
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.: 281-8232
SRP Section: 14.02 – Initial Plant Test Program - Design Certification and New License Applicants
Application Section: 14.2
Date of RAI Issue: 11/02/2015

Question No. 14.02-46

Regulatory Guide 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” provides guidance on initial tests that are acceptable to staff as part of the initial test program. This includes information on testing area and airborne radiation monitors.

While APR1400 FSAR Table 14.2-1 indicates that FSAR Subsection 14.2.12.1.107 provides a preoperational test for the airborne and area radiation monitoring system test, a review of FSAR Section 14.2.12.1.107 indicates that the test only includes the area radiation monitoring system test and not the airborne radiation monitoring system.

Please include airborne radiation monitors in this test or justify why it is unnecessary to test the airborne radiation monitors.

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)

The airborne radiation monitors are part of process and effluent radiological monitoring system as specified in DCD Tier 2 Subsection 11.5.1.1 and, therefore, belong to the test presented and

discussed in subsection 14.2.12.1.106. Consequently Table 14.2-1 will be revised as marked in the Attachment.

Impact on DCD

DCD Tier 2, Table 14.2-1 submitted by KHNP Letter No. MKD/NW-16-0156L, dated February 24, 2016 will be revised as indicated in the attachment associated with this response.

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 Report.

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Table 14.2-1 (4 of 5)

Subsection	Test
14.2.12.1.82	Compressed air system test
14.2.12.1.83	Process sampling system test
14.2.12.1.84	Heat tracing system test
14.2.12.1.85	Fire protection system test
14.2.12.1.86	Emergency diesel generator mechanical system test
14.2.12.1.87	Emergency diesel generator electrical system test
14.2.12.1.88	Emergency diesel generator auxiliary systems test
14.2.12.1.89	Alternate AC source system test
14.2.12.1.90	Alternate AC source support systems test
14.2.12.1.91	Containment polar crane test
14.2.12.1.92	Fuel handling area cranes test
14.2.12.1.93	Reactor containment building HVAC system test
14.2.12.1.94	Reactor containment purge HVAC system test
14.2.12.1.95	Control room area HVAC system test
14.2.12.1.96	Turbine generator building HVAC system test
14.2.12.1.97	Emergency diesel generator area HVAC system test
14.2.12.1.98	Fuel handling HVAC system test
14.2.12.1.99	Compound building HVAC system test
14.2.12.1.100	Balance of control room HVAC system test
14.2.12.1.101	Hydrogen mitigation system test
14.2.12.1.102	Containment hydrogen recombiner system test
14.2.12.1.103	Liquid waste management system test
14.2.12.1.104	Solid waste management system test
14.2.12.1.105	Gaseous waste management system test
14.2.12.1.106	Process and effluent radiological monitoring system test
14.2.12.1.107	Airborne and area radiation monitoring system test


 Area

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Application Section: 14.2
Date of RAI Issue: 11/02/2015

Question No. 14.02-48

Regulatory Guide 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” provides guidance on initial tests that are acceptable to staff as part of the initial test program. Appendix A to Regulatory Guide 1.68 provides guidance on the types of tests that should be included as part of the initial test program. Section A-1.k. “Radiation Protection Systems” indicates that, “For radiation monitoring equipment that is used to perform automatic control functions, the tests should confirm, using established instrumentation set-points, that upon detecting elevated levels of radioactivity, the system initiates the proper automatic control features in ensuring the timely closures of isolation valves or dampers.”

FSAR Section 10.4.10, indicates that the auxiliary steam system is equipped with a radiation monitor which continuously checks for contamination and if the condensate is contaminated the monitor actuates an alarm in the main control room and automatically redirects the condensate to the liquid waste management system for treatment. However, there does not appear to be anything in the initial test program verifying that this monitor will automatically redirect the condensate to the liquid waste management system for treatment. In addition, in reviewing FSAR Chapters 11 and 12 it is unclear which monitor is performing this function.

1. Please update FSAR Section 14.2 to include a test to ensure that the monitor performs its function of automatically redirecting the condensate to the liquid waste management system.
2. Please specify which radiation monitor performs this function and update FSAR Chapters 11 and 12 to ensure it is clear which monitor performs this function.

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)

1. KHNP will update the DCD Tier 2 Subsection 14.2.12.1.128 to include a specific objective to verify that proper system operation occurs on the detection of a radiation signal. Tests for the function of automatically redirecting the condensate to the liquid waste management system will be performed through verifying proper operation of designated components and operating control valves as described below in the Test Method section currently contained in Subsection 14.2.12.1.128.

