WCAP-18810-NP, Revision 0
"Advanced Logic System® v2 Platform Elimination of Technical Specification Surveillance Requirements"
(Non-Proprietary)

Westinghouse Electric Company
1000 Westinghouse Drive
Cranberry Township, PA 16066

WCAP-18810-NP
Revision 0

December 2023

Advanced Logic System® v2 Platform

Elimination of Technical Specification Surveillance Requirements

Westinghouse

WCAP-18810-NP
Revision 0

Advanced Logic System® v2 Platform

Elimination of Technical Specification Surveillance Requirements

Matthew A. Shakun*, Principal Licensing Engineer
Licensing Engineering

December 2023

Reviewer: Warren R. Odess-Gillett*, I&C Licensing Engineer
Licensing Engineering

Verifier: Thomas Tweedle*, Fellow Engineer
Advanced Reactors I&C

Approved: James Mermigos*, Manager
Advanced Reactors I&C

Anthony Schoedel*, Manager
Advanced Reactors Licensing

*Electronically approved records are authenticated in the electronic document management system.

Westinghouse Electric Company LLC
1000 Westinghouse Drive
Cranberry Township, PA 16066, USA

LIST OF CONTRIBUTORS

Revision	Name and Title
0	Terrence C. Tuite Principal Engineer, Instrumentation and Monitoring Systems

REVISION HISTORY

RECORD OF CHANGES

Revision	Author	Description	Date
0	Matthew A. Shakun	Initial Issue	See PRIME

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND TRADEMARKS

The following lists acronyms used in this document that are not defined in 6002-00040, "ALS Terms and Abbreviations" (Reference 28) or WNA-PS-00016-GEN, "Standard Acronyms and Definitions" (Reference 2), or they are included below to ensure unambiguous understanding of their use within this document.

Acronym	**Definition**
ADC	Analog to Digital Converter
ALT	Actuation Logic Test
ASU	ALS Service Unit
CLB	Core Logic Board
COT	Channel Operational Test
CR	Condition Report
DLS	Diesel Load Sequencer
ESFAS	Engineered Safety Features Actuation System
FMEA	Failure Modes and Effects Analysis
FMEDA	Failure Modes, Effects, and Diagnostics Analysis
FPGA	Field-Programmable Gate Array
I/O	Input/Output
I&C	Instrumentation & Control
IV&V	Independent Verification and Validation
LCO	Limiting Conditions for Operation
LRA	Licensee Required Action
MCR	Main Control Room
NRC	United States Nuclear Regulatory Commission
RAB	Reliable ALS Bus
PPS	Plant Protection System using the ALS v2 Platform
RMS	Root Mean Square
RTCB	Reactor Trip Circuit Breakers
RT	Reactor Trip
RTS	Reactor Trip System
RTT	Response Time Testing
SER	Safety Evaluation Report
SR	Surveillance Requirement
TAB	Test ALS Bus
TADOT	Trip Actuation Device Output Test
TS	Technical Specifications
TX	Transmit

REFERENCES

1. WNA-PS-00016-GEN, Rev. 8, "Standard Acronyms and Definitions." Westinghouse Electric Company LLC.

2. NUREG-1431, Rev. 5.0, "Standard Technical Specifications Westinghouse Plants – Volume 1, Specifications," United States Nuclear Regulatory Commission.

3. NUREG-1431, Rev. 5.0, "Standard Technical Specifications Westinghouse Plants – Volume 2, Bases," United States Nuclear Regulatory Commission.

4. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," United States Nuclear Regulatory Commission.

5. IEEE 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

6. IEEE 338-1987, "IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems," Institute of Electrical and Electronics Engineers.

7. Regulatory Guide 1.118, Rev. 3, "Periodic Testing of Electric Power and Protection Systems," United States Nuclear Regulatory Commission.

8. IEEE 338-2022, " IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems," Institute of Electrical and Electronics Engineers.

9. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," United States Nuclear Regulatory Commission.

10. WCAP-18762-P, Rev. 0, "Advanced Logic System v2 Platform Topical Report," Westinghouse Electric Company LLC.

11. Regulatory Guide 1.152, Rev. 4, "Criteria for Programmable Digital Devices in Safety-Related Systems of Nuclear Power Plants, United States Nuclear Regulatory Commission.

12. IEEE 7-4.3.2-2016, "IEEE Standard Criteria for Programmable Digital Devices in Safety Systems of Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers.

13. WCAP-14036-P-A, Rev. 1, "Elimination of Periodic Protection Channel Response Time Tests," Westinghouse Electric Company LLC.

14. WCAP-18780-P, Rev. 0, "Advanced Logic System® v2 Development Process Topical Report," Westinghouse Electric Company LLC.

REFERENCES (cont.)

15. 6002-00301-P-A, Revision 4, "Advanced Logic System Topical Report," Westinghouse Electric Company LLC.

16. 6003-00033, Revision 2, "Advanced Logic System (ALS) v2 Self-Diagnostics Functionality," Westinghouse Electric Company LLC.

17. "Ceramic Capacitor Aging Made Simple," Johanson Dielectrics Inc., 2012.

18. 6003-15212, Revision 0, "ALS-152 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

19. 6003-35212, Revision 0, "ALS-352 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

20. 6003-36112, Revision 1, "ALS-361 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

21. 6003-37112, Revision 0, "ALS-371 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

22. 6003-45212, Revision 0, "ALS-452 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

23. 6003-47112, Revision 0, "ALS-471 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

24. 6003-65112, Revision 1, "ALS-651 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

25. 6003-85012, Revision 0, "ALS-850 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

26. 6003-85212, Revision 1, "ALS-852 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

27. 6003-85312, Revision 1, "ALS-853 FPA, FMEA and Reliability Analysis," Westinghouse Electric Company LLC.

28. 6002-00040, Revision 4, "ALS Terms and Abbreviations," Westinghouse Electric Company LLC.

(Last Page of Front Matter)

1 INTRODUCTION

1.1 PURPOSE

The purpose of this topical report is to provide a methodology to eliminate certain Technical Specification (TS) Surveillance Requirements (SRs) related to the ALS v2 platform. In this topical report a reference is made to a document describing each diagnostic in the ALS v2 platform (Reference 16), and references to the ALS v2 Failure Modes, Effects, and Diagnostic Analyses (FMEDAs) for each ALS v2 board (see Section 6). A licensee applying this topical report will develop a system level Failure Modes and Effects Analysis (FMEA) and will need to validate that the ALS v2 board FMEDAs cover all failure modes identified in the system level FMEA.

The ALS v2 Self-diagnostics described in Reference 16 are categorized as follows:

- Platform diagnostics: those diagnostics inherent in the design of the ALS v2 platform.
- Application diagnostics: those diagnostics specific to an application of the platform. An example of an application diagnostic is the logic to compare signals across safety division boundaries to support the channel check SR.

This topical report will provide both the necessary analysis to justify SR elimination, along with corresponding markups of the Westinghouse Standard TS (see Appendix C). Based on U.S. Nuclear Regulatory Commission (NRC) review, this will potentially allow for the elimination of certain surveillances on safety-related Instrumentation and Control (I&C) equipment based on the ALS v2 platform. This will lead to increased duration of plant operations without reducing safety by ensuring full I&C safety system redundancy over the life of the safety system and reducing human interaction with the equipment.

1.2 BACKGROUND

Technical Specifications establish requirements that a nuclear facility must meet during operations. The regulatory basis for these specifications is Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities" (Reference 4), Section 36, "Technical specifications". Specifically relating to the safety system of a nuclear plant is 10 CFR 50.36(c)(ii)(A) which establishes limiting safety system settings for nuclear reactors.

To demonstrate that the safety system is operable, which ensures that limiting conditions of operation (LCOs) are met, the TS stipulate SRs for various protective functions. These SRs range from tests and calibration, to visual inspection; and are performed on a periodic interval governed by the TS (e.g., 12 hours to 24 months). The number of Reactor Trip (RT) and Engineered Safety Feature Actuation System (ESFAS) functions contained within Section 3.3 of NUREG-1431 (Reference 2), coupled with the SR frequency, results in significant testing that is to be performed over the life of the safety system. This includes extensive testing during refueling outages that operating experience shows can sometimes lead to critical path. The current frequencies in the aforementioned TS SRs were based on analog control systems. Advantages introduced by using a digital I&C safety system, such as the ALS v2 based safety system, were not accounted for when deciding what SRs and respective frequencies should be included in the TS.

To eliminate SRs which inherently improves safety by reducing the duration that a plant operates with I&C Safety Equipment at less than full redundancy, Westinghouse has produced this topical report detailing the analyses necessary to eliminate SRs, as well as the corresponding results. These simplifications take full advantage of the ALS v2 platform self-diagnostic features, something not accounted for in TS. The elimination of SRs will also reduce the burden on operations and maintenance personnel, as well as the burden of generating and preserving procedures related to SR testing.

(Last Page of Section 1)

2 SCOPE OF ANALYSIS

The scope of this topical report is not limited to only an ALS v2 Safety System under Westinghouse Technical Specification SRs. This topical report uses NUREG-1431, "Standard Technical Specifications Westinghouse Plants – Volume 1, Specifications," Reference 2, (further clarified in NUREG-1431, "Standard Technical Specifications Westinghouse Plants – Volume 2, Bases", Reference 3) as an example of SR types that could be eliminated using the information in this document. The SRs are related to Reactor Trip Systems (RTS), Engineered Safety Features Actuation Systems (ESFAS), and Diesel-loading Sequencers (DLS). Note that for an ALS v2 based safety system in a plant not covered by the standard Westinghouse TS (References 2 and 3), Appendix C provides a framework for how this topical report can be applied.

Each licensee's TS SRs can be evaluated to determine which SRs can be eliminated based on the FMEDAs listed in Section 6 and the system level FMEA produced for the replacement safety system using the ALS v2 platform. The ALS v2 platform is defined within WCAP-18762, "Advanced Logic System v2 Platform Topical Report" (Reference 10).

2.1 SURVEILLIANCE REQUIREMENTS SUBJECT FOR ELIMINATION

2.1.1 Westinghouse Standard Technical Specification Surveillance Requirements

The following Westinghouse Standard TS SRs (from Reference 2) are analyzed in this report as an example. As stated earlier, similar TS SRs may exist for other nuclear technologies. This document provides a method for assessing ALS v2 diagnostic coverage for a TS SR allowing for the SR to be eliminated for any nuclear technology. Note that it is assumed that a Setpoint Control Program is in place, which means only TS Section 3.3.#B is considered here.

Channel Checks

Per NUREG-1431 (Reference 2) a Channel Check, "*shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.*" These visual comparisons are performed by reactor operators in the Main Control Room (MCR), verifying that redundant sensors (or calculations) have not grossly failed.

Channel Operational Test (COT)

A COT is defined as an "*injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy. The COT may be performed by means of any series of sequential, overlapping, or total channel steps.*"

Actuation Logic Test (ALT)

An ALT is defined as, "*the application of various simulated or actual input combination in conjunction with each possible interlock logic state required for OPERABILITY of a logic circuit and the verification of the required logic output. The ACTUATION LOGIC TEST, as a minimum, shall include a continuity check of output devices*." The ALT verifies different components based on whether the function under test is for reactor trip (RT) or engineered safety features (ESF):

- For RT functions, the scope for the ALT is the trip logic up to the ALS v2 interface with the Reactor Trip Initiation circuit (which interfaces with the Reactor Trip Circuit Breakers, RTCBs).
- For ESF actuation system (ESFAS) functions, the scope for the ALT is the actuation logic up to the safety system output.

Response Time Testing (RTT)

The TS in NUREG-1431 (Reference 2) contain two response time definitions, one for reactor trip system (RTS) Response Time and one for ESF Response Time. Both definitions state that the response time shall be defined as the time interval from when a monitored parameter exceeds its trip setpoint at the channel sensor until loss of stationary gripper coil voltage for RTS or until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.) for ESF functions. In other words, response time testing validates the entire actuation path for RT functions and for ESF functions (for ESF functions, times include diesel generator starting and sequence loading delays, where applicable). In addition, it is stated in both definitions that, "*The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC*."

Remaining surveillances, such as Calibration and Trip Actuating Device Operational Test (TADOT) are not considered in this report and, in some cases, can be credited for providing overlapping testing coverage.

(Last Page of Section 2)

3 REGULATIONS, INDUSTRY STANDARDS, AND REGULATORY GUIDANCE

The following regulations, industry standards, and regulatory guidance are applicable to periodic testing during normal plant operations and therefore related to this effort:

- 10 CFR 50 (specifically Section 36, Section 55a, Appendix A, and Appendix B)
- IEEE 603-1991
- IEEE 338-1987 and Regulatory Guide 1.118, Revision 3
- IEEE 7-4.3.2-2016 and Regulator Guide 1.152, Revision 4
- BTP 7-17 Rev. 6

These regulations, standards, and regulatory guidance are discussed in the following sections. Although not endorsed by NRC, IEEE 338-2022 is also discussed below to provide context as to the current industry position regarding self-diagnostics and how they relate to surveillance testing.

3.1 10 CFR 50

10 CFR 50 (Reference 4) contains several regulations related to manual surveillance testing requirements. These are summarized as follows:

1. 10 CFR 50 (Reference 4), Section 36, “Technical Specifications” – 10 CFR 50.36 requires Technical Specifications to be established for licensees to verify the operability of select systems and components in the plant. The Technical Specifications are derived from the analyses and evaluations included in the safety analysis report. The Technical Specifications include, in part, limiting conditions for operation and surveillance requirements. When a limiting condition for operation of a nuclear reactor is entered, the licensee is required to follow the remedial action required by the Technical Specifications until the condition can be met. Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that the facility will be within safety limits, and that the LCOs will be met.

2. 10 CFR 50 (Reference 4), Section 55a, “Codes and Standards” – Paragraph h of this section establishes the requirement to meet IEEE 603-1991. This is discussed in more detail in Section 3.2.

3. 10 CFR 50 (Reference 4), Appendix A, “General Design Criteria for Nuclear Power Plants” – There are two General Design Criteria (GDC) applicable to this effort:

   - GDC 18, “Inspections and Testing of Electric Power Systems,” requires (in part) that electric power systems important to safety be designed to permit periodic testing, including periodic testing of the performance of the components of the system and the system as a whole.

   - GDC 21, “Protection System Reliability and Testability,” requires (in part) that the protection system be designed to permit its periodic testing during reactor operation, including a capability to test channels independently to determine failures and losses of redundancy that may have occurred.

4. 10 CFR 50 (Reference 4), Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants” – Criterion XI, “Test Control”, requires (in part) that a test program be established to ensure that all testing, including operational testing required to demonstrate that systems and components will perform satisfactorily in-service, is identified and performed in accordance with written test procedures.

3.2 IEEE 603

IEEE 603-1991, “IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations” (Reference 5) contains sections that require the protection system to have certain capabilities regarding testing. Section 5.7 “Capability for Test and Calibration”, requires the protection system to have the capability for testing and calibration during power operations while retaining the capability of the safety systems to accomplish their safety functions. Per this section, the protection system design must be capable of providing testing in accordance with IEEE 338-1987. Similarly, Section 6.5 (which relates to the functional and design requirements for the Sense and Command Features of the safety system) requires that a means be provided for checking the operational availability of the protection equipment during plant operations. These sections do not state that the safety system needs to use these features as part of a testing program, but just that they are available.

3.3 IEEE 338 AND REGULATORY GUIDE 1.118

IEEE 338-1987, "IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems" (Reference 6) provides design and operational criteria for the performance of periodic testing as part of the surveillance program of nuclear power generating station safety systems. Per Regulatory Guide 1.118, “Periodic Testing of Electric Power and Protection Systems” (Reference 7) IEEE 338-1987 provides a method acceptable to the NRC staff for satisfying the underlying regulations associated with periodic testing.

The scope of periodic testing is defined within this standard as including functional tests and checks, calibration verification, and time response measurements, as required, to verify the safety system performs to meet its defined safety function. The standard provides guidance for those tests within the surveillance program. This includes the safety system being designed with the capability for periodic surveillance testing. Even though the self-diagnostics are not part of the surveillance program, they do support the basis of the standard (i.e., IEEE 338-1987, Reference 6, Section 4) in that they continuously and periodically check the system to verify operability.

IEEE 338-2022, “IEEE Standard Criteria for the Periodic Surveillance Testing of Nuclear Power Generating Station Safety Systems,” (Reference 8) Section 5.4.3, though not currently endorsed by the NRC, provides a basis for eliminating periodic surveillance tests as evidenced by the following statement, *“Digital control/protection systems that have self-test and self-diagnostic features that continuously verify proper digital processing can be credited for periodic surveillance testing only if the system or component satisfies all of the following automatically:*

a) All used input interfaces are tested.
b) All used output interfaces are tested, without introducing inadvertent, unintended actuations.
c) Functionality is tested.

d) Time delay, or range of time delay, through the system is demonstrated at the system acceptance test.
e) A mechanism, such as a checksum, capable of detecting single and multiple bit errors is provided to verify that the non-modifiable software and configuration are correct.
f) All identified credible internal failures are detected by the system.
g) Any detected malfunction in the system is alarmed in the control room for timely response.

Any required functional testing which cannot be continuously demonstrated by digital processing shall be tested periodically."

