AREVA

June 13, 2008
NRC:08:041

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Response to a Second Request for Additional Information Regarding ANP-10284, "U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report" (TAC No. MD5884)

Ref. 1: Letter, Ronnie L. Gardner (AREVA NP Inc.) to Document Control Desk (NRC), "Request for Review and Approval of ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report'," NRC:07:022, June 20, 2007.

Ref. 2: Letter, Getachew Tesfaye (NRC) to Ronnie L. Gardner (AREVA NP Inc.), "AREVA NP Inc. - Request for Additional Information Regarding ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report' (TAC No. MD5884)," November 1, 2007.

Ref. 3: Letter, Getachew Tesfaye (NRC) to Ronnie L. Gardner (AREVA NP Inc.), "AREVA NP Inc. – Request for Additional Information Regarding ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report' (TAC NO. MD5884)," May 15, 2008.

Ref. 4: Letter, Getachew Tesfaye (NRC) to Sandra M. Sloan (AREVA NP Inc.), "AREVA NP Inc. - U.S. EPR Standard Design Certification Application Review Schedule," March 26, 2008.

AREVA NP Inc. (AREVA NP) requested the NRC's review and approval of the topical report ANP-10284 in Reference 1. The NRC provided a second Request for Additional Information (RAI) regarding this topical report in Reference 3. The response to this RAI (Attachment A) is enclosed with this letter, ANP-10284Q2, "Response to Request for Additional Information ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report'."

AREVA NP references the topical report ANP-10284 in the Final Safety Analysis Report for the U.S. EPR. Reference 4 states that the NRC plans to complete its review of the topical report and issue the draft safety evaluation by November 13, 2008. AREVA NP understands that this timely response to the RAI supports the scheduled deliverable of the draft safety evaluation.

AREVA NP considers some of the material contained in the attachments to this letter to be proprietary. As required by 10 CFR 2.390(b), an affidavit is enclosed to support the withholding of the information from public disclosure. Proprietary and non-proprietary versions of the enclosure to this letter are provided.

AREVA NP INC.
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NRO

If you have any questions related to this submittal, please contact Ms. Sandra M. Sloan, Regulatory Affairs Manager for New Plants Deployment. She may be reached by telephone at 434-832-2369 or by e-mail at sandra.sloan@areva.com.

Sincerely,

Ronnie L. Gardner, Manager
Corporate Regulatory Affairs
AREVA NP Inc.

Enclosure

cc: G. Tesfaye
J. Rycyna
Docket No. 52-020

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is George L. Pannell. I am Manager, Product Licensing, for AREVA NP Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA NP to determine whether certain AREVA NP information is proprietary. I am familiar with the policies established by AREVA NP to ensure the proper application of these criteria.

3. I am familiar with the AREVA NP information contained in the attachments to letter, NRC:08:041, entitled, "Response to a second Request for Additional Information Regarding ANP-10284, 'U.S. EPR Instrumentation and Control Diversity and Defense-In-Depth Methodology Topical Report'," dated June 13, 2008 and referred to herein as "Document." Information contained in this Document has been classified by AREVA NP as proprietary in accordance with the policies established by AREVA NP for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA NP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in these Documents as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in

accordance with 10 CFR 2.390. The information for which withholding from disclosure is requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by AREVA NP to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA NP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA NP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by AREVA NP, would be helpful to competitors to AREVA NP, and would likely cause substantial harm to the competitive position of AREVA NP.

The information in the Document is considered proprietary for the reasons set forth in paragraphs 6(b), 6(c), 6(d), and 6(e) above.

7. In accordance with AREVA NP's policies governing the protection and control of information, proprietary information contained in this Document has been made available, on a limited basis, to others outside AREVA NP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA NP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

SUBSCRIBED before me this 12th

day of June, 2008.

