KHNPDCDRAIsPEm Resource

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Sent:	Monday, November 16, 2015 10:52 AM
To:	apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; James Ross
Cc:	Le, Hien; McKirgan, John; Ward, William; Lee, Samuel
Subject:	APR1400 Design Certification Application RAI 307-7835 (05.04 - Reactor Coolant System Component and Subsystem Design)
Attachments:	APR1400 DC RAI 307 SRSB 7835.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 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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REQUEST FOR ADDITIONAL INFORMATION 307-7835

Issue Date: 11/16/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 05.04 - Reactor Coolant System Component and Subsystem Design
Application Section: DCD 5.4.1

QUESTIONS

05.04-1

10 CFR 52.47(a)(2) and GDC 44 of Appendix A to 10 CFR Part 50 provide the regulatory basis for the following questions.

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

GDC 44, "Cooling Water," states "a system to transfer heat from structures, systems, and components important to safety, to an ultimate heat sink shall be provided. The system safety function shall be to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions." SRP Section 9.2.2, "Reactor Auxiliary Cooling Water System," provides guidance for this area of review. SRP Section 9.2.2, Point II.4.G (for meeting, in part, requirements of GDC 44) requires "[D]emonstration by testing that RCPs withstand a complete loss of cooling water for 20 minutes and instrumentation in accordance with Institute of Electrical and Electronics Engineers Standard (IEEE Std) 603, as endorsed by RG 1.153 with control room alarms detecting loss of cooling water so a period of 20 minutes is available for the operator to have sufficient time to initiate manual protection of the plant."

1. DCD Subsection 5.4.1.2 states that "The RCP shaft seals are cooled by (1) seal injection water from the CVCS and (2) the component cooling water (CCW) through a high-pressure seal cooler. Pump seal operation may continue indefinitely provided either seal injection water or the CCW is available. The APR1400 design includes an additional support system (i.e., auxiliary charging pump). This system features a positive displacement pump to provide a diverse means of seal injection to the RCPs if the normal means of seal cooling are lost. Detailed descriptions are given in Subsections 9.2.2.3 and 9.3.4.2." The staff could not find a detailed description of the seal injection flow paths into and within each of the seal stages in the DCD Subsections 9.2.2.3 and 9.3.4.2. Without such details, the staff could not validate that pump seal operation may continue indefinitely as stated above. At the staff's request in the non-Chapter 15 audit plan, the applicant presented a non-proprietary document which shows the seal injection flow paths including the existence of an auxiliary impeller, integral to the pump shaft, which provides the driving force for recirculation of seal water through the external high-pressure seal cooler. The applicant is requested to add those details to DCD Subsection 5.4.1 as part of the pump design description.
2. DCD Subsection 9.2.2.5, Instrumentation Requirements, states, in part, "RCPs 1A, 1B, 2A, and 2B thermal barrier (e.g., seal cooler, high-pressure cooler) outlet temperatures." The staff noted that term "thermal barrier" is not used nor described in DCD Subsection 5.4.1. The applicant is requested to address this inconsistency between DCD Subsection 9.2.2.5 and DCD Subsection 5.4.1.
3. DCD Subsection 5.4.1.2 states that "In the event of loss of either seal injection to the seal assembly or loss of CCWS flow to the high-pressure seal cooler, the seal cooling water temperature increases. Performance tests and analyses have shown that a minimum margin of 12.2 C (22 F) exists between the seal cooling water outlet temperature and the seal cooling water temperature limit specified by the pump manufacturer. The staff could not find a summary of

these performance tests and analyses within DCD Subsection 5.4.1. Without such information, the staff could not validate the stated temperature margin. The applicant is requested to provide a summary of the test results in DCD Subsection 5.4.1, and a reference to the document where these tests and analyses are described.

4. In DCD Figure 5.1.2-2, the staff noted the use of a jet pump in the seal injection line from CVCS. A description of this jet pump and its functional requirements are not provided in DCD Subsection 5.4.1. The applicant is requested to add these details for the jet pump in DCD Subsection 5.4.1.
5. DCD Subsection 5.4.1.2 states "If there is a simultaneous loss of CCW to all RCP and motor bearing assemblies but seal injection water is available to the seals, the RCP can operate for at least 30 minutes without bearing seizure, which could affect normal RCP coastdown."

   DCD Subsection 9.2.2 identifies RCP pump/motor oil coolers and the charging pump mini-flow heat exchanger as nonessential components supported by the Division I CCW pump.

   Based on the above descriptions, a failure of the Division I CCW pump will affect both the charging pump and the RCP pump/motor bearings. Therefore, the staff questions the availability of seal injection water during the stated 30-minute period. The applicant is requested to provide more detail on the following:
   a) Since the CCWS provides cooling water to both the CVCS (charging pump mini flow heat exchangers) and oil coolers for the RCP pump/motor bearings, explain what is meant by loss of CCW, and
   b) If "loss of CCW" includes cooling flow to CVCS, explain how seal injection flow to the RCPs will not be affected for "up to 30 minutes" to prevent seal damage.
6. In DCD Subsection 5.4.1.2, the bases for the design of an anti-reverse rotation device are provided, but the staff could not find the description of this device within DCD Section 5.4.1. At the staff's request in the non-Chapter 15 audit plan, the applicant presented a non-proprietary document which shows details of the anti-reverse rotation device. The applicant is requested to add those details to DCD Subsection 5.4.1 as part of the pump design description.
7. In DCD Subsection 5.4.1.2, the applicant states "As the seal is intended to withstand adverse SBO conditions, it is verified by a robust test program. The applicant is requested to provide a summary of the test results in DCD Secton 5.4.1, and a reference to the document that describes this program.
8. In DCD Subsection 5.4.1.2, the applicant provides very limited information on the pump and motor bearing types used to support safe and reliable pump operation. At the staff's request in the non-Chapter 15 audit plan, the applicant presented a non-proprietary document which shows needed details for these pump and motor bearings. The applicant is requested to add those details to DCD Subsection 5.4.1 as part of the pump design description.


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