3.0 TEST METHOD

3.1 Verify proper operation of designated components such as protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

3.2 Operate control valves from all appropriate control positions. Observe valve operation and position indication and measure opening and closing times.

2. Subsections 11.5.2.3.5.d and 11.5.2.3.5.e have been revised to state that Condensate polishing area sump water monitor (RE-164) and Condenser pit sump water monitor (RE-165) perform the function of automatically diverting the condensate to the liquid radwaste management system. The markups of Subsections 11.5.2.3.5.d and 11.5.2.3.5.e were included in the revised response to RAI 132-8088 Question 11.05-2. (ref. MKD/NW-16-0481L dated May 12, 2016).

Impact on DCD

The revised DCD Tier 2, Subsection 14.2.12.1.128 submitted by KHNP Letter No. MKD/NW-16-0156L, dated February 24, 2016 will be revised as indicated in the attachment associated with this response.

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 Report.

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3.4 Verify the proper operation and installation of all peak recording accelerographs.

4.0 DATA REQUIRED

4.1 Recorded sensor response to simulated seismic inputs

5.0 ACCEPTANCE CRITERIA

5.1 The seismic monitoring instrumentation system operates as designed and described in ~~Subsection~~subsection 3.7.4.

14.2.12.1.128 Auxiliary Steam System Test1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the auxiliary steam system provides the steam to various plant components at designed pressures and flow

1.2 Demonstrate the manual and automatic operation of system pumps

1.3 Demonstrate the manual and automatic operation of system valves

1.4 Demonstrate all status lights and system alarms

1.5 Demonstrate the fail positions of system valves

1.6 Demonstrate all system alarms

← 1.7 To demonstrate system responses to PR-RE/RT-103 signal

2.0 PREREQUISITES

2.1 Construction activities on the auxiliary steam system have been completed.

2.2 Auxiliary steam system instrumentation has been calibrated.

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RAI No.: 281-8232
SRP Section: 14.02 – Initial Plant Test Program – Design Certification and New License Applicants
Application Section: 14.2
Date of RAI Issue: 11/02/2015

Question No. 14.02-54

Regulatory Guide 1.68, “Initial Test Programs for Water-Cooled Nuclear Power Plants,” provides guidance on initial tests that are acceptable to staff as part of the initial test program. Appendix A to Regulatory Guide 1.68 provides guidance on the types of tests that should be included as part of the initial test program. Various radiation protection related items that RG 1.68 indicates should be tested do not appear to be addressed in the initial plant test program for the APR1400 design. These include the following:

1. Testing of laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations (see RG 1.68, Appendix A, Section A-1.k. item 3).
2. Testing for leakage control and detection for the chemical and volume control system and testing the gaseous systems for leak detection or equivalent testing (see RG 1.68, Appendix A, Section A-1.l).
3. Testing of components to control the temperature of the steam generator blowdown system, as discussed in FSAR Section 10.4.8, to protect the steam generator blowdown resin beds, preventing a sudden loss of resin bed efficiency and the release of radioactivity above established limits and contamination of otherwise clean portions of plant systems (see RG 1.68, Appendix A, Section A-1.k).

Please provide the above tests in the initial test program or justify an alternative.

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)

The following responses are provided to address the above questions on the initial plant test program.

1. The COL applicant is to develop the test program of laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations. The revised DCD Tier 2, Section 14.2 submitted by KHNP (ref. letter MKD/NW-16-0156L, dated February 24, 2016; ML16056A003) will be revised to add to the existing COL 14.2(10) the requirement that the COL applicant develop the appropriate test program for the subject equipment.
2. Testing of leakage control and detection is not required for the chemical and volume control system (CVCS) and gaseous radwaste system (GRS), since the accident source term does not enter into these systems due to the containment isolation as a result of the accident. Therefore, testing of the leak detection specified in RG 1.68 App. A-1.I does not apply (refer to DCD Tier 2, Table 14.2-7, Sh. 9). The leak test for the CIV is performed based on DCD Tier 2 Subsection 14.2.12.1.124.
3. The revised DCD Tier 2, Subsection 14.2.12.1.66 submitted by KHNP (ref. letter MKD/NW-16-0156L, dated February 24, 2016; ML16056A003) addresses the testing of components to control the temperature of the steam generator blowdown system and the release of radioactivity. Isolation based on high temperature is tested based on objective 1.3, using test method 3.7, recording data in 4.4, and verifying the result in accordance with acceptance criteria 5.2.

