ArevaEPRDCPEm Resource

From: WELLS Russell (AREVA) [Russell.Wells@areva.com]
Sent: Monday, April 04, 2011 5:01 PM
To: Tesfaye, Getachew
Cc: HUDSON Greg (AREVA); BUDZIK Dennis (AREVA); BENNETT Kathy (AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); WILLIFORD Dennis (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Question 7.1-31
Attachments: RAI 442 Question 07 01-31 Response US EPR DC - DRAFT.pdf

Getachew,

Attached is a draft response for RAI No. 442, FSAR Ch. 7, Question 7.1.31 as shown below in advance of the April 7, 2011 final date.

Let me know if the staff has questions or if this can be sent as a final response.

Thanks,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Tuesday, March 15, 2011 12:51 PM
To: 'Tesfaye, Getachew'
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 6

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. Supplement 3 response was sent on February 18, 2011 to provide technically correct and complete responses to four questions. Supplement 4 response was sent on February 25, 2011 to provide technically correct and complete response to one question. Supplement 5 response was sent on March 2, 2011 to provide technically correct and complete responses to three of the 12 remaining questions. Based on discussions with NRC, the attached file, “RAI 442 Supplement 6 Response US EPR DC.pdf” provides technically correct and complete responses to two of the 9 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 442 Supplement 6 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 442 07.01-32	2	3
RAI 442 07.09-67	4	5

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

Question #	Response Date
RAI 442 — 7.1-26	April 21, 2011
RAI 442 — 7.1-27	April 14, 2011
RAI 442 — 7.1-28	April 7, 2011
RAI 442 — 7.1-30	April 28, 2011
RAI 442 — 7.1-31	April 7, 2011
RAI 442 — 7.3-32	April 14, 2011
RAI 442 — 7.9-64	April 28, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Wednesday, March 02, 2011 4:52 PM
To: Tesfaye, Getachew
Cc: BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 5

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. Supplement 3 response was sent on February 18, 2011 to provide technically correct and complete responses to four questions. Supplement 4 response was sent on February 25, 2011 to provide technically correct and complete response to one question. Based on discussions with NRC, the attached file, "RAI 442 Supplement 5 Response US EPR DC.pdf" provides technically correct and complete responses to three of the 12 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 442 Supplement 5 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 442 07.03-33	2	2
RAI 442 07.03-34	3	4
RAI 442 07.09-61	5	8

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

Question #	Response Date
RAI 442 — 7.1-26	April 21, 2011
RAI 442 — 7.1-27	April 14, 2011
RAI 442 — 7.1-28	April 7, 2011
RAI 442 — 7.1-30	April 28, 2011
RAI 442 — 7.1-31	April 7, 2011
RAI 442 — 7.1-32	April 7, 2011
RAI 442 — 7.3-32	April 14, 2011
RAI 442 — 7.9-64	April 28, 2011
RAI 442 — 7.9-67	April 7, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: WELLS Russell (RS/NB)
Sent: Friday, February 25, 2011 8:07 AM
To: Tesfaye, Getachew
Cc: BRYAN Martin (External RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Supplement 4

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. Supplement 3 response was sent on February 18, 2011 to provide technically correct and complete responses to four questions. Based on discussions with NRC, the attached file, "RAI 442 Supplement 4 Response US EPR DC.pdf" provides technically correct and complete responses to one of the 13 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report and Technical Report ANP-10309P, in redline-strikeout format which support the response to RAI 442 Question 07.09-63.

The following table indicates the respective pages in the response document, "RAI 442 Supplement 4 Response US EPR DC.pdf," that contain AREVA NP's response to the subject question.

Question #	Start Page	End Page
RAI 442 07.09-63	2	2

Based upon the information presented to the NRC during the February 15, 2011, Public Meeting, the schedule for the remaining questions has been changed.

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	April 21, 2011
RAI 442 — 7.1-27	April 14, 2011
RAI 442 — 7.1-28	April 7, 2011
RAI 442 — 7.1-30	April 28, 2011
RAI 442 — 7.1-31	April 7, 2011
RAI 442 — 7.1-32	April 7, 2011
RAI 442 — 7.3-32	April 14, 2011
RAI 442 — 7.3-33	April 7, 2011
RAI 442 — 7.3-34	April 7, 2011
RAI 442 — 7.9-61	April 7, 2011
RAI 442 — 7.9-64	April 28, 2011
RAI 442 — 7.9-67	April 7, 2011

Sincerely,

Russ Wells
U.S. EPR Design Certification Licensing Manager
AREVA NP, Inc.
3315 Old Forest Road, P.O. Box 10935
Mail Stop OF-57
Lynchburg, VA 24506-0935
Phone: 434-832-3884 (work)
434-942-6375 (cell)
Fax: 434-382-3884
Russell.Wells@Areva.com

From: BRYAN Martin (External RS/NB)
Sent: Friday, February 18, 2011 12:21 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 3

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
702 561-3528 cell
Martin.Bryan.ext@areva.com

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: 2804

Mail Envelope Properties (1F1CC1BBDC66B842A46CAC03D6B1CD41042EEC3D)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Question 7.1-31
Sent Date: 4/4/2011 5:00:57 PM
Received Date: 4/4/2011 5:01:14 PM
From: WELLS Russell (AREVA)

Created By: Russell.Wells@areva.com

Recipients:
"HUDSON Greg (AREVA)" <Greg.Hudson@areva.com>
Tracking Status: None
"BUDZIK Dennis (AREVA)" <Dennis.Budzik@areva.com>
Tracking Status: None
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"HALLINGER Pat (EXTERNAL AREVA)" <Pat.Hallinger.ext@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"RYAN Tom (AREVA)" <Tom.Ryan@areva.com>
Tracking Status: None
"WILLIFORD Dennis (AREVA)" <Dennis.Williford@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	18083	4/4/2011 5:01:14 PM
RAI 442 Question 07 01-31 Response US EPR DC - DRAFT.pdf		681563

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

Response to

Request for Additional Information No. 442, Question 07.01-31

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)

DRAFT

Question 07.01-31:

Follow-up RAI 321, Question 07.01-19.

The staff requests that the following additional information be provided:

a. Information which adequately describes your commercial grade dedication program.

b. Information which adequately identifies the specific critical characteristics.

In the original question, the staff RAI requested the following:

> Describe the software development process (SDP) used for the video display that will be used in the safety information and control systems (SICS), particularly with respect to identification of aspects that differ from the SDP used for the TELEPERM XS.
>
> The applicant needs to provide a description of the differences in the SDP for the safety-related video display. The staff needs to be able to determine acceptability with regards to the quality requirements of 10 CFR 50.55a(a)(1); 10 CFR Part 50, Appendix A, General Design Criteria 1; 10 CFR Part 50, Appendix B; and 10 CFR 50.55a(h) are met.

In its response, AREVA NP indicated that: "QDS system software is commercial software. … qualify the QDS … through a commercial dedication process that conforms to the guidance of EPRI TR-106439, 'Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications.' … The QDS specific [development] tools [used to create the QDS application software] will be qualified as part of the commercial grade dedication process. …"

The NRC staff safety evaluation (SE) of TR-106439 stated that applicants referencing TR-106439 need to provide details regarding the dedication process. AREVA NP listed the following four (4) items as the process they would follow for commercial dedication.

1. Identification of the critical characteristics the system software must exhibit.
2. Definition of a combination of supplemental testing, supplier surveys, source verifications, or performance reviews, which demonstrate that the system software exhibits the critical characteristics.
3. Performance of the defined combination of supplemental testing, supplier surveys, source verifications, or performance reviews.
4. Creation of a dedication acceptance package that documents the results of activity 3 and provides evidence that the QDS system software exhibits the required critical characteristics.

The staff has determined that the four (4) items do not provide a detailed description of their dedication process. Additional information is requested which describes the detailed commercial dedication process that AREVA NP will follow, in conformance with EPRI TR-106439. Additionally, in its response, AREVA NP did not provide the specific critical characteristics. The NRC staff SE of TR-106439 stated that applicants referencing TR-106439 need to provide specific critical characteristics. Additional information is requested which provides the specific critical characteristics.

DRAFT

Response to Question 07.01-31:

In U.S. EPR FSAR, Revision 2, the qualified display system (QDS) is safety-related and is used extensively for monitoring and controlling the safety information and control system (SICS).

The Response to RAI 442, Question 07.01.26, which was submitted to the NRC on March 21, 2011 and provided U.S. EPR FSAR Tier 2, Section 7.1, presents a revised I&C architecture which included a new SICS design that is predominately hardwired instrumentation and controls (I&C) with limited QDS use. Specifically, the indications required on the SICS are provided with a dedicated hardwired indicator, and only those parameters that are important to provide situational awareness to the operator are provided on the QDS (in addition to the hardwired indicator).

On March 15, 2011, NRC staff indicated that the trending requirements in IEEE 497-2002 Clause 8.2 may be met with non-safety-related equipment since any PAM variables required for trending are also displayed on a hardwired indicator designed to the necessary qualification requirements.