3.4 IEEE 7-4.3.2-2016 AND REGULATORY GUIDE 1.152

Regulatory Guide 1.152, "Criteria for Programmable Digital Devices in Safety-Related Systems of Nuclear Power Plants," Reference 11, endorses IEEE 7-4.3.2-2016, "IEEE Standard Criteria for Programmable Digital Devices in Safety Systems of Nuclear Power Generating Stations," Reference 12. Regulatory Guide 1.152, Clarification 1.2.2 provides the following criteria for crediting self-diagnostics to eliminate TS SRs:

(a) The design of self-diagnostic features maintains channel independence and system integrity and meets the single-failure criterion.
(b) The safety classification of the hardware and software used to perform self-diagnostics is equivalent to that of the tested system unless physical, electrical, and communication independence are maintained such that no failure of the test function can inhibit the performance of the safety function.
(c) Failures detected by self-diagnostics are consistent with the failure detectability assumptions of the single-failure analysis and the failure modes and effects analysis.
(d) The design of self-diagnostic features should minimize complexity added to the safety-related system while maximizing the system reliability and fault detection capabilities. Interfaces between software that performs protection functions and software for other functions such as self-diagnostics should be designed to minimize the complexity of the software logic and data structures.
(e) Self-diagnostic functions are verified during periodic functional tests.

RG 1.152, Clarification 1.2.3 provides additional criteria for crediting self-diagnostics to eliminate the TS SRs:

(a) Self-diagnostic features do not adversely impact the reliability of the DI&C safety-related system and its ability to perform safety functions.
(b) Self-diagnostics achieve the same acceptance criteria applied to the manual periodic channel operability test.
(c) Provisions are in place to confirm the execution of the self-diagnostics during plant operation. The capability to periodically test and calibrate the automatic test equipment should also be provided.
(d) Administrative control and operation procedures are maintained to periodically verify the performance of self-diagnostics (e.g., periodic checks of event logs, manual verification of setpoints, rebooting of startup self-diagnostics).

These criteria are assessed in relation to this topical report in the evaluation in Section 3.6.

3.5 BTP 7-17

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (Reference 9), Branch Technical Position (BTP) 7-17, "Guidance on Self-Test and Surveillance Test Provisions," provides NRC review guidance into periodic surveillance testing and self-diagnostic features for a digital system. This BTP acknowledges the use of automatic self-testing as an appropriate method to perform periodic surveillance tests. Additionally, BTP 7-17 states, "Self-test functions should be verified during periodic functional tests." This statement is assessed in relation to this topical report in the evaluation Section 3.6.

3.6 EVALUATION/CONCLUSION

Although historically industry and regulatory standards have required periodic surveillance for safety systems testing during normal operations, exceptions have been allowed. Specifically:

- **IEEE 603-1991**: Allows an exception to testing (if testing affects safety and/or operability) based on providing justification and acceptable reliability. However, the approach taken in this topical report is to eliminate manual testing by crediting self-diagnostics. The self-diagnostics being credited within the SR elimination analysis (Section 7 of this topical report) are automatic self-tests that are performed within the platform at an interval significantly shorter than the current SR interval. These proposed TS modifications for elimination of SRs result in improved safety system availability and reduced potential for human error.

- **IEEE 338-1987**: This topical report proposes the removal of several TS surveillances due to self-diagnostic test coverage. These self-diagnostics will not be part of the surveillance program, and therefore, the requirements in IEEE 338-1987 are not directly applicable. Additionally, this standard is written specifically for analog systems, resulting in guidance that does not explicitly address self-diagnostic testing features.

  Regarding response time testing, IEEE 338-1987, Section 6.3.4, item 3, states that in lieu of response time testing, response time can be verified by other periodic tests (e.g., functional testing and calibration checks). This can be done if it can be shown that changes in response time beyond acceptable limits are accompanied by changes in performance characteristics that would be detected during the aforementioned periodic tests.

- **IEEE 338-2022**: Though not endorsed by the NRC, this standard provides an exception to periodic surveillance tests based on the ability to continuously verify proper digital processing. This demonstrates how the industry has adapted IEEE 338 for digital systems.

- **IEEE 7-4.3.2-2016 AND REGULATORY GUIDE 1.152**

  The RG 1.152, Revision 4 criteria in Section 3.4 are evaluated as follows for the ALS v2 Platform:

  Clarification 1.2.2:

a) The design of self-diagnostic features maintains channel independence and system integrity and meets the single-failure criterion.

   Disposition: Each Field Programmable Gate Array (FPGA) on an ALS v2 board has a set of self-diagnostics that do not cross ALS v2 board boundaries and do not cross channel or division boundaries for a system. When a self-diagnostic detects an error within the board it will annunciate and/or set the board to a safe state. The diagnostics are developed using the same FPGA safety-related design process as the safety functions of the board.

b) The safety classification of the hardware and software used to perform self-diagnostics is equivalent to that of the tested system unless physical, electrical, and communication independence are maintained such that no failure of the test function can inhibit the performance of the safety function.

   Disposition: The development of the self-diagnostics follows the same safety-related design process as the safety functions of the ALS v2 board. Every self-diagnostic is defined by a requirement and then traced from requirement to design and test. The independent verification and validation program encompasses the self-diagnostic requirements to ensure these requirements are adequately designed and implemented. This process ensures that the self-diagnostics do not interfere with the safety function of the ALS v2 board.

c) Failures detected by self-diagnostics are consistent with the failure detectability assumptions of the single-failure analysis and the failure modes and effects analysis.

   Disposition: As described in this methodology, each ALS v2 board has a set of self-diagnostics and a FMEDA. Each application of the ALS v2 platform will have a system level FMEA. An analysis will be performed for each application verifying that the system level failure modes (i.e., FMEA) are covered by self-diagnostics (i.e., ALS v2 board FMEDA). Those system failure modes not covered by self-diagnostics would require a periodic surveillance test.

d) The design of self-diagnostic features should minimize complexity added to the safety-related system while maximizing the system reliability and fault detection capabilities. Interfaces between software that performs protection functions and software for other functions such as self-diagnostics should be designed to minimize the complexity of the software logic and data structures.

   Disposition: The ALS v2 board FPGA logic in the safety path for safety functions is different logic than that for the self-diagnostics.

e) Self-diagnostic functions are verified during periodic functional tests.

   Disposition: A set of Licensee Required Actions (LRAs) are defined in this topical report including an action requiring the licensee to provide a description of plant administrative controls that will provide assurance that the self-diagnostics are functioning. This can include routine plant personnel actions necessary to assure adequate operations of the ALS v2 system diagnostic functions that are credited. This includes (but are not limited to) operator rounds and MCR board walkdowns, as well as system health checks performed by system engineering on a periodic basis. The result of the system engineer checks can be summarized in system health reports, and any adverse condition will be captured in plant condition reports (CRs). Should it be determined that the source of a diagnostic problem is the ALS v2 platform, a CR would be filed by the licensee and transmitted to Westinghouse who will then take the appropriate corrective actions to resolve the issue.

Clarification 1.2.3:

a) Self-diagnostic features do not adversely impact the reliability of the DI&C safety-related system and its ability to perform safety functions.

   Disposition: The development of the self-diagnostics follows the same safety-related design process as the safety functions of the ALS v2 board. Every self-diagnostic is defined by a requirement and then traced from requirement to design and test. The independent verification and validation program encompasses the self-diagnostic requirements to ensure these requirements are adequately designed and implemented. This process ensures that the self-diagnostics do not interfere with the safety function of the ALS v2 board.

b) Self-diagnostics achieve the same acceptance criteria applied to the manual periodic channel operability test.

   Disposition: The ALS v2 self-diagnostics cover the same functionality that is being tested in COT. This coverage is documented in the FMEDAs listed in Section 6, and ultimately the system level FMEA.

c) Provisions are in place to confirm the execution of the self-diagnostics during plant operation. The capability to periodically test and calibrate the automatic test equipment should also be provided.

   Disposition: LRA 6 defined in this report requires the licensee to provide a description of plant administrative controls that will provide assurance that the self-diagnostics are functioning. Self-diagnostics are developed integrated into the platform, and no automatic testing equipment is being used external to the platform.

d) Administrative control and operation procedures are maintained to periodically verify the performance of self-diagnostics (e.g., periodic checks of event logs, manual verification of setpoints, rebooting of startup self-diagnostics).

   Disposition: LRA 6 defined in this report requires the licensee to provide a description of plant administrative controls that will provide assurance that the self-diagnostics are functioning.

- **BTP 7-17**: Acknowledges automatic self-testing as an appropriate substitute to periodic surveillance tests. Acceptance Criterion 3 is similar to the criteria in Regulatory Guide 1.152, “Self-diagnostic functions are verified during periodic functional tests.” The criterion is addressed by plant administrative controls that provide assurance that the self-diagnostics are functioning. This includes (but are not limited to) operator rounds and MCR board walkdowns, as well as system health checks performed by system engineering on a periodic basis.

In summary, the elimination of SRs by crediting self-diagnostics meets the applicable NRC regulations. Although some of these standards/guidance documents assume a testing program is in place, others allow for exceptions to testing given that designated criteria are met justifying the change. This topical report provides the methodology for licensees to demonstrate that the ALS v2 self-diagnostics can be credited in lieu of an SR. Therefore, compliance with the applicable standards/regulations will be maintained even when SRs are eliminated.

4 INTRODUCTION TO ALS V2 SELF-DIAGNOSTICS

4.1 OVERVIEW

There are two types of self-diagnostics which are used to detect faults in the ALS v2 platform. These are:

- Platform diagnostics: those diagnostics inherent in the design of the ALS v2 platform.
- Application diagnostics: those diagnostics specific to an application of the platform. An example of an application diagnostic is the logic to compare signals across safety division boundaries to support the channel check SR.

4.1.1 ALS v2 Platform Self-Diagnostics

The ALS v2 platform self-diagnostics have been designed, implemented, tested, and verified & validated by an organizationally independent team under the same processes as the ALS v2 platform safety-related functions as described in WCAP-18780-P, "Advanced Logic System v2 Development Process Topical Report," (Reference 14).

The ALS v2 platform is described in WCAP-18762 (Reference 10).

4.1.2 Guaranteed Completion of ALS v2 Self-Diagnostics

[

]a,c

4.1.3 Application Self-Diagnostics

The system application logic is hosted by the ALS v2 Core Logic Board (CLB) FPGA. It is programmed for a specific application such as an RTS or ESFAS. RTS and ESFAS systems have multiple divisions allowing for self-diagnostics at the application level. Section 5.2 discusses application self-diagnostics, but there are others that could be implemented for a system to address a plant-specific TS SR. The application self-diagnostics are developed, implemented, and subjected to Independent Verification & Validation (IV&V) under the processes described in WCAP-18780-P, (Reference 14).

4.2 SINGLE FAILURE CRITERION

In evaluating the single failure criterion, it is necessary to consider single failures together with all other identifiable, but non-detectable failures that may be present in the system. In the current regulatory framework, failures not detected by self-diagnostics are expected to be detected by a surveillance test. With the methodology for eliminating SRs within this topical report, the diagnostics must cover these postulated failure modes. This is done by developing a system level Failure Modes and Effects Analysis (FMEA) for the ALS v2 Platform application (e.g., RTS or ESFAS). The ALS v2 FMEDAs listed in Section 6 are for each ALS v2 board. A licensee will have to compare the plant-specific application

FMEA with the FMEDAs in Section 6 to ensure that the failure modes outlined in these tables are bounding.

4.3 DIVISION FAULT ALARM PATH

Annunciation is necessary to alert operators when a fault is detected by diagnostics within the ALS v2 safety system. There are multiple ways that the operator can be informed of an ALS v2 safety system fault. These are: [

]a,c

The licensee's application needs to describe how the results of the ALS v2 safety system diagnostics are communicated and displayed in the MCR. If the pathway for these self-diagnostic results involves non-safety equipment, then the licensee's application needs to provide the safety case that the non-safety path is reliable and if it fails, the failure will be alerted to the operator. Such justifications can include the continuous frequent action of the non-safety information display path. The information display path may consist of multiple data points transmitted and received over the same hardware components on a continuing basis. [

]a,c

(Last Page of Section 4)

5 SELF-DIAGNOSTIC FUNCTIONS

This section describes the scope of the ALS v2 self-diagnostics described in Reference 16. The ALS v2 platform incorporates advanced fault detection and isolation techniques. The operation of the platform is deterministic in nature and allows for self-monitoring to validate its functional performance. The ALS v2 platform implements fault detection and mitigation in the safety path to avoid unintended plant events.

5.1 TS COVERAGE OF ALS V2 SELF-DIAGNOSTICS

The ALS v2 platform incorporates self-diagnostic features that provide a means to detect and alarm any fault that impacts the safety path within the platform. Details of the ALS Board self-diagnostic features are described Reference 16.

The ALS v2 platform is designed to support the elimination of manual periodic surveillance testing of an installed ALS v2 safety system. In safety system applications, such as RT or ESF, the ALS v2 platform is operating at steady state where it is monitoring plant conditions to initiate safety system actuations when necessary to keep the plant in a safe state. Currently, and in analog safety systems, to verify operability, it is necessary to test these static commands on a regular basis. For specific safety systems, this has been done with periodic surveillance testing which involves plant personnel placing the system into a bypassed state and then testing the critical functions. The ALS v2 platform is designed to eliminate the need for periodic surveillance testing with self-testing which automatically and transparently verifies critical system functions.

Reference 16 which describes the ALS v2 platform self-diagnostics describes how the self-diagnostics detect, mitigate, and react to faults within the ALS v2 platform. Section 4.3 describes the typical manner in which ALS v2 based safety system faults are annunciated to the operator. Reference 16 describes how the platform supports this annunciation. The licensee’s application needs to compare the annunciation path described in Section 4.3 and justify any deviations.

Self-testing of the ALS v2 platform can be divided into segments as shown in Figure 5-1. Reference 16 describes the self-test strategy for each of these segments. Figure 5-1 depicts a full safety path from the field input through the CLB to the field output.

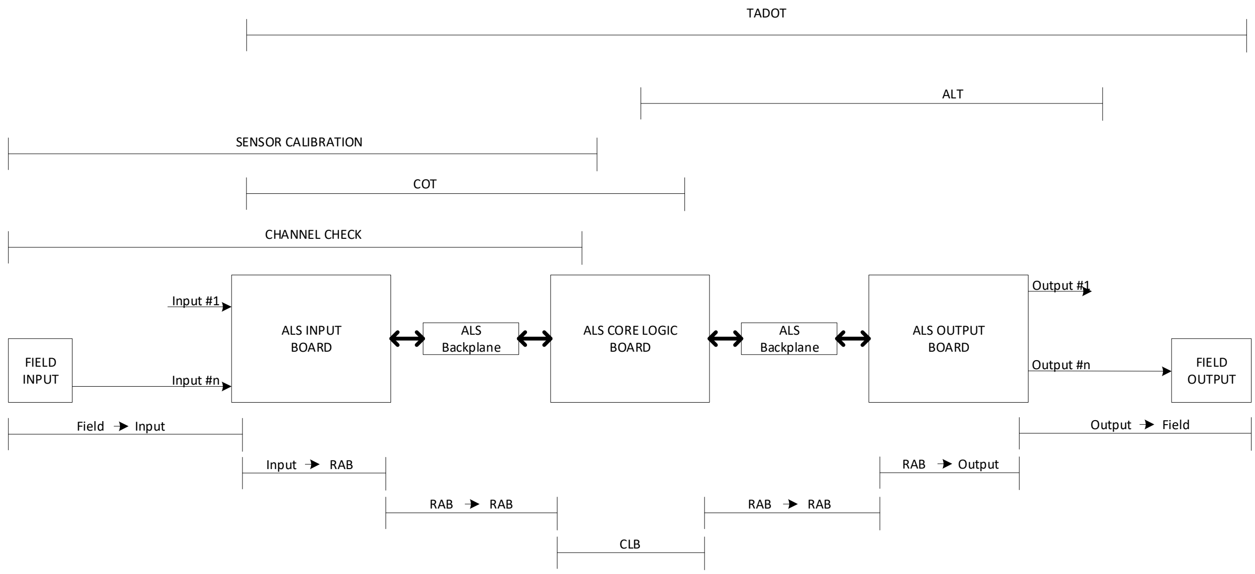

Figure 5-1. ALS Platform Self-Testing

Figure 5-1 is replicated from Reference 16 with an overlay of the TS SRs that would typically cover the portion of the safety system path under test. As stated in Section 2.1.1, the TS SRs of interest in analyzing for this topical report are:

- Channel Check
- Channel Operability Test
- Actuation Logic Test

The ALS v2 self-diagnostics cannot detect a sensor out calibration and therefore the manual Sensor Calibration TS SR would remain for safety systems based on the ALS v2 platform.

At the bottom of Figure 5-1 are labels for each segment of the safety system that is tested via ALS v2 platform self-diagnostics. These are:

- Field→Input
- Input→RAB (Reliable ALS Bus)
- RAB→RAB
- CLB (ALS-152 Core Logic Board)
- RAB→Output
- Output→Field

Reference 16 describes the ALS v2 self-diagnostics that cover each one of these segments of the safety system. Section 6 in this topical report describes the FMEDAs for each ALS v2 board. In addition to the FEMDAs identifying the diagnostic detecting each postulated failure mode of the ALS v2 board, they use self-test codes that identify which segment of the safety system is being protected.

5.2 APPLICATION DIAGNOSTICS

The safety system application in the ALS-152 CLB can add additional diagnostics to augment the platform diagnostics or to address plant-specific TS SRs. Three of these are listed here and described in Reference 16:

- Inter-Channel Comparison Check
- Double RAB Timeout
- Addressable Constant Verification

The first, Inter-Channel Comparison Check, can automate the TS SR Channel Check to allow the elimination of the SR for the ALS v2 safety system. The second, Double RAB Timeout, augments the platform diagnostics RAB1 Timeout and RAB2 Timeout.

The third application diagnostic, addressable constant verification, can address the aspect of COT that includes “adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy.” The Addressable Constant Verification Application Diagnostic can ensure the addressable constants stored by the platform have not been corrupted, eliminating the need to test the system to verify that the logic trips in accordance with the setpoints entered into the system. This diagnostic also ensures that the setpoint requested to be modified via the ASU is not corrupted between entering the value in the ASU and storing the requested setpoint value in the platform.

