ArevaEPRDCPEm Resource

From: Pederson Ronda M (AREVA NP INC) [Ronda.Pederson@areva.com]
Sent: Tuesday, March 03, 2009 3:28 PM
To: Getachew Tesfaye
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); PANNELL George L (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 56, Supplement 3
Attachments: RAI 56 Supplement 3 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided a schedule for a technically correct and complete response to RAI No. 56 on November 26, 2008. AREVA NP submitted Supplement 1 to the response on January 14, 2009 to address 14 of the remaining 45 questions. AREVA NP submitted Supplement 2 to the response on February 4, 2009 to address 5 of the remaining 31 questions. The attached file, "RAI 56 Supplement 3 Response US EPR DC.pdf" provides technically correct and complete responses to 9 of the remaining 26 questions, as committed.

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 56 Question 07.09-22.

The following table indicates the respective pages in the response document, "RAI 56 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 56 — 07.09-8	2	2
RAI 56 — 07.09-13	3	4
RAI 56 — 07.09-15	5	5
RAI 56 — 07.09-16	6	8
RAI 56 — 07.09-20	9	9
RAI 56 — 07.09-21	10	10
RAI 56 — 07.09-22	11	12
RAI 56 — 07.09-24	13	13
RAI 56 — 07.09-38	14	14

The schedule for response to RAI 56 – 07.09-18 has been changed from March 3, 2009 to March 31, 2009. The schedule for technically correct and complete responses to the remaining 17 questions is unchanged, as indicated in the table provided below:

Question #	Response Date
RAI 56 — 07.09-2	March 31, 2009
RAI 56 — 07.09-3	March 31, 2009
RAI 56 — 07.09-4	March 31, 2009
RAI 56 — 07.09-6	March 31, 2009
RAI 56 — 07.09-9	March 31, 2009
RAI 56 — 07.09-10	March 31, 2009
RAI 56 — 07.09-14	March 31, 2009
RAI 56 — 07.09-18	March 31, 2009
RAI 56 — 07.09-23	March 31, 2009
RAI 56 — 07.09-26	March 31, 2009
RAI 56 — 07.09-27	March 31, 2009
RAI 56 — 07.09-31	March 31, 2009

RAI 56 — 07.09-39	March 31, 2009
RAI 56 — 07.09-40	March 31, 2009
RAI 56 — 07.09-41	March 31, 2009
RAI 56 — 07.09-42	March 31, 2009
RAI 56 — 07.09-43	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
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, February 04, 2009 2:34 PM
To: 'Getachew Tesfaye'
Cc: BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC); PANNELL George L (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 56, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) submitted Response to RAI No. 56, Supplement 1 on January 14, 2009 to address 14 of the 45 questions. The attached file, "RAI 56 Supplement 2 Response US EPR DC.pdf" provides technically correct and complete responses to 5 of the remaining 31 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 56 Supplement 2 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 56 — 07.09-29	2	3
RAI 56 — 07.09-34	4	6
RAI 56 — 07.09-36	7	9
RAI 56 — 07.09-37	10	12
RAI 56 — 07.09-44	13	14

The schedule for technically correct and complete responses to the remaining 26 questions is unchanged and provided below:

Question #	Response Date
RAI 56 - 07.09-2	March 31, 2009
RAI 56 - 07.09-3	March 31, 2009
RAI 56 - 07.09-4	March 31, 2009
RAI 56 - 07.09-6	March 31, 2009
RAI 56 - 07.09-8	March 3, 2009
RAI 56 - 07.09-9	March 31, 2009
RAI 56 - 07.09-10	March 31, 2009
RAI 56 - 07.09-13	March 3, 2009

RAI 56 - 07.09-14	March 31, 2009
RAI 56 - 07.09-15	March 3, 2009
RAI 56 - 07.09-16	March 3, 2009
RAI 56 - 07.09-18	March 3, 2009
RAI 56 - 07.09-20	March 3, 2009
RAI 56 - 07.09-21	March 3, 2009
RAI 56 - 07.09-22	March 3, 2009
RAI 56 - 07.09-23	March 31, 2009
RAI 56 - 07.09-24	March 3, 2009
RAI 56 - 07.09-26	March 31, 2009
RAI 56 - 07.09-27	March 31, 2009
RAI 56 - 07.09-31	March 31, 2009
RAI 56 - 07.09-38	March 3, 2009
RAI 56 - 07.09-39	March 31, 2009
RAI 56 - 07.09-40	March 31, 2009
RAI 56 - 07.09-41	March 31, 2009
RAI 56 - 07.09-42	March 31, 2009
RAI 56 - 07.09-43	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
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, January 14, 2009 1:26 PM
To: 'Getachew Tesfaye'
Cc: PANNELL George L (AREVA NP INC); DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 56, Supplement 1

Getachew,

The attached file, “RAI 56 Supplement 1 Response US EPR DC.pdf,” provides technically correct and complete responses to 14 of the 45 questions, as committed.