As a result, AREVA NP will downgrade the QDS to non-safety-related, and a QDS will not be qualified as safety-related through a commercial dedication process. U.S. EPR FSAR Tier 1, Section 2.4.2 and Tier 2, Sections 3.2, 3.11, 7.1, and 7.5 will be revised to downgrade the QDS to non-safety-related.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.4.2 and Tier 2, Sections 3.2, 3.11, 7.1, and 7.5 will be revised as described in the response and indicated on the enclosed markup.

DRAFT

U.S. EPR Final Safety Analysis Report Markups

DRAFT

2.4.2 Safety Information and Control System

1.0 Description

07.01-31

The safety information and control system (SICS) provides the human-machine interface (HMI) means to perform control and information functions needed to monitor the plant safety status and bring the unit to and maintain it in a safe shutdown state ~~in case of the inoperability of the process information and control system (PICS)~~.

~~In case of the unavailability of the PICS, the~~ The SICS provides the following safety-related functions:

- Manual actuation of reactor trip in the main control room (MCR) and remote shutdown station (RSS).
- Manual component-level actuation of safety-related actuators (MCR only).
- Manual system-level actuation of engineered safety features (MCR only).
- Monitoring and control of systems required to achieve and maintain safe shutdown (MCR).
- Display of Type A through Type C post-accident monitoring variables (MCR only).

2.0 Arrangement

2.1 SICS equipment is located as listed in Table 2.4.2-1—Safety Information and Control System Equipment.

2.2 Deleted.~~Physical separation exists between the four Class 1E panel interface divisions of the SICS~~.

2.3 Deleted.~~Physical separation exists between the four Class 1E QDS divisions of the SICS.~~

2.4 Physical separation exists between Class 1E SICS equipment and non-Class 1E equipment.

3.0 Mechanical Design Features

3.1 Equipment identified as Seismic Category I in Table 2.4.2-1 can withstand seismic design basis loads without loss of safety function.

4.0 I&C Design Features, Displays and Controls

4.1 The capability to transfer control of the SICS from the MCR to the RSS exists in a fire area separate from the MCR. The transfer switches are each associated with a single division of the safety-related control and allow transfer of control without entry into the MCR.

4.2 Deleted.

DRAFT

4.3 Electrical isolation is provided on connections between the safety-related parts of the SICS and non-Class 1E equipment.

4.4 Class 1E SICS equipment can perform its safety function when subjected to electromagnetic interference (EMI), radio-frequency interference (RFI), electrostatic discharges (ESD), and power surges.

07.01-31

4.5 Deleted.~~The SICS system design and application software are developed using a process composed of six life cycle phases with each phase having outputs which must conform to the requirements of that phase. The six life cycle phases are the following:~~

~~1.Basic Design Phase.~~

~~1.Detailed Design Phase.~~

~~2.Manufacturing Phase.~~

~~3.System Integration and Testing phase.~~

~~4.Installation and Commissioning Phase.~~

~~5.Final Documentation Phase.~~

4.6 Electrical isolation is provided on connections between the RSS and the MCR for the SICS.

4.7 Deleted.~~Electrical isolation is provided on connections between the four SICS divisions.~~

4.8 Deleted.~~Communications independence is provided between the four SICS divisions.~~

4.9 Deleted.~~Communications independence is provided between SICS equipment and non-Class 1E equipment~~.

4.10 The SICS is designed so that safety-related functions required for an anticipated operational occurrence (AOO) or postulated accident (PA) ~~design basis events (DBE)~~ are performed in the presence of the following:

- Single detectable failures within the SICS ~~concurrent with identifiable but non-detectable failures~~.
- Failures caused by the single failure.
- Failures and spurious system actions that cause or are caused by the AOO or PA ~~DBE~~ requiring the safety function.

4.11 Deleted.~~The equipment for each SICS division is distinctly identified and distinguishable from other identifying markings placed on the equipment, and the identifications do not require frequent use of reference material.~~

4.12 Deleted.~~Locking mechanisms are provided on the SICS cabinet doors located outside of the MCR. Opened SICS cabinet doors are indicated in the MCR~~.

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4.13 Deleted.~~Key lock switches on the QDS restrict connections between the QDS and the QDS service unit.~~

4.14 Deleted.~~The SICS is capable of performing its safety function when one of the SICS divisions is out of service. Out of service divisions of SICS are indicated in the MCR.~~

4.15 Deleted.~~The SICS PI hardware and system software are designed to conform to the key TELEPERM XS principles, features, and quality methods.~~

4.16 Deleted.~~The SICS QDS hardware and system software are evaluated and accepted for use in safety-related applications through a commercial grade dedication process.~~

5.0 Electrical Power Design Features

5.1 Class 1E SICS components are powered from a Class 1E division in a normal or alternate feed condition.

6.0 System Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.4.2-2 lists the SICS ITAAC.

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Table 2.4.2-1—Safety Information and Control System Equipment (2 Sheets)

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Description	Tag Number (1)	Location	Seismic Category	IEEE Class 1E (2)
~~SICS PI Cabinets, Division 1~~	~~30CWY1~~	~~Safeguard Building 1~~	~~I~~	~~1^N~~ ~~2^A~~
~~SICS PI Cabinets, Division 2~~	~~30CWY2~~	~~Safeguard Building 2~~	~~I~~	~~2^N~~ ~~1^A~~
~~SICS PI Cabinets, Division 3~~	~~30CWY3~~	~~Safeguard Building 3~~	~~I~~	~~3^N~~ ~~4^A~~
~~SICS PI Cabinets, Division 4~~	~~30CWY4~~	~~Safeguard Building 4~~	~~I~~	~~4^N~~ ~~3^A~~
~~SICS QDS Units MCR for safety-related I&C functions, Division 1~~	~~N/A~~	~~MCR~~	~~I~~	~~1^N~~ ~~2^A~~
~~SICS QDS Units MCR for safety-related I&C functions, Division 2~~	~~N/A~~	~~MCR~~	~~I~~	~~2^N~~ ~~1^A~~
~~SICS QDS Units MCR for safety-related I&C functions, Division 3~~	~~N/A~~	~~MCR~~	~~I~~	~~3^N~~ ~~4^A~~
~~SICS QDS Units MCR for safety-related I&C functions, Division 4~~	~~N/A~~	~~MCR~~	~~I~~	~~4^N~~ ~~3^A~~
~~SICS QDS Units MCR for non-safety-related I&C functions~~	~~N/A~~	~~MCR~~	~~N/A~~	~~N/A~~
~~SICS QDS Units RSS, Division 1~~	~~N/A~~	~~RSS~~	~~I~~	~~1^N~~ ~~2^A~~
~~SICS QDS Units RSS, Division 2~~	~~N/A~~	~~RSS~~	~~I~~	~~2^N~~ ~~1^A~~
~~SICS QDS Units RSS, Division 3~~	~~N/A~~	~~RSS~~	~~I~~	~~3^N~~ ~~4^A~~
~~SICS QDS Units RSS, Division 4~~	~~N/A~~	~~RSS~~	~~I~~	~~4^N~~ ~~3^A~~
Hardwired (Conventional) I&C, Division 1	N/A	MCR, RSS	I	1^N 2^A
Hardwired (Conventional) I&C, Division 2	N/A	MCR, RSS	I	2^N 1^A
Hardwired (Conventional) I&C, Division 3	N/A	MCR, RSS	I	3^N 4^A

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
2.1	SICS equipment is located as listed in Table 2.4.2-1.	Inspection will be performed of the location of the SICS equipment.	The SICS equipment listed in Table 2.4.2-1 is located as listed in Table 2.4.2-1.
2.2	Deleted.~~Physical separation exists between the four Class 1E panel interface divisions of the SICS.~~	Deleted.~~Inspections will be performed to verify that the divisions of Class 1E panel interface cabinets are located in separate Safeguard Buildings.~~	Deleted.~~The four divisions of Class 1E panel interface cabinets are located in separate Safeguard Buildings as listed in Table 2.4.2-1.~~
2.3	Deleted.~~Physical separation exists between the four Class 1E QDS divisions of the SICS.~~	Deleted.~~a. Design analyses will be performed to determine the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between the four Class 1E QDS divisions of the SICS.~~ Deleted.~~b. Inspections will be performed to verify that the required safety-related structures, separation distance, barriers, or any combination thereof exist between the divisions of Class 1E QDS equipment.~~	Deleted.~~a. A report exists and defines the required safety-related structures, separation distance, barriers, or any combination thereof to achieve adequate physical separation between the four Class 1E QDS divisions of the SICS.~~ Deleted.~~b. The required safety-related structures, separation distance, barriers, or any combination thereof exist between the divisions of Class 1E QDS equipment. Reconciliation is performed of any deviations to the design.~~