5.3 PLANT PROTECTION SYSTEM (PPS) HEALTH OBSERVATIONS BY PLANT PERSONNEL

The PPS performs RT and ESF functions. The operability of the safety system, as demonstrated in this topical report, is verified by the self-diagnostics credited in the FMEDA tables described in Section 6, as well as any remaining manual surveillances to cover failure modes that are not detected by self-diagnostics (see the FMEDA tables referenced in Section 6 and the subsequent TS SR elimination analyses in Section 7 for more information). As described in Section 4.3, an alarm will be triggered which results in MCR annunciation. Upon receipt of an alarm or abnormal conditions, the control room will have alarm response procedures that will require operators to perform system checks to verify the operability of the safety system functions. Often this will entail the operator dispatching a maintenance technician to determine the source of the alarm.

Additionally, routine plant personnel actions will be necessary to assure adequate operation of the ALS v2 diagnostic functions that are credited. This includes (but are not limited to) operator rounds and MCR board walkdowns, as well as system health checks performed by system engineering on a periodic basis. The result of the system engineer checks will be summarized in system health reports, and any adverse condition will be captured in plant condition reports. Should it be determined that a diagnostic problem is identified as part of the ALS v2 platform, a CR would be filed by the licensee and transmitted to Westinghouse who will then take the appropriate corrective actions to resolve the issue. The licensee would describe its plant-specific approach to ensure operability of the credited diagnostics in their license amendment submittal.

(Last Page of Section 5)

6 FAILURE MODES, EFFECTS, AND DIAGNOSTIC ANALYSES

The evaluations of the suitability of the self-diagnostics to replace the manual TS SRs are documented by the FMEDA Tables for each ALS v2 board. For each board failure mode that is postulated in the FMEDA table, the self-diagnostic(s) capable of detecting the failure is identified as well as the segment of the safety system being protected (see Section 5.1). The following FMEDA tables were developed:

- 6003-15212, "ALS-152 FPA, FMEA and Reliability Analysis," (Reference 18)
- 6003-35212, "ALS-352 FPA, FMEA and Reliability Analysis," (Reference 19)
- 6003-36112, "ALS-361 FPA, FMEA and Reliability Analysis," (Reference 20)
- 6003-37112, "ALS-371 FPA, FMEA and Reliability Analysis," (Reference 21)
- 6003-45212, "ALS-452 FPA, FMEA and Reliability Analysis," (Reference 22)
- 6003-47112, "ALS-471 FPA, FMEA and Reliability Analysis," (Reference 23)
- 6003-65112, "ALS-651 FPA, FMEA and Reliability Analysis," (Reference 24)
- 6003-85012, "ALS-850 FPA, FMEA and Reliability Analysis," (Reference 25)
- 6003-85212, "ALS-852 FPA, FMEA and Reliability Analysis," (Reference 26)
- 6003-85312, "ALS-853 FPA, FMEA and Reliability Analysis," (Reference 27)

The FMEDAs reveal that the large majority of component failures that could affect the principal functions of the modules will be detected by the self-diagnostic features or will lead to global failure of the module which is readily noticeable (e.g., loss of power). In some cases, the FMEDAs identified undetected failures. Undetectable failures are those identified in the FMEDA tables as FAIL or Unknown, and which are not detectable by the Self-Test. The following subsections identify and provide a justification for the undetectable failures.

6.1 ALS-152 UNDETECTABLE FAILURE

The ALS-152 FMEDA (Reference 18) identifies the following undetectable failures:

Table 6.1-1. ALS-152 Component FMEDA

a,c

Table 6.1-1. ALS-152 Component FMEDA

a,c

Table 6.1-1. ALS-152 Component FMEDA

a,c

Table 6.1-1. ALS-152 Component FMEDA

a,c

Table 6.1-1. ALS-152 Component FMEDA

a,c

Table 6.1-1. ALS-152 Component FMEDA

a,c

Disposition

[

]a,c

6.2 ALS-352 UNDETECTABLE FAILURE

The ALS-352 FMEDA (Reference 19) identifies the following undetectable failures:

Table 6.2-1. ALS-352 Component FMEDA

a,c

Table 6.2-1. ALS-352 Component FMEDA

a,c

Disposition

[

]a,c

6.3 ALS-361 UNDETECTABLE FAILURE

[ ]a,c

6.4 ALS-371 UNDETECTABLE FAILURE

The ALS-371 FMEDA (Reference 21) identifies the following undetectable failures:

Table 6.4-1. ALS-371 Component FMEDA

a,c

Table 6.4-1. ALS-371 Component FMEDA

a,c

Table 6.4-1. ALS-371 Component FMEDA

a,c

[

]

Justification

[

]a,c

6.5 ALS-452 UNDETECTABLE FAILURE

[ ]a,c

6.6 ALS-471 UNDETECTABLE FAILURE

The ALS-471 FMEDA (Reference 23) identifies the following undetectable failures:

Table 6.6-1. ALS-471 Component FMEDA

a,c

[

]

Table 6.6-1. ALS-471 Component FMEDA

a,c

Disposition

[

]a,c

6.7 ALS-651 UNDETECTABLE FAILURE

The ALS-651 FMEDA (Reference 24) identifies the following undetectable failures

Table 6.7-1. ALS-651 Component FMEDA

a,c

Table 6.7-1. ALS-651 Component FMEDA

a,c

Disposition

[

]a,c

6.8 ALS-850 UNDETECTABLE FAILURE

The ALS-850 FMEDA (Reference 25) identifies the following undetectable failures:

Table 6.8-1. ALS-850 Component FMEDA

a,c

Disposition

[

]a,c

6.9 ALS-852 UNDETECTABLE FAILURE

The ALS-852 FMEDA (Reference 26) identifies the following undetectable failures:

Table 6.9-1. ALS-852 Component FMEDA

a,c

Disposition

[

]a,c

[

]a,c

6.10 ALS-853 UNDETECTABLE FAILURE

[ ]a,c

(Last Page of Section 6)

7 TECHNICAL SPECIFICATION SURVEILLANCE REQUIREMENT MAPPING

The general approach to showing how TS SRs can be eliminated can be summarized as follows:

- The ALS v2 components that are tested by current manual TS SRs are identified.
- The failure modes for these components are identified (see FMEDAs in Section 6).
- The platform and application self-diagnostics are mapped to the failure modes (see FMEDAs in Section 6)
- If all failure modes for all components within the test envelope of the current manual TS SRs are covered by the ALS v2 self-diagnostics, then that surveillance test can be eliminated as a requirement for safety systems using the ALS v2 platform.

This approach is best suited for establishing the elimination of manual COT and ALT SRs for an ALS v2 safety system. A different approach is used to eliminate manual channel checks and response time testing SRs. These approaches are described in more detail within the corresponding sub-section within Section 7. Section 7.1 contains the analysis for the Westinghouse manual Channel Check and COT SRs, Section 7.2 is an analysis for the elimination of RTT. The scope of the analysis for RTT is the response time of an ALS v2 safety system from ALS v2 input board through ALS v2 output board (see Figure 5-1).

7.1 WESTINGHOUSE STANDARD TS SR MAPPING/ANALYSIS

7.1.1 Channel Check Elimination Analysis

To eliminate manual Channel Check SRs in NUREG-1431 (Reference 2), [

]a,c

To credit the ALS v2 safety system Inter-Channel Comparison Check application diagnostic for a given TS Function required to be verified by a manual Channel Check SR, that function needs to meet the following criteria (Channel Check Elimination Criteria): [

]a,c

Table 7.1-1 lists out the Channel Check SRs and applicable functions within Section 3.3 of NUREG-1431 (Reference 2). [

]a,c

Table 7.1-1. NUREG-1431 Channel Check Elimination Analysis

a,c

Row	SR Number	Table/Function	Description
1	SR 3.3.1.1	3.3.1-1, Function 2a	Power Range Neutron Flux - High
2	SR 3.3.1.1	3.3.1-1, Function 2b	Power Range Neutron Flux – Low
3	SR 3.3.1.1	3.3.1-1, Function 4	Intermediate Range Neutron Flux
4	SR 3.3.1.1	3.3.1-1, Function 5	Source Range Neutron Flux
5	SR 3.3.1.1	3.3.1-1, Function 6	Overtemperature ΔT
6	SR 3.3.1.1	3.3.1-1, Function 7	Overpower ΔT
7	SR 3.3.1.1	3.3.1-1, Function 8a	Pressurizer Pressure – Low
8	SR 3.3.1.1	3.3.1-1, Function 8b	Pressurizer Pressure – High
9	SR 3.3.1.1	3.3.1-1, Function 9	Pressurizer Water Level – High
10	SR 3.3.1.1	3.3.1-1, Function 10	Reactor Coolant Flow – Low
11	SR 3.3.1.1	3.3.1-1, Function 14	Steam Generator (SG) Water level – Low Low
12	SR 3.3.1.1	3.3.1-1, Function 15	SG Water Level – Low Coincident with Steam Flow/Feedwater Flow Mismatch
13	SR 3.3.1.1	3.3.1-1, Function 18f	Reactor Trip System Interlocks – Turbine Impulse Pressure, P-13
14	SR 3.3.2.1	3.3.2-1, Function 1c	Safety Injection – Containment Pressure High-1
15	SR 3.3.2.1	3.3.2-1, Function 1d	Safety Injection – Pressurizer Pressure Low
16	SR 3.3.2.1	3.3.2-1, Function 1e(1)	Safety Injection – Steam Line Pressure Low
17	SR 3.3.2.1	3.3.2-1, Function 1e(2)	Safety Injection – Steam Line Pressure – High Differential Pressure Between Steam Lines
18	SR 3.3.2.1	3.3.2-1, Function 1f	Safety Injection – High Steam Flow in Two Steam Lines Coincident with T_{AVG} – Low Low
19	SR 3.3.2.1	3.3.2-1, Function 1g	Safety Injection – High Steam Flow in Two Steam Lines Coincident with Steam Line Pressure - Low
20	SR 3.3.2.1	3.3.2-1, Function 2c, 2d	Containment Spray – Containment Pressure High-3
21	SR 3.3.2.1	3.3.2-1, Function 3b(3)	Containment Isolation – Phase B Isolation – Containment Pressure High-3
22	SR 3.3.2.1	3.3.2-1, Function 4c	Steam Line Isolation – Containment Pressure High-2
23	SR 3.3.2.1	3.3.2-1, Function 4d(1)	Steam Line Isolation – Steam Line Pressure Low
24	SR 3.3.2.1	3.3.2-1, Function 4d(1)	Steam Line Isolation – Steam Line Pressure Negative Rate High
25	SR 3.3.2.1	3.3.2-1, Function 4e	Steam Line Isolation – High Steam Flow in Two Steam Lines Coincident with T_{AVG} – Low Low
26	SR 3.3.2.1	3.3.2-1, Function 4f	Steam Line Isolation – High Steam Flow in Two Steam Lines Coincident with Steam Line Pressure - Low
27	SR 3.3.2.1	3.3.2-1, Function 4g	Steam Line Isolation – High Steam Flow Coincident with Safety Injection and T_{AVG} – Low Low
28	SR 3.3.2.1	3.3.2-1, Function 4h	Steam Line Isolation – High High Steam Flow Coincident with Safety Injection

Table 7.1-1. Channel Check Elimination Analysis (cont.)

a,c

Row	SR Number	Table/Function	Description
29	SR 3.3.2.1	3.3.2-1, Function 5b	Turbine Trip and Feedwater Isolation – SG Water Level – High High (P-14)
30	SR 3.3.2.1	3.3.2-1, Function 6c	Auxiliary Feedwater – SG Water Level – Low Low
31	SR 3.3.2.1	3.3.2-1, Function 6h	Auxiliary Feedwater – Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low
32	SR 3.3.2.1	3.3.2-1, Function 7b	Automatic Switchover to Containment Sump – Refueling Water Storage Tank (RWST) Level – Low Low
33	SR 3.3.2.1	3.3.2-1, Function 7c	Automatic Switchover to Containment Sump – RWST Level – Low Low Coincident with Safety Injection and Containment Sump Level - High
34	SR 3.3.2.1	3.3.2-1, Function 8b	ESFAS Interlocks – Pressurizer Pressure, P-11
35	SR 3.3.2.1	3.3.2-1, Function 8c	ESFAS Interlocks – T_{AVG} – Low Low, P-12
36	SR 3.3.3.1	3.3.3-1, Function 1	Power Range Neutron Flux
37	SR 3.3.3.1	3.3.3-1, Function 2	Source Range Neutron Flux
38	SR 3.3.3.1	3.3.3-1, Function 3	Reactor Coolant System (RCS) Hot Leg Temperature
39	SR 3.3.3.1	3.3.3-1, Function 4	RCS Cold Leg Temperature
40	SR 3.3.3.1	3.3.3-1, Function 5	RCS Pressure (Wide Range)
41	SR 3.3.3.1	3.3.3-1, Function 6	Reactor Vessel Water Level
42	SR 3.3.3.1	3.3.3-1, Function 7	Containment Sump Water Level (Wide Range)
43	SR 3.3.3.1	3.3.3-1, Function 8	Containment Pressure (Wide Range)
44	SR 3.3.3.1	3.3.3-1, Function 9	Penetration Flow Path Containment Isolation Valve Position
45	SR 3.3.3.1	3.3.3-1, Function 10	Containment Area Radiation (High Range)
46	SR 3.3.3.1	3.3.3-1, Function 11	Pressurizer Level
47	SR 3.3.3.1	3.3.3-1, Function 12	Steam Generator Water Level (Wide Range)
48	SR 3.3.3.1	3.3.3-1, Function 13	Condensate Storage Tank Level
49	SR 3.3.3.1	3.3.3-1, Function 14	Core Exit Temperature – Quadrant [1]
50	SR 3.3.3.1	3.3.3-1, Function 15	Core Exit Temperature – Quadrant [2]
51	SR 3.3.3.1	3.3.3-1, Function 16	Core Exit Temperature – Quadrant [3]
52	SR 3.3.3.1	3.3.3-1, Function 17	Core Exit Temperature – Quadrant [4]
53	SR 3.3.3.1	3.3.3-1, Function 18	Auxiliary Feedwater Flow
54	SR 3.3.5.1	N/A	Loss of Power Diesel Generator Start Instrumentation – Loss of Voltage and Degraded Voltage Functions
55	SR 3.3.6.1	3.3.6-1, Function 3a	Containment Radiation - Gaseous

Table 7.1-1. Channel Check Elimination Analysis (cont.)

a,c

Row	SR Number	Table/Function	Description
56	SR 3.3.6.1	3.3.6-1, Function 3b	Containment Radiation – Particulate
57	SR 3.3.6.1	3.3.6-1, Function 3c	Containment Radiation - Iodine
58	SR 3.3.6.1	3.3.6-1, Function 3d	Containment Radiation - Gaseous
59	SR 3.3.7.1	3.3.7-1, Function 3a	Control Room Radiation – Control Room Atmosphere
60	SR 3.3.7.1	3.3.7-1, Function 3b	Control Room Radiation – Control Room Air Intakes
61	SR 3.3.8.1	3.3.8-1, Function 3a	Fuel Building Radiation - Gaseous
62	SR 3.3.8.1	3.3.8-1, Function 3b	Fuel Building Radiation - Particulate
63	SR 3.3.9.1	N/A	Boron Dilution Protection System (BDPS) – Source Range Neutron Flux
64	SR 3.4.15.1	N/A	Containment Radiation – Gaseous or Particulate
65	SR 3.9.3.1	N/A	Source Range Neutron Flux and Source Range Audible Count Rate Circuit

Notes:

a,c

Channel Check Summary

As shown in Table 7.1-1, all channel check SRs can be eliminated except for SR 3.3.3.1 for Table 3.3.3-1, Function 9 "Penetration Flow Path Containment Isolation Valve Position". [

]a,c Additionally, for plants that assume a boron dilution event that is mitigated by operator response to audible indication, SR 3.9.3.1 cannot be eliminated.

7.1.2 Channel Operational Test Elimination Analysis

As shown in Figure 5-1, a COT is a test of the ALS v2 Input Board and the ALS v2 CLB. NUREG-1431 (Reference 2) identifies the following COT SRs:

Table 7.1-2. NUREG-1431 COT SRs

TS SR	Section
3.1.8.1	Physics Tests Exceptions – MODE 2
3.3.1.7	RTS Instrumentation
3.3.1.8 (1)	RTS Instrumentation
3.3.1.13	RTS Instrumentation
3.3.2.5	ESFAS Instrumentation
3.3.5.1 (2)	Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation
3.3.6.6	Containment Purge and Exhaust Isolation Instrumentation
3.3.7.2	Control Room Emergency Filtration System (CREFS) Actuation Instrumentation
3.3.8.2	Fuel Building Air Cleanup System (FBACS) Actuation Instrumentation
3.3.9.2	Boron Dilution Protection System (BDPS)
3.4.15.2	RCS Leakage Detection Instrumentation
3.4.19.2	RCS Loops - Test Exceptions

Notes:

1. This Surveillance shall include verification that interlocks P-6 and P-10 are in their required state for existing unit conditions. This is irrelevant to this analysis since the mode of operation has nothing to do with the ability for the ALS/Application diagnostics to work.
2. NUREG-1431 SR 3.3.5.1 is a Channel Check of the DLS system. However, when implementing a digital I&C safety system, this is assumed to become a COT SR (since this type of test is more appropriate for undervoltage signals).

