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.:	**43-7887**
SRP Section:	**7.1 - Instrumentation and Controls**
Application Section:	**7.1**
Date of RAI Issue:	**06/22/2015**

Question No. 07.01-15

Describe the design techniques that will be used to prevent loss of the protection function in order to meet the requirements of 10 CFR Part 50, Appendix A, GDC 22 are met.

GDC 22, "Protection system independence" states, “The protection system shall be designed to assure that the effects of natural phenomena, and of normal operating, maintenance, testing, and postulated accident conditions on redundant channels do not result in loss of the protection function, or shall be demonstrated to be acceptable on some other defined basis. Design techniques, such as functional diversity or diversity in component design and principles of operation, shall be used to the extent practical to prevent loss of the protection function.” The APR1400 FSAR, Tier 2, Section 7.1.2.24, "Conformance with GDC 22" states, “The I&C systems that are applicable to GDC 22, as shown in Table 7.1-1, are designed in accordance with GDC 22. The protection systems comply with the independence requirements of IEEE Std. 603 except for the CEA [control element assembly] position inputs described in Subsection 7.1.2.3.” The applicant does not describe the design techniques (e.g. functional diversity and other design techniques) that will be used to prevent loss of the protection function. Modify the FSAR to include this information.

Response

The conformance to the requirements of IEEE Std. 603 and GDC 22 regarding independence and functional diversity is described and provided in Sections 7.2.2.3 and 7.3.2.3 as well as in Section 4.1 of Safety I&C System Technical Report.

Section 7.1.2.24 of DCD Tier 2 will be revised to include the reference sections of the application document as indicated on the attached mark-up.

Before Revision:
“The I&C systems that are applicable to GDC 22, as shown in Table 7.1-1, are designed in accordance with GDC 22.”

After Revision:
“The applicable I&C systems listed in Table 7.1-1 are designed to meet the requirement of GDC 22 as described in Subsections 7.2.2.3 and 7.3.2.3 as well as in Section 4.1 of the Safety I&C System Technical Report.”

Impact on DCD

Section 7.1.2.24 of DCD Tier 2 will be revised as indicated on 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 any Technical, Topical or Environmental Reports.

7.1.2.21 Conformance with GDC 19

The I&C systems that are applicable to GDC 19, as shown in Table 7.1-1, are designed in accordance with GDC 19. The capabilities with regard to the safe operation of the plant from the MCR during normal and accident conditions are described in Section 7.4.

7.1.2.22 Conformance with GDC 20

The I&C systems that are applicable to GDC 20, as shown in Table 7.1-1, are designed in accordance with GDC 20. The protection function is described in Sections 7.2 and 7.3.

7.1.2.23 Conformance with GDC 21

The I&C systems that are applicable to GDC 21, as shown in Table 7.1-1, are designed in accordance with GDC 21. The protection system is designed to comply with the requirements of IEEE Std. 603. No credible single failure would result in a loss of the protection function.

7.1.2.24 Conformance with GDC 22

~~The I&C systems that are applicable to GDC 22, as shown in Table 7.1-1, are designed in accordance with GDC 22.~~ The protection systems comply with the independence requirements of IEEE Std. 603 except for the CEA position inputs described in Subsection 7.1.2.3.

7.1.2.25 Conformance with GDC 23

The I&C systems that are applicable to GDC 23, as shown in Table 7.1-1, are designed in accordance with GDC 23. Failure modes and effects analysis (FMEA) for protection systems is described in Subsections 7.2.3.1 and 7.3.3.1.

7.1.2.26 Conformance with GDC 24

The applicable I&C systems listed in Table 7.1-1 are designed to meet the requirement of GDC 22 as described in Subsections 7.2.2.3 and 7.3.2.3 as well as in Section 4.1 of the Safety I&C System Technical Report.

~~accordance with GDC 24. Electrical isolation, physical separation, and communication~~

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Docket No. 52-046

RAI No.:	**43-7887**
SRP Section:	**07.01 – Instrumentation and Controls – Introduction**
Application Section:	**07.01**
Date of RAI Issue:	**06/22/2015**

Question No. 07.01-20

Verify that identification requirements for safety I&C systems conform to the guidance of RG 1.75 in order to demonstrate compliance to IEEE Std. 603-1991, Clause 5.11.