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		c. Inspections will be performed on connections between the safety-related parts of the SICS and non-Class 1E equipment.	c. Class 1E electrical isolation devices exist on connections between the safety-related parts of the SICS and non-Class 1E equipment.
4.4	Class 1E SICS equipment can perform its safety function when subjected to EMI, RFI, ESD, and power surges.	Type tests or type tests and analysis of these will be performed for the Class 1E equipment listed in Table 2.4.1-1.	A report exists and concludes that the equipment identified as Class 1E in Table 2.4.2-1 can perform its safety function when subjected to EMI, RFI, ESD, and power surges.
4.5	Deleted.~~The SICS system design and application software are developed using a process composed of six life cycle phases, with each phase having outputs which must conform to the requirements of that phase. The six life cycle phases are the following:~~ ~~1) Basic Design Phase.~~ ~~2) Detailed Design Phase.~~ ~~3) Manufacturing Phase.~~ ~~4) System Integration and Testing Phase~~ ~~5) Installation and Commissioning Phase.~~ ~~6) Final Documentation Phase.~~	Deleted.~~a. Analyses will be performed to verify that the outputs for the SICS basic design phase conform to the requirements of that phase. {{DAC}}~~ ~~b. Analyses will be performed to verify that the outputs for the SICS detailed design phase conform to the requirements of that phase. {{DAC}}~~ ~~c. Analyses will be performed to verify that the outputs for the SICS manufacturing phase conform to the requirements of that phase.~~ ~~d. Analyses will be performed to verify that the outputs for the SICS system integration and testing phase conform to the requirements of that phase.~~ ~~e. Analyses will be performed to verify that the outputs for the SICS installation and commissioning phase conform to the requirements of that phase..~~	Deleted.~~a. A report exists and concludes that the outputs conform requirements of the basic design phase of the SICS. {{DAC}}~~ ~~b. A report exists and concludes that the outputs conform to requirements of the detailed design phase of the SICS. {{DAC}}~~ ~~c. A report exists and concludes that the outputs conform to the requirements of the manufacturing phase of the SICS.~~ ~~d. A report exists and concludes that the outputs conform to the requirements of the system integration and testing phase of the SICS.~~ ~~e. A report exists and concludes that the outputs conform to the requirements of the installation and commissioning phase of the SICS.~~

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
		~~f. Analyses will be performed to verify that the outputs for the SICS final documentation phase conform to the requirements of that phase.~~	~~f. A report exists and concludes that the outputs conform to the requirements of the final documentation phase of the SICS.~~
4.6	Electrical isolation is provided on connections between the RSS and the MCR for the SICS.	a. Analyses will be performed to determine the test specification for electrical isolation devices on connections between the RSS and the MCR for the SICS. b. Type tests, analyses, or a combination of type tests and analyses will be performed on the electrical isolation devices between the RSS and the MCR for the SICS. c. Inspections will be performed on connections between the RSS and the MCR for the SICS.	a. A test plan exists that provides the test specification for determining whether a device is capable of preventing the propagation of credible electrical faults on connections between the RSS and the MCR for the SICS. b. A report exists and concludes that the Class 1E isolation devices used between the RSS and the MCR for the SICS prevent the propagation of credible electrical faults. c. Class 1E electrical isolation devices exist on connections between the RSS and the MCR for the SICS.
4.7	Deleted.~~Electrical isolation is provided on connections between the four SICS divisions.~~	Deleted.~~a. Analyses will be performed to determine the test specification for electrical isolation devices on connections between the four SICS divisions.~~	Deleted.~~a. A test plan exists that provides the test specification for determining whether a device is capable of preventing the propagation of credible electrical faults on connections between the four SICS divisions.~~

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
		~~b. Type tests, analyses, or a combination of type tests and analyses will be performed on the electrical isolation devices between the four SICS divisions.~~ ~~c. Inspections will be performed on connections between the four SICS divisions.~~	~~b. A report exists and concludes that the Class 1E isolation devices used between the four SICS divisions prevent the propagation of credible electrical faults.~~ ~~c. Class 1E electrical isolation devices exist on connections between the four SICS divisions.~~
4.8	Deleted.~~Communications independence is provided between the four SICS divisions.~~	Deleted.~~Tests, analyses, or a combination of tests and analyses will be performed on the SICS equipment.~~	Deleted.~~A report exists and concludes that:~~ ~~•The SICS function processors do not interface directly with a network. Separate communication processors interface directly with the network.~~ ~~•Separate send and receive data channels are used in both the communications processor and the SICS function processor.~~ ~~•The SICS function processors operate in a strictly cyclic manner.~~ • ~~The SICS function processors operate asynchronously from the SICS communications processors.~~
4.9	Deleted.~~Communications independence is provided between SICS equipment and non-Class 1E equipment.~~	Deleted.~~Tests, analyses, or a combination of tests and analyses will be performed on the SICS equipment.~~	Deleted.~~A report exists and concludes that communications independence is provided between SICS equipment and non-Class 1E equipment.~~

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.10	The SICS is designed so that safety-related functions required for an AOO or PA ~~DBE~~ are performed in the presence of the following: • Single detectable failures within the SICS ~~concurrent with identifiable but non-detectable failures~~. • Failures caused by the single failure. • Failures and spurious system actions that cause or are caused by the AOO or PA ~~DBE~~ requiring the safety function.	A failure modes and effects analysis will be performed on the SICS at the level of replaceable modules and components.	A report exists and concludes that the SICS is designed so that safety-related functions required for an AOO or PA ~~DBE~~ are performed in the presence of the following: • Single detectable failures within the SICS ~~concurrent with identifiable but non-detectable failures~~. • Failures caused by the single failure. • Failures and spurious system actions that cause or are caused by the AOO or PA ~~DBE~~ requiring the safety function.
4.11	Deleted.~~The equipment for each SICS division is distinctly identified and distinguishable from other identifying markings placed on the equipment, and the identifications do not require frequent use of reference material.~~	Deleted.~~Inspections will be performed on the SICS equipment to verify that the equipment for each SICS division is distinctly identified and distinguishable from other markings placed on the equipment and that the identifications do not require frequent use of reference material.~~	Deleted.~~The equipment for each SICS division is distinctly identified and distinguishable from other identifying markings placed on the equipment, and the identifications do not require frequent use of reference material.~~
4.12	Deleted.~~Locking mechanisms are provided on the SICS cabinet doors located outside of the MCR. Opened SICS cabinet doors are indicated in the MCR.~~	Deleted.~~a. Inspections will be performed to verify the existence locking mechanisms on the SICS cabinet doors located outside the MCR.~~ ~~b. Tests will be performed to verify the proper operation of the locking mechanisms on the SICS cabinet doors located outside of the MCR.~~	Deleted.~~a. Locking mechanisms exist on the SICS cabinet doors located outside of the MCR.~~ ~~b. The locking mechanisms on the SICS cabinet doors located outside of the MCR operate properly.~~

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
		~~c. Tests and inspections will be performed to verify an indication exists in the MCR when a SICS cabinet door located outside of the MCR is in the open position.~~	~~c. Opened SICS cabinet doors located outside of the MCR are indicated in the MCR.~~
4.13	Deleted.~~Key lock switches on the QDS restrict connections between the QDS and the QDS service unit.~~	Deleted.~~Tests will be performed to verify that the key lock switches on the QDS restrict modifications to the SICS software.~~	Deleted.~~Key lock switches on the QDS restrict modifications to the SICS software.~~
4.14	Deleted.~~The SICS is capable of performing its safety function when one of the SICS divisions is out of service. Out of service divisions of SICS are indicated in the MCR.~~	Deleted.~~a. A test of the SICS will be performed to verify the SICS can perform its safety function when one of the SICS divisions is out of service.~~ ~~b. Inspections will be performed to verify the existence of indications in the MCR when a SICS division is placed out of service.~~	Deleted.~~a. The SICS can perform its safety functions when one of the SICS divisions is out of service.~~ ~~b. Out of service divisions of SICS are indicated in the MCR.~~
4.15	Deleted.~~The SICS PI hardware and system software are designed to conform to the key TELEPERM XS principles, features, and quality methods.~~ ~~{{DAC}}~~	Deleted.~~A TELEPERM XS platform changes analysis will be performed on the SICS hardware and system software to verify its conformance to the key TELEPERM XS principles, features, and quality methods.~~ ~~{{DAC}}~~	Deleted.~~A report exists and concludes that the SICS PI hardware modules and system software modules:~~ ~~a. Conform to the key TELEPERM XS design principles.~~ ~~{{DAC}}~~ ~~b. Conform to the key TELEPERM XS processing features.~~ ~~{{DAC}}~~ ~~c. Conform to the key TELEPERM XS communication independence features.~~ ~~{{DAC}}~~

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
			~~d. Do not introduce more than a minimal increase in the likelihood of occurrence of a software malfunction relative to predecessor modules. {{DAC}}~~ ~~e. Do not introduce more than a minimal increase in the consequences of a malfunction relative to predecessor modules. {{DAC}}~~ ~~f. Do not create the possibility for a malfunction with a different result relative to predecessor modules. {{DAC}}~~ ~~g. Were developed according to procedures that do not result in a reduction in the TELEPERM XS quality methods. {{DAC}}~~

