

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Monday, September 14, 2015 7:15 AM
To: apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Christopher Tyree
Cc: Li, Chang; Dias, Antonio; Wunder, George; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 211-8236 (09.02.01 - Station Service Water System)
Attachments: APR1400 DC RAI 211 SPSB 8236.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, 30 days, 30 days, 45 days, 45 days, 45 days, and 30 days, respectively, to respond to these RAI questions. We may adjust the schedule accordingly.

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

Thank you,

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Issue Date: 09/14/2015

Application Title: APR1400 Design Certification Review – 52-046

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

Docket No. 52-046

Review Section: 09.02.01 - Station Service Water System

Application Section:

QUESTIONS

09.02.01-1

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.

Per SRP Section 9.2.1, Subsection III.1, the essential service water system (ESWS) description was reviewed for its design adequacy. The staff finds some inadequacies in the DCD Tier 2 ESWS description.

The applicant is requested to provide additional detail on the following issues. DCD Tier 2 should be modified accordingly:

- a) DCD Tier 2, Section 9.2.1.2.1 indicates that ESW pumps are located in the ESW building. However, ESW pump coolers and ESW building coolers are not addressed. Discuss the design of the ESW pump coolers and building coolers to maintain safety function of the ESWS pumps.
- b) In DCD Tier 2, Table 9.2.1-2, "ESWS Failure Modes and Effects Analysis," ESW pump discharge isolation MOVs SX-045, -046, -047, -048 are not included. Include these MOVs in the table.
- c) In DCD Tier 2, Table 9.2.1-2, "ESWS Failure Modes and Effects Analysis," check valves in pump discharge V1001, V1002, V1003, V1004 are identified. However, the valve numbers are inconsistent with the numbers listed in DCD Tier 1, Table 2.7.2.1-2, "Essential Service Water System Components List," which shows the valve numbers of SX-1001 through 1004 for the check valves in pump discharge. Clarify the inconsistency of the valve numbering between these two tables.
- d) Discuss the ESWS pump discharge MOV logic for opening and closing during any accident conditions. Describe the results if the MOV does not open with the pump operating, which system alarms in the MCR could provide operators information, and what the operator could do to mitigate the consequences.
- e) DCD Tier 1 Section 2.7.2.1.1, Item 8.d states that all displays and alarms exist in the remote shutdown room (RSR) as defined in Tables 2.7.2.1-2 and 2.7.2.1-3. Tier 2 of the DCD Section 9.2.1 does not indicate any instrument and control for monitoring or control in the RSR. Tier 2 information should include all Tier 1 information. Provide in DCD Tier 2 a description of the ESWS instrument and control in the RSR.
- f) The DCD does not discuss valve isolation and other means (such as procedures) that would be used to isolate the leakage in the event of radioactive leakage from the CCWS to ESWS. Provide a discussion to address the isolation of the radioactive contamination event in accordance with SRP Section 9.1 Subsection III.3.D.

09.02.01-2

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.

Per SRP Section 9.2.1, Subsection III.1, the ESWS description and flow diagrams were reviewed by the staff for its design adequacy.

DCD Tier 2, Section 9.2.1.2.2.2 states that

"the ESW piping to the CCW heat exchanger building is routed through a seismic Category I reinforced concrete pipe tunnels buried in the yard. The ESW piping to

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the UHS structures is routed through a seismic Category I reinforced concrete pipe tunnel.”

The staff finds these ESW piping sections are an essential part of the ESWS to carry the cooling water for its heat removal function. However, these piping sections are not shown in the classification table of DCD Tier 2, Table 3.2-1; or in the ESWS equipment and piping table of DCD Tier 1, Table 2.7.2.1-1; and are not considered in the failure modes and effects analysis of DCD Tier 2, Table 9.2.1-2.

The applicant is requested to include the piping information in the applicable tables, as identified above.

09.02.01-3

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.

Per SRP Section 9.2.1, Subsection III.1, the ESWS description was reviewed for the design adequacy of the ESWS.

DCD Tier 2, Section 9.2.1.2.2.2 states that

“piping is carbon steel pipe or internally lined carbon steel pipe depending on the ESW chemistry. Cathodic protection is applied to the pipe depending on the ESW chemistry.”

Such information about the ESWS piping is identified as conceptual design information, which the application does not seek certification.

The staff finds the application lacking a COL information item with detailed information about the materials that are being used for the ESWS piping.