Sherry L. McFaden
NOTARY PUBLIC, COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES: 10/31/2010
Registration # 7079129

SHERRY L. MCFADEN
Notary Public
Commonwealth of Virginia
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My Commission Expires Oct 31, 2010

Response to Second Request for Additional Information – ANP-10284 "U.S. EPR Instrumentation and Control Diversity and Defense in Depth [D3] Methodology Topical Report" (TAC No. MD5884)

RAI-18: *What is the architecture of the DAS as it relates to the PAS? Is the DAS implemented on its own hardware/software component within the PAS system, or is it implemented on the same hardware as other PAS functions as a particular software function? Please provide detailed explanation.*

Response 18:

The architecture of PAS consists of four subsystems, one of which is the DAS. The four subsystems are:

- Nuclear island subsystem (NIS)
- Turbine island subsystem (TIS)
- Balance of plant subsystem (BPS)
- Diverse actuation subsystem (DAS)

The DAS is organized in four redundant divisions located in separate Safeguards Buildings. Each division of DAS contains diverse actuation units (DAU). The arrangement of the DAS is shown in Figure RAI 18-1. Hardwired signals can be acquired from sensors or other I&C systems. The method of acquiring signals from the Protection System (PS) is described in RAI-19 response. Fiber optic data connections are provided to share trip requests, and two out of four voting is done in each DAU. Outputs are sent to the Priority and Actuator Control System (PACS) via hardwired connections. The DAU's interface with the Process Information and Control System (PICS) via the plant data network for the display of information.

The DAS functions are implemented on hardware and software contained in the DAU, which is separate from the equipment used to implement other PAS functions in the other subsystems of PAS. Segregation is achieved by housing the DAS hardware in cabinets separate from the other PAS cabinets. Figures RAI 18-2 and RAI 18-3 illustrate the architectures for the other PAS subsystems (NIS, TIS, and BPS). Control Units (CU) contain the processors in the other PAS subsystems. The PAS subsystems are interconnected via the plant data network. The PAS is a completely diverse system from the PS in hardware and software.

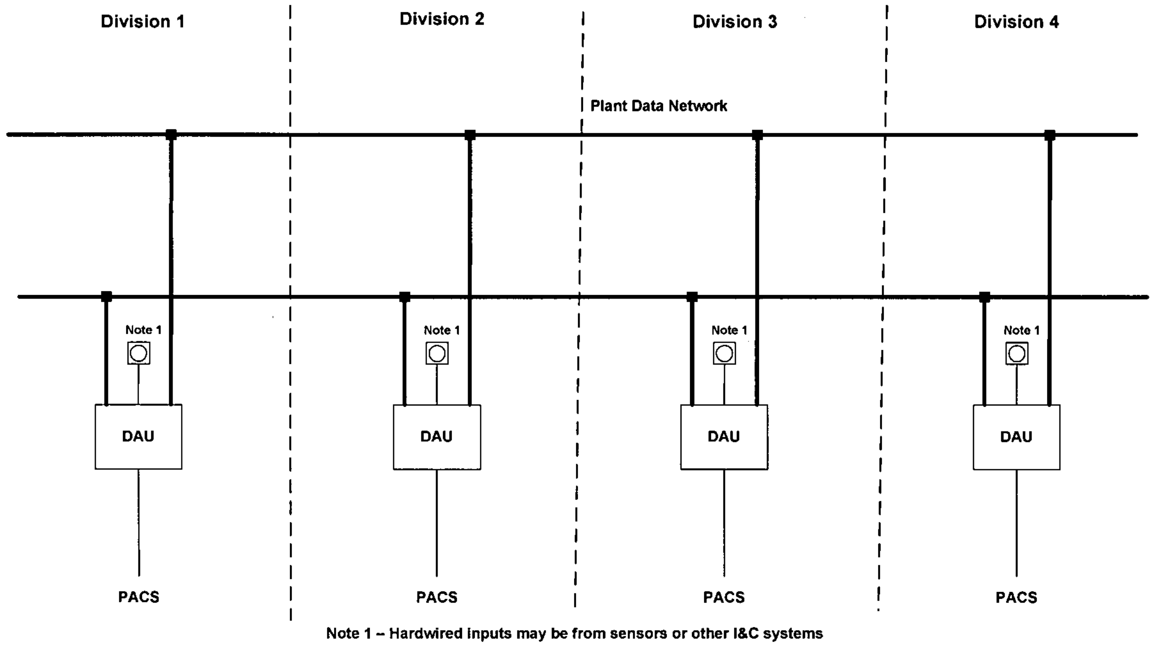


Figure RAI 18-1: Process Automation System (Diverse Actuation Subsystem)

