KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Tuesday, October 20, 2015 2:06 PM
To: KHNPDCDRAIsPEm Resource
Subject: FW: APR1400 Design Certification Application RAI 256-8321 (09.02.02 - Reactor Auxiliary Cooling Water Systems)
Attachments: APR1400 DC RAI 256 SPSB 8321.pdf

From: Ciocco, Jeff
Sent: Monday, October 19, 2015 9:36 AM
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Subject: APR1400 Design Certification Application RAI 256-8321 (09.02.02 - Reactor Auxiliary Cooling Water Systems)

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 response times. We may adjust the schedule accordingly.

09.02.02-4: 30 days
09.02.02-5: 45 days
09.02.02-6: 30 days
09.02.02-7: 45 days
09.02.02-8: 30 days
09.02.02-9: 45 days
09.02.02-10: 30 days

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

Thank you,

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United States Nuclear Regulatory Commission
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REQUEST FOR ADDITIONAL INFORMATION 256-8321

Issue Date: 10/19/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 09.02.02 - Reactor Auxiliary Cooling Water Systems
Application Section: 9.2.2

QUESTIONS

09.02.02-4

General Design Criterion (GDC) 44 provides requirements for the transfer of heat from systems, structures and components (SSCs) important to safety to a heat sink during both normal and accident conditions assuming a single active failure. The component cooling water system (CCWS) provides cooling to the reactor coolant pump (RCP) thermal barrier. Because there is a large pressure differential between the reactor coolant system (RCS) and the CCWS, cooling of the pumps seals is important in preventing excessive thermal barrier leakage. SRP 9.2.2, Section I, Item 12 identifies, as a specific area of review for the CCWS, the systems capability for adequately cooling all RCP seals and bearing. Section I, Item 7 of the SRP states the following is to be reviewed with respect to the RCP seal cooling:

- controls to ensure that the component cooling water loop to the RCP seal does not automatically isolate, and

- provisions for the control room operators to isolate the RCP seal coolant line by remote manual means.

In DCD Tier 2, Section 9.2.2.3, “Safety Evaluation,” it is stated that “The CCW supply to the RCP coolers is isolated on a low-low surge tank level signal. However, this isolation signal can be overridden by manual operations from the MCR to protect the RCP seal”.

The staff finds that the automatic isolation of the CCW supply and return lines are not consistent with the guidance provide in SRP 9.2.2. Based on the guidance, cooling design provisions should be made for isolation of component cooling water supply and return lines to the RCP by remote manual means only. Also, design provisions should be made for the control room operator to have the necessary information to determine when it is appropriate to isolate the lines by remote manual means and how soon the lines should be isolated if they become release paths from the containment during a LOCA.

Since RCP seals generally requires continuous cooling, and automatic isolation of the CCWS supply and return lines to the RCP coolers will occur should a low-low surge tank level signal be received, the applicant is requested to discuss how the proposed design and operation of the CCWS either adhere to SRP 9.2.2 subsection III.4.F (in regards to the isolation of CCWS flow to the RCP seal cooling by remote manual means only) or if an alternative approach is used to provide an acceptable method for assuring adequate cooling of the RCP seals in support of compliance with GDC 44.

09.02.02-5

As discussed in Standard Review Plan (SRP) 9.2.2 Section II, "Acceptance Criteria," General Design Criteria (GDC) 2 requires the capability of structures housing the Component Cooling Water System (CCWS) and the system itself to withstand the effects of natural phenomena like earthquakes, tornadoes, hurricanes, and floods.

All of the buildings housing CCWS equipment are shown in DCD Tier 2, Figure 1.2-1, “Typical APR1400 Site Arrangement Plan,” to be in scope of the standard plant and thus the DCD. The Auxiliary Building, Diesel Generator Building, and CCWHX building are all designed as seismic Category I and protect the CCWS components from external environmental hazard such as wind, tornado, hurricane, flood, and earthquakes.

Based on a review of the general arrangement drawings in Chapter 1 of the DCD, and the component cooling water flow diagram in Section 9.2 of the DCD, it appears that there are CCWS SSCs housed in tunnels connecting the CCW equipment in the Auxiliary Building to components in other buildings like the EDG and CCW heat exchanger buildings. The staff is unable to verify that the SSCs in piping tunnels will be adequately protected against external environmental hazard since DCD Figure 1.2-1 does not identify the pipe tunnels to be in scope of the DCD, and protection of the CCWS SSCs inside the pipe tunnel is not discussed in the DCD. Therefore, the applicant is requested to:

a. Identify pipe tunnels or any other features used to provide connection between CCWS SSCs in buildings that are physically separated from one another, and specify whether the tunnel/structure used is in scope of the DCD.

b. Discuss how the requirements of GDC 2 are met in regards to the capability of the tunnels/structure housing the CCWS SSCs to withstand the effects of natural phenomena like earthquakes, tornadoes, hurricanes, and floods.

c. If the pipe tunnels are not considered to be in scope of the DCD, provide requirements to ensure CCWS SSCs are protected from the environment hazards, and add a COL item specifying the COL applicant requirements regarding the CCWS tunnels.

d. Discuss how CCWS piping and SSCs located outside of plant buildings are protected from the effects of exposure to subfreezing environments

09.02.02-6

As discussed in Standard Review Plan (SRP) 9.2.2 Section II, "Acceptance Criteria," General Design Criteria (GDC) 4 requires the Component Cooling Water System (CCWS) to be designed to withstand the effects of missiles inside and outside of containment, effects of pipe whip, jets, environmental conditions from high- and moderate-energy line breaks, and dynamic effects of flow instabilities and attendant loads (i.e., water hammer) during normal plant operation as well as upset or accident conditions.