10 CFR 50.55a(h)(3) states, in part, that 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 5.11, "Identification," requires that (1) safety system equipment be distinctly identified for each redundant portion of a safety system in accordance with the requirements of IEEE Std. 384-1981, (2) components or modules mounted in equipment or assemblies that are clearly identified as being in a single redundant portion of a safety system do not themselves require identification, (3) identification of safety system equipment be distinguishable from other purposes, (4) identification of safety system equipment does not require frequent use of reference material, and (5) the associated documentation be distinctly identified in accordance with the requirements of IEEE Std. 494-1974. SRP Section 7.1, Appendix 7.1-C, provides staff review criteria on meeting the requirements of IEEE Std. 603-1991. Section 5.11 of this appendix states, “Guidance on identification is provided in Regulatory Guide (RG) 1.75, which endorses IEEE Std. 384-1992. The preferred identification method is color coding of components, cables, and cabinets.”

Section A.5.11, "Identification," of Technical Report APR1400 Z-J-NR-14001-P, Revision 0, "Safety I&C System," Appendix A, "Conformance to IEEE STD. 603-1991," states that all equipment, including panels, modules, and cables associated with the RPS [reactor protection system] and ESF [engineered safety features] systems, are marked in order to facilitate identification. The safety I&C system is configured in accordance with specific identification requirements which provide a standardized method for identifying equipment, diagrams and signals for the purpose of consistency during the installation process." The staff finds that the application did not state that these specific identification requirements of the safety I&C system will conform to the guidance of the guidance of RG 1.75. Verify whether

these specific identification requirements conform to the guidance of RG 1.75 or if an alternate method is proposed. If an alternate method is used, provide justification as to why the method provides a comparable level of safety to the guidance in RG 1.75.

Response

The RPS and ESF systems meet the identification requirements stated in Section 6.1.2, “Identification” of IEEE Std. 384-1992, which is endorsed by RG 1.75, Rev.3. The conformance analysis for identification requirements is provided in Section A.5.11 of the Safety I&C System Technical Report.

The following will be added to Section A.5.11, “Identification,” of the Safety I&C System Technical Report (APR1400-Z-J-NR-14001):

“The safety I&C system design meets the identification requirements of IEEE Std. 384-1992, as endorsed by RG 1.75, Rev.3.”

Impact on DCD

There is no impact on DCD.

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

Section A.5.11 of the Safety I&C System Technical Report(APR1400-Z-J-NR-14001-P/NP) will be revised as indicated on the attached mark-up.

All equipment, including panels, modules, and cables associated with the RPS and ESF systems, are marked in order to facilitate identification. The safety I&C system is configured in accordance with specific identification requirements which provide a standardized method for identifying equipment, diagrams and signals for the purpose of consistency during the installation process. Interconnecting cabling is color-coded.

The physical identification is provided so that an operator can confirm if the safety I&C system cabinets and related cable are the safety class. The safety I&C system cabinets are distinguished by name plates. The safety I&C system components are uniquely identified by designations per project procedures and as defined in contract specifications. The physically isolated cable from sensor to actuation devices is identified by different colors between divisions.

The identification of software is assured by identification provisions as discussed in the SPM TeR.

A.5.12 Auxiliary Features

Clause 5.12:

The safety I&C system meets the identification requirements of IEEE 384-1992, as endorsed by RG 1.75, Rev.3.

"5.12.1 Auxiliary supporting features shall meet all requirements of this standard.

5.12.2 Other auxiliary features that (1) perform a function that is not required for the safety systems to accomplish their safety functions, and (2) are part of the safety systems by association (that is, not isolated from the safety system) shall be designed to meet those criteria necessary to ensure that these components, equipment, and systems do not degrade the safety systems below an acceptable level. Examples of these other auxiliary features are shown in Figure 3 and an illustration of the application of this criterion is contained in Appendix A."

Analysis:

Any features (components, equipment and systems) of the safety I&C system that perform safety functions satisfy the Clause 5.12 requirements of IEEE Std. 603-1991. All of these features are designated as safety-related and are part of the safety I&C system. The Communication architecture provides the ability to transmit information to non-safety related devices and is classified as safety-related until the non-safety boundary.

Auxiliary features (bypass, CWP signal, test, and calibration functions) are designed not to affect the protection system from accomplishing their safety functions.

