KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Monday, February 01, 2016 1:06 PM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Erin Wisler
Cc: Makar, Gregory; Mitchell, Matthew; Umana, Jessica; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 391-8462 (06.02.02 - Containment Heat Removal Systems)
Attachments: APR1400 DC RAI 391 MCB 8462.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, the following RAI question response times. We may adjust the schedule accordingly.

06.02.02-32: 45 days
06.02.02-33: 45 days
06.02.02-34: 60 days
06.02.02-35: 45 days
06.02.02-36: 45 days
06.02.02-37: 45 days
06.02.02-38: 45 days
06.02.02-39: 45 days
06.02.02-40: 45 days

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

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REQUEST FOR ADDITIONAL INFORMATION 391-8462

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: 06.02.02 - Containment Heat Removal Systems
Application Section:

QUESTIONS

06.02.02-32

FSAR Subsection 6.8.4.5.3 ("Debris Characteristics") and GSI-191 technical report Section 3.3 ("Debris Characteristics") state that coating debris was assumed to be in the form of small particles based on Subsection 3.4.3.2 of NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," and the staff's corresponding Safety Evaluation Report (SER). However, in its SER on NEI 04-07, the staff stated that small particles should be assumed when a plant can "substantiate the formation of a thin bed" of fibrous debris on the strainers. For plants that can "substantiate that the formation of a thin bed which can collect particulate debris will not occur," the staff found that "that coating debris should be sized based on plant-specific analyses for debris generated from within the ZOI [zone of influence] and from outside the ZOI, or that a default area equivalent to the area of the sump-screen openings, be used for coatings size." The staff reaffirmed this approach in its supplementary guidance for coatings (ADAMS No. ML080230462).

Therefore, revise the FSAR and GSI-191 technical report to justify how it is conservative for the APR1400 design to assume that all coating debris is in small particulate form.

06.02.02-33

In Regulatory Guide 1.82, Rev. 4, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," position C 1.3.5 identifies the need to consider generation and characterization of debris from protective coatings. The calculated quantity of coating debris generated by a postulated design-basis accident (DBA) depends, in part, on the coating area, thickness, and density used in the calculations. The staff needs the following information to evaluate the calculated quantity of coating debris for the APR1400 in FSAR Section 6.8 and the corresponding technical reports:

a. Appendix B of Technical Report APR1400-E-N-NR-14001-P, Rev. 0, describes the zone of influence (ZOI) applied to coating debris and summarizes the thicknesses for the coating systems in containment (Table B.3-1). Because various coating types are used in containment, and specifications may vary from product to product, provide the basis for the thickness values listed in Table B.3-1. In addition, explain and justify the differences between the coating thickness values in Table B.3-1 and the values in FSAR Table 6.2.1-23).
b. Provide the basis for the density values for epoxy and inorganic zinc coatings listed in Table 3.3-2 of APR1400-E-N-NR-14001-P, Rev. 0. Describe how

these density values result in conservative values for the calculated quantity of coating debris.

c. If appropriate, describe your plans to revise the FSAR and/or Technical Report to ensure the coatings debris evaluation is conservative.

06.02.02-34

The APR1400 Generic Safety Issue 191 (GSI-191) technical report, "Design Features to Address GSI-191," APR1400-E-N-NR-14001-P, Rev. 0, ADAMS No. ML15009A323, and FSAR do not reference the staff's most recent guidance on chemical effects.

> "NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Plant-Specific Chemical Effects," Enclosure 3 to Revised Guidance for Review of Final Licensee Responses to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors", March 28, 2008, ADAMS No. ML080380214.

Please discuss your plans to revise the FSAR and GSI-191 technical report to discuss how this guidance was used in the APR1400 chemical effects evaluation, and to identify any exceptions to this guidance. Add references to the NRC guidance documents to the FSAR and/or GSI-191 technical report, if appropriate.

06.02.02-35

In order to evaluate the applicant's use of the WCAP-16530-NP-A methodology, the staff requests the following information about the temperature transient for the design-basis case:

- Provide the source of the temperature profile used for the chemical effects evaluation shown in Table 3.8-5 of the GSI-191 technical report (TR) (APR1400-E-N-NR-14001-P, Rev. 0). The staff was not able to match the temperature profile with the temperature profiles shown in the figures in FSAR Tier 2, Section 6.2.
- Provide the temperature profiles for both the submerged and unsubmerged materials. The results of the chemical effects analysis in the TR show one temperature profile but state that it was conservative to treat unsubmerged materials as if they were submerged.
- Clarify the source of the temperature profiles used in the chemical effects calculation and evaluation of deposition on the fuel (LOCADM). The TR refers to temperature "data." TR Section 3.8.2 indicates it is a combination of data and extrapolation, while TR Table 4.3-6 calls it data.

06.02.02-36

The November 24, 2015, response (ML15328A218) to MCB Issue #3 (KHNP AI 6-19.3) states that the concrete surface area is calculated using a 10D zone of influence (ZOI) rather than 4D. Please clarify these statements about the meaning of the assumed ZOI (where "D" is the number of diameters of the broken pipe). For example, if ZOI in this case refers to that of the coating on the concrete, it should be described as such.

06.02.02-37

The November 24, 2015, response (ML15328A218) to MCB Issue #6 (KHNP AI 6-19.6) states that the maximum IRWST water volume was used instead of effective water volume to maximize the material dissolution and precipitate quantity. In order to support the staff's understanding of the APR1400 chemical effects analysis, please describe how this was determined.

06.02.02-38

Based on the TR and the November 24, 2015, responses (ML15328A218) to MCB Issues #7 and #8 (KHNP AI 6-19.7 and -19.8), it is the staff's understanding that the APR1400 chemical effects analysis was based on bounding pH values in the WCAP-16530-NP-A methodology. However, the TR includes Figure 3.8-1, "Minimum IRWST pH vs. Time Curve," without explaining how it was used. In order to support the staff's understanding of the APR1400 chemical effects analysis, please describe how Figure 3.8-1 was generated and how it was used in the analysis. Explain whether multiple WCAP-16530-NP-A analysis were performed to compare different pH transients or whether only the bounding analysis in the TR was performed.

06.02.02-39

The November 24, 2015, response (ML15328A218) to MCB Issue #9 (KHNP AI 6-19.9) states that it is conservative for the APR1400 chemical effects analysis to treat unsubmerged aluminum and concrete as if it were submerged. The response also proposes stating this as an assumption in Section 3.8.2 of the GSI-191 Technical Report. Please describe the basis for concluding it is conservative to treat the unsubmerged materials as being submerged, including consideration of the temperature of the containment atmosphere and pH profile of the containment spray solution. (The WCAP model assumes unsubmerged materials are at the containment temperature.) It is not clear to that staff how that assumption was justified since the report does not discuss the pH of the containment spray solution or temperature profile of the containment atmosphere (corresponding to unsubmerged coupons).

06.02.02-40

Section C.5.1.3 of Technical Report APR1400-E-N-NR-14001-P, Rev. 0, describes the procedure for preparing and testing aluminum oxyhydroxide surrogate for the strainer head-loss testing. The information provided is consistent with the procedures and criteria in WCAP-16530-NP-A, but other information is absent. The description in Section C.5.1.3 does not provide the sample size, nor confirm that the sample was diluted to 2.2 grams per liter. In addition, it does not state whether the sample was evaluated for both settlement criteria (the one-hour settled volume shall be 6 ml or greater and within 1.5 ml of the freshly prepared surrogate.) In order to complete its evaluation of the use of the AlOOH surrogate, the staff requests the sample size, dilution, and the surrogate used for each strainer test met all of the settlement criteria.

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