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Table 2.4.2-2—Safety Information and Control System ITAAC (10 Sheets)

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	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.16	Deleted.~~The SICS QDS hardware and system software are evaluated and accepted for use in safety related applications through a commercial grade dedication process.~~	Deleted.~~a. Analyses will be performed to determine the critical characteristics of the QDS. {{DAC}}~~ ~~b. Analyses will be performed to determine a combination of special tests, surveys, source verifications, or performance record reviews that is sufficient to demonstrate that the QDS exhibits the required critical characteristics. {{DAC}}~~ ~~c. Inspections, tests, analyses or a combination thereof will be performed to demonstrate that the QDS exhibits the required critical characteristics.~~	Deleted.~~a. A report exists and defines the critical characteristics for acceptance of the QDS. {{DAC}}~~ ~~b. A dedication acceptance plan exists and defines a combination of special tests, surveys, source verifications, or performance reviews that is sufficient to demonstrate that the QDS exhibits the required critical characteristics. {{DAC}}~~ ~~c. A dedication acceptance package exists and documents results of special tests, surveys, source verifications, or performance reviews that demonstrate the QDS exhibits the required critical characteristics.~~
5.1	Class 1E SICS components are powered from a Class 1E division in a normal or alternate feed condition.	a. Testing will be performed for components identified as Class 1E in Table 2.4.2-1 by providing a test signal in each normally aligned division. b. Testing will be performed for components identified as Class 1E in Table 2.4.2-1 by providing a test signal in each division with the alternate feed aligned to the divisional pair.	a. The test signal provided in the normally aligned division is present at the respective Class 1E components identified in Table 2.4.2-1. b. The test signal provided in each division with the alternate feed aligned to the divisional pair is present at the respective Class 1E components identified in Table 2.4.2-1.

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Table 3.2.2-1—Classification Summary
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KKS System or Component Code	SSC Description	Safety Classification (Note 15)	Quality Group Classification	Seismic Category (Note 16)	10 CFR 50 Appendix B Program (Note 5)	Location (Note 17)	Comments/ Commercial Code
CWY	**Safety Information & Control System**						
~~CWY~~	~~SICS Cabinets~~	~~S~~	~~N/A~~	~~I~~	~~Yes~~	~~UJK~~	
~~CWY~~	~~SICS QDS for Safety Related I&C Functions~~	~~S~~	~~N/A~~	~~I~~	~~Yes~~	~~2UJK, 3UJK~~	07.01-31
CWY	~~SICS QDS for Non Safety Related I&C Functions~~SICS QDS	NS-AQ	N/A	II	Yes	2UJK	
CWY	Hardwire (Conventional) I&C for Safety Related I&C Functions	S	N/A	I	Yes	2UJK, 3UJK	
CWY	Hardwire (Conventional) I&C for Non-Safety Related I&C Functions	NS-AQ	N/A	II	Yes	2UJK	
CWY	Type A, B, C Post-accident Monitoring Instrumentation	S	N/A	I	Yes	2UJK	
JKR	**Reactor Pressure Vessel Level Measurement System**						
JKR	Portion of Guide Tube Only	S	N/A	I	Yes	UJA	

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Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment (Sheet 88 of 131)

Name Tag (Equipment Description)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)	Safety Class (Note 4)	EQ Program Designation (Note 5)
PS Cabinets Division 4	30CLH	34UJK18025	M	M	RT ES PAM SI	S 1E EMC	Y (5) Y (6)
Safety Automation System (SAS)							
SAS Cabinets Division 1	30DRA1	31UJK18025	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
SAS Cabinets Division 2	30DRA2	32UJK18004	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
SAS Cabinets Division 3	30DRA3	33UJK18004	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
SAS Cabinets Division 4	30DRA4	34UJK18025	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
Diverse Actuation System (DAS)							
DAS Cabinets Division 1	30CME51	31UJK18025	M	M	SII	NS-AQ EMC	Y (5) Y (6)
DAS Cabinets Division 2	30CMF51	32UJK18004	M	M	SII	NS-AQ EMC	Y (5) Y (6)
DAS Cabinets Division 3	30CMG51	33UJK18004	M	M	SII	NS-AQ EMC	Y (5) Y (6)
DAS Cabinets Division 4	30CMH51	34UJK18025	M	M	SII	NS-AQ EMC	Y (5) Y (6)
Priority & Actuator Control System (PACS)							
PACS Cabinets Division 1	30CLE6	31UJK18025	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
PACS Cabinets Division 2	30CLF6	32UJK18004	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
PACS Cabinets Division 3	30CLG6	33UJK18004	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
PACS Cabinets Division 4	30CLH6	34UJK18025	M	M	ES PAM SI	S 1E EMC	Y (5) Y (6)
Signal Conditioning and Distribution System (SCDS)							
SCDS Cabinets Division 1	30CLE51	31UJK18025	M	M	RT ES PAM SI	S 1E EMC	Y (5) Y (6)
SCDS Cabinets Division 2	30CLF51	32UJK18004	M	M	RT ES PAM SI	S 1E EMC	Y (5) Y (6)
SCDS Cabinets Division 3	30CLG51	33UJK18004	M	M	RT ES PAM SI	S 1E EMC	Y (5) Y (6)
SCDS Cabinets Division 4	30CLH51	34UJK18025	M	M	RT ES PAM SI	S 1E EMC	Y (5) Y (6)
SCDS Cabinets Division 1	30CLE52	31UJK18025	M	M	PAM SI	NS-AQ EMC	Y (5) Y (6)
SCDS Cabinets Division 2	30CLF52	32UJK18004	M	M	PAM SI	NS-AQ EMC	Y (5) Y (6)
SCDS Cabinets Division 3	30CLG52	33UJK18004	M	M	PAM SI	NS-AQ EMC	Y (5) Y (6)
SCDS Cabinets Division 4	30CLH52	34UJK18025	M	M	PAM SI	NS-AQ EMC	Y (5) Y (6)
Safety Information & Control System (SICS)							
~~SICS Cabinets Division 1~~	~~30CWY1~~	~~31UJK18025~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~
~~SICS Cabinets Division 2~~	~~30CWY2~~	~~32UJK18004~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~
~~SICS Cabinets Division 3~~	~~30CWY3~~	~~33UJK18004~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~

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Table 3.11-1—List of Environmentally Qualified Electrical/I&C Equipment (Sheet 89 of 131)

Name Tag (Equipment Description)	Tag Number	Local Area KKS ID (Room Location)	EQ Environment (Note 1)	Radiation Environment Zone (Note 2)	EQ Designated Function (Note 3)	Safety Class (Note 4)	EQ Program Designation (Note 5)
~~SICS Cabinets Division 4~~	~~30CWY4~~	~~34UJK18025~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~
~~SICS Cabinets MCR~~	~~N/A~~	~~32UJK26030~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~
~~SICS Cabinets RSS~~	~~N/A~~	~~33UJK22030~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~
~~SICS QDS Units MCR~~	~~N/A~~	~~32UJK26030~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~
SICS QDS Units MCR	N/A	32UJK26030	M	M	SII	NS-AQ EMC	Y(5) Y(6)
~~SICS QDS Units RSS~~	~~N/A~~	~~33UJK22030~~	~~M~~	~~M~~	~~ES PAM SI~~	~~S 1E EMC~~	~~Y (5) Y (6)~~
Reactor Trip Button Division 1	30JRE00CH100	32UJK26030	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Reactor Trip Button Division 2	30JRF00CH100	32UJK26030	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Reactor Trip Button Division 3	30JRG00CH100	32UJK26030	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Reactor Trip Button Division 4	30JRH00CH100	32UJK26030	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation System (ICIS)							
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 1	30CLE12GH001	31UJK18025	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 1	30CLE15GH	31UJK18025	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 2	30CLF12GH002	32UJK18004	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 2	30CLF15GH	32UJK18004	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 3	30CLG12GH003	33UJK18004	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 3	30CLG15GH	33UJK18004	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 4	30CLH12GH004	34UJK18025	M	M	RT SI	S 1E EMC	Y (5) Y (6)
Incore Instrumentation ~~SPND~~ Conditioning Cabinet Division 4	30CLH15GH	34UJK18025	M	M	RT SI	S 1E EMC	Y (5) Y (6)
AMS Computer Cabinet	30CNC01GH004	32UJK26002	M	M	SI	S 1E EMC	Y (5) Y (6)
AMS Control Cabinet	30CNN01GH001	30UJA23042	H	H	SI	S 1E EMC	Y (1) Y (5)
AMS Load Cabinet	30CNN02GH002	30UJA23042	H	H	SI	S 1E EMC	Y (1) Y (5)
AMS Instrumentation Cabinet	30CNN03GH003	30UJA23041	H	H	SI	S 1E EMC	Y (1) Y (5)
Coordinate in Core: P16	30JKQ11BZ501	30UJA11001	H	H	SI	S 1E EMC	Y (1) Y (5)
Coordinate in Core: T7	30JKQ12BZ502	30UJA11001	H	H	SI	S 1E EMC	Y (1) Y (5)
Coordinate in Core: S4	30JKQ13BZ503	30UJA11001	H	H	SI	S 1E EMC	Y (1) Y (5)

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- The diverse reactor trip functions are described in Section 7.8.
- The diverse ESF actuation functions are described in Section 7.8.
- The process indications are described in Chapters 5, 6, 8, 9, 10, and 11.
- The post-accident monitoring (PAM) indications are described in Section 7.5.
- The severe accident indications are described in Chapter 19.
- The alarms are described in Section 7.5.