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 56 Question 07.09-7.

The following table indicates the respective page(s) in the response document, “RAI 56 Supplement 1 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject questions.

Question #	Start Page	End Page
RAI 56 - 07.09-1	2	3
RAI 56 - 07.09-5	4	4
RAI 56 - 07.09-7	5	7

RAI 56 - 07.09-11	7	8
RAI 56 - 07.09-12	9	9
RAI 56 - 07.09-17	10	13
RAI 56 - 07.09-19	14	14
RAI 56 - 07.09-25	15	16
RAI 56 - 07.09-28	17	18
RAI 56 - 07.09-30	19	19
RAI 56 - 07.09-32	20	20
RAI 56 - 07.09-33	21	22
RAI 56 - 07.09-35	23	23
RAI 56 - 07.09-45	24	24

The schedule for technically correct and complete responses to the remaining 31 questions is unchanged and provided below:

Question #	**Response Date**
RAI 56 - 07.09-2	March 31, 2009
RAI 56 - 07.09-3	March 31, 2009
RAI 56 - 07.09-4	March 31, 2009
RAI 56 - 07.09-6	March 31, 2009
RAI 56 - 07.09-8	March 3, 2009
RAI 56 - 07.09-9	March 31, 2009
RAI 56 - 07.09-10	March 31, 2009
RAI 56 - 07.09-13	March 3, 2009
RAI 56 - 07.09-14	March 31, 2009
RAI 56 - 07.09-15	March 3, 2009
RAI 56 - 07.09-16	March 3, 2009
RAI 56 - 07.09-18	March 3, 2009
RAI 56 - 07.09-20	March 3, 2009
RAI 56 - 07.09-21	March 3, 2009
RAI 56 - 07.09-22	March 3, 2009
RAI 56 - 07.09-23	March 31, 2009
RAI 56 - 07.09-24	March 3, 2009
RAI 56 - 07.09-26	March 31, 2009
RAI 56 - 07.09-27	March 31, 2009
RAI 56 - 07.09-29	March 3, 2009
RAI 56 - 07.09-31	March 31, 2009
RAI 56 - 07.09-34	March 3, 2009
RAI 56 - 07.09-36	March 3, 2009
RAI 56 - 07.09-37	March 3, 2009
RAI 56 - 07.09-38	March 3, 2009
RAI 56 - 07.09-39	March 31, 2009
RAI 56 - 07.09-40	March 31, 2009
RAI 56 - 07.09-41	March 31, 2009
RAI 56 - 07.09-42	March 31, 2009
RAI 56 - 07.09-43	March 31, 2009
RAI 56 - 07.09-44	March 3, 2009

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Wednesday, November 26, 2008 3:18 PM
To: 'Getachew Tesfaye'
Cc: PANNELL George L (AREVA NP INC); DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 56, FSAR Ch 7, Revised Schedule

Getachew,

On October 10, 2008, AREVA NP provided a schedule for responding to the 45 questions in NRC's RAI No. 56. On October 22, 2008, a public meeting was held between AREVA NP Inc. and the NRC to discuss the U.S. EPR FSAR Chapter 7 and RAI No.'s 56 through 61.

A revised schedule for a technically correct and complete response to each of the 45 questions of RAI No. 56 is provided below.

Question #	Response Date
RAI 56 - 07.09-1	January 15, 2009
RAI 56 - 07.09-2	March 31, 2009
RAI 56 - 07.09-3	March 31, 2009
RAI 56 - 07.09-4	March 31, 2009
RAI 56 - 07.09-5	January 15, 2009
RAI 56 - 07.09-6	March 31, 2009
RAI 56 - 07.09-7	January 15, 2009
RAI 56 - 07.09-8	March 3, 2009
RAI 56 - 07.09-9	March 31, 2009
RAI 56 - 07.09-10	March 31, 2009
RAI 56 - 07.09-11	January 15, 2009
RAI 56 - 07.09-12	January 15, 2009
RAI 56 - 07.09-13	March 3, 2009
RAI 56 - 07.09-14	March 31, 2009
RAI 56 - 07.09-15	March 3, 2009
RAI 56 - 07.09-16	March 3, 2009
RAI 56 - 07.09-17	January 15, 2009
RAI 56 - 07.09-18	March 3, 2009
RAI 56 - 07.09-19	January 15, 2009
RAI 56 - 07.09-20	March 3, 2009
RAI 56 - 07.09-21	March 3, 2009
RAI 56 - 07.09-22	March 3, 2009
RAI 56 - 07.09-23	March 31, 2009
RAI 56 - 07.09-24	March 3, 2009

