

ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Friday, February 18, 2011 12:21 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); RYAN Tom (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 3
Attachments: RAI 442 Supplement 3 Response US EPR DC.pdf

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. Supplement 2 response was sent on February 9, 2011 to provide a revised schedule. Based on discussions with NRC, the attached file, "RAI 442 Supplement 3 Response US EPR DC.pdf" provides technically correct and complete responses to four of the 17 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report and Technical Report ANP-10281P, in redline-strikeout format which support the response to RAI 442 Question 07.01-29.

The following table indicates the respective pages in the response document, "RAI 442 Supplement 3 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 442 07.01-29	2	2
RAI 413 07.09-62	3	4
RAI 413 07.09-65	5	5
RAI 413 07.09-66	6	6

The schedule for technically correct and complete responses to the remaining 13 questions is unchanged and provided below:

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-30	March 15, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	March 15, 2011
RAI 442 — 7.3-32	March 15, 2011
RAI 442 — 7.3-33	March 15, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	March 15, 2011

RAI 442 — 7.9-63	March 15, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-67	March 15, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)
Sent: Wednesday, February 09, 2011 5:07 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 2

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. Supplement 1 response was sent on January 7, 2011 to provide a revised schedule for four of the questions. To allow additional time to interact with the staff and to process the responses a revised schedule is provided below. It should be noted that the dates below may need to be adjusted following the February 15, 2011 public meeting between AREVA and the NRC on digital instrumentation and controls.

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-29	March 15, 2011
RAI 442 — 7.1-30	March 15, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	March 15, 2011
RAI 442 — 7.3-32	March 15, 2011
RAI 442 — 7.3-33	March 15, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	March 15, 2011
RAI 442 — 7.9-62	March 15, 2011
RAI 442 — 7.9-63	March 15, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-65	March 15, 2011
RAI 442 — 7.9-66	March 15, 2011
RAI 442 — 7.9-67	March 15, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (External RS/NB)
Sent: Friday, January 07, 2011 11:15 AM
To: Tesfaye, Getachew
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); RYAN Tom (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 1

Getachew,

On November 19, 2010, AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to the questions in RAI 442. To allow additional time to interact with the staff a revised schedule is provided below for questions 7.1.29, 7.1.32, 7.9-65 and 7.9-67. The schedule for the other questions remains unchanged.

AREVA NP's schedule for providing a technically correct and complete response to all questions in RAI 442 is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-29	February 9, 2011
RAI 442 — 7.1-30	February 9, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	February 9, 2011
RAI 442 — 7.3-32	February 9, 2011
RAI 442 — 7.3-33	February 9, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	February 9, 2011
RAI 442 — 7.9-62	February 9, 2011
RAI 442 — 7.9-63	February 9, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-65	March 15, 2011
RAI 442 — 7.9-66	February 9, 2011
RAI 442 — 7.9-67	February 9, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016

From: BRYAN Martin (External RS/NB)
Sent: Friday, November 19, 2010 5:12 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); PANNELL George (CORP/QP)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 442 Response US EPR DC.pdf" provides a schedule since a technically correct and complete response to the 17 question (s) is not provided.

The following table indicates the respective pages in the response document, "RAI 442 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 442 — 7.1-26	2	2
RAI 442 — 7.1-27	3	3
RAI 442 — 7.1-28	4	4
RAI 442 — 7.1-29	5	5
RAI 442 — 7.1-30	6	6
RAI 442 — 7.1-31	7	8
RAI 442 — 7.1-32	9	9
RAI 442 — 7.3-32	10	10
RAI 442 — 7.3-33	11	11
RAI 442 — 7.3-34	12	12
RAI 442 — 7.9-61	13	13
RAI 442 — 7.9-62	14	14
RAI 442 — 7.9-63	15	15
RAI 442 — 7.9-64	16	16
RAI 442 — 7.9-65	17	17
RAI 442 — 7.9-66	18	18
RAI 442 — 7.9-67	19	19

A complete answer is not provided for the 17 questions. The schedule for a technically correct and complete response to these questions is provided below.