A.5.13 Multi-Unit Stations

Clause 5.13:

"The sharing of structures, systems, and components between units at multi-unit generating stations is permissible provided that the ability to simultaneously perform required safety functions in all units is not impaired. Guidance on the sharing of electrical power systems between units is contained in IEEE Std. 308-1980. Guidance on the application of the single failure criterion to shared systems is contained in IEEE Std. 379-1988."

Analysis:

This requirement is not applicable as there is no planned sharing between units.

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.:	**43-7887**
SRP Section: Section	**07.01 - Instrumentation and Controls - Introduction**
Application Section:	**Section 7.1**
Date of RAI Issue:	**06/22/2015**

Question No. 07.01-21

Identify and describe auxiliary features in the APR1400 design in order to demonstrate compliance to IEEE Std. 603-1991, Clause 5.12. Specifically, describe how auxiliary features within the protection system will not adversely impact safety functions. In addition, provide a comprehensive list of all safety related auxiliary supporting features.

10 CFR 50.55a(h)(3) requires compliance to IEEE Std. 603-1991. IEEE Std. 603-1991, Clause 5.12, "Auxiliary Features," states that (1) auxiliary supporting features shall meet all requirements of this standard, and (2) other auxiliary features that perform a function that is not required for the safety systems to accomplish their safety functions, and are part of the safety system by association, shall be designed to meet those criteria necessary to ensure that these components, equipment, and systems do not degrade the safety systems below an acceptable level. APR1400 FSAR Tier 2, Section 7.1.1.10, "Auxiliary Support Features" states that auxiliary supporting features and other auxiliary features are safety systems or components of systems that provide the services that are required for the safety systems to accomplish their safety functions. HVAC and electrical power systems are examples of auxiliary supporting features. The I&C aspects of auxiliary supporting features are described primarily in Chapters 8 and 9. Examples of other auxiliary features are built-in test equipment and isolation devices. Section A.5.12, "Auxiliary Features," of Technical Report APR1400-Z-J-NR-14001-P, Rev. 0, "Safety I&C System" states that any features (components, equipment and systems) of the safety I&C system that perform safety functions satisfy the Clause 5.12 requirements of IEEE Std. 603-1991. All of these features are designated as safety-related and are part of the safety I&C system. The communication architecture provides the ability to transmit information to non-safety related devices and is classified as safety-related until the non-safety boundary. Auxiliary features (bypass, control element assembly withdrawal prohibit (CWP) signal, test, and calibration functions) are designed not to affect the protection system from accomplishing their safety functions.

The staff finds that additional information is required regarding the auxiliary features that are designed to not affect the protection system from accomplishing their safety function. Specifically, the staff requests the applicant to identify and describe how the auxiliary features (bypass, CWP signal, test, and calibration functions) within the protection system do not affect the protection system from accomplishing their safety functions. In addition, the application states that the HVAC and electrical power systems, built-in test equipment, and isolation devices are examples of safety-related auxiliary support systems. The staff requests the applicant to provide a comprehensive list of all safety-related auxiliary supporting features in the APR1400 design in order to meet the requirements of IEEE Std. 603-1991, Clause 5.12.

Response

Identify and describe how the auxiliary features (bypass, CWP signal, test, and calibration functions) within the protection system do not affect the protection system from accomplishing their safety functions

The other auxiliary features of the plant protection system (PPS) meet the requirements of IEEE Std. 603, IEEE Std. 384, NRC RG 1.75, and DI&C-ISG-04. Operation of other auxiliary features requires the use of a function enable (FE) key switch, which is controlled by administrative procedures to prevent loss of protection functions.

- **Setpoint Change**

As described in Section 7.2.1.2 of DCD Tier 2, the setpoint for bistable logic is adjustable from the maintenance and test panel (MTP). The setpoint change can be applied only if the FE key switch is enabled. Also, the setpoint change is restricted by a cabinet door open alarm, door keylock, and administrative procedure.

As described in Section 4.2.3.4 of the Safety I&C System Technical Report, both setpoint change and testing require the FE key switch on the MTP switch panel to be enabled. The safety-critical class software (for bistable logic and local coincidence logic) performs a logical block on incoming setpoint data and testing signals based on the FE key switch signal. The logical block is implemented as an AND gate for the incoming data and the FE key switch signal.