RAI 56 - 07.09-25	January 15, 2009
RAI 56 - 07.09-26	March 31, 2009
RAI 56 - 07.09-27	March 31, 2009
RAI 56 - 07.09-28	January 15, 2009
RAI 56 - 07.09-29	March 3, 2009
RAI 56 - 07.09-30	January 15, 2009
RAI 56 - 07.09-31	March 31, 2009
RAI 56 - 07.09-32	January 15, 2009
RAI 56 - 07.09-33	January 15, 2009
RAI 56 - 07.09-34	March 3, 2009
RAI 56 - 07.09-35	January 15, 2009
RAI 56 - 07.09-36	March 3, 2009
RAI 56 - 07.09-37	March 3, 2009
RAI 56 - 07.09-38	March 3, 2009
RAI 56 - 07.09-39	March 31, 2009
RAI 56 - 07.09-40	March 31, 2009
RAI 56 - 07.09-41	March 31, 2009
RAI 56 - 07.09-42	March 31, 2009
RAI 56 - 07.09-43	March 31, 2009
RAI 56 - 07.09-44	March 3, 2009
RAI 56 - 07.09-45	January 15, 2009

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR(TM) Design Certification
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Pederson Ronda M (AREVA NP INC)
Sent: Friday, October 10, 2008 6:50 PM
To: 'Getachew Tesfaye'
Cc: DELANO Karen V (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); PANNELL George L (AREVA NP INC); DUNCAN Leslie E (AREVA NP INC); WELLS Russell D (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 56 (942), FSAR Ch7

Getachew,

The attached file, “RAI 56 Response US EPR DC.pdf” provides an interim response to each of the 45 questions.

A complete answer is not provided for 45 of the 45 questions.

A complete response to each of the questions will be provided by December 1, 2008.

Sincerely,

Ronda Pederson
ronda.pederson@areva.com
Licensing Manager, U.S. EPR Design Certification
New Plants Deployment
AREVA NP Inc.
An AREVA and Siemens company
3315 Old Forest Road
Lynchburg, VA 24506-0935
Phone: 434-832-3694
Cell: 434-841-8788

From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Friday, September 12, 2008 5:44 PM
To: ZZ-DL-A-USEPR-DL
Cc: Deanna Zhang; Terry Jackson; Michael Canova; Joseph Colaccino; John Rycyna; Mario Gareri
Subject: U.S. EPR Design Certification Application RAI No. 56 (942), FSAR Ch7

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on August 26, 2008, and on September 5, 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: 279

Mail Envelope Properties (5CEC4184E98FFE49A383961FAD402D31B88EDE)

Subject: Response to U.S. EPR Design Certification Application RAI No. 56, Supplement 3
Sent Date: 3/3/2009 3:28:07 PM
Received Date: 3/3/2009 3:28:11 PM
From: Pederson Ronda M (AREVA NP INC)

Created By: Ronda.Pederson@areva.com

Recipients:
"BENNETT Kathy A (OFR) (AREVA NP INC)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen V (AREVA NP INC)" <Karen.Delano@areva.com>
Tracking Status: None
"PANNELL George L (AREVA NP INC)" <George.Pannell@areva.com>
Tracking Status: None
"Getachew Tesfaye" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	13082	3/3/2009 3:28:11 PM
RAI 56 Supplement 3 Response US EPR DC.pdf	127023	

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

Response to

Request for Additional Information No. 56, Supplement 3

9/12/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 07.09 - Data Communication Systems
Application Section: Section 7.1
ICE1 Branch

Question 07.09-8:

Clarify the specific functionality of the data communications between the SICS and other I&C systems and components.

DC fsar, Tier 2, Section 7.1.1.3.1, provides the summary of data communications implemented within the safety-related and non-safety related portions of the SICS. The data communications summary only provides the description of the communication type (i.e. point-to-point), indication of whether the communication is bi-directional or uni-directional, and the type of protocol used. This summary does not provide the description of the communication functions. For example, the summary states that the PS communicates with the SICS for control purposes, but it does not state what exactly is the SICS controlling within the PS. Provide the description of the communication functions for each of the interfaces described.

