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.:	**317-8271**
SRP Section:	**14.03.05 – Instrumentation and Controls - Inspections, Tests, Analyses, and Acceptance Criteria**
Application Section:	**14.03.05**
Date of RAI Issue:	**11/17/2015**

Question No. 14.03.05-24

Provide design descriptions and corresponding ITAAC to address Type A variables.

10 CFR 50.55a(h)(3) states, in part, that an application filed on or after May 13, 1999, for design certifications must meet the requirements for safety systems in IEEE Std 603-1991 and the correction sheet dated January 30, 1995. IEEE Std 603-1991, Clause 5.8.1, states that the display instrumentation provided for manually controlled actions for which no automatic control is provided and the display instrumentation required for the safety systems to accomplish their safety functions shall be part of the safety systems."

In RAI 38-7878, Question 07.05-1, the staff requested the applicant to justify why Type A variables are not required for this design when it appears that manually controlled actions were credited for cases where no automatic controls exist during several events analyzed in Chapter 15. As such, if the applicant determines that Type A variables are needed in response to this RAI, the staff requests the applicant to provide design descriptions and a corresponding ITAAC to verify that the as-built design provides indications for manually controlled actions for which no automatic control is provided as required by IEEE Std 603-1991, Clause 5.8.1.

Response

As a result of discussions between KHNP and the NRC staff pertaining to the supplied response to RAI 38-7878, Question 07.05-1, a list of Type A variables as well as Type B and C variables will be provided in a revised response to RAI 38-7878, Question 07.05-1. That revised response will address all of the related changes associated with incorporating Type A variables into the APR1400 design, including the ITAAC for DCD Tier 1, Table 2.5.3-2 and the corresponding design descriptions in Section 2.5.3.1, Item 4.

Impact on DCD

DCD Tier 1, Table 2.5.3-2 will be revised as indicated in the attachment of the revised response to RAI 38-7878, Question 07.05-1.

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 the Technical/Topical/Environmental Report.

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Question No. 14.03.05-25

Demonstrate how control of access features are verified in the as-built QIAS-P.

10 CFR 50.55a(h)(3) states, in part, that an application filed on or after May 13, 1999, for design certifications must meet the requirements for safety systems in IEEE Std 603-1991 and the correction sheet dated January 30, 1995. IEEE Std 603-1991, Clause 5.9, states "The design shall permit the administrative control of access to safety system equipment. These administrative controls shall be supported by provisions within the safety systems, by provision in the generating station design, or by a combination thereof." The staff could not identify any design descriptions or corresponding ITAACs to verify that the control of access features exist for the QIAS-P equipment identified in APR1400 FSAR Tier 1, Table 2.5.3-1 (e.g. cabinet keylocks). As such, the staff request the applicant to clarify whether any control of access features are employed to prevent unauthorized or unintended access of QIAS-P equipment identified in APR1400 FSAR Tier 1. If such features exists, the staff requests the applicant to provide an ITAAC that verify that these control of access features exist for the as-built QIAS-P equipment identified in APR1400 FSAR Tier 1. Otherwise, the staff requests the applicant to justify why such features are not required.

Response

KHNP interprets IEEE Std 603-1991, Clause 5.8.1 that the display instrumentation for AMI Type A variables is sufficient to accomplish its safety functions if it meets the requirements of IEEE Std 497-2002 and, therefore, can conclude that the QIAS-P does not need to meet any requirement of IEEE Std 603-1991 other than Clause 5.8.1.

The as-built QIAS-P will have the control of access features in accordance with IEEE Std. 497-2002, Clause 6.10 as described in DCD Tier 2, Section 7.5.2.1. a. 7). That is, the cabinets containing the QIAS-P processors listed in DCD Tier 1, Table 2.5.3-1 will have key

locks and door open alarms and are located in a vital area of the facility which is a controlled access area.

For clarification, a design description and corresponding ITAAC will be added in DCD Tier 1, Section 2.5.3.1 and Table 2.5.3-3 to verify that the control of access features exist for the QIAS-P equipment identified in DCD Tier 1, Table 2.5.3-1.

Impact on DCD

DCD Tier 1, Section 2.5.3.1 and Table 2.5.3-3 will be revised as indicated in the attached mark-up.

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 the Technical/Topical/Environmental Report.

2.5.3 Qualified Indication and Alarm System

2.5.3.1 Design Description

The qualified indication and alarm system (QIAS) is a monitoring system that is used to display safety-related information and non-safety information.

The QIAS consists of the two subsystems as follows:

a. QIAS - P, Divisions A and B

b. QIAS - N

In this section, QIAS-N which is non-safety system is not described.

The QIAS-P equipment are located in the auxiliary building.