To perform a setpoint change, which is not required during normal operation, the safety division shall be placed in a bypass state. After applying the setpoint change, the functional test is performed to ensure that the intended setpoint change is applied. This ensures that the setpoint change does not affect the protection system from accomplishing the intended safety functions.

- **Testing**

As described in Section 7.2.1.7 of DCD Tier 2, administrative controls are placed on the testing function of the PPS to ensure only one of four safety divisions can be tested at a time. Before testing can occur, the FE key switch must be enabled and the channel to be tested must be placed in bypass. The FE key switch enables both the bypass and the testing functions. Likewise, initiation circuit testing is restricted to one safety division at a time by

administrative procedures to ensure that the testing function does not affect the protection system from accomplishing the intended safety functions.

- **Bypass**

As described in Section 7.2.1.7 of DCD Tier 2, bypassing the same parameter in more than one division is restricted by administrative procedures to ensure that the bypass does not affect the protection system from accomplishing the intended safety functions.

- **CWP**

As described in Section A.6.3 of the Safety I&C System Technical Report, low DNBR, high LPD, and high pressurizer pressure pre-trip provide a CWP, which is treated as an associated circuit. As an associated circuit, it meets the requirements of IEEE Std. 603-1991 so that it cannot affect the protection system from accomplishing the intended safety functions.

- **Calibration**

As described in Section A.5.7 of the Safety I&C System Technical Report, the channel calibrations are performed during refueling outages when the PPS is not required to be operable. Calibration and testing is performed according to plant specific approved procedures that establish specific surveillance techniques and surveillance intervals intended to maintain high reliability.

- **Electrical Isolation**

As described in Section 7.2.2.3 of DCD Tier 2, the PPS and non-safety systems are isolated using qualified isolation devices or fiber-optic cables so that any failure in a non-safety system does not cause loss of the safety system function.

- **Independence**

The PPS includes other auxiliary features beside the reactor trip function and ESF initiation function. The other auxiliary features conform to the independence requirements described in Section A.5.6 of the Safety I&C System Technical Report.

Provide a comprehensive list of all safety-related auxiliary supporting features

The auxiliary supporting features and other auxiliary features are listed as follows:

- **Auxiliary Supporting Features**
  - Electric power supply system for the reactor protection system and engineered safety features systems
  - I&C portions of the component cooling water system, essential service water system, and ultimate heat sink
  - I&C portions of safety-related heating, ventilation, and air conditioning systems

- **Other Auxiliary Features**
  - Equipment protection devices (monitoring for door open and cabinet high temperature)
  - Operating bypass, trip channel bypass

- Setpoint reset/change function
- Built-in test functions
- Diagnostic functions
- Trip, pre-trip, sequence of events, and status indications/alarms
- Qualified isolators to interface with non-safety systems
- Emergency diesel generator support systems
  - Emergency diesel engine fuel oil system
  - Emergency diesel engine cooling water system
  - Emergency diesel engine starting air system
  - Emergency diesel engine lubrication system
  - Emergency diesel engine combustion air intake and exhaust system

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Impact on DCD

There is no impact on the DCD.

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.

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.:	**43-7887**
SRP Section:	**7.1 - Instrumentation and Controls**
Application Section:	**7.1**
Date of RAI Issue:	**06/22/2015**

Question No. 07.01-23

Clarify what standards are used for equipment qualification (EQ) of the safety-related I&C system equipment.

GDC 4, "Environmental and Dynamic Effects Design Bases" states, in part, that "structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents." RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference [EMI/RFI] in Safety-Related Instrumentation and Control Systems" states that it is intended that either set of test methods (MIL-Std-461E or IEC 61000-6-4) be applied in its entirety, without selective application of individual methods (i.e., no mixing and matching of test methods) for emissions testing. Technical Report APR1400-Z-J-NR-14001-P, Rev. 0, "Safety I&C System," Section 6.3, "EMI/RFI Testing," identifies both MIL-Std-461E and IEC-61000 Part 4 Series standards as used for EQ of safety-related I&C system equipment. Clarify which set of standards is used to demonstrate that the safety I&C system equipment will meet the EQ requirements for the electromagnetic compatibility or provide justification for why the sets of standards are mixed, which is contrary to the guidance in RG 1.180. If IEC-61000 Part 4 series standards are used, identify which version of those standards are used.