Response to Question 07.09-8:

U.S. EPR FSAR Tier 2, Section 7.1 contains summaries of the functions performed by each instrumentation and controls (I&C) system, including the safety information and control system (SICS). Under the sub-heading “Functions” in U.S. EPR FSAR Tier 2, Section 7.1.1.3.1, the following functionality is defined for the SICS:

- Manual actuation of reactor trip (RT).
- Manual actuation and control of engineered safety features systems for accident mitigation.
- Manual control of systems to achieve and maintain safe shutdown.
- Display of Type A through Type C post-accident monitoring variables.
- Monitoring and control of essential non-safety-related systems to achieve and maintain hot standby on a loss of the process information and control system (PICS).
- Monitoring and control of systems to mitigate severe accidents (SAs).
- Backup safety parameter display system functions.
- Display of high priority alarms.

The first two functions listed, manual RT and manual engineered safety features actuation, utilize hardwired connections to the protection system (PS). This functionality is independent of any data communications between the SICS and the PS.

The remainder of the listed functions performed by the SICS require communication interfaces to the other I&C systems. These functions, as well as the SICS role in performing the functions, is described in more detail in the appropriate sections of U.S. EPR FSAR Tier 2, Chapter 7.

Specifically, U.S. EPR FSAR Tier 2, Section 7.4 describes safe shutdown functionality related to the SICS, and U.S. EPR FSAR Tier 2, Section 7.5 describes display and monitoring functions related to the SICS.

FSAR Impact:

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

Question 07.09-13:

Address the acceptance criteria of NUREG-0800, the Standard Review Plan (SRP), Section 7.9, "Data Communications Systems," for the data communications systems and components within the Safety Automation System (SAS).

10 CFR 52.47(a)(9) requires, in part, that for applications for light-water cooled nuclear power plants, an evaluation of the standard plant design against the SRP revision in effect 6 months before the docket date of the application. The evaluation required by this section shall include an identification and description of all differences in design features, analytical techniques, and procedural measures proposed for a facility and those corresponding features, techniques, and measures given in the SRP acceptance criteria. Where such a difference exists, the evaluation shall discuss how the alternative proposed provides an acceptable method of complying with those rules or regulations of commission, or portions thereof that underlie the corresponding SRP acceptance criteria. SRP, Section 7.9, provides the performance design considerations for data communications systems used in the various I&C systems. This includes verification that the protocol selected for the DCS meets the performance requirements of all supported systems.

DC FSAR, Tier 2, Section 7.1.1.4.2, provides a summary of the communication between the gateway (GW) and the plant data network within the SAS. However, it does not provide information on the network protocol used to implement this communication. The staff requests additional information regarding the communications protocol used to implement the point-to-point bi-directional communication between the GW and the plant data network. Demonstrate that the communications protocol selected adequately supports the required data communications between the SAS components and the non-safety I&C systems.

Response to Question 07.09-13:

U.S. EPR FSAR Tier 2, Section 7.1.1.4.2 states the following about the data communication between the GW and the plant data network:

> "GW-Plant Data Network – non-safety-related, divisional, bi-directional, networked communications."

The data communications links of concern in this question are denoted in U.S. EPR FSAR Tier 2, Figure 7.1-7—Safety Automation System Architecture, which illustrates the data communications links. The data communications links between the GW and the plant data network are non-safety-related networked communication links.

U.S. EPR FSAR Tier 2, Figure 7.1-1—Chapter 7 Symbol Legend shows that the data connections in U.S. EPR FSAR Tier 2, Figure 7.1-7 are functional data connections that are implemented with point-to-point or networked data connections. U.S. EPR FSAR Tier 2, Figure 7.1-1 refers to the U.S. EPR FSAR text description for the specific implementation. In this case, U.S. EPR FSAR Tier 2, Section 7.1.1.4.2 states that, for SAS, the GW implementation is networked. As stated in U.S. EPR FSAR Tier 2, Section 7.1, page 7.1-18, Data Communications, the GW and the plant data network connections are networked data connections, not point-to-point connections as stated in this RAI question.

The protocol used to implement the communication between the GW and the plant data network will be determined later in the design process. The communication protocol will be selected to meet the non-safety system requirements, but the protocol is not necessary to meet the safety system requirements. The failure of the communication link including the failure of the protocol used for the link will not result in the loss of the safety functions implemented by SAS.

FSAR Impact:

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

Question 07.09-15:

Describe the testing and calibration capabilities for the data communications components within the Safety Automation System (SAS) to meet IEEE clause 603-1991, Clause 5.7.