Other I&C systems in the plant include dedicated systems for specific functions, such as acquisition and processing of neutron flux measurements. Section 7.1.1.5 describes these systems.

I&C equipment is also contained in mechanical and electrical systems. This equipment includes instrumentation and black boxes for packaged equipment, such as emergency diesel generators (EDGs). I&C equipment contained in mechanical and electrical systems are described in Chapters 5, 6, 8, 9, 10, and 11.

~~The U.S. EPR I&C architecture is represented in Figure 7.1-2—U.S. EPR I&C ArchitectureDistributed Control System Functional Architecture. The overall I&C architecture is categorized into four levels:~~

- ~~Level 3: business management systems—These consist of plant information management systems. Other than interfaces provided from Level 2, these systems are not within the scope of this document and are not shown on Figure 7.1-2.~~
- ~~Level 2: unit supervision and control—These I&C systems are provided as an interface between the operator and the automation systems. Typical functions include monitoring plant processes and manual control of plant components.~~
- ~~Level 1: system automation—These I&C systems acquire and process sensor information to perform automatic system control functions and transmit information for display to the operator. These systems also process manual commands to operate plant equipment.~~

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- ~~Level 0: process interface—These I&C systems act as the coupling between the physical process and the I&C systems. They include sensing components, actuation devices, and actuated equipment such as pressure sensors, thermocouples, switchgear, pumps and valves.~~

7.1.1.2 Use of TELEPERM XS ~~and Qualified Display System~~ in the U.S. EPR

TELEPERM XS (TXS) is a digital I&C platform that has been specifically designed and qualified for use in nuclear safety-related applications.

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~~The qualified display system (QDS) is a digital human machine interface (HMI) that is qualified for use in safety-related applications through a commercial grade dedication process.~~

7.1.1.2.1 TXS Platform Design

The TXS platform is described in the Reactor Protection System Topical Report (EMF-2110(NP)(A) (Reference 3). Because of advances in technology and rapid obsolescence of components, the various modules described in ~~EMF-2110(NP)(A) (~~Reference 3~~)~~ will be modified and upgraded over time, and new modules will be developed. The design and qualification of new or upgraded TXS hardware and system software used in U.S. EPR plants will be performed consistent with the methods described in Reference 3.

~~The aspects of the TXS platform discussed in EMF-2110(NP)(A) can be classified in three broad categories:~~

1. ~~Hardware design and qualification.~~
2. ~~System software design and qualification.~~
3. ~~Various configurations and arrangements of hardware and software to form a project-specific system architecture.~~

~~Modified, upgraded or new TXS hardware modules and system software modules will be used in the U.S. EPR without further NRC review provided they conform to the key TXS principles, features, and methods described in EMF-2110(NP)(A) and identified in ANP-10272. The U.S. EPR FSAR Tier 1, Chapter 2 sections for the PS, and SAS contain commitments that those systems' "hardware modules and system software modules conform to the key TELEPERM XS principles, features and quality methods." The criteria and evaluation process specified in TELEPERM XS Software Program Manual (ANP-10272) (Reference 8) Sections 4.1.1 through 4.1.4 is used to satisfy these Tier 1 commitments by determining that modified, upgraded or new hardware modules and system software modules conform to the key TXS principles, features, and methods.~~

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~~7.1.1.2.2 QDS Platform Design~~

~~The QDS was not included in the scope of EMF-2110NP(A), but is designed to interface with the standard TXS hardware and system software. The QDS hardware and system software are different from the standard TXS platform because the QDS performs video display functionality as opposed to system automation functionality. The QDS is qualified for use in safety-related applications through a commercial grade dedication process that conforms to the guidance of EPRI TR-106439, "Guidance on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications" (Reference 40).~~

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~~The U.S. EPR-specific I&C system architectures that will be implemented using the TXS and QDS platforms are described in Section 7.1 for NRC review against the current regulations and guidance. The U.S EPR-specific system architectures supersede the example system architectures that were included in EMF-2110(NP)(A) to provide context for the review of the generic TXS platform.~~

7.1.1.2.2 Application of the TXS ~~and QDS~~ Platform~~s~~

TELEPERM XS Software Topical Report (ANP-10272) (Reference 5) describes the lifecycle processes for application software development used in safety-related applications of the TXS ~~and QDS~~ platform~~s~~ for the U.S. EPR, as well as software V&V processes. These phases are listed below along with the primary activities included in each phase:

- Basic design:
  - System requirements.
  - System design.
  - Software requirements.
  - Initiate software requirements traceability.
  - Summary reports for V&V activities (i.e., acquisition support, planning, concept, and requirements).
- Detailed design:
  - Software design.
  - Automatic code generation.
  - Application software integration validation test planning (using an NRC-approved simulation test tool).
  - Application software integration validation test execution (using an NRC-approved simulation test tool).
  - Application software integration validation test reporting (using an NRC-approved simulation test tool).
  - Software safety analyses.
  - Continue software requirements traceability.
  - Hardware design.
  - Summary reports for V&V activities (i.e., design and implementation.

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- Manufacturing:
  - Hardware manufacturing.
  - Approval of supplier manufactured, tested hardware, and required supplier hardware documentation.
  - Cabinet design.
  - Cabinet internal wiring design.
- System integration and testing:
  - Integration of hardware and software.
  - Software integration, system and acceptance validation test planning.
  - Software integration, system and acceptance validation test execution.
  - Software integration, system and acceptance validation test reporting.
  - Continue software requirements traceability.
  - Summary reports for V&V activities.
- Installation and commissioning:
  - Installation and commissioning test planning.
  - Installation and commissioning test execution.
  - Installation and commissioning test reporting.
  - Summary reports for V&V activities.
- Final Documentation:
  - Generation of final documentation before system is placed in service.

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The primary documentation generated as outputs of each of these phases is described in ANP-10272 (Reference 5), Section 4.5. ~~While the development of the QDS application software is performed in accordance with the lifecycle and configuration controls defined in ANP-10272 for the standard TXS platform, there is one difference: the development tools to create the application software (i.e., SPACE) described in ANP-10272 are not used to create QDS application software. The QDS-specific tools are qualified as part of the commercial grade dedication process described in Section . Once qualified, these tools will be controlled under configuration management as required by IEEE 7-4.3.2-2003, Section 5.3.2.~~

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The U.S. EPR I&C systems supported by the TXS platform are described in Sections 7.1.1.4.1, 7.1.1.4.2, and 7.1.1.4.5 for review against NRC regulations and guidance. The U.S. EPR-specific system architectures supersede the example system architectures that were included in EMF-2110(NP)(A) to provide context for the review of the generic TXS platform.

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7.1.1.2.3 Reliability of Communications with the TXS Platform in the U.S EPR

The safety-related I&C systems use proprietary, time-triggered operating systems that do not rely on hardware and interrupt only on cyclic processing of the software. Because there are no process-driven interrupts, every operation is cyclic and predictive, which verifies that the output of messages on networks link prevents collision.

The hardware components only read the incoming memory buffer or generate a packet to send only when the operating system generates the order. The cyclic operations of the processing units verify that the operator does not simultaneously perform a reading and writing operation.

The communication process sends information written in memory and writes in memory received information. Packet numbering verifies that information is only processed once and that the information is processed without relying on synchronizing both tasks.

7.1.1.3 ~~Level 2 - Unit Supervision and Control~~DCS HMI Systems

7.1.1.3.1 Safety Information and Control System

The safety information and control system (SICS) is provided as a safety-related HMI. The process information and control system (PICS) is normally used by the operator to monitor and control ~~process~~plant systems, and the SICS is used in the unlikely event that the PICS is not available. ~~The SICS provides control capabilities in both the main control room (MCR) and remote shutdown station (RSS).~~

~~This section describes the SICS with regards to I&C design. Details such as screen displays, levels of automation, and panel layout are designed using the HFE principles described in Chapter 18.~~

Classification

The SICS is classified as safety-related.

Functions

Table 7.1-3 shows ~~T~~the functions of the SICS ~~are specified for the MCR or the RSS~~.

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Interfaces

Table 7.1-4—DCS Interface Matrix shows the interfaces of the SICS.

