HITACHI

GE Hitachi Nuclear Energy

James C. Kinsey
Vice President, ESBWR Licensing

PO Box 780 M/C A-55
Wilmington, NC 28402-0780
USA

T 910 675 5057
F 910 362 5057
jim.kinsey@ge.com

MFN 08-372 Revision 1

Docket No. 52-010

May 29, 2008

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

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application - Technical Specifications - RAI Numbers 16.2-135, 16.2-145, 16.2-152, 16.2-153, and 16.2-154**

This letter submits a revised response for RAI 16.2-154, which was originally submitted in Reference 2. Responses for the other RAIs submitted in Reference 2 remain unchanged; however, they are repeated in this revised letter for completeness.

Enclosures 1, 2, 3, and 4 contain the GE Hitachi Nuclear Energy (GEH) responses to the subject NRC RAIs transmitted via the Reference 1 letter.

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

James C. Kinsey

James C. Kinsey
Vice President, ESBWR Licensing

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NRO

References:

1. MFN 07-292, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application,* May 10, 2007
2. MFN 08-372, Letter from James C. Kinsey to U.S. Nuclear Regulatory Commission, *Response to Portion of NRC Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application – Technical Specifications – RAI Numbers 16.2-135, 16.2-145, 16.2-152, 16.2-153, and 16.2 154*, April 21, 2008

Enclosures:

1. MFN 08-372 Revision 1 – Response to Portion of NRC Request for Additional Information Letter No. 97 Related to ESBWR Design Certification Application – Technical Specifications – RAI Numbers 16.2-135, 16.2-145, 16.2-152, 16.2-153, and 16.2 154
2. MFN 08-372 Revision 1 – DCD Markups for RAI Number 16.2-135
3. MFN 08-372 Revision 1 – DCD Markups for RAI Number 16.2-145
4. MFN 08-372 Revision 1 – DCD Markups for RAI Number 16.2-145

cc:	AE Cubbage	USNRC (with enclosures)
	DH Hinds	GEH (with enclosures)
	RE Brown	GEH (with enclosures)
	eDRFs	79-2657, 79-2728, 79-2736, 79-2753, 79-2760/1

Enclosure 1

MFN 08-372 Revision 1

Response to Portion of NRC Request for

Additional Information Letter No. 97

Related to ESBWR Design Certification Application

- Technical Specifications -

RAI Numbers 16.2-135, 16.2-145, 16.2-152, 16.2-153, and 16.2-154

NRC RAI 16.2-135

Equipment within an RPS division of trip actuators includes load drivers and controllers for automatic scram and air header dump initiation. Load drivers are addressed in LCO 3.3.1.2. Operability requirements for the controllers are not addressed within the ESBWR DCD TS. Justify excluding controllers for automatic scram and air header dump initiation from TS.

GEH Response

DCD Revision 4, Section 7.2.1.2.4.1, describes the arrangement of the Reactor Protection System (RPS) division of trip actuators. Equipment within a division of trip actuators includes load drivers and controllers for automatic scram and air header dump initiation. The RPS includes two physically separate and electrically independent divisions of trip actuators receiving inputs from the four divisions of the Trip Logic Unit (TLU).

The DCD Revision 4 description of the RPS division of trip actuators refers to the primary automatic scram trip actuators as "load drivers" and the backup scram air header dump trip actuators as "controllers". The intent was to distinguish that the backup trip actuators are physically and electrically independent from the primary trip actuators.

The primary automatic scram trip actuators (load drivers) are included in the Technical Specifications. The backup scram air header dump trip actuators (controllers) are not included in the Technical Specifications. Excluding the backup scram air header dump initiation trip actuators (or "controllers") from Technical Specifications is justified in the response to RAI 16.0-1 (MFN 06-263). The Alternate Rod Insertion function of the control rod drive air header dump valves was included in the Availability Controls Manual (ACM 3.3.1, "Alternate Rod Insertion") in DCD Revision 4.

GEH has reviewed the DCD Chapter 7 and Chapter 16B sections that describe the RPS division of trip actuators and the use of the term "controller" and determined that clarifying changes are warranted for consistency. The term "controller" is deleted since it implies a programmable logic controller. The description of the division of trip actuators is enhanced to clarify that the RPS has primary and backup scram trip actuators that are physically and electrically independent from each other. The trip actuators are described as load drivers for consistency with NEDO-33288, "Application of Nuclear Measurement Analysis and Control (NUMAC) for the ESBWR Reactor Trip System". These editorial clarifications will be included in DCD Revision 5.

DCD Impact

DCD Chapter 7 and Chapter 16B will be revised in Revision 5 as shown in Enclosure 2.

NRC RAI 16.2-145

Channel operability based on allowable values (AVs), pre-defined as-found tolerance bands, and as-left tolerance bands as specified in the TS for the ESBWR are applicable only to analog protection systems using bistables. For the ESBWR digital protection systems, setpoints are controlled in the TS. The ESBWR TS require that the Nominal trip setpoint, embedded in the digital protection system, be equal to or conservative with respect to the LSSS.

Provide documentation to show that TS will require surveillances to verify operability of the critical functions (1) internal diagnostic methods that can monitor the "health" of different processors/memory boards and perform software checks to ensure that the proper software is executing, and (2) power-up tests (RAM, EPROM, etc.) and error checking on the data links as well as tests by a transmitting channel to ascertain that the transmitted signal has been properly received by the receiving channels during the channel functional test. This information is needed to understand how the proposed Setpoint Control Program will ensure that the requirements of 10 CFR 50.36.(c)(ii)(A) are met.

GEH Response

Channel operability (i.e., operability of instrumentation channels and actuation divisions) for the ESBWR continues to be based on providing automatic protective action consistent with meeting the Limiting Safety System Settings (LSSS) assumptions provided by the Setpoint Control Program (Technical Specification 5.5.11) that utilizes nominal trip setpoints, allowable values, as-found tolerances, and as-left tolerances. The basic operability requirements and objectives of the LSSS are not unique to digital protection systems compared to analog protection systems using bistables. The requirements for frequent monitoring for gross channel failure (Channel Checks), and periodic confirmation of actuation settings (Channel Calibrations), and the overall functioning of all the devices in the system (Channel Functional Test, Logic System Functional Test, Response Time Test) continue to apply to the ESBWR digital protection system.

The requirements of power-up tests, monitoring processor "health," code execution, and error checking on data links are met by the online self-diagnostic features of the ESBWR Distributed Control and Information System (DCIS) platforms in conjunction with the Technical Specification Monitor (TSM), which satisfy the Channel Check requirements by automatic cyclic comparison of channel outputs for unacceptable deviations. Trip setpoint parameters are continuously sent to the TSM for comparison of consistency between divisions and the required values.

The DCIS platforms are tested for errors, from the sensor input point to logic contact output during power-up and cyclically during subsequent operation. The self-diagnostic capabilities include features like microprocessor checks, system initialization, watchdog timers, monitoring memory integrity, checking I/O data integrity and communication bus interfaces, and checks on the application program (checksum). The TSM provides a log of the results, and sends out-of-limits alarms to the Alarm Management System (AMS). The online self-diagnostic features of the DCIS, in conjunction with the TSM, support the Channel Check requirements; which are enhanced over what is required in Standard Technical Specifications for BWR/6, providing overall instrumentation and actuation logic system verification of functionality.