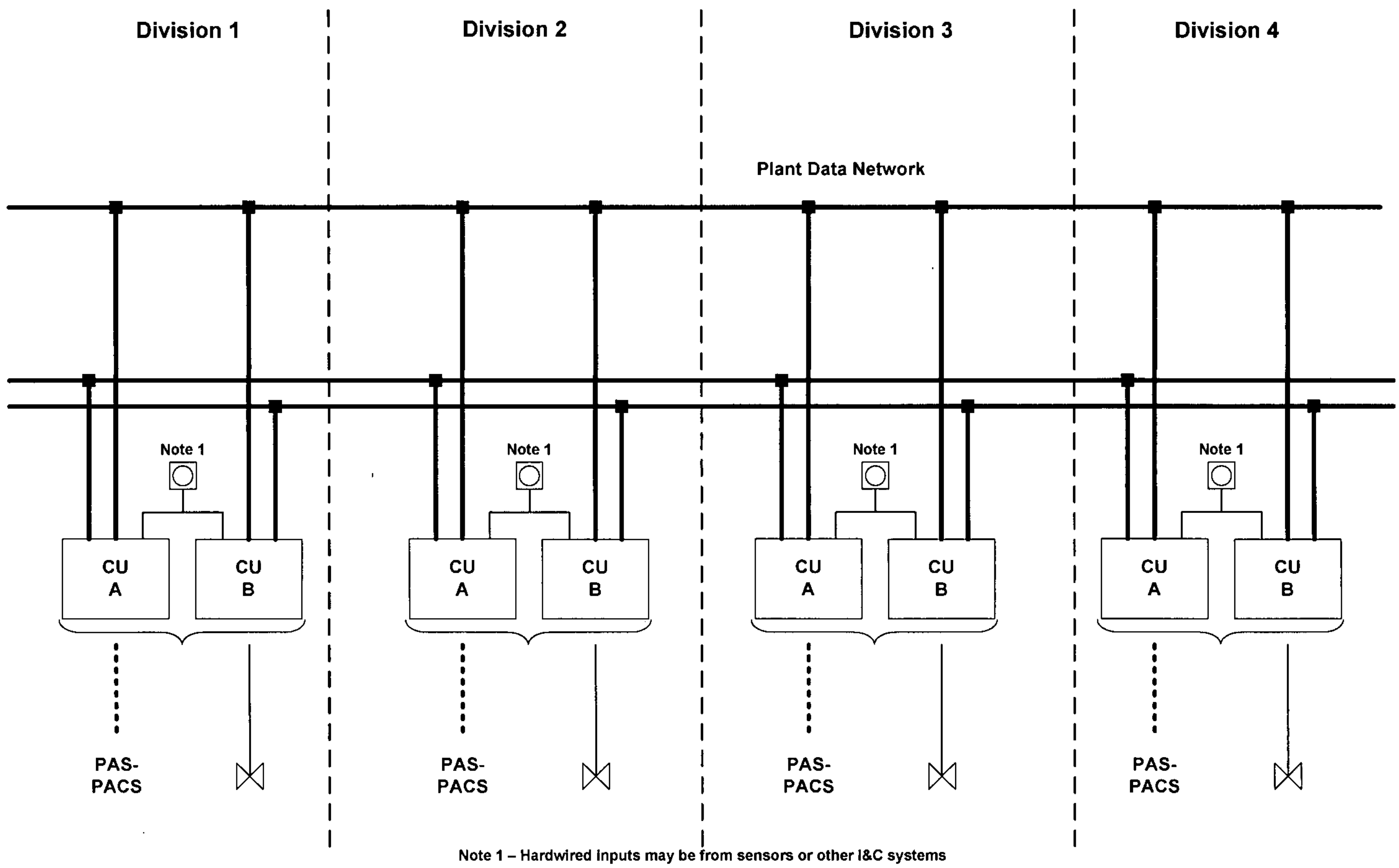
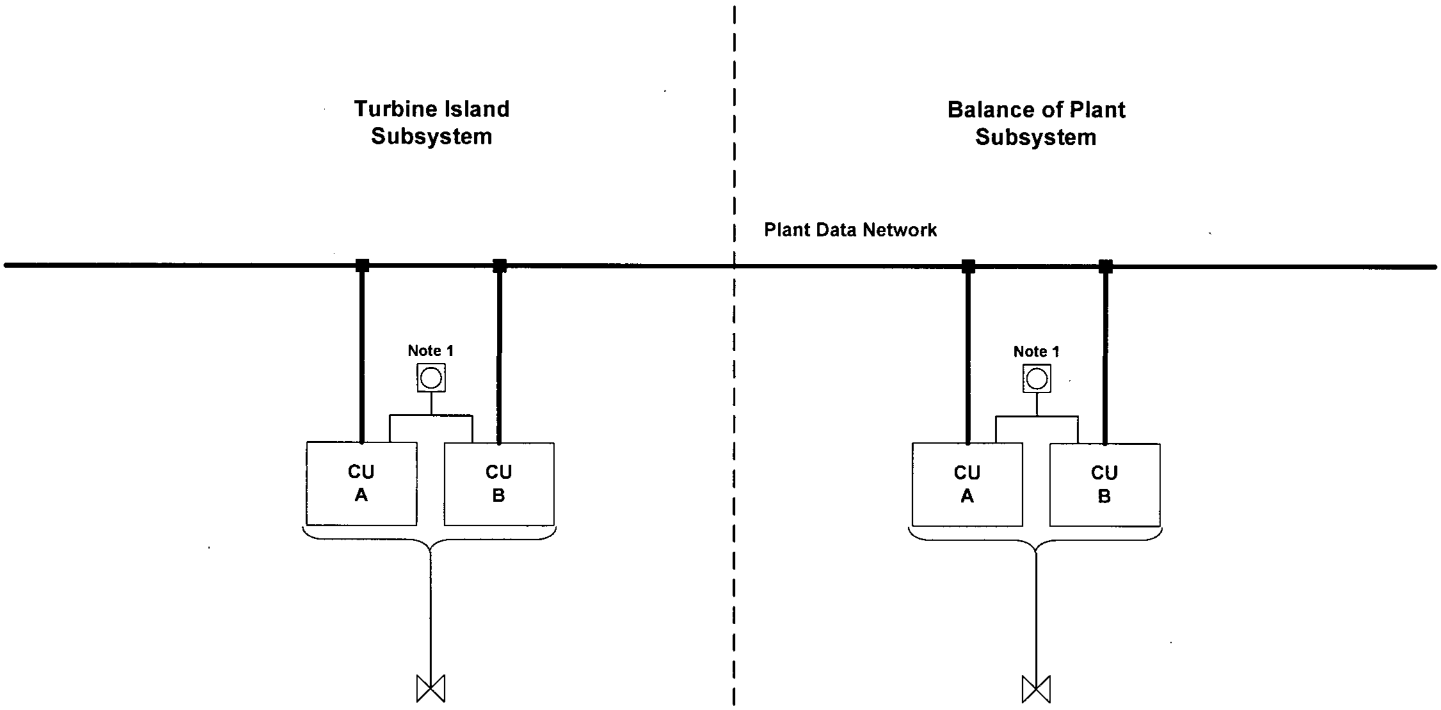


