REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**462-8571**
SRP Section:	**09.02.02 – Reactor Auxiliary Cooling Water Systems**
Application Section:	**9.2.8**
Date of RAI Issue:	**04/19/2016**

Question No. 9.2.2-17

This is a supplemental question To RAI 8307 question 09.02.02-2

1. In its response to RAI 8307 question 09.02.02-2 the applicant stated:

   DCD Tier 2, COL item 9.2(35) will be revised as indicated in the attachment to clarify what is required of the COL applicant.

The staff reviewed the DCD markup provided in the RAI response and finds that COL item 9.2(35) is deleted; therefore there is no clarification of what is required by a COL applicant.

2. In its response to RAI 8307 question 09.02.02-2 the applicant stated:

   The COL applicant is to confirm that there are no departures and shall meet the interface requirements (i.e., cooling duties and temperature requirements, piping and control interfaces) as defined in the conceptual design.

The staff reviewed the DCD markup provided in the RAI response and finds that there is no COL item provided.

3. In its response to RAI 8307 question 09.02.02-2 the applicant stated:

   KHNP also confirms that the TGBCCW is part of the design being certified, and that conceptual design information is presented in the DCD as follows:

   - System design and operation description in DCD Subsection 9.2.8
   - TGBCCW System component design parameters in Table 9.2.8-1, and
   - TGBCCW flow diagrams in DCD Figure 9.2.8-1

The staff reviewed the DCD markups for Sections 9.2.8, and 9.2.9; Figures 9.2.8-1 and 9.2.9-1, that were provided in the RAI response and finds that the only component regarded as conceptual design are the three 50 percent heat exchangers. However in the markup provided for Table 9.2.8-1, the staff finds:

- That portions of the Turbine Generator Building Closed Cooling Water Pump requirements are also included as a conceptual design.
- That portions of the Turbine Generator Building Closed Cooling Water Heat Exchanger are not included in the conceptual design

The applicant is requested to reconcile the noted discrepancies.

Response

KHNP has reviewed the subject question and understands the staff's request. KHNP is in the process of upgrading the test plans presented in Section 14.2 of the DCD. This effort is focused on adding additional SSCs that are important to safety and risk significant as well as increasing the level of detail described in the DCD for test prerequisites, test methods and acceptance criterial for the various tests. It has been determined that the actions to be taken as a result of this question is within the scope of the upgrade effort. Therefore, KHNP will address the noted items in the upgrade effort, which is scheduled to be completed by February 1, 2016. A revised response to this question that incorporates the results of the upgrade effort will be submitted to the NRC after completion.

Response – (Rev.1)

1. Following a conference call held on May 24, 2016 between the NRC and KHNP/KEPCO to discuss RAI 246-8307 Question 9.2.8-3, an agreement was made to keep the COL Items relating to RG 4.21 programs and documentation in the DCD for each system in their respective subsections. The COL Item 9.2(35) is therefore not deleted but is edited in the revised response to RAI 246-8307 Question 09.02.02-2.

2. The COL 9.2 (39) will be added as shown below :

   "The COL applicant is to confirm that there are no departures and shall meet the interface requirements (i.e., cooling duties and temperature requirements, piping and control interfaces)."

3. The TBCCW heat exchangers are included as CDI as shown in the markup of Figure 9.2.8-1 in the response to RAI 8307 Question 09.02.02-2. However, as shown in the markup of Table 9.2.8-1 provided in RAI 8307 Question 09.02.02-2, not all parameters are CDI, just some of the parameters are CDI and those parameters that are CDI have been indicated as such in the response to Question 09.02.02-2.

   In case of the TBCCW pump, the design flow and TDH are included in the CDI, but the number of pumps is not included tin the CDI.

   The quantity and heat load of the heat exchanger are included in the CDI.

Therefore, just the portion of the TGBCCW heat exchanger was included in the Markup of the response to RAI 8307 Question 09.02.02-2.

4. On page 9.2-87 item “c” at the bottom of the page, the “TGBOCWS” will be changed into “the cooling water” as discussed in a conference call on April 17, 2016.

