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## 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.:** 116-8054  
**SRP Section:** 14.03.08 – Radiation Protection Inspections, Tests, Analyses, and Acceptance Criteria Application Section:  
**Application Section:** Tier 1, Various Sections  
**Date of RAI Issue :** 07/27/2015

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### **Question No. 14.03.08-9**

10 CFR 50.49 and 10 CFR 50, Appendix A, criterion 4 require that certain components important to safety be designed to withstand environmental conditions, including the effects of radiation, associated with design basis events, including normal operation, anticipated operational occurrences, and design basis accidents.

SRP Section 14.3 indicates that the purpose of inspections, tests, analysis, and acceptance criteria (ITAAC), is to verify that a facility referencing the design certification is built and operates in accordance with the design certification and applicable regulations.

In addition, SRP Section 14.3.8 indicates that the reviewer should ensure that Tier 1 identifies and describes, commensurate with their safety significance, those SSCs that provide radiation shielding, confinement or containment of radioactivity, ventilation of airborne contamination, or radiation (or radioactivity concentration) monitoring for normal operations and during accidents.

While various ITAAC throughout Tier 1 provide ITAAC verifying that Class 1E components located in potentially harsh environmental conditions are being qualified for the harsh environmental conditions for which they are located, not all Class 1E equipment identified in the equipment qualification program in Tier 2, Section 3.11, as being located in a harsh environment, contain an ITAAC, specifying that they are being qualified to withstand harsh environmental conditions.

For example, both Tier 1, Table 2.7.6.5-1 and Tier 2, Table 3.11-3 identify containment radiation monitors (231A, 232B, 233A, and 234B) as class 1E monitors. While Tier 2, Table 3.11-3, lists these monitors as being located in harsh environmental and radiological environments, Tier 1 does not list the environmental conditions for these monitors and does not provide an ITAAC requiring that an analysis be performed to ensure the monitors can withstand the environmental conditions that they will be exposed to where they are located.

Please explain why some safety related, class 1E equipment, which are identified in Tier 2 Table 3.11-3 as being located within harsh environments, contain Tier 1 ITAAC associated with them verifying that they can withstand the environmental condition where they are located, while others do not.

### **Response – (Rev.1)**

In response to RAI 184-8209 Question 03.11-14, pertinent information from Table 3.11-3 such as radiation condition, equipment designation, etc. is being relocated to Table 3.11-2 and Table 3.11-3 will be deleted. Table 3.11-2 will also include all Class 1E and the mechanical equipment located in a harsh environment.

KHNP will revise the Tier 1 ITAAC tables to include the Class 1E equipment in a harsh environment that did not have an associated ITAAC and also the mechanical equipment located in a harsh environment. Prior to this revision, KHNP compared the ITAAC tables with Tier 2, Table 3.11-2. As a result of this completed review, there are three systems (Area Radiation Monitoring System, Containment Hydrogen Control System and Fuel Handling Area HVAC System) which do not fully describe the associated inspections, tests and analyses in the ITAAC tables. Therefore, the ITAAC Table for Area Radiation Monitoring System and Containment Hydrogen Control System will be revised as shown in Attachment 1. The response to RAI 8470 Question 14.03.08-14 (ref. KHNP submittal MKD/NW-16-0362L dated April 22, 2016) reinstated the proposed deletion of the ARM for the instrument calibration facility, RE-286. This revision changes the added harsh environmental qualification column to be consistent with that RAI response. The wording of the existing ITAAC for the Fuel Handling Area HVAC System will be revised to be consistent with that of other similar ITAAC as shown in Attachment 2.

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### **Impact on DCD**

DCD Tier 1 Sections 2.7.6.5.1 and 2.11.4.1 and Tables 2.7.6.5-1, 2.7.6.5-3, 2.11.4-1, 2.11.4-3, and 2.7.3.2-3 will be revised as indicated in Attachment 1 and Attachment 2.

### **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.

### 2.7.6.5 Area Radiation Monitoring System

#### 2.7.6.5.1 Design Description

The area radiation monitoring system (ARMS) monitors the radiation levels in selected areas throughout the plant. The area monitors warn operators and station personnel of the visible and audible alarm when unusual radiological events occur.

Components of the ARMS are located in the containment building, the auxiliary building, and the compound building.

1. The functional arrangement of the ARMS is described in the Design Description of Subsection 2.7.6.5.1 and in Table 2.7.6.5-1.
2. The ARMS provides operating personnel with an indication and record of radiation levels in the MCR.
3. The monitors provide local readout and alarm units at the detector locations.
4. Separation is provided between Class 1E channels, and between Class 1E division and non-Class 1E division.
5. The seismic Category I monitors of the ARMS identified in Table 2.7.6.5-1 can withstand seismic design basis loads without loss of safety function.
6. The safety-related divisional cabinet (SRDC) of the ARMS provides an automatic ESF initiation signals, as shown in Table 2.7.6.5-2.

