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.:	**550-8737**
SRP Section:	**03.09.03 - ASME Code Class 1, 2, and 3 Components Application Section: Section 3.9.3**
Application Section:	**3.9.3**
Date of RAI Issue:	**07/14/2017**

Question No. 03.09.03-7

In August 2015, the NRC staff conducted a regulatory audit of the APR1400 design and procurement specifications for ASME Code components, including valves; pumps; component supports; dynamic restraints; equipment seismic qualifications; and component classifications.

As a result of this audit, the NRC staff had audit observations that are listed in the Summary Audit Report of APR1400 Design Specifications (ML15350A057). Subsequently, a follow-up audit was conducted to resolve the August 2015 audit observations. Based on the results of the follow-up audit of KHNP design and procurement specifications, KHNP is requested to submit to the NRC the following items that were identified in the follow-up audit report, ML17095A754.

1) KHNP is requested to submit to the NRC the DCD modifications planned in response to the audit findings; and

2) KHNP is requested to submit a letter notifying the NRC when the design and procurement specifications reviewed during this audit (and other applicable design specifications) incorporating the modifications made in response to the audit findings have been signed, dated, and made available in the electronic reading room for verification by the NRC staff, where appropriate.

Response

1) During the review of “Design Specification for Heated Junction Thermocouple Probe Assembly, 9-728-Z-S-404-22”, it was found that the Table 3.2-1 of the DCD should be revised to “SC-1: Seal plug” as stated in the HJTC Design Specification. The DCD markup is provided in Attachment 1.

During the review of Procurement Specification, 9-447-N206, “IRWST Sump Strainers”, a COL item has been added for a COL applicant to confirm that the IRWST sump strainer head loss is less than the allowable head loss of 2 ft.-water, as indicated in Attachment 1.

2) The final signed packages for Design Specifications requiring revision will be transmitted to the electronic reading room for verification by the NRC staff.

In addition, KHNP had prepared several supporting documents which demonstrate the relationship between the procurement specification and design documents. Comments from the NRC and KHNP’s responses have been applied to the relevant supporting documents and have been issued, as listed in Table 1. Table 2 summarizes the remaining documents to be issues as a result of the audit

A COL applicant will be responsible for plant specific procurement specification, as required by KHNP Quality Assurance Program Description for the APR1400 (APR1400-K-Q-TR-11005-NP, Revision 5).

Table 1 - List of Procurement Specifications uploaded into ERR

Audit Documents		ERR Documents			
Spec. No.	**Title**	**Doc. No**	**Title**	**Rev. No.**	**Issue Date**
9-132-N201	ESW Pumps and Screen Wash Pumps	1-037-N464-001	BOP Procurement Specification Basis Document	0	07/19/2017
9-132-N202	Safety Related Centrifugal Pumps				
9-442-N203	Containment Spray Pump				
9-542-M206	AFW Pumps and Drivers	1-037-M464-001	BOP Procurement Specification Basis Document	1	08/07/2017
9-521-M243	Main Steam Isolation Valves and Main Feedwater Isolation Valves				
9-184-J233	Butterfly Valves for Nuclear Service	1-037-J464-001	BOP I&C Procurement Specification Basis Document	0	03/31/2017
9-184-J237A	Main Steam Safety Valves				
9-184-J237B	Safety/Relief Valves				
9-145-P207	Safety & Non-safety Related Manual Steel Gate, Globe & Check Valves, 2” and Smaller	1-037-P464-001	BOP Procurement Specification Basis Document	0	03/31/2017
9-145-P206A	Safety Related Steel Gate and Globe Valves with Actuator				
9-145-P206D	Safety & Non-safety Related Tilting Disc. Check Valves				
1-037-N407-001	Piping System Design Specification for General	1-037-N407-001	Piping System Design Specification for General	1	07/31/2017
Appendix 4I	Dynamic Qualification Requirements for Nuclear Safety-Related Equipment	Appendix 4I	Dynamic Qualification Requirements for Seismic Category I Equipment	0	07/25/2017