Impact on DCD

DCD Tier 2, Subsection 14.2.13 and Table 1.8-2 will be revised as shown in the attachment.

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 Report.

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Table 1.8-2 (25 of 29)

Item No.	Description
COL 14.2(8)	The COL applicant that references the APR1400 design certification is to identify the specific operator training to be conducted as part of the low-power testing program related to the resolution of TMI Action Plan Item I.G.1, as described in (1) NUREG-0660, "NRC Action Plans Developed as a Result of the TMI-2 Accident," Revision 1, August 1980 and (2) NUREG-0737, "Clarification of TMI Action Plan Requirements."
COL 14.2(9)	The COL applicant is to prepare the pre-operational test of cooling tower and associated auxiliaries, and raw water and service water cooling systems.
COL 14.2(10)	The COL applicant is to develop the test program of personnel monitors and radiation survey instruments.
COL 14.2(11)	The COL applicant is to develop the test procedure of the communication system.
COL 14.3(1)	The COL applicant is to provide the ITAAC for the site-specific portion of the plant systems specified in Subsection 14.3.3.
COL 14.3(2)	The COL applicant is to provide the test program for the performance of the security hardware addressed in Subsection 14.3.2.12. , and laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations
COL 14.3(3)	The COL applicant is to provide the test program for the performance of the security hardware addressed in Subsection 14.3.2.12.
COL 14.3(4)	The COL applicant is to provide a DAC closure schedule for implementing the piping DAC.
COL 15.0(1)	The COL applicant is to perform the radiological consequence analysis using site-specific χ/Q values, unless the χ/Q values used in the DCD envelop the site-specific short-term or long-term χ/Q values of the DCD, and to show that the resultant doses are within the guideline values of 10 CFR 50.34 for EAB and LPZ and that of 10 CFR Part 50, Appendix A, GDC 19 for the MCR and TSC.
COL 17.4(1)	The COL applicant is to develop and implement Phases 2 and 3 of the design RAP, including QA requirements. In Phase 2, the plant's site-specific information is to be subjected to the design RAP process, and the site-specific risk-significant SSCs are combined with the APR1400 design risk-significant SSCs into one list for the plant. Phase 2 is to be performed during the COL application phase and updated/maintained during the COL license holder phase. In Phase 3, procurement, fabrication, construction, and test specifications for the SSCs within the scope of the RAP provide reasonable assurance that key assumptions, such as equipment reliability, are realistic and achievable. The QA requirements are implemented during the procurement, fabrication, construction, and pre-operational testing of the SSCs within the scope of the RAP. Phase 3 is to be performed during the COL license holder phase and prior to initial fuel loading. The COL applicant is to propose a method for incorporating the objectives of the reliability assurance program into other programs for design or operational errors that degrade non-safety-related, risk-significant SSCs.

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- COL 14.2(4) The COL applicant is to perform review and evaluation of individual test results.
- COL 14.2(5) The COL applicant is to develop the detailed description of test and acceptance criteria for the Security System.
- COL 14.2(6) The COL applicant is to develop a schedule for the development of the plant operating and emergency procedures should allow sufficient time for trial use of these procedures during the Initial Test Program. The schedule for plant startup is to be developed by the COL applicant to allow sufficient time to systematically perform the required testing in each phase.
- COL 14.2(7) The COL applicant is to describe its program for reviewing available information on reactor operating and testing experiences and discusses how it used this information in developing the initial test program. The description is to include the sources and types of information reviewed, the conclusions or findings, and the effect of the review on the initial test program.
- COL 14.2(8) The COL applicant that references the APR1400 design certification is to identify the specific operator training to be conducted as part of the low-power testing program related to the resolution of TMI Action Plan Item I.G.1, as described in (1) NUREG-0660 – NRC Action Plans Developed as a Result of the TMI-2 Accident, Revision 1, August 1980 and (2) NUREG-0737 – Clarification of TMI Action Plan Requirements.
- COL 14.2(9) The COL applicant is to prepare the preoperational test of cooling tower and associated auxiliaries, and raw water and service water cooling systems.
- COL 14.2(10) The COL applicant is to develop the test program of personnel monitors and radiation survey instruments.
- COL 14.2(11) The COL applicant is to develop the test procedure of the communication system.

, and laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations