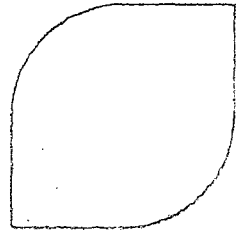


# **U.S. EPR I&C: Discussion of Specific NRC RAIs**

Shelby Small  
I&C Systems Engineer  
January 25 & 26 2010

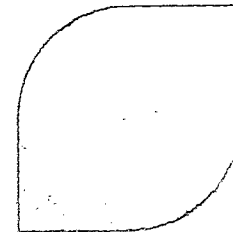


# Meeting Objective



- ▶ **Address Jan. 6 E-mail: “Discussion on Specific NRC Requests for Additional Information”**
- ▶ **22 RAIs identified and prioritized. For each, AREVA will present:**
  - ◆ **Technical position**
  - ◆ **Response content**
  - ◆ **Response date**
- ▶ **Primary objective: Allow the NRC staff to finalize SER with open items.**

# High Priority Questions



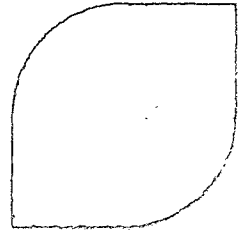
## ► Identified “High Priority” in Jan. 6 email

◆ 7.03-28

◆ 7.09-46

◆ 7.09-59

# RAI 303 Question 7.03-28



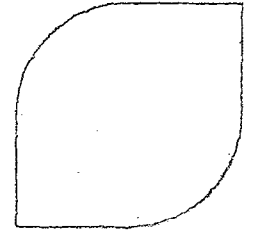
## ► Question Topic

- ◆ **System based priority of PACS: Ability of DAS to operate given a SCCF in PS, SAS, or SICS**

## ► AREVA Position

- ◆ **The SICS does not access PACS except through PS and SAS. With respect to “blocking” DAS actions, PS and SAS failures bound SICS failures.**
- ◆ **PS does not fail in a manner that can prevent DAS actions.**
- ◆ **SAS SCCF: DAS actions are not required**

# RAI 303 Question 7.03-28 (cont.)

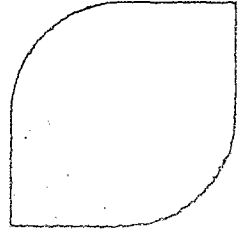


## ► Response Content

- ◆ Reference to D3 report Section 4.5 - PS functions credited in Ch. 15 analysis “do not respond” and PS outputs not credited in Ch. 15 analysis “do not fail in a manner to worsen the consequences of the event”.
- ◆ Reference to D3 report Section 4.11 - SAS is not subject to same SCCF as PS concurrent with DBE.
  - If SAS failure is concurrent with DBE, PS remains available and has higher priority than SAS (DAS response is not required).
  - If SAS failure is non concurrent with DBE, DAS response is not required.

## ► Response Date: Feb. 19 (contingent on today’s discussions)

# RAI 286 Question 7.09-46



## ▶ Question Topic

- ◇ Data communications – Conformance with ISG-04

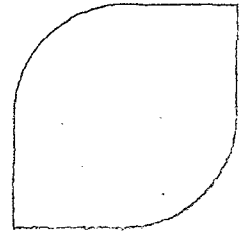
## ▶ AREVA Position

- ◇ U.S. EPR largely conforms to the twenty criteria in Section 1 of ISG-04
- ◇ When strict conformance is not present, alternatives exist that address the intent of the guidance

## ▶ Response Content

- ◇ ~ 25 pages
- ◇ Definitions
- ◇ Table
- ◇ Series of “notes” corresponding to table

# RAI 286 Question 7.09-46 (cont.)

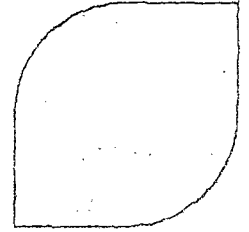


## ► Response Content

◆ The table:

Type of Interface	Data Communication Interface	Independence Aspects			
		Physical Separation	Electrical Isolation	Communications Independence	Functional Independence
Safety to Safety	PS division - PS division	Note 1	Note 2	Note 15	Note 3
	SAS division - SAS division	Note 1	Note 2	Note 15	Note 3
	SICS division - SICS division	Note 4	Note 2	Note 15	Note 3
Safety to Nonsafety	PS - PICS	Note 5	Note 6	Note 15	Note 7
	SAS - PICS	Note 5	Note 6	Note 15	Note 8
	PS – Service Unit	Note 9	Note 9	Note 15	Note 10
	SAS – Service Unit	Note 9	Note 9	Note 15	Note 10
	SICS – Service Unit	Note 11	Note 12	Note 15	Note 13
	PACS – PAS	Note 14			

# RAI 286 Question 7.09-46 (cont.)



## ► Response Content – Points of Interest

### ◇ Definitions:

- RAI states, “Identify all data communication interfaces between safety and non-safety systems, and between redundant safety divisions...”
- U.S. EPR FSAR Tier 2, Section 7.1 defines “Data Communication” as opposed to “Hardwired Signal”. Hardwired signals are not addressed in the response.

### ◇ Functional Independence:

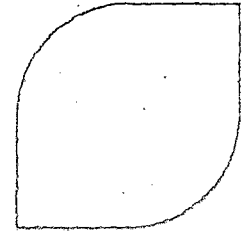
- Consistent with RAI request, “functional independence” description only provided for non-safety to safety interfaces.
- However, staff position 2 is addressed for all interdivisional data communication interfaces

### ◇ PAS – PACS Interface:

- Data communication is only between PAS and PACS non-safety communication module.
- Interface is included in the table for clarity; corresponding note describes why the 20 ISG-04 criteria are not required to be addressed for this interface.



# RAI 286 Question 7.09-46 (cont.)



## ► Response Content – Alternatives to Guidance

### ◆ Staff Position 10:

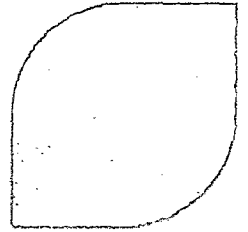
- Guidance suggests “hardwired interlocks” or “physical disconnection” of maintenance and monitoring equipment.
- TXS Service Unit interfaces use a hybrid hardwired/software interlock.
- This interface has been reviewed and approved (TXS topical report). Approval expected to be re-affirmed in very recent application.

### ◆ Staff Position 14:

- Guidance suggests “point-to-point connections”.
- PS design uses a series of ring networks for RAU to APU connections. Remainder of system is point-to-point.
- AREVA and NRC have discussed the ring networks multiple times. AREVA has submitted information on these networks demonstrating communication independence.

### ◆ Response Date: Feb. 19 (contingent on today’s discussions)

# RAI 309 Question 7.09-59



## ▶ Question Topic

- ◇ 1 RAU in maintenance, single failure of other RAU in division

## ▶ AREVA Position

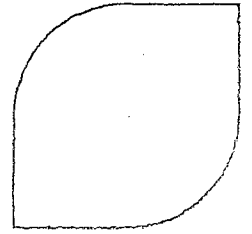
- ◇ The current design (including Tech. Spec. limits on how long an RAU can be removed from service for maintenance) satisfies IEEE-603 criteria.

## ▶ Response Content

- ◇ Discussion of IEEE 603 Clause 6.7, which allows that portions of the sense and command features not meet the single failure criteria during maintenance bypass if “removal for maintenance is sufficiently short”.
- ◇ Reference to U.S. EPR Tech. Specs. which limit RAU maintenance to 6 hours.
- ◇ Examples of how this same concept is applied in current operating plants (two-train ECCS systems) and various mechanical systems in the U.S. EPR design.

