

United States Nuclear Regulatory Commission

Protecting People and the Environment

Update on Remaining Open Items – Phase Four

U.S. EPR Design Certification Review

Chapter 7: Instrumentation and Controls

October 30th, 2012

Wendell Morton – NRC/NRO/DE/ICE1

Update on Remaining Open Items – Phase 4 U.S. EPR I&C System Review



Objective

 Provide a brief overview of remaining OI based on the Chapter 7 portion of the U.S. EPR design review.

Expected Outcome

 Ensure there is a clear understanding between the Staff and applicant on all remaining review concerns.

Outline of Presentation



- Introduction
- General Overview
- Open Items
- Discussion / Questions

Introduction



- The NRC Staff initially identified a number of technical issues that were documented as OIs (with associated RAIs) in the Phase Two SER.
- In order to bring resolution to these technical issues:
 - The applicant issued draft RAI responses for the Staff to review.
 - The Staff conducted weekly teleconferences with the applicant to discuss the draft responses as well as any follow up questions and feedback on the content of the draft responses.
- Although many of the Ols were resolved through these efforts, several key issues remain unresolved.

Introduction (cont.)



- Besides the initial unresolved technical issues from Phase Two, the Staff identified a number of new technical concerns. These new technical concerns are distinct from the originally identified Phase Two OI. These new concerns are a result of the Staff's review of:
 - Revision 3 of the FSAR, docketed at the end of Phase Two. The Phase Two SER with OI was reviewed primarily with Revision 2 of the FSAR with interim Revision 3 markups.
 - New design information contained within Technical Reports issued after the close of Phase Two.
 - New design information submitted as part of RAI responses (including drafts) provided in Phase 4, not necessarily tied the original RAI question (e.g. conforming changes, etc.)
- Based upon the new technical issues identified, the Staff issued a number of Phase Four RAI questions.

General Overview



Major Documents Reviewed

Doc. Number	Title	Revision
Docket 52-020	U.S. EPR DCD FSAR, Tier 1 Section 2.4 and Tier 2 Chapter 7	2,3 Interim Revision 4
ANP-10309P	U.S. EPR Protection System Technical Report	4
ANP-10304	U.S. EPR Diversity and Defense-in-Depth Assessment Technical Report	5
ANP-10310P	Methodology for 100% Combinatorial Testing of the U.S. EPR Priority Module Technical Report	1
ANP-10315P	U.S. EPR Protection System Surveillance Testing and TXS Self-Monitoring Technical Report	1, Interim Revision 2
ANP-10272-A	Software Program Manual for TXS Safety Systems Topical Report	3
NP-10273P	AV42 Priority Actuation and Control Module Topical Report (Withdrawn and Replaced by ANP-10310P)	0



General Overview of OI – Phase Four

	SRP Section/FSAR Section	No. of Questions	No. of OI
7.1	Introduction	55	11
7.2	Reactor Trip System	33	0
7.3	Engineered Safety Features Systems	38	0
7.4	Systems Required for Safe Shutdown	15	0
7.5	Information Systems Important to Safety	11	0
7.6	Interlock Systems Important to Safety	3	0
7.7	Control Systems Not Required for Safety	21	0
7.8	Diverse Instrumentation and Control Systems	50	1
7.9	Data Communication Systems	71	1*
Totals		297	12

* Open Item Associated with RAI 7.1-35 regarding SAS interdivisional communication.



- RAI 505, Question 07.01-35: Initially, the Staff requested an FMEA and ITAAC be provided for the SAS. The Staff reviewed the applicant's draft response and found a significant amount of new design information beyond the scope of the original RAI question. In addition to concerns found with the original scope of the draft RAI response, the Staff had numerous concerns with the new design information in the applicant's initial draft RAI response. Staff concerns included the following topics:
 - I&C/Mechanical System Interfaces (LHSI pump trip, SAS/CCWS Interlocks, Voting etc.)
 - Independence Interdivisional communication utilized to perform system interlock functions within SAS.
 - Single Failure Concerns Failures in the I&C system affecting the safety function of mechanical systems.
 - The Staff has been working with the applicant to resolve all technical issues identified in the various draft supplemental responses to Question 07.01-35. The Staff is currently in the process of reviewing the latest draft supplemental response provided by the applicant in order to bring closure to this OI.



- RAI 505, Question 07.01-36: The Staff requested information on the voting logic design implemented within the SAS, specifically how SAS voting logic is modified in the presence of a single failure or other types of bad signals received by SAS function processors. The Staff reviewed the applicant's response and provided the applicant with clarifying questions and additional feedback.
- RAI 505, Question 07.01-39: This RAI question address the Staff's concerns associated with periodic verification of U.S. EPR self-testing features, as the applicant does not intend to directly test the self-testing features when performing periodic surveillances. The Staff reviewed the applicant's response and provided feedback and additional clarifying questions to the applicant on the Staff's concerns.
- RAI 505, Question 07.01-44: Requested the applicant to identify the credited self-test features for the other safety-related I&C systems in addition to coverage provided to the PS and SAS. Within its draft response, the applicant also provided interim revision 2 of ANP-10315P, "U.S. EPR Surveillance Testing and TELEPERM XS Self-Monitoring Technical Report". The Staff provided the applicant feedback on the entire RAI response.