Table 2 - List of Procurement Specifications to be revised

Audit Documents /ERR Documents				
PNS No.	**Doc No.**	**Title**	**Rev. No**	**Issue Date (due)**
9-441-Z-S-404-11	11A60-FS-DS411-03-1	Design Specification for Safety Injection Pump	4	09/15/2017
9-450-Z-S-404-11	11A60-FS-DS701-02-1	Design Specification for Pressurizer Pilot Operated Safety Relief Valves(POSRVs)	3	09/15/2017
9-450-Z-S-404-00	11A60-FS-DS710-04-1	Design Specification for Check Valves Greater than Two Inches	5	09/15/2017
9-450-Z-S-404-14	11A60-FS-DS705-03-1	Design Specification for Motor Operated Valves	4	09/15/2017
9-450-Z-S-404-13	11A60-FS-DS704-03-1	Design Specification for Pneumatic Operated Valves	4	09/15/2017
9-450-Z-S-404-18R	11A60-FS-DS711-03-1	Design Specification for Solenoid Operated Valves	4	09/15/2017
9-450-Z-S-404-16	11A60-FS-DS708-04-1	Design Specification for Manual Valves	5	09/15/2017
9-450-Z-S-404-19	11A60-FS-DS715-04-1	Design Specification for Miscellaneous Safety and Relief Valves	5	09/15/2017
9-431-Z-S-404-20	11A60-ME-DS270-00-03-1	Design for Pressurizer Assembly	4	09/15/2017
9-431-Z-S-404-91	11A60-FS-DS480-03-1	Design Specification for Reactor Coolant Pump	4	09/15/2017

Impact on DCD

DCD Tier 2 Table 3.2-1 (53 of 86), Table 1.8-2 (13 of 38), 6.8.4.5.5 and 6.8.6 will be revised as indicated on the Attachment 1 markup.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

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

Table 3.2-1 (53 of 86)

SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
w. Air sample/return line in containment building, portion of post-accident sample return line and sample line & component in aux. building	AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
x. Normal primary sample cooler rack	CPB	NNS	D	ASME B31.1-2010	N/A	III	
y. Normal primary sample sink	CPB	NNS	D	ASME B31.1-2010	N/A	III	
z. Post-accident primary sample cooler rack	AB	NNS	D	ASME B31.1-2010	N/A	III	
aa. Post-accident primary sample sink	AB	NNS	D	ASME B31.1-2010	N/A	III	
bb. Primary off-gas sample pump	AB	NNS	D	ASME B31.1-2010	N/A	III	
77. QN – Qualified Indication and Alarm – Non-Safety (QIAS-N)							
a. QIAS-N display device (QIAS-N FPD, mini-LDP and SODP)	AB	NNS	N/A	IEEE 384-1992	A	I	
b. QIAS-N processing device and related equipment	AB	NNS	N/A	IEEE 384-1992	A	I	
78. QP – Qualified Indication and Alarm – P(QIAS-P)							
a. QIAS-P display		SC-3	N/A	IEEE-323-2003 IEEE-344-2004 IEEE-379-2000 IEEE-383-2003 IEEE-497-2002 IEEE-603-1991 IEEE-7-4.3.2-2003	Yes	I	
b. QIAS-P processing controller (including ICCMS)		SC-3	N/A		Yes	I	(7)
c. HJTC instrumentation flange assembly		SC-1	A		Yes	I	
d. Heated junction thermocouple probe assembly		SC-1/ SC-3	A/C		Yes	I	SC-3: Seal plug

SC-1

Table 1.8-2 (13 of 38)

Item No.	Description
COL 6.8(6)	The COL applicant is responsible for the establishment and implementation of the Maintenance Rule program in accordance with 10 CFR 50.65.
COL 7.1(1)	The COL applicant is to provide the software installation plan, the software training plan, and the software operation and maintenance plan for the safety I&C systems, as described in the Software Program Manual Technical Report.
COL 7.2(1)	The COL applicant is to provide site-specific CPCS startup test requirement
COL 7.5(1)	The COL applicant is to provide a description of the site-specific AMI variables such as wind speed, and atmosphere stability temperature difference.
COL 7.5(2)	The COL applicant is to provide a description of the site-specific EOF.
COL 7.5(3)	The COL applicant is to provide the bases document accounting for measurement uncertainties for the EOP action points.
COL 8.2(1)	The COL applicant is to identify the circuits from the transmission network to the onsite electrical distribution system that are supplied by two physically independent circuits.
COL 8.2(2)	The COL applicant is to provide information on the location of rights-of-way, transmission towers, voltage level, and length of each transmission line from the site to the first major substation that connects the line to the transmission network.
COL 8.2(3)	The COL applicant is to describe the switchyard voltage related to the transmission system provider/operator (TSP/TSO) and the formal agreement between the nuclear power plant and the TSP/TSO. The COL applicant is to describe the capability and the analysis tool of the TSP. The COL applicant is also to describe the protocols for the plant to remain cognizant of grid vulnerabilities.
COL 8.2(4)	The COL applicant is to describe and provide layout drawings of the circuits connecting the onsite distribution system to the preferred power supply.
COL 8.2(5)	The COL applicant is to describe the site-specific design for the switchyard equipment, including breaker arrangement, electrical schematics of breaker control system, protective devices and their settings, and auxiliary power supplies (ac and dc) for control and protection.
COL 8.2(6)	The COL applicant is to provide a high-impedance ground fault detection feature that provides an alarm in the MCR upon detection of a high-impedance ground fault at the primary side of MT or SATs.
COL 8.2(7)	The COL applicant is to provide an FMEA of the switchyard components to assess the possibility of simultaneous failure of both circuits as a result of single events. In addition, the COL applicant is to provide the results of grid stability analyses to demonstrate that the offsite power system does not degrade the normal and alternate preferred power sources to a level where the preferred power sources do not have the capacity or capability to support the onsite Class 1E electrical distribution system in performing its intended safety function.

COL 6.8(7)
The COL applicant is to confirm that the IRWST sump strainer has the total strainer head loss less than the allowable head loss (0.61 m (2ft)).

6.8.4.5.5 Debris Head Loss

The IRWST sump strainer is designed to fit over the top of the IRWST sump pits with flow directly into the pit to minimize clean strainer head losses. As a calculation results of the clean strainer head losses, 7.62 cm (0.25 ft) for a temperature of 60 °C (140 °F) is determined.

The strainer head loss testing was planned and conducted to develop experimental head loss data with the design debris loading. This testing was designed to either demonstrate that the head loss associated with the strainer is acceptable for the design debris loading or to identify the maximum allowable debris loading that will result in acceptable head loss.

A 46.45 m^2 (500 ft^2) effective strainer area is conservatively applied considering a 9.29 m^2 (100 ft^2) penalty of sacrificial strainer surface area for miscellaneous debris such as signs, placards, tags or stickers. As a result of testing, the maximum head loss for the 46.45 m^2 (500 ft^2) effective strainer area with the maximum debris load is 24.69 cm (0.81 ft) at the design flow rate and includes a clean screen component of 15.85 cm (0.52 ft). Therefore, the debris only head loss is 8.84 cm (0.29 ft). The test result is provided in Appendix B of Reference 4.

The prototype debris head loss test results and calculated clean strainer head loss were combined to provide a total strainer head loss that is compared to the allowable head loss. The total strainer head loss value is the sum of the clean strainer head loss and debris head loss. This will be conservatively calculated by double counting the clean screen component (using the analytical value and the test value inherent in the measure debris head loss) or 7.62 cm (0.25 ft) plus 24.69 cm (0.81 ft) equals 32.31 cm (1.06 ft) at 60 °C (140 °F). Consequently, the result of a total strainer head loss less than the allowable head loss (0.61 m (2 ft)) validates the design.

6.8.4.5.6 Vortexing, Flashing, and Deaeration

Vortexing, flashing and deaeration is one of the primary safety concerns about long-term recirculation cooling following a LOCA in RG 1.82 (Reference 3). Visual observation and analysis were conducted to verify the IRWST sump strainer performance.

For vortexing, visual observation during the strainer head loss test was performed at the submergence requirement of 0.61 m (2 ft) submergence and no vortices were observed. Additionally, there is no possibility to occur vortexing and air ingestion geometrically

The COL applicant is to confirm that the IRWST sump strainer has the total strainer head loss less than the allowable head loss (0.61 m (2ft)) (COL 6.8(7)).

6.8.5 Testing and Inspection

Inservice inspection and testing of ASME Section III Class 2 and 3 components are conducted in accordance with the programs described in Subsection 3.9.6 and Section 6.6.

6.8.6 Combined License Information

COL 6.8(1) The COL applicant is to provide the operational procedures and maintenance program for leak detection and contamination control.

COL 6.8(2) The COL applicant is to provide the preparation of cleanliness, housekeeping, and foreign materials exclusion program.

COL 6.8(3) The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations.

COL 6.8(4) The COL applicant is to confirm that the RMI is one of the tested RMIs in NUREG/CR-6808.

COL 6.8(5) The COL applicant is to evaluate the potential increase of flowrates in ECCS and CSS due to component wear and to verify that any increased flowrates in ECCS and CSS are within the maximum allowable flowrates for at least 30 days of post-LOCA operation.

COL 6.8(6) The COL applicant is responsible for the establishment and implementation of the Maintenance Rule program in accordance with 10 CFR 50.65.

6.8.7 References

1. 10 CFR 20.1406, "Radiological Criteria for Unrestricted Use," U.S. Nuclear Regulatory Commission.

2. Regulatory Guide 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," Rev. 0, U.S. Nuclear Regulatory Commission, June 2008.

3. Regulatory Guide 1.82, "Water Source For Long-Term Recirculation Cooling Following a Loss-Of-Coolant Accident," Rev. 4, U.S. Nuclear Regulatory Commission, March 2012.

COL 6.8 (7)
The COL applicant is to confirm that the IRWST sump strainer has the total strainer head loss less than the allowable head loss (0.61 m (2ft)).