Compliance with the requirements of GDC 4 is based on identification of the essential portions of the system that are to be protected from dynamic effects (mentioned above) and how the system will be capable of continuing to perform its safety function in the environmental conditions that may result from high and moderate energy line breaks and the resulting discharged fluid.

APR1400 DCD Table 3.5-4, “Essential Systems and Components to be protected from Externally Generated Missiles,” contains a list of protected SSCs and the missile barrier. In reviewing Table 3.5-4, the staff noticed that the component cooling water heat exchanger (CCWHX) building was identified as the missile barrier for all of the protected components associated with the CCWS; however, based on the staffs review of the general arrangement drawings in DCD Tier 2, Figures 1.2-11 through1.2-19 and the information provided in DCD Tier 1, Table “2.7.2.2-1, “Component Cooling Water System Equipment and Piping Location / Characteristics,” the only CCWS components contained in the CCWHX building are the component cooling water system exchangers. The CCW pumps and CCW makeup pumps are located in the Auxiliary Building. The staff beliefs that the identification of the CCWHX building as the missile barrier for the CCW pumps and CCW makeup pumps may be in error. Therefore, the applicant is requested to update Table 3.5-4 to be consistent with the design presented in the application.

09.02.02-7

General Design Criterion (GDC) 4 requires safety systems be designed to accommodate the effects of and to be compatible with the environmental conditions associate with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These structures systems and components shall be appropriately protected against dynamic effects of flow instabilities and attendant loads (i.e. water hammer).

Water hammer prevention for the CCWS is addressed in DCD Tier 2, Section 9.2.2.2.2.4, “Pipe Valves, and Fittings.” The Component Cooling Water System (CCWS) design includes features to minimize the potential for water hammer. To ensure that adequate precautions are taken to prevent water hammer once the system has been put into operation, the applicant specifies COL Item 9.2(9), indicating that a COL applicant is to develop procedures for water systems filling, venting, keeping the system full, and operation to minimize the potential for water hammer; to analyze the system for water hammer impacts; to design the piping system to withstand potential water hammer forces; and to analyze inadvertent water hammer events in accordance with NUREG-0927.

The staff has reviewed the information in the DCD, including COL item 9.2(9). While the staff agrees with the need for the COL applicant to develop appropriate operation and maintenance procedures addressing water hammer concerns, the staff does not understand the need for the requirements related to system design, since the system design is fully within the scope of the DCD. Therefore, the applicant is requested to clarify:

a. As the CCWS designer, to what extent has the CCWS design been analyzed for water hammer impacts, and to what extent has the CCWS piping been designed to withstand potential water hammer.

b. What portions of the CCWS system is the COL Item requesting the COL applicant to analyze for water hammer impacts.

09.02.02-8

The Component Cooling Water System (CCWS) must be designed so that it is capable of transferring the heat generated by all the heat loads being serviced by the system to the Essential Service Water System for rejection to the ultimate heat sink in order to satisfy GDC 44. In SRP 9.2.2, Section III Item 3D indicates that the system will be reviewed to see that the system is designed for removal of heat loads during normal operation and for emergency core cooling heat loads during accident conditions with appropriate design margins for adequate operation. The applicant did not state or justify the amount of excess margins that are included in the design to account for uncertainties, component wear and aging effects, fouling of heat transfer surfaces, etc. Therefore, the applicant is requested to identify, in the DCD, margins in the design and discuss why the specified margins are considered to be adequate.

09.02.02-9

10CFR 20.1406(b) requires that “Applicants for standard design certifications, standard design approvals, and manufacturing licenses under part 52 of this chapter, whose applications are submitted after August 20, 1997, shall describe in the application how facility design will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.” Regulatory Guide 4.21 describes a method acceptable to the U.S. Nuclear Regulatory Commission (NRC) for use in the implementation of Title 10, Section 20.1406, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning”

DCD Tier 2, Section 9.2.2.2.5 describes the design features for minimization of contamination. In item c and d, on page 9.2-37 of the DCD, it is stated that sloped floors with epoxy coatings will facilitate draining of radioactively contaminated or potentially contaminated fluids into local sumps, which will have level switched to facilitate pumping when levels reach a predetermined setpoint. However, no information has been included on where the contents of the sump is routed to, or the system (pipes, pumps, valves, etc.) through which it is being routed through. Therefore, staff request that the applicant,

a. Specify where the sump contents are routed to for treatment and/or storage

b. Discuss the measures taken to prevent potential contamination due to the potential for system leakage during the transfer of the sumps content to where it is ultimately treated and/or stored.

09.02.02-10

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 therefore, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

DCD Tier 2, Section 9.2.2.2.3, “Electric Power,” states that “each division of safety-related equipment receives power from its associated division of the Class 1E ac power distribution system with the exception of the containment isolation valves (CIVs) and associated instrumentation and controls (I&C).” The staff finds that the DCD has no discussion on how ac power is supplied to the CIVs and associated I&C. Since the CIVs are safety related and are require to be powered by a class 1E power system, the applicant is requested to revise the DCD by providing additional information on the power supply for the CIVs and associated I&C. The DCD should also include the identification of the normal and backup power supply for the CIVs.