Question #	Response Date
RAI 442 — 7.1-26	March 15, 2011
RAI 442 — 7.1-27	March 15, 2011
RAI 442 — 7.1-28	March 15, 2011
RAI 442 — 7.1-29	January 7, 2011
RAI 442 — 7.1-30	February 9, 2011
RAI 442 — 7.1-31	March 15, 2011
RAI 442 — 7.1-32	January 7, 2011
RAI 442 — 7.3-32	February 9, 2011

RAI 442 — 7.3-33	February 9, 2011
RAI 442 — 7.3-34	March 15, 2011
RAI 442 — 7.9-61	February 9, 2011
RAI 442 — 7.9-62	February 9, 2011
RAI 442 — 7.9-63	February 9, 2011
RAI 442 — 7.9-64	March 15, 2011
RAI 442 — 7.9-65	January 7, 2011
RAI 442 — 7.9-66	February 9, 2011
RAI 442 — 7.9-67	January 7, 2011

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, October 20, 2010 8:09 AM
To: ZZ-DL-A-USEPR-DL
Cc: Zhao, Jack; Morton, Wendell; Mott, Kenneth; Spaulding, Deirdre; Truong, Tung; Zhang, Deanna; Jackson, Terry; Canova, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 442(4295,5076,5068,5067), FSAR Ch. 7

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 10, 2010, and discussed with your staff on October 13, 2010. Drat RAI Questions 07.01-26 and 07.03-33 were modified as a result of that discussion. 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: 2576

Mail Envelope Properties (199EBB4D1CD9644D9472AA84D5D8EFA71FB8AF)

Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 3
Sent Date: 2/18/2011 12:21:12 PM
Received Date: 2/18/2011 12:21:31 PM
From: BRYAN Martin (EXTERNAL AREVA)

Created By: Martin.Bryan.ext@areva.com

Recipients:

"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
"Tsfaye, Getachew" <Getachew.Tsfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	Size	Date & Time
MESSAGE	9655	2/18/2011 12:21:31 PM
RAI 442 Supplement 3 Response US EPR DC.pdf		179811

Options

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

Response to
Request for Additional Information No. 442, Supplement 3

10/20/2010

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020

SRP Section: 07.01 - Instrumentation and Controls - Introduction
SRP Section: 07.03 - Engineered Safety Features Systems
SRP Section: 07.09 - Data Communication Systems

Application Section: FSAR Ch 7

QUESTIONS for Instrumentation, Controls and Electrical Engineering 1
(AP1000/EPR Projects) (ICE1)

Question 07.01-29:

Clarify FSAR and technical report figures associated with manual engineered safety feature actuation.

10 CFR 52.47(a)(2) requires, in part, a description of structures, systems, and components sufficient to permit understanding of the system designs. The staff, noticed there are some differences between the logic drawings that depict a "typical ESFAS actuation sequence" in Figure 8-1 ANP-10281P, "US EPR Digital Protection System Technical Report, Revision 0, and Figure 7.3-1 of US EPR FSAR Tier 2, Section 7.3. The staff also observed that there is no manual actuation signal line depicted in either figure for ESF, whereas a manual actuation is shown for RT functions shown in Figures 7-4 and 7.2-3 of ANP-10281P, "US EPR Digital Protection System Technical Report, Revision 0, and US EPR FSAR Tier 2, Section 7.2, respectively. The staff presented its observations to the applicant in a teleconference and the applicant agreed to modify Figure 8-1 ANP-10281P, "US EPR Digital Protection System Technical Report, Revision 0, and Figure 7.3-1 of US EPR FSAR Tier 2, Section 7.3 to bring them in line with each other. The applicant also verbally committed to adding detail for manual actuation for each ESF figure to accurately reflect that this functionality does exist in the typical ESF actuation sequence.

Response to Question 07.01-29:

U.S. EPR FSAR Tier 2, Figure 7.3-1, Sheet 2 will be added to show detail of the typical engineered safety features (ESF) manual actuation sequence. U.S. EPR FSAR Tier 2, Section 7.3.1.1 will be revised to reference the added figure.

Technical Report ANP-10281P, Figure 8-1 was not revised. However, Technical Report ANP-10281P, Figure 8-3 will be added to show the typical ESF manual actuation during the next revision, as shown in the attached Technical Report ANP-10281P markup. In addition, Technical Report ANP-10281P, Section 8.5 will be revised to reference the added figure. Technical Report ANP-10281P, Figure 8-3 is identical to U.S. EPR FSAR Tier 2, Figure 7.3-1, Sheet 2.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 7.3.1.1 will be revised and Figure 7.3-1, Sheet 2 will be added as described in the response and indicated on the enclosed markup.