Figure RAI 18-2: Process Automation System Architecture (Nuclear Island Subsystem)



Note 1 – Hardwired inputs may be from sensors or other I&C systems

Figure RAI 18-3: Process Automation System Architecture (Turbine Island and Balance of Plant)

RAI-19: *Please describe, in detail, the electrical isolation circuitry that is used between the PS system and the DAS system, starting from the output of a sensor.*

If Section 13, SAFETY TO NON-SAFETY INTERFACE, of ANP-10281P, U.S. EPR Digital Protection System Topical Report, Revision 0, is to be referenced, please provide a figure, such as Figure 13-2 on page 13-4 of ANP-10281P, that includes (identified on figure) the sensor output connection to the PS, the electrical isolation circuitry used and the DAS connection.

Response 19:

The electrical isolation circuitry that is used between the PS and the DAS is provided by the standard TXS signal multiplier module. For a sensor shared between the PS and the DAS, the module resides in a safety related signal conditioning cabinet associated with the PS. After multiplication and isolation, the signal is routed from the safety related cabinet to a cabinet containing the DAS equipment.

This module is designed to multiply one analog voltage or current input signal to up to four output channels. Each output channel is electrically isolated from the other output channels, the input channel, and the module power supply. A block diagram of the standard TXS signal multiplier module is shown in Figure RAI 19-1.

A sensor signal that is shared by the PS and the DAS is supplied to either the voltage or current input terminals of the module. One of the four outputs is supplied to the PS and a second output to the DAS. Two other outputs are available for use by other I&C systems. A typical implementation of this arrangement is provided in Figure RAI19-2.

