

Draft

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U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 07.03 - Engineered Safety Features Systems
Application Section: 7.3
ICE1 Branch

QUESTIONS

07.03-1

Describe how the inspections, tests, analyses, and acceptance criteria (ITAAC) for the U.S. EPR Protection System will adequately verify the functionality and capabilities of the TELEPERM XS self-testing features to meet IEEE Std. 603-1991, Clauses 5.7 and 6.5.

10 CFR 52.47(b)(1) requires, in part, that ITAAC that are necessary and sufficient to provide reasonable assurance that, if the ITAAC are performed and the acceptance criteria met, a facility that incorporates the design certification has been constructed and will be operated in conformity to the design certification, the provisions of the Act, and the Commission's rules and regulations. The ITAAC provided in DC FSAR, Tier 1, Section 2.4, does not appear to incorporate adequate ITAAC to verify the functionality of the self-testing features and its capability to meet the requirements in Clause 5.7 and 6.5 of IEEE 603-1991.

07.03-2

For DC-FSAR Section 7.3.2.3.6, provide comprehensive detail and design documentation concerning the self-test features and its specific interaction with ESFAS.

07.03-3

DC FSAR, Tier 1, Section 2.4, does not contain a test and verification for manually actuating a protective function that is normally an automatic function, at the division level. Please explain or provide additional details. This is a requirement of IEEE Std. 603-1991, Clause 6.2.1 and 7.2 which is endorsed by 10CFR50.55a(h).

07.03-4

DC-FSAR, Section 7.3.1.2.7, identifies three initiating conditions to actuate main steam isolation, which are Steam Generator(SG) Pressure Drop, SG pressure less than Min1p,

and for a SG isolation signal. For the Protection System ITAAC, located in DCD Tier 1, Section 2.4, Table 2.4.1-4, there are only two isolations provided for testing. Please confirm the veracity of Table 2.4.1-4 or the write-up in Section 7.3.1.2.7.

07.03-5

DC-FSAR, Section 7.3.1.2.15, states two initiating conditions:

- Low differential pressure across the RCP coincident with an SIS actuation signal, and
- Stage Two containment isolation signal generated.

For the Protection System ITAAC located in DC FSAR, Tier 1, Section 2.4, Table 2.4.1-4, there is no mention of the Stage Two Containment isolation for RCP Trip. Please verify the correctness of Table 2.4.1-4 or the write-up in Section 7.3.1.2.7.

07.03-6

Provide additional detail and or design documentation on the 'failure states' for the ESFAS design.

General Design Criteria 23 states in part, that the Protection System shall be designed, "to fail into a safe state or into a state demonstrated to be acceptable on some other defined basis if conditions such as disconnection of the system, loss of energy(e.g. electrical power, instrument air). . . ."

DC-FSAR Sections 7.3.2.2 and 7.1.2.2.12 do not adequately address this topic because there is no mention in either section that the system will 'fail safe' during an anticipated operating occurrence, or in particular, upon a loss of electrical power. Loss of electrical power is also not accounted for in Table 7.3-2. In addition, the failure modes and effects analysis in Section 7.3.2.2 does not specify that for a specific energized component (i.e. voter), whether it will fail in an 'as-is' state, so as to preclude the possibility of a system-induced transient.

07.03-7

Describe how the inspections, tests, analyses, and acceptance criteria (ITAAC) for the U.S. EPR Protection System will adequately verify the functionality and capabilities of ESFAS to initiate an automatic protective function with the failure of a single instrument channel, or loss of division of logic to meet IEEE Std. 603-1991, Clauses 5.1.

IEEE Std. 603-1991, Clauses 5.1 requires, in part, the the safety systems shall perform all safety functions required for a design basis event in the presence of a single credible failure.