Technical Report ANP-10281P Impact:

Technical Report ANP-10281P, Section 8.5 will be revised and Figure 8-3 will be added in the next revision as described in the response and indicated on the enclosed markup.

Question 07.09-62:**Follow-up to RAI 286, Question 7.09-49.**

Incorporate the response to RAI 286, Question 7.09-49 into the U.S. EPR, Tier 2 FSAR.

10 CFR Part 50, Appendix A, General Design Criteria 13, requires, in part, instrumentation be provided to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety. The NRC issued Information Notice: 2007-15, "Effects of Ethernet-Based, Non-Safety Related Controls on the Safe and Continued Operation of Nuclear Power Stations," (ADAMS Accession No. ML071510428), describing operational experience on the effects of a data storm on non-safety control networks. The staff issued RAI 286, Question 7.09-49 to request the applicant to demonstrate how operating experience insights regarding the effects of data storms on non-safety data communications networks are addressed for the plant data network, which provides important to safety functions such as alarms, indications, and controls for all operational conditions. In response, the applicant states that sound engineering and design practices will be applied to development of the U.S. EPR plant data network and the instrumentation and controls (I&C) systems connected to the network. The plant data network will be designed to withstand data traffic, and the interfacing I&C systems will be designed with thresholds for network traffic that are consistent with maximum data rates of the network. Specific design details regarding preclusion of data storm events on a non-safety-related network will be developed later in the design process, and are thus not planned for inclusion in the application for design certification. However, the design features of the safety-related I&C systems that protect the safety-related functions will protect against loss of safety functions in case of data storm events on the non-safety-related plant data network. The staff finds this response acceptable. However, the staff requests the applicant to incorporate this response into the U.S. EPR, Tier 2, FSAR.

Response to Question 07.09-62:

U.S. EPR FSAR Tier 2, Section 7.1 will be revised to include the following information:

"Sound engineering and design practices will be applied to the development of the U.S. EPR plant data network and the instrumentation and controls (I&C) systems connected to the network. The plant data network will be designed to withstand data traffic, and the interfacing I&C systems will be designed with thresholds for network traffic that are consistent with maximum data rates of the network. Specific design details regarding preclusion of data storm events on a non-safety-related network will depend on the specific technology chosen for these non-safety-related networks, and they are not included in the U.S. EPR FSAR. However, design features of the safety-related I&C systems protect against loss of safety function in case of data storm events on the non-safety-related plant data network. Specifically, the monitoring service interface (MSI) acts as a qualified communication barrier with the non-safety-related systems. It only accepts and transmits one set of messages each cycle, using the same deterministic processing cycle. This protects the safety-related function processors from communication events outside of their safety-related system. Loss of communication between the MSI and either the service unit (SU) or gateway does not impair performance of the safety-related functions."

To support submittal of complete and consistent information, and considering multiple RAI responses and design changes communicated to the NRC staff, the U.S. EPR FSAR Tier 2, Section 7.1 revisions described in this response will be submitted with the Response to RAI 442, Question 07.01-26.

FSAR Impact:

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

Question 07.09-65:

Incorporate the response to RAI 24 and 38 for Topical Report ANP-10281P into the U.S. EPR, Tier 2, FSAR or its referenced documents, to demonstrate independence when the ring network topology is used in the Protection System.

10 CFR Part 50, Appendix A, GDC 23, "Protection System Failure Modes," requires the protection system to be designed to fail into a safe state or into a state demonstrated to be acceptable on some other defined basis if conditions such as disconnection of the system, loss of energy (e.g., electric power, instrument air), or postulated adverse environments (e.g., extreme heat or cold, fire, pressure, steam, water, and radiation) are experienced. NUREG/CR-6082, "Data Communications," provides additional discussion of independence and failure modes. In response to RAI 24, the applicant described the network failure modes and how these failures are bounded. In RAI 38 of the "Third Request for Additional for Information" for Topical Report ANP-10281P, the staff requested the applicant to describe the failure modes of the ring network employed in the U.S. EPR digital PS used to provide SPND measurements to the RAU and certain APUs, as required by GDC 23 of Appendix A to 10 CFR Part 50. The applicant provided in "Response to Third Request for Additional Information" for the Topical Report ANP-10281P, a description of how data messages are interpreted for validity and different types of message failures. The response also described how the APU will process each type of failure mode. In addition, the applicant provided in "U.S. EPR Digital Protection System Topical Report, Supplemental Information" a table detailing postulated communications failures within the TXS communications system. The staff requests the applicant to incorporate these responses from RAI 24 and RAI 38 for Topical Report ANP-10281P and the information in "U.S. EPR Digital Protection System Topical Report, Supplemental Information" into the U.S. EPR, Tier 2 FSAR or Technical Report ANP-10309P to demonstrate compliance to GDC 23.

