ArevaEPRDCPEm Resource

From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Thursday, February 17, 2011 11:23 AM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); HUDSON Greg (AREVA); GARDNER Darrell (AREVA); WILLIFORD Dennis (AREVA); HALLINGER Pat (EXTERNAL AREVA); BUDZIK Dennis (AREVA)
Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Question 7.1-32
Attachments: RAI 442 Response US EPR DC - DRAFT.pdf

Getachew,

To support the final response date of March 15, 2011, attached is a draft response for RAI 442 question 7.1-32. Please let me know if the staff has questions or if the response can be sent as a final response.

Thanks,

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.
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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,

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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
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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: 2565

Mail Envelope Properties (199EBB4D1CD9644D9472AA84D5D8EFA71FB68E)

Subject: DRAFT Response to U.S. EPR Design Certification Application RAI No. 442, FSAR Ch. 7, Question 7.1-32
Sent Date: 2/17/2011 11:22:39 AM
Received Date: 2/17/2011 11:23:09 AM
From: BRYAN Martin (EXTERNAL AREVA)

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

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Files	**Size**	**Date & Time**
MESSAGE	7937	2/17/2011 11:23:09 AM
RAI 442 Response US EPR DC - DRAFT.pdf	528401	

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

Response to

Request for Additional Information No. 442(4295, 5076, 5068, 5067), Revision 1

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 07.01-32:

Follow-up RAI to 321, Question 07.01-19.

The staff requests that the following additional information be provided:

AREVA NP addressed the issue concerning the language "without further NRC review" in its Software Program Manual (SPM). How will AREVA NP address this language in the EPR FSAR, Tier 2?

In the Question 07.01-19, the staff 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.

The staff reviewed the AREVA NP response to RAI 321, Question 07.01-19, and found that the proposed FSAR markup (Tier 2, Revision 2 Interim, Page 7.1-5) contains language which is problematic. The problematic phase is "without further NRC review." AREVA NP addressed this issue in its Software Program Manual (SPM). How will AREVA NP address this language in the EPR FSAR, Tier 2?

Response to Question 07.01-32:

The phrase "without further NRC review" will be deleted from U.S. EPR FSAR Tier 2, Section 7.1.1.2.1. Additionally, U.S. EPR FSAR Tier 2, Section 7.1.1.2.1 will be revised because of recent changes to the software program manual (SPM). U.S. EPR FSAR Tier 1, Section 2.4.1, Section 2.4.2, and Section 2.4.4 will be revised to remove the commitments made for the Teleperm XS (TXS) hardware and software change process.

FSAR Impact:

U.S. EPR FSAR Tier 1, Section 2.4.1, Section 2.4.2, and Section 2.4.4 and Tier 2, Section 7.1.1.2.1 will be revised as described in the response and indicated on the enclosed markup.

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U.S. EPR Final Safety Analysis Report Markups

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- Failures caused by the single failure.
- Failures and spurious system actions that cause or are caused by the DBE requiring the safety function.

4.19 The equipment for each PS 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.

4.20 Locking mechanisms are provided on the PS cabinet doors. Opened PS cabinet doors are indicated in the MCR.

4.21 Key lock switches are provided at the PS cabinets to restrict modifications to the PS software.

07.01-32

4.22 The operational availability of each input variable can be confirmed during reactor operation including post-accident periods.

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

4.24 The PS response time for RT and ESF signals is less than the value required to satisfy the design basis safety analysis response time assumptions.

5.0 Electrical Power Design Features

5.1 Class 1E PS 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 2.4.1-7 lists the PS ITAAC.

DRAFT

Table 2.4.1-7—Protection System ITAAC (13 Sheets)

Commitment Wording		Inspections, Tests, Analyses	Acceptance Criteria
4.22	The operational availability of each input variable can be confirmed during reactor operation including post-accident periods.	Analysis will be performed to demonstrate that the operational availability of each input variable listed in Table 2.4.1-2 and Table 2.4.1-3 can be confirmed during reactor operation including post-accident periods by one of the following methods: • By perturbing the monitored variable. • By introducing and varying, a substitute input of the same nature as the measured variable. • By cross-checking between channels that bear a known relationship to each other. • By specifying equipment that is stable and the period of time it retains its calibration during post-accident conditions.	A report exists and concludes that the operational availability of each input variable listed in Table 2.4.1-2 and Table 2.4.1-3 can be confirmed during reactor operation including post-accident periods by one of the following methods: • By perturbing the monitored variable. • By introducing and varying, a substitute input of the same nature as the measured variable. • By cross-checking between channels that bear a known relationship to each other. • By specifying equipment that is stable and the period of time it retains its calibration during post-accident conditions.
4.23	Deleted.~~The PS hardware and system software are designed to conform to the key TELEPERM XS principles, features, and quality methods.~~	Deleted.~~A TELEPERM XS platform changes analysis will be performed on the PS 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 PS 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}}~~

07.01-32

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07.01-32

Table 2.4.1-7—Protection System ITAAC (13 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}}~~
4.24	The PS response time for RT and ESF signals is less than the value required to satisfy the design basis safety analysis response time assumptions.	a. Analyses will be performed to determine the required response time from sensor to ALU output, including sensor delay, which supports the safety analysis response time assumptions for the RT signals listed in Table 2.4.1-2 and ESF signals listed in Table 2.4.1-3.	a. A report exists and identifies the required response time from sensor to ALU output which supports the safety analysis response time assumptions for the RT signals listed in Table 2.4.1-2 and ESF signals listed in Table 2.4.1-3.

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

4.14 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.~~

07.01-32

4.16 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 2.4.2-2—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 an as-built SICS cabinet door located outside of the MCR is in the open position.	c. Opened as-built SICS cabinet doors located outside of the MCR are indicated in the MCR.
4.13	Key lock switches on the QDS restrict connections between the QDS and the QDS service unit.	Tests will be performed to verify that the key lock switches on the as-built QDS restrict modifications to the SICS software.	Key lock switches on the as-built QDS restrict modifications to the SICS software.
4.14	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. 07.01-32	a. A test of the as-built 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 an as-built SICS division is placed out of service.	a. The as-built SICS can perform its safety functions when one of the SICS divisions is out of service. b. Out of service divisions of as-built 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
		07.01-32	~~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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07.01-32

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

5.0 Electrical Power Design Features

5.1 Class 1E SAS 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 2.4.4-5 lists the SAS ITAAC.

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Table 2.4.4-5—Safety Automation System ITAAC (10 Sheets)

07.01-32

	Commitment Wording	Inspections, Tests, Analyses	Acceptance Criteria
4.16	Deleted.~~The SAS 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 SAS 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 SAS 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}}~~ ~~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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- 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.

- 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.

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

1. Hardware design and qualification.

07.01-32

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~~

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07.01-32

~~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.~~

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).

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.

7.1.1.2.3 Application of the TXS and QDS Platforms

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 platforms 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).

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