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.:	**278-8226**
SRP Section:	**14.02 – Initial Plant Test Program - Design Certification and New License Applicants**
Application Section:	**14.2**
Date of RAI Issue:	**10/30/2015**

Question No. 14.02-40

In RG 1.68, Section A, “Introduction,” page 3, states, “While regulations require all SSCs important to safety be tested, all of them need not be tested to the same stringent requirements. Specifically, GDC 1, “Quality Standards and Records,” of Appendix A to 10 CFR Part 50 requires, in part, that SSCs important to safety shall be tested to quality standards commensurate with the importance of the safety functions to be performed.

RG 1.68, Appendix B, “Discussion,” states, in part, “As mentioned in the introduction to this regulatory guide, the ITP is required to include suitable testing of all SSCs important to safety. Both Appendices A and B to 10 CFR Part 50 recognize that some SSCs are more important to safety than others. Thus, the NRC does not intend that the same test requirements be established for all SSCs important to safety. Rather, applicants should implement a graded approach to testing in order to provide reasonable assurance, considering the importance to safety of the item, that the item will perform satisfactorily while, at the same time, accomplishing the testing in a cost-effective manner. Documentation (such as procedures and records) associated with testing also should be commensurate with the importance to safety of the item being tested. In addition, RG 1.68, Page 9, states, that “the ITP should include testing the performance of non-safety related risk significant systems.”

The NRC staff reviewed APR1400 DCD Table 17.4-1, “Risk-Significant Within-Scope RAP SSCs” and DCD Chapter 19 and identified a significant number of non-safety related risk significant SSCs that are important to safety and should be tested under the ITP. For example, the NRC staff identified the Auxiliary Charging Pump, SSC ID CV-PP03, and the Auxiliary Charging Pump Discharge Check Valve, SSC ID CV334, in DCD Table 17.4-1 as risk-significant components; however, no test method and test acceptance criteria are identified in DCD Sections 14.2.12.1.2 and/or 14.2.12.1.7 to demonstrate a diverse means of RCP seal cooling to prevent a RCP seal Loss of Coolant Accident (LOCA) event.

Please provide tests methods and acceptance criteria for all non-safety-related risk significant SSCs that are also considered important to safety and identified in APR1400 DCD Table 17.4-1 and should be included within the scope of the ITP in APR1400 DCD Section 14.2.

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 criteria for the various tests. It has been determined that the actions to be taken as a result of this question are 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)

It is appropriate that the auxiliary charging pump (ACP) and the ACP discharge check valve CV-334 are to be tested as part of the Initial Test Program since they are included in the list of risk-significant components of DCD Tier 2 Table 17.4-1. During the plant pre-operational testing, tests are performed to verify proper operation of the ACP and the flow path to the RCP seals through the ACP discharge check valve CV-334. The test objectives, method, and acceptance criteria for these components were added to Section 14.2.12.1.7, Chemical and Volume Control System Charging Subsystem Test, of the revised markup to DCD Tier 2 Section 14.2 in KHNP submittal MKD/NW-16-0156L dated February 24, 2016; ML16056A003. The added sections that address the ACP and ACP discharge check valve testing are denoted in the clouded sections in the Attachment.

Impact on DCD

DCD Tier 2 Section 14.2.12.1.7 will be revised as indicated in 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.

5.3 CVCS VCT subsystem valve stroke time (open and close) is within the design value

5.4 CVCS VCT subsystem valves fail to the required position on loss of air or power, and go to the position indicated upon restoration of power. Upon restoration of air, the valves go to the pre-failed position

5.5 CVCS VCT subsystem valve interlocks and control are verified

5.6 VCT level alarms, interlocks, temperature and pressure alarms are verified

14.2.12.1.7 Chemical and Volume Control System Charging Subsystem Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify the ~~proper performance~~total developed head of the ~~chemical~~charging pumps

1.2 To verify proper operation of the charging pumps, and ~~volume~~response to manual controls and loss of power

1.3 To verify proper operation of the auxiliary charging pump packing lube water system including alarms

1.4 To verify proper operation of the auxiliary charging pump, and response to manual controls and loss of power

1.5 To verify proper operation of the auxiliary charging pump lubricating oil systems including alarms

1.6 To verify valve operation, position indication, response to failed conditions, and to measure stroke times in charging, seal injection and RCP controlled bleed off subsystems

1.7 To verify charging and seal injection system flowpaths

1.8 To demonstrate proper operation of charging, seal injection and RCP controlled bleedoff pressure and flow alarms

1.9 To verify the proper operations of seal injection flow instrumentation channels including signal output, indication and alarm locations, and controls of seal injection control ~~system (~~valves

1.10 To verify the proper response to CSAS of RCP controlled bleedoff containment isolation valves

1.11 To verify the proper operation of seal injection filter differential pressure instrumentation channel including signal output, indication and alarm location.

