KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Tuesday, November 24, 2015 6:38 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Steven Mannon
Cc: Le, Tuan; Clark, Theresa; Umana, Jessica; Ng, Ronnie; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 319-8360 (03.09.03 - ASME Code Class 1, 2, and 3 Components)
Attachments: APR1400 DC RAI 319 MEB 8360.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 response times for the RAI questions. We may adjust the schedule accordingly.

03.09.03-2: 60 days
03.09.03-3: 45 days
03.09.03-4: 60 days
03.09.03-5: 45 days
03.09.03-6: 60 days

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

Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
Email Number: 368

Mail Envelope Properties (2e746d1398784e50b93d81b31c79b214)

Subject: APR1400 Design Certification Application RAI 319-8360 (03.09.03 - ASME Code Class 1, 2, and 3 Components)
Sent Date: 11/24/2015 6:37:47 AM
Received Date: 11/24/2015 6:37:48 AM
From: Ciocco, Jeff

Created By: Jeff.Ciocco@nrc.gov

Recipients:
"Le, Tuan" <Tuan.Le@nrc.gov>
Tracking Status: None
"Clark, Theresa" <Theresa.Clark@nrc.gov>
Tracking Status: None
"Umana, Jessica" <Jessica.Umana@nrc.gov>
Tracking Status: None
"Ng, Ronnie" <Ronnie.Ng@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
"Steven Mannon" <steven.mannon@aecom.com>
Tracking Status: None

Post Office: HQPWMSMRS07.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	753	11/24/2015 6:37:48 AM
APR1400 DC RAI 319 MEB 8360.pdf	117622	
image001.jpg	5040	

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

REQUEST FOR ADDITIONAL INFORMATION 319-8360

Issue Date: 11/24/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 03.09.03 - ASME Code Class 1, 2, and 3 Components
Application Section: Section 3.9.3

QUESTIONS

03.09.03-2

DCD Tier 2, Table 3.9-2 indicates that the load combination for Service Level C includes dynamic system loadings associated with the emergency condition. However, DCD Tier 2, Section 3.9.1 states that there are no transient events for the emergency condition. These two sections appear to be inconsistent. The staff requests that the applicant describe the specific dynamic system loads that are included in the load combination for Service Level C, and add a clarification note in Table 3.9-2, as applicable.

03.09.03-3

The requirements in 10 CFR 50.55a and 10 CFR Part 50, Appendix A, GDC 1 relate to structures and components being designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. One aspect of this design, as described further in SRP Section 3.9.3, is the evaluation of stresses based on an appropriate set of load combinations. In DCD Tier 2, Table 3.9-2, Service Level D has the "DF" load included in the load combination. In the Legend in Note (2), the applicant provides the definition of DF loads to be dynamic system loadings associated with pipe breaks (not eliminated by a leak-before-break analysis). Note (2) is not clear whether the DF load includes loadings associated with relief valve opening and closure in a closed system. To the extent that these valve operations are expected following the pipe break referenced in this load combination, the applicant is requested to describe how these loads are considered in the analysis.

03.09.03-4

GDC 2 and 10 CFR Part 50, Appendix S, relate to structures and components important to safety being designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. These requirements are evaluated in part in the staff's review of DCD Tier 2, Section 3.9.3, particularly in the use of seismic loads in the load combinations for ASME Class 1, 2, and 3 components and core support structures. The applicant has presented in Technical Report APR1400-E-S-NR-14004-P, Rev. 1, "Evaluation of Effects of HRHF [Hard Rock High Frequency] Response Spectra on SSCs [Structures, Systems, and Components]," an evaluation of the HRHF spectra on certain components (referred to below as the HRHF TR). The relationship of this report to the component structural analyses presented in DCD Tier 2, Section 3.9.3 is unclear. Therefore, the staff requests additional information in several areas related to this report.