RAI-20: *On Table 2-2, page 2-9 of TR-ANP-10284, should the Risk Reduction column have an 'X' for RT and ESF since the risk reduction line of defense includes the PAS and incorporates the DAS? Please explain why or why not.*

Response 20:

Table 2-2 of ANP-10284 is used to present a comparison of the U.S. EPR lines of defense with the four echelons of defense discussed in NUREG/CR-6303. NUREG/CR-6303 provides the following definitions in section 2:

The reactor trip echelon is that **safety** equipment designed to reduce reactivity rapidly in response to an uncontrolled excursion.

The ESFAS echelon is that **safety** equipment which removed heat or otherwise assists in maintaining the integrity of the three physical barriers to radioactive release.

Based on the above definitions, one can conclude that the RT and ESF (ESFAS) echelons correlate best to the U.S. EPR Main line of defense, which contains the Protection System (PS), because the PS implements RT and ESF functions using **safety** related equipment. The PAS, which is part of the Risk Reduction line of defense for the U.S. EPR, also implements RT and ESF functions via the DAS, however, the DAS uses diverse **non safety** related equipment, and therefore the DAS does not meet the definitions of RT and ESFAS echelons in NUREG/CR-6303. Therefore, Table 2-2 should not be revised as suggested in the question.

RAI-21: *How does the approved D3 description in EMF-2110(NP)(A), Revision 1, "TELEPERM XS: A Digital Reactor Protection System," Siemens Power Corporation, May 2000, compare to the architecture and methodology provided in TR-ANP-10284?*

Response 21:

For readability considerations, throughout this response three topical reports are referred to by common names rather than by report numbers:

- EMF-2110(NP)(A), "TELEPERM XS: A Digital Reactor Protection System" is referred to as "TXS Topical Report".
- EMF-2267(P), "Siemens Power Corporation Methodology Report for Diversity and Defense-in-Depth" is referred to as "Siemens D3 Report".
- TR-ANP-10284, "U.S. EPR Instrumentation and Control Diversity and Defense-in-Depth Methodology Topical Report" is referred to as "U.S. EPR D3 Report".

The Siemens D3 Report was submitted in support of the TXS Topical Report. Therefore, the requested comparison is provided between the Siemens D3 Report and the U.S. EPR D3 Report.

The D3 methodologies presented in the Siemens D3 Report and the U.S. EPR D3 Report are fundamentally the same. Both consist of three main elements:

1.) A defense-in-depth concept.
2.) Design features used to prevent or mitigate the effects of a software CCF.
3.) A method for assessing the adequacy of the I&C design with respect to D3.

The three main elements of the U.S. EPR D3 Report methodology compare to the three main elements of the Siemens D3 Report methodology as follows:

1.) Defense-in-Depth Concept:

Siemens D3 Report:
Section 8.1 of the Siemens D3 Report addresses the defense-in-depth concept by providing the following description:

"In the defense-in-depth concept of the plant, the reactor protection system (RPS) represents the main echelon of defense. A second line of defense is provided by a combination of plant control systems as well as the ATWS mitigation system actuation circuitry (AMSAC). In the very unlikely event the RPS is unavailable due to a postulated software common-mode failure, the Siemens architecture has been carefully designed to assure that the plant control systems, AMSAC, and indications necessary for operator action remain available".

This description is generic with respect to the levels of defense because of the nature of the Siemens submittal (description of a generic application of the TXS platform). The remainder of Section 8 describes a typical RPS architecture with the focus on demonstrating that a software failure in the RPS would not affect the function of plant control systems, AMSAC, or indications necessary for operator action.

U.S. EPR D3 Report:
Section 2.4 of the U.S. EPR D3 Report addresses the U.S. EPR I&C defense-in-depth concept. This is accomplished by defining three specific lines of defense, discussing the purpose of each line of defense, and identifying the specific I&C systems that support each line of defense. Section 2.5 provides a mapping between the three U.S. EPR lines of defense and the four echelons of defense described in NUREG/CR-6303.

The defense-in-depth concept presented in the U.S. EPR D3 Report is more detailed than that found in the Siemens D3 report. This is because the U.S. EPR D3 Report had the benefit of a complete, plant-wide architecture to describe, while the Siemens D3 Report did not.

The two overall defense-in-depth concepts share the same basis; multiple lines of defense, with a software CCF in the main line being mitigated by diverse and independent I&C in other lines of defense. The circumstances surrounding the submittal of each report simply allow the U.S. EPR D3 submittal to present a more detailed and comprehensive view of the defense-in-depth concept.