Impact on DCD

DCD Tier 2, Subsection 9.2.8.1, 9.2.9.1, 9.2.10, Table 1.8-1(2 of 2), Table 1.8-2 (14 of 29) will be revised as indicated in the attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

9.2.8 Turbine Generator Building Closed Cooling Water System

The turbine generator building closed cooling water (TGBCCW) system provides cooling water for the removal of heat from turbine generator building equipment and non-safety-related equipment. The heat is dissipated to the turbine generator building open cooling water system (TGBOCWS). See Subsection 9.2.9 for the description of the TGBOCWS.

9.2.8.1 Design Bases

The TGBCCW system meets the following design bases:

a. The TGBCCW system provides a continuous supply of cooling water to the turbine generator building during normal plant operation.

b. The TGBCCW system rejects heat from the equipment to the TGBOCWS through TGBCCW heat exchangers.

c. Demineralized water with corrosion inhibitors is used for cooling water.

d. The cooler cold side of the equipment is protected from overpressure by the thermal relief valve.

e. The TGBCCW system supplies cooling water to the independent closed loop cooling system that allows operation of one air compressor when the TGBCCW system is not available.

9.2.8.2 System Description

9.2.8.2.1 General Description

The COL applicant is to confirm that there are no departures and shall meet the interface requirements (i.e., cooling duties and temperature requirements, piping and control interface) (COL 9.2 (37))

The TGBCCW system consists of three 50 percent heat exchangers, two 100 percent pumps, one surge tank, one chemical addition tank, associated piping, valves, instrumentation and controls that are located in the turbine generator building. The TGBCCW system is a closed loop system. A flow diagram of the TGBCCW system is shown in Figure 9.2.8-1, and major system components are described in Table 9.2.8-1.

(COL 9.2 (39))

When the pressure at the TGBCCW pump discharge is low, an alarm is provided in the MCR. The water level in the surge tank is indicated locally and in the MCR. An alarm also is provided on the high or low water level in the surge tank in the MCR.

Makeup water flow to the surge tank is initiated automatically by surge tank water level low signal and is continued until the normal level is re-established.

The TGBCCW heat exchangers water outlet header temperature is indicated in the MCR and RSR.

9.2.9 Turbine Generator Building Open Cooling Water System

The turbine generator building open cooling water system (TGBOCWS) supplies cooling water to remove heat from the turbine generator building closed cooling water (TGBCCW) heat exchangers.

9.2.9.1 Design Bases

The TGBOCWS meets the following design bases:

a. The TGBOCWS supplies sufficient cooling water to the TGBCCW heat exchangers during all modes of plant operation.

b. Upon isolation or loss of one of two operating TGBCCW heat exchangers or strainer, the remaining standby heat exchanger or strainer is capable of heat removal.

c. The cooling water is branched off from the discharge header of the circulating water (CW) pump and is returned back to the CW discharge conduit, after cooling the TGBCCW heat exchangers. ~~The TGBOCWS~~ then discharges the heat to the CW cooling towers.

The cooling water

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COL 9.2(31) The COL applicant is to provide the inspection and testing of the UHS to demonstrate that fouling and degradation mechanisms applicable to the site are effectively managed to maintain acceptable heat sink performance and integrity.

COL 9.2(32) The COL applicant is to provide the alarms, instrumentation, and controls required for the safety-related functions of the UHS.

COL 9.2(33) The COL applicant is to develop the following procedures for the water system: filling, venting, keeping it full, and operating it to minimize the potential for water hammer. The COL applicant is also to analyze the system for water hammer impacts, design the piping system to withstand potential water hammer forces, and analyze inadvertent water hamm events in the ECWS in accordance with NUREG-0927.

Do not delete the COL item

COL 9.2 (34) The COL applicant is either to prepare or to include operational procedures and maintenance programs.

Deleted

COL 9.2 (35) The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.

COL 9.2(36) The COL applicant is to include a site-wide radiological environmental monitoring program to monitor both the horizontal and vertical variability of the onsite hydrogeology and the potential effects of the construction and operation of the plant.

9.2.11 References

COL 9.2 (37) The COL applicant is to confirm that there are no departures and shall meet the interface requirements (i.e., cooling duties and temperature requirements, piping and control interface)

(COL 9.2 (39))

1. 40 CFR Part 141, "Na Protection Agency.

2. 29 CFR 1910, "Occupational Safety and Health Standard," Occupational Safety and Health Administration.