07.03-8

Describe how the inspections, tests, analyses, and acceptance criteria (ITAAC) for the U.S. EPR Protection System will adequately verify the functionality and capabilities of ESFAS to initiate an automatic protective function while in maintenance bypass or under testing to meet IEEE Std. 603-1991, Clauses 5.7, 6.7 and 8.3.

IEEE Std. 603-1991, Clauses 5.7, 6.7, and 8.3 requires the safety systems shall be able to initiate an automatic protective function while under testing or under a maintenance bypass. The ITAAC which is provided in DC FSAR, Tier 1, Section 2.4 and as such, does not appear to provide adequate testing to ensure that these requirements are met.

07.03-9

Describe how the inspections, tests, analyses, and acceptance criteria (ITAAC) for the U.S. EPR Protection System will adequately verify the functionality and capabilities of the Protection System to sense a completion of a protective action, and requirement of operator intervention to reset the system in order to meet IEEE Std. 603-1991, Clauses 5.2 and 7.3.

Clauses 5.2 and 7.3 require that when the sense and command features reset, the execute features shall not automatically return to normal; they require separate, deliberate operator action to be returned to normal. The ITAAC provided in DC FSAR, Tier 1, Section 2.4, does not specify a test and/or inspection that verifies completion of a specific protective action and subsequent operator reset such that the Protection System meets the requirements in IEEE 603-1991 Clauses 5.2 and 7.3.

07.03-10

Describe how the inspections, tests, analyses, and acceptance criteria (ITAAC) for the U.S. EPR Protection System will adequately verify the functionality and capabilities of Protection System to initiate the appropriate safety function while blocking an impending operating bypass to meet IEEE Std. 603-1991, Clauses 6.6 and 7.4.

IEEE Std. 603-1991, Clauses 6.6 and 7.4 requires that whenever the applicable permissive conditions are not met, a safety system shall automatically prevent the activation of an operating bypass or initiate the the appropriate safety functions. The ITAAC which is provided in DC FSAR, Tier 1, Section 2.4 does not appear to provide adequate testing to ensure that these requirements are met in order to satisfy clauses 6.6 and 7.4 of IEEE 603-1991.

07.03-11

Please describe in detail the systems accuracies and response time of the Protection System in the U.S. EPR DC FSAR, and how they adequately address functionality requirements as per IEEE Std. 603-1991, Clause 4.4.

Per guidance from Standard Review Plan, Section 7.1-C-4, IEEE Std. 603-1991 Clause 4.4 requires the identification of system response times and accuracies. This information does not appear to be available in DC-FSAR, Section 7.3, nor is it tested and/or inspected in the Protection System ITAAC, documented in DC FSAR, Tier 1, Section 2.4.

07.03-12

Please describe in detail how the Protection system (ESFAS) in the U.S. EPR DC FSAR adequately addresses functionality requirements as per IEEE Std. 603-1991, Clauses 4.5.

IEEE Std. 603-1991, Clause 4.5, has four sub-clauses as follows:

4.5.1 The points in time and the plant conditions during which manual control is allowed.

4.5.2 The justification for permitting initiation or control subsequent to initiation solely by manual means.

4.5.3 The range of environmental conditions imposed upon the operator during normal, abnormal, and accident circumstances throughout which manual operations shall be performed.

4.5.4 The variables in 4.4 that shall be displayed for the operator to use in taking manual action.

DC-FSAR Section 7.3.2.1.4 does not explicitly describe when manual control is available nor the variables that will be displayed for the operator to use in taking manual action which are subclauses 4.5.1 and 4.5.4. The ITAAC also do not explicitly mention and/or tests for these clauses as well.

07.03-13

Describe how the Protection System (ESFAS) for the U.S. EPR, as described in the DC FSAR, will adequately satisfy the functionality and capabilities IEEE Std. 603-1991, Clauses 4.10.2 and 4.10.4.

