

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Thursday, October 22, 2015 9:46 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Christopher Tyree
Cc: Nolan, Ryan; Dias, Antonio; Wunder, George; Lee, Samuel; Umana, Jessica
Subject: APR1400 Design Certification Application RAI 269-8319 (09.02.02 - Reactor Auxiliary Cooling Water Systems)
Attachments: APR1400 DC RAI 269 SPSB 8319.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 days to respond to the RAI questions. We may adjust the schedule accordingly.

09.02.02-11: 30 days
09.02.02-12: 45 days
09.02.02-13: 30 days
09.02.02-14: 45 days
09.02.02-15: 45 days
09.02.02-16: 60 days

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

Thank you,

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REQUEST FOR ADDITIONAL INFORMATION 269-8319

Issue Date: 10/22/2015

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: 9.2.7

QUESTIONS

09.02.02-11

GDC 2 requires, in part, that SSCs important to safety be protected against natural phenomena, including seismic events. In addition, 10 CFR 52.6 requires that information provided by an applicant be complete and accurate. During the staff's review of the chilled water system several discrepancies were identified and should be clarified or corrected.

- a) DCD Tier 2, Section 9.2.7.1.2, specifies that nonsafety-related portions of the plant chilled water system (PCWS) are designed to seismic category II requirements; however, Table 3.2-1, Sheet 79, identifies portions of the PCWS in the compound building that are designed to seismic category III criteria. The applicant is requested to clarify in the DCD whether this statement is applicable to all portions of the PCWS or only those located in the auxiliary building.
- b) The DCD Tier 2, Section 9.2.7, description and figures, as well as, the general arrangement figures (DCD Tier 2, Figures 1.2-11 and 1.2-13) use the term "essential" when the component is associated with the essential chilled water system (ECWS) and "central" when the component is associated the PCWS. However, the staff notes that the term "essential central" is used in various locations within the application. For example, DCD Tier 2, Table 3.4-2, uses the term "essential central chilled water pump" in several locations, and DCD Tier 2, Table 8.3.1-3, uses the term "essential central chiller." The use of these terms conflict with DCD Tier 2, Section 9.2.7, and are misleading and cause confusion. The applicant is requested to establish and use consistent terms within the DCD for the components of the ECWS and PCWS.

09.02.02-12

The essential chilled water system (ECWS) must be capable of removing heat from structures, system and components (SSCs) important to safety during normal operating and accident conditions over the life of the plant in accordance GDC 44 requirements. The ECWS description and flow diagrams in DCD Tier 2, Section 9.2.7, were reviewed to assess the design adequacy of the ECWS for performing its heat removal functions. While the description and figures show the ECWS components and identifies the boundaries between safety-related and nonsafety-related parts of the system, some of the information is incomplete, or inconsistent. The staff notes that:

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- a) Nominal pipe sizes are not shown on the DCD Tier 2, Section 9.2.7, figures and the system description does not explain the criteria that are used for establishing the appropriate pipe sizes (e.g. limiting flow velocities).
- b) Filters or strainers are not shown in the DCD Tier 2, Section 9.2.7 figures and DCD Tier 2, Section 9.2.7, does not discuss how particulate and other foreign material will be controlled in the system.
- c) SRP 9.2.2 specifies that essential components and subsystems can function as required in a loss of offsite power and instrument air systems. DCD Tier 2 describes the ECW control valves as air-operated three-way control valves that fail open upon a loss of control signal or electrical power. However, the DCD does not discuss or evaluate the impact the ECW control valves have on the system when they fail closed due to loss of instrument air.
- d) SRP 9.2.2 states the system should be 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. It is not apparent to the staff that the design of the ECWS pumps and chillers have appropriate design margin to account for uncertainties, component wear and aging effects, fouling of heat exchangers.
- e) SRP 9.2.2 states the application should describe allowable component operational degradation (e.g., pump leakage) and the procedures followed to detect and correct these conditions when degradation becomes excessive. In addition, it states the seismic source of makeup can be made available within a time frame consistent with the surge tank capacity (time zero starts at low level alarm). DCD Tier 2, Section 9.2.7.2.1.2, describes the ECW compression tank; however, it does not include an evaluation of the assumed leak rate through sources such as boundary valves, packing, pump seals, and unidentified leakage, or the timeliness of the ECW makeup pump to provide water to the system.