1.12 To verify the proper operations of RCP controlled bleedoff header pressure instrumentation channel including signal output, indication and alarm location, and alarm setpoints

1.13 To verify the CVCS~~)~~ charging and seal injection subsystem valve interlocks and control function

1.14 To verify the miniflow and balancing leakoff flow of the charging pumps

1.15 To balance the system flow using charging restricting orifices

1.16 To verify auxiliary charging pump power transfer from BUS A to BUS B or vice versa

2.0 PREREQUISITES

2.1 Construction activities on the ~~reactor coolant~~CVCS charging subsystem have been completed.

2.2 The CVCS charging subsystem is operational to supply charging pump suction.

2.3 The ~~volume control tank (~~VCT~~)~~ subsystem is operational to supply charging pump suction.

2.4 The ~~reactor vessel (~~RV~~)~~ is ready to receive water from the charging headers.

2.5 The pressurizer is ready to receive water from the auxiliary spray line.

2.6 ~~Reactor coolant pumps (RCP)~~RCPs are operational.

2.7 Support systems required for operation of the ~~reactor coolant~~CVCS charging subsystem are operational.

3.0 TEST METHOD

3.1 Operate power-operated valves from all appropriate control positions. Observe valve operation and position indication and, where required, measure opening and closing times.

3.2 Manually start each charging pump. ~~–~~Observe charging pump operation, including charging pump alarms and interlocks.

3.3 ~~Simulate pressurizer level error signals and observe~~Observe the charging control valve ~~response~~responses to manual demand signals.

3.4 With a charging pump running, open the seal injection lines and observe the flow.

3.5 With a charging pump running, open the auxiliary spray valve and observe flow.

3.6 Verify the operation of the RCP seal injection flow control valves.

3.7 Verify performance, including head and flow characteristics, of the charging pumps.

3.8 With the auxiliary charging pump running, open the seal injection lines and observe the flow through auxiliary charging pump discharge check valve.

4.0 DATA REQUIRED

4.1 Valve opening and closing times, where required

4.2 Valve position indication

4.3 Position response of valves to loss of motive power

4.4 Charging pump and oil lubrication system performance

4.5 Charging pump running data

4.6 Response of charging control valves to ~~simulated pressurizer level error~~manual demand signals

4.7 Setpoints at which alarms and interlocks occur

4.8 Seal injection flow rates

4.9 Auxiliary spray flow rates

4.10 ~~Pump~~Charging pump head vs. flow

4.11 Auxiliary charging pump running data

5.0 ACCEPTANCE CRITERIA

5.1 The CVCS charging subsystem performs as described in Subsection 9.3.4.2.1.

5.2 At rated flow condition, charging pumps miniflow is within the design value

5.3 Shut-off head of charging pumps is less than design limit

5.4 Rated head of charging pumps is within design range

5.5 Auxiliary charging pump is capable of providing a flow of minimum design value through auxiliary charging pump discharge check valve.

5.6 Suction trip pressure of charging pumps and auxiliary charging pump is verified as specified

5.7 Maximum charging flow in each flow paths is within design range

5.8 The charging pump and auxiliary charging pump stops on the load shed signal

5.9 The suction pressure shall be greater than design value while the following suction flow paths allow the operation of a charging pump

5.10 The suction pressure shall be greater than design value while the following suction flow paths allow the operation of the auxiliary charging pump

5.11 Alarms and setpoint in the charging line should meet the required value

5.12 Low, high and high-high flow in the seal injection is within design values

5.13 CVCS charging and seal injection subsystem valves can be opened and closed by their respective hand switches as specified

5.14 CVCS charging and seal injection subsystem valve stroke time (open and close) should meet the required time

5.15 CVCS charging subsystem valve interlock is verified as specified

14.2.12.1.8 Chemical Addition Subsystem Test

1.0 ~~OBJECTIVE~~OBJECTIVES

~~1.1 To demonstrate that the chemical addition subsystem can inject water into the charging pump suction line~~

1.1 To verify proper operation of CAP

1.2 To verify ~~a~~ the flow path from the ~~chemical addition tank~~MSH to the ~~miscellaneous liquid waste management system~~charging line through the CAT

1.3 To verify the flow path from the CAT to LWMS

2.0 PREREQUISITES

2.1 Support systems required for operation of the chemical addition subsystem are complete and operational.

2.2 The chemical addition tank has been filled from the makeup system with a predetermined amount of RMW.

2.3 The charging subsystem is in operation.

2.4 Associated instrumentation has been calibrated.