2.) Design Features:

Siemens D3 Report:
Section 9 of the Siemens D3 Report describes various features of the TXS platform that reduce the likelihood of a software CCF occurring. These features include: Deterministic system behavior, quality of design process, and software design principles. As previously mentioned, Section 8 describes features of a typical TXS system architecture that prevent a software CCF from affecting other diverse I&C systems.

Due to the generic nature of the Siemens D3 report, features in a plant-wide I&C architecture that mitigate a TXS software CCF could not be addressed in any detail.

U.S. EPR D3 Report:
Section 3.1 of the U.S. EPR D3 Report describes features of the TXS platform that reduce the likelihood of a software CCF occurring. These are the same features described in the TXS

Topical Report and the Siemens D3 Report. In fact, those two reports are referenced by the U.S. EPR D3 Report to provide descriptions of these features. Sections 3.1.2 and 3.1.3 of the U.S. EPR D3 Report describe additional features of the U.S. EPR-specific TXS implementation that reduce the probability of the postulated software CCF.
In the area of design features that reduce the likelihood of the postulated software CCF, the U.S. EPR D3 Report expands on the Siemens D3 Report by addressing application specific features in addition to TXS platform features.

Section 3.2 of the U.S. EPR D3 Report describes features of the U.S. EPR I&C architecture that mitigate the effects of a TXS software CCF. This is accomplished by addressing diversity between the main line of defense and the risk reduction line. The methods for performing diverse reactor trip, ESF actuations, and ESF system control are identified and located in the plant-wide I&C architecture. Independence between the lines of defense is also addressed in Section 3.2.

This holistic plant-wide approach to diversity was not expressed in the Siemens D3 Report because the generic TXS system described therein was not placed in the context of a larger plant-wide I&C architecture.

3.) Method of Assessment:

Siemens D3 Report:
Section 10 of the Siemens D3 Report proposes a D3 analysis method. Fundamentally, this method is simply to follow the guidance found in NUREG/CR-6303. Only certain elements from the "Review Procedures" section of BTP 7-19 are discussed in any detail. A specific, comprehensive method of analysis and allocation of diverse functionality cannot be defined without the context of a specific plant-wide I&C architecture.

U.S. EPR D3 Report:
Section 4 of the U.S. EPR D3 Report outlines a six step analysis method. This method addresses Point 1 of BTP 7-19 and uses the guidance of NUREG/CR-6303 as a model. The method for evaluation of AOOs and postulated accidents is outlined, as well as the specific methods of allocating diverse functionality to specific I&C systems when acceptance criteria are not met. This comprehensive method is defined in the context of the U.S. EPR specific plant-wide architecture.

Other than the general level of detail presented, there are two specific points in which the two assessment methods differ:

1.) Section 10.1 of the Siemens D3 Report states that "Diversity can be demonstrated for all six of the diversity elements listed above." This statement is made in reference to the six types of diversity defined in NUREG/CR-6303. Section 4.6 of the U.S. EPR D3 Report indicates that signal diversity (one of the six types) is not used to establish diversity between the TXS platform and the diverse I&C systems.

This difference is not significant and does not prevent either method from complying with the regulatory guidance.

2.) In reference to providing justification for not correcting specific vulnerabilities, Section 10.5 of the Siemens D3 Report states that: "The Siemens diversity and defense-in-depth methodology addresses all identified vulnerabilities by provision of alternate trip or mitigation capability". Section 4.2 of the U.S. EPR D3 Report allows for providing justification for not correcting specific vulnerabilities. AREVA NP asserts that, in certain cases, adding functionality to the plant specifically to mitigate extremely low probability events is contrary to safety. These certain cases are when the additional functionality would increase complexity at the risk of decreasing reliability, or introduce risk of spurious actuations during normal operation that could challenge the plant safety systems.

Again, this difference is not significant and does not prevent either method from complying with the regulatory guidance.