Response to Question 07.09-65:

As discussed in public meetings with NRC staff on February 15, 2011, the ring networks connecting the four divisions of the remote acquisition units (RAU) to each division of the acquisition and processing units (APUs) will be removed from the U.S. EPR protection system (PS) design.

U.S. EPR FSAR Tier 2, Section 7.1 and Section 7.2, and Technical Report ANP-10309P will be revised to reflect the design change.

To support submittal of complete and consistent information, and considering multiple RAI responses and design changes communicated to the NRC staff, U.S. EPR FSAR Tier 2, Section 7.1 revisions described in this response will be submitted with the Response to RAI 442, Question 07.01-26. The U.S. EPR FSAR Tier 2, Section 7.2 and Technical Report ANP-10309 revisions described in this response will be submitted with the Response to RAI 442, Question 07.01-27.

FSAR Impact:

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

Question 07.09-66:**Follow-up to RAI 286, Question 7.9-52.**

Incorporate the response to RAI 286, Question 7.9-52 regarding the quality of the plant data network to demonstrate compliance to 10 CFR Part 50 General Design Criterion (GDC) 1.

GDC 1 requires structures, systems, and components important to safety to be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. The Processing Information and Control System (PICS) is used to operate the plant during normal and accident conditions. This operation is achieved using the plant data network. In RAI 286, Question 7.9-52, the staff requested the applicant to demonstrate the quality and network capacity of the plant data network to support PICS functions. In response, the applicant stated that the normal control systems that will be utilized in the U.S. EPR must have adequate bandwidth to reliably operate and maneuver all the other systems in the reactor plant needed for plant operation and also to keep the plant reliably online. These I&C systems will be specified and procured consistent with the application of digital control technology currently in use in other power generation facilities. The staff requests the applicant to include the commitment to have adequate bandwidth to reliably operate and maneuver all systems in the reactor plant needed for plant operation and to keep the plant reliably online in the U.S. EPR, Tier 2, FSAR to demonstrate compliance to GDC 1. In addition, clarify whether the plant data network and terminal data network are classified as part of the PICS.

Response to Question 07.09-66:

U.S. EPR FSAR Tier 2, Section 7.1 will be revised to include the following information regarding quality and network capacity of the plant data network:

“The control systems that will be utilized in the U.S. EPR must have adequate bandwidth to reliably operate and maneuver the process systems in the reactor plant needed for plant operation and to keep the plant reliably online.”

U.S. EPR FSAR Tier 2, Section 7.1 will be revised to clarify that the plant data network and terminal data network are classified as part of the process information and control system (PICS).

To support submittal of complete and consistent information, and considering multiple RAI responses and design changes communicated to the NRC staff, the U.S. EPR FSAR Tier 2, Section 7.1 revisions described in this response will be submitted with the Response to RAI 442, Question 07.01-26.

FSAR Impact:

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

U.S. EPR Final Safety Analysis Report Markups

7.3 Engineered Safety Features Systems

7.3.1 Description

The U.S. EPR provides safety-related instrumentation and controls to sense accident conditions and automatically initiate the engineered safety features (ESF) systems. ESF systems are automatically actuated when selected variables exceed setpoints that are indicative of conditions that require protective action. Additionally, the ability to manually initiate ESF systems is provided in the main control room (MCR). Manual system-level actuation of ESF systems initiates all actions performed by the corresponding automatic actuation, including starting auxiliary or supporting systems and performing required sequencing functions. Component-level control ESF system actuators is also provided in the MCR.