1. The seismic Category I equipment, identified in Table 2.5.3-1, can withstand seismic design basis loads without loss of its safety function.

2. QIAS-P equipment, identified in Table 2.5.3-1, can withstand the electrical surge, electromagnetic interference (EMI), radio frequency interference (RFI), and electrostatic discharge (ESD) conditions that would exist before, during, and following a postulated accidents without loss of its safety function for the time required to perform the safety function.

3.a Class 1E equipment identified in Table 2.5.3-1 is powered from its respective Class 1E train.

3.b Class 1E equipment identified in Table 2.5.3-1, and associated equipment are physically separated and electrically independent from each other and physically separated and electrically independent from non-Class 1E equipment.

4. The QIAS-P monitors and displays the accident monitoring instrumentation variables identified in Table 2.5.3-2.

5. The QIAS-P software is implemented according to the software lifecycle process.

6. The cabinets for processors listed in Table 2.5.3-1 have key locks and door open alarms and are located in a vital area of the facility.

Table 2.5.3-3 (3 of 3)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. The QIAS-P software is implemented according to the software lifecycle process.	5.a An inspection will be performed for the requirements phase result summary report of QIAS-P software.	5.a The requirements phase result summary report exists and concludes that the plant requirements phase activities of QIAS-P software are performed.
	5.b An inspection will be performed for the design phase result summary report of QIAS-P software.	5.b The design requirements phase result summary report exists and concludes that the design phase activities of QIAS-P software are performed.
	5.c An inspection will be performed for the implementation phase result summary report of QIAS-P software.	5.c The implementation phase result summary report exists and concludes that the implementation phase activities of QIAS-P software are performed.
	5.d An inspection will be performed for the test phase result summary report of QIAS-P software.	5.d The test phase result summary report exists and concludes that the test phase activities of QIAS-P software are performed.
	5.e An inspection will be performed for the installation and checkout phase result summary report of QIAS-P software.	5.e The installation phase result summary report exists and concludes that the installation and checkout phase activities of QIAS-P software are performed.

An ITAAC to be added to this table as shown on the next page.

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
6. The cabinets for processors listed in Table 2.5.3-1 have key locks and door open alarms, and are located in a vital area of the facility.	6.a A test of the as-built cabinets for processors listed in Table 2.5.3-1 for key lock capability and a test of door open alarms will be performed.	6.a Each as-built cabinet for a processor has key lock capability, and alarms are received in the as-built MCR when cabinet doors are opened.
	6.b Inspection of the cabinets for processors listed in Table 2.5.3-1 will be performed.	6.b The cabinets for processors listed in Table 2.5.3-1 are located in a vital area of the facility.

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Question No. 14.03.05-30

Provide design descriptions and a corresponding ITAAC to verify means are provided for manual initiation and control of the protective actions that have not been selected for automatic control.

10 CFR 50.55a(h)(3) states, in part, that an application filed on or after May 13, 1999, for design certifications must meet the requirements for safety systems in IEEE Std 603-1991 and the correction sheet dated January 30, 1995. IEEE Std 603-1991, Clause 6.2.2, states “Means shall be provided in the control room to implement manual initiation and control of the protective actions identified in [Clause] 4.5 that have not been selected for automatic control under 6.1. The displays provided for these actions shall meet the requirements of [Clause] 5.8.1." In RAI 38-7878, Question 07.05-2, the staff requested the applicant to justify why Type A variables are not required for this design when it appears that manually controlled actions were credited for cases where no automatic controls exist during several events analyzed in Chapter 15. As such, if the applicant determines that Type A variables are needed in response to this RAI, the staff requests the applicant to provide design descriptions and a corresponding ITAAC to verify means are provided for manual initiation and control of the protective actions that have not been selected for automatic control as required by IEEE Std 603-1991, Clause 6.2.2.

Response

In response to RAI 294-8302 Question 07.05-6, KHNP has determined that Type A variables are to be included in the APR1400 design. The applicable Type A variables, (e.g., related operator actions), pertain to the component and are listed in a new Table 2.5.4-6 to be added to the APR1400 DCD, Tier 1.

A description will be added to Section 2.5.4.1 of APR1400 DCD Tier 1 to state that means are provided for manual initiation and control of the protective actions that have not been selected for automatic control. A corresponding ITAAC, Item 24, will be added to Table 2.5.4-4 to detail

the associated testing that is to be performed for the as-built manual initiation and control switches. The addition of these items into Tier 1 of the DCD meets the requirements for safety systems as specified in IEEE Std 603-1991, Clause 6.2.2.

Impact on DCD

Section 2.5.4.1 and Table 2.5.4-4 of APR1400 DCD Tier 1 will be revised as indicated in the attachment. Table 2.5.4-6 of APR1400 DCD Tier 1 will be added as indicated 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 Environment Report.