#### 2.7.6.5.2 Inspections, Tests, Analyses, and Acceptance Criteria

The ITAAC for the area radiation monitoring system is described on Table 2.7.6.5-3.

7. The Class 1E components and instruments identified in Tables 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.

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Table 2.7.6.5-1

Radiochemistry Lab

Area Radiation Monitoring System Components List

(mSv/hr)

Display & Alarm at MCR/RSR/Local

Description	Tag No <sup>(1)</sup>	Class <sup>(2)</sup>			Range	Display/Alarm at MCR/RSR
		S	SE	E		
Post Accident Primary Sample Room	RE-205	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Normal Primary Sample Room	RE-285	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Main Steam & FW Containment Piping Penetration Area	RE-237 RE-238	N	II	N	10 <sup>0</sup> ~10 <sup>5</sup>	Yes/Yes/Yes
Fuel Handling ACC & POST-ACC High Range Monitor In Containment	RE-231A RE-232B	3	I	A B A B	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
	RE-233A RE-234B				10 <sup>1</sup> ~10 <sup>8</sup>	Yes/Yes/Yes
Incore Instrument	RE-235	N	II	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Containment Personnel Access Hatch Area	RE-236	3	I	A B	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Spent Fuel Pool Area	RE-241A RE-242B	N	II	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
New Fuel Storage Area	RE-245	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Hot Machine Shop	RE-293	II	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Low Level Lab	RE-257	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Instrument Calibration Facility	RE-286	N	II	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Main Control Room Area	RE-275	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
TSC Area	RE-279	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Truck Bay	RE-289	II	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Waste Drum Storage Area	RE-292	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes
Compound Building Dry Active Waste Storage Area	RE-284	N	III	N	10 <sup>-3</sup> ~10 <sup>2</sup>	Yes/Yes/Yes

(1) The column "Tag No" is information only (not part of certified design).

(2) S : Safety Class per ANSI/ANS-51.1; 1=SC-1, 2=SC-2, 3=SC-3, N=NNS

SE : Seismic Category; I, II, III

E : Electrical Class ; A, B, C, D=Class 1E Separation Division, N=Non-Class 1E

Retain

~~Deleted~~

RE-288  
RE-289

N	II	N
3	I	A B

Truck Bay Area

Insert "A" on the attached page.

Containment Operating Area	RE-231A RE-232B	3	I	A B	10 <sup>-3</sup> ~ 10 <sup>2</sup>	Yes/Yes/Yes
Containment Upper Operating Area	RE-233A RE-234B	3	I	A B	10 <sup>1</sup> ~ 10 <sup>8</sup>	Yes/Yes/Yes

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Table 2.7.6.5-3 (2 of 2)

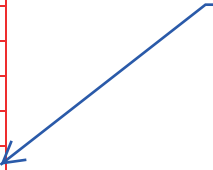
Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. The seismic Category I monitors of the ARMS identified in Table 2.7.6.5-1 can withstand seismic design basis loads without loss of safety function.	5.a. Inspections will be performed to verify that the as-built seismic Category I monitor identified in Table 2.7.6.5-1 is located in a seismic Category I structure(s).	5.a. The as-built seismic Category I monitor identified in Table 2.7.6.5-1 is located in a seismic Category I structure(s).
	5.b. Type test, analyses, or a combination of type tests and analyses of seismic Category I monitor identified in Table 2.7.6.5-1 will be performed.	5.b. A report exists and concludes that the seismic Category I monitor identified in Table 2.7.6.5-1 withstands seismic design basis loads without loss of safety function.
	5.c. Inspections and analyses will be performed to verify that the as-built seismic Category I monitor identified in Table 2.7.6.5-1 including anchorages is seismically bounded by the tested or analyzed conditions.	5.c. A report exists and concludes that the seismic Category I monitor identified in Table 2.7.6.5-1 including anchorages is seismically bounded by the tested or analyzed conditions.
6. The safety-related divisional cabinet (SRDC) of the ARMS provides an automatic ESF initiation signals, as shown in Table 2.7.6.5-2.	6. A Testing of the as-built SRDC will be performed using an integral activated check source.	6. Each as-built ESF initiation signal is sent to ESF-CCS group control cabinet upon detection of high radiation of containment operating area and fuel handling area defined in Table 2.7.6.5-2, if plant's radiation monitors exceed predetermined setpoints for containment purge isolation actuation signal (CPIAS) and fuel handling area emergency ventilation actuation signal (FHEVAS).

Insert "B" on the attached page.

A

Harsh Envir. Qual.
No
No
No
Yes
Yes
No
No
No
No
No
No
Component to be deleted
No
No
No
No
No

No



B

<p>7. The Class 1E components and instruments identified in Tables 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.</p>	<p>7.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.</p>	<p>7.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 withstand 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.</p>
	<p>7.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.</p>	<p>7.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.</p>

5.d Displays and alarms in the RSR exist as defined in Table 2.11.4-1.