## ▶ Response Date: Feb. 19 (contingent on today’s discussions)

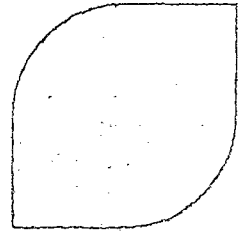
# Medium Priority Questions



## ► Identified “Medium Priority” in Jan. 6 email

- ◇ 7.01-15
- ◇ 7.01-16
- ◇ 7.01-17
- ◇ 7.01-18
- ◇ 7.01-19
- ◇ 7.01-20
- ◇ 7.02-30
- ◇ 7.03-21
- ◇ 7.03-26
- ◇ 7.03-27
- ◇ 7.03-29
- ◇ 7.04-11
- ◇ 7.04-13
- ◇ 7.05-09
- ◇ 7.08-09
- ◇ 7.09-49
- ◇ 7.09-52
- ◇ 7.09-57
- ◇ 7.09-60

# RAI 285 Question 7.01-15



## ▶ Question Topic

- ◆ I&C related operating experience to satisfy 10 CFR 52.47(a)(22) not identified in Table 1.9-3 as being evaluated and incorporated into the plant design

## ▶ AREVA Position

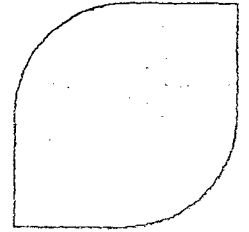
- ◆ FSAR Table 1.9-3 is not intended to address 10 CFR 52.47(a)(22) operating experience
- ◆ Table 1.9-3 addresses 10 CFR 52.47(a)(21) generic issues and TMI requirements
- ◆ FSAR Section 1.9.4 deals with compliance to 10 CFR 52.47(a)(22)

## ▶ Further Discussion Requested

- ◆ AREVA would like to better understand the NRC staff's regulatory basis for the requested information.
- ◆ What is the NRC staff's interpretation of the 10 CFR 52.47 sections cited above, and the corresponding NUREG-0800 guidance.

## ▶ Response Date: Contingent on today's discussions

# RAI 285 Question 7.01-16



## ▶ Question Topic

- ◇ Provide ITAAC to verify that as-installed TXS systems are in accordance with TXS Topical Report.

## ▶ AREVA Position

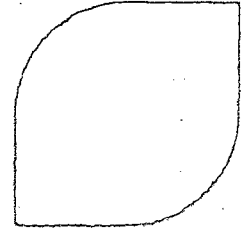
- ◇ Revision 1 of the Software Program Manual (ANP-10272) provides the evaluation process and criteria for changes or upgrades to the TXS platform.

## ▶ Response Content

- ◇ ITAAC developed to verify any platform changes conform to key TXS design features, principles, and quality methods.
- ◇ ITAAC to apply to safety related TXS systems

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 285 Question 7.01-17



## ▶ Question Topic

- ◇ Identify deviations from the U.S. EPR design and the TXS Topical Report (SER in May 2000)
- ◇ Example deviation cited:
  - TXS topical report mentions unidirectional communication
  - U.S. EPR design using bidirectional communication

## ▶ AREVA Position

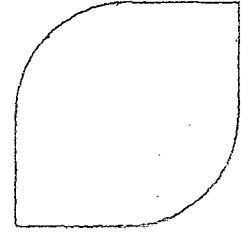
- ◇ TXS design is intended to provide a qualified generic digital I&C platform, not plant specific.
- ◇ Changes and upgrades from specifics of TXS TR are acceptable as long as the key TXS design features, principles and quality methods are not compromised. Evaluation process and criteria are specified in TXS SPM (verified for U.S. EPR through ITAAC).

## ▶ Response Content

- ◇ Refers to TXS platform change process described in RAI 7.01-16
- ◇ Summarizes evaluation process for example cited

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 321 Question 7.01-18



## ▶ Question Topic

- ◆ **Hardware and software qualification of embedded digital control systems; D3**