[

]a,c

[

]a,c

7.1.2.1 Analog Input Card Drift

The ALS-361 and ALS-371 input boards include Channel Input Processing circuitry comprised of the Analog Devices AD7794 Analog to Digital Converter (ADC) that can drift. If the analog input board is not in the safety path or there is not a COT SR, then diagnostic coverage is not required. If the analog input board is in the safety path, the channel check application diagnostic would detect any ADC drift, and therefore any applicable COT SR is no longer required.

7.1.3 Actuation Logic Test Elimination Analysis

As shown in Figure 5-1, an ALT is an overlap test of the CLB logic within the safety I&C system through the output of the ALS v2 Output module. NUREG-1431 (Reference 2) identifies the following ALT SRs:

Table 7.1-3. NUREG-1431 ALT SRs

TS SR	Section
3.3.1.5	RTS Instrumentation
3.3.2.2 (1)	ESFAS Instrumentation
3.3.2.3 (2)	ESFAS Instrumentation
3.3.6.2	Containment Purge and Exhaust Isolation Instrumentation
3.3.6.4 (3)	Containment Purge and Exhaust Isolation Instrumentation
3.3.7.3	Control Room Emergency Filtration System (CREFS) Actuation Instrumentation
3.3.7.5 (3)	Control Room Emergency Filtration System (CREFS) Actuation Instrumentation
3.3.8.3	Fuel Building Air Cleanup System (FBACS) Actuation Instrumentation
3.3.9.4 (4)	Boron Dilution Protection System (BDPS)
3.4.19.3	RCS Loops - Test Exceptions

Notes:

1. This Surveillance applies to the “Automatic Actuation Logic and Actuation Relays” functions within Table 3.3.2-2, which would not exist in an ALS v2 safety system (since these legacy system functions are integrated into the digital safety system).
2. This Surveillance has a note that the continuity check may be excluded for the corresponding tests.
3. This Surveillance has a note stating that the ALT only applies to the actuation logic of the ESFAS Instrumentation.
4. NUREG-1431 SR 3.3.9.4 does not exist. However, when implementing a digital I&C safety system, this is assumed to become a required surveillance, since the actuation logic for this function would need to be verified.

Figure 5-1 shows the ALS v2 platform equipment that would be tested in a manual ALT SR. ALT also requires a continuity check of the actuating devices. As described in Reference 16, the capability of testing the connection to a field device is determined by the specific application (or equipment) and the particular ALS v2 output board (Output→Field [see Section 5.1]) : The ALS v2 output board determines the integrity of the wiring and component and performs an application specific action in case of a fault. The field testing may be a combination of wire-break, current/voltage level detection and component integrity. Examples are an ALS-452 digital output channel that is configured to ‘energize-to-trip’, a continuity self-test is performed to validate field wiring and AC or DC power supply continuity. For an ALS-471 analog output channel, the analog output board is equipped with an analog to digital converter (ADC) capable of reading back the actual level of the analog output channel. In the case of the ALS-471 board, using the commanded output level and the actual measured level of the channel the ALS-471 FPGA is able to determine the integrity of the output channel.

Regardless of the function under test while performing a manual ALT SR, the following ALS v2 modules would be involved:

- CLB
- RAB
- ALS Output Board (ALS-452 and ALS-471)

The failure modes for these ALS v2 components have full diagnostic coverage or a disposition provided, as demonstrated in Section 6. Therefore, the ALT SRs are no longer required. However, the continuity requirement in ALT would have to be evaluated on a case-by-case for the plant-specific application. If the output device supports the ALS-452 digital output channel self-test to validate field wiring continuity and the AC or DC power supply, then ALT can be completely eliminated as a manual SR for that device, otherwise that portion would need to be manually tested or combined with a TADOT for the device.

7.1.3.1 Analog Output Card Drift

The ALS-471 analog output board includes Channel Output Circuitry which is comprised of the AD5422 precision digital to analog converter (DAC) that can drift. If the analog output board is not in the safety path or there is not a COT SR, then diagnostic coverage is not required. If the analog output board is in the safety path, that portion would need to be manually tested or combined with a TADOT for the device.

7.2 RESPONSE TIME TESTING ELIMINATION ANALYSIS

The foundation for the Response Time Testing (RTT) SR elimination analysis consists of the following two criteria:

- The ALS v2 based safety system and application diagnostics that are credited in this topical report to eliminate other SRs in this topical report, although only designed to test the operability of the system, would still capture failures of the ALS v2 based safety system that could result in slower response times.
- Portions of the ALS v2 based safety system actuation paths are tested under other SRs not eliminated within this topical report.

Based on these two criteria, only failures that cause a response time delay, but have no functional effect on the component, will be considered.

These failures are those that will either affect the FPGA process execution used for execution control of the safety system application functions within the CLB or hardware failures that result in response time delays. Therefore, to eliminate RTT SRs, it must be demonstrated that both the FPGA cycle time and associated ALS v2 hardware boards are covered by diagnostics (FPGA implementation logic is not included since it can only fail due to a hardware failure).

7.2.1 Methodology

The methodology to be used to eliminate RTT is to analyze the ALS v2 components associated with safety system application implementations for potential failures that could generate delays in response time. For identified failures, diagnostics will be discussed which will be credited to ensure the response time will not continue to degrade to a point that would be qualitatively worse than the current frequency of checking the response time of the system. This will be done by analyzing the ALS v2 hardware components in three groups:

a. Input Modules
b. Processing and Communication Components
c. Output Modules

This captures the ALS v2 chassis portion of the safety system actuation paths which constitutes the scope of this SR elimination task.

7.2.2 Response Time Paths

Table 7.2-1 provides the list of ALS v2 components that need to be analyzed per the identified safety actuation paths identified above.

Table 7.2-1. ALS v2 Components with Paths of TS RTT SRs

Type of Component	ALS v2 Chassis Components within SR Path
Input Boards	- ALS-352, Digital Input Board - ALS-361, Temperature Sensor Input Board - ALS-371, Analog Input Board
Processing/Communication Boards	- ALS-152, Core Logic Board - ALS-651, Communications Board - ALS-850, [ ][a,c] Daughter Card(1) - ALS-852, [ ][a,c] Daughter Card(1) - ALS-853, [ ][a,c] Daughter Card(1)
Output Boards	- ALS-452, Digital Output Board - ALS-471, Analog Output Board
Miscellaneous Components	- ALS-060, ASU Interface Board(2) - ALS-050, 16-Slot Backplane Board(3) - ALS-055, Split Backplane(4) - ALS-010, Chassis Assembly(5) - ALS-015, Chassis/Split Backplane Assembly(6)

Notes:

1. These are the ALS v2 associated daughter cards used to implement the diverse FPGA design implementation. The associated process circuitry will be included with the ALS Board Analysis.
2. The ALS-060 is the ALS Service Unit (ASU) Interface board which supports the ALS-050, 16 slot monolithic backplane and ALS-055, split backplane. The ASU Interface is not part of the Safety System Protection Function threads; therefore, this board has been screened out of further analyses.
3. The ALS-050 is the 16-slot monolithic backplane board with no active components; therefore, this component has been screened out of further analyses.
4. The ALS-055 is the Split backplane configurations board with no active components; therefore, this component has been screened out of further analyses.

5. ALS-010 is the Chassis/16 slot monolithic backplane assembly. Includes the ALS-060 and the ALS-050. The Chassis assembly is comprised of metal work only; therefore, this component has been screened out of further analyses.
6. ALS-015 is the Chassis/split backplane assembly. Includes the ALS-060 and the ALS-055. The Chassis is comprised of metal work only; therefore, this component has been screened out of further analyses.

7.2.3 General Analysis of ALS v2 Boards

The ALS v2 safety system platform is comprised of the ALS-152 Core Logic Board (CLB) and associated Input, Output, and Communications slave boards. The ALS v2 platform is an FPGA based product and due to the inherent design architecture of the RAB communications, if any ALS board clock crystal were to drift beyond an allowable tolerance, this would manifest itself in the continuous RAB communications and RAB Self-Test error checking.

A Daughter Card is utilized on each CLB and slave board. The Daughter Card comprises the FPGA and the clock crystal oscillator for the CLB or slave board. The details of how a clock crystal drift issue is detected in the RAB timing below. Using RAB timing detection provides the following self-testing features:

1. If the CLB has the failure, the bus won't communicate.
2. If any slave board fails, the bus won't communicate.
3. If two slave boards drift together, the bus won't work (the CLB won't communicate with either slave board).
4. If a CLB and a slave board drift together, the communication with that slave board may work, but the CLB won't be able to communicate with the other slaves.

The ALS v2 platform RAB Self-Testing always detects the failure, and is covered for multiple crystals drifting. A platform calculation note quantifies the maximum drift of the crystal oscillator before a platform diagnostic detects the drift. This calculated drift value will be reflected in the application response time calculation note. This is LRA_8. Therefore, the ALS v2 platform is inherently not susceptible to a time response concern.

Additionally, the majority of the ALS board components are digital components such as FPGA chips and solid-state components. All analog circuitry is implemented on dedicated IC Chips. A detailed analysis of each ALS v2 board and components has been completed and is documented below.

7.2.4 Input Boards Analyses

7.2.4.1 ALS-352, Digital Input Board Analysis:

7.2.4.1.1 ALS-352 Background

The ALS-352 is a member of the ALS v2 platform, providing high performance digital input capabilities. The ALS-352 provides 32 independent high-integrity digital input channels in two groups of 16. Group 1 channels are isolated from Group 2 channels. Both Group 1 and Group 2 channels are also isolated from the FPGA logic portion of the board. The ALS-352 supports industry DC contact wetting voltages up to 48VDC.

7.2.4.1.2 ALS-352 Description

The ALS-352 interfaces with DC wetted plant contact loads. Each channel supports a contact current of greater than 3mA. Typical contact current is 3.5mA to 4.5mA. The ALS-352 has a digital debounce filter that is configurable on a per channel basis. Debounce values are 10ms, 50ms, 120ms and 450ms.

Contact wetting power is provided by an external power supply from a cabinet-mounted or remote power-supply. The board may be used over a wide range of applications with different channel and wiring configurations.

The ALS-352 provides automatic self-test features which, in an overlap approach, maintain the integrity of ALS-352 board input channel to the plant device.

Each channel performs a self-test to maintain integrity of the individual channel. Surge and over-voltage protection is provided on each channel. Channel status and board status are visible on the front panel indicators, providing a quick status assessment for the board.

The ALS-352 supports online testing of individual board input channels. Each channel can be independently placed into test mode and forced OPEN or CLOSED by utilizing the ALS service unit (ASU). Additional detailed information regarding the board configuration, diagnostics and status is also available via the ASU.

The ALS-352 is designed for autonomous operation, allowing the system level design to maintain the overall integrity of the application, whether a fault occurs within the individual board or at the system level. A failure in one channel does not impact the other channels.

The ALS-352 is designed by Westinghouse and is built and manufactured under Westinghouse control per an approved 10CFR50 Appendix B Quality Assurance program. The ALS-352 is subjected to a board level reliability analysis so the highest level of reliability is achieved. Additionally, the ALS-352 is subjected to a FMEA at the individual component level.

7.2.4.1.3 ALS-352 Response Time Analysis

As described in Reference 10, this board contains connectors for a Daughter Card containing an FPGA and associated circuitry which performs the board’s logic functionality. Also, this board includes Channel Input Processing circuitry. All electronic circuitry is comprised of solid-state components, and any components susceptible to drift are covered by self-diagnostics (See Section 7.2.3); therefore, self-diagnostics cover any degradation of response time. The ALS-352 supports a configurable digital contact de-bounce filter. This digital filter functionality is contained within the ALS-352 FPGA component. The ALS-352 digital input board has been screened out of further analyses.

7.2.4.2 ALS-361, Temperature Sensor Input Board Analysis:

7.2.4.2.1 ALS-361 Background

The ALS-361 temperature sensor board is a member of the ALS v2 platform, providing high performance temperature sensor capabilities. The ALS-361 provides eight isolated independent high-integrity temperature sensing channels, which can be individually configured to interface with the resistance temperature detector (RTD) or thermocouple sensors. The ALS-361 supports a wide range of RTDs and thermocouples to provide compatibility with the existing sensors located in the plant.

7.2.4.2.2 ALS-361 Description

The ALS-361 interfaces with both 3-wire and 4-wire Pt100 and Pt200 RTDs. The ALS-361 provides a highly accurate measurement throughout the full range of the RTD sensors, eliminating the industry notion of “wide” and “narrow” range RTDs.

The ALS-361 supports the most popular thermocouples including types J, K, E, T, N, R and S, providing a temperature measurement of up to 1,700 degrees centigrade. Automatic cold junction compensation is performed by using a single cold junction sensed on channel 8, from an external cold junction temperature supplied from the ALS core logic board, or from an externally sourced cold junction temperature.

The ALS-361 provides automatic self-test and fault detection features which, in an overlap approach, maintain the integrity of the sensor measurement through the ALS-361 board and transmission to the ALS CLB for logical decision making. Each channel performs a self-test to provide integrity of the individual channel. Additionally, each channel provides “out-of-range” detection and automatic recovery from an overload condition. Channel status and board status are visible on the front panel indications providing a quick status assessment for the board. The status indication includes the standard ALS platform indications, as well as the following channel-specific indications:

- Input temperature signal within range and operational
- Input temperature signal outside range or integrity error
- Channel in calibration
- Channel in bypass
- Channel disabled

The ALS-361 allows for customization of each measurement channel. The configurable parameters for each channel include:

- Enable or disable of the channel
- Configure for two-wire thermocouple, 3-wire RTD or 4-wire RTD
- Linearization parameters for the particular sensing element
- Cold junction compensation source
- Out-of-range limits

The ALS-361 supports online calibration of individual sensor channels. Each channel is independently calibrated with OFFSET and SPAN. Only the channel under calibration is impacted, and therefore requires only one bypassed channel at a time. Calibration of a channel while online is achieved by utilizing the ASU. Additional detailed information regarding the board configuration, diagnostics and status is also available via the ASU.

The ALS-361 is designed for autonomous operation, allowing the system level design to maintain the overall integrity of the application whether a fault occurs within the individual board or at the system level. A failure in one of the input channels does not impact the other channels.

The ALS-361 is designed by Westinghouse and is built and manufactured under Westinghouse control per an approved 10CFR50 Appendix B Quality Assurance program. The processes and procedures for the design and development have been reviewed and approved by the U.S. Nuclear Regulatory Commission for use in Class 1E systems.

The ALS-361 was subjected to a board level reliability analysis so the highest level of reliability is achieved. Additionally, the ALS-361 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

7.2.4.2.3 ALS-361 Response Time Analysis

As described in Reference 10, this board contains connectors for a Daughter Card containing an FPGA and associated circuitry which performs the board's logic functionality. The ALS-361 input circuitry supports configurable digital input filtering contained within the ALS-361 FPGA component. The board also implements a low pass filtering circuit prior to the ADC channel processing. This is an analog circuit comprised of a resistor-capacitor (RC) network used to filter out input signal noise. An open or short circuit on the RC components within the filter networks would lead to a channel input fault and thus detected and alarmed by the ALS-361 input channel integrity monitoring function. However, a change in the values of these components would not be detected as a failure but would result in a change in the board's response time. The time constant of an RC circuit is the product of its resistance and capacitance (i.e., $\tau = R \cdot C$). Therefore, if the resistance or capacitance increases or decreases within the circuit, the time constant will increase or decrease respectively. Time-degradation of capacitors leads to the capacitance of the devices to degrade (reduce) over time (Reference 17). This reduction of capacitance will lead to the "system" (in this case the filter) to have a faster response time since the response time of the system is the product of the resistance and capacitance. This will induce more noise on the output of the filter but is of no consequence to RTT. It's worth mentioning that although resistor degradation can occur, the resistance of a system increasing to a point that exceeds the decrease in system capacitance is considered to be not credible due to very low long-term drift coefficients for these parts and would more likely result in an open circuit that would be detected by the ALS-361 input channel integrity monitoring function. The ALS-361 Temperature Sensor Input board has been screened out of further analyses. All electronic circuitry is comprised of solid-state components, and any components susceptible to drift are covered by self-diagnostics (See Section 7.2.3); therefore, self-diagnostics cover any degradation of response time.

7.2.4.3 ALS-371, Analog Input Board:

7.2.4.3.1 ALS-371 Background

The ALS-371 is a member of the ALS v2 platform, providing high performance analog input capabilities. The ALS-371 provides eight independent isolated high-integrity and highly accurate analog input channels, which can be individually configured for voltage mode or current mode operation. The ALS-371 supports industry standard current loops and voltage levels to provide compatibility with the existing sensors and transmitters located in the plant.

7.2.4.3.2 ALS-371 Description

The ALS-371 interfaces with standard current loops and provides the option of using an internal dropping resistor, or by using an external precision dropping resistor between 90-210 Ω. This option is provided on a channel-by-channel basis. The external dropping resistor is typically located on the terminal blocks of an assembly panel within the cabinet. If the external resistor option is utilized, then the channel will operate in voltage input mode.

The ALS-371 supports the most popular voltage mode configurations including 0 to 10V or -10V to 10V inputs.

Each input channel is highly accurate, linear and extremely stable over temperature, aging and component spread.

Process instrument loop power is provided by an external loop power supply from a cabinet-mounted or remote power-supply. The board may be used over a wide range of applications with different channel and wiring configurations.

The ALS-371 provides automatic self-test features which, in an overlap approach, maintain the integrity of the measurement from the sensor through the ALS-371 board and transmission to the ALS CLB for logical decision making.

Each channel performs a self-test to maintain integrity of the individual channel. Additionally, the channel provides “out-of-range” detection and automatic recovery from an overload condition. Surge and over-voltage protection is provided for all inputs. Channel status and board status are visible on the front panel indicators, providing a quick status assessment for the board.

The analog inputs are converted into digital values representing the detected current or voltage levels and are made available on the RAB together with integrity information for each channel. The ALS-371 senses voltage from an external voltage source/transmitter or current from an externally wetted and controlled current source/transmitter and uses a high precision sigma-delta analog-to-digital converter to convert the raw sensor data into highly accurate digital readings. The information is made available on the RAB bus, where it is provided to the CLB upon request.

The ALS-371 supports online calibration of individual sensor channels. Each channel is independently calibrated with OFFSET and SPAN. Only the channel under calibration is impacted, and therefore requires only one channel to be bypassed at a time. Calibration of a channel while online is achieved by utilizing the ASU. Additional detailed information regarding the board configuration, diagnostics and status is also available via the ASU.

The ALS-371 is designed for autonomous operation, allowing the system level design to maintain the overall integrity of the application, whether a fault occurs within the individual board or at the system level. A failure in one channel does not impact the other channels.

The ALS-371 is designed by Westinghouse and is built and manufactured under Westinghouse control per an approved 10CFR50 Appendix B Quality Assurance program. The processes and procedures for the design and development have been reviewed and approved by the U.S. Nuclear Regulatory Commission for use in Class 1E systems.

The ALS-371 was subjected to a board level reliability analysis so that the highest level of reliability is achieved. Additionally, the ALS-371 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

7.2.4.3.3 ALS-371 Response Time Analysis

As described in Reference 10, this board contains connectors for a Daughter Card containing an FPGA and associated circuitry which performs the board's logic functionality. The ALS-371 input circuitry supports configurable digital input filtering contained within the ALS-371 FPGA component. The board also implements a low pass filtering circuit prior to the ADC channel processing. This is an analog circuit comprised of a RC network used to filter out input signal noise. An open or short circuit on the RC components within the filter networks would lead to a channel input fault and thus detected and alarmed by the ALS-371 input channel integrity monitoring function. However, a change in the values of these components would not be detected as a failure but would result in a change in the board's response time. The time constant of an RC circuit is the product of its resistance and capacitance (i.e., $\tau = R \cdot C$). Therefore, if the resistance or capacitance increases or decreases within the circuit, the time constant will increase or decrease respectively. Time-degradation of capacitors leads to the capacitance of the devices to degrade (reduce) over time (Reference 17). This reduction of capacitance will lead to the "system" (in this case the filter) to have a faster response time since the response time of the system is the product of the resistance and capacitance. This will induce more noise on the output of the filter but is of no consequence to RTT. It's worth mentioning that although resistor degradation can occur, the resistance of a system increasing to a point that exceeds the decrease in system capacitance is considered to be not credible due to very low long-term drift coefficients for these parts and would more likely result in an open circuit that would be detected by the ALS-371 input channel integrity monitoring function. All electronic circuitry is comprised of solid-state components, and any components susceptible to drift are covered by self-diagnostics (See Section 7.2.3); therefore, self-diagnostics cover any degradation of response time. The ALS-371 Analog Input board has been screened out of further analyses.

7.2.5 Processing/Communication Boards Analysis

7.2.5.1 ALS-152, Core Logic Board:

7.2.5.1.1 ALS-152 Background

The ALS-152 is a member of the ALS v2 platform, providing the fundamental control and logic for a specific application. The ALS-152 is a versatile, highly integrated, and highly reliable design that is referred to in the ALS platform as the CLB. The CLB is customizable, based upon the requirements of a given application, and can contain any type of digital building blocks that can be generated from a NAND2 device, such as AND/OR/XOR-gates and flip-flops (D, JK, SR). These building blocks can then be combined into more complex logic circuits, such as counters, timers, multiplexers, comparators, lead/lag functions or finite state machines (FSMs).

7.2.5.1.2 ALS-152 Description

The CLB controls all sequencing and I/O states within the ALS v2 platform. It can be customized for each application to perform the desired safety function, which may be a sequencer function, coincidence logic voter function, process protection function, or whatever function is required by the customer's system requirements.

The ALS-152 provides six contact input channels that are intended to be used for system-related inputs such as an input toggle switch to acknowledge and/or clear alarms or to detect the state of a maintenance key switch, a door open alarm, a power supply health, etc.

The ALS-152 provides four independent single-pole solid state relay output channels intended to support de-energize-to-actuate outputs that are typically used for alarm, trouble, and status indication. Internal dedicated and independent alarm circuits control and generate these signals based on operability and integrity of the system. These output channels can drive external alarms and plant indicators and include adequate isolation to also interface with non-safety systems. The two types of alarm actuations are the "application-related failures" such as a pressure point exceeding its alarm value, or the "system failures" related to internal ALS platform operation such as the detection of a device failure or a communication failure.

The ALS-152 provides two independent transmit only isolated RS-422 data links. One datalink is typically used to transmit system parameters, health, and status information to the ALS service unit (ASU). These data links can continuously transmit a unidirectional data stream to other devices such as a qualified display system mounted on the main control board, or to non-safety systems as required by the application.

The ALS-152 has a dedicated non-volatile memory device to store application-specific configuration information that is used for comparator set points, tuning constants, gain, offset, etc. The ALS-152 does not require calibration; however, it does support adjustments of set points and trip-values utilizing the ASU.

The ALS-152 is designed for autonomous operation, allowing the system level design to maintain the overall integrity of the application whether a fault occurs within the individual board or at the system level. A failure in one of the input, output or communication channels does not impact the other channels.

7.2.5.1.3 Response Time Analysis

As described in Reference 10, this board contains connectors for a Daughter Card containing an FPGA and associated circuitry which performs the board's logic functionality. Also, this board includes Channel Input Processing circuitry, Channel Output (solid-state relays) Circuitry and Serial Data Communication Links. All electronic circuitry is comprised of solid-state components, and any components susceptible to drift are covered by self-diagnostics (See Section 7.2.3); therefore, self-diagnostics cover any degradation of response time. The ALS-152 supports a configurable digital input contact de-bounce filter. This digital filter functionality is contained within the ALS-152 FPGA component. The ALS-152 core logic board has been screened out of further analyses.

7.2.5.2 ALS-651, Communications Board:

7.2.5.2.1 ALS-651 Background

The ALS-651 board is a versatile, highly reliable communications board with eight independent and isolated channels capable of RS-422 or RS-485 communications. The target application for this board is providing highly reliable communication links between ALS v2 platform racks, communications to/from third party equipment, communications to a plant computer and communications to data-logging equipment.

7.2.5.2.2 ALS-651 Description

The ALS-651 receives RAB request packets with data and transmits the data through the isolated communication output channels. The communication board also receives data/packets and makes received information available to the RAB.

The ALS-651 supports a "byte mode" where data is transmitted one byte at a time. In this mode, the ALS-651 relies on the ALS-152 CLB to perform higher-level data synchronization and integrity checking. The "byte mode" is used to communicate with simple display devices or legacy devices, where the ALS-651 must conform to an existing packet format.

The ALS-651 also supports a "packet mode," which is advantageous when the ALS-651 is used to transfer data to another ALS v2 rack with a corresponding ALS-651. In "packet mode," the ALS-651 will encapsulate data sets in a packet format with a header and a checksum. The receiving ALS-651 automatically synchronizes to the header information and checks and strips the checksum. The packet mode may also be used when sensor data is sent to third-party equipment as long as it conforms to the ALS-651 packet format.

Each channel operates unidirectionally (either receive or transmit). When a channel is configured for receive mode, the unused transmitter is disabled by the ALS-651; similarly, when a channel is configured for transmit mode, the unused receiver is disabled.

All communication channels are galvanically isolated from the ALS logic and from each other. Communication channels are isolated and capable of withstanding 1,500 Vrms between field and logic circuits. All communication channels are surge protected to prevent permanent damage from momentary faults.

Each ALS-651 communication channel includes a built-in self-test loop-back feature used to detect transceiver failures. All looped back data bits are compared by the FPGA with the previously transmitted data bits. Self-test capabilities provide detection communication failures in the channel, the FPGA logic circuits, the configuration of non-volatile memory and the power management logic. The integrity for each channel is indicated locally and reported to the core logic board.

The ALS-651 is designed by Westinghouse and is built and manufactured under Westinghouse control per an approved 10CFR50 Appendix B Quality Assurance program. The processes and procedures for the design and development have been reviewed and approved by the U.S. Nuclear Regulatory Commission for use in Class 1E systems.

The ALS-651 was subjected to a board level reliability analysis so that the highest level of reliability is achieved. Additionally, the ALS-651 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

7.2.5.2.3 ALS-651 Response Time Analysis

As described in Reference 10, this board contains connectors for a Daughter Card containing an FPGA and associated circuitry which performs the board's logic functionality. Also, includes Serial Data Communication Links. All electronic circuitry is comprised of solid-state components, and any components susceptible to drift are covered by self-diagnostics (See Section 7.2.3); therefore, self-diagnostics cover any degradation of response time. The ALS-651 communications board has been screened out of further analyses.

7.2.6 Output Boards Analysis

7.2.6.1 ALS-452, Digital Output Board:

7.2.6.1.1 ALS-452 Background

The ALS-452 is a member of the ALS v2 platform, providing high performance digital output capabilities. The ALS-452 provides 16 independent isolated high-integrity digital output channels, which are individually isolated from other channels and the FPGA logic portion of the board. The ALS-452 supports industry standard AC and DC contact wetting voltages up to 250VDC and 200Vrms.

7.2.6.1.2 ALS-452 Description

The ALS-452 interfaces with AC or DC wetted plant contact loads. Each channel supports a switched output current of 2A continuous and 5A for 100ms. Output response time is less than 20ms.

Contact wetting power is provided by an external power supply from a cabinet-mounted or remote power-supply. The board may be used over a wide range of applications with different channel and wiring configurations.

The ALS-452 provides automatic self-test features which, in an overlap approach, maintain the integrity of ALS-452 board output channel to the plant device.

Each channel performs a self-test to maintain integrity of the individual channel. Surge and over-voltage protection is provided on each channel. Channel status and board status are visible on the front panel indicators, providing a quick status assessment for the board.

The ALS-452 supports online testing of individual board output channels. Each channel can be independently placed into test mode and forced OPEN or CLOSED by utilizing the ASU. Additional detailed information regarding the board configuration, diagnostics and status is also available via the ASU.

The ALS-452 is designed for autonomous operation, allowing the system level design to maintain the overall integrity of the application, whether a fault occurs within the individual board or at the system level. A failure in one channel does not impact the other channels.

The ALS-452 is designed by Westinghouse and is built and manufactured under Westinghouse control per an approved 10CFR50 Appendix B Quality Assurance program. The ALS-452 is subjected to a board level reliability analysis so the highest level of reliability is achieved. Additionally, the ALS-452 is subjected to a FMEA at the individual component level.

7.2.6.1.3 ALS-452 Response Time Analysis

As described in Reference 10, this board contains connectors for a Daughter Card containing an FPGA and associated circuitry which performs the board's logic functionality. Also, includes Channel Output (solid-state relays) Circuitry. All electronic circuitry is comprised of solid-state components, and any components susceptible to drift are covered by self-diagnostics (See Section 7.2.3); therefore, self-diagnostics cover any degradation of response time. The ALS-452 digital output board has been screened out of further analyses.

7.2.6.2 ALS-471, Analog Output Board:

7.2.6.2.1 ALS-471 Background

The ALS-471 analog output board is a member of the ALS v2 platform, providing high performance analog output capabilities. The ALS-471 provides eight independent high integrity and highly accurate analog output channels, which can be individually configured for voltage mode or current mode operation. The ALS-471 supports industry standard current loops and voltage outputs to provide compatibility with the existing indicators and receivers located in the plant.

7.2.6.2.2 ALS-471 Description

The ALS-471 supports the most popular voltage output mode configurations such as 0 to 5V, -5 to 5V, 0 to 10V and -10 to 10V.

The ALS-471 supports the most popular current mode configurations such as 4 to 20mA, 0 to 20mA, 4 to 22mA and 0 to 22mA outputs.

Each input channel is highly accurate, linear, and extremely stable over temperature, aging and component spread.

The eight channels are powered from an isolated on-board power supply capable of withstanding 1,500 Vrms. The eight output channels are independent but located on a common isolation domain. The board may be used over a wide range of applications with different channel and wiring configurations.

The ALS-471 provides automatic self-test features which, in an overlap approach, maintain the integrity of the output signal from the ALS core logic board through the transmission on the busses and through the output channel to the end receiver.

The ALS-471 channels receive the digital channel value and state information from the CLB via the RAB. Each channel performs the digital-to-analog conversion and drives the output channel to the specified voltage or current, depending upon the configuration of the channel.

The ALS-471 channels conduct self-testing to provide channel output integrity. This integrity check is performed by comparing the actual value (the channel output current or voltage) with the expected value, i.e., the value requested by the core logic board through the RAB. This is done using a feedback loop with an analog-to-digital converter sensing the actual level sent to the field. Each channel can detect a difference between the desired analog value and the actual analog value output to the receiver. Additionally, each channel can determine if the output is being driven correctly, and thus detect a “failed” channel.

All channels are surge protected, short circuit protected, and over-voltage protected to prevent permanent damage.

The ALS-471 supports online calibration of individual sensor channels. Each channel is independently calibrated with OFFSET and SPAN. Only the channel under calibration is impacted, and therefore requires only one channel to be bypassed at a time. Calibration of a channel while online is achieved by utilizing the ASU. Additional detailed information regarding the board configuration, diagnostics and status is also available via the ASU.

The ALS-471 is designed for autonomous operation, allowing the system level design to maintain the overall integrity of the application, whether a fault occurs within the individual board or at the system level. A failure in one channel does not impact the other channels.

The ALS-471 is designed by Westinghouse and is built and manufactured under Westinghouse control per an approved 10CFR50 Appendix B Quality Assurance program. The processes and procedures for the design and development have been reviewed and approved by the U.S. Nuclear Regulatory Commission for use in Class 1E systems.

The ALS-471 was subjected to a board level reliability analysis so that the highest level of reliability is achieved. Additionally, the ALS-471 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

7.2.6.2.3 ALS-471 Response Time Analysis

As described in Reference 10, this board contains connectors for a Daughter Card containing an FPGA and associated circuitry which performs the board’s logic functionality. All electronic circuitry is comprised of solid-state components, and any components susceptible to drift are covered by self-diagnostics (See Section 7.2.3); therefore, self-diagnostics cover any degradation of response time. The ALS-471 analog output board has been screened out of further analyses.

8 CONCLUSIONS

8.1 WESTINGHOUSE STANDARD TS SR ELIMINATION SUMMARY

The evaluations within Section 7 show that most of the surveillances analyzed can be eliminated based on the ALS v2 self-diagnostics (along with required application software self-diagnostics). This is summarized, along with the limitations of the analysis, as follows:

1. **Channel Checks** – If the Channel Check application diagnostic is implemented as described in Section 7.1.1, then all Channel Check SRs within NUREG-1431 (Reference 2) can be removed except for SR 3.3.3.1 for Table 3.3.3-1, Function 9 "Penetration Flow Path Containment Isolation Valve Position". Additionally, for plants that assume a boron dilution event that is mitigated by operator response to audible indication, SR 3.9.3.1 cannot be eliminated.

2. **Channel Operational Tests** – If the system FMEA is evaluated to be covered by the board FMEDAs as described in Section 7.1.2, then all COT SRs within NUREG-1431 (Reference 2) can be removed based on full self-diagnostic coverage of the ALS v2 platform within the scope of this surveillance test.

3. **Actuation Logic Tests** – Once determined that all continuity tests can be covered as described in Section 7.1.3, then all ALT SRs within NUREG-1431 (Reference 2) can be removed based on full self-diagnostic coverage of the ALS v2 components within the scope of this surveillance test.

4. **Response Time Testing** - Response time testing of the ALS v2, per the RTT SRs within NUREG-1431 (Reference 2), can be eliminated. In lieu of performing response time tests on this equipment, a time value will need to be assigned to the ALS v2 portion of the RT/ESF function that currently have RTT SRs.

In addition to the SRs eliminated via the analyses within this topical report, the ALS v2 system would also no longer require the Master Relay and Slave Relay SRs.

Markups of the Westinghouse Standard TS (NUREG-1431, Reference 2) can be found in Appendix C.

(Last Page of Section 8)

APPENDIX A APPLICATION AND TS ASSUMPTIONS

This Appendix details the assumptions made throughout this topical report. This includes assumptions regarding the target plant TS that are documented within this appendix. Any deviation from these assumptions will need to be analyzed when a licensee makes a submittal leveraging this topical report to eliminate ALS v2 I&C TS SRs.

A.1 ARCHITECTURE AND APPLICATION SW ASSUMPTIONS

[

]a,c

[

]a,c

A.2 TECHNICAL SPECIFICATION ASSUMPTIONS

A.2.1 Westinghouse Standard TS Assumptions

Channel Operational Test

NUREG-1431 SR 3.3.5.1 is a Channel Check of the DLS system. However, when implementing a digital I&C safety system using the ALS v2 platform, this is assumed to become a COT SR (since this type of test is more appropriate for undervoltage signals).

Actuation Logic Test

The following surveillances are modified (or added) in Section 7.1.3:

The boron dilution system does not have an ALT. However, it would if an ALS v2 system was used, and therefore SR 3.3.9.4 was added to the analysis. This was done for accounting of the existing NUREG-1431 LCOs only since this functionality would be integrated into the RTS/ESFAS architecture of an ALS v2 system, and thus this subsystem would not exist.

A.2.2 Other Considerations

Channel Calibration is not included as a candidate for the elimination analysis in this topical report. However, this surveillance is necessary to provide coverage for portions of the safety system that are not covered by diagnostics. Therefore, the assumed scope of this surveillance is listed below to avoid any ambiguity in what is covered by remaining SRs once credit is taken for the ALS v2 Self Diagnostics.