These continuous automatic online diagnostics for both the safety-related DCIS (Q-DCIS) and nonsafety-related DCIS (N-DCIS) detect data transmission errors and hardware failures at the replaceable card or module level. Q-DCIS online diagnostics meet the self-diagnostic characteristics for the safety-related digital computer based protection systems recommended by IEEE Std. 7-4.3.2.

DCD Revision 4, Section 7.1.3.4, "Q-DCIS Testing and Inspection Requirements," and Section 7.1.5.4, "N-DCIS Testing and Inspection Requirements," will be revised to provide basic design information for Technical Specification surveillance tests.

DCD Impact

DCD Subsections 7.1.3.4 and 7.1.5.4 will be revised in Revision 5 as shown in Enclosure 3.

NRC RAI 16.2-152

A Channel Functional Test (CFT) shall be the 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. Add Bases to ESBWR DCD Instrumentation TS to identify all devices in the channel required to be tested by a CFT for each instrument function.

GEH Response

The ESBWR CFT tests the entire channel from sensor input to logic contact output. The instrumentation channel and actuation divisions are adequately described in the DCD and outlined in the Technical Specification Bases. Revising the Chapter 16B Bases for CFT to include a specific list of devices tested would result in a level of detail not incorporated in NUREG-1434, "Standard Technical Specifications General Electric Plants, BWR/6," Bases. This level of detail more properly belongs in the design documents.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 16.2-153

ESBWR instrumentation TS require a Logic System Functional Test (LSFT) to be a test of all components required for operability of a logic circuit. Add Bases to ESBWR DCD Instrumentation TS to define logic circuit and identify the logic circuit devices tested by LSFT.

GEH Response

The ESBWR LSFTs test the instrumentation channel's logic components from the sensor input to logic contact output up to, but not including, the actuating device. This is defined in Section 1.1, Definitions, of DCD Tier 2 Chapter 16, Technical Specifications.

Descriptions of the instrumentation channel and actuation divisions are provided in the DCD and outlined in the Technical Specification Bases.

Revising the Chapter 16B Bases for LSFT to include a specific list of devices tested would result in a level of detail not incorporated in NUREG-1434, "Standard Technical Specifications General Electric Plants, BWR/6," Bases. This level of detail is contained in the design documents.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 16.2-154

Identify all ESBWR DCD TS LCO instrumentation devices required to be operable to ensure the LCO specified safety function can be met. Show that ESBWR DCD TS required testing and calibration will ensure the necessary quality of instrumentation devices is maintained.

GEH Response

The instrumentation channels and actuation divisions are adequately described in the DCD and outlined in the Technical Specification (TS) Bases. Revising the Chapter 16 Bases to include a specific list of all instrumentation devices necessary for the LCO-specified safety function would result in a level of detail not required by NUREG-1434, "Standard Technical Specifications General Electric Plants, BWR/6," Bases. This level of detail is contained in the design documents.

The primary assurance of the necessary quality of the ESBWR TS instrumentation is provided by the Channel Check Surveillance Requirements. The online self-diagnostic features of the Distributed Control and Information System (DCIS), in conjunction with the Technical Specifications Monitor, support the Channel Check requirements; which are enhanced over what is required in Standard Technical Specifications for BWR/6. The enhanced Channel Check Surveillance Requirements provide overall instrumentation and actuation logic system verification of continued functionality.

In DCD Revision 5, the ESBWR Channel Check requirements are standardized at a frequency of 24 hours. This frequency is reasonable based on the continuous automatic online diagnostics that are inherent in the design basis for the ESBWR digital I&C systems, as further described in the response to RAI 16.2-145.

While the requirements of Channel Functional Test are arguably met by the self-diagnostic features in conjunction with the Technical Specifications Monitor, Channel Functional Tests continue to be required by the ESBWR TS. However, based on the extensive continuous automatic online diagnostics that are confirmed as part of the required Channel Check Surveillance Requirements, the Channel Functional Test Frequency is standardized in DCD Revision 5 at a frequency of 24 months. Furthermore, since by definition the Channel Calibration includes a Channel Functional Test, retaining and specifying a Channel Functional Test at 24-month intervals is consistent with and accomplished in conjunction with the Channel Calibration, which is required at 24-month intervals. The Channel Functional Test is retained for continuity with historical presentations and for alignment with IEEE 338 that specifies a Channel Functional Test be performed.

Since the Channel Calibration explicitly addresses setpoint verification, and is performed at the same frequency as the Channel Functional Test, the Channel Functional Test TS Bases discussion of setpoint adjustment is deleted.

To consistently apply these provisions, as shown in the enclosed DCD Revision 5 changes for Chapter 16 and Chapter 16B:

- Channel Check and Channel Functional Test Surveillance Requirements are being added to the actuation Specifications
- Channel Check Surveillance Requirement is being added to Specification 3.3.2.1, "Control Rod Block Instrumentation"

- Channel Check Surveillance Requirement is being expanded to apply to all Specification 3.3.4.1, "Leakage Detection Instrumentation,"

Also, for consistent application of the appropriate required testing, Response Time Testing requirements are added to TS 3.3.7.1, "Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS) Instrumentation," and 3.3.7.2, "Control Room Habitability Area (CRHA) Heating, Ventilation, and Air Conditioning (HVAC) Subsystem (CRHAVS) Actuation."

In summary, the above-described changes for consistent and broad application of Channel Check Surveillance Requirements that take advantage of the online self-diagnostic capabilities, combined with the Channel Functional Test, Channel Calibration, Logic System Functional Test, and Response Time Testing Surveillances collectively ensure the necessary quality of ESBWR TS instrumentation devices is maintained.

DCD Impact

DCD Chapters 16 and 16B will be revised in Revision 5 as shown in Enclosure 4.

Enclosure 2

MFN 08-372 Revision 1

DCD Markups for

RAI Number 16.2-135

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

- ~~ICS~~ PAM system (Subsection 7.45.41);
- CMS (Subsection 7.5.2);
- PRMS (Subsection 7.5.3); and
- Interlock s~~S~~ystems (Section 7.6).

7.1.6.6.1.2 Single Failure Criterion (IEEE Std. 603, 5.1)

The safety-related control systems include sufficient redundancy, diversity, and independence to meet system performance requirements if the system is degraded by any single credible failure. In the RP~~S~~, NMS, ~~logic controller (reactor~~ and SSLC/ESF~~)~~, two-out-of-four redundancy and trip logic prevent a single failure from inhibiting a scram or reactor core cooling safety-related function. They also prevent a single failure from causing either an inadvertent reactor trip or an ~~emergency core cooling~~ECCS action. Redundancy begins with the sensors monitoring the variables and continues through the signal processing, output devices, and actuators. More than one diverse sensor and control system initiates most protective actions. No single failure or two -division failure within the safety-related system causes an AOO to degrade to an Infrequent Event or an Infrequent Event to degrade to an Accident.