7.3.1.1 System Description

Automatic actuation of ESF systems and auxiliary supporting systems is performed by the protection system (PS) when selected plant parameters reach the appropriate setpoints. These automatic actuation orders are sent to the priority and actuator control system (PACS) for prioritization and interface to the actuators. The typical ESF actuation sequence performed by the protection system is illustrated in Figure 7.3-1—Typical ESF Actuation ([Sheet 1 of 2](#)), and is described as follows:

07.01-29

- An acquisition and processing unit (APU) in each division acquires one-fourth of the redundant sensor measurements that are inputs to a given ESF actuation function.
- The APU in each division performs any required processing using the measurements acquired by that division (e.g., filtering, range conversion, calculations). The resulting variable is compared to a relevant actuation setpoint in each division. If a setpoint is breached, the APU in that division generates a partial trigger signal for the appropriate ESF function.
- The partial trigger signals from each division are sent to redundant actuation logic units (ALU) in the PS division responsible for the associated actuation. Two out of four voting is performed in each ALU on the partial trigger signals from all four divisions. If the voting logic is satisfied, an actuation order is generated.
- The actuation signals of the redundant ALU in each subsystem are combined in a hardwired “OR” configuration so that either redundant unit can actuate the function.

Actuation orders are sent from the PS to the PACS priority module associated with each actuator required for the function. Exceptions to this are the emergency diesel generator (EDG) start function and the turbine trip function. These actuation orders are received by the associated control system (EDG or turbine controls) and do not involve the PACS. The PS and the PACS are discussed in Section 7.1.

The safety automation system (SAS) performs closed loop automatic controls of certain ESF systems following their actuation by the PS. These controls are described in Section 7.3.1.2 with their associated actuation functions. The SAS is described in Section 7.1.

The capability for manual system-level ESF actuations is available to the operator through the safety information and control system (SICS) in the MCR. These manual actuations are acquired by the ALUs in the protection system and combined with the automatic actuation logic. The manual actuations are described with the corresponding automatic function in Section 7.3.1.2.

07.01-29

The capability for component-level control of ESF system actuators is available to the operator on both the PICS and the SICS. Commands from the PICS are processed by the PAS and sent to the PACS for prioritization. Commands from the SICS are processed by the SAS and sent to the PACS for prioritization. For any ESF actuator commands from the SICS have priority over those from the PICS. The typical manual ESF actuation sequence is shown in Figure 7.3-1 (Sheet 2 of 2).

The capability for manual reset of sense and command ESF actuation outputs is provided on both the process information and control system (PICS) and the SICS. Not all ESF actuations require a manual reset. There are cases where a sense and command output is cleared after the PS determines that the initiating condition has cleared. The reset functionality related to each ESF actuation is described in Section 7.3.1.2. Further description of the operation of the PICS and SICS is presented in Section 7.1.

7.3.1.2 Engineered Safety Features Actuation Functional Descriptions

7.3.1.2.1 Safety Injection System Actuation

To mitigate a loss of coolant accident (LOCA), a safety injection signal is required to actuate the appropriate ESF and support systems and to isolate non-qualified reactor coolant system (RCS) piping.

In case of a decrease in RCS water inventory due to a LOCA, the RCS is supplied by medium head safety injection (MHSI) in the high pressure phase of the event and low head safety injection (LHSI) in the low pressure phase.

The operation of the MHSI and LHSI systems is described in Section 6.3.