The applicant is requested to establish a COL information item providing detailed information concerning materials that will be used for the ESWS including the basis for determining that the materials being used are appropriate for a given COL site location and for the fluid properties that apply.

09.02.01-4

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 2 requires that the ESWS SSCs providing essential cooling for safety-related equipment be designed to withstand the effects of seismic events.

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The staff finds that DCD Tier 2, Section 9.2.1 lacks information such as demonstrating how the ESWS conforms to Position C.2 in RG 1.29 where the failure of nonsafety-related SSCs would not result in the failure of safety-related SSCs. Also missing is the identification of the boundary isolation valves separating the nonsafety- from the safety-related portions of the ESWS.

The applicant is requested to demonstrate that the ESWS conforms to RG 1.29 Position C.2 including the identification of boundary isolation valves. These valves should be listed in DCD Tier 2, Table 3.2-1, with their safety classification and seismic qualification. Also requested is a clarification on whether these boundary isolation valves are included for inservice testing and inspection.

09.02.01-5

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.

SRP Section 9.2.1, Subsection II.2 indicates that the safety-related ESWS should be designed in accordance with GDC 4 to consider the environmental effects (such as flood hazards) of pipe failures. The safety-related ESWS is subject to flood protection, and is a water carrying system such that its failure could cause flood hazards.

The staff finds that DCD Tier 2, Section 9.2.1 is missing some important information regarding flooding.

The applicant is requested to describe:

- a) How the system and components of ESWS are protected from internal and external flooding.
- b) How the ESWS pumps are isolated in order to address the flooding protection.
- c) What the design features are to mitigate the consequences of flooding from ESWS.
- d) Why a failure of the ESWS piping would not result in the failure of its heat removal functional capability.
- e) Why the failure of ESWS piping would not result in the internal flood hazards for other safety-related SSCs.

09.02.01-6

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.

The acceptance criteria in SRP Section 9.2.1 states that the essential service water system (ESWS) must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements.

DCD Tier 2, Section 9.2.1.2.1 states that Table 9.2.5-3 provides information on heat loads and water flow balance for various operating modes. However, Table 9.2.5-3 is denoted as a conceptual design of the ultimate heat sink (UHS), which the application does not seek certification.

The ESWS removes heat from the component cooling water system (CCWS) and transfer the heat to the UHS. The above DCD statement on a conceptual design does not provide the necessary ESWS heat load information that is subject to certification.

The applicant is requested to include additional information in DCD Tier 2, Section 9.2.1, to fully describe and explain the heat loads on the ESWS for normal operating, refueling, and accident conditions. The flow and temperature requirements and the cooling capability are also to be provided, including a supporting design basis discussion addressing available margins.

The applicant is requested to include a COL item identifying the heat load and interface requirements for the UHS in accordance with 10 CFR 47(a)(25), including the explanation on the bases for the determination of these values.

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09.02.01-7

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.

The acceptance criteria in SRP Section 9.2.1 states that the ESWS must be capable of removing heat from SSCs important to safety during normal operating and accident conditions over the life of the plant in accordance with GDC 44 requirements.

DCD Tier 2, Section 9.2.1.2.1 states the following:

“The ESWS blowdown line is installed at the ESW pump discharge common pipe to remove impurities concentrated in the UHS. The ESWS is designed with the capability to isolate nonessential portions of the system. The ESW blowdown operation is terminated by the engineered safety features actuation signal (ESFAS), ESW pump stop signal, or UHS basin low-level signal. An ESW blowdown bypass line is provided to bypass the ESW blowdown flow during the ESW blowdown isolation valve maintenance.”

“The ESW flow of 71,923 L/min (19,000 gpm) excluding ESW blowdown is maintained during normal operating conditions. During shutdown and refueling, the ESW flow of 100,692 L/min (26,600 gpm) excluding ESW blowdown is maintained. The ESW flow of 75,708 L/min (20,000 gpm) is maintained during accident and safe shutdown conditions.”

The above information is denoted as conceptual design information, which the application does not seek certification. However, the staff finds that the above information is an essential part of the standard design and should be subject to the certification review.

The applicant is requested to confirm that the above information is included in the standard design and revise DCD Tier 2 accordingly. If any portions of the ESWS are determined as conceptual design only, the applicant should provide justification for its determination and establish an appropriate COL information item to require COL applicants provide such information.



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