Communication between redundant divisions or between safety-related control systems and nonsafety-related control systems is electrically isolated and one-way. (Refer to Subsection 7.1.3.3.) Communication is typically by optical couplers and fiber optic cable~~ing~~.

Each division is sufficiently independent from the other divisions so that no one division is dependent on information, timing data, or communication from any other division to initiate a safety-related trip signal. The failure of a single division does not prevent the initiation of a safety-related trip. Each safety-related logic ~~controller~~ evaluates the data from its own division's sensors and continuously broadcasts the result of its evaluation to the other divisions as either a "trip" or "no trip" signal.

A safety-related trip is initiated whenever any two working divisions sense conditions that require a safety-related trip. Each division receives input data from its own set of diverse and/or redundant sensors connected to the same process source and separately transmits trip signals to the other divisions. The trip actuators go to their trip state whenever they receive concurrent, like parameter trip signals from any two safety-related logic ~~controller~~ transmissions. The two-out-of-four voting logic treats the absence of an interdivisional trip signal as a signal. The signal isolators are qualified to withstand all credible faults, such as short circuits or high voltage, so that faults cannot propagate and degrade the performance of any safety-related control function.

Reference 7.1-4 describes the type of diversity that exists among the four echelons of defense-in-depth and identifies the dependency, redundancy, and independence among the echelons.

An analysis of the redundancy and independence of the safety-related protection systems and a block level ~~F~~failure ~~M~~mode and ~~E~~effects ~~A~~analysis (FMEA) is performed of the complete safety-related reactor protection, ESF, and DPS designs. In addition, the platform specific LTRs for the safety-related system architectures include analysis summaries of the architecture's conformance ~~with~~ to the requirements of IEEE Std. 603.

BPU and other control interfaces in the same division. Signals from one RPS division to another RPS division are isolated electronically using fiber optic cables.

The various manual switches provide the operator with the means to enforce interlocks within RPS trip logic for special operation, maintenance, testing, and system reset. The BPUs perform bypass and interlock logic for the division of channel sensors bypass and the division TLU bypass. Each BPU sends a separate bypass signal for the four channels to the TLU in the same division for channel sensors bypass. Each RPS BPU also sends the TLU bypass signal to the OLU in the same division.

The OLUs perform division trip, seal-in, reset, and trip test functions. Each OLU receives bypass inputs from the RPS BPU, trip inputs from the TLU of the same division, and manual inputs from switches within the same division. Each OLU provides trip outputs to the trip actuators.

Equipment within a division of trip logic is powered from the same division of safety-related power source. However, different pieces of equipment ~~may be~~are powered from separate low-voltage DC power supplies in the same division.

Divisions of Trip Actuators: Equipment within a division of trip actuators includes load drivers ~~and controllers~~ for automatic primary scram and air header dump initiation backup scram. The RPS includes two physically separate and electrically independent divisions of trip actuators receiving inputs from the four divisions of the ~~T~~OLU. The load drivers are isolated, solid-state, current-interrupting devices with fast response times and are used for the primary and backup scram actuators. The~~y~~ primary scram actuators are powered by 120 VAC and can tolerate the high current levels associated with Hydraulic Control Unit (HCU) scram solenoid operation.

The operation of the load drivers is such that a trip signal on the input side creates a high impedance current-interrupting condition on the output side. The output side of each load driver is isolated electrically from its input signal. The load driver outputs are arranged in the primary scram logic circuitry between the scram solenoids and scram solenoid 120 VAC power source. When in a tripped state, the load drivers cause the scram solenoids (scram initiation) to de-energize. The load drivers within a division interconnect with the OLU of all other divisions to form a special arrangement (connected in series and in parallel in two separate groups) that results in two-out-of-four scram logic. Reactor scram occurs if load drivers associated with any two or more divisions receive trip signals from the OLUs (Refer to Figure 7.2--1).

~~The controllers~~ Load drivers are also used for back-up scram actuators, scram–follow initiation, and scram reset permissive actuators. When in a tripped state, the ~~controllers~~ load drivers for backup scram cause the air header dump valve solenoids (air header dump) to energize. The ~~controllers~~load drivers of the backup scram are arranged in a two-out-of four configuration similar to that described above for the primary scram load drivers. Backup scram is diverse in power source and function from primary scram.

Divisions of Manual Scram Controls: Equipment within a division of manual scram controls includes manual switches, contactors, and relays providing an alternate, diverse, manual means to initiate a scram and air header dump. Each division's manual scram function controls the

- Conformance: The RPS system design conforms to RG 1.209.

7.2.1.3.5 Branch Technical Positions

BTP HICB-3,~~:~~ Guidance on Protection System Trip Point Changes for Operation with Reactor Coolant Pumps Out of Service:

- Conformance: Because ~~T~~there is no reactor coolant pump, BTP HICB-3~~so this BTP~~ does not apply. ~~.~~

BTP HICB-8,~~:~~ Guidance on Application of RG 1.22:

- Conformance: The RPS ~~design~~ conforms ~~with~~to BTP HICB-8~~this BTP~~.

BTP HICB-9,~~:~~ Guidance on Requirements for RPS Anticipatory Trips:

- Conformance: Hardware used to provide trip signals in the RPS is designed in accordance with IEEE Std. 603, Section 5.4 and is considered safety-related and meets the design requirements of BTP HICB-9~~this BTP~~.

BTP HICB-11,~~:~~ Guidance on Application and Qualification of Isolation Devices:

- Conformance: The RPS ~~design~~ conforms ~~with~~to this position. The RPS logic ~~controllers~~ use optical CIM and fiber optic cables for interconnections between safety-related divisions for data exchange and for interconnections between safety-related and nonsafety-related devices.

  Certain diverse and hardwired portions of RPS may use coil-to-contact isolation of relays or contactors. This is acceptable according to BTP HICB-11~~the BTP~~ when the application is analyzed or tested per the guidelines of RG 1.75 and RG 1.153.

BTP HICB-12,~~:~~ Guidance on Establishing and Maintaining Instrument Setpoints:

- Conformance: The RPS ~~design~~ conforms ~~with~~to BTP HICB-12~~this position~~. The nominal setpoints are calculated based on the GEH instrument setpoint methodology (Reference 7.2-1). The setpoints are established based on instrument accuracy, calibration capability, and estimated design drift allowance data, and are within the instrument best accuracy range.

  The digital RPS trip setpoints do not drift and any changes are reported to the N-DCIS as alarms~~ed for any change~~. The analog-to-digital converters are self-calibrating, and the RPS uses self-diagnostics, all of which are reported to the N-DCIS through isolated gateways. It is expected that all of the variability in the parameter channel will be attributable to the field sensor. The established setpoints provide margin to fulfill both safety requirements and plant availability objectives.

BTP HICB-13,~~:~~ Guidance on Cross-Calibration of Protection System Resistance Temperature Detectors:

- Conformance: Because ~~T~~the RPS uses sensor input for suppression pool temperature monitoring, which is based on thermocouple-type temperature sensors, ~~so~~ BTP HICB-13~~this BTP~~ does not apply.

