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:	**14.02**
Date of RAI Issue:	**11/02/2015**

Question No. 14.02-50

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.” It also indicates that, “depending upon design features, the logic sequence and interdependence of the actuation of automatic features should be tested as well when linked to radiation levels process streams and radioactive effluents.” In addition, RG 1.68, Section A-1.k, item 6, indicates that radiation monitoring computer systems should be tested.

In addition, FSAR Chapter 12 the applicant references ANSI/ANS-HPSSC-6.8.1-1981 for the area radiation monitoring system. ANSI/ANS-HPSSC-6.8.1-1981 indicates that in preforming functional tests of radiation monitor channels, including alarm functions, a radioactive check source is preferable to other means such as simulated signals.

However, in reviewing FSAR Sections 14.2.12.1.106 and 14.2.12.1.107, it indicates that simulated signals will be used to test control actions and alarms, instead of a calibration source.

1. Please revise the initial test program in order to test the functionality of the radiation monitor computer system in order to ensure that radiation levels, alarms, and control actions are properly being communicated between the radiation monitors, the monitor computer system, the main control room, and any applicable system actuation, or justify why the current approach is acceptable.

2. Update FSAR Sections 14.2.12.1.106 and 14.2.12.1.107, to test the control functions or alarms associated with high radiation levels with a radiation calibration source, or justify why the use of simulated signals is acceptable.

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. 2)

1. The response to Subquestion 4.a of RAI 368-8470, Question 14.03.08-14 (ref. MKD/NW-16-0362L dated April 21, 2016; ML16113A303) provided the explanation on why a radioactive check source should not be used to verify the setpoint for the alarm and radiation level.

   A radiation check source cannot be used to verify the monitor alarm setpoint and radiation level indication. Verification of the alarm setpoint and radiation level indication will normally be accomplished periodically using an appropriate calibration source. A simulated radiation signal will be used to replicate the radiation level required to test the BOP ESFAS signals and RMS alarm functionality.

   Testing of each channel of the PERMSS and ARMS will be conducted using a radiation check source with fixed source strength to activate the channel. The DCD Tier 1 will be revised to reflect the ITAAC in Item 10 of Table 2.7.6.4-3 and Item 9 of Table 2.7.6.5-3 as a result of recent changes proposed in the response provided to RAI 368-8470 Question 14.03.08-14 (attached for reference). Since the radiation monitors are tested with a radiation check source as part of ITAAC, they do not need to be retested as part of the initial test program.

2. In accordance with the discussion provided in (1) above, the use of a simulated test signal is suitable for the intended test.

Impact on DCD

DCD Tier 1, Rev.1, Table 2.7.6.4-3 and Table 2.7.6.5-3 will be revised as indicated in the attached markup, as previously proposed in the revised response to RAI 368-8470 Question 14.03.08-14.

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.

Table 2.7.6.4-3 (2 of 2)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. (cont.)	6.b. Type test, analyses, or a combination of type tests and analyses of seismic Category I monitor identified in Table 2.7.6.4-1 will be performed.	6.b. A report exists and concludes that the seismic Category I monitor identified in Table 2.7.6.4-1 withstands seismic design basis loads without loss of safety function.
	6.c. Inspections and analyses will be performed to verify that the as-built seismic Category I monitor identified in Table 2.7.6.4-1 including anchorages is seismically bounded by the tested or analyzed conditions.	6.c. A report exists and concludes that the seismic Category I monitor identified in Table 2.7.6.4-1 including anchorages is seismically bounded by the tested or analyzed conditions.
7. Separation is provided between Class 1E divisions, and between Class 1E divisions and non-Class 1E divisions.	7. Inspection of the as-built Class 1E divisions will be performed.	7. Physical separation and electrical isolation exists in accordance with NRC RG 1.75 between these Class 1E divisions, and also between class 1E divisions and non-class 1E divisions.
8. The moderate-energy piping systems are reconciled with pipe rupture hazards analyses report to ensure that the safety-related SSCs are protected against or are qualified to withstand the environmental effects associated with postulate failures of these piping systems.	8. Inspections and analyses of the as-built moderate-energy piping and safety-related SSCs will be performed.	8. Pipe rupture hazard analysis report exists 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 moderate-energy piping system.
9. The steam generator blowdown radiation monitor provides an alarm in the MCR of high radioactive contamination and isolation signal to blowdown valve	9. A signal test is conducted to verify the radiation monitor setpoint and alarm and isolation functions in the MCR.	9. Upon detection of high radiation levels above the predetermined setpoint, the steam generator blowdown monitor provides an alarm in the MCR and closes the blowdown valve, isolating the blowdown system.
Add 10. Each monitor channel function of PERMSS identified in Table 2.7.6.4-1 is functioning.	10. Testing of each channel of the PERMSS will be conducted using a radiation check source with fixed source strength to activate the channel.	10. Each monitor channel is functioning (alive) when the built-in radiation check source is remotely activated by the operator.

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Table 2.7.6.5-3 (3 of 3)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
7. ~~The containment monitors are located in an unimpeded location for each intended function as follows:~~ ~~- Upper area monitors (RE-233A and 234B) are located just below the containment polar crane for a wide open, unobstructed communication with the entire containment free air volume.~~ ~~- Lower area monitors (RE-231A and 232B) are located directly above the refueling pool to detect a fuel handling accident condition.~~	7. ~~Inspections well be performed to verify that containment monitors are located in an unimpeded location for each intended function.~~	7. ~~As-built containment monitors are located in an unimpeded location for each intended function described in the design commitment.~~
8. The Class 1E components and instruments identified in Table 2.7.6.5-1 as being qualified for a harsh environment are capable of withstanding the environmental conditions that would exist before, during, and following a design basis accident without loss of safety function for the time required to perform the safety function.	8.a Type tests, analyses or a combination of type tests and analyses will be performed on Class 1E components and instruments located in a harsh environment.	8.a A report exists and concludes that the Class 1E components and instruments identified in Table 2.7.6.5-1 as being qualified for a harsh environment are capable of withstanding the environmental conditions that would exist before, during, and following a design basis accident without loss of safety function for the time required to perform the safety function.
	8.b Inspections will be performed on the as-built Class 1E components and instruments and the associated wiring, cables, and terminations located in a harsh environment.	8.b A report exists and concludes that the as-built Class 1E components and instruments and the associated wiring, cables, and terminations identified in Table 2.7.6.5-1 as being qualified for a harsh environment are bounded by type tests, analyses, or a combination of type tests and analyses.

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"A"

7. The containment monitors are located in an unimpeded location for each intended function as follows: - Upper area monitor (RE-234B) is located level just below the containment polar crane for a direct, unimpeded exposure path of the entire containment free air volume. RE-233A is located to accommodate operator's easy access, but still at an elevation that provides observation of a large fraction of containment free air volume. - Lower area monitors (RE-231A and 232B) are located directly overhead with an unimpeded view of the refueling pool to detect a fuel handling accident condition.	7. Inspections will be performed to verify that containment monitors are located in an unimpeded location for each intended function.	7. As-built containment monitors are located in an unimpeded location for each intended function described in the design commitment.

"B"

9. Each monitor channel of ARMS identified in table 2.7.6.5-1 is functioning.	9. Testing of each channel of the ARMS will be conducted using the radiation check source with fixed source strength to activate the channel.	9. Each monitor channel is functioning (alive) when the built-in radiation check source is remotely activated by the operator.