Channel Calibration

Channel Calibrations shall be performed on the sensors which interface with the ALS v2 Safety System to ensure operability of the sensor. Note that Channel Calibration does not need to include any verification of addressable constants per the discussion outlined in Section 5.2.

NUREG-1431 TADOT

Digital inputs and outputs that perform a safety function shall be cycled to ensure operability. This includes digital inputs from the field (e.g., undervoltage relays, switch contacts etc.) as well as digital inputs that come from the MCR. This also includes digital outputs that initiate safety actuations.

(Last Page of Appendix A)

APPENDIX B LICENSEE REQUIRED ACTIONS

This Appendix contains the licensee required actions (LRAs) that must be performed by the licensee prior to utilizing this topical report to eliminate plant technical specification SRs.

LRA_1 – The licensee will have to compare the plant-specific application FMEA with the failure modes identified in the FMEDA tables cited in this analysis to conclude that all system failure modes are covered by diagnostics, otherwise specific surveillances would need to be identified or other SRs that cover this gap.

LRA_2 – Identification of licensee's plant-specific functions that deviate from those within the applicable standard Westinghouse technical specifications will need to be analyzed to remove the applicable SRs. The analysis/methodology in this topical report provides a framework for this task. Additionally, the licensee needs to ensure that the assumptions made regarding the TS in Appendix A are met in the current licensing basis, otherwise necessary changes will need to be implemented.

LRA_3 – The licensee will have to ensure that alarm response procedures for the safety system are adequate for plant operators to respond to a failure identified by the safety system self-diagnostics.

LRA_4 – When applying this topical report, the licensee needs to document that any existing interdependencies between surveillance requirements that may be impacted by the elimination of an SR are addressed in the technical specification bases.

LRA_5 – When applying this topical report, the licensee shall provide a description of how failures identified by self-diagnostics will be reported to plant operators.

LRA_6 – The licensee will provide a description of plant administrative controls that will provide assurance that faults are captured and investigated. This may include items such as operator rounds, and system engineer monthly reports that evaluate and document the health, errors, and faults of the safety system. In doing so, the anticipated actions in Section 5.3 of this topical report will be met.

LRA_7 – The licensee's application needs to describe how the results of the ALS v2 safety system diagnostics are communicated and displayed in the MCR. If the pathway for these self-diagnostic results involves non-safety equipment, then the licensee's application needs to provide the safety case that the non-safety path is reliable and if it fails, the failure will be alerted to the operator. Such justifications can include the continuous frequent action of the non-safety information display path. See Section 4.3.

LRA_8 – A platform calculation note is performed to quantify the maximum drift of the crystal oscillator before a platform diagnostic detects the drift. This calculated drift value needs to be reflected in the application response time calculation note. See Section 7.2.3.

(Last Page of Appendix B)

APPENDIX C NUREG-1431 MARKUPS

This appendix provides markups to the Westinghouse Standard TS (NUREG-1431, Reference 2) based on this topical report. These markups are provided as a framework for how to markup TS based on the analyses provided within this topical report. This framework can be applied to any set of TS (standard, plant specific, including other nuclear technologies) by following the generic methodology provided herein. Therefore, any set of TS can be changed (with prior NRC approval) as long as the following approach is used: [

]a,c

1.0 USE AND APPLICATION

1.1 Definitions

---NOTE---
The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

Term	Definition
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
ACTUATION LOGIC TEST	An ACTUATION LOGIC TEST shall be the application of various simulated or actual input combinations in conjunction with each possible interlock logic state required for OPERABILITY of a logic circuit and the verification of the required logic output. The ACTUATION LOGIC TEST, as a minimum, shall include a continuity check o
AXIAL FLUX DIFFERENCE (AFD)	AFD shall be the difference in normalized fl between the [top and bottom halves of a tw neutron detector].
CHANNEL CALIBRATION	A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. The CHANNEL CALIBRATION shall encompass all devices in the instrument channel from the sensor to the analog-to-digital converter ~~in the channel required for channel OPERABILITY~~. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an inplace qualitative assessment of sensor behavior and normal calibration of the remaining adjustable devices in the channel. The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping, or total channel steps[, and each step must be performed within the Frequency in the Surveillance Frequency Control Program for the devices included in the step].
CHANNEL CHECK	A CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.

1.1 Definitions

LEAKAGE

LEAKAGE shall be:

a. Identified LEAKAGE

1. LEAKAGE, such as that from pump seals or valve packing (except reactor coolant pump (RCP) seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank;

2. LEAKAGE into the containment atmosphere from sources that are both specifically located and known to not interfere with the operation of leakage detection systems; or

3. Reactor Coolant System (RCS) LEAKAGE through a steam generator to the Secondary System (primary to secondary LEAKAGE);

b. Unidentified LEAKAGE

All LEAKAGE (except RCP seal water injection or leakoff) that is not identified LEAKAGE; and

c. Pressure Boundary LEAKAGE

LEAKAGE (except primary to secondary LEAKAGE) through a fault in an RCS component body, pipe wall, or vessel wall. LEAKAGE past seals, packing, and gaskets is not pressure boundary LEAKAGE.

~~MASTER RELAY TEST~~

~~A MASTER RELAY TEST shall consist of energizing all master relays in the channel required for channel OPERABILITY and verifying the OPERABILITY of each required master relay. The MASTER RELAY TEST shall include a continuity check of each associated required slave relay. The MASTER RELAY TEST may be performed by means of any series of sequential, overlapping, or total steps.~~

MODE

A MODE shall correspond to any one inclusive combination of core reactivity condition, power level, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 1.1-1 with fuel in the reactor vessel.

1.1 Definitions

REACTOR TRIP SYSTEM (RTS) RESPONSE TIME	The RTS RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its RTS trip setpoint at the channel sensor until loss of stationary gripper coil voltage. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC, or the components have been evaluated in accordance with an NRC approved methodology.
SHUTDOWN MARGIN (SDM)	SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming: a. All rod cluster control assemblies (RCCAs) are fully inserted except for the single RCCA of highest reactivity worth, which is assumed to be fully withdrawn. However, with all RCCAs verified fully inserted by two independent means, it is not necessary to account for a stuck RCCA in the SDM calculation. With any RCCA not capable of being fully inserted, the reactivity worth of the RCCA must be accounted for in the determination of SDM, and b. In MODES 1 and 2, the fuel and moderator temperatures are changed to the [nominal zero power design level].
~~SLAVE RELAY TEST~~	~~A SLAVE RELAY TEST shall consist of energizing all slave relays in the channel required for channel OPERABILITY and verifying the OPERABILITY of each required slave relay. The SLAVE RELAY TEST shall include a continuity check of associated required testable actuation devices. The SLAVE RELAY TEST may be performed by means of any series of sequential, overlapping, or total steps.~~
[STAGGERED TEST BASIS	A STAGGERED TEST BASIS shall consist of the testing of one of the systems, subsystems, channels, or other designated components during the interval specified by the Surveillance Frequency, so that all systems, subsystems, channels, or other designated components are tested during *n* Surveillance Frequency intervals, where *n* is the total number of systems, subsystems, channels, or other designated components in the associated function.]

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition C not met.	D.1 Be in MODE 3.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
~~SR 3.1.8.1~~	~~Perform a CHANNEL OPERATIONAL TEST on power range and intermediate range channels per [SR 3.3.1.7, SR 3.3.1.8, and Table 3.3.1-1].~~	~~Prior to initiation of PHYSICS TESTS~~
SR 3.1.8.2	Verify the RCS lowest loop average temperature is ≥ [531]°F.	[30 minutes <u>OR</u> In accordance with the Surveillance Frequency Control Program]
SR 3.1.8.3	Verify THERMAL POWER is ≤ 5% RTP.	[30 minutes <u>OR</u> In accordance with the Surveillance Frequency Control Program]

SURVEILLANCE REQUIREMENTS

--NOTE--
Refer to Table 3.3.1-1 to determine which SRs apply for each RTS Function.

SURVEILLANCE		FREQUENCY
~~SR 3.3.1.1~~	~~Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
SR 3.3.1.2	----------------------------NOTE------------------------------ Not required to be performed until [12] hours after THERMAL POWER is ≥ 15% RTP. --- Compare results of calorimetric heat balance calculation to power range channel output. Adjust power range channel output if calorimetric heat balance calculations results exceed power range channel output by more than +2% RTP.	[24 hours <u>OR</u> In accordance with the Surveillance Frequency Control Program]

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.3	-----------------------------NOTE------------------------------ Not required to be performed until [24] hours after THERMAL POWER is ≥ [15]% RTP. --- Compare results of the incore detector measurements to Nuclear Instrumentation System (NIS) AFD. Adjust NIS channel if absolute difference is ≥ 3%.	[31 effective full power days (EFPD) <u>OR</u> In accordance with the Surveillance Frequency Control Program]
SR 3.3.1.4	------------------------------NOTE------------------------------ This Surveillance must be performed on the reactor trip bypass breaker prior to placing the bypass breaker in service. --- Perform TADOT.	[62 days on a STAGGERED TEST BASIS <u>OR</u> In accordance with the Surveillance Frequency Control Program]

Note: This page is shown for context only. There are no markups on this page.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.1.5~~	~~Perform ACTUATION LOGIC TEST.~~	~~[92 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
SR 3.3.1.6	------------------------------NOTE------------------------------ Not required to be performed until [24] hours after THERMAL POWER is ≥ 50% RTP. -- Calibrate excore channels to agree with incore detector measurements.	[[92] EFPD OR In accordance with the Surveillance Frequency Control Program]
~~SR 3.3.1.7~~	~~------------------------------NOTE------------------------------~~ ~~Not required to be performed for source range instrumentation prior to entering MODE 3 from MODE 2 until 4 hours after entry into MODE 3.~~ ~~--~~ ~~Perform COT.~~	~~[184 days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.1.8~~	~~-----NOTE-----~~ ~~This Surveillance shall include verification that interlocks P-6 and P-10 are in their required state for existing unit conditions.~~ ~~----------~~ ~~Perform COT.~~	~~-----NOTE-----~~ ~~Only required when not performed within [the Frequency specified in the Surveillance Frequency Control Program or previous 184 days]~~ ~~----------~~ ~~Prior to reactor startup~~ ~~AND~~ ~~Four hours after reducing power below P-6 for source range instrumentation~~ ~~AND~~ ~~[Twelve] hours after reducing power below P-10 for power and intermediate range instrumentation~~ ~~AND~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
		~~[Every 184 days thereafter~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
SR 3.3.1.9	------------------------------NOTE------------------------------ Verification of setpoint is not required. --- Perform TADOT.	 [[92] days OR In accordance with the Surveillance Frequency Control Program]
SR 3.3.1.10	~~------------------------------NOTE------------------------------~~ ~~This Surveillance shall include verification that the time constants are adjusted to the prescribed values.~~ ~~---~~ Perform CHANNEL CALIBRATION.	 [[18] months OR In accordance with the Surveillance Frequency Control Program]

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.11	------------------------------NOTE------------------------------ Neutron detectors are excluded from CHANNEL CALIBRATION. -- Perform CHANNEL CALIBRATION.	[[18] months OR In accordance with the Surveillance Frequency Control Program]
SR 3.3.1.12	------------------------------NOTE------------------------------ This Surveillance shall include verification of Reactor Coolant System resistance temperature detector bypass loop flow rate. -- Perform CHANNEL CALIBRATION.	[[18] months OR In accordance with the Surveillance Frequency Control Program]
~~SR 3.3.1.13~~	~~Perform COT.~~	~~[18 months~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.14	-----------------------------NOTE------------------------------ Verification of setpoint is not required. --- Perform TADOT.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]
SR 3.3.1.15	-----------------------------NOTE------------------------------ Verification of setpoint is not required. --- Perform TADOT.	Prior to exceeding the [P-9] interlock whenever the unit has been in MODE 3, if not performed within the previous 31 days

Note: This page is shown for context only. There are no markups on this page.

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.16	-----------------------------NOTE------------------------------ Neutron detectors are excluded from response time testing. -- Verify RTS RESPONSE TIME is within limits.	[[18] months on a STAGGERED TEST BASIS <u>OR</u> In accordance with the Surveillance Frequency Control Program]

Note: This page is shown for context only. There are no markups on this page.

Table 3.3.1-1 (page 1 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL(l) TRIP SETPOINT]
1. Manual Reactor Trip	1,2	2	B	SR 3.3.1.14	NA	NA
	3(a), 4(a), 5(a)	2	C	SR 3.3.1.14	NA	NA
2. Power Range Neutron Flux						
a. High	1,2	4	D	~~SR 3.3.1.1~~ SR 3.3.1.2 ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.11(b)(c) SR 3.3.1.16	≤ [111.2]% RTP	[109]% RTP
b. Low	1(d),2	4	E	~~SR 3.3.1.1~~ ~~SR 3.3.1.8(b)(c)~~ SR 3.3.1.11(b)(c) SR 3.3.1.16	≤ [27.2]% RTP	[25]% RTP
3. Power Range Neutron Flux Rate						
a. High Positive Rate	1,2	4	E	~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.11(b)(c)	≤ [6.8]% RTP with time constant ≥ [2] sec	[5]% RTP with time constant ≥ [2] sec
b. High Negative Rate	1,2	4	E	~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.11(b)(c) SR 3.3.1.16	≤ [6.8]% RTP with time constant ≥ [2] sec	[5]% RTP with time constant ≥ [2] sec

(a) With Rod Control System capable of rod withdrawal or one or more rods not fully insert.

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(d) Below the P-10 (Power Range Neutron Flux) interlocks.

---REVIEWER'S NOTE---

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.1-1 (page 2 of 8)
Reactor Trip System Instrumentation

	FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL(l) TRIP SETPOINT]
4.	Intermediate Range Neutron Flux	1(d), 2(e)	2	F,G	~~SR 3.3.1.1~~ ~~SR 3.3.1.8(b)(c)~~ SR 3.3.1.11(b)(c)	≤ [31]% RTP	[25]% RTP
5.	Source Range Neutron Flux	2(f)	2	H,I	~~SR 3.3.1.1~~ ~~SR 3.3.1.8(b)(c)~~ SR 3.3.1.11(b)(c) SR 3.3.1.16	≤ [1.4 E5] cps	[1.0 E5] cps
		3(a), 4(a), 5(a)	2	I,J	~~SR 3.3.1.1~~ ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.11(b)(c) SR 3.3.1.16	≤ [1.4 E5] cps	[1.0 E5] cps
6.	Overtemperature ΔT	1,2	[4]	E	~~SR 3.3.1.1~~ SR 3.3.1.3 SR 3.3.1.6 ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.12(b)(c) SR 3.3.1.16	Refer to Note 1 (Page 3.3.1-19)	Refer to Note 1 (Page 3.3.1-19)
7.	Overpower ΔT	1,2	[4]	E	~~SR 3.3.1.1~~ ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.12(b)(c) SR 3.3.1.16	Refer to Note 2 (Page 3.3.1-20)	Refer to Note 2 (Page 3.3.1-20)

(a) With Rod Control System capable of rod withdrawal or one or more rods not fully insert.

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(d) Below the P-10 (Power Range Neutron Flux) interlocks.

(e) Above the P-6 (Intermediate Range Neutron Flux) interlocks.

(f) Below the P-6 (Intermediate Range Neutron Flux) interlocks.

---REVIEWER'S NOTE---

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.1-1 (page 3 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
8. Pressurizer Pressure						
a. Low	$1^{(h)}$	[4]	L	~~SR 3.3.1.1~~ ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.10(b)(c) SR 3.3.1.16	≥ [1886] psig	[1900] psig
b. High	1,2	[4]	E	~~SR 3.3.1.1~~ ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.10(b)(c) SR 3.3.1.16	≤ [2396] psig	[2385] psig
9. Pressurizer Water Level - High	$1^{(g)}$	3	L	~~SR 3.3.1.1~~ ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.10(b)(c)	≤ [93.8]%	[92]%
10. Reactor Coolant Flow - Low	$1^{(g)}$	3 per loop	L	~~SR 3.3.1.1~~ ~~SR 3.3.1.7(b)(c)~~ SR 3.3.1.10(b)(c) SR 3.3.1.16	≥ [89.2]%	[90]%
11. Reactor Coolant Pump (RCP) Breaker Position						
a. Single Loop	$1^{(h)}$	1 per RCP	N	SR 3.3.1.14	NA	NA
b. Two Loops	$1^{(i)}$	1 per RCP	P	SR 3.3.1.14	NA	NA
12. Undervoltage RCPs	$1^{(g)}$	[3] per bus	L	SR 3.3.1.9 SR 3.3.1.10(b)(c) SR 3.3.1.16	≥ [4760] V	[4830] V

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(g) Above the P-7 (Low Power Reactor Trips Block) interlock.

(h) Above the P-8 (Power Range Neutron Flux) interlock.

(i) Above the P-7 (Low Power Reactor Trips Block) interlock and below the P-8 (Power Range Neutron Flux) interlock.

---REVIEWER'S NOTE---

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.1-1 (page 4 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
13. Underfrequency RCPs	1[(g)]	[3] per bus	L	SR 3.3.1.9 SR 3.3.1.10[(b)(c)] SR 3.3.1.16	≥ [57.1] Hz	[57.5] Hz
14. Steam Generator (SG) Water Level - Low Low	1,2	[4 per SG]	E	~~SR 3.3.1.1~~ ~~SR 3.3.1.7[(b)(c)]~~ SR 3.3.1.10[(b)(c)] SR 3.3.1.16	≥ [30.4]%	[32.3]%
15. SG Water Level - Low	1,2	2 per SG	E	~~SR 3.3.1.1~~ ~~SR 3.3.1.7[(b)(c)]~~ SR 3.3.1.10[(b)(c)] SR 3.3.1.16	≥ [30.4]%	[32.3]%
Coincident with Steam Flow/Feedwater Flow Mismatch	1,2	2 per SG	E	~~SR 3.3.1.1~~ ~~SR 3.3.1.7[(b)(c)]~~ SR 3.3.1.10[(b)(c)] SR 3.3.1.16	≤ [42.5]% full steam flow at RTP	[40]% full steam flow at RTP
16. Turbine Trip						
a. Low Fluid Oil Pressure	1[(j)]	3	R	SR 3.3.1.10[(b)(c)] SR 3.3.1.15	≥ [750] psig	[800] psig
b. Turbine Stop Valve Closure	1[(j)]	4	R	SR 3.3.1.10 SR 3.3.1.15	≥ [1]% open	[1]% open
17. Safety Injection (SI) Input from Engineered Safety Feature Actuation System (ESFAS)	1,2	2 trains	T	SR 3.3.1.14	NA	NA

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(g) Above the P-7 (Low Power Reactor Trips Block) interlock.