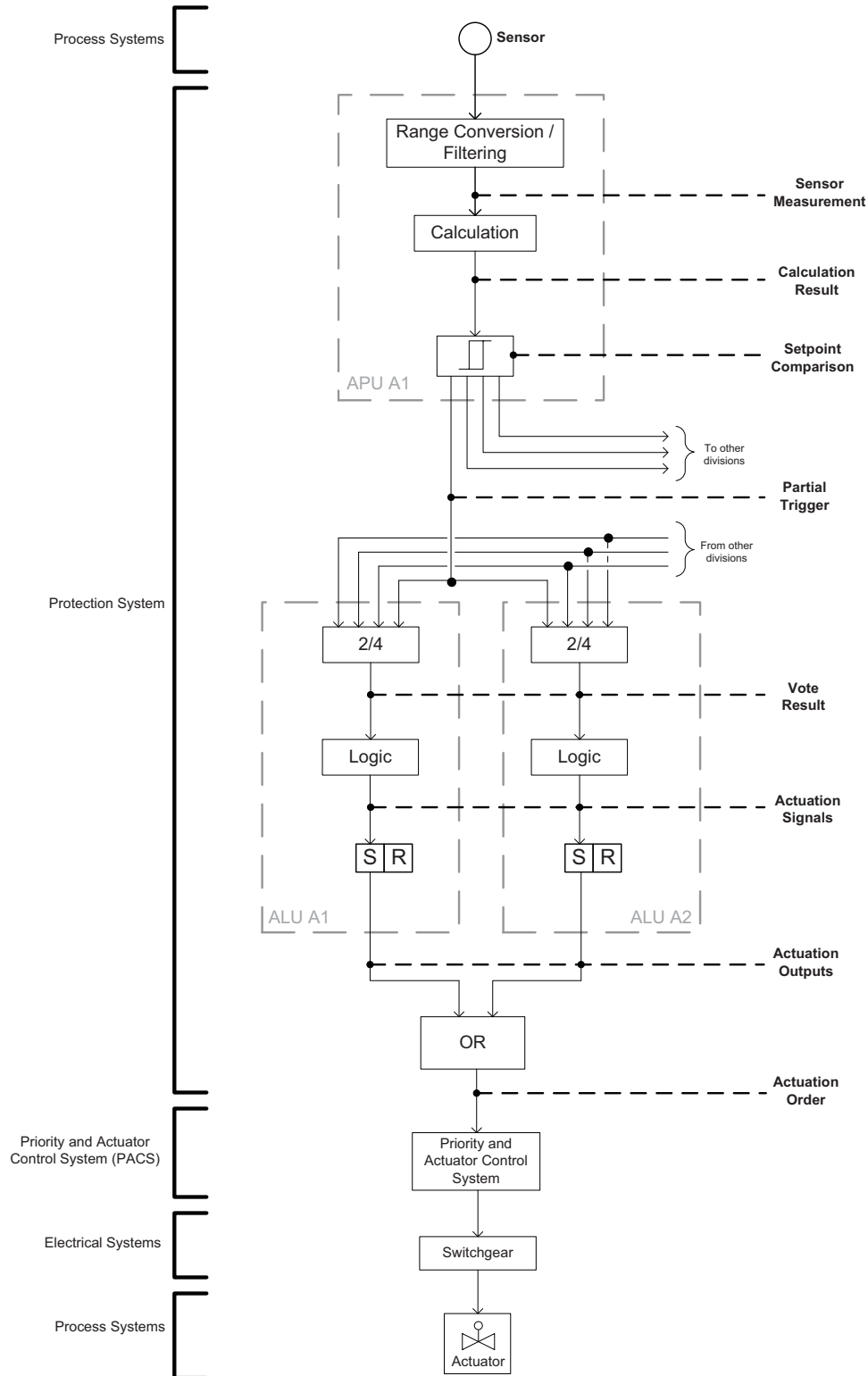
The U.S. EPR design provides for automatic generation of the safety injection signal during all modes of plant operation by utilizing three different initiation parameters depending on the current plant state:

- Pressurizer pressure <Min3p.

Figure 7.3-1—Typical ESF Actuation

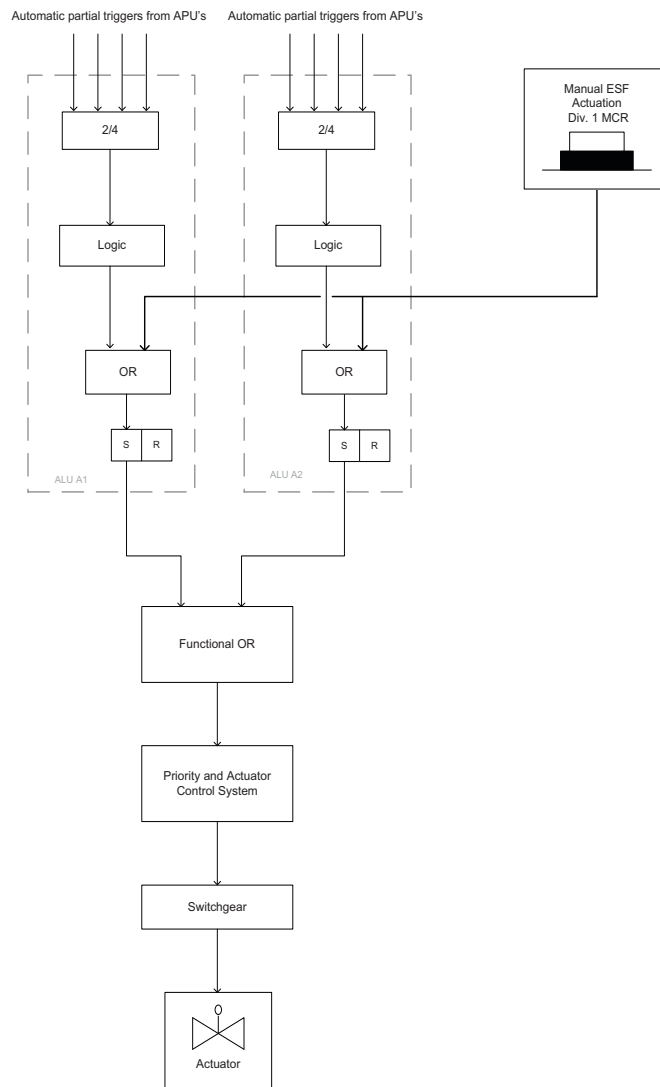
(Sheet 1 of 2)

