

KHNPDCDRAIsPEm Resource

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Subject: APR1400 Design Certification Application RAI 221-8248 (05.04.07 - Residual Heat Removal (RHR) System)
Attachments: APR1400 DC RAI 221 SRSB 8248.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 221-8248

Issue Date: 09/23/2015

Application Title: APR1400 Design Certification Review – 52-046

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

Docket No. 52-046

Review Section: 05.04.07 - Residual Heat Removal (RHR) System

Application Section: DCD Section 5.4.7

QUESTIONS

05.04.07-1

Shutdown Cooling System Heat Removal Capability Testing

10 CFR Part 50, Appendix A, GDC 34 requires the capability to transfer decay heat and other residual heat from the reactor such that fuel and pressure boundary design limits are not exceeded. In addition, the system must be designed with sufficient redundancy and isolation capability to ensure that the safety function can be accomplished assuming a single failure of an active component with or without a coincident loss of offsite power. BTP 5-4 provides an acceptable approach to ensure compliance with GDC 34 with regard to accomplishing the RHR system safety functions assuming a single failure. Compliance with GDC 34 enhances plant safety by providing assurance that decay and RHR will be accomplished and the RCS pressure boundary and fuel cladding integrity will be maintained, thereby minimizing the potential for the release of fission products to the environment.

In DCD subsection 5.4.7.4.1.2 “Heat Removal Capability,” the applicant states, “A test is performed on SDCHXs during pre-core hot functional testing. Shutdown cooling and component cooling water flow rates to each heat exchanger, reactor coolant temperatures at SDCHX inlet and outlet, and component cooling water temperature at SDCHX inlet are measured. Test results are used to verify that the heat removal capability of each SDCHX meets the heat removal capability required to achieve a safe cold shutdown.”

The preoperational test described above is 14.2.12.1.46 “Pre-Core Hot Functional Test Controlling Document.” Under the test method section, the applicant states, “Specify plant conditions and coordinate the execution of the related pre-core hot functional test appendices.” However, the staff was unable to locate the appendix for the shutdown cooling system in applicable reports including the DCD.

Also, during Phase II, Fuel loading and post-core hot functional testing per subsection 14.2.12.2.1, “Post-Core Hot Functional Test Controlling Document,” the applicant refers to “post-core hot functional test appendices.”

In order to complete the evaluation of the SCS functional design testing, please provide the pre-core hot functional test appendices and post-core hot functional test appendices.

05.04.07-2

SCP and CSP Net Positive Suction Head (NPSH) During Shutdown Cooling

10 CFR Part 50, Appendix A, GDC 34 requires the capability to transfer decay heat and other residual heat from the reactor such that fuel and pressure boundary design limits are not exceeded. BTP 5-4 provides an acceptable approach to ensure compliance with GDC 34 with regard to accomplishing the RHR system safety functions assuming a single failure.

REQUEST FOR ADDITIONAL INFORMATION 221-8248

As discussed in subsection 5.4.7.1.2, "Functional Design Bases," the shutdown cooling system (SCS) and containment spray system (CSS) pumps are interchangeable to provide flexibility to backup each system when a pump is out of service. For shutdown cooling, the applicant must demonstrate that the net positive suction head (NPSH) is sufficient when the CSS pump is connected to the shutdown cooling system since the piping configuration is different. Also, it must be shown that the NPSH available exceeds the NPSH required for both SCS and CSS one/two pumps in shutdown cooling mode under all operational conditions of which the pumps will be operated to ensure the flow paths for normal decay heat removal is not impacted by other shutdown cooling operations such as flow to chemical and volume control system for purification, transfer of refueling water to the IRWST, and cooling of the IRWST that may be initiated during shutdown cooling.

The applicant provided limited discussion related to SCS NPSH design calculations and the impact of the other SCS functions on heat removal capability. In DCD Table 5.4.7-1, NPSH (available, 19 ft @ 5,425 gpm) exceeded NPSH (required, 18 ft @ 5,425 gpm) by 1 ft; however, no NPSH information was found in DCD Sections 5.4.7 or 6.2 related to NPSH when CSP is substituted for SCP during shutdown cooling.

Therefore, in order to complete SCS NPSH technical evaluation, please provide the NPSH calculations for both a SCS and a CSS pump(s) in the shutdown cooling configuration including line losses and the elevation drawings.