IEEE Std. 603-1991, Clause 5.7, requires capability for testing and calibration of safety system equipment while retaining the capability of the safety systems to accomplish their safety functions.

DC FSAR, Tier 2, Section 7.1.1.4.2, provides the summary of data communications implemented within the SAS. This section does not describe the testing and calibration capabilities for the data communications systems and components used in the SAS. For example, what is method is used to determine whether a communications link is operating correctly? Provide information regarding the testing and calibration capabilities for the data communications components and systems used in the SAS, including the detection of faulty communications link, incomplete data transmission, and out of order messages to meet the requirements of IEEE Std. 603-1991, Clause 5.7.

Response to Question 07.09-15:

The SAS is implemented using the Teleperm XS (TXS) platform. Siemens Topical Report EMF-2110, Revision 1, "TELEPERM XS: A Digital Reactor Protection System," Section 2.7.1.1.4 describes the testing features of TXS data communications. The NRC safety evaluation report (SER) associated with EMF-2110 summarizes communication fault detection on page 29. On page 51 of the SER, the staff concluded that the TXS system satisfies the testability and reliability requirements of IEEE Std. 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Clause 5.7.

FSAR Impact:

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

Question 07.09-16:

Demonstrate how the optical link module used in the protection system meets IEEE Std. 603-1991, Clause 5.4, and 10 CFR Part 50, Appendix A, General Design Criteria 21.

IEEE Std. 603-1991, Clause 5.4, stipulates requirements for equipment qualification. This clause requires safety system equipment to be qualified by type test, previous operating experience, or 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. In addition, GDC 21 requires the design to be shall be designed for high functional reliability and inservice testability commensurate with the safety functions to be performed. Redundancy and independence designed into the protection system shall be sufficient to assure that (1) no single failure results in loss of the protection function and (2) removal from service of any component or channel does not result in loss of the required minimum redundancy unless the acceptable reliability of operation of the protection system can be otherwise demonstrated.

Topical report ANP-10281P Revision 0, U.S. EPR Digital Protection System, has been submitted for NRC review in March, 2007. This topical report is currently under review by the NRC and has yet to be approved. This topical report provides a description of the network topologies implemented within the protection system. This topical report states that a redundant ring network topology consists of at least three OLMs and their corresponding double fiber optical links. A given redundant ring network topology can contain only a finite number of OLMs. Each network in the PS contains fewer OLMs than the maximum allowed. Each double fiber optical link consists of a separate transmit and receive channel. In this topology, a break in one of the double fiber optical connections, or a failure in one optical port of one OLM, does not affect network availability. If an OLM is lost, only the unit(s) directly connected to the failed OLM is affected. The remaining units accessing the ring network can still communicate with one another. Although this topical report states that the OLM is mapped to the SLLM component qualified in the Topical Report EMF-2110, Revision 1, TELEPERM XS: A Digital Reactor Protection System [Adams Accession No. ML003732662], it does not indicate whether there have been any modifications or variations in the design of the OLM from the SLLM design that was qualified in the TELEPERM XS topical report. If there are modifications or variations in the design of the OLM, demonstrate how the hardware and software of the OLM is designed to meet IEEE Std. 603-1991, Clause 5.4, and GDC 21. In addition, demonstrate that the malfunction within the OLM will not influence the signal such that a failure will propagate to multiple redundant divisions.

Response to Question 07.09-16:

This question contains three separate requests. Each request is identified and addressed individually.

Request 1:

“Demonstrate how the optical link module used in the protection system meets IEEE Std. 603-1991 Clause 5.4.”

Response 1:

IEEE Std. 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Clause 5.4 requires the classification of safety system equipment to IEEE Class 1E standards. Teleperm XS (TXS) equipment used in safety-related instrumentation and controls (I&C) systems is qualified to IEEE Class 1E standards. Information regarding equipment qualification of specific versions of TXS equipment will not be submitted as a part of design certification because the TXS equipment will evolve and be upgraded over the life a plant. When a version of TXS equipment is selected for a specific power plant, the appropriate documentation will be available for NRC audit.

U.S. EPR FSAR Tier 2, Section 7.1.1.4.1 provides qualification requirements for equipment used in the protection system (PS).

The IEEE Class 1E qualification of the equipment used in the as-built system will be verified by the closure of ITAAC items related to equipment qualification.

Request 2:

"Demonstrate how the optical link module used in the protection system meets… 10 CFR Part 50, Appendix A, General Design Criteria 21."