~~The SICS performs these safety-related functions:~~

- ~~Manual actuation of reactor trip (MCR and RSS).~~
- ~~Manual actuation and control of engineered safety features (ESF) systems for accident mitigation (MCR).~~
- ~~Manual control of systems to achieve and maintain safe shutdown (MCR).~~
- ~~Display of Type A through Type C post-accident monitoring (PAM) variables (MCR).~~

~~The SICS performs these non-safety-related functions:~~

- ~~Monitoring and control of essential non-safety-related systems to achieve and maintain hot-standby on a loss of PICS (MCR).~~
- ~~Monitoring and control of systems to mitigate severe accidents (MCR).~~
- ~~Backup safety parameter display system (SPDS) functions (MCR).~~
- ~~Display high priority alarms (MCR).~~

Architecture

Figure 7.1-2 shows the basic architecture of the SICS.

Figure 7.1-3—Safety Information and Control System Architecture (QDS Portion) shows the QDS architecture.

The SICS provides control capabilities in the main control room (MCR) and limited control capabilities in the remote shutdown station (RSS). At each control location, the inventory of controls and indications is laid out in accordance with relevant electrical separation criteria and the HFE principles described in Chapter 18.

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The controls and indications required to be on the SICS are implemented with dedicated, hardwired I&C. In addition, a subset of plant parameters are duplicated on the non-safety-related QDS for situational awareness. Chapter 18 describes the subset of parameters chosen are selected in accordance with the HFE principles.

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Each QDS receives input from the four divisions of the protection system (PS). Isolation between the PS and the QDS is provided by the PS. The four QDS shown are a nominal number. The final number and placement of the QDS is determined in accordance with the HFE principles described in Chapter 18.

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~~*Non-Safety-Related Portion of SICS*~~

~~Figure 7.1-4—Safety Information and Control System Architecture (Non-Safety-Related PortionDeleted) provides a functional representation of the non-safety-related portion of the SICS.~~

~~These functional units are implemented in the non-safety-related portion of the SICS:~~

- ~~Gateways (GW).~~
- ~~Qualified display systems.~~
- ~~Service units.~~

~~GWs are provided to interface to the plant data network.~~

~~QDSs provided in divisions 2 and 3 to monitor and control other non-safety-related I&C systems via GWs on a loss of PICS.~~

~~QDSs are provided in divisions 1 and 4 to monitor and control equipment dedicated to mitigate severe accidents. These QDS utilize point-to-point data connections to transmit and receive information to the severe accident I&C (SA I&C).~~

~~Hardwired I&C is also provided to monitor and control non-safety-related I&C systems. The human factors principles described in Chapter 18 are used to select the type of HMI used.~~

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~~SUs are provided for configuration and maintenance of the SICS. The PIs are serviced by the SUs of the safety automation system (SAS) via the monitoring and service interface (MSI) of the SAS.~~ The QDSs have dedicated non-safety-related SUs for service and maintenance of the QDS. ~~that are only connected to the QDS when the QDS is out of service. They are normally isolated through a key lock switch.~~ The number and location of SUs is determined based on the number and layout of QDSs.

Equipment

The SICS is implemented with hardwired I&C equipment and~~the TXS digital I&C platform,~~ the QDS platform~~, and hardwired I&C equipment~~. The SICS includes both safety-related and non-safety-related equipment as shown in Figure 7.1-2.

The hardwired I&C consists of conventional HMI devices such as buttons, switches, and digital indicators that are hardwired from the various I&C systems. ~~The PIs utilize the TXS platform and generally consist of subracks, I/O modules, function processors, communication modules, optical link modules, and qualified isolation devices.~~ The QDS consists of a computer, video display with touch screen capabilities, and input devices such as a keyboard and trackball. The non-safety-related QDS is capable of

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trending of information, including post-accident monitoring Type A, B, and C variables, needed to provide situational awareness by the operator. ~~The hardwired I&C consists of conventional HMI devices such as buttons, switches, and analog and digital indicators that are hardwired from the various I&C systems.~~ Fiber optic and copper cable are used for the various data and hardwired connections.

Qualification Requirements

The safety-related equipment used in ~~the safety-related portion of the~~ SICS is qualified for environmental, seismic, electromagnetic interference and radio frequency interference (EMI/RFI) conditions in accordance with the environmental qualification program described in Section 3.11.

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Quality Requirements

Safety-related hardwired I&C will meet the general quality requirements outlined in ANP-10266A. ~~Quality for the TXS platform is described in Section 7.1.1.2.1.~~

~~Quality for the QDS platform is described in Section .~~

~~The application software used in the safety-related portion of the SICS is developed using the lifecycle processes described in Section 7.1.1.2.2.~~

Diversity Requirements

There are no specific diversity requirements for the SICS because the equipment is specified to be hardwired I&C. The QDS is not used in the demonstration of satisfying defense-in-depth and diversity requirements. The use of SICS ~~is credited~~ in the demonstration of defense-in-depth and diversity ~~analysis~~ is described in Section 7.8. ~~Diversity requirements for the SICS are identified in Reference 8. The manual reactor trip actuation is implemented from the SICS using a hardwired path that is not affected by a software common cause failure (CCF) of the SICS or PS.~~

Data Communications

Data communications implemented in the ~~safety-related portion of the~~ SICS include:

- ~~PS-SICS (Control) – bi-directional, point-to-point data connections implemented with the TXS Profibus protocol.~~
- ~~SAS-SICS (Control) – bi-directional, point-to-point data connections implemented with the TXS Profibus protocol.~~
- PS-SICS (~~Monitoring~~QDS) – uni-directional (PS to SICS), point-to-point data connections implemented with the TXS ~~Profibus~~Ethernet protocol.

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The safety systems provide to the PICS their bypassed and inoperable status. This allows the operator to identify the specific bypassed functions and determine the state of actuation logic.

The arrangement of displays and controls shall be determined using the HFE principles described in Chapter 18.

7.1.2.6.20 Control of Access (Clause 5.9)

The safety systems meet the requirements of Clause 5.9 of IEEE Std 603-1998 (Reference 1).

Access to the cabinets of the SICS, PS, SAS, SCDS, and PACS are provided via doors that are normally closed and locked. Door positions are monitored, allowing operators the ability to investigate unexpected opening of cabinet doors. Cabinets are also located in physically separate equipment rooms within the four Safeguard~~s~~ Buildings and can only be accessed by authorized personnel.

Access to software of the digital safety systems is limited to the SU. The SU and the safety systems have multiple features to control access and prevent unauthorized changes to software including:

- Authorized personnel may only access the SU.
- Access to the SU is password protected.
- Access is provided to the safety computers via the MSI.
- The Class 1E MSI, which serves as a communication isolation point between a division of PS or SAS and the SU, prevents unauthorized communication from entering the division and affecting the safety processors.

The computer terminals for the SUs are located in the I&C service center (I&C SC). Additional control of access measures are provided in Reference 3.

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The SICS equipment is located in the MCR and RSS. Both rooms are controlled security areas. ~~Refer to Section 7.1.1 for a description of access controls for the QDS.~~

7.1.2.6.21 Repair (Clause 5.10)

The safety systems meet the requirements of Clause 5.10 of IEEE Std 603-1998 (Reference 1).

Safety systems built upon the TXS platform contain self-diagnostic test features to detect both hardware and software faults and assist in diagnostic and repair activities. Details on the self-test diagnostic capabilities are provided in EMF-2110(NP)(A) (Reference 3).

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Figure 7.1-2—~~U.S. EPR I&C Architecture~~Distributed Control System Functional Architecture