BTP HICB-14,~~:~~ Guidance on Software Reviews for Digital Computer-based Instrumentation and Control Safety Systems:

- Conformance: Development of software for the safety-related system functions within RPS conforms ~~with~~to the guidance of BTP HICB-14~~this BTP~~. Discussion of software development is included in the LTRs "ESBWR I&C Software Management Plan," NEDO-33226, NEDE-33226P, and "ESBWR I&C Software Quality Assurance Plan," NEDO-33245, NEDE-33245P. (References 7.2-3 and 7.2-4.) Safety-related software (to be embedded in the memory of the RPS ~~controllers~~logics) is developed according to a structured plan as described in References 7.2-3 and 7.2-4. These plans follow the software life cycle process described in ~~the~~ BTP HICB-14.

BTP HICB-16~~:~~, Guidance on Level of Detail Required for Design Certification Applications Under 10 CFR Part 52:

- Conformance: ~~This~~ BTP HICB-16 is applicable to all sections of the DCD. The RPS ~~S~~section content conforms ~~with~~to ~~this~~ BTP HICB-16.

BTP HICB-17,~~:~~ Guidance on Self-Test and Surveillance Test Provisions:

- Conformance: The RPS ~~controller~~logics conform ~~with~~to BTP HICB-17~~this BTP~~. Discussions on self-test and surveillance tests of RPS are provided in Subsection 7.2.1.4.

BTP HICB-18~~:~~, Guidance on Use of Programmable Logic Controllers in Digital Computer-based Instrumentation and Control Systems:

- Conformance: Q-DCIS hardware, embedded and operating system software, and peripheral components conform to the guidance of BTP HICB-18. The Q-DCIS is built and qualified specifically for ESBWR applications as safety-related and not as commercial grade programmable logic controllers (PLCs). The embedded and operating system software meet the acceptance criteria contained in BTP HICB-14, for safety-related applications.~~Any portions of RPS design using commercial grade programmable logic controllers (PLCs) for safety-related functions conform with this BTP (and with BTPs 14, 17, and 21). Such PLCs are qualified to a level commensurate with safety-related system requirements.~~

BTP HICB-19,~~:~~ Guidance for Evaluation of Defense-in-Depth and Diversity in Digital Computer-Based Instrumentation and Control Systems (Item II.Q of SECY-93-087):

- Conformance: The Reactor Trip (Protection) System designs conform ~~with~~to BTP HICB-19~~this BTP~~ by implementation of an additional diverse instrumentation and control (I&C) system described in Section 7.8 as the DPS.

BTP HICB-21,~~:~~ Guidance on Evaluation of Digital System Architecture and Real-Time Performance:

- Conformance: The real-time performance of RPS in meeting the requirements for safety-related system trip and initiation response conforms ~~with~~to BTP HICB-21~~this BTP~~. The real-time performance of the safety-related control system is deterministic based on the Q-DCIS internal and external communication system design and the RPS ~~controller~~ logic design. – Timing signals are neither exchanged between divisions of independent equipment nor between controllers within a division.

7.2.1.3.6 Three Mile Island Action Plan Requirements

In accordance with the SRP for Chapter 7 and with Table 7.1-1, 10CFR50.34(f)(2)(v)(I.D.3) applies to the RPS and is addressed in Subsection 7.2.1.3.1. TMI action plan requirements are generally addressed in Table 1A-1 of ~~Tier 2, Chapter 1,~~ Appendix 1A.

7.2.1.4 Testing and Inspection Requirements

7.2.1.4.1 System Testing: Operational Verifiability

The RPS is designed so its individual operating elements are tested periodically and independently to demonstrate that RPS reliability is maintained (IEEE Std. 603, Section 5.7 and 6.5).

The RPS design and the design of other systems providing the RPS with instrument channel inputs permit verification~~ying~~ of the operational availability of each input sensor used by the RPS with a high degree of confidence even during reactor operation. Channel checks are continuously performed by the PCF.

The instrument channels are calibrated periodically and adjusted to verify that the necessary precision and accuracy ~~is~~ are being maintained. Such periodic checking and testing during plant operation is possible without loss of scram capability and without causing an inadvertent scram.

Safety-related sensors are designed with the capability for test and calibration during reactor operation, with the following two exceptions in the Reactor Protection System:

- MSIV limit switches, and
- TSV limit switches.

These limit switches are not accessible during reactor operation. While they are tested/checked for operability during reactor operation, they cannot be calibrated until the reactor is shutdown.

Safety-related RPS equipment is designed to allow inspection and testing during periodic shutdowns of the nuclear reactor and during refueling shutdowns.

7.2.1.4.2 Surveillance Testing and In-Service ~~Inspection~~Testing

The RPS equipment testing includes~~ the following~~:

- Preoperational, startup and refueling/outage inspection testing; and

The trip setpoints are adjustable. The SRNM trip functions are shown in Table 7.2-2 (IEEE Std. 603, Section 6.8). A short period signal (the period withdrawal permissive) inhibits continuous control rod withdrawal to avoid a reactor scram (due to a shorter reactor period caused by excessive rod withdrawal).

7.2.2.2.4.6 Bypasses and Interlocks

The 12 SRNM channels are divided into four bypass groups. A ~~controller~~ logic processor allows only one SRNM at a time to be bypassed in each bypass group, allowing up to four SRNM channels to be bypassed at any one time. There is no additional SRNM bypass capability at the divisional level. However, it is possible to bypass all three SRNMs belonging to the same division. When this is required, a divisional bypass allows that division's NMS DTM to be bypassed. For SRNM calibration or repair, the bypass can be ~~done~~ performed for each individual channel separately through these SRNM bypasses without putting the whole division out of service. The SRNM subsystem satisfies the repair requirement of IEEE Std. 603, Section 5.10. Note that bypassing any of the SRNM sensors within a division does not affect the ability of the NMS to perform two-out-of-four trip determinations using the trip decisions from the SRNM divisions (with any three of the four divisions of safety-related power available). The SRNM subsystem satisfies the IEEE Std. 603, Section 5.1 single-failure criterion.

The SRNM bypass switches are mounted on the MCR panel. Bypass functions for the SRNM and the APRM in the NMS are separate. There is no single NMS divisional bypass affecting both the SRNM and the APRM. No APRM bypass forces a SRNM bypass. The individual SRNM power signals are combined and averaged to form a divisional SRNM power signal. Also, all NMS bypass logic control functions are located within the NMS, not in the RPS.

The SRNM has several major interlock logics. The SRNM trip functions are in effect when the Reactor Mode Switch is not in the Run position. The SRNM upscale trip setpoint is lowered (IEEE Std. 603, Section 6.8) in the NMS ~~N~~non-~~C~~coinciden~~ce~~t mode (Table 7.2-2). The SRNM ATWS permissive signals are sent to the ATWS/SLC system to control initiation of SLC system boron injection and associated functions (such as feedwater runback).

7.2.2.2.4.7 Redundancy and Diversity

The signal outputs from the 12 SRNM channels are arranged so each of the four divisions includes a different set of designated SRNM channels covering different regions of the core. The SRNM monitoring and protection function is provided by an individual channel. Failure of an un-bypassed single SRNM channel causes an inoperative trip to only one of the four divisions, whereas a full scram requires divisional trips in two-out-of-four divisions within the NMS. Bypassing a single SRNM channel does not cause a trip output to the related SRNM division and does not prevent the remaining SRNM channels from performing their safety-related functions.