Response 2:

General Design Criteria (GDC) 21 imposes two general requirements: redundancy and independence. The optical link module (OLM) itself is not required to meet these requirements; instead, the PS as a whole meets these requirements as described in U.S. EPR FSAR Tier 2, Section 7.1.1.6.3, Section 7.1.1.6.4, Section 7.2, and Section 7.3.

Electrical isolation is provided between OLMs in redundant divisions by fiber optic cabling. Communication independence is not provided by the OLMs. However, features designed into each communication processor and function processor in the system provide communication independence between divisions as described in ANP-10281P, "U.S. EPR Digital Protection System Topical Report," Section 12.2. Acceptable redundancy of the system is demonstrated by the system level failure modes and effects analysis for the PS, described in U.S. EPR FSAR Tier 2, Section 7.2 and Section 7.3. Single failures of OLMs are bounded by the network failures described in these sections.

Request 3:

"In addition, demonstrate that the malfunction within the OLM will not influence the signal such that a failure will propagate to multiple redundant divisions."

Response 3:

In the PS design, OLMs are used in both point-to-point and redundant ring topologies as described in ANP-10281P, Section 6.

A safety-related design function of each OLM in a network is to correctly propagate data messages, while a safety-related design function of each function processor is to detect and

disposition invalid received messages. Application of the single failure criterion dictates that a postulated failure of an OLM resulting in an invalid message, concurrent with a failure of a receiving unit to detect the message as being invalid, is beyond the design basis of the system.

In a point-to-point network, an error caused by an OLM in the sending division (single failure) will propagate to the receiving division. If the receiving entity does not recognize and accommodate the error (additional single failure), then communication independence has been compromised, which is an unacceptable result.

Similarly, in a TXS ring topology, an error caused by an OLM in the sending division (single failure) will propagate to the other divisions on the ring. If the function processors on the ring do not detect and accommodate the error (additional single failures), then communication independence has been compromised, which is an unacceptable result.

The PS design is subject to, and satisfies, the single failure criterion. The use of IEEE Class 1E qualified equipment, along with design processes and testing carried out under a 10 CFR 50, Appendix B quality assurance program, dictate that no more than one safety-related failure at a time is considered.

When analyzing an OLM failure, communications independence is only compromised by a postulated failure of both the OLM in the sending division and the function processor in the receiving division. This type of multiple-failure scenario is beyond the design basis of the PS, similar to a postulated software common cause failure affecting more than one redundant division. The diverse actuation subsystem of the process automation system (PAS) is provided to cope with these beyond design basis events (BDBEs).

FSAR Impact:

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

Question 07.09-20:

Demonstrate how the cables for the Protection System data communications systems meet 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 2, “Design bases for protection against natural phenomena.”

GDC 2, “Design bases for protection against natural phenomena” requires structures, systems, and components important to safety to be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. Section 7 and 8 of the AREVA NP Topical Report ANP-10281 “U.S. EPR Digital Protection System Topical Report” provides a description of the system level reactor trip system (RTS) and engineered safety features actuation system (ESFAS) design.

DC FSAR, Tier 2, Sections 7.2 and 7.3, provide additional details on the RTS and ESFAS design. The protection system functional units are implemented with the TELEPERM XS platform, which the NRC has found to be in compliance with GDC 2. However, the cables used to interconnect these functional units have not been qualified to meet GDC 2. The staff requests additional information to demonstrate that adequate shielding or housing has been provided for the cables used to interconnect functional units within the Protection System.

Response to Question 07.09-20:

U.S. EPR FSAR Tier 2, Section 7.1.2.2.2 describes the protection system (PS) compliance with GDC 2.

The cables used to interconnect functional units within the PS are part of the PS. The PS is located in the Safeguard Buildings (SBs), and the concrete structures that compose the SBs are designed to withstand natural phenomena and provide protection for the PS from these external hazards.

Equipment used in U.S. EPR FSAR safety-related instrumentation and controls (I&C) systems is qualified to IEEE Class 1E standards. Detailed information regarding qualification of specific versions of equipment will not be submitted as a part of design certification because the equipment will evolve and be upgraded over the life of a plant. When a version of equipment is selected for a specific power plant, the appropriate documentation will be available for NRC audit.

The IEEE Class 1E qualification of the equipment used in the as-built systems will be verified by the closure of ITAAC items related to equipment qualification.

U.S. EPR FSAR Tier 2, Section 7.1.1.4.1 provides qualification requirements for equipment used in the PS, including seismic qualification.

Refer to the Response to RAI 75, Question 7.02-5 for more details.