- RAI 505, Question 07.01-46: This question was with regards to the OICS, which was a new US EPR design attribute introduced in Revision 3 of the FSAR. The Staff requested additional information on OICS design and implementation. The OICS ensures that, within the PACS module, manual operator actions originating from the safety-related SICS are not overridden by automatic commands originating from the non-safety related PAS. Based upon the Staff's review of the applicant's response, this OI is unresolved and resolution is being addressed through RAI 555, Questions 07.01-54 & 07.01-55.
- <u>RAI 505, Question 07.01-48</u>: For Question 07.01-48, the Staff requested more information on the automatic and manual controls available on the SAS. This question remains an unresolved OI for two reasons:
 - Conforming changes based on this RAI question's content are included in the applicant's draft response to RAI 505, Question 07.01-35. The latest draft response to RAI 505, Question 07.01-35 is currently under review by the Staff.
 - RAI 555, Question 07.01-53 was created based on the Staff's review of the applicant's response as well as multiple teleconference meetings with the applicant.



- RAI 542, Question 07.01-52: This RAI question requested more information on the design and implementation of WDT functionality on the ALUs. Specifically, the ability of the WDT to initiate a reactor trip signal in the event that an ALU malfunctions. This is a Phase 4 RAI and the review for this question is pending receipt of the applicant's initial draft response.
- RAI 555, Question 07.01-53 (Follow up question to RAI 505, Question 07.01-48): Requested the applicant provide information or analysis on how the US EPR design is protected from and how the Safety Analyses bounds the effects of potential failures of non-safety related I&C systems, specifically PAS and PICS. This is a Phase 4 RAI question and the review for this question is pending receipt of the applicant's initial draft response. Resolution to this RAI question may also require an audit of certain select design documentation to support a safety finding to support closing this OI.
- RAI 555, Question 07.01-54 (Follow up question to RAI 505, Question 07.01-46): Requested the applicant provide an analysis of the priority logic scheme in order to verify the absence of potential conflicts with concurrent and non-current signals from multiple I&C systems. This is a Phase 4 RAI question and the review for this question is pending receipt of the applicant's initial draft response. In addition to Question 07.01-53, an audit of selected design information may be necessary in order to support a safety finding and close this OI.



- RAI 555, Question 07.01-55 (Follow up question to RAI 505, Question 07.01-46): Based upon the Staff's review of RAI 505, Question 07.01-46, the Staff issued this RAI question as a follow-up due to the complexity of the information being requested. For Question 07.01-55, the Staff requested the applicant provide more information on the OICS including:
 - All the operational situations which would require OICS functionality.
 - Clarify the impact of OICS operation and potential failure on affected I&C systems.
 - The impact of OICS on credited manual actions and PA/AOO mitigation.

This review is on-going, pending receipt of the applicant's initial response to this RAI question.



- <u>RAI 512, Question 07.08-50</u>: This OI captures the continuing evaluation and review of the D3 failure analysis. An audit on selected design information may be required to support closure of this RAI question.
- <u>RAI 505, Question 07.01-33</u>: Tracks the applicant commitment to revise Topical Report ANP-10287P, "In-core Trip Setpoint and Transient Methodology For U.S. EPR Topical Report," adding the method for including the undetected SPND failure. Based on the revised in-core trip set point and transient methodology, the applicant also committed to re-analyze FSAR Tier 2, Chapter 15 events which take the credit for the in-core DNBR and linear power density (LPD) trips.





- The Staff will continue to interface with AREVA to address the identified issues.
- Future activities to support closure of these items include:
 - Weekly teleconferences to discuss and resolve remaining issues
 - Audits to support closure of open items.
- The Staff seeks a closure plan from AREVA to provide a path forward on these remaining open items.

List of Acronyms



•	EPR	_	Evolutionary Power Reactor
•	SER	_	Safety Evaluation Report
•	FSAR	_	Final Safety Analysis Report
•	SIS	_	Safety Injection System
•	SICS	_	Safety Information and Control System
•	PICS	_	Process Information and Control System
•	PACS	_	Priority and Actuator Control System
•	SPND	_	Self Powered Neutron Detector
•	PS	_	Protection System
•	SAS	_	Safety Automation System
•	PAS	_	Process Automation System
•	ESFAS	_	Engineered Safety Features Actuation System
•	I&C	_	Instrumentation and Controls
•	ICE1	_	Instrumentation, Controls and Electrical Engineering Branch 1
•	WDT	_	Watchdog Timer
•	ALU	_	Actuation Logic Unit
•	OICS	_	Operational I&C Disable Switches
•	OI	_	Open Item(s)
•	RAI	_	Request for Additional Information
•	FMEA	_	Failure Modes and Effects Analysis



Discussion / Questions