Response

The description “The safety I&C system equipment is qualified to comply with the guidance of MIL Std. 461E and IEC 61000 Part 4 Series as endorsed by RG 1.180.” in Section 6.3 of Safety I&C System Technical Report indicates that each of the EMI/RFI emissions test, EMI/RFI susceptibility/immunity test, and surge withstand capability test for qualification of the safety I&C system equipment is performed based on the designated set of test methods either from MIL Std. 461E or from IEC 61000 Part 4 Series.

For the emissions testing on the safety I&C system equipment, the MIL-Std. 461E test methods are applied without any individual test methods from IEC 61000 Part 4 Series. For the susceptibility/immunity testing and surge withstand capability testing on the safety I&C system equipment, the IEC 61000 Part 4 Series test methods are applied without any individual test methods from MIL-Std. 461E.

This conforms to the intention of NRC RG 1.180, Rev.1 that either MIL Std. 461E test methods or IEC 61000 test methods be applied in its entirety for each test.

In summary, each of the three tests (emissions, susceptibility, surge withstand) is performed without selective application of individual test methods of MIL Std. 461E and IEC 61000 Part 4 Series, which is consistent with the guidance in NRC RG 1.180, Rev.1.

Impact on DCD

There is no impact on the DCD.

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.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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RAI No.:	**43-7887**
SRP Section:	**7.1 - Instrumentation and Controls**
Application Section:	**7.1**
Date of RAI Issue:	**06/22/2015**

Question No. 07.01-24

Clarify what qualification tests will be included in the EQ program of the safety-related I&C system equipment. Also clarify the inconsistency on which version for IEEE Std. 323 is used.

GDC 4 states, in part, that "structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents." RG 1.180, RG 1.100, RG 1.209 and their endorsed IEEE Std. 323-2003, EPRI TR-107330, and EPRI TR-102323, state, in part, that tests for electrical fast transient, electrostatic discharge, surge withstand capability, and Class 1E to Non-Class 1E isolation should be included as part of the EQ testing program for the safety I&C system equipment. The staff could not identify design information for these EQ tests in Section 6, “Equipment Qualification” of Technical Report APR1400-Z-J-NR-14001-P, Rev. 0, "Safety I&C System." Provide necessary design information to demonstrate that the EQ program of the safety I&C system equipment will include those EQ tests. Also clarify which associated ITAAC items will include those EQ tests. In addition, IEEE Std. 323-2003 is endorsed in RG 1.209. However, the 1983 and 2003 version of IEEE Std. 323 are used in Section 6 and Section A.5.4 of the above Safety I&C System TeR. Clarify the inconsistent use of version for IEEE Std. 323 and provide necessary justification for use of the older version of this IEEE standard.

Response

The equipment qualification testing includes electrical fast transient, electrostatic discharge, surge withstand capability, and Class 1E to Non-Class 1E isolation testing. This information will be added in Section 6 of the Safety I&C System Technical Report. The related ITAAC items are items 2 and 3 of Table 2.5.1-5 and items 2 and 16 of Table 2.5.4-4 of DCD Tier 1.

The safety I&C system equipment located in the mild environment is qualified to the guidance of IEEE Std. 323-2003, as endorsed by RG 1.209, Rev.0, which is specified in Section 3.4.24 of the Safety I&C System Technical Report. Therefore, references to IEEE Std. 323-1983 in the Safety I&C System Technical Report will be replaced by IEEE Std. 323-2003.

Impact on DCD

There is no impact on the DCD.

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

Section 6 and A.5.4 of the Safety I&C System Technical Report (APR1400-Z-J-NR-14001-P/NP) will be revised as indicated on the attached mark-up.

6 EQUIPMENT QUALIFICATION

The objective of equipment qualification is to demonstrate that the safety I&C system equipment is capable of performing its designated safety functions during and following a DBE.

Equipment qualification is composed of three major components: environmental, seismic and electromagnetic compatibility (EMC) qualification.

2003

Equipment testing and analysis are performed to meet the requirements of IEEE Std. 603-1991, IEEE Std. 323-~~1983~~, EPRI TR-107330, EPRI TR-102323 Rev.1 and RG 1.180 Rev. 1. This testing/analysis confirms that the safety I&C system is fully qualified and capable of performing its designated safety functions while exposed to normal, abnormal, test, accident, and post-accident environmental conditions, as required.

includes electrical fast transient, electrostatic discharge, surge withstand capability, and Class 1E to Non-Class 1E isolation testing and

6.1 Environmental Qualification

The safety I&C system equipment is qualified to meet the guidance of IEEE Std. 323-2003, as endorsed by RG 1.209. Since this equipment is located in the mild environments (MCR/RSR and/or I&C equipment rooms) where qualified heating, ventilation, and air conditioning (HVAC) is provided, the qualification is performed by a heat rise test and a subsequent analysis using linear temperature data extrapolation.

The tests are performed with the cabinet/enclosure energized to obtain temperature heat rise data at various locations within the cabinet assembly. Temperatures are monitored until they are stable within the cabinet with its doors and cable entrance areas closed. Then by linear extrapolation, the internal temperature profile based on a change in the external ambient temperature is determined.

The analysis demonstrates, using extrapolated test data, that individual component and equipment temperature specifications are not exceeded within the cabinet/enclosure when exposed to the environmental conditions. The environmental ranges to which equipment is exposed are specified in Table 6.1-1.

Table 6-1 Environmental Design Requirements

Environmental Parameter	Normal		
	Min.	Max.	Duration
Safety I&C System Cabinets in I&C Equipment Room			
Temperature	21ºC (70ºF)	25ºC (77ºF)	Continuous
Humidity	40 %RH (1)	60 % RH	Continuous
Pressure	Atmospheric		Continuous
Radiation	10 Gamma (3)		Continuous
Safety I&C System in the MCR SC and RSC			
Temperature (2)	21ºC (70 ºF)	35ºC (95 ºF)	Continuous
Humidity	40 %RH	60 % RH	Continuous
Pressure	Atmospheric		Continuous
Radiation	10 Gamma (3)		Continuous

Notes:

(1) Relative humidity is based on standard temperature and pressure of 21ºC (70 ºF) and 0 psig.

"Components and modules shall be of a quality that is consistent with minimum maintenance requirements and low failure rates. Safety system equipment shall be designed, manufactured, inspected, installed, tested, operated, and maintained in accordance with a pre-scribed quality assurance program (ANS/ASME NQAI-1989)."

Analysis:

The platform to be used for the safety I&C system is qualified as described in Reference 12. Development of the safety I&C system is performed under a quality assurance program in accordance with 10 CFR Part 50 Appendix B.

The QAPD describes the quality assurance program that is used for the design, manufacture, inspection, installation, testing, operation, and maintenance of the safety I&C system.

A.5.4 Equipment Qualification

Clause 5.4:

"Safety system equipment shall be qualified by type test, previous operating experience, analysis, or any combination of these three methods, to substantiate that it will be capable of meeting, on a continuing basis, the performance requirements as specified in the design basis. Qualification of Class 1E equipment shall be in accordance with the requirements of IEEE Std. 323-1983 and IEEE Std. 627-1980."

Analysis:

Equipment qualification (environmental, seismic and EMI/RFI qualification) of the safety I&C system is described in Section 6.

2003

Section 6 of this report provides a summary of the equipment testing and analysis performed to meet the requirements of IEEE Std. 603-1991, IEEE Std. 323-~~1983~~, EPRI TR-107330, EPRI TR-102323 Rev.1 and RG 1.180 Rev.1. This report addresses the specific required environmental conditions and testing/analysis performed to qualify this equipment.

A.5.5 System Integrity

Clause 5.5:

"The safety systems shall be designed to accomplish their safety functions under the full range of applicable conditions enumerated in the design basis."

Analysis:

Type testing of components, separation of sensors and channels, and qualification of the cabling are performed to ensure that the channels maintain their functional capability required under applicable extremes of environment, power supplied, malfunction, and DBE conditions.

Loss of any one channel will not prevent the protective action of the PPS and ESF-CCS. Sensors are connected so that blockage or failure of any one connection does not prevent protective system action. The process transducers located in the containment building are specified and rated for the intended service. Components that must operate during or after a limiting fault (postulated accident) are qualified for the most limiting environment for the period of time for which they must maintain their functional capability. Results of type tests are used to verify this.