FSAR Impact:

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

Question 07.09-21:

Demonstrate how the Protection System (PS) data communications systems meet 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 4, "Environmental and Dynamic Effects Design Basis."

GDC 4, "Environmental and Dynamic Effects Design Basis" requires structures, systems, and components important to safety to 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. Sections 7 and 8 of the AREVA NP Topical Report ANP-10281 "U.S. EPR Digital Protection System Topical Report" provides a description of the system level reactor trip system and engineered safety features actuation system design.

DC FSAAR, Tier 2, Sections 7.2 and 7.3, provide additional details on the reactor trip system and engineered safety features actuation system design. The protection system functional units are implemented with the TELEPERM XS platform, which the NRC has found to be in compliance with GDC 4. However, the cables used to interconnect these functional units have not been qualified to meet GDC 4. The staff requests additional information regarding the physical layout of the communications cables and the cabinets used to house the data communications systems within the PS. Demonstrate that there is adequate protection of the communications cables form the environmental effects described in GDC 4. Show that the physical layout of the communications cables cabinents adequately meets the requirements GDC 4.

Response to Question 07.09-21:

U.S. EPR FSAR Tier 2, Section 7.1.2.2.3 addresses PS compliance with GDC 4.

The cables used to interconnect functional units within the PS are considered part of the PS.

Data communication cables will be routed throughout the plant and may be placed in the same raceway as low-level analog cables. When possible, routing of communication cables is limited to non-hazard and limited-hazard areas. If any safety-related communication cables are routed through a hazard area, acceptable means of physical protection will be provided. When passing through another divisional building, IEEE Class 1E communication cables will be in a fire-protected enclosure to prevent a fire in one division from damaging communication cables of another division. Damage to fiber optic communication cables will not result in spurious actuations of equipment, but may result in loss of component function. However, divisional redundancy allows supported safety functions to be maintained.

The data communication modules (e.g., communication processors, optical link modules) that are part of the PS are located within the PS cabinets. These cabinets are located in mild environment areas within the four Safeguard Buildings (SBs).

Equipment used in U.S. EPR FSAR safety-related instrumentation and controls (I&C) systems is qualified to IEEE Class 1E standards. Detailed information regarding qualification of specific versions of equipment will not be submitted as a part of design certification because the equipment will evolve and be upgraded over the life of a plant. When a version of equipment is

selected in a specific power plant, the appropriate documentation will be available for NRC audit.

U.S. EPR FSAR Tier 2, Section 7.1.1.4.1 provides qualification requirements for equipment used in the PS.

The IEEE Class 1E qualification of the equipment used in the as-built system will be verified by the closure of ITAAC items related to equipment qualification.

FSAR Impact:

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

Question 07.09-22:

Demonstrate how the safety I&C systems are physically separated to meet 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 22, "Protection System Independence," requirements.

GDC 22, “Protection System Independence” requires the protection system to 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.

DC FSAR, Tier 2, Section 7.1.1.6.4, provides a description of the independence requirements for redundant divisions of the safety I&C systems. This section states that independent divisions are located in each of the four physically separated Safeguards Buildings. Safety I&C systems may be implemented in other safety-related structures, where redundant divisions are adequately separated. The staff requests additional information regarding how redundant divisions will be physically separated for safety I&C systems that are located in other safety-related structures and what criteria is used to demonstrate that the physical separation is adequate to meet GDC 22.

Response to Question 07.09-22:

Safety instrumentation and controls (I&C) systems will be implemented according to the physical separation guidance of IEEE Std. 384-1992, “IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits.” U.S. EPR FSAR Tier 2, Table 7.1-2—I&C System Requirements Matrix identifies the safety I&C systems subject to the guidance of IEEE Std. 384-1992.

The sentence in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4, “Safety I&C systems may be implemented in other safety-related structures, where redundant divisions are adequately separated” will be deleted for clarity.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 7.1.1.6.4 will be revised as described in the response and indicated on the enclosed markup.

Question 07.09-24:

Demonstrate how IEEE Std. 603-1991, Clause 5.6.1, requirements are met regarding communications independence as implemented within the U.S. EPR Instrumentation and Control (I&C) design.

DC FSAR, Tier 2, Section 7.1.1.6.4, provides a description of the independence requirements for redundant divisions within the safety I&C systems. This section states that the Safety Information and Control System, Protection System, and Safety Automation System implement interdivisional communications to support the system functional requirements. Communications independence is provided by implementing the communications independence principles described in the TELEPERM XS platform. The staff requests additional information to demonstrate that the communications processors, functional processors, and communications principles approved in the TELEPERM XS topical report safety evaluation report (ML003703082) have not been modified in the design of the U.S. EPR safety I&C systems. If any modifications have been completed, provide information regarding the changes in hardware and software design, equipment qualification, and type testing completed.