## ▶ AREVA Position

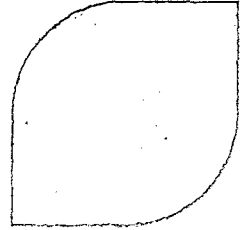
- ◆ **Hardware and software will be qualified in one of three ways:**
  - TXS systems subject to TXS qualification program and application software development program (TXS equipment is covered by existing SER; application software development program is currently under review by NRC.)
  - Systems purchased from vendors under an Appendix B QA program (Hardware and software are subject to vendor's approved QA program.)
  - Systems purchased and dedicated as Commercial Grade by AREVA NP (AREVA NP will follow EPRI TR-106439, which has been evaluated and approved by NRC.)
- ◆ **D3 analysis is performed in accordance with BTP 7-19; scope is limited to "digital protection systems". IEEE 603 defines "protection system" as "sense and command features". Embedded digital control systems are execute features and outside scope of D3 analysis.**

## ▶ Response Content

- ◆ **Description of above position. No FSAR changes.**

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 321 Question 7.01-19



## ▶ Question Topic

- ◇ Describe the software development process (SDP) used for the video display that will be used in the SICS, particularly with respect to identification of aspects that differ from TXS.

## ▶ AREVA Position

- ◇ QDS will be qualified, both hardware and software, to NRC approved standards.
- ◇ Differences exist between the QDS and current TXS control and protection equipment, which will be addressed in the qualification documents for the U.S. EPR
- ◇ For the U.S. EPR, requirements for design and qualification of QDS hardware and software included in the FSAR as DAC and ITAAC items

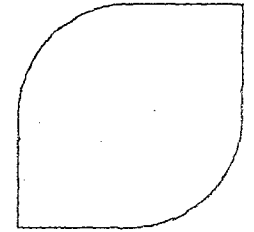
## ▶ Response Content

- ◇ Description of the above position

## ▶ Response Date: April, 2010



# RAI 321 Question 7.01-20



## ▶ Question Topic

- ◇ Will AREVA NP use the single-sided reduction factor in measurement uncertainty analysis?

## ▶ AREVA Position

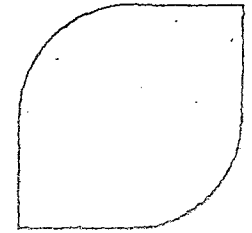
- ◇ AREVA NP will not use the single-sided reduction factor.

## ▶ Response Content

- ◇ 2 pages; FSAR revisions in Tier 2, Sections 7.1, 7.2, and 7.3

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 285 Question 7.02-30



## ▶ Question Topic

- ◇ Provide an exemption request to redefine the terms “detectable failure” and “non-detectable failure”

## ▶ AREVA Position

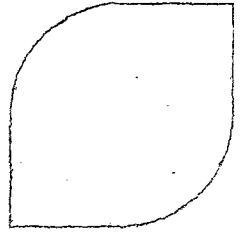
- ◇ The terms “detected” and “undetected” are not defined in IEEE 603-1998. AREVA NP has not redefined or changed the definitions in IEEE 603-1998, and an exemption request is not required

## ▶ Response Content

- ◇ The PS FMEA summaries in U.S. EPR FSAR Tier 2, Section 7.2 and Section 7.3 use the terms “detected” and “undetected.”
- ◇ IEEE 603-1998 defines the terms “detectable” and “non-detectable.”

## ▶ Response Date: Feb. 19 (contingent on today’s discussions)

# RAI 285 Question 7.03-21



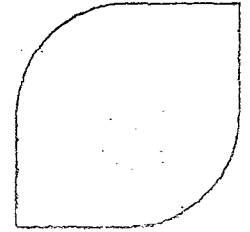
## ▶ Question Topic

- ◆ Provide specific details on the design capabilities of the self-testing features, and their intended use to fulfill IEEE Std 603-1991.

## ▶ AREVA Position

- ◆ Credit is taken for self-test features to satisfy IEEE 603 Clause 5.7.
- ◆ Coverage capabilities of TXS self-test are described in detail in EMF-2341(P) and are acknowledged in SER for EMF-2110(NP).
- ◆ Response to RAI 103 Supplement 1, Question 16-193 describes how self-tests overlap with surveillance testing for complete coverage of U.S. EPR protection system.
- ◆ As described in response to RAI 75, Question 7.02-09, there are no identifiable but non-detectable failures (EPR FMEA undetected failures are IEEE 603 detectable failures...).
- ◆ Operation of self-testing features are not required to be verified on a periodic basis. Consistent with ISG-04, Section 1, staff position 13 (See next slide).