In summary, a detailed review of the two D3 methodologies reveals differences that are not substantive in nature; instead the differences are primarily in the level of detail presented. These differing levels of detail can be attributed to the following:

- The TXS Topical Report describes the generic application of the safety-related TXS platform without regard to the nature of other I&C systems that would also be present in a nuclear power plant.
- The Siemens D3 Report was submitted in support of the TXS Topical Report and the typical RPS described therein is not placed in the context of a specific plant-wide I&C architecture. Therefore, the Siemens D3 Report is focused on demonstrating that a TXS software CCF will not affect the diverse I&C systems intended to mitigate such a failure. Plant-wide D3 considerations cannot be addressed in any detail without definition of a specific plant-wide I&C architecture.
- The U.S. EPR D3 Report describes a specific plant-wide I&C architecture that includes TXS systems. Therefore, this report presents a more detailed and holistic D3 methodology that includes plant-wide D3 considerations

Architectural Comparison:

RAI 21 also requests a comparison of the "architecture" described in the two reports. Other than the Siemens RPS focus, versus the U.S. EPR D3 plant-wide focus that has already been described, there are two main architectural points to consider.

1.) Section 8 of the Siemens D3 report describes a typical RPS architecture. This RPS architecture is not the same as that used in the U.S. EPR design. ANP-10281P, "U.S. EPR Digital Protection System Topical Report" describes the U.S. EPR protection system architecture in detail. The fact that the architectures are different has no bearing on the D3 methodologies. This is because, in each methodology, the portions of the architecture that are not subject to the postulated software CCF are clearly identified (e.g., relay voters in the Siemens D3 report, PACS modules in the U.S. EPR D3 report).

2.) With respect to plant-wide architecture, the Siemens D3 report simply assumes the use of TXP as a diverse platform to implement unspecified diverse functionality if needed (Sections 10.1, 10.4 and 10.6). The U.S. EPR D3 report does not specifically assume the use of TXP. Instead, Section 4.6 describes the analysis and attributes that are used to demonstrate the diversity of the platform used for the PICS and PAS systems.

RAI-22: *On Page 3-2, second paragraph from bottom, of TR-ANP-10284, it is stated:*

> *"The results of this review, as discussed in Section 9.5 of Reference 14, demonstrate that CCFs are not credible if appropriate design and testing measures are taken."*

What does AREVA mean by this statement?

Response 22:

This statement above references Siemens Topical Report, EMF-2267 (P), Revision 0, "Siemens Power Corporation Methodology Report for Diversity and Defense in Depth," September 1999 (Reference 14). This report along with Siemens Topical Report, EMF-2110 (NP) (A), Revision 1, "TELEPERM XS: A Digital Reactor Protection System," May 2000, contains details of features of the TELEPERM XS system that are summarized on page 3-2 of ANP-10284 and are listed below:

- Cyclic, deterministic, asynchronous operation
- Interference free communication
- Independence of the TXS platform operation from the application software program
- Fault tolerance
- Equipment and system software qualification
- The use of a standard library of application function blocks with operating experience

It is the above design features along with the proven record of TELEPERM XS operating experience (discussed in the last paragraph on page 3-2 of ANP-10284) that makes a common cause failure in the TELEPERM XS system very unlikely. However, AREVA NP recognizes the NRC's concern that software design errors are a credible source of common-cause failure, despite high quality of design and use of defensive design measures. This concern is described in BTP 7-19. Therefore, AREVA NP proposes the following change to the wording in the statement above:

Proposed text:

> "The results of this review, as discussed in Section 9.5 of Reference 14, demonstrate that **a CCF is very unlikely** if appropriate design and testing measures are taken."

RAI-23: *On Page 3-3 of TR-ANP-10284, AREVA states that the programmable logic device (PLD) in the AV42 Priority Module contains no software. How is this statement consistent with the definition of firmware in IEEE 100?*

Response 23:

The statement in TR-ANP-10284 is consistent with the structure of the AV42 PLD. The PLD used for safety related functions on the AV42 does not contain software.

The PLD contains only basic combinatorial logic (AND, OR, NOR, etc.) and flip-flops. No software runs on a processor that could potentially "hang" or "freeze" and would subsequently require rebooting. This also means that software is not loaded on the device. As soon as power is applied, the PLD is active, and the logic starts determining the priority of the incoming signals.

The PLD used for the AV42 is implemented using a logic device that is non-volatile. When the PLD loses power, the gates remain set the way they were programmed.

'Firmware' is a broad term that has multiple definitions. This is evident based on the following notes under the definition of firmware in IEEE 100-2000:

> "*Notes:* 1. This term is sometimes used to refer only to the hardware device or only to the computer instructions or data, but these meanings are deprecated. 2. The confusion surrounding this term has led some to suggest that it be avoided altogether."