In order to demonstrate that the chilled water system is capable of performing its intended safety function for normal and abnormal conditions as required by GDC 44, the applicant is requested to address the above items in the DCD.

09.02.02-13

GDC 45 and 46 require that the essential cooling water system (ECWS) be designed to allow for periodic inspection and testing, respectively. SRP 9.2.2 specifies that the application delineates a testing and inspection program, and the system drawings show the necessary test recirculation loops around pumps or isolation valves necessary for this program.

The staff reviewed DCD Tier 2, Section 9.2.7, and associated tables and figures to determine whether the design of the ECWS allows periodic testing and inspection. However, it is not clear to the staff whether:

- a) All portions of the ECWS are accessible in the auxiliary building.
- b) The current design allows for component maintenance due to the absence of isolation/maintenance valves.

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In order to ensure the integrity and capability of the system to perform its safety-related functions during normal operations, anticipated operational occurrences, and accident conditions, the applicant is requested to include in the DCD a discussion on the accessibility and maintenance capabilities of the ECWS (including any necessary revisions to the figures) and, if portions of the system are not accessible, a discussion on how they will be inspected and maintained.

09.02.02-14

RG 1.206, Section C.1.9.2.2.5, "Instrumentation Requirements," states "[t]he applicant should describe the system alarms, instrumentation, and controls. Include a description of the adequacy of instrumentation to support required testing, as well as the adequacy of alarms to notify operators of degraded conditions."

DCD Tier 2, Section 9.2.7.5, "Instrumentation Requirements," provides a high-level description of the essential chilled water system (ECWS) instrumentation as well as indication and alarms. However, the staff finds that DCD Tier 2, Section 9.2.7.5, and associated figures are incomplete. For example:

- a) DCD Tier 2, Section 9.2.7.5 states "local temperature and pressure indicators are provided at selected points in the system;" however, it is unclear to the staff if this information is included on Figure 9.2.7-1.
- b) DCD Tier 2, Section 9.2.7.5 specifies that inlet and outlet pressure of the evaporators are provided; however, this is not shown on Figure 9.2.7-1.
- c) DCD Tier 2, Section 9.2.7.5 provides a list of main control room (MCR) and remote shutdown room (RSR) indication and alarms; however, it is not clear to the staff what control instrumentation is available to the operators and which instruments provide the input to specific indication or alarms.
- d) DCD Tier 2, Section 9.2.7.5 or Figure 9.2.7-1 do not include instrumentation, controls, or alarms for protection against freezing, high/low refrigerant pressure, refrigerant leak detection, flow, and temperature.

The applicant is requested to address the above items regarding instrumentation and controls for the ECWS. DCD Tier 2, Section 9.2.7, Figure 9.2.7-1, and DCD Tier 1, including Table 2.7.2.3-3, should be revised accordingly.

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09.02.02-15

10 CFR 20.1406(b) requires that “[a]pplicants 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.”

The staff reviewed DCD Tier 2, Section 9.2.7, for a description of essential chilled water system (ECWS) design features necessary to meet the requirements of 10 CFR 20.1406. However, a discussion on minimizing contamination with respect to the essential chilled water system (ECWS) is not included in DCD Tier 2, Section 9.2.7. The applicant is requested to provide an evaluation of the ECWS design features necessary to meet the requirements of 10 CFR 20.1406 or the basis for not needing the aforementioned features.

09.02.02-16

10 CFR 52.47(b)(1) requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC’s regulations.

The staff found that the proposed ITAAC in DCD Tier 1, Section 2.7.2.3, Table 2.7.2.3-4, are incomplete, or that clarification is needed. Consequently, the Tier 1 information should be revised to address the following:

- a) Item 10 provides the ITAAC for the essential chilled water (ECW) pump head. The acceptance criteria require that available net positive suction head (NPSH) exceed the NPSH required. This conflicts with DCD Tier 2, Section 9.2.7.2.1.2, which specifies that the available NPSH is a minimum of 25 percent greater than the required NPSH. In addition, the ITAAC does not specify the analysis to be performed assuming worst case parameters such as low compression tank water level and high water temperature.
- b) DCD Tier 1, Table 2.7.2.3-4, does not include an ITAAC for the ECW pump flow testing.

The applicant is requested to revise DCD Tier 1, Table 2.7.2.3-4, to address the above items in order to ensure that the APR 1400 will be built and operated in accordance with the design certification.



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