# RAI 285 Question 7.03-21 (cont.)



## ▶ AREVA Position (cont.)

### ◇ ISG-04, Section 1, staff position 13:

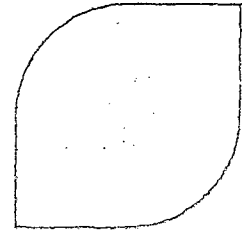
- Vital communications... should include provisions for ensuring that received messages are correct... Such communications should employ error-detecting... The effectiveness of error detection should be demonstrated in the design and proof testing of the associated codes, but once demonstrated is not subject to periodic testing.

## ▶ Response Content

- ◇ Provide reference to pertinent sections of topical report and SER.
- ◇ Provide reference to RAI 103 response.
- ◇ Provide reference to RAI 75 response.
- ◇ Discussion of ISG-04 Section 1, staff position 13 and how effectiveness of TXS self testing software is demonstrated by proof testing.

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 285 Question 7.03-26



## ▶ Question Topic

- ◆ Equipment protective provisions that could prevent safety systems from accomplishing their safety functions

## ▶ AREVA Position

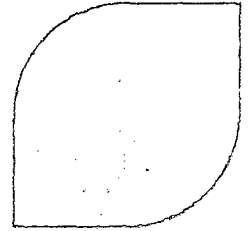
- ◆ Process system requirements, including equipment protection provisions that could impact safety, are discussed in Chapters 5, 6, 8, 9, 10, and 11 of the U.S. EPR FSAR.
- ◆ No single equipment protective function (equivalent to single failure of the equipment) can prevent performance of a safety function.

## ▶ Response Content

- ◆ Description of above position.
- ◆ Protective provisions for medium voltage electric motors and EDGs are discussed as examples.

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 285 Question 7.03-27



## ▶ Question Topic

- ◆ Operator actions are credited for isolating an affected SG during a steam generator tube rupture event (SGTR) when automatic mechanisms are available.

## ▶ AREVA Position

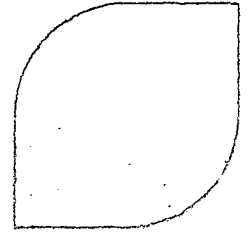
- ◆ The slow progression of the event allows credit to be taken for manual actions after 30 minutes.

## ▶ Response Content

- ◆ The nature of the event (slow progression, multiple scenarios) makes it difficult to determine exactly when the automatic function would be actuated.
- ◆ If the automatic function initiates prior to 30 minutes, the event results are more favorable (not crediting the automatic function is conservative).

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 303 Question 7.03-29



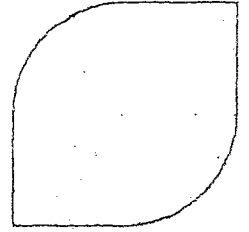
## ► Question Topic

- ◇ List and describe the Safety Automation System (SAS) functions
- ◇ Categorize the functions as follows:
  - PS initiated functions
  - Manually initiated functions
  - Automatically actuated functions

## ► AREVA Position

- ◇ Only 2 PS initiated functions (within Ch. 7 scope)
  - EFW – SG level control (within Ch. 7 scope)
  - MSRT – Partial cooldown control (within Ch. 7 scope)
- ◇ Manual functions
  - Component level control of ESF actuators from SICS (within Ch. 7 scope)
  - Component level control of EAS actuators from SICS (outside Ch. 7 scope)
  - “Grouped” control of EAS actuators from PICS (outside Ch. 7 scope)
- ◇ Automatically actuated functions
  - Closed loop control of EAS systems (outside Ch. 7 scope)
  - Interlocks (outside Ch. 7 scope)

# RAI 303 Question 7.03-29 (cont.)



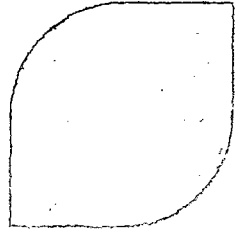
## ▶ Response Content

- ◇ Description of position on previous slide.