7.2.2.2.4.8 Environmental Considerations

The wiring, cables, and connectors located within the drywell are designed for continuous duty in the environmental conditions described in Appendix 3H.

protected from any rising neutron flux potentially exceeding these values. The nominal setpoints are calculated to be consistent with the GEH standard setpoint methodology (Reference 7.2-1), which conforms ~~with~~to RG 1.105. The setpoint margin calculated by this method also has considered additional uncertainties with the calibration interval. Therefore, the NMS meets BTP HICB-12~~this BTP~~.

Most of the uncertainty associated with safety-related NMS trip setpoints is associated with the various neutron sensors because the digital electronics in the NMS do not drift, and the setpoints are monitored and alarmed by the PCF of N-DCIS.

BTP HICB-14~~—~~, Guidance on Software Reviews for Digital Computer-based Instrumentation and Control Safety Systems:

- Conformance: Development of software for the safety-related system functions within NMS conforms ~~with~~ to the guidance of BTP HICB-14~~this BTP~~ as discussed in the LTRs "ESBWR I&C Software Management Plan," NEDO-33226, and "ESBWR I&C Software Quality Assurance Plan," NEDO-33245. (References 7.2-3 and 7.2-4.) Safety-related software to be embedded in the memory of the NMS ~~controllers~~ logics is developed according to a structured plan described in References 7.2-3 and 7.2-4. These plans follow the software life cycle process described in BTP HICB-14~~the BTP~~.

BTP HICB-16~~—~~, Guidance on Level of Detail Required for Design Certification Applications Under 10 CFR Part 52:

- Conformance: ~~This BTP is applicable to all sections of the DCD.~~ The NMS section content conforms ~~with~~to BTP HICB-16~~this BTP~~.

BTP HICB-17~~—~~, Guidance on Self-Test and Surveillance Test Provisions:

- Conformance: The safety-related subsystems of the NMS are designed to support the required periodic testing. (Refer to Subsection 7.2.2.4.) The NMS system equipment features a self-test design operating in all modes of plant operations. This self-test function does not interfere with the safety-related functions of the system. The NMS design conforms ~~with~~to BTP HICB-17~~this BTP~~.

BTP HICB-18~~—~~, Guidance of Use of Programmable Logic Controllers in Digital Computer-based Instrumentation and Control Systems:

- Conformance: Q-DCIS hardware, embedded and operating system software, and peripheral components conforms to the guidance of Branch Technical Position HICB-18. Q-DCIS is built and qualified specifically for ESBWR applications as safety-related and not as commercial grade PLCs. The embedded and operating system software meet the acceptance criteria contained in BTP HICB-14, for safety-related applications.~~Any portions of the NMS design using commercial grade programmable logic controllers (PLCs) for safety-related functions conform with this BTP. The PLCs are qualified to a level commensurate with safety-related system requirements.~~

BTP HICB-19~~—~~, Guidance for Evaluation of Defense-in-Depth and Diversity in Digital Computer-based Instrumentation and Control Systems:

BASES

BACKGROUND (continued)

of the same division, and various manual inputs from switches within the same division. Each OLU provides trip outputs to the trip actuators.

Equipment within a division of trip logic is powered from the same division of safety-related power source. However, different pieces of equipment may be powered from separate low voltage dc power supplies in the same division. OPERABILITY requirements for the Divisions of Trip Logic are addressed in LCO 3.3.1.2, "Reactor Protections System (RPS) Actuation," with the exception of the digital trip function, which is addressed in LCO 3.3.1.1.

Divisions of Trip Actuators

Equipment within a division of trip actuators includes load drivers ~~and controllers~~ for automatic scram and air header dump initiation. The RPS includes two physically separate and electrically independent divisions of trip actuators that receive inputs from the four Divisions of Trip Logic. The load driver outputs are arranged in the scram logic circuitry, which is between the scram solenoids and scram solenoid 120 VAC power source. When in a tripped state, the load drivers within a division interconnect with the OLU of all other divisions to form an arrangement (connected in series and in parallel in two separate groups) that results in two-out-of-four scram logic. Reactor scram occurs if load drivers associated with any two or more divisions receive trip signals from the OLUs.

~~The controllers~~ Load drivers are also used for back-up scram actuators, scram-follow initiation, and scram reset permissive actuators. When in a tripped state, ~~the controllers~~ load drivers cause the air header dump valve solenoids to energize. The ~~controllers~~ load drivers of the backup scram are arranged in a two-out-of-four configuration similar to that described above for the primary scram load drivers. Backup scram is diverse in power source and function to primary scram.

A manual switch associated with each Division of Trip Actuators provides means to reset the seal-in at the input of all trip actuators in the same division. The reset does not have any effect if the conditions that caused the division trip have not cleared when a reset is attempted. All manual resets are inhibited for ten seconds to allow sufficient time for scram completion.

BASES

BACKGROUND (continued)

OPERABILITY requirements for the load drivers are addressed in LCO 3.3.1.2. OPERABILITY requirements for the ~~controllers~~ backup scram load drivers are not addressed within the Technical Specifications.

Divisions of Manual Scram Controls

OPERABILITY requirements for the Divisions of Manual Scram Controls are addressed in LCO 3.3.1.3, "Reactor Protection System (RPS) Manual Trip Actuation."

Divisions of Scram Logic Circuitry

The two divisions of primary scram logic circuitry are powered from independent and separate power sources. One of the two divisions of scram logic circuitry distributes division 1 safety-related 120 VAC power to the A solenoids of the hydraulic control units (HCUs). The other division of scram logic circuitry distributes division 2 safety-related 120 VAC power to the B solenoids of the HCUs. The HCUs (which include the scram pilot valves and the scram valves, including their solenoids) are, components of the CRD system. A full scram of control rods associated with a particular HCU occurs when both A and B solenoid of the HCU are de-energized.

One scram pilot valve is located in the Hydraulic Control Unit (HCU) for each control rod drive pair. Each scram pilot valve is operated by two solenoids, with both solenoids normally energized. The scram pilot valve controls the air supply to the scram inlet valve for the associated control rod drive pair. When either of two scram pilot valve solenoids is energized, air pressure holds the scram valve closed and therefore, both scram pilot valve solenoids must be de-energized to cause a control rod pair to scram. The scram valve controls the supply for the control rod drive (CRD) water during a scram.

OPERABILITY requirements for components of the Divisions of Scram Logic Circuitry are addressed in LCO 3.1.3, "Control Rod OPERABILITY."

The RPS is designed to provide reliable single-failure proof capability to automatically or manually initiate a reactor scram while maintaining protection against unnecessary scrams resulting from single failures. The RPS satisfies the single-failure criterion even when one entire division of channel sensors is bypassed and/or when one of the four automatic RPS trip logic divisions is out-of-service.

B 3.3 INSTRUMENTATION

B 3.3.1.2 Reactor Protection System (RPS) Actuation

BASES

BACKGROUND

The RPS is designed to initiate a reactor scram when one or more monitored parameters exceed their specified limit, to preserve the integrity of the fuel cladding, preserve the integrity of the reactor coolant pressure boundary, and preserve the integrity of the containment by minimizing the energy that must be absorbed following a LOCA. This can be accomplished either automatically or manually.