(j) Above the P-9 (Power Range Neutron Flux) interlock.

--REVIEWER'S NOTE--

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.1-1 (page 5 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
18. Reactor Trip System Interlocks						
a. Intermediate Range Neutron Flux, P-6	2[f]	2	V	SR 3.3.1.11 ~~SR 3.3.1.13~~	≥ [6E-11] amp	[1E-10] amp
b. Low Power Reactor Trips Block, P-7	1	1 per train	W	~~SR 3.3.1.5~~	NA	NA
c. Power Range Neutron Flux, P-8	1	4	W	SR 3.3.1.11 ~~SR 3.3.1.13~~	≤ [50.2]% RTP	[48]% RTP
d. Power Range Neutron Flux, P-9	1	4	W	SR 3.3.1.11 ~~SR 3.3.1.13~~	≤ [52.2]% RTP	[50]% RTP
e. Power Range Neutron Flux, P-10	1,2	4	V	SR 3.3.1.11 SR 3.3.1.13	≥ [7.8]% RTP and ≤ [12.2]% RTP	[10]% RTP
f. Turbine Impulse Pressure, P-13	1	2	W	~~[SR 3.3.1.1]~~ SR 3.3.1.10 ~~SR 3.3.1.13~~	≤ [12.2]% turbine power	10]% turbine power
19. Reactor Trip Breakers[k] (RTBs)	1,2	2 trains	U	SR 3.3.1.4	NA	NA
	3[a], 4[a], 5[a]	2 trains	C	SR 3.3.1.4	NA	NA

(a) With Rod Control System capable of rod withdrawal or one or more rods not fully inserted.

(f) Below the P-6 (Intermediate Range Neutron Flux) interlocks.

(k) Including any reactor trip bypass breakers that are racked in and closed for bypassing an RTB.

---REVIEWER'S NOTE---

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.1-1 (page 6 of 8)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
20. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms	1,2	1 each per RTB	Y	SR 3.3.1.4	NA	NA
	$3^{(a)}$, $4^{(a)}$, $5^{(a)}$	1 each per RTB	C	SR 3.3.1.4	NA	NA
21. Automatic Trip Logic	1,2	2 trains	T	~~SR 3.3.1.5~~ None.	NA	NA
	$3^{(a)}$, $4^{(a)}$, $5^{(a)}$	2 trains	C	~~SR 3.3.1.5~~	NA	NA

(a) With Rod Control System capable of rod withdrawal or one or more rods not fully inserted.

--REVIEWER'S NOTE--

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
O. Required Action and associated Completion Time of Conditions H, I, or J not met.	O.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

--NOTE--
Refer to Table 3.3.2-1 to determine which SRs apply for each ESFAS Function.

SURVEILLANCE		FREQUENCY
~~SR 3.3.2.1~~	~~Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.2.2~~	~~Perform ACTUATION LOGIC TEST.~~	~~[92 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.2.3~~	~~-----NOTE-----~~ ~~The continuity check may be excluded.~~ ~~----------~~ ~~Perform ACTUATION LOGIC TEST.~~	~~[31 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~-----REVIEWER'S NOTE-----~~ ~~The Frequency remains at 31 days on a STAGGERED TEST BASIS for plants with a Relay Protection System.~~ ~~----------~~		
~~SR 3.3.2.4~~	~~Perform MASTER RELAY TEST.~~	~~[92 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.2.5~~	~~Perform COT.~~	~~[184 days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.2.6~~	~~Perform SLAVE RELAY TEST.~~	~~[[92] days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
SR 3.3.2.7	-----------------------------NOTE----------------------------- Verification of relay setpoints not required. -- Perform TADOT.	[[92] days OR In accordance with the Surveillance Frequency Control Program]
SR 3.3.2.8	-----------------------------NOTE----------------------------- Verification of setpoint not required for manual initiation functions. -- Perform TADOT.	[[18] months OR In accordance with the Surveillance Frequency Control Program]

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.2.9	~~------------------------------NOTE------------------------------~~ ~~This Surveillance shall include verification that the time constants are adjusted to the prescribed values.~~ ~~--~~ Perform CHANNEL CALIBRATION.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]
SR 3.3.2.10	------------------------------NOTE------------------------------ Not required to be performed for the turbine driven AFW pump until [24] hours after SG pressure is ≥ [1000] psig. -- Verify ESFAS RESPONSE TIMES are within limit.	[[18] months on a STAGGERED TEST BASIS <u>OR</u> In accordance with the Surveillance Frequency Control Program]
SR 3.3.2.11	------------------------------NOTE------------------------------ Verification of setpoint not required. -- Perform TADOT.	Once per reactor trip breaker cycle

Table 3.3.2-1 (page 1 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL(l) TRIP SETPOINT]
1. Safety Injection						
a. Manual Initiation	1,2,3,4	2	B	SR 3.3.2.8	NA	NA
b. Automatic Actuation Logic ~~and Actuation Relays~~	1,2,3,4	2 trains	C	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~ None.	NA	NA
c. Containment Pressure - High 1	1,2,3	3	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≤ [3.86] psig	[3.6] psig
d. Pressurizer Pressure - Low	1,2,3 (a)	[3]	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [1839] psig	[1850] psig
e. Steam Line Pressure						
(1) Low	1,2,3 [(a)]	3 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [635](d) psig	[675](d) psig
(2) High Differential Pressure Between Steam Lines	1,2,3	3 per steam line	D	~~[SR 3.3.2.1]~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≤ [106] psig	[97] psig

(a) Above the P-11 (Pressurizer Pressure) interlock.

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(d) Time constants used in the lead/lag controller are $t_1 \geq [50]$ seconds and $t_2 \leq [5]$ seconds.

--REVIEWER'S NOTE--

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 2 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
1. Safety Injection						
f. High Steam Flow in Two Steam Lines	1,2,3 (e)	2 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	(f)	(g)
Coincident with T_{avg} - Low Low	1,2,3 (e)	1 per loop	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [550.6]°F	[553]°F
g. High Steam Flow in Two Steam Lines	1,2,3 (e)	2 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	(f)	(g)
Coincident with Steam Line Pressure - Low	1,2,3 (e)	1 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [635](d) psig	[675] psig
2. Containment Spray						
a. Manual Initiation	1,2,3,4	2 per train, 2 trains	B	SR 3.3.2.8	NA	NA

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(d) Time constants used in the lead/lag controller are $t_1 \geq [50]$ seconds and $t_2 \leq [5]$ seconds.

(e) Above the P-12 (T_{avg} - Low Low) interlock.

(f) Less than or equal to a function defined as ΔP corresponding to [44]% full steam flow below [20]% load, and ΔP increasing linearly from [44]% full steam flow at [20]% load to [114]% full steam flow at [100]% load, and ΔP corresponding to [114]% full steam flow above 100% load.

(g) Less than or equal to a function defined as ΔP corresponding to [40]% full steam flow between [0]% and [20]% load and then a ΔP increasing linearly from [40]% steam flow at [20]% load to [110]% full steam flow at [100]% load.

--------------------REVIEWER'S NOTE--------------------

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 3 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
2. Containment Spray						
b. Automatic Actuation Logic ~~and Actuation Relays~~	1,2,3,4	2 trains	C	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~ None.	NA	NA
c. Containment Pressure High - 3 (High High)	1,2,3	4	E	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~(b)(c) SR 3.3.2.9(b)(c) SR 3.3.2.10	≤ [12.31] psig	[12.05] psig
d. Containment Pressure High - 3 (Two Loop Plants)	1,2,3	[3] sets of [2]	E	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~(b)(c) SR 3.3.2.9(b)(c) SR 3.3.2.10	≤ [12.31] psig	[12.05] psig
3. Containment Isolation						
a. Phase A Isolation						
(1) Manual Initiation	1,2,3,4	2	B	SR 3.3.2.8	NA	NA
(2) Automatic Actuation Logic ~~and Actuation Relays~~	1,2,3,4	2 trains	C	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~ None.	NA	NA
(3) Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

------------------------------------REVIEWER'S NOTE------------------------------------

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 4 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
3. Containment Isolation						
b. Phase B Isolation						
(1) Manual Initiation	1,2,3,4	2 per train, 2 trains	B	SR 3.3.2.8	NA	NA
(2) Automatic Actuation Logic ~~and Actuation Relays~~	1,2,3,4	2 trains	C	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~ None.	NA	NA
(3) Containment Pressure High - 3 (High High)	1,2,3	[4]	E	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≤ [12.31] psig	[12.05] psig
4. Steam Line Isolation						
a. Manual Initiation	1,2 (j),3 (j)	2	F	SR 3.3.2.8	NA	NA
b. Automatic Actuation Logic ~~and Actuation Relays~~	1,2 (j),3 (j)	2 trains	G	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~ None.	NA	NA
c. Containment Pressure - High 2	1,2 (j),3 (j)	[4]	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≤ [6.61] psig	[6.35] psig

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(j) Except when all MSIVs are closed and [de-activated].

--REVIEWER'S NOTE--

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 5 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
4. Steam Line Isolation						
d. Steam Line Pressure						
(1) Low	1,2 [j],3 [j] [a]	3 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9[b][c] SR 3.3.2.10	≥ [635][d] psig	[675][d] psig
(2) Negative Rate - High	3 [h] [j]	3 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9[b][c] SR 3.3.2.10	≤ [121.6][i] psi	[110][i] psi

(a) Above the P-11 (Pressurizer Pressure) interlock.

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(d) Time constants used in the lead/lag controller are $t_1 \geq [50]$ seconds and $t_2 \leq [5]$ seconds.

(h) Below the P-11 (Pressurizer Pressure) interlock.

(i) Time constant utilized in the rate/lag controller is ≥ [50] seconds.

(j) Except when all MSIVs are closed and [de-activated].

---REVIEWER'S NOTE---

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 6 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
4. Steam Line Isolation						
e. High Steam Flow in Two Steam Lines	1,2 [j],3 [j]	2 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	(f)	(g)
Coincident with T_{avg} - Low Low	1,2 [j],3 [e] [j]	1 per loop	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [550.6]°F	[553]°F
f. High Steam Flow in Two Steam Lines	1,2 [j],3 [j]	2 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	(f)	(g)
Coincident with Steam Line Pressure - Low	1,2 [j],3 [j]	1 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [635][d] psig	[675][d] psig

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(d) Time constants used in the lead/lag controller are t_1 ≥ [50] seconds and t_2 ≤ [5] seconds.

(e) Above the P-12 (T_{avg} - Low Low) interlock.

(f) Less than or equal to a function defined as ΔP corresponding to [44]% full steam flow below [20]% load, and ΔP increasing linearly from [44]% full steam flow at [20]% load to [114]% full steam flow at [100]% load, and ΔP corresponding to [114]% full steam flow above 100% load.

(g) Less than or equal to a function defined as ΔP corresponding to [40]% full steam flow between [0]% and [20]% load and then a ΔP increasing linearly from [40]% steam flow at [20]% load to [110]% full steam flow at [100]% load.

(j) Except when all MSIVs are closed and [de-activated].

--REVIEWER'S NOTE--

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 7 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
4. Steam Line Isolation						
g. High Steam Flow	1,2 [j],3 [j]	2 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5[b][c]~~ SR 3.3.2.9[b][c] SR 3.3.2.10	≤ [25]% of full steam flow at no load steam pressure	[ ] full steam flow at no load steam pressure
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
and						
Coincident with T_{avg} - Low Low	1,2 [j],3 [e] [j]	[2] per loop	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5[b][c]~~ SR 3.3.2.9[b][c] SR 3.3.2.10	≥ [550.6]°F	[553]°F
h. High High Steam Flow	1,2 [j],3 [j]	2 per steam line	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5[b][c]~~ SR 3.3.2.9[b][c] SR 3.3.2.10	≤ [130]% of full steam flow at full load steam pressure	[ ] of full steam flow at full load steam pressure
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(e) Above the P-12 (T_{avg} - Low Low) interlock.

(j) Except when all MSIVs are closed and [de-activated].

---REVIEWER'S NOTE---
(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 8 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL(l) TRIP SETPOINT]
5. Turbine Trip and Feedwater Isolation				None.		
a. Automatic Actuation Logic ~~and Actuation Relays~~	1, 2 (k),[3] (k)	2 trains	H[G]	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~	NA	NA
b. SG Water Level - High High (P-14)	1,2 (k),[3](k)	[3] per SG	I[D]	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≤ [84.2]%	[82.4]%
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
6. Auxiliary Feedwater				None.		
a. Automatic Actuation Logic ~~and Actuation Relays (Solid State Protection System)~~	1,2,3	2 trains	G	~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~	NA	NA
~~b. Automatic Actuation Logic and Actuation Relays (Balance of Plant ESFAS)~~	~~1,2,3~~	~~2 trains~~	~~G~~	~~SR 3.3.2.3~~	~~NA~~	~~NA~~

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

(k) Except when all MFIVs, MFRVs, [and associated bypass valves] are closed and [de-activated] [or isolated by a closed manual valve].

------------------------------------REVIEWER'S NOTE------------------------------------

(j) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Note: Function 6b is deleted. In an ALS v2-based system, there is no distinction between "Automatic Actuation Logic" for the solid state protection system and the balance of plant ESFAS.

Table 3.3.2-1 (page 9 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
6. Auxiliary Feedwater						
c. SG Water Level - Low Low	1,2,3	[3] per SG	D	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [30.4]%	[32.2]%
d. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
e. Loss of Offsite Power	1,2,3	[3] per bus	F	SR 3.3.2.7 SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [2912] V with ≤ 0.8 sec time delay	[2975] V with ≤ 0.8 sec time delay
f. Undervoltage Reactor Coolant Pump	1,2	[3] per bus	I	SR 3.3.2.7 SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [69]% bus voltage	[70]% bus voltage
g. Trip of all Main Feedwater Pumps	1,2	[2] per pump	J	SR 3.3.2.8(b)(c) SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [ ] psig	[ ] psig
h. Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low	1,2,3	[2]	F	~~SR 3.3.2.1~~ SR 3.3.2.7 SR 3.3.2.9(b)(c)	≥ [20.53] [psia]	[ ] [psia]
7. Automatic Switchover to Containment Sump						
a. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	None. ~~SR 3.3.2.2~~ ~~SR 3.3.2.4~~ ~~SR 3.3.2.6~~	NA	NA

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

-----REVIEWER'S NOTE-----

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 10 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[l] TRIP SETPOINT]
7. Automatic Switchover to Containment Sump						
b. Refueling Water Storage Tank (RWST) Level - Low Low	1,2,3,4	4	K	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [15]% and ≤ [ ]%	[ ]% and [ ]%
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
c. RWST Level - Low Low	1,2,3,4	4	K	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [15]%	[18]%
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
and						
Coincident with Containment Sump Level - High	1,2,3,4	4	K	~~SR 3.3.2.1~~ ~~SR 3.3.2.5(b)(c)~~ SR 3.3.2.9(b)(c) SR 3.3.2.10	≥ [30] in. above el. [703] ft	[ ] in. above el. [ ]ft

(b) If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service.

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (field setting) to confirm channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].

---REVIEWER'S NOTE---

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

Table 3.3.2-1 (page 11 of 11)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	[NOMINAL[(l)] TRIP SETPOINT]
8. ESFAS Interlocks						
a. Reactor Trip, P-4	1,2,3	1 per train, 2 trains	F	SR 3.3.2.11	NA	NA
b. Pressurizer Pressure, P-11	1,2,3	3	L	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ SR 3.3.2.9	≤ [1996] psig	[ ] psig
c. T_{avg} - Low Low, P-12	1,2,3	[1] per loop	L	~~SR 3.3.2.1~~ ~~SR 3.3.2.5~~ SR 3.3.2.9	≥ [550.6]°F	[553]° F

--REVIEWER'S NOTE--

(l) Unit specific implementations may contain only Allowable Value depending on Setpoint Study methodology used by the unit.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. As required by Required Action D.1 and referenced in Table 3.3.3-1.	E.1 Be in MODE 3. <u>AND</u> E.2 Be in MODE 4.	6 hours 12 hours
F. As required by Required Action D.1 and referenced in Table 3.3.3-1.	F.1 Initiate action in accordance with Specification 5.6.5.	Immediately

, except as indicated in the Note on SR 3.3.3.1

SURVEILLANCE REQUIREMENTS

---NOTE---
SR 3.3.3.1 and SR 3.3.3.2 apply to each PAM instrumentation Function in Table 3.3.3-1.

SURVEILLANCE		FREQUENCY
SR 3.3.3.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	[31 days <u>OR</u> In accordance with the Surveillance Frequency Control Program]

- NOTE -
Only required to be met for Penetration Flow Path Containment Isolation Valve Position.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.3.2	-------------------------------NOTE------------------------------ Neutron detectors are excluded from CHANNEL CALIBRATION. --- Perform CHANNEL CALIBRATION.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]

Note: This page is shown for context only. There are no markups on this page.