## ▶ Response Date: March 5 (Contingent on today's discussion).



# RAI 285 Question 7.04-11



## ▶ Question Topic

- ◆ Compliance of RSS transfer functionality to the requirements of GDC 3

## ▶ AREVA Position

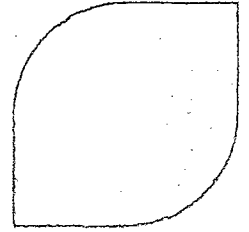
- ◆ FSAR commitments adequately address the guidance in GDC 3 and RG 1.189.
- ◆ ITAAC will be added to FSAR Tier 1 to verify that the transfer means exist in a fire area separate from the MCR.

## ▶ Response Content

- ◆ Reference to FSAR commitments that address GDC 3 and RG 1.189 concerns relative to the transfer switches are provided in the response.
- ◆ ITAAC will be added to FSAR Tier 1, Sections 2.4.2 and 2.4.10
- ◆ The common database for the MCR and RSS can not be affected by fire due to the redundancy and location of equipment.

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 285 Question 7.04-13



## ▶ Question Topic

- ◇ PICS operability: Consistency of data between PICS and SICS

## ▶ AREVA Position

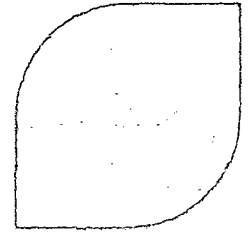
- ◇ FSAR will be updated to include requested information.
- ◇ “Significantly” refers to an unacceptable numerical value of deviation between corresponding data displayed on the PICS and the SICS.

## ▶ Response Content

- ◇ The two mechanisms that prompt a manual comparison of data on PICS and SICS to verify consistency:
  - A periodic verification surveillance will be performed as part of normal operating procedures
  - An operator detects a potential error and performs a comparison of data between PICS and SICS using the periodic verification surveillance

## ▶ Response Date: Feb. 19 (contingent on today’s discussions)

# RAI 285 Question 7.05-09



## ▶ Question Topic

- ◇ The ITAAC for the post-accident monitoring instrumentation to develop the final list of variables, their accuracy and ranges, etc. should be identified as DAC in the ITAAC itself.

## ▶ AREVA Position

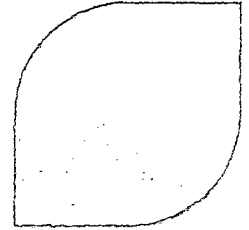
- ◇ The Response to RAI 307, Question 14.03.03-45 will address identification of all DAC for the U.S. EPR design.

## ▶ Response Content

- ◇ Response to the question will point to the response to RAI 14.03.03-45.

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 286 Question 7.08-09



## ▶ Question Topic

- ◇ Justification as to why PICS does not need to meet GDC 1

## ▶ AREVA Position

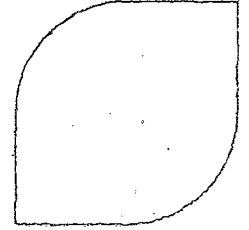
- ◇ GDC 1 applies to safety related SSCs only.
- ◇ Precedence has been set for this approach.

## ▶ Response Content

- ◇ U.S. EPR FSAR Section 3.1 defines GDC 1 applicability to safety related SSCs for the entire U.S. EPR design. I&C cannot be inconsistent with the rest of the design.
- ◇ The same approach was presented in section 3.1.1 of the AP1000 FSAR and subsequently approved by the staff in NUREG-1793.
- ◇ Reference to SRP 14.3 subsection II.B: Specifies GDC 1 applicability to only safety related I&C systems.
- ◇ The Terminal Data Network and the Plant Data Network are part of the PICS system and are also not safety related.

