5 °F is commonly used by the industry in containment response analysis. If the value listed in Table C-1A includes an instrument uncertainty then the initial atmosphere temperature of 115 °F would not be conservative; and if it doesn't, then an initial atmosphere temperature of 125 °F should have been used for all the analyses. Please explain whether the containment initial atmosphere temperature is based on the typical value commonly used in the containment response analysis or obtained from an energy balance analysis for the reactor coolant system (RCS) heat loss versus fan coolers heat removal.

06.02.01.01.A-5

The APR-1400 break spectrum analysis finds a double-ended slot break on the pump discharge side of a cold leg (DEDLSB) with maximum safety injection pump (SIP) flow to be the limiting design basis LOCA. The maximum safety injection rate would result in a higher mass and energy (M&E) release, and subsequently, a higher containment pressure. The applicant is requested to clarify whether the nominal flow rate of the SIPs has been increased to account for a potentially higher (usually 2%) emergency diesel generator (EDG) frequency. A higher EDG frequency would increase SIPs Total Dynamic Head (TDH), resulting in higher flow rate, which would be conservative.

06.02.01.01.A-6

As stated in the TeR Section 3.6, “Description of Core Reflood Model,” following the termination of critical flow, the containment backpressure is assumed to be 58 psia that would remain constant throughout the reflood phase. Please specify the basis for selecting this pressure for input to the FLOOD3 code, and explain whether a lower value for containment back pressure would be more conservative for break flow rate during the reflood phase of the design basis LOCA.

06.02.01.01.A-7

In Section A.2.3.1 of the TeR, it is stated that “The containment free volume is calculated by subtracting the volume occupied by equipment inside containment from the gross volume calculated from the building dimensions.” The section tabulates the containment atmosphere design value and the value used for LOCA that is conservatively smaller. Please clarify the basis for the uncertainty that was applied to estimate the containment free volume for vapor expansion. This will demonstrate the level of conservatism exercised in the analysis.

06.02.01.01.A-8

Please explain whether heat transfer to the containment basemat is credited or is conservatively ignored.

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