A detailed description of the RPS instrumentation and RPS actuation logic is provided in the Bases for LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation."

This Specification provides requirements for the RPS actuation circuitry that consists of the Divisions of Trip Logic (with the exception of OPERABILITY of the digital trip function, which is addressed in LCO 3.3.1.1), and the Divisions of Trip Actuators (except for OPERABILITY of the ~~controllers~~ backup scram load drivers which are not addressed within the Technical Specifications).

APPLICABLE SAFETY ANALYSES

The actions of the RPS are assumed in the safety analyses of Reference 1. The RPS initiates a reactor scram when monitored parameter values exceed the trip setpoints to preserve the integrity of the fuel cladding, preserve the integrity of the reactor coolant pressure boundary, and preserve the integrity of the containment by minimizing the energy that must be absorbed following a LOCA. RPS actuation channels support the OPERABILITY of the RPS Instrumentation, "LCO 3.3.1.1, Reactor Protection System (RPS) Instrumentation" and therefore is required to be OPERABLE.

RPS Actuation satisfies the requirements of Selection Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Although there are four RPS automatic actuation divisions, only three RPS automatic actuation divisions are required to be OPERABLE to ensure no single automatic actuation division failure will preclude a scram to occur on a valid signal. The three required divisions are those divisions associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems -

Enclosure 3

MFN 08-372 Revision 1

DCD Markups for

RAI Number 16.2-145

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

any clarification or justification for exceptions, is presented in the safety evaluation sections for each specific system.

7.1.3.4 Q-DCIS Testing and Inspection Requirements

~~The testing and inspection requirements for each system within the Q-DCIS are presented in specific subsections in Chapter 7.~~

~~The components of the Q-DCIS are readily accessible for testing purposes. The continuous automatic online diagnostics of the Q-DCIS detect most data transmission errors and hardware failures at the replaceable card or module level. Continuous self-diagnostics in each RMU monitor the status of each module or card.~~

~~The DCIS functions are closely interfaced with the following:~~

- ~~Safety-related logic functions,~~
- ~~Integrated hardware and software functions of the Q-DCIS, and~~
- ~~Safety-related logic including network parameters.~~

~~Data status of these functions are checked and tested together. Some of the key diagnostics include the following:~~

- ~~CPU status check,~~
- ~~Parity checks,~~
- ~~Watchdog timer status,~~
- ~~Voltage level in controllers,~~
- ~~Data path integrity and data validation checks, and~~
- ~~Data cycling time.~~

~~The DCIS functions are closely interfaced with the safety-related logic functions, the integrated hardware and software functions of the Q-DCIS and safety-related logic including network parameters and data status are checked and tested together. Some of the key diagnostics include the CPU status check, parity checks, watchdog timer status, voltage level in controllers, data path integrity and data validation checks, and data cycling time. The A/D converters (and the D/A converters if used) in the RMUs are the only components requiring periodic calibration checks, which can be performed automatically. In the Q-DCIS, online diagnostics are qualified as safety-related in conjunction with functional software qualification (IEEE Std. 603, Section 5.7).~~

~~Any detected hardware failure results in an alarm in the MCR. Corrupted data are detected through error detection functions in the network.~~

The Q-DCIS uses two diverse platforms, NUMAC for RTIF functions (RPS/NMS and the MSIV isolation function) and TRICON for SSLC/ESF functions (ADS, GDCS, ICS, SLC, LD&IS functions (except MSIV isolation), and CRHS).

Both platforms are readily accessible for testing purposes. Their continuous automatic online diagnostics detect data transmission errors and hardware failures at the replaceable card or module level. Online diagnostics for NUMAC and TRICON are qualified as safety-related in conjunction with functional software qualification (IEEE Std. 603, Section 5.7), and also meet the self-diagnostic characteristics for digital computer based protection systems recommended by IEEE Std. 7-4.3.2.

Both NUMAC and TRICON have self-diagnostic features that check the validity of input signals. An analog input outside expected limits creates an alarm.

The NUMAC hardware has a watchdog timer that monitors the execution of the software. If the software stops executing (suspending the self-diagnostics), the watchdog timer resets the affected instrument. This results in a channel trip and alarm while the instrument is resetting.

The TRICON, a Triple Modular Redundant (TMR) system, has three Main Processors (MPs). The MPs are monitored by individual watchdog timers that reset or fail an MP depending on the severity of the problem. A single or double MP failure causes alarms, but the division continues to function to provide the required automatic protective actions.

Both NUMAC and TRICON are cyclically tested from the sensor input point to logic contact output. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, I/O data integrity checks, communication bus interfaces checks, and checks on the application program (checksum). Cyclically monitored items include:

- Sensor inputs to the I/O for unacceptably high/low levels,
- Proper execution of application code/checksum verification of code integrity,
- Internal clocks,
- Functionality of input cards/modules, and their MP communication,
- MP communication with the output contact (TRICON),
- Inter-divisional communication between RPS/NMS instruments (NUMAC), and
- Functionality of the output contact by momentarily reversing its state and confirming readiness to change state on demand (TRICON).

Subsequent to verification and validation (V&V) of software during factory and preoperational testing in accordance with approved test procedures, there is no mechanism for the NUMAC/TRICON code, response time, or coded trip setpoints to inadvertently change. For user adjustable parameters a new checksum is calculated at the time acceptable changes are implemented. The new checksum is used from that point forward to validate the application software. The trip setpoint parameters are continuously sent to the N-DCIS technical specifications monitor (TSM) for comparison of the setpoints to confirm consistency between divisions and the required values.

The following describes the periodic testing performed to support surveillance requirements of the Technical Specifications. Additional information on testing and inspection requirements for each system within the Q-DCIS is presented in specific subsections in Chapter 7.

Channel Check

The channel check is a qualitative assessment of channel behavior during operation. The online self-diagnostic features of NUMAC/TRICON, in conjunction with the TSM, accomplish the channel check requirements for detecting unacceptable deviations by automatic cyclic comparison of channel outputs. Technical specifications monitor provides a log of the results and sends out-of-limits alarms to the Alarm Management System (AMS). The TSM uses a hardware/software platform different from NUMAC and TRICON. The TSM functions are listed in Subsection 7.1.5.2.4.5.

If there are any self-diagnostic test results and indicating alarms, a summary report is available to the operator on demand.

Sensor and actuation logic channel monitoring capability are provided at the VDUs to enable manual validation of TSM report results.

Channel Functional Test

The channel functional test ensures that the entire sensor and actuation logic channel performs its intended function. The online self-diagnostic features of NUMAC and TRICON, in conjunction with the TSM, support the channel functional test requirements. The channel functional test can be conducted by manual injection of a simulated signal, one division at a time. The channel functional test confirms the channel through its logic output contact is functioning correctly. The coincidence logic, involving more than one channel, and the final control elements are not activated in the channel functional test.

Logic System Functional Test

The logic system functional test is performed from sensor inputs to the actuated devices for all logic components required for operability of a logic circuit. To confirm that the trip logic is functioning, testing requires manual injection of simulated signals in two sensor channels of NUMAC/TRICON.