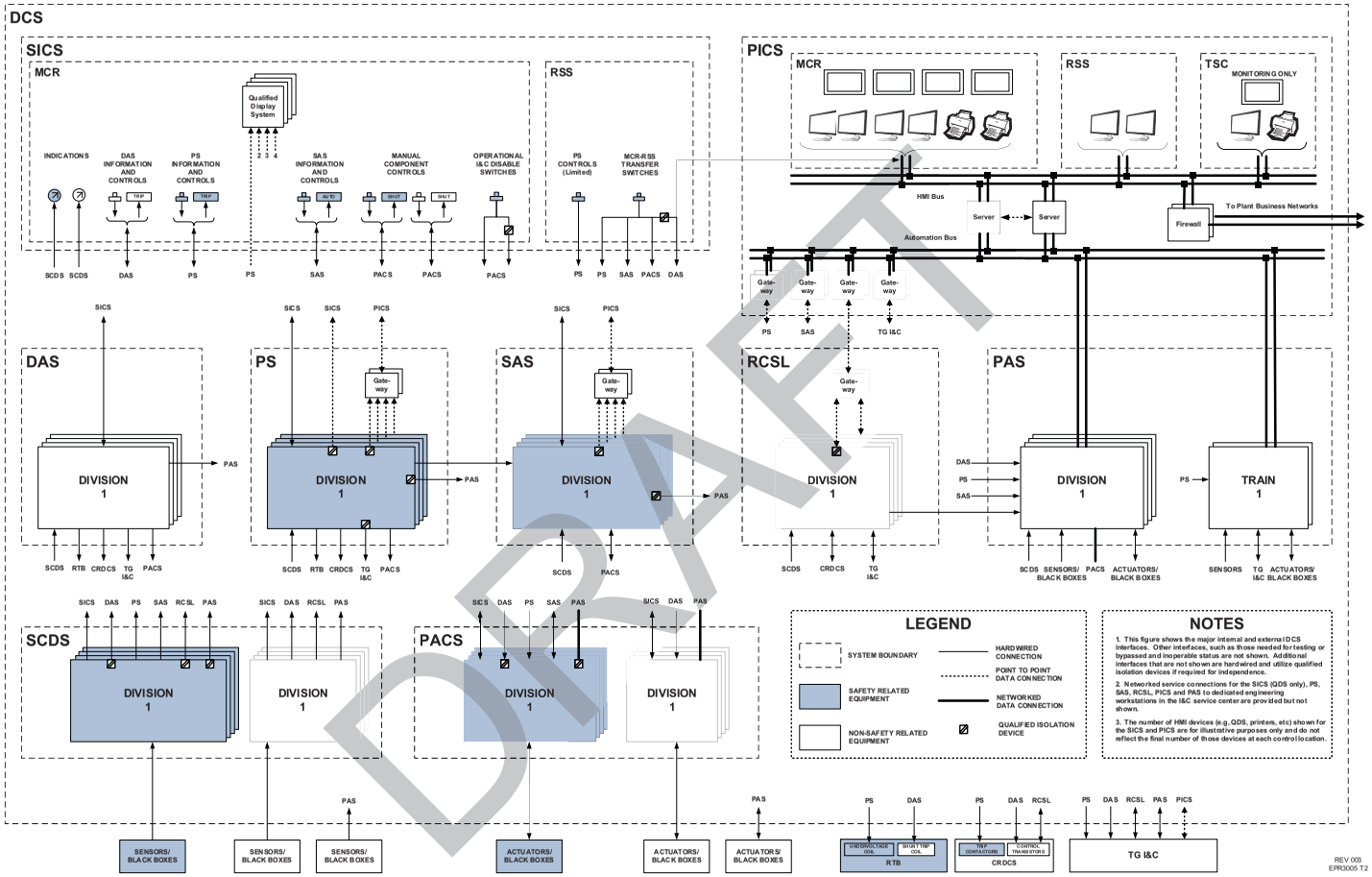

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Figure 7.1-3—Safety Information and Control System Architecture (~~Safety Related Portion~~QDS Portion)

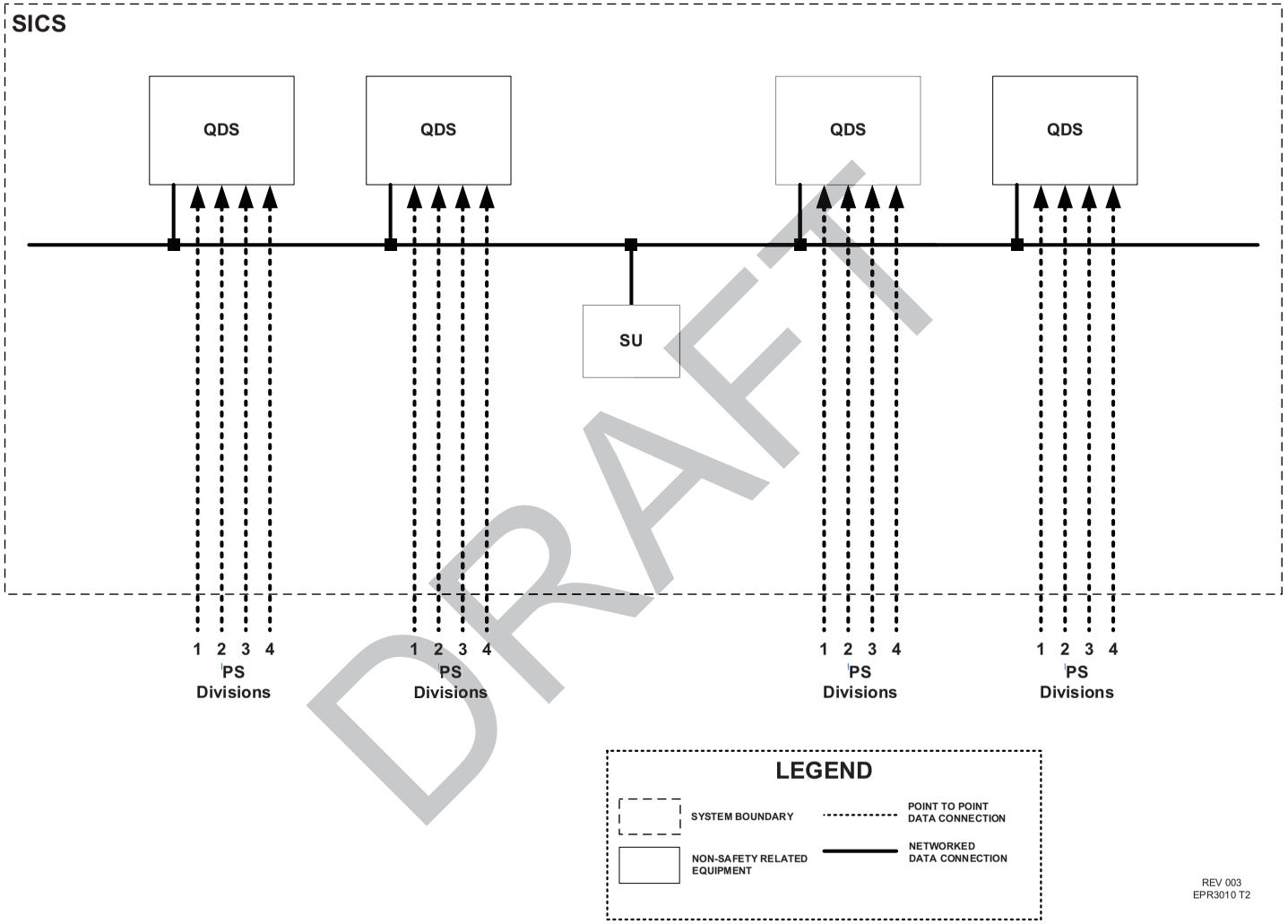

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Figure 7.1-6—Protection System Architecture