3. ASME B31.1-2010, "Power Piping," The American Society of Mechanical Engineers, 2010.

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Table 1.8-2 (14 of 29)

Item No.	Description
COL 9.2(23)	The COL applicant is to specify the following UHS chemistry requirements for bio-fouling and chemistry control: a. A chemical injection system to provide non-corrosive, non-scale-forming conditions to limit biological film formation b. The type of biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor, and silt dispersant, if necessary to maintain system performance based on site conditions.
COL 9.2(24)	The COL applicant is to verify the piping layout of the ESWS and UHS to prevent water hammer and develop operating procedures to provide reasonable assurance that the ESWS and UHS water pressure are above saturation conditions for all operating modes.
COL 9.2(25)	The COL applicant is to develop maintenance and testing procedures to monitor debris buildup and flush out and to remove the debris in the UHS.
COL 9.2(26)	The COL applicant is to evaluate the potential wind and recirculation effects of cooling towers based on meteorological condition.
COL 9.2(27)	The COL applicant is to provide the material specifications for piping, valves, and fittings of the UHS system based on site-specific conditions and meteorological conditions.
COL 9.2(28)	The COL applicant is to provide the evaluation of maximum evaporation and other losses based on the site-specific conditions and meteorological conditions in the UHS.
COL 9.2(29)	The COL applicant is to provide the detailed evaluation for UHS capability with consideration of site-specific conditions and meteorological data in the UHS.
COL 9.2(30)	The COL applicant is to provide chemical and blowdown to prevent biofouling and long-term corrosion, considering site water quality in the UHS.
COL 9.2(31)	The COL applicant is to provide the inspection and testing of the UHS to demonstrate that fouling and degradation mechanisms applicable to the site are effectively managed to maintain acceptable heat sink performance and integrity.
COL 9.2(32)	The COL applicant is to provide the alarms, instrumentation, and controls required for the safety-related functions of the UHS.
COL 9.2(33)	The COL applicant is to develop the following procedures for the water system: filling, venting, keeping it full, and operating it to minimize the potential for water hammer. The COL applicant is also to analyze the system for water hammer impacts, design the piping system to withstand potential water hammer forces, and analyze inadvertent water hammer events in the ECWS in accordance with NUREG-0927.
COL 9.2(34)	The COL applicant is either to prepare or to include operational procedures and maintenance programs.
COL 9.2(35)	The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.
COL 9.2(36)	The COL applicant is to include a site-wide radiological environmental monitoring program to monitor both the horizontal and vertical variability of the onsite hydrogeology and the potential effects of the construction and operation of the plant.
COL 9.3(1)	The COL applicant is to provide operational procedures and maintenance programs as related to leak detection and contamination control.

Do not delete the COL item

Deleted

(COL 9.2 (39))

COL 9.2 (37) The COL applicant is to confirm that there are no departures and shall meet the interface requirements (i.e., cooling duties and temperature requirements, piping and control interface)

Table 1.8-1 (2 of 2)

Structure, System or Component	Interface Type	DCD Tier 2 Section
Components		
UHS cooling tower	CDI	9.2.5.2.2.1
UHS piping, valves, and fittings	CDI	9.2.5.2.2.2
UHS cooling tower basin	CDI	9.2.5.2.2.3
UHS cooling tower basin screens	CDI	9.2.5.2.2.4
Circulating water pumps	CDI	10.4.5.2.1
Cooling tower	CDI	10.4.5.2.3
Cooling tower basin	CDI	10.4.5.2.3
Cooling tower basin screen	CDI	10.4.5.2.3
Cooling tower makeup and blowdown pump	CDI	10.4.5.2.3
ESW blowdown piping	CDI	9.2.1.2.1
Condenser vacuum pressure of a high pressure alarm and turbine trip	CDI	10.4.1.5, 10.4.2.2.2
Cooling tower chemical injection system	CDI	10.4.5.2.3
Cation-bed ion exchanger vessels	CDI	Table 10.4.6-1
Mixed-bed ion exchanger vessels	CDI	Table 10.4.6-1
Spent resin holding tanks	CDI	Table 10.4.6-1
Resin holding tank	CDI	Table 10.4.6-1
Resin mixing and holding tank	CDI	Table 10.4.6-1
Resin traps	CDI	Table 10.4.6-1
TBCCW pumps and heat exchagers	CDI	Table 9.2.8-1