07.01-29



EPR3285 T2

Figure 7.3-1—Typical ESF Actuation
(Sheet 2 of 2)



EPR3286 T2

↑
 07.01-29

ANP-10281P, "US EPR
Digital Protection System
Technical Report,"
Revision 0 Markups

8.5 ***System Level Manual ESF Actuations***

In addition to the automatic ESF actuation functions performed by the PS, the capability to manually initiate these functions at the system level is provided in the MCR. While the U.S. EPR design includes the ability to manually manipulate these actuators at the individual component level from the non-safety-related PICS (the component level manipulations are not processed through the PS), the system level actuations addressed in this section are implemented through Class 1E actuation paths and are single failure tolerant.

Figure 8-3 illustrates the implementation of a typical manual ESF actuation.

The manual ESF actuation functions are available to the operator on the safety information and control system (SICS). The signals from the SICS are acquired by the ALUs of the PS and are combined with the automatic actuation logic for the corresponding automatic ESF function. This way, the same PS outputs are energized whether the actuation occurred automatically or manually. The implementation of each system level manual ESF function is described in U.S. EPR FSAR Tier 2, Section 7.3.

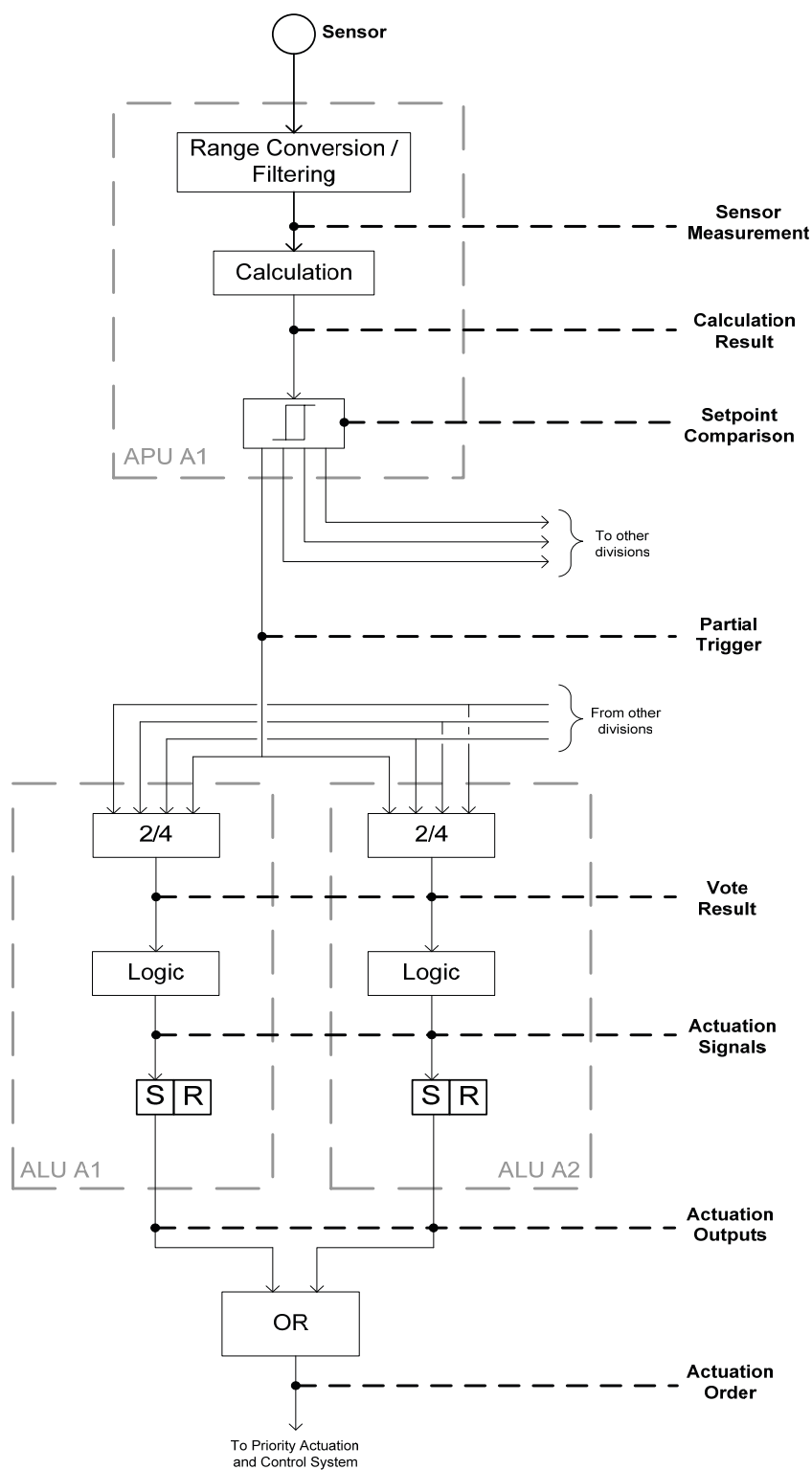
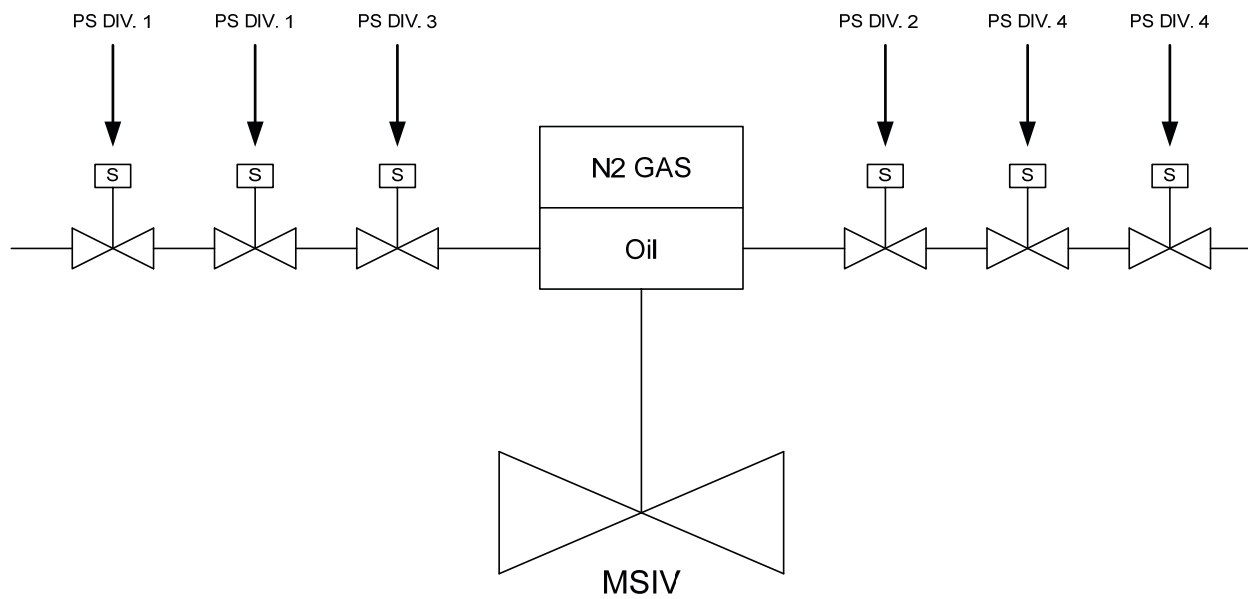
Figure 8-1—Typical ESFAS Actuation Sequence (One Division)

Figure 8-2—Example of PS Divisional Assignment to an ESF Actuation

INSERT as Figure 8-3 - Typical Manual ESFAS Actuation Sequence (One Division)

