Response to

Request for Additional Information No. 59 (955), Revision 0

9/12/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 07.01 - Instrumentation and Controls - Introduction
Application Section: 7.1.2.2.12
ICE1 Branch

Question 07.01-1:

Provide the entire failure modes and effects analysis (FMEA) for the U.S. EPR Instrumentation and Control (I&C) System.

Clause 5.1 of IEEE Std. 603-1991 requires, in part, that safety systems shall perform all safety functions required for a design basis event in the presence of: (1) any single detectable failure within the safety systems concurrent with all identifiable but non-detectable failures; (2) all failures caused by the single failure; and (3) all failures and spurious system actions that cause or are caused by the design basis event requiring the safety functions. Appendix 7.1-C of the Standard Review Plan identifies the guidance in Regulatory Guide 1.53 as acceptance criteria. The applicant provided an FMEA for the protection system as part of one of the RAI responses for the U.S. EPR Digital Protection System Topical Report. But, an FMEA was not seen for the entire U.S. EPR I&C system. In addition, the RAI response said that the results and additional details for the Protection System FMEA will be provided in Sections 7.2 and 7.3. In the DC FSAR, Section 7.1.2.2.12, the applicant stated that only applicable sections of the I&C FMEA will be included in Sections 7.2.2.2 and 7.3.2.2. This is not acceptable as the entire FMEA is needed for staff review.

Response to Question 07.01-1:

A response to this question will be provided by December 4, 2008.

Question 07.01-2:

Confirm the correct acronym to be used for Incore Instrumentation System.

DC FSAR, Tier 1, Section 2.4.19 and Table 2.4.19-3, use the acronym IIS for the Incore Instrumentation System, but Tier 2, Section 7.1.1.5.2, uses ICIS. Clarify the correct acronym to be used for the Incore Instrumentation System and verify if a similar issue occurs in other sections.

Response to Question 07.01-2:

The correct acronym for incore instrumentation system is ICIS. U.S. EPR FSAR Tier 1, Section 2.4.19 and Table 2.4.19-3—Incore Instrumentation System ITAAC will be revised to reflect the correct acronym.

AREVA NP has searched the U.S. EPR FSAR and found no other occurrences.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.4.19 and Table 2.4.19-3 will be revised as described in the response and indicated on the enclosed markup.

Question 07.01-3:

Provide clarification regarding the limited number of systems shown/depicted in Fig. 7.1-2 "U.S. EPR I&C Architecture."

DC FSAR, Tier 1, Section 2.4, and Tier 2, Section 7.1, describe the Instrumentation and Control (I&C) architecture including the specific I&C systems. Some of these I&C systems are shown in Fig. 7.1-2 but many are not shown. Explain why Fig. 7.1-2 leaves out the I&C systems that follow: ICIS, EIS, BCMS, RMS, HMS, RPVL, SMS, LPMS, VMS, LDS, PFAS, Fatigue Monitoring System, and Communication System.

Response to Question 07.01-3:

U.S. EPR FSAR Tier 2, Figure 7.1-2—U.S. EPR I&C Architecture focuses on the major instrumentation and controls (I&C) Level 2 and Level 1 systems, which provide both control and monitoring capabilities of plant systems. The only Level 0 system shown on Figure 7.1-2 is the control rod drive control system (CRDCS), as it provides important functionality regarding actuation of control rods.

The incore instrumentation system (ICIS), excore instrumentation system (EIS), boron concentration measurement system (BCMS), radiation monitoring system (RMS), hydrogen monitoring system (HMS), reactor pressure vessel level (RPVL), seismic monitoring system (SMS), loose parts monitoring system (LPMS), vibration monitoring system (VMS), fatigue monitoring system, and leak detection system (LDS) are Level 0 I&C systems. These are specialized monitoring systems that do not provide for control capability of plant systems. To maintain the simplicity and readability of Figure 7.1-2, most Level 0 systems are not included. However, U.S. EPR FSAR Tier 2, Section 7.1.1.5 describes these Level 0 systems.

The communication system is described in U.S. EPR FSAR Tier 2, Section 9.5.2, and the plant fire alarm system (PFAS) is described in U.S. EPR FSAR Tier 2, Section 9.5.1.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 07.01-4:

Provide additional clarification/justification on why CRDCS is not classified as safety-related.

DC FSAR, Tier 2, Section 7.1.1.5.1, indicates that the trip contactors which are within the CRDCS are safety-related but the classification of the CRDCS is "primarily" classified as non-safety-related. The distinction between classified and "primarily" classified is not clear . Provide justification on why CRDCS does not meet the criteria to be classified as safety-related.

Response to Question 07.01-4:

The classification of structures, systems, and components (SSC) is based on and consistent with ANSI 58.14-1993, "Safety and Pressure Integrity Classification Criteria for Light Water Reactors" Section 5.4.1, which states:

> "A system is non-safety-related if all its primary design functions are non-safety-related, even though it might contain safety-related items. For example, the primary design function of the RWCU is non-safety-related, so the system is non-safety-related even though it contains safety-related isolation valves and safety-related RCPB piping."

The primary design function of the control rod drive control system (CRDCS) is to control the movement of the 89 rod cluster control assemblies (RCCAs) in the reactor vessel. Since this is a non-safety-related function, CRDCS is classified as non-safety-related. The CRDCS contains components (trip contactor modules) capable of interrupting power to the control rod drive mechanisms (CRDM) when a trip signal is received from the protection system (PS). The trip contactor modules within the CRDCS are safety-related components since they perform the safety function of shutting down the reactor.

For clarification, U.S. EPR FSAR Tier 2, Section 7.1.1.5.1 will be revised to remove the word "primarily" when referring to the non-safety-related classification of the CRDCS.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 7.1.1.5.1 will be revised as described in the response and indicated on the enclosed markup.

Question 07.01-5:

Provide clarification on why the Plant Fire Alarm System and Communication System are not included in Section 7.1.

Why does DC FSAR, Section 7.1 leave out Plant Fire Alarm System and Communication System when both are included in Tier 1, Section 2.4?

Response to Question 07.01-5:

U.S. EPR FSAR Tier 2, Section 7.1 does not include the plant fire alarm system (PFAS) and the communication system because these systems are described elsewhere in the U.S. EPR FSAR.

The PFAS is described in U.S. EPR FSAR Tier 2, Section 9.5.1 and the communication system is described in U.S. EPR FSAR Tier 2, Section 9.5.2, consistent with the guidance of NUREG-0800.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 07.01-6:

Explain why Instrumentation and Control (I&C) - related generic issues that are applicable to the U.S. EPR are not identified in DC FSAR, Tier 2, Section 1.9, Table 1.9-3 or specifically discussed in other section(s) of the DC FSAR.

For example, new Generic Issue 45 involves assuring that safety-related process, instrument, and sampling lines do not freeze during extreme cold weather. In response to this issue, acceptance criteria for the design of protective measures against freezing in instrument lines of safety-related systems were included in RG 1.151.

DC FSAR, Tier 2, Section 7.1, indicates conformance to guidance in RG 1.151 and that safety-related components are designed to be qualified to operate in the normal and abnormal environments but no specific detail relating to Issue 45 seems to be provided. Has Generic Issue 45 been addressed/resolved? Why are I&C related Generic Issues not included in Table 1.9-3? Provide a list of all I&C Generic Issues that are applicable to U.S. EPR as well as the necessary information to address the issue.

Response to Question 07.01-6:

A response to this question will be provided by December 4, 2008.

Question 07.01-7:

Provide details regarding any modifications to the TELEPERM XS (TXS) platform design processes, hardware, and software since the TXS topical report was approved in May 2000, or since the last documented staff review of TXS platform changes to demonstrate that the system hardware, system software, and engineering tools development processes continue to meet the quality requirements of 10 CFR 50.55a(a)(1) and GDC 1. This includes software verification and validation (V&V) methods.

Staff recognizes that the TXS platform will continue to evolve as a result of process, hardware, and software changes to address problems and enhancements to the platform. Some of these changes may have the potential to impact conclusions made by the staff in the approved May 2000 TXS topical report. The DC-FSAR does not clearly address such modifications to the TXS platform design processes, hardware, and software since the TXS topical report was approved, or since the last documented staff review of TXS platform changes. Address such changes by providing a detailed response to this RAI.

Response to Question 07.01-7:

A response to this question will be provided by December 4, 2008.

Question 07.01-8:

Provide the complete design requirements and configuration of the TELEPERM XS components to implement the Protective System (PS) architecture.

While the U.S. EPR Digital PS topical report identified the TELEPERM XS components to be used in the PS, the topical report did not completely describe how the components would be configured to implement the proposed architecture.

Response to Question 07.01-8:

A response to this question will be provided by December 4, 2008.

Question 07.01-9:

Describe where all of the plant-specific action items from the TELEPERM XS topical report have been addressed in the DC-FSAR. The response should have sufficient detail for staff to determine acceptability of meeting those plant-specific action items.

Response to Question 07.01-9:

A response to this question will be provided by December 4, 2008.

Question 07.01-10:

Identify all deviations taken from the TELEPERM XS topical report and provide sufficient detail on each deviation to demonstrate that SE from May 2000 is still applicable.

The DC-FSAR does not have an adequate discussion on deviations taken from the TELEPERM XS topical report. Applicant needs to identify each deviation taken from the TELEPERM XS topical report and provide sufficient information for staff to determine that deviations still meet requirements. For example, the protection system architecture and the D3 approach are different from the description in the topical report but it's not clear what information in the topical report still applies. Applicant needs to provide all deviations as well as supporting information so that staff is able to determine acceptability.

Response to Question 07.01-10:

A response to this question will be provided by December 4, 2008.

Question 07.01-11:

Provide clarification on status of design and availability of current design information.

Staff recognizes that some of the design is not present (i.e., particularly the software design, but would include real-time performance and possibly some hardware qualification). Is current design information available for staff review? If yes, where is it? If not, when will this information be provided?

Response to Question 07.01-11:

A response to this question will be provided by December 4, 2008.

U.S. EPR Final Safety Analysis Report Markups

2.4.19 Incore Instrumentation System

1.0 Description

07.01-2

07.01-2

The incore instrumentation system (ICIS) provides information about the conditions inside the reactor core.

The ICIS has the following safety related functions:

- Provides self powered neutron detector (SPND) output signals to be used by the protection system (PS).
- Provides a measurement of core outlet temperatures.

07.01-2

2.0 Arrangement

2.1 The ICIS equipment is located as listed in Table 2.4.19-1—Incore Instrumentation System Equipment.

3.0 Seismic 1 Classifications

3.1 Equipment identified as Seismic Category I in Table 2.4.19-1 can withstand seismic design basis loads without loss of safety function.

07.01-2

4.0 I&C Design Features, Displays and Controls

4.1 The ICIS equipment classified as Class 1E in Table 2.4.19-1 can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

07.01-2

4.2 The ICIS provides output signals listed in Table 2.4.19-2.

5.0 Environmental Considerations

5.1 Equipment listed as Class 1E in Table 2.4.19-1 that are designated as harsh environment will perform their safety function in the environments that exist before and during the time required to perform their safety function.

6.0 System Inspections, Tests, Analyses, and Acceptance Criteria

6.1 Table 2.4.19-3—Incore Instrumentation System ITAAC specifies the inspections, tests, analyses, and acceptance criteria for the ICIS.

07.01-2

Table 2.4.19-3—Incore Instrumentation System ITAAC

	Commitment Wording	Inspection, Test or Analysis	Acceptance Criteria
2.1	The ICIS equipment is located as listed in Table 2.4.19-1.	Inspections will be performed of the location of the ICIS equipment.	The equipment listed in Table 2.4.19-1 is located as listed in Table 2.4.19-1.
3.1	Equipment identified as Seismic Category I in Table 2.4.19-1 can withstand seismic design basis loads without loss of safety function.	Inspections, type tests, tests, analyses or a combination of tests and analyses will be performed on the equipment designated as Seismic Category I in Table 2.4.19-1.	(1) A report exists and concludes that the equipment listed as Seismic Category I in Table 2.4.19-1 is installed as designed. (2) A report exists and concludes that the equipment listed as Seismic Category I in Table 2.4.19-1 can withstand seismic design basis loads without loss of safety function.
4.1	The ICIS equipment classified as Class 1E in Table 2.4.19-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.	Type tests, tests, analyses or a combination of these will be performed for the Class 1E equipment listed in Table 2.4.19-1.	A report exists and concludes that the equipment listed as Class 1E in Table 2.4.19-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.
4.2	The ICIS provides output signals listed in Table 2.4.19-2.	Tests will be performed to verify the existence of output signals.	The ICIS provides output signals to the recipients listed in Table 2.4.19-2.
5.1	Equipment listed as Class 1E in Table 2.4.19-1 that are designated as harsh environment will perform their safety function in the environments that exist before and during the time required to perform their safety function.	Type tests, tests, analyses or a combination of tests and analyses will be performed to demonstrate the ability of the equipment to perform their safety function in the environments that exist before and during the time required to perform their safety function.	A report exists and concludes that equipment listed as Class 1E in Table 2.4.19-1 are qualified to perform their associated safety function in the environments that exist before and during the time required to perform their safety function.

Next File

7.1.1.5.1 Control Rod Drive Control System

Classification

07.01-4

The CRDCS is ~~primarily~~ classified as non-safety-related. The trip contactors are safety-related.

Description

The CRDCS controls the actuation of the 89 RCCAs in the reactor vessel. The CRDCS accomplishes this task by providing current to the individual coils of the control rod drive mechanism (CRDM) to move ~~its respective~~ the corresponding rod cluster control assembly (RCCA).

The CRDCS receives DC power from the NUPS to move and hold the CRDMs. The reactor trip breakers are upstream of the CRDCS. Refer to Section 8.3 for more information on the NUPS and the reactor trip breakers.

Within the CRDCS, the safety-related trip contactor modules interrupt power to the CRDMs when a trip signal is received from the PS. The trip contactors get a signal from each division of the PS and are arranged to implement two-out-of-four logic. The contactor modules are environmentally qualified, including seismic, ~~and~~ EMI, and RFI effects.

~~The~~ RCSL transmits commands containing the direction of movement (i.e., withdrawal or insertion), speed of movement, and drop and hold information to the CRDCS. Withdrawal and insertion commands are used for reactor control functions. Drop orders are issues for a partial or full reactor trip in support of the reactor limitation functions. Refer to Section 7.7.1 for a description of the reactor control and limitation functions.

The non-safety-related components of the CRDCS are designed such that a seismic event does not result in damage that disables the safety function of the trip contactors.

Refer to Section 4.6.2 for more information on the reactivity control systems.

7.1.1.5.2 Incore Instrumentation System

Classification

The incore instrumentation system (ICIS) is classified as safety-related.

Description

~~Figure 4.4-8—Arrangement of Incore Instrumentation Components~~Figure 4.4-8—Arrangement of Incore Instrumentation (Top View) shows the arrangement of the various components within the core.