Response Time Test

The response time test is performed by a series of sequential, overlapping, or total steps to measure the entire response time. The instrument self-diagnostics and the TSM support the performance of the response time test for the NUMAC/TRICON. Watchdog timers monitor instrument internal clocks and alarms for out-of-limit conditions and the completion of application code per instrument cycle. Since the clocks set the response time, there is no mechanism for the response time to change without alarm or trip. All time delays incorporated into system logics are performed by software and the values are set during factory and preoperational testing in accordance with approved test procedures. Subsequent to final V&V of the code, there is no mechanism for the time delay values to inadvertently change.

The response time tests for the remaining portions (i.e. sensors (except neutron radiation detectors) and final control elements/actuators) are performed separately from self-diagnostics and the TSM.

7.1.3.5 Q-DCIS Instrumentation and Control Requirements

The data transmission function delivers system data to all nodes in the network, such as distributed logics of the Q-DCIS RMUs and specific safety-related logic system components, and in certain safety-related systems through dedicated data paths. The Q-DCIS thus provides the necessary integrated support for the distributed control logic functions of the RMUs and safety-related logic equipment. The data I/O and transmission functions do not require any manual operator intervention and have no operator controls.

The Q-DCIS operates continuously in all modes of plant operation to support the data transmission requirements of the interfacing systems. When one network of the dual network system fails, operation continues automatically without operator intervention. In the event that a channel failure occurs, the network alarms in the MCR indicate the failed component. The failed segment of the channel can be isolated from the operating segments and repaired on-line (IEEE Std. 603, Section 5.7, 5.10, and 6.5).

The following Q-DCIS displays and alarms, as a minimum, are provided in the MCR (IEEE Std. 603, Section 5.8).

- MCR Alarms:
  - Division 1 Q-DCIS trouble,
  - Division 2 Q-DCIS trouble,
  - Division 3 Q-DCIS trouble, and
  - Division 4 Q-DCIS trouble.
- MCR Indications:
  - Division 1 Q-DCIS diagnostic displays,
  - Division 2 Q-DCIS diagnostic displays,
  - Division 3 Q-DCIS diagnostic displays, and
  - Division 4 Q-DCIS diagnostic displays.

7.1.3.6 Q-DCIS Boundaries

The Q-DCIS does not include any N-DCIS components. In addition, the Q-DCIS ~~does not~~ includes neither the sensors, ~~or~~ the sensor wiring to the RMUs, nor the RMU output wiring to the actuators.

7.1.5.3.5 Branch Technical Positions

BTP HICB-14~~:~~, Guidance on Software Reviews for Digital Computer-based I&C Safety-related systems:

- Conformance: The N-DCIS conforms ~~with~~to the intent of BTP HICB-14~~this guideline~~ as outlined in References 7.1-8, 7.1-10, and 7.1-12 ~~ISO 17799~~ for Security Management of the N-DCIS Control Network.

BTP HICB-16~~:~~, Guidance on Level of Detail Required for Design Certification Applications Under 10 CFR Part 52:

- Conformance: The level of detail ~~is~~ in this subsection (7.1.5) conforms to BTP HICB-16~~commensurate with this BTP~~.

From the foregoing analyses, it is concluded that the N-DCIS meets its regulatory and industry design bases.

7.1.5.4 N-DCIS Testing and Inspection Requirements

~~The t~~Testing and inspection requirements for N-DCIS systems~~for each system within the N-DCIS~~ are presented as specific subsections in Chapter 7.

Channel check, channel functional test, logic system functional test, channel calibration, and response time test are required for some N-DCIS systems in support of technical specification surveillance requirements. Similar to the tests described for Q-DCIS in Section 7.1.3.4, the N-DCIS online diagnostic features described below support the technical specification surveillance requirements.

The N-DCIS controllers, displays, monitoring and I/O communication interfaces continuously function during normal power operation. Abnormal operation of these components ~~can be~~is detected and alarmed. In addition, similar to the functionality of the Q-DCIS platforms described in Section 7.1.3.4, the N-DCIS controllers are equipped with on-line diagnostic capabilities for cyclically monitoring the operability~~identifying and isolating failure~~ of I/O signals, buses, power supplies, processors, and inter-processor communications. On-line diagnostics are performed without interrupting the normal ~~control~~ operation of the N-DCIS.

The N-DCIS components and critical components of interfacing systems are tested to ensure that the specified performance requirements are satisfied. Factory, construction, and preoperational testing of the N-DCIS ~~are~~ is performed before fuel loading and startup testing to ensure that the system functions as designed and that tested system performance is within specified criteria.

As in the case of Q-DCIS, N-DCIS interfaces with the TSM for automatic cyclic comparison of channel outputs and monitoring of unacceptable deviations. The TSM provides a log of the results, and sends out-of-limits alarms to the AMS.

The N-DCIS uses diverse platforms for implementing nonsafety-related nuclear functions for 3D Monicore, RC&IS, automatic fixed in-core probe (AFIP), multi-channel rod block monitor

(MRBM), automated thermal limit monitor (ATLM), and rod worth minimizer (RWM). Self-diagnostic routines with alarms ensure operability.

- 3D Monicore monitors the reactor core, by accepting signals from the AFIP and the LPRMs. The LPRMs are calibrated with respect to the AFIP signals. Failed sensor inputs are rejected so that they do not contribute to calculations. Subsection 7.1.5.2.4.8 provides a functional description of 3D Monicore. There are two active redundant trains, but only one is manually selected by the operator at any time to periodically send fuel thermal limits information to the two redundant ATLMs. The same information is also sent to the TSM to support channel check and channel functional test surveillances.
- The MRBM and the AFIP are subsystems of the NMS. AFIP signals are routed to the 3D Monicore for calibrating the LPRM. Subsection 7.7.6.2.1 provides a functional description of the AFIP. The MRBM sends rod block signals to RC&IS to ensure that fuel thermal safety limits are not violated. Subsections 7.7.6.2.2 and 7.7.2.2.7.4 respectively provide a functional description of the MRBM and the rod block function.
- The ATLM and the RWM have two redundant channels that are subsystems of RC&IS, which ensures consistency between specific control rod pattern restrictions and the actual pattern of the rods in the reactor. Subsection 7.7.2 provides a functional description, and Figure 7.7-2 shows a block diagram of RC&IS.
- The ATLMs receive data from 3D Monicore through message-authenticated data links. They interchange data and generate alarms on disagreements. They send rod block signals to RC&IS to prevent violation of fuel operating thermal limits. Subsection 7.7.2.2.7.7 provides a functional description of the ATLM. ATLM failure automatically generates a rod block and an alarm. Only one ATLM can be bypassed at any time, and so there is always an active ATLM in service; additionally automated plant operation is not possible without both ATLMs being in service.
- Fuel thermal limits and rod block signals from the ATLMs and the MRBM are periodically sent to the TSM to support Channel Check and Channel Functional Test surveillances.

As described above, the 3D Monicore and ATLMs send fuel thermal limit information to the TSM to support channel check and channel functional test surveillances. The data downloads from the two systems are synchronized. The TSM conducts a check to compare the values, and generates alarms if the values are not comparable within acceptable limits.