Within AREVA NP, the use of the term 'Configware'(derived from configurable hardware) is used to differentiate the programming of a PLD from that of a computer or microprocessor with serially executed instructions. However, in most of the AV42 PLD development documentation, the term 'firmware' is also used.

RAI-24: *10 CFR 50.62 requires that the ATWS mitigation system operate in a reliable manner. Provide information in TR-ANP-10284 describing the quality requirements of the ATWS mitigation system.*

Response 24:

The ATWS mitigation functions for the U.S. EPR are implemented in the Diverse Actuation System (DAS), therefore the quality requirements related to ATWS mitigation systems will be imposed on the DAS. The quality requirements for DAS can be found in Section 7.1.1.4.6 of the U.S. EPR Final Safety Analysis Report (FSAR). In this section, the following quality requirements are provided:

- The DAS is designed, fabricated, erected, and tested under the augmented quality program described in Chapter 17 of the U.S. EPR FSAR. Chapter 17 references ANP-10266A, Revision 1, "AREVA NP Inc. Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR." In the QAP, it states that AREVA NP Inc. implements quality requirements to ATWS in accordance with Generic Letter 85-06, "Quality Assurance Guidance for ATWS Equipment that is not Safety Related."

- The application software of the DAS is developed using the lifecycle processes described in Section 7.1.1.2.2 of the U.S. EPR FSAR.

RAI-25: *On page 4-3 of TR-ANP-10284, it is stated:*

> *"If it is judged that automated plant response using the I&C systems not affected by the postulated CCF will not be sufficient to meet the acceptance criteria stated in NUREG-0800, BTP 7-19, then one of the following actions will be performed:*
>
> - *Identify additional functionality to mitigate the event.*
> - *<u>Determine if there is adequate justification to preclude adding additional functionality."</u>*
>
> *[Underline added]*

Describe the kind of determination intended in this situation and how does that meet the NRC guidance as identified in BTP 7-19?

Response 25:

The kind of determination intended in this situation is a best engineering judgment. The decision to add additional automated functionality necessary to meet the acceptance criteria must be balanced against the decreased reliability or spurious actuation during normal operation that may be introduced as a result of the additional automated functionality. This judgment may conclude that manual actions are the best solution for providing a diverse means of effective response to a given AOO/PA coincident with a software common mode failure.

This evaluation does not undermine the NRC guidance as identified in BTP 7-19. Being part of Step 2 – Qualitative Evaluation of AOOs and Postulated Accidents, this evaluation aids in addressing points 2 and 3 of NUREG -0800, BTP 7-19 in that it determines a means of diversity for each AOO/PA coincident with a software common cause failure.

RAI-26: *On page 4-3 of TR-ANP-10284, it is stated:*

> *"If qualitative evaluations are insufficient to verify that acceptance criteria are met for specific AOOs or postulated accidents, then quantitative analysis of those events will be performed in Step 4."*

Describe in detail what encompasses the quantitative analysis and how it would be used. Additionally, discuss how it meets current NRC guidance for D3 analysis.

Response 26:

The quantitative analysis referred to in the passage above encompasses utilizing the same codes and methods as those used in Chapter 15 of the U.S. EPR Final Safety Analysis Report (FSAR). Best estimate methods may be used in lieu of Chapter 15 analysis methods. When best estimate methods are used, they will be described in the analytical results documentation.

The quantitative analysis meets the intent of NRC guidance in that it addresses Point 2 of BTP 7-19:

> "In performing the assessment, the vendor or applicant/licensee should analyze each postulated common-cause failure for each event that is evaluated in the accident analysis section of the safety analysis report (SAR) using best-estimate or SAR Chapter 15 analysis methods."

RAI-27: *On page 4-5 of TR-ANP-10284, it is stated:*

> *"As discussed in Step 2, quantitative analyses might be required for some events to confirm that the applicable acceptance criteria are met. The best estimate methods used to perform these analyses will be described in the analytical results documentation.*
>
> *If quantitative analyses do not demonstrate that the design meets the acceptance criteria, the evaluation process will be performed again for that event using the quantitative results as input to achieve an acceptable design."*

Describe in detail what encompasses the quantitative analysis and how it would be used. Additionally, discuss how it meets current NRC guidance for D3 analysis.

Response 27:

See AREVA NP's response to RAI-26.