IEEE Std. 603-1991, Sub-clauses 4.10.2 and 4.10.4, require documentation of the point in time or plant conditions that define the proper completion of the safety function, the points in time or the plant conditions that require automatic control of protective actions and the point in time or the plant conditions that allow returning a safety system to normal. DC-FSAR Section 7.3.2.1.6 does not adequately address these clauses.

07.03-14

Describe how the Protection System (ESFAS) for the U.S. EPR, as described in the DC FSAR, will adequately satisfy the functionality and capabilities IEEE Std. 603-1991, Clause 4.11.

IEEE Std. 603-1991, Clause 4.11 requires documentation of equipment protective provisions that prevent a safety systems from accomplishing its design function. This clause is not addressed in DC-FSAR Section 7.3 and there is insufficient detail in DC-FSAR Section 7.1.2.6.10 to make any evaluation concerning Clause 4.11.

07.03-15

Describe how the Protection System (ESFAS) for the U.S. EPR, as described in the DC FSAR, will Adequately satisfy the functionality and capabilities IEEE Std. 603-1991, Clause 4.12

IEEE Std. 603-1991, Clause 4.12 requires documentation of any special design basis imposed on the system design. This clause is not addressed in DC-FSAR Section 7.3 and there is insufficient detail in DC-FSAR Section 7.1.2.6.11 to make any evaluation concerning Clause 4.12.

07.03-16

Describe how human factors considerations have been incorporated into the Protection System Design Basis for the U.S. EPR as described in the DC fsar, in order to satisfy the requirements of IEEE Std. 603-1991, Clause 5.14.

Clause 5.14 requires that human factors shall be considered at the initial stages and throughout the design process to assure that the function allocated in whole or in part to the human operator(s) and maintainer(s) can be successfully accomplished to meet the safety system design goals. There is insufficient detail provided in DC-FSAR Sections 7.1 or 7.3 to determine whether human factors have been used in the design. In addition, the ITAAC has no verification of human factor issues.

07.03-17

Describe how Class 1E equipment identification considerations have been in the ITAAC.

Per review guidance from Standard Review Plan Section 7.1-C-11, Class 1E equipment identification should be made to conform to IEEE Std. 384-1992, which is endorsed by Regulatory Guide 1.75. The staff was not able to identify ITAAC that verifies the identification of Class 1E equipment.

07.03-18

Please describe how the main control room information displays for the Protection System design for the U.S. EPR, as described in the DC FSAR, satisfy the requirements of IEEE Std. 603-1991, Clause 5.8.

Per review guidance from Standard Review Plan Section 7.1-C-11, Information displays in the Main Control Room should conform to the guidelines of Regulatory Guide 1.47 to satisfy the requirements of IEEE 603-1991, Clause 5.8. Please provide more details on conformance to this regulatory guide or another method of analysis that may be used.

07.03-19

Please provide more details on how the Protection System Design ITAAC for the U.S. EPR, as described in the DC FSAR, addresses the requirements of IEEE Std. 603-1991, Clause 5.5.

As per guidance from Standard Review Plan Section 7.1-C-9, for computer-based systems, instruments should fail into a safe-state, a failure of hardware or software should not inhibit manual initiation of a protective function and upon system restoration from a loss of power condition, actuated components should not automatically transfer out of the predefined failure state. The ITAAC in DC FSAR, Tier 1, Section 2.4, does not appear to test for these topics.

07.03-20

Provide additional details concerning lightning protection for the Protection System of the U.S. EPR, as described in the DC FSAR.

Per guidance from Standard Review Plan 7.1-C.8 and IEEE 7-4.3.2-2003, part of the analysis for satisfying IEEE 603-1991, Clause 5.4, should include lightning protection and that the features should conform to guidelines of Regulatory Guide 1.204. DC-FSAR Section 7.1.2.6.15 does not address lightning protection, and the staff could not identify any other sections of the DC-FSAR that may address this issue. Additionally, the ITAAC has no inspection concerning lightning protection or electrical grounding for the safety system components.