Table 3.3.3-1 (page 1 of 1)
Post Accident Monitoring Instrumentation

	FUNCTION	REQUIRED CHANNELS	CONDITION REFERENCED FROM REQUIRED ACTION D.1
1.	Power Range Neutron Flux	2	E
2.	Source Range Neutron Flux	2	E
3.	Reactor Coolant System (RCS) Hot Leg Temperature	2 per loop	E
4.	RCS Cold Leg Temperature	2 per loop	E
5.	RCS Pressure (Wide Range)	2	E
6.	Reactor Vessel Water Level	2	F
7.	Containment Sump Water Level (Wide Range)	2	E
8.	Containment Pressure (Wide Range)	2	E
9.	Penetration Flow Path Containment Isolation Valve Position	2 per penetration flow path[(a)(b)]	E
10.	Containment Area Radiation (High Range)	2	F
11.	Pressurizer Level	2	E
12.	Steam Generator Water Level (Wide Range)	2 per steam generator	E
13.	Condensate Storage Tank Level	2	E
14.	Core Exit Temperature - Quadrant [1]	2[(c)]	E
15.	Core Exit Temperature - Quadrant [2]	2[(c)]	E
16.	Core Exit Temperature - Quadrant [3]	2[(c)]	E
17.	Core Exit Temperature - Quadrant [4]	2[(c)]	E
18.	Auxiliary Feedwater Flow	2	E

(a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

(b) Only one position indication channel is required for penetration flow paths with only one installed control room indication channel.

(c) A channel consists of two core exit thermocouples (CETs).

--REVIEWER'S NOTE--
Table 3.3.3-1 shall be amended for each unit as necessary to list:
1. All Regulatory Guide 1.97, Type A instruments and
2. All Regulatory Guide 1.97, Category I, non-Type A instruments in accordance with the unit's Regulatory Guide 1.97, Safety Evaluation Report.

Note: This page is shown for context only. There are no markups on this page.

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. One or more Functions with two or more channels per bus inoperable.	B.1	Restore all but one channel per bus to OPERABLE status.	1 hour [OR In accordance with the Risk Informed Completion Time Program]
C. Required Action and associated Completion Time not met.	C.1	Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
~~SR 3.3.5.1~~	~~[Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]]~~

SURVEILLANCE REQUIREMENTS

---NOTE---
Refer to Table 3.3.6-1 to determine which SRs apply for each Containment Purge and Exhaust Isolation Function.

SURVEILLANCE		FREQUENCY
~~SR 3.3.6.1~~	~~Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.6.2~~	~~Perform ACTUATION LOGIC TEST.~~	~~[31 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.6.3~~	~~Perform MASTER RELAY TEST.~~	~~[31 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~-----REVIEWER'S NOTE-----~~ ~~The Frequency of 92 days on a STAGGERED TEST BASIS is applicable to the actuation logic processed through the Relay or Solid State Protection System.~~ ~~-----~~		
~~[SR 3.3.6.4~~	~~-----NOTE-----~~ ~~This Surveillance is only applicable to the actuation logic of the ESFAS Instrumentation.~~ ~~-----~~ ~~Perform ACTUATION LOGIC TEST.~~	~~[92 days on a STAGGERED TEST BASIS]~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~-----REVIEWER'S NOTE-----~~ ~~The Frequency of 92 days on a STAGGERED TEST BASIS is applicable to the master relays processed through the Solid State Protection System.~~ ~~----------~~		
~~[SR 3.3.6.5~~	~~-----NOTE-----~~ ~~This Surveillance is only applicable to the master relays of the ESFAS Instrumentation.~~ ~~----------~~ ~~Perform MASTER RELAY TEST.~~	~~[92 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]]~~
~~SR 3.3.6.6~~	~~Perform COT.~~	~~[92 days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.6.7~~	~~Perform SLAVE RELAY TEST.~~	~~[[92] days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
SR 3.3.6.8	-------------------------------NOTE------------------------------ Verification of setpoint is not required. -- Perform TADOT.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]
SR 3.3.6.9	Perform CHANNEL CALIBRATION.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]

Table 3.3.6-1 (page 1 of 1)
Containment Purge and Exhaust Isolation Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	1,2,3,4, (a)	2	SR 3.3.6.8	NA
2. Automatic Actuation Logic ~~and Actuation Relays~~	1,2,3,4, (a)	2 trains	~~SR 3.3.6.2~~ ~~SR 3.3.6.3~~ ~~[SR 3.3.6.4]~~ ~~[SR 3.3.6.5]~~ ~~SR 3.3.6.7~~ None.	NA
3. [Containment Radiation				
a. Gaseous	1,2,3,4, (a)	[1]	~~SR 3.3.6.1~~ ~~SR 3.3.6.6~~ SR 3.3.6.9	≤ [2 x background]
b. Particulate	1,2,3,4, (a)	[1]	~~SR 3.3.6.1~~ ~~SR 3.3.6.6~~ SR 3.3.6.9	≤ [2 x background]
c. Iodine	1,2,3,4, (a)	[1]	~~SR 3.3.6.1~~ ~~SR 3.3.6.6~~ SR 3.3.6.9	≤ [2 x background]
d. Area Radiation	1,2,3,4, (a)	[1]	~~SR 3.3.6.1~~ ~~SR 3.3.6.6~~ SR 3.3.6.9	≤ [2 x background]]
4. Containment Isolation - Phase A	Refer to LCO 3.3.2, "ESFAS Instrumentation," Function 3.a., for all initiation functions and requirements.			

(a) During movement of [recently] irradiated fuel assemblies within containment.

SURVEILLANCE REQUIREMENTS

---NOTE---
Refer to Table 3.3.7-1 to determine which SRs apply for each CREFS Actuation Function.

SURVEILLANCE		FREQUENCY
~~SR 3.3.7.1~~	~~Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.7.2~~	~~Perform COT.~~	~~[92 days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.7.3~~	~~Perform ACTUATION LOGIC TEST.~~	~~[31 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.7.4~~	~~Perform MASTER RELAY TEST.~~	~~[31 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~-----REVIEWER'S NOTE-----~~ ~~The Frequency of 92 days on a STAGGERED TEST BASIS is applicable to the actuation logic processed through the Relay or Solid State Protection System.~~ ~~----------~~		
~~SR 3.3.7.5~~	~~-----NOTE-----~~ ~~This Surveillance is only applicable to the actuation logic of the ESFAS Instrumentation.~~ ~~----------~~ ~~Perform ACTUATION LOGIC TEST.~~	~~[92 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~-----REVIEWER'S NOTE-----~~ ~~The Frequency of 92 days on a STAGGERED TEST BASIS is applicable to the master relays processed through the Solid State Protection System.~~ ~~----------~~		
~~SR 3.3.7.6~~	~~-----NOTE-----~~ ~~This Surveillance is only applicable to the master relays of the ESFAS Instrumentation.~~ ~~----------~~ ~~Perform MASTER RELAY TEST.~~	~~[92 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.7.7~~	~~Perform SLAVE RELAY TEST.~~	~~[[92] days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.7.8	------------------------------NOTE------------------------------ Verification of setpoint is not required. -- Perform TADOT.	[[18] months OR In accordance with the Surveillance Frequency Control Program]
SR 3.3.7.9	Perform CHANNEL CALIBRATION.	[[18] months OR In accordance with the Surveillance Frequency Control Program]

Note: This page is shown for context only. There are no markups on this page.

Table 3.3.7-1 (page 1 of 1)
CREFS Actuation Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	1, 2, 3, 4, [5, 6], (a)	2 trains	SR 3.3.7.8	NA
2. Automatic Actuation Logic ~~and Actuation Relays~~	1, 2, 3, 4, [5, 6], (a)	2 trains	~~SR 3.3.7.3~~ ~~SR 3.3.7.4~~ ~~SR 3.3.7.5~~ ~~SR 3.3.7.6~~ ~~SR 3.3.7.7~~ None.	NA
3. Control Room Radiation				
a. Control Room Atmosphere	1, 2, 3, 4 [5, 6], (a)	[2]	~~SR 3.3.7.1~~ ~~SR 3.3.7.2~~ SR 3.3.7.9	≤ [2] mR/hr
b. Control Room Air Intakes	1, 2, 3, 4, [5, 6], (a)	[2]	~~SR 3.3.7.1~~ ~~SR 3.3.7.2~~ SR 3.3.7.9	≤ [2] mR/hr
4. Safety Injection	Refer to LCO 3.3.2, "ESFAS Instrumentation," Function 1, for all initiation functions and requirements.			

(a) During movement of [recently] irradiated fuel assemblies.

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time for Condition A or B not met during movement of [recently] irradiated fuel assemblies in the fuel building.	C.1	Suspend movement of [recently] irradiated fuel assemblies in the fuel building.	Immediately
D. [Required Action and associated Completion Time for Condition A or B not met in MODE 1, 2, 3, or 4.	D.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	D.2	--------------NOTE-------------- LCO 3.0.4.a is not applicable when entering MODE 4. ------------------------------------- Be in MODE 4.	12 hours]

SURVEILLANCE REQUIREMENTS

---NOTE---
Refer to Table 3.3.8-1 to determine which SRs apply for each FBACS Actuation Function.

SURVEILLANCE		FREQUENCY
~~SR 3.3.8.1~~	~~Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
~~SR 3.3.8.2~~	~~Perform COT.~~	~~[92 days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.8.3~~	~~[Perform ACTUATION LOGIC TEST.~~	~~[31 days on a STAGGERED TEST BASIS~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]]~~
SR 3.3.8.4	-------------------------------NOTE------------------------------ Verification of setpoint is not required. -- Perform TADOT.	[[18] months OR In accordance with the Surveillance Frequency Control Program]

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.8.5	Perform CHANNEL CALIBRATION.	[[18] months OR In accordance with the Surveillance Frequency Control Program]

Note: This page is shown for context only. There are no markups on this page.

Table 3.3.8-1 (page 1 of 1)
FBACS Actuation Instrumentation

FUNCTION	APPLICABLE MODES OR SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	[1,2,3,4], (a)	2	SR 3.3.8.4	NA
2. [Automatic Actuation Logic ~~and Actuation Relays~~	1,2,3,4, (a)	2 trains	~~SR 3.3.8.3~~ None.	NA]
3. Fuel Building Radiation				
a. Gaseous	[1,2,3,4], (a)	[2]	~~SR 3.3.8.1~~ ~~SR 3.3.8.2~~ SR 3.3.8.5	≤ [2] mR/hr
b. Particulate	[1,2,3,4], (a)	[2]	~~SR 3.3.8.1~~ ~~SR 3.3.8.2~~ SR 3.3.8.5	≤ [2] mR/hr

(a) During movement of [recently] irradiated fuel assemblies in the fuel building.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
	B.2.1 Restore one train to OPERABLE status. OR B.2.2.1 Close unborated water source isolation valves. AND B.2.2.2 Perform SR 3.1.1.1.	1 hour 1 hour 1 hour AND Once per 12 hours thereafter

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
~~SR 3.3.9.1~~ ~~Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.3.9.2~~ ~~Perform COT.~~	~~[[184] days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.9.3	-------------------------------NOTE------------------------------ Neutron detectors are excluded from CHANNEL CALIBRATION. --- Perform CHANNEL CALIBRATION.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]

Note: This page is shown for context only. There are no markups on this page.

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
G. All required monitors inoperable.	G.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

None.

SURVEILLANCE		FREQUENCY
~~SR 3.4.15.1~~	~~Perform CHANNEL CHECK of the required containment atmosphere radioactivity monitor.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~
~~SR 3.4.15.2~~	~~Perform COT of the required containment atmosphere radioactivity monitor.~~	~~[92 days~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.15.3	Perform CHANNEL CALIBRATION of the required containment sump monitor.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]
SR 3.4.15.4	[Perform CHANNEL CALIBRATION of the required containment atmosphere radioactivity monitor.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]]
SR 3.4.15.5	[Perform CHANNEL CALIBRATION of the required containment air cooler condensate flow rate monitor.	[[18] months <u>OR</u> In accordance with the Surveillance Frequency Control Program]]

Note: This page is shown for context only. There are no markups on this page.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.19 RCS Loops - Test Exceptions

LCO 3.4.19 The requirements of LCO 3.4.4, "RCS Loops - MODES 1 and 2," may be suspended with THERMAL POWER < P-7.

APPLICABILITY: MODES 1 and 2 during startup and PHYSICS TESTS.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. THERMAL POWER ≥ P-7.	A.1 Open reactor trip breakers.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.19.1	Verify THERMAL POWER is < P-7.	[1 hour <u>OR</u> In accordance with the Surveillance Frequency Control Program]
~~SR 3.4.19.2~~	~~Perform a COT for each power range neutron flux - low channel, intermediate range neutron flux channel, P-10, and P-13.~~	~~Prior to initiation of startup and PHYSICS TESTS~~
~~SR 3.4.19.3~~	~~Perform an ACTUATION LOGIC TEST on P-7.~~	~~Prior to initiation of startup and PHYSICS TESTS~~

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Two [required] source range neutron flux monitors inoperable.	B.1	Initiate action to restore one source range neutron flux monitor to OPERABLE status.	Immediately
	AND		
	B.2	Perform SR 3.9.1.1.	Once per 12 hours
-----REVIEWER'S NOTE----- Condition C is included only for plants that assume a boron dilution event is mitigated by operator response to an audible source range indication. ------------------------------------- C. [Required source range audible [alarm] [count rate] circuit inoperable.	C.1	Initiate action to isolate unborated water sources.	Immediately]

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
~~SR 3.9.3.1~~	~~Perform CHANNEL CHECK.~~	~~[12 hours~~ ~~OR~~ ~~In accordance with the Surveillance Frequency Control Program]~~

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.9.3.2	-------------------------------NOTE------------------------------ Neutron detectors are excluded from CHANNEL CALIBRATION. --- Perform CHANNEL CALIBRATION.	[[18] months OR In accordance with the Surveillance Frequency Control Program]

Note: This page is shown for context only. There are no markups on this page.

5.5 Programs and Manuals

5.5.18 Setpoint Control Program (continued)

1. [Insert reference to NRC safety evaluation that approved the setpoint methodology.]

c. The program shall establish methods to ensure that Functions described in paragraph a. will function as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

d. -----------------------------------REVIEWER'S NOTE--------------------------------------
A license amendment request to implement a Setpoint Control Program must list the instrument functions to which the program requirements of paragraph d. will be applied. Paragraph d. shall apply to all Functions in the Reactor Trip System and Engineered Safety Feature Actuation System specifications unless one or more of the following exclusions apply:

1. Manual actuation circuits, automatic actuation logic circuits or to instrument functions that derive input from contacts which have no associated sensor or adjustable device, e.g., limit switches, breaker position switches, manual actuation switches, float switches, proximity detectors, etc. are excluded. In addition, those permissives and interlocks that derive input from a sensor or adjustable device that is tested as part of another TS function are excluded.

2. Settings associated with safety relief valves are excluded. The performance of these components is already controlled (i.e., trended with as-left and as-found limits) under the ASME Code for Operation and Maintenance of Nuclear Power Plants testing program.

3. Functions and Surveillance Requirements which test only digital components are normally excluded. There is no expected change in result between SR performances for these comp separate as-left and as-found tolerance is estab component SRs, the requirements would apply.

, which are verified by self-diagnostics tests.

----

performing

The program shall identify the Functions described in paragraph a. that are automatic protective devices related to variables having significant safety functions as delineated by 10 CFR 50.36(c)(1)(ii)(A). The NTSP of these Functions are Limiting Safety System Settings. These Functions shall be demonstrated to be functioning as required by ~~applying the following requirements during~~ CHANNEL CALIBRATIONS~~, CHANNEL OPERATIONAL TESTS,~~ and TRIP ACTUATING DEVICE OPERATIONAL TESTS that ~~verify the NTSP~~.

~~1 The as-found value of the instrument channel trip setting shall be compared with the previous as-left value or the specified NTSP.~~

5.5 Programs and Manuals

5.5.18 Setpoint Control Program (continued)

2. ~~If the as-found value of the instrument channel trip setting differs from the previous as-left value or the specified NTSP by more than the pre-defined test acceptance criteria band (i.e., the specified AFT), then the instrument channel shall be evaluated before declaring the SR met and returning the instrument channel to service. This condition shall be entered in the plant corrective action program.~~

3. ~~If the as-found value of the instrument channel trip setting is less conservative than the specified AV, then the SR is not met and the instrument channel shall be immediately declared inoperable.~~

4. ~~The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the NTSP at the completion of the surveillance test; otherwise, the channel is inoperable (setpoints may be more conservative than the NTSP provided that the as-found and as-left tolerances apply to the actual setpoint used to confirm channel performance).~~

e. The program shall be specified in [insert the facility FSAR reference or the name of any document incorporated into the facility FSAR by reference].]

[5.5.19 Surveillance Frequency Control Program

This program provides controls for Surveillance Frequencies. The program shall ensure that Surveillance Requirements specified in the Technical Specifications are performed at intervals sufficient to assure the associated Limiting Conditions for Operation are met.

a. The Surveillance Frequency Control Program shall contain a list of Frequencies of those Surveillance Requirements for which the Frequency is controlled by the program.

b. Changes to the Frequencies listed in the Surveillance Frequency Control Program shall be made in accordance with NEI 04-10, "Risk-Informed Method for Control of Surveillance Frequencies," Revision 1.

c. The provisions of Surveillance Requirements 3.0.2 and 3.0.3 are applicable to the Frequencies established in the Surveillance Frequency Control Program.]

[5.5.20 Risk Informed Completion Time Program

This program provides controls to calculate a Risk Informed Completion Time (RICT) and must be implemented in accordance with NEI 06-09-A, Revision 0, "Risk-Managed Technical Specifications (RMTS) Guidelines." The program shall include the following: