ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Wednesday, January 14, 2009 2:09 PM
To: Getachew Tesfaye
Cc: PANNELL George L (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 75, Supplement 1
Attachments: RAI 75 Supplement 1 Response USEPRDC.pdf

Getachew,

AREVA NP Inc. provided responses to 12 of the 31 questions of RAI No. 75 on November 3, 2008. The attached file, "RAI 75 Supplement 1 Response USEPRDC.pdf," provides technically correct and complete responses to 5 of the remaining 19 questions, as committed.

The following table indicates the respective page(s) in the response document, "RAI 75 Supplement 1 Response USEPRDC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 75 — 07.02-1	2	5
RAI 75 — 07.02-2	6	6
RAI 75 — 07.02-4	7	7
RAI 75 — 07.02-16	8	8
RAI 75 — 07.02-26	9	9

The schedule for technically correct and complete responses to the remaining 14 questions is unchanged and provided below:

Question #	Response Date
RAI 75 — 07.02-7	March 31, 2009
RAI 75 — 07.02-10	March 31, 2009
RAI 75 — 07.02-11	March 31, 2009
RAI 75 — 07.02-15	March 31, 2009
RAI 75 — 07.02-17	March 31, 2009
RAI 75 — 07.02-18	March 31, 2009
RAI 75 — 07.02-20	March 31, 2009
RAI 75 — 07.02-21	March 31, 2009
RAI 75 — 07.02-22	March 31, 2009
RAI 75 — 07.02-25	March 31, 2009
RAI 75 — 07.02-27	March 31, 2009
RAI 75 — 07.08-4	March 31, 2009
RAI 75 — 07.02-5	March 31, 2009
RAI 75 — 07.02-6	March 31, 2009

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company

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Lynchburg, VA 24506-0935
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From: WELLS Russell D (AREVA NP INC)
Sent: Monday, November 03, 2008 8:15 PM
To: 'Getachew Tesfaye'
Cc: 'John Rycyna'; Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 75, FSAR Ch 7

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 75 Response US EPR DC.pdf" provides technically correct and complete responses to 12 of the 31 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 75 Questions 07.02-23, 07.02-24, and 07.02-28.

The following table indicates the respective pages in the response document, "RAI 75 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 75 — 07.02-1	2	2
RAI 75 — 07.02-2	3	3
RAI 75 — 07.02-3	4	4
RAI 75 — 07.02-4	5	5
RAI 75 — 07.02-5	6	7
RAI 75 — 07.02-6	8	8
RAI 75 — 07.02-7	9	9
RAI 75 — 07.02-8	10	10
RAI 75 — 07.02-9	11	11
RAI 75 — 07.02-10	12	12
RAI 75 — 07.02-11	13	13
RAI 75 — 07.02-12	14	15
RAI 75 — 07.02-13	16	16
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RAI 75 — 07.02-15	18	18
RAI 75 — 07.02-16	19	19
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RAI 75 — 07.02-19	22	22
RAI 75 — 07.02-20	23	23
RAI 75 — 07.02-21	24	24
RAI 75 — 07.02-22	25	25
RAI 75 — 07.02-23	26	26
RAI 75 — 07.02-24	27	27
RAI 75 — 07.02-25	28	28
RAI 75 — 07.02-26	29	29
RAI 75 — 07.02-27	30	30
RAI 75 — 07.02-28	31	31

RAI 75 — 07.08-4	32	32
RAI 75 — 07.02-5	33	34
RAI 75 — 07.02-6	35	35

A complete answer is not provided for 19 of the 31 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 75 — 07.02-1	January 15, 2009
RAI 75 — 07.02-2	January 15, 2009
RAI 75 — 07.02-4	January 15, 2009
RAI 75 — 07.02-7	March 31, 2009
RAI 75 — 07.02-10	March 31, 2009
RAI 75 — 07.02-11	March 31, 2009
RAI 75 — 07.02-15	March 31, 2009
RAI 75 — 07.02-16	January 15, 2009
RAI 75 — 07.02-17	March 31, 2009
RAI 75 — 07.02-18	March 31, 2009
RAI 75 — 07.02-20	March 31, 2009
RAI 75 — 07.02-21	March 31, 2009
RAI 75 — 07.02-22	March 31, 2009
RAI 75 — 07.02-25	March 31, 2009
RAI 75 — 07.02-26	January 15, 2009
RAI 75 — 07.02-27	March 31, 2009
RAI 75 — 07.08-4	March 31, 2009
RAI 75 — 07.02-5	March 31, 2009
RAI 75 — 07.02-6	March 31, 2009

Sincerely,

(Russ Wells on behalf of)
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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, October 02, 2008 8:36 PM
To: ZZ-DL-A-USEPR-DL
Cc: Tung Truong; Kenneth Mott; Michael Canova; Terry Jackson; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 75 (570_1131),FSAR Ch 7

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 9, 2008, and on October 2, 2008, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this

information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 120

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D3197A988)

Subject: Response to U.S. EPR Design Certification Application RAI No. 75, Supplement 1
Sent Date: 1/14/2009 2:08:49 PM
Received Date: 1/14/2009 2:08:54 PM
From: Pederson Ronda M (AREVA NP INC)

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MESSAGE	6148	1/14/2009 2:08:54 PM
RAI 75 Supplement 1 Response USEPRDC.pdf	54875	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 75 Supplement 1 (570, 1131), Revision 0

10/2/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 07.02 - Reactor Trip System
SRP Section: 07.08 - Diverse Instrumentation and Control Systems
Application Section: FSAR Ch 7

Question 07.02-1:

Provide sufficient information for the staff to conclude that the period testing, including self-testing, meets the requirements stated below. Specifically, address the following:

1. Description of all testing that is performed, including self-tests
2. How will the tests detect all detectable failures?
3. Why self-tests and other surveillance tests will not influence safety function and what are the mechanisms to ensure this? (Does the FMEA also show this and will it meet the single-failure criterion?)
4. Specific list of all self tests (i.e., watchdog timer, memory checks, communication checks, data integrity check, etc).
5. What is the safety classification of the self-test feature?
6. How is the execution of automatic tests confirmed during plant operation?
7. What are the provisions to periodically test and calibrate (if needed) the automatic test features?
8. What components cannot be tested with the reactor at power? What are the justifications for not testing them at power and when will they be tested?

IEEE STD 603-1991, Clause 5.7, states that "Capability for testing and calibration of safety system equipment shall be provided while retaining the capability of the safety systems to accomplish their safety functions. The capability for testing and calibration of safety system equipment shall be provided during power operation and shall duplicate, as closely as practicable, performance of the safety system." Acceptance criteria for this requirement is found in Regulatory Guides 1.22, 1.47, and 1.53.

FSAR 7.2.2.3.5 states that the “majority of the components required for RT can be tested with the reactor at power…During outages, extended computer self-testing is performed to verify functionality that cannot be tested with the reactor at power.” The staff needs additional information to determine that Clause 5.7 is adequately addressed in the U.S. EPR design.

Response to Question 07.02-1:

Parts 1 and 2:

Please see the response to question 3 of ANP-10281Q1P (Reference 1), which provides an explanation of features that support periodic surveillance and self-testing of the U.S. EPR protection system (PS).

U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.3.1, “Protection System”, identifies the surveillance requirements applicable to the PS. Technical Specifications Bases 3.3.1 describes each of the surveillance requirements. Technical Specifications Section 1.1 provides definitions of the individual tests that comprise the surveillance requirements.

The TXS platform also includes self-monitoring that is performed automatically; either continuously or cyclically. Additional information regarding these features is provided in Section

2.7.1.1, “Inherent Mechanisms for Detecting and Signaling Failures” of EMF-2110(NP) (Reference 2).

EMF-2341(P) (Reference 3) describes how the various periodic tests and TXS self-monitoring features detect failures.

Part 3:

Redundancy designed into the system provides reasonable assurance that periodic surveillance tests will not prevent the PS from performing its safety function. Additional system features that support this claim are described in U.S. EPR FSAR Tier 2, Section 7.2.2.3.5, “Compliance to Requirements on System Testing and Inoperable Surveillance Requirement (Clause 5.7 of IEEE 603-1998)”. In addition to the system features, Technical Specifications administratively control removal of components from service to maintain capability of performing the function while testing is performed.

Section 2.1.2 of Reference 3 describes the mechanisms that prevent self-monitoring from inhibiting the safety function:

> “The Cyclic Self-Monitoring checks the functions of the Function Computer SVE and the connected components, which are tested during operation without jeopardizing the safety tasks. It operates as an independent task with lowest priority and can be interrupted by programs with a higher priority; e.g. the Run Time Environment executing the Function Diagram Group Modules.
>
> The time elapsing between the end of processing of the functional tasks and the beginning of the next cycle is used for processing of Cyclic Self Monitoring. As a complete self-test procedure requires much more time than a computer cycle, the Cyclic Self Monitoring is divided into small sections that cannot be interrupted. Their size ensures that the deterministic cyclic operation of the system is not influenced by the Cyclic Self Monitoring. In addition, the sections end with states that cannot influence the higher-priority tasks functionally.”

The PS system-level failure modes and effects analysis (FMEA) considers bounding single failures, as described in U.S. EPR FSAR Tier 2, Section 7.2.2.2. A single failure of a given PS function processor that involves, or is caused by, the self-monitoring features is bounded by the failure modes considered in the PS FMEA. Technical specifications provide the administrative controls to maintain compliance with the single failure criteria during periodic surveillance testing of the PS.

Parts 4 and 5:

Section 2 of Reference 3 contains the list of self-monitoring tasks performed by the TXS platform. These TXS self-test features are safety related.

Part 6:

The TXS cyclic self-monitoring task is described in Reference 2 and has been reviewed and accepted by the NRC as described in MA1983 (Reference 4).

If the execution of the cyclic self-monitoring tasks is not completed, this error is indicated as described in Section 2.1.2 of Reference 3:

> "A complete pass of these tests lasts a few minutes, depending on the duty cycle of the SVE. The task of the Cyclic Self Monitoring is monitored by the RTE using a cycle counter. If the Cyclic Self Monitoring is not completed within one hour, a RTE error message is generated."

Part 7:

The self-monitoring features do not require periodic testing or calibration. The adequacy of the cyclic self-monitoring features is based on the software development methodology including verification and validation. These features are qualified through type-testing of the TXS platform software.

The basic intent of type-testing is to separate tests and inspections that are independent of a specific application from those that are specific to a particular power plant. Type testing of specific software is executed only once; successful completion of the type test provides the basis for subsequent use of that software.

The TXS system software type-testing methods are presented in Section 3.2.1 of Reference 2. These methods were reviewed and accepted by the NRC staff as described in Reference 4.

Part 8:

With respect to periodic surveillance testing, U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Section 3.3.1, "Protection System" identifies the surveillance requirements applicable to the PS. As with any reactor trip and engineered safety features system, some surveillance testing which includes sensor calibrations, divisional testing, and actuation of devices, is not normally performed at power unless it is required as part of corrective maintenance. As part of the development of surveillance test procedures, each surveillance is evaluated to determine scheduling constraints based, in part, on an evaluation of risk. The scheduling of the individual surveillance tests necessary to satisfy Technical Specification requirements is an operational detail which is beyond the scope of the design certification.

With respect to self-monitoring, functionality that requires shut-down and restart of a PS function processor normally is not tested at power. This functionality is tested as part of the processor startup self-testing, as described in Section 3.0 of Reference 3. U.S. EPR FSAR Tier 2, Chapter 16, Technical Specifications Surveillance Requirement 3.3.1.7 requires the startup testing to be performed once per fuel cycle.

References for Question 07.02-1:

1. ANP-10281Q1P, "Response to Request for Additional Information – ANP-10281P "U.S. EPR Digital Protection System Topical Report," (TAC No. MD3971).

2. Siemens Topical Report EMF-2110(NP) Revision 0, "TELEPERM XS: A Digital Reactor Protection System."

3. Topical report EMF-2341(P), “Generic Strategy for Periodic Surveillance Testing of TELEPERM XS Systems in U.S. Nuclear Generating Stations.”

4. Letter dated Mar 5, 2000, from Stuart A. Richards, NRC, to Jim Mallay, Siemens Power Corporation, "Acceptance for Referencing of Licensing Topical Report EMF-2110(NP), Revision 1, "TELEPERM XS: A Digital Reactor Protection System" (TAC No. MA1983).

FSAR Impact:

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

Question 07.02-2:

Why are not all initiating events in the DC FSAR Tier 2, Table 15.0-1 not listed in Table 15.0-10, the latter listing initiating events and associated reactor trip functions? What are the protective actions for initiating events listed in Table 15.0-1, but not in Table 15.0-10?

Clause 4.2 of IEEE Standard 603-1991 requires the safety functions and corresponding protective actions of the execute features for each design basis event.

DC FSAR, Tier 2, Section 7.2.2.1.1 states that Table 15.0-10 lists the correlation between each initiating event and corresponding RT function.

Response to Question 07.02-2:

The events listed in U.S. EPR FSAR Tier 2, Table 15.0-1 and Table 15.0-10 are not identical. However, the differences between the two tables are minor. For categories 15.1, 15.3, 15.4, 15.5, and 15.6 the events listed in the two tables are identical. For category 15.2, *Loss of External Load* and *Loss of Condenser Vacuum* do not appear in Table 15.0-10. These events do not appear because they both result in isolation of the turbine from the secondary system, similar to a turbine trip, and the respective transient responses are bounded by the turbine trip event analysis. The *Loss of External Load* event (U.S. EPR FSAR Tier 2, Section 15.2.1) results in fast closure of the turbine control valves, while a turbine trip results in fast closure of the turbine stop valves. A *Loss of Condenser Vacuum* (U.S. EPR FSAR Tier 2, Section 15.2.3) results in a turbine trip. The equipment challenged by these events is the same as for the turbine trip event.

U.S. EPR FSAR Tier 2, Table 15.0-1 also includes events associated with 15.0.3 *Radioactive Release from Subsystem or Component*. These events are the same as events listed under categories 15.1 *Steam System Piping Failure*s, 15.3 RCP *Rotor Seizure*, 15.4 *RCCA Ejection*, 15.6 *SGTR*, and 15.6 *Loss-of-Coolant Accident*, with the exception of the *Fuel Handling Accident* and *Failure of Small Line Carrying Primary Coolant Outside Containment* event. The *Fuel Handling Accident* and *Failure of Small Line Carrying Primary Coolant Outside Containment* event are discussed separately in U.S. EPR FSAR Tier 2, Sections 15.0.3.5 and 15.0.3.10 respectively.

FSAR Impact:

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

Question 07.02-4:

Identify all spatially dependent sensors or variables that are being monitored. What is the minimum number of spatially dependent sensors required to provide adequate protection and what is the basis for that number?

Clause 4.6 of IEEE Standard 603-1991 requires in part the identification of the minimum number and location of sensors for those variables in Clause 4.4 of IEEE Standard 603-1991 that have a spatial dependence. The applicant/licensee's analysis should demonstrate that the number and location of sensors are adequate. FSAR Tier 2, Section 7.2.2.1.5, states that "SPND are located systematically throughout the core to provide the spatially dependent neutron flux information." DC FSAR, Tier 2, Section 7.2.2.1.5, states that "Provisions are made in the RT logic to accommodate any five failed SPNDs for the HLPD function, and any number of failed SPND on up to five fingers for the low DBNR." What are the bases for accommodating any five failed SPNDs and any number of failed SPND on up to five fingers?

Response to Question 07.02-4:

The high linear power density (HLPD)and low departure from nucleate boiling ratio (DNBR) reactor trip (RT) setpoints are configured to accommodate a limited number of self-powered neutron detector (SPND) failures during plant operation. This is accomplished by using more limiting setpoints based on the number of SPNDs that are failed or declared out of service. The more limiting setpoints provide protection against the loss of power distribution resolution that occurs when a SPND is lost.

AREVA NP topical report ANP-10287P (Reference 1) presents the methods used to calculate the HLPD and low DNBR trip setpoints, including those corresponding to SPNDs out of service. These methods consider up to five failed SPNDs for the HLPD function, and five failed SPND fingers for the low DNBR function.

The analysis considers a large number of cases with SPND failures chosen at random and determines setpoints that protect the specificed acceptable fuel design limits (SAFDL) on DNBR or linear power density (LPD)in the affected condition 95 percent of the time with 95 percent confidence.

References for Question 07.02-4:

1. ANP-10287P, "Incore Trip Setpoint and Transient Methodology for U.S. EPR Topical Report," AREVA NP Inc., November 2007.

FSAR Impact:

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

Question 07.02-16:

What are the auxiliary features that are not required to be operable for the safety systems?

Clause 5.12 of IEEE Std 603-1991 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, or 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. DC FSAR, Tier 2, Section 7.1.2.6.23, states that safety systems meet the requirements of Clause 5.12 of IEEE 603-1998 and that auxiliary supporting systems include EUPS, EPSS, and safety-related HVAC systems throughout the plant. Also, that other auxiliary features that are not required to be operable for the safety systems to perform their functions are designed to meet criteria that do not degrade the safety functionality of the safety systems below an acceptable level.

Response to Question 07.02-16:

The auxiliary features that are not required to be operable for the safety instrumentation and control (I&C) systems are those features that are provided through the service unit (SU). These features include the following:

- Authorized software modifications.
- Functional tests and periodic tests.
- Monitoring of correct processing.
- Fault detection and failure diagnosis.

The SU requests access to the safety related processors through the monitoring and service units (MSI). The MSIs provide communication independence between the safety systems and the non-safety-related SUs as described in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4. The MSIs provide reasonable assurance that the auxiliary features provided by the SU do not degrade the safety functionality of the safety systems, as required by Clause 5.12 of IEEE 603-1998. The SU interface with the safety I&C systems was approved in MA 1983 (Reference 1).

References for Question 07.02-16:

1. Letter dated May 5, 2000 from Stuart A Richards, NRC to Jim Mallay, Siemens Power Corporation, “Acceptance for Referencing of Licensing Topical Report EMF-2110 (NP), Revision 1, “TELEPERM XS: A Digital Reactor Protection System” (TAC NO. MA1983),“ and associated Safety Evaluation Report.

FSAR Impact:

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

Question 07.02-26:

What tests are available to check themaintenance bypass capability described below? How will plant staff verify conformance to requirement?

IEEE 603-1991, Clause 8.3, states in part that the capability of the safety systems to accomplish their safety functions shall be retained while power sources are in maintenance bypass.

DC FSAR, Tier 2, Section 7.1.2.38, states that safety systems can perform their safety functions while power source are in maintenance bypass; details on the electrical power systems that fulfill this requirement are described in Chapter 8.

Response to Question 07.02-26:

The safety-related instrumentation and control (I&C) systems (protection system, safety automation system, safety information and control system, priority and actuator control system) are powered by four redundant, independent and separated Class 1E uninterruptible power supply (EUPS) divisions. Each specific I&C cabinet group has two power supply feeds operated in parallel. The EUPS is powered from either offsite power or emergency diesel generators. The EUPS is battery backed for at least two hours. The power supply arrangement and I&C system redundancy maintains the I&C systems safety function capability when one power supply is in maintenance bypass.

Power supply maintenance bypass is equivalent to loss of power to a subsystem component in any one I&C system division. Test performance is not necessary to verify the capability of the safety systems to accomplish their safety functions while power sources are in maintenance bypass. The capability of the safety systems to perform their safety functions is demonstrated through analysis of the safety system redundancy during various conditions. The capability to maintain the I&C system safety function during system failures consistent with power system maintenance bypass and therefore conformance to IEEE Std. 603 Clause 8.3, is described in the response to RAI question 07.03-6.

FSAR Impact:

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