

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.: 279-8175
Review Section: 14.02 – Initial Plant Test Program
Application Section: SRP Section 14.2 and RG 1.68
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Question No. 14.02-43

NRC Regulatory Guide (RG) 1.68, "Initial Test Program for Nuclear Power Plants," Appendix A, "Initial Test Program," Section A-1, "Preoperational Testing," Subsection A-1.a. "Reactor Coolant System," states, in part, that:

The reactor coolant system (RCS) includes all pressure containing components (such as pressure vessels, piping, pumps, and valves) within the reactor coolant pressure boundary, as defined in 10 CFR 50.2, "Definitions." For the reactor coolant system the following tests should be performed:

1. *Integrated Systems Tests.* Perform expansion and restraint tests to confirm the acceptability of clearances and displacements of vessels; piping; piping hangers; and seismic and other hold down, support, or restraining devices in the as built system during normal hot functional testing plant conditions. The system should be subjected to hot and/or cold testing with simultaneous operation of auxiliary systems.
2. *Component Tests.* The following RCS components should undergo appropriate tests and measurements:
 - a. pressurizer, including pressurizer heaters and pressurizer spray and throttle valves (PWR);
 - b. pumps, motors, and associated power sources;
 - c. steam generators;
 - d. pressure relief valves, block valves, and associated dump tanks, as well as supports and restraints for discharge piping;
 - e. other valves;
 - f. instrumentation used to monitor system performance or perform permissive and prohibit interlock functions;
 - g. reactor vessel and reactor internal vent valves;
 - h. safety and relief valves including testing of acoustic monitors used to

- i. detect leakage downstream from safety and relief valves;
heat exchangers;
- 3. Vibration Tests. The Reactor internal and other components, such as piping systems, heat exchangers and rotating machinery undergo vibration testing (i.e., to meet RG.120)
- 4. Pressure Boundary Integrity Tests. All pressure boundaries should be subject to hydrostatic tests to obtain baseline data for subsequent inservice inspection and testing.

The NRC staff noted that many of the RCS test descriptions in APR1400 DCD Section 14.2.12.1, "Preoperational Tests," start out at the RCS component or subsystem level, instead of RCS integrated system test level followed by component tests, vibration tests, and the pressure boundary integrity tests.

The NRC staff identified the following RCS related preoperational tests at the component and sub-system level in DCD Section 14.2.12.1 include:

- 14.2.12.1.1, Reactor Coolant Pump Motor Initial Operation Test
- 14.2.12.1.2, Reactor Coolant System Test
- 14.2.12.1.3, Pressurizer Pilot-Operated Safety Relief Valve (POS RVs) Test
- 14.2.12.1.4, Pressurizer Pressure and Level Control Systems Test
- 14.2.12.1.9, Reactor Coolant Drain Tank Subsystem Test
- 14.2.12.1.22, Safety Injection Tank Subsystem Test
- 14.2.12.1.35, Reactor Cooling System Hydrostatic Test
- 14.2.12.1.37, Safety Depressurization and Vent System Test
- 14.2.12.1.41, Internal Vibration Monitoring System Test
- 14.2.12.1.43, Acoustic Leak Monitoring System Test
- 14.2.12.1.46, Pre-Core Hot Functional Test Controlling Document
- 14.2.12.1.47, Pre-Core Instrument Correlation
- 14.2.12.1.51, Pre-Core Reactor Coolant System Expansion Measurements
- 14.2.12.1.52, Pre-Core Reactor Coolant and Secondary Water Chemistry Data
- 14.2.12.1.53, Pre-Core Pressurizer Performance Test
- 14.2.12.1.55, Pre-Core Reactor Coolant System Flow Measurements
- 14.2.12.1.56, Pre-Core Reactor Coolant System Heat Loss Measurement
- 14.2.12.1.57, Pre-Core Reactor Coolant System Leak Rate Measurement

However, the list noted above may not be all inclusive for identifying all the RCS preoperational tests. The NRC staff determined that APR1400 DCD Section 14.2.12.1.35

should address the vibration tests needed to meet RG 1.20 and that DCD Subsection 14.2.12.1.41 should cover the pressure boundary integrity tests needed to meet RG 1.68.

The NRC staff could not verify that the DC applicant adequately addressed all of the RCS component preoperational tests listed in RG 1.68, Appendix A, Subsection A-1.a, Reactor Coolant System, Item 2, Component Tests. For example, the NRC staff could not identify preoperational tests under the RCS preoperational test program for some components and subsystem preoperational tests listed above for block valves, other valves, instrumentation used to monitor system performance or perform permissive and prohibit interlock functions, and heat exchangers listed in RG 1.68, Appendix A, Subsection A-1.a, Reactor Coolant System, Item 2, Component Tests.

Please justify the use of several different RCS component and subsystem preoperational tests noted above to meet the intent of RG 1.68, Appendix A, Subsection A-1, or expand DCD Subsection 14.2.12.1.2, "Reactor Coolant System Preoperational Tests," to include the preoperational tests listed in the DCD Subsections above, including any other RCS components listed in RG 1.68, Appendix A, Subsection A-1.a, Item 2, Component Tests. Please provide additional information in the appropriate preoperational tests noted above or add the information to DCD Subsection 14.2.12.1.2. The information should capture adequate test objectives, test prerequisites, test methods, data required and test acceptance criteria to verify that the preoperational tests for the RCS will demonstrate that the RCS can perform its intended functions to safely operate the plant before plant fuel load and initial operations.

Please update all 178 tests within the scope of the APR 1400 DC Section 14.2, "Initial Plant Test Program" to capture adequate test objectives, test prerequisites, test methods, data required and test acceptance criteria from the APR1400 DCD design chapters to meet the guidance in RG 1.68, Appendix A, Initial Test Program.

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 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

To better demonstrate conformance to the guidance in RG 1.68, Appendix A, Initial Test Program and the NRC comments included above, KHNP has completed an upgrade program to provide more detailed content of the individual test plan including, test objectives, prerequisites, test methods, data required and acceptance criteria. The results of the upgrade were included in a draft revision of the APR1400 DCD Tier 2 Section 14.2 which was

previously submitted to the NRC (ref. KHNP submittal MKD/NW-16-0156L "Submittal of Revised DCD Section 14.2 Initial Plant Test Program" dated February 24, 2016; ML16056A003).

Though the sequence of RCS component and subsystem preoperational tests are not tiered from the integrated system test level followed by component tests, vibration tests, and the pressure boundary integrity tests, the specified tests cover the aspects of RG 1.68. In order to correlate the specified guidance in RG 1.68, KHNP provided Table 14.2-7, "Conformance Matrix of RG 1.68 Appendix A versus Individual Test Descriptions" that provides a cross-reference of the ITPs to the sections of the regulatory guide.

Impact on DCD

The ITPs in Section 14.2 will be changed as shown in the enclosure to KHNP letter MKD/NW-16-0156L, "Submittal of Revised DCD Section 14.2 Initial Plant Test Program."

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 Environmental Reports.