

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Monday, January 11, 2016 10:34 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Steven Mannon
Cc: Li, Yueh-Li; Clark, Theresa; Ng, Ronnie; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 359-8448 (03.06.02 - Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping)
Attachments: APR1400 DC RAI 359 MEB 8448.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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Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
Email Number: 408

Mail Envelope Properties (330e66733e0f452f8dda0c3217f1c8ac)

Subject: APR1400 Design Certification Application RAI 359-8448 (03.06.02 - Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping)

Sent Date: 1/11/2016 10:34:09 AM

Received Date: 1/11/2016 10:34:11 AM

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Files	Size	Date & Time
MESSAGE	608	1/11/2016 10:34:11 AM
APR1400 DC RAI 359 MEB 8448.pdf		99139
image001.jpg	5040	

Options

Priority: Standard

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REQUEST FOR ADDITIONAL INFORMATION 359-8448

Issue Date: 01/11/2016

Application Title: APR1400 Design Certification Review – 52-046

Operating Company: Korea Hydro & Nuclear Power Co. Ltd.

Docket No. 52-046

Review Section: 03.06.02 - Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping
Application Section: 3.6.2

QUESTIONS

03.06.02-6

The applicant submitted a technical report, APR1400-E-N-NR-14003-P, "Evaluation Methodology of Jet Impingement Loads on SSCs," on October 6, 2015, to support DCD Tier 2, Section 3.6.2. In Appendix A of this report, the applicant describes the modeling approach and verification and validation using industry standards. The subject was also discussed in a meeting on December 1-2, 2015 between the staff and the applicant. The relevant discussion was later documented in the applicant's December 9, 2015, letter (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15343A398).

Based on its review of the information provided in Appendix A of the report and the applicant's December 9, 2015 letter, the staff determined that the following additional information is needed on the verification and validation of the model used to determine that it meets the requirements of 10 CFR Part 50, Appendix B, and GDC 1, as described in the relevant SRP Section 3.9.1, Subsection II, SRP Acceptance Criterion 2.

1. The applicant is requested to provide an explanation of the data used to generate the tables presented in the Appendix A of the report, including how the results as shown in the table demonstrate the convergence of different solutions.
2. The staff noted that numerous statements or equations included in the report refer to either literature or test data. However, the report does not identify the respective literature or test data in the list of references. The applicant is requested to provide a more detailed explanation of the references pertaining to Appendix A of the report.
3. The applicant is requested to clarify how the uncertainty in the overall approach is addressed, how uncertainties are combined and carried forward to the application, and how specific reference information was applied (such as convergence to the desired goal). The applicant was requested to provide clarifications in other sections (e.g., Subsections 11 and 12 of Appendix A) to support the wording in Section A.15.0, Bullet A.2 regarding the validation of uncertainty with respect to CFD modeling.

03.06.02-7

To address the APR1400 design's compliance with GDC 4 requirements, the applicant describes the criteria and methods of analysis used in the APR1400 design to assess the dynamic effects of jet impingement and blast wave pressure in Appendix B of APR1400-E-N-NR-14003-P. The subject was also discussed in a closed meeting on December 1-2, 2015, between the staff and the applicant. The relevant discussion was later documented in the applicant's December 9, 2015, letter (ADAMS Accession No. ML15343A398).

Based on its review of the information provided in Appendix B of the report and the applicant's December 9, 2015, letter, the staff determined that the following additional information (discussed in the previously referenced meeting) is needed to determine that the proposed methodology is bounding and representative for the APR1400 design to mitigate the dynamic effects of blast wave pressure as described in Appendix B of the technical report.

1. In Section B.3.3 and Section B.4.0 of the report, the applicant referred to literature and experimental data for determining the blast wave overpressure correlation. However, the report does not identify the respective literature or test data in the list of references. The applicant is requested to provide a more detailed explanation with references pertaining to the information presented in Appendix B of the report.

REQUEST FOR ADDITIONAL INFORMATION 359-8448

2. The applicant is requested to clarify in Appendix B which data is used and where the experimental data came from. Also, the applicant is requested to explain how equations (e.g., those on Page B19 in the report) were derived and used in the analysis.
3. In determining the maximum positive impulse correction, the applicant referred to specific experiments. The applicant is requested to describe on the applicability of the experiments to the APR1400 design.
4. The applicant is requested to provide a more detailed explanation of how the recommended factor of safety for blast wave overpressure and maximum positive static pressure impulse were derived.
5. The applicant is requested to provide more clarification on shock wave propagation in Section B.3.3.
6. The applicant is also requested to add a discussion of the comparison of the blast wave correlation to the results in Section B.5.4.
7. The applicant is requested to correct the referenced section (3.1.3) on page 65 and correlate it to the associated equations (e.g., B-19, B-12a).
8. The applicant is requested to explain the dominant force in the methodology depicted in Figure B-1 of the technical report and in the Modified Moody jet zone.
9. The applicant is requested to provide an explanation of the steps that are taken in Section B.5.5 to obtain the dynamic load factor and pressure ratios.

03.06.02-8

The staff's guideline as delineated in Appendix A of mPower DSRS 3.6.2 recommends that the effect of potential oscillatory jet loads (i.e., resonance) should be considered when the impingement surface is within 10D of the jet opening. In Sections 4.2.1.2.3 and 4.2.1.2.2 of APR1400-E-N-NR-14003-P, the applicant provides information to support excluding certain jet impingement oscillatory loads with reference to additional studies. The uncertainties in the calculation of this range, however, are unclear. The staff noted that there are certain conservatism in the applicant's proposed jet impingement load evaluation methodology. Therefore, it may be justifiable for the applicant to use a different distance than staff's recommendation of 10D for excluding the potential oscillatory jet loads for the APR1400 design. The applicant is requested to provide further justification, including a discussion of uncertainty and the location of critical components, for its proposed distance criterion for considering oscillatory jet loads.



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