1. The HRHF TR is referred to only in Appendix 3.7B of Chapter 3 of DCD Tier 2 and not in other sections that use seismic inputs in their evaluation of component structural integrity and dynamic qualification (e.g., DCD Tier 2, Sections 3.9.2, 3.9.3, 3.9.4, 3.9.5, 3.10, and 3.12). Because this report is incorporated by reference into the DCD through Tier 2, Table 1.6-2, however, it appears that the applicant intends these HRHF spectra to be part of the review of the APR1400 design certification application. The applicant is requested to describe, for each section that uses proposed certified seismic design response spectra (CSDRS) seismic inputs, how the HRHF spectra were also considered in the design, analysis, and testing of components (including piping). Appropriate changes to the DCD discussions in these and other sections may also be necessary. (Note that a similar observation was made specific to DCD Tier 2, Section 3.12 in RAI 8278, so these responses should be coordinated.)
2. In Section 6.2.2 of the HRHF TR, the applicant stated that "the RCS [reactor coolant system] component nozzles of the RV [reactor vessel], SG [steam generator], and RCP [reactor coolant pump] are included in the evaluation since a component nozzle has greater potential for failure than at other locations and the cold leg, hot leg, and crossover leg are relatively sensitive to high frequencies when compared with other components." The HRHF TR does not provide details of how these component locations were selected from the overall population and how the evaluation was performed. The applicant is requested to (1) describe the screening criteria used to select components (including piping) for evaluation of the effects of HRHF spectra, (2) list the components so evaluated, and (3) compare the calculated stresses using HRHF seismic inputs to the analyses conducted using CSDRS seismic inputs in the load combinations.

03.09.03-5

10 CFR Part 50, Appendix A, GDC 2 and Appendix S, require that structures and components important to safety be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. One aspect of compliance with these requirements, as described in SRP Section 3.9.3, is the inclusion of energy-absorbing snubbers in the design. As stated in the acceptance criteria in SRP Section 3.9.3, Subsection II, the snubber end fitting clearance, mismatch of end fitting clearances, mismatch of activation and release rates, and lost motion should be minimized and should be considered when calculating snubber reaction loads and stress which are based on a linear analysis of the system or component. This is especially important in multiple snubber applications where mismatch of end fitting clearance has a greater effect on the load sharing of these snubbers than does the mismatch of activation level or release rate. Equal load sharing of multiple snubber supports should not be assumed if mismatch in end fitting clearance exists.

In DCD Tier 2, Section 3.9.3.4 "Component Supports" the applicant states that "where required, snubber supports are used as shock arrestors for safety-related systems and components. Snubbers are used as structural supports during a dynamic event such as an earthquake or a pipe break but during normal operation act as passive devices that accommodate normal expansions and contractions of the systems without resistance. For the APR1400, snubbers are minimized to the extent practical through the use of design optimization."

To the extent that snubbers may be used in the detailed design of the APR1400 plant, their general design should be described in DCD Tier 2, Section 3.9.3.4. The applicant is requested to provide additional information, with a summary in the DCD, of the following snubber-related information (as well as other general information as appropriate on the snubber design):

- The snubber end fitting clearance, mismatch of end fitting clearances, mismatch of activation and release rates
- The snubber lost motion when calculating snubber reaction loads
- The load sharing, release rate when multiple snubber applications are used

03.09.03-6

During a recent audit of component design and procurement specifications, the staff observed that uncertainties in net positive suction head required (NPSHr) did not appear to be clearly addressed in the portions of specifications that addressed qualification of pumps. In Table 3.6-1, "$NPSH_r$ for SI Pump and CS Pump," of technical report (TR) APR1400-E-N-NR-14001, "Design Features to Address GSI-191," the applicant addresses uncertainties in $NPSH_r$ for the SI and CS pumps. Specific values are provided for $NPSH_{r3\%}$ (provided by the pump vendor as a result of factory testing as the value of NPSH which results in a 3 percent drop in pump discharge head) and for $NPSH_{reff}$ (the $NPSH_{r3\%}$ value with uncertainties in NPSHr included). As described in SECY-11-0014, "Use of Containment Accident Pressure in Analyzing Emergency Core Cooling System and Containment Heat Removal System Pump Performance in Postulated Accidents," dated January 31, 2011, which was referenced by the applicant in the notes to Table 3.6-1, experience has shown that the uncertainty in $NPSH_r$ of a pump installed in the field is greater than the uncertainty obtained by testing at the pump vendor's facility for several reasons. However, uncertainties in $NPSH_r$ were not described in the audited specifications or in the TR for safety-related pumps other than the SI and CS pumps. Therefore, the applicant is requested to describe provisions to account for uncertainties in NPSHr for safety-related pumps other than the SI and CS pumps and revise the TR as appropriate, such that the application integrates this operating experience consistent with 10 CFR 52.47(a)(22).


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