Once per shift, in steady state operation, an automatic check of rod block capability is generated by the ATLM to close rod block contacts to RC&IS (this signal can also be sent by operator VDU command). The TSM detects the rod block command and generates an alarm. This routine tests the functionality of the output contacts for rod block, and will execute only after checking and confirming that the nuclear parameters as seen by 3D Monicore are in steady-state.

Additional surveillance tests associated with RC&IS ensure control rod operability and control rod pattern control. The control rod separation switches are also checked for functionality during a refuel outage, along with individual scram time testing on all the rods. A physical coupling and decoupling of the control rod is carried out to actuate the corresponding separation switches and validate the rod block functionality.

7.1.5.5 N-DCIS Instrumentation and Control Requirements

7.1.5.5.1 Uninterruptible Nonsafety-Related AC Power Supply

The N--DCIS components and cabinets that are key to power generation are supplied with either dual redundant or triple redundant power supplies and power feeds. The sources of this power are three independent UPS inverters, normally supported by AC power. If off-site power fails and the diesel generators fail, the N--DCIS inverters receive power from three independent battery systems. All of these AC power feeds are well regulated and supply 120 ±10% volt AC, 60 Hz. Inverter operation~~.~~, ~~F~~frequency, voltages, currents, and battery and charger operation are monitored and alarmed. The N--DCIS panel is designed so that the loss of one power supply or incoming power source does not affect the N--DCIS or its functional or plant operation.

7.1.5.5.2 Lighting and Service Power System

The LSP supplies 120 VAC power to the N--DCIS for lighting and maintenance equipment. This includes internal cabinet lighting and convenience outlets.

7.1.5.6 N-DCIS Major System Interfaces

The N--DCIS has interfaces with almost all of the I&C and electrical nonsafety-related plant systems. Safety-related system information acquired by the Q--DCIS is available to N--DCIS through qualified isolation devices that are part of the Q--DCIS. System interfaces with nonsafety-related systems, or portions of systems, and systems acquiring Q--DCIS data through isolation devices/gateways/datalinks include:

- ARMS;
- Auxiliary Boiler System (ABS);
- C&FS;
- Chilled Water System;
- CIRC;
- Condensate Storage and Transfer System;
- C~~ontainment~~ I~~nerting~~ S~~ystem~~;
- CMS;
- CB HVAC;
- CPS;
- CRD system;

Enclosure 4

MFN 08-372 Revision 1

DCD Markups for

RAI Number 16.2-154

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in DCD Revision 5.

SURVEILLANCE REQUIREMENTS

- NOTE -
Refer to Table 3.3.1.1-1 to determine which SRs apply for each RPS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.1	Perform CHANNEL CHECK on each required channel.	24 hours
SR 3.3.1.1.2	Perform CHANNEL FUNCTIONAL TEST on each required channel.	~~184 days~~24 months
SR 3.3.1.1.3	Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months
SR 3.3.1.1.4	Verify the RPS RESPONSE TIME of each required channel is within limits.	24 months on a STAGGERED TEST BASIS for four channels

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. RPS automatic actuation capability not maintained in MODE 6. <u>OR</u> Required Action and associated Completion Time of Condition A not met in MODE 6.	D.1	Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
<u>SR 3.3.1.2.1</u>	<u>Perform CHANNEL CHECK on each required division.</u>	<u>24 hours</u>
<u>SR 3.3.1.2.2</u>	<u>Perform CHANNEL FUNCTIONAL TEST on each required division.</u>	<u>24 months</u>
SR 3.3.1.2.~~1~~<u>3</u>	Perform LOGIC SYSTEM FUNCTIONAL TEST for each required RPS automatic actuation division.	24 months on a STAGGERED TEST BASIS for four divisions
SR 3.3.1.2.~~2~~<u>4</u>	Verify the RPS RESPONSE TIME of each required division is within limits.	24 months on a STAGGERED TEST BASIS for four divisions

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. Required Action and associated Completion Time of Condition A, B, or C not met in MODE 1 or 2.	D.1	Be in MODE 3.	12 hours
E. Required Action and associated Completion Time of Condition A, B, or C not met in MODE 6.	E.1	Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.1.3.1	Perform CHANNEL FUNCTIONAL TEST for ~~the~~ each RPS manual ~~scram~~ actuation channel~~s~~.	~~92 days~~24 months
~~SR 3.3.1.3.2~~	~~Perform CHANNEL FUNCTIONAL TEST for the Reactor Mode Switch-Shutdown position channels.~~	~~24 months~~

SURVEILLANCE		FREQUENCY
SR 3.3.1.4.2	------------------------------------ **- NOTE -** Not required to be performed until 12 hours after THERMAL POWER ≥ 25% RTP. ------------------------------------ Verify the absolute difference between the average power range monitor (APRM) channels and the calculated power ≤ 2% RTP while operating at ≥ 25% RTP for each required channel.	7 days
SR 3.3.1.4.3	------------------------------------ **- NOTE -** For Functions 1.a, 1.b, 1.c, and 2.a not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. ------------------------------------ Perform CHANNEL FUNCTIONAL TEST on each required channel.	~~92 days~~24 months
SR 3.3.1.4.4	Calibrate the local power range monitors on each required channel.	1000 MWD/T average core exposure
SR 3.3.1.4.5	------------------------------------ **- NOTES -** 1. For Functions 1.a, 1.b, 1.c, and 2.a not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. 2. Neutron detectors may be excluded. ------------------------------------ Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. As required by Required Action C.1 and referenced in Table 3.3.1.5-1.	D.1	Be in MODE 3.	12 hours
E. As required by Required Action C.1 and referenced in Table 3.3.1.5-1.	E.1	Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.1.5.1	Perform CHANNEL CHECK on each required division.	24 hours
SR 3.3.1.5.2	Perform CHANNEL FUNCTIONAL TEST on each required division.	24 months
SR 3.3.1.5.~~1~~3	Perform LOGIC SYSTEM FUNCTIONAL TEST for each required division.	24 months on a STAGGERED TEST BASIS for four divisions
SR 3.3.1.5.~~2~~4	Verify the RPS RESPONSE TIME of each required division is within limits.	24 months on a STAGGERED TEST BASIS for four divisions

SURVEILLANCE REQUIREMENTS

- NOTE -

Refer to Table 3.3.1.6-1 to determine which SRs apply for each applicable MODE or other specified conditions.

SURVEILLANCE		FREQUENCY
SR 3.3.1.6.1	Perform CHANNEL CHECK.	~~12~~ 24 hours
SR 3.3.1.6.2	**- NOTES -** 1. Only required to be met during CORE ALTERATIONS. 2. One SRNM may be used to satisfy more than one of the following. Verify an OPERABLE SRNM detector is located in: a. The fueled region; b. The core quadrant where CORE ALTERATIONS are being performed when the associated SRNM is included in the fueled region; and c. A core quadrant adjacent to where CORE ALTERATIONS are being performed, when the associated SRNM is included in the fueled region.	12 hours
~~SR 3.3.1.6.3~~	~~Perform CHANNEL CHECK.~~	~~24 hours~~

SURVEILLANCE		FREQUENCY
SR 3.