## ▶ Response Date: Feb. 19 (contingent on today's discussions)

# RAI 286 Question 7.09-49



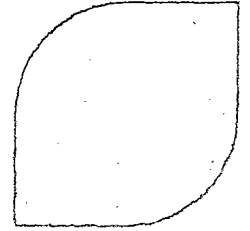
## ▶ Question Topic

- ◇ Operating experience regarding the effects of data storms on non-safety data communication networks

## ▶ AREVA Position

- ◇ 10 CFR 52.47(a)(22) does not require an applicant to address Information Notices
- ◇ 10 CFR 52.47(a)(22) compliance is not acceptance criteria for the review under SRP Chapter 7
- ◇ Compliance with 10 CFR 52.47(a)(22) for the US EPR is addressed in FSAR Tier 2, Section 1.9.4.

# RAI 286 Question 7.09-49 cont'd

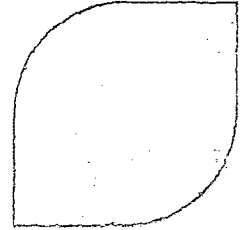


## ► Response Content

- ◆ Reference to NUREG-0800, chapter 1.0, section I.9 for acceptance criteria required to comply with 10 CFR 52.47(a)(22)
  - Generic Letters and Bulletins are the only two Generic Communications required for compliance
- ◆ NUREG-0800, Table 7-1 does not list 10 CFR 52.47(a)(22) as a requirement or acceptance criteria applicable to the review of FSAR chapter 7

## ► Response Date: Feb. 19 (contingent on today's discussions)

# RAI 286 Question 7.09-52



## ▶ Question Topic

- ◇ Provide ITAAC that verifies the plant data network is of sufficient quality and capacity to support PICS functions.
- ◇ GDC 19 “Control Room” and Point 4 of SECY-093-87 on D3 are the regulatory bases for the question.

## ▶ AREVA Position

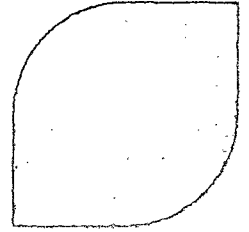
- ◇ ITAAC related to quality and capacity of plant data network would not address GDC 19 considerations in SRP 14.3, Appendix C.
- ◇ Point 4 of SECY-093-87 not addressed in SRP 14.3, Appendix C.
- ◇ Inclusion of plant data network in ITAAC is inconsistent with Tier 1 screening process described in FSAR Chapter 14.

## ▶ Response Content

- ◇ Description of above position

## ▶ Response Date: Feb. 19 (contingent on today’s discussions)

# RAI 286 Question 7.09-57



## ▶ Question Topic

- ◆ Input from the plant data network to overspeed control of the Turbine Generator I&C System

## ▶ AREVA Position

- ◆ The overspeed control of the Turbine Generator I&C System does not use the plant data network

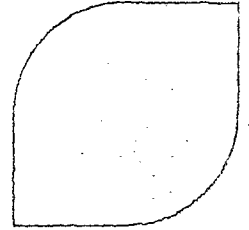
## ▶ Response Content

- ◆ Overspeed protection system is a part of the turbine control system and does not require input from plant data network to perform its function
- ◆ Overspeed protection for the steam turbine is provided by two separate and independent turbine protection systems, which are designed and manufactured by different vendors
- ◆ Reference to FSAR, Section 10.2.2.9, RAI No. 243 response to Question 10.02-6 and Figure 10.02-6-1 - detailed information regarding overspeed protection of the steam turbine

## ▶ Response Date: Response submitted December 18, 2009



# RAI 309 Question 7.09-60



## ▶ Question Topic

- ◇ Independence of RSS workstations from MCR workstations in a fire event

## ▶ AREVA Position

- ◇ The RSS workstations are both electrically and physically isolated from the MCR

## ▶ Response Content

- ◇ The terminal data network provides electrical isolation between the various PICS operator workstations and the redundant PUs.
- ◇ The PUs and plant data network are physically located in a separate fire area from the MCR
- ◇ Damage from a fire event in the MCR will be limited to the workstations in the MCR

## ▶ Response Date: Feb. 19 (contingent on today's discussions)