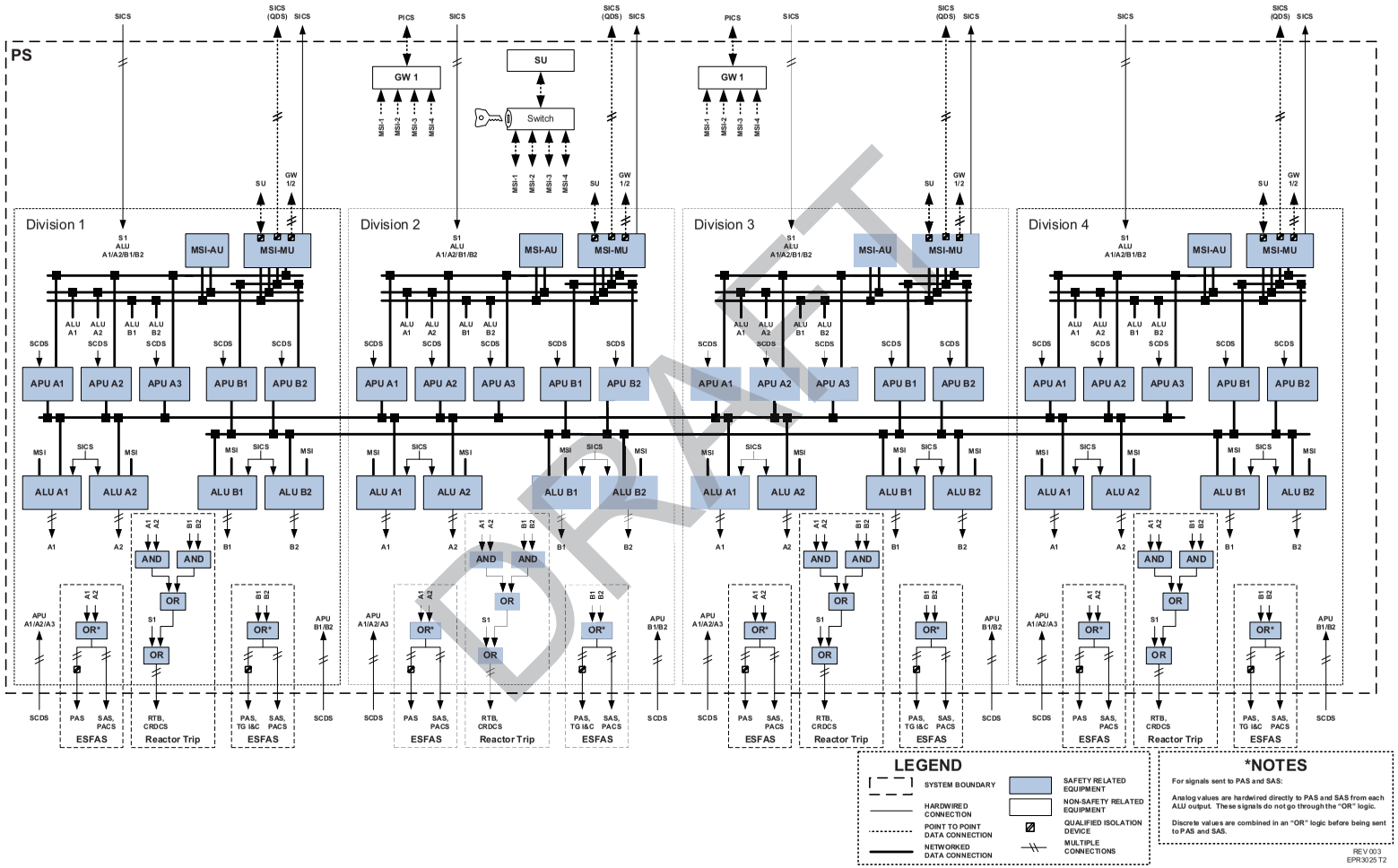

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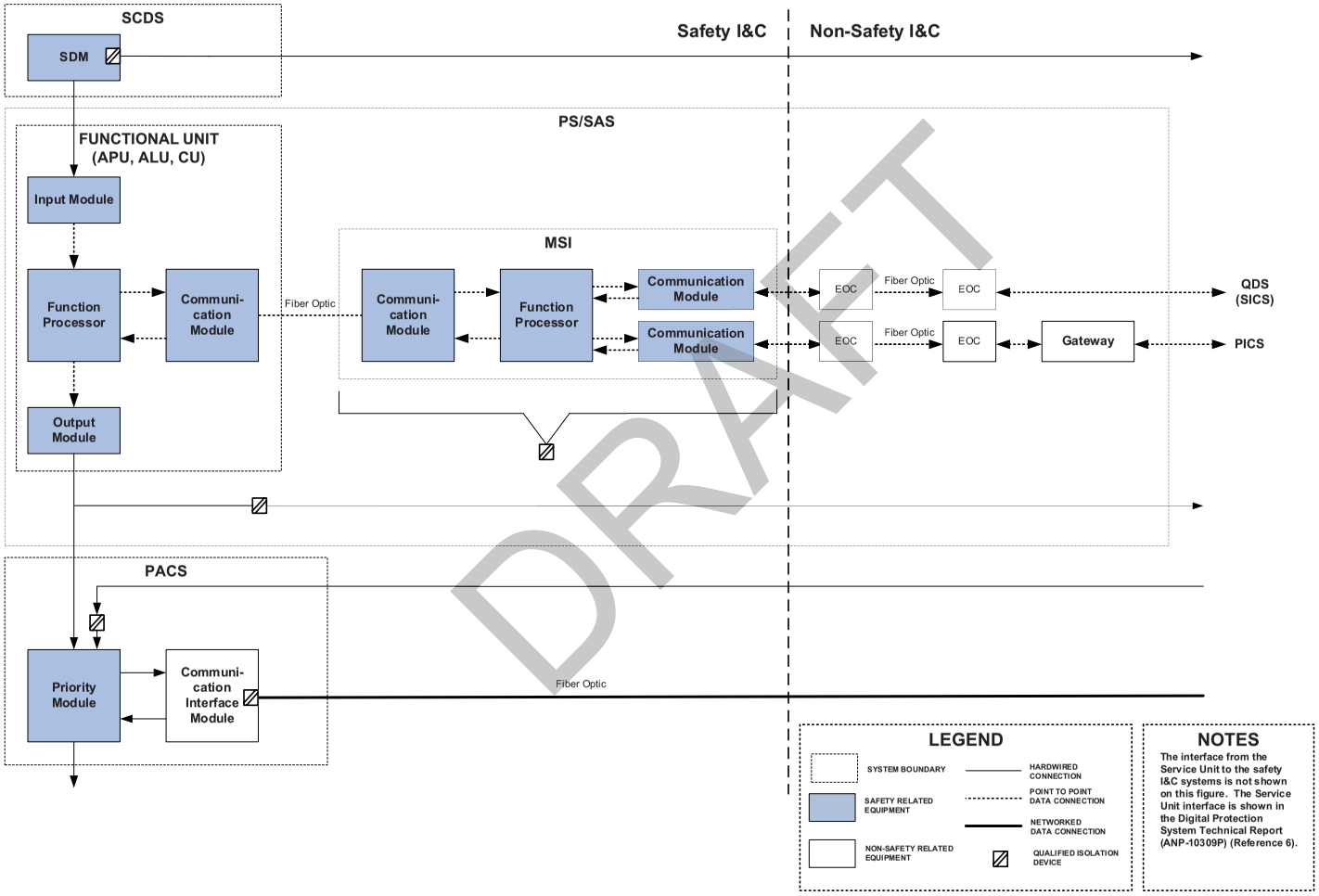
Figure 7.1-20—Implementation of Independence Between Safety and Non-Safety I&C



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- Monitor radiation levels and radioactivity in the control room and selected plant areas where access may be required for plant recovery.

Accident Monitoring Instrumentation Criteria

The I&C systems that perform the AMI functions are designed in accordance with the performance (criterion 5), design (criterion 6), qualification (criterion 7), and display criteria (criterion 8) of Reference 1 with the modifications specified in RG 1.97, Revision 4, and in accordance with the supplemental guidance provided in BTP 7-10 (Reference 7).

7.5.2.2.2 Use of Digital Systems

~~The supervisory control system level (level 2) consists of data processing related to HMI for process control and monitoring.~~The human machine interface (HMI) systems provide the ability to control and monitor the plant operation. The HMI systems consist of the SICS and PICS. ~~are the systems that make up the supervisory control system level and are~~ The PICS is implemented using a digital computer platform~~s~~. The SICS is implemented using hardwired I&C and the qualified display system (QDS).

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The QDS is an HMI that is qualified to non-safety-related supplemented grade (NS-AQ) to meet Seismic Class II criteria.~~The software and hardware development of the SICS is performed in accordance with the quality criterion for digital computers specified in IEEE Std 7-4.3.2-2003 (Reference 2).~~

To minimize the potential for non-safety digital control system failures that could challenge safety systems, non-safety digital control system hardware and software is developed using a structured process similar to that applied to safety system software; however, the process is tailored to account for the lower safety significance. The hardware and software development process for PICS is described in Section 7.1~~7~~.

7.5.2.2.3 Monitoring for Severe Accidents

Instrumentation used to monitor severe accident conditions are identified in Table 19.2-3. The severe accident response instrumentation is designed so there is reasonable assurance that the instrumentation will operate in the severe accident environment for which they are intended and over the time span for which they are needed.

7.5.2.2.4 Conformance to Regulatory Guide 1.47

If a protective function of some part of a safety system has been bypassed or deliberately rendered in-operative, continued indication of the bypassed condition for each affected safety group is provided in the MCR.

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~~IEEE Std 603-1991 and IEEE 603-1998 is described in Digital Protection System Technical Report ANP-10309P (Reference 9).~~

7.5.2.2.8 ~~Self Test Provisions~~

~~Branch Technical Position BTP 7-17 (Reference 8), provides guidance on the use of self-testing features of digital I&C system. The SICS is designed to maximize the use of automated self-testing features to minimize the burden on plant personnel. The safety-related qualified display system (QDS) within the SICS has the capability to perform automatic self-testing to verify its ability to perform the intended functions. This self-testing feature includes, but is not limited to, the availability of components such as processors, communication and link modules, power supplies, and input-output modules. The positive aspect of these self-testing features is to provide a mechanism for detecting all detectable failures. Furthermore, the positive aspects of the self-test features are not compromised by the additional complexity added to the system design. The self-test features of the SICS do not affect the ability of the system to perform its safety functions.~~

7.5.3 References

1. IEEE Std 497-2002, "Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2002.

2. Deleted.~~IEEE 7-4.3.2-2003, "IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2003.~~

3. IEEE Std 603-1998, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 1998.

4. NUREG-0696, "Functional Criteria for Emergency Response Facility," Nuclear Regulatory Commission, 1981.

5. NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Nuclear Regulatory Commission, 1980.

6. NUREG-0737, "Clarification of TMI Action Plan Requirements," Nuclear Regulatory Commission, 1980.

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7. NUREG-0800, BTP 7-10, "Guidance on Application of Regulatory Guide 1.97," Nuclear Regulatory Commission, March 2007.

8. Deleted.~~NUREG-0800, BTP 7-17, "Guidance on Self Test and Surveillance Provisions," Nuclear Regulatory Commission, March 2007.~~

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