Response to Question 07.09-24:

Information regarding specific versions of Teleperm XS (TXS) equipment will evolve and be upgraded over the life of a plant and will not be submitted as a part of design certification. When a version of TXS equipment is selected in a specific power plant, the appropriate documentation will be available for NRC audit.

The key characteristics of the TXS platform that provide communications independence are described in U.S. EPR FSAR Tier 2, Section 7.1.1.6.4. These characteristics, by inclusion in the U.S. EPR FSAR, are not subject to change and must be present in any version of TXS equipment used in a U.S. EPR unless a departure is identified.

The existence of these characteristics in the as-built system is verified by the closure of ITAAC items related to communications independence.

FSAR Impact:

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

Question 07.09-38:

Demonstrate how the communication path between the Reactor Control, Surveillance, and Limitation (RCSL) System and the other instrumentation systems meets IEEE Std. 603-1991, Clause 5.6.3, independence between safety and other systems.

IEEE Std. 603-1991, Clause 5.6.3, requires independence between safety systems and other systems. This clause requires the safety system be designed such that credible failures in and consequential actions by other systems shall not prevent the safety systems from performing their intended safety functions.

DCFSAR, Tier 2, Section 7.1.1.4.5, provides a description of data communications within the RCSL System. The applicant states in this section that the RCSL receives hardwired inputs from the isolated outputs of the safety I&C system. In addition, the maintenance service interface (MSI) provide a communication path between the RCSL and other instrumentation and control (I&C) systems via the gateways (GW)s for both display of information and transfer of manual commands. Provide additional information regarding how outputs from the safety I&C systems to the RCSL are properly isolated to meet IEEE Std. 603-1991, Clause 5.6.3. Provide the specific design of this isolation device, including whether it is Class 1E qualified. In addition, clarify what manual commands are transferred from the RCSL system to the safety I&C system via the MSI and GW and which specific safety I&C systems is the RCSL communicating with?

Response to Question 07.09-38:

The RCSL is a non-safety-related system. U.S. EPR FSAR Tier 2, Section 7.1.1.6.4, subsection “Independence between the Safety I&C Systems and Non-Safety I&C Systems” and U.S. EPR FSAR Tier 2, Figure 7.1-20—Implementation of Independence Between Safety and Non-Safety I&C describe implementation of communication independence between safety-related and non-safety-related instrumentation and controls (I&C) systems. For a hardwired connection between safety and non-safety I&C systems, an IEEE Class 1E qualified isolation device is used. U.S. EPR FSAR Tier 2, Section 7.1.1.6.4 describes electrical isolation between safety and non-safety systems. The IEEE Class 1E qualification of these devices is verified through the closure of ITACC items associated with electrical isolation.

There are no manual commands transferred from the RCSL to the safety I&C systems.

FSAR Impact:

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

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- Independence between the safety-related I&C systems and the non-safety-related I&C systems.

Independence of Redundant Safety Divisions

~~Figure 7.1-19—Independence Between Redundant Safety Divisions~~Figure 7.1-19—Implementation of Independence Between Redundant Divisions illustrates the implementation of inter-divisional independence.

The SICS, PS, SAS and PACS each consists of four independent divisions. Independence between redundant divisions is maintained using the following:

- Physical separation.
- Electrical isolation.
- Communications independence.

Independent divisions are located in each of the four physically separated Safeguards Buildings. ~~Safety I&C systems may be implemented in other safety-related structures, where redundant divisions are adequately separated.~~

07.09-22

Electrical isolation is required for hardwired and data connections, and is provided through the use of qualified isolation devices and fiber optic cable.

The SICS, PS, and SAS implement interdivisional communications to support the system functional requirements. Communications independence is provided by the following features of the TXS platform:

- Communications modules are provided separate from the function processors performing the safety function.
- Communications are implemented with separate send and receive data channels.
- Asynchronous, cyclic operation of the function processors and communications modules.

In addition, only predefined messages are accepted by the receiving function processor, and data integrity checks are performed on the received messages. Faulted messages are flagged and ignored in subsequent logic.

Refer to Section 2.9 of Reference 3 for more information on the principles of communications independence.

Independence from the Effects of Design Basis Events

The TXS equipment used in the safety-related I&C systems is qualified to withstand the effects of DBEs.