18. The Class 1E equipment and components listed in Table 2.5.4-1 are protected from accident related hazards such as missiles, pipe breaks and flooding.

19. The ESF-CCS cabinets listed in Table 2.5.4-1 have key locks and door position alarms, and are located in a vital area of the facility.

20. The ESF-CCS provides ESF actuation within required response time for ESF functions identified in Table 2.5.4-2.

21. The ESF-CCS has the testing functions.

2.5.4.2 Inspections, Tests, Analyses, and Acceptance Criteria

The inspections, tests, analyses, and associated acceptance criteria for the ESF-CCS are specified in Table 2.5.4-4.

24. Means are provided for manual initiation and control of the protective actions that have not been selected for automatic control in Table 2.5.4-6.

Table 2.5.4-4 (7 of 7)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
18. The Class 1E equipment and components listed in Table 2.5.4-1 are protected from accident related hazards such as missiles, pipe breaks and flooding.	18. An inspection and analysis will be performed on the locations of the as-built Class 1E equipment and components listed in Table 2.5.4-1.	18. A report exists and concludes that the as-built equipment and components listed in Table 2.5.4-1 are protected from accident related hazards such as missiles, pipe breaks and flooding.
19. The ESF-CCS cabinets listed in Table 2.5.4-1 have key locks and door position alarms, and are located in a vital area of the facility.	19.a A test of the as-built cabinets listed in Table 2.5.4-1 for key lock capability, and a test of door position alarms, will be performed.	19.a Each as-built cabinet listed in Table 2.5.4-1 has key lock capability, and door position alarms are received in the as-built MCR when cabinet doors are opened.
	19.b An inspection of the cabinets listed in Table 2.5.4-1 will be performed.	19.b The cabinets listed in Table 2.5.4-1 are located in a vital area of the facility.
20. The ESF-CCS provides ESF actuation within required response time for ESF functions identified in Table 2.5.4-2.	20.a A type test and analysis will be performed on the ESF-CCS to verify that the ESF-CCS actuates the ESF functions identified in Table 2.5.4-2.	20.a A report exists and concludes that the ESF-CCS actuates the ESF functions identified in Table 2.5.4-2 within response time requirements.
	20.b An inspection will be performed on the as-built ESF-CCS to determine if the response time of ESF actuation functions identified in Table 2.5.4-2.	20.b The as-built ESF actuation functions identified in Table 2.5.4-2 with response time requirements are bounded by type tests or a combination of a type test and analysis.
21. The ESF-CCS has the testing functions.	21. A type tests and analysis of the ESF-CCS will be performed using simulated failure condition.	21. A report exists and concludes that the ESF-CCS has the testing functions to detect malfunctioning components or modules and have them replaced, repaired, or adjusted.

insert from the following page

24. Means are provided for manual initiation and control of the protective actions that have not been selected for automatic control.	24. A test will be performed to verify the actuation of the as-built manual initiation and control switch in the MCR.	24. Each as-built manual initiation and control switch actuates the associated component identified in Table 2.5.4-6 to the specified position when manually operated.

Table 2.5.4-6

Control for Credited Manual Operator Action

Variables	Operator Action	Control/Component
- Pressurizer Pressure (Wide Range) - Pressurizer Level	Close letdown line containment isolation valve (Diagnosis of letdown line break)	[CVCS] - Letdown Line CIV
- Pressurizer Pressure (Wide Range) - Pressurizer Level - SG Pressure - SG level	Isolation of SG atmospheric dump valve of affected SG (Diagnosis of steam generator tube rupture (SGTR))	- SG 1 MSADV - SG 2 MSADV
- Pressurizer Pressure (Wide Range) - Pressurizer Level - SG Pressure - SG Level - Hot Leg Temperature (Wide Range) - Cold Leg Temperature (Wide Range) - Reactor Coolant System (RCS) Subcooling Margin - Core Exit Temperature (CET) Subcooling Margin	Termination of safety injection for SGTR	[Stop SIP-1,2,3,4] - SI Pump 1 - SI Pump 2 - SI Pump 3 - SI Pump 4
- SG Pressure - SG Level	Termination of auxiliary feedwater (AFW) for main steam line break and main feedwater line break	[Stop AFWPs] - AFW Pump A Motor Driven - AFW Pump B Motor Driven - AFW Turbine A Reset - AFW Turbine B Reset
- Logarithmic Reactor Power	Stop charging pump (Terminate chemical and volume control system (CVCS) charging flow for boron dilution event)	[Stop Charging Pump 1,2] - Charging Pump A - Charging Pump B

Added