2.11.4.2 Inspections, Tests, Analyses, and Acceptance Criteria

The inspections, tests, analyses, and associated acceptance criteria for the containment hydrogen control system are specified in Table 2.11.4-3.

6. The Class 1E components and instruments identified in Tables 2.11.4-1 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.



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Table 2.11.4-1

Containment Hydrogen Control System Components List

Component Name	Item No. <sup>(1)</sup>	Location	ASME Section III Class	Seismic Category	Class 1E/Harsh Envir. Qual.	Display/Control at MCR	Display/Control at RSR	Control Signal	Active Safety Function	Loss of Motive Power Position
Passive Autocatalytic Recombiner	HR01A/01B ~ HR15A/15B	Containment	-	I	-/-	-/-	-/-	-	No	-
Hydrogen Igniter	HI01 ~ HI08	Containment	-	I	No/-	Yes/Yes	Yes/Yes	-	No	-

(1) The column "Item No." is information only (not part of certified design).

(2) Dash(-) indicates not applicable.

Containment Temperature Element	CM-TE-031A	Containment	-	I	Yes/Yes	Yes/No	Yes/No	-	No	-
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Table 2.11.4-3 (2 of 2)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
4. The electrical power for HIs is supplied from the Class 1E division. On loss of offsite power and failure of the emergency diesel generator to start or run, the HIs have the alternate power supply from the alternate alternating current (AAC) generator. Also, HIs are powered by battery back-up.	4. Tests will be performed on the as-built HIs.	4. The as-built HIs listed in Table 2.11.4-1 are powered from class 1E division, the emergency diesel generator, the AAC generator, and DC battery.
5.a Controls exist in the MCR to start and stop the HIs identified in Table 2.11.4-1.	5.a Tests will be performed using the controls in the MCR.	5.a Controls in the as-built MCR start and stop the hydrogen igniters listed in Table 2.11.4-1.
5.b Controls exist in the RSR to start and stop the HIs identified in Table 2.11.4-1.	5.b Tests will be performed using the controls in the RSR.	5.b Controls in the as-built RSR start and stop the hydrogen igniters listed in Table 2.11.4-1.
5.c Displays and alarms in the MCR exist as defined in Table 2.11.4-2.	5.c Inspections will be performed on the displays and alarms in the MCR.	5.c Displays and alarms exist and are retrieved in the MCR as defined in Tables 2.11.4-2.
5.d Displays and alarms in the RSR exist as defined in Tables 2.11.4-2.	5.d Inspections will be performed on the displays and alarms in the RSR.	5.d Displays and alarms exist and are retrieved in the RSR as defined in Table 2.11.4-2.

Insert "A" on the next page.

A

<p>6. The Class 1E components and instruments identified in Tables 2.11.4-1 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.</p>	<p>7.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.</p>	<p>7.a A report exists and concludes that the Class 1E components and instruments identified in Table 2.11.4-1 as being qualified for a harsh environment withstand 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.</p>
	<p>7.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.</p>	<p>7.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 2.11.4-1 as being qualified for a harsh environment are bounded by type tests, analyses, or a combination of type tests and analyses.</p>

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Table 2.7.3.2-3 (2 of 5)

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Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>3.a The Class 1E components and instruments identified in Tables 2.7.3.2-1 and 2.7.3.2-2 as being qualified for a harsh environment withstand 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.</p>	<p>3.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.</p>	<p>3.a A report exists and concludes that the Class 1E components and instruments identified in Tables 2.7.3.2-1 and 2.7.3.2-2 as being qualified for a harsh environment withstand the environmental conditions that would exist before, during, and following a design basis accident</p>
<p>3.b Each of the Class 1E components and instruments identified in Tables 2.7.3.2-1 and 2.7.3.2-2 is powered from its respective Class 1E division.</p>	<p>3.b Tests will be performed by providing a test signal in only one Class 1E division at a time.</p>	<p>3.b The test signal exists at the Class 1E components and instruments identified in Tables 2.7.3.2-1 and 2.7.3.2-2 powered from the Class 1E division under test.</p>
<p>3.c Separation is provided between Class 1E divisions, and between Class 1E division and non-Class 1E division.</p>	<p>3.c Inspection of the as-built Class 1E divisions will be performed.</p>	<p>3.c Physical separation or electrical isolation exists in accordance with NRC RG 1.75 between Class 1E divisions, and also between Class 1E division and non-Class 1E division.</p>

3.a.i

3.a.ii

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.

A report exists and concludes that the as-built Class 1E components and instruments and the associated wiring, cables, and terminations identified in Table 2.7.3.2-1 and 2.7.3.2-2 as being qualified for a harsh environment are bounded by type tests, analyses, or a combination of type tests and analyses.