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.:	**216-8221**
SRP Section:	**15.04.06 – Inadvertent Decrease in Boron Concentration in the Reactor Coolant (PWR)**
Application Section:	**15.4.6**
Date of RAI Issue:	**09/16/2015**

Question No. 15.04.06-6

10 CFR Part 50 Appendix A, GDC 10 requires that the reactor core and associated coolant, control and protection systems shall be designed with appropriate margin to assure that specified acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. The inadvertent reactor coolant system (RCS) boron dilution event is classified as anticipated operational occurrence per SRP 15.4.6. SRP 15.4.6 states that at least a 15 minute operator action time should be available to terminate a dilution during Modes 1 through 5.

The dilution rate is a function of the maximum charging flow rate. In review of DCD Tier 1, Table 2.4.6-4 (6 of 6), “Chemical and Volume Control System ITAAC”, ITAAC item 9.a, the staff noted that a minimum charging pump flow rate is established but no maximum value is provided. Staff needs to understand the basis for not establishing a maximum charging pump flow rate ITAAC item. The applicant is requested to provide the basis and update the DCD as appropriate.

Response - (Rev.1)

The limitation of the magnitude of a boron dilution source (i.e., charging flow rate) to prevent inadvertent RCS boron dilution will be added as an ITAAC item in DCD Tier 1 Section 2.4.6.1 and Table 2.4.6-4 as presented in Attachment 1. The maximum limits of charging flow rates are 567.8 L/min (150 gpm) with two charging flow restricting valves (CV-576 and CV-577) closed and 681.4 L/min (180 gpm) with one charging flow restricting valve (CV-576) closed. These maximum limits for the charging flow rates, as specified in the acceptance criteria, are consistent with the maximum charging flow rates used as the inputs in inadvertent RCS boron dilution event analyses for Mode 5 (with the RCS partially drained) and the other Modes, respectively, as provided in DCD Tier 2 Table 15.4.6-1. This test is to be performed at

atmospheric pressure of the RCS, because the higher charging flow rate is established at this condition than the other RCS pressure conditions.

In relation to addition of this ITAAC item, DCD Tier 2 Table 14.3.4-1 will be revised as presented in Attachment 2.

Impact on DCD

DCD Tier 1 Section 2.4.6.1 and Table 2.4.6-4 will be revised as indicated on the attached markup.
DCD Tier 2 Table 14.3.4-1 will be also revised as indicated on the attached 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.

8.d All displays and alarms required by the design exist in the RSR as defined in Tables 2.4.6-2 and 2.4.6-3.

9.a The CVCS provides makeup capability to maintain the RCS volume.

9.b The CVCS supplies seal water to the RCP seals.

9.c The CVCS provides pressurizer auxiliary spray water for depressurization.

10. The high-energy piping systems, including the protective features are reconciled with pipe rupture hazards analyses report to ensure that the safety-related SSCs are protected against or are qualified to withstand the dynamic effects associated with postulate failures of these piping systems.

2.4.6.2 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.6-4 specifies the ITAAC for the CVCS.

The ITAAC associated with the CVCS equipment, components, and piping that comprise a portion of the containment isolation system are described in Table 2.11.3-2.

9.d The CVCS limits the magnitude of a boron dilution source to the RCS to prevent inadvertent RCS boron dilution.

Table 2.4.6-4 (6 of 6)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
9.a The CVCS provides makeup capability to maintain the RCS volume.	9.a A test of as-built CVCS will be performed to measure the makeup flow rate.	9.a Each as-built CVCS charging pump delivers a flow rate to the RCS of greater than or equal to 586.7 L/min (155 gpm) at normal operating pressure of RCS.
9.b The CVCS supplies seal water to the RCP seals.	9.b A test of as-built CVCS will be performed by aligning a flow path to each RCP.	9.b Each as-built CVCS charging pump provides a flow rate of greater than or equal to 99.9 L/min (26.4 gpm) to four RCPs.
9.c The CVCS provides pressurizer auxiliary spray water for depressurization.	9.c A test of the as-built CVCS will be performed by aligning a flow path to the pressurizer auxiliary spray.	9.c The as-built CVCS charging pump provides spray flow to the pressurizer.
10. The high-energy piping systems, including the protective features are reconciled with pipe rupture hazards analyses report to ensure that the safety-related SSCs are protected against or are qualified to withstand the dynamic effects associated with postulate failures of these piping systems.	10. Inspections and analyses of the as-built high-energy piping including the protective features and safety-related SSCs will be performed.	10. Pipe rupture hazard analysis report exits and concludes that the as-built safety-related SSCs are protected against or are qualified to withstand the effects of postulated pipe failures of the as-built high-energy piping system.
9.d The CVCS limits the magnitude of a boron dilution source to the RCS to prevent inadvertent RCS boron dilution.	9.d A test of as-built CVCS will be performed to measure the charging flow rate through the charging restricting orifices .	9.d The as-built charging restricting orifices limit the charging flow rate to less than or equal to the following at atmospheric pressure of RCS: 567.8 L/min (150 gpm) with two charging flow restricting valves closed and 681.4 L/min (180 gpm) with one charging flow restricting valve closed.

Table 14.3.4-1 (4 of 4)

Item #	Tier 1 Reference	Design Features	Tier 2 Reference
1-25	2.5.1 Table 2.5.1-2, ITACC #4.a	A reactor trip occurs on high containment pressure.	Table 7.2-4
1-26	2.5.1 Table 2.5.1-2, ITACC #4.a	A reactor trip occurs on low reactor coolant flow.	Table 7.2-4
1-27	2.5.1 Table 2.5.1-3, ITACC #4.a	The safety injection actuation signal is initiated on low pressurizer pressure or high containment pressure.	Table 7.3-5A
1-28	2.5.1 Table 2.5.1-3, ITACC #4.a	The containment isolation actuation signal is initiated on high containment pressure or low pressurizer pressure.	Table 7.3-5A
1-29	2.5.1 Table 2.5.1-3, ITACC #4.a	The containment spray actuation signal is initiated on high high containment pressure.	Table 7.3-5A
1-30	2.5.1 Table 2.5.1-3, ITACC #4.a	The main steam isolation signal is initiated on low steam generator pressure, high containment pressure or high steam generator level.	Table 7.3-5A
1-31	2.5.1 Table 2.5.1-3, ITACC #4.a	The auxiliary feedwater actuation signal-1 is initiated on low steam generator 1 level.	Table 7.3-5A
1-32	2.5.1 Table 2.5.1-3, ITACC #4.a	The auxiliary feedwater actuation signal-2 is initiated on low steam generator 2 level.	Table 7.3-5A
1-33	2.4.6 ITAAC #9.d	The as-built charging restricting orifices limit the charging flow rate to less than or equal to the following at atmospheric pressure of RCS: 567.8 L/min (150 gpm) with two charging flow restricting valves closed and 681.4 L/min (180 gpm) with one charging flow restricting valve closed.	Table 15.4.6-1

(Added)