KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Wednesday, February 10, 2016 9:33 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Christopher Tyree
Cc: Gilmer, James; Karas, Rebecca; Steckel, James; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 404-8488 (15.06.05 - Loss of Coolant Accidents Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary)
Attachments: APR1400 DC RAI 404 SRSB 8488.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.

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

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From: Ciocco, Jeff

Created By: Jeff.Ciocco@nrc.gov

Recipients:
"Gilmer, James" <James.Gilmer@nrc.gov>
Tracking Status: None
"Karas, Rebecca" <Rebecca.Karas@nrc.gov>
Tracking Status: None
"Steckel, James" <James.Steckel@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
"Christopher Tyree" <Christopher.tyree@aecom.com>
Tracking Status: None

Post Office: HQPWMSMRS07.nrc.gov

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REQUEST FOR ADDITIONAL INFORMATION 404-8488

Issue Date: 02/10/2016
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 15.06.05 - Loss of Coolant Accidents Resulting From Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary
Application Section: 15.6.5.2.2 (SBLOCA)

QUESTIONS

15.06.05-10

Title 10 of the Code of Federal Regulations, Part 50.46, “Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors,” requires that Emergency Core Cooling System cooling performance must be calculated in accordance with an acceptable evaluation model and must be calculated for a number of postulated loss-of-coolant accidents of different sizes, locations, and other properties sufficient to provide assurance that the most severe postulated loss-of-coolant accidents are calculated. Section 2.1 of Technical Report APR1400-F-A-NR-14001-P, Revision 0, “Small Break LOCA Evaluation Model,” refers to a break size sensitivity study in CENP SBLOCA methodology to justify not considering break sizes between 0.5 ft^2 and 1.0 ft^2. The C-E SBLOCA methodology report documented in CENPD-137P, “Calculative Methods for the C-E Small Break LOCA Evaluation Model,” was issued in 1974. The sensitivity study did not consider the phenomenon of steam generator reflux cooling and loopseal liquid formation. Therefore, considering this and the APR1400 design differences from the C-E System 80 model used for the sensitivity study, please demonstrate that the 0.5 ft^2 break size remains the largest SBLOCA which must be considered, or provide discussion of limiting break sizes between 0.5 ft^2 and 1.0 ft^2.

15.06.05-11

REGULATORY BASIS

Title10 of the Code of Federal Regulations, Part 50.46(b)(5) requires that after any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core. Additionally, 10CFR50, Appendix A, General Design Criterion (GDC) 35, Emergency core cooling, requires that a system to provide abundant emergency core cooling shall be provided. GDC 4 requires structures, systems, and components (including pumps, valves, and strainers) important to safety to accommodate the effects of and to be compatible with the dynamic and environmental conditions associated with postulated accidents.

Regulatory Guide 1.82, Revision 4, “Water Sources for Long-term Recirculation Cooling Following a Loss-of-Coolant Accident," provides detailed guidance for evaluating the adequacy and the availability of the containment sump for long-term recirculation cooling following a loss-of-coolant accident.

REQUEST FOR ADDITIONAL INFORMATION 404-8488

ISSUE

The following requests for additional information pertain to technical report APR1400-E-N-NR-14001-P, Revision 0, “Design Features to Address GSI-191”:

REQUESTS

1. In Section 3.8.1, a logarithmic temperature decrease is assumed for the containment air and IRWST temperatures from 1,000,000 seconds to 2,592,000 seconds post-LOCA. Please justify this assumption by comparing to the GOTHIC code results from Technical Report APR1400-Z-A-NR-14007-P, Rev. 0, “LOCA Mass and Energy Release Methodology.”
2. In Section 4.3.3.1, “Available Driving Head under the Hot-leg Break Condition”, it is stated that “the downcomer liquid density is based on the IRWST liquid conditions.” Please justify this assumption considering that the downcomer liquid temperature will be higher than the IRWST temperature, and the density would be reduced.
3. In Section 4.3.4.4, states that “The RV coolant temperature is assumed to be 10 °F higher than the containment temperature. The containment temperature profile is shown in Table 4.3-6.” Please provide the basis for this assumption and explain whether the value used in the LOCADM analysis is conservative.
4. In Section 4.3.2.2, it is assumed that in the case of a cold leg LOCA, all debris is generated during the first 700 seconds after the cold-leg break. However, in Section 4.3.4.3, it is stated that “It is assumed that Mode 3 for recirculation injection from the IRWST begins at 900 seconds (15 minutes).” Please, explain the basis for this assumption, the reason for discrepancy, and describe the extent of conservatism (or lack thereof) by using 900 vs. 700 seconds for the recirculation time.
5. In Section 4.3.4.3 is stated that “There is no fiber insulation inside the ZOI. Only latent fiber amount is assumed to be 6.80 kg (15 lb_m) inside the entire containment. However, 13.6 kg (30 lb_m) of latent fiber is assumed to bypass the ECCS sump strainers for conservatism.” The values shown in Table 4.2-3, ‘Total Quantity of Debris Generated during a LOCA’ and Table 4.3-2, ‘Bypass Debris Types and Amounts per FA’ do not show 30 lb_m of latent fiber. These tables show total latent fiber debris of 15 lb_m where about 25% of the total latent fiber, or 3.68 lb_m, would bypass the sump strainer and be entrained into the ECCS and CSS streams. Please, clarify the reason for this difference.
6. In Table 4.2-3, ‘Total Quantity of Debris Generated During a LBLOCA,’ it is shown that total latent debris of particulate type is 185 lb_m and total latent debris of fibers type is 15 lb_m. This would add up to total latent debris of 200 lb_m. Therefore, the faction of debris of fibers type would be calculated as 15/200 = 7.5% by weight. The guidelines of NEI 04-07 assume the amount of fiber should be 15% by weight. Please clarify the reason for the difference between the weight fraction of fibrous debris in the analysis versus that of NEI 04-07. Note that any increase in the fiber weight percent would increase the calculated fiber load per fuel assembly and reduce the available driving head.
7. Please explain how the LOCADM code input of 9344 ft^2 for concrete was determined. The staff notes that typical large dry containments’ concrete area is on the order of 60,000 to 70,000 ft^2.
8. Please provide the Sump Pool Volume (ft^3) specified on the Material Input worksheet of the LOCADM program.

9. LOCADM, the analysis tool used to assess the impact of debris and chemical effects on fuel heat transfer, accounts for fiber by using “bump-up” factors for the impact of chemical effects on fuel heat transfer, resulting in a decrease in heat transfer. With the fiber levels in APR1400 being much less than in current operating plants, justify that these “bump-up” factors are still valid.

15.06.05-12

Title 10 of the Code of Federal Regulations, Part 50.55a(h), "Protection and Safety Systems," requires compliance with IEEE Std. 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," and the correction sheet dated January 30, 1995. Clause 6.8.1 of IEEE Std. 603-1991 requires that allowances for uncertainties between the analytical limit and device setpoint be determined using a documented methodology such as ISA S67.040-1987 (updated as ISA S67.04-1994). Regulatory Guide 1.105, Rev. 3 describes a method acceptable to the NRC staff for complying with the NRC's regulations for ensuring that setpoints for safety-related instrumentation are initially within and remain within the technical specification limits, and endorses ISA-S67.04-1994 Part I. DCD Tier 2 Sections 7.1, 7.2, and 7.3 cite compliance with Regulatory Guide 1.105, Rev. 3. Technical Report APR1400-Z-J-NR-14004-P, Rev. 0, “Uncertainty Methodology and Application for Instrumentation” cites ISA-RP67.04-1994 Part II, which is not endorsed or approved by Regulatory Guide 1.105 Rev. 3, as the standard that “provides the systematic method to identify the definition, classification, sources, and calculation method of uncertainties.” Part II of ISA-RP67.04-1994 provides recommended practices and guidance for implementing Part I of ISA-S67.04-1994.

Please confirm that the classification, sources, and calculational method of uncertainties were performed consistent with Regulatory Guide 1.105, Rev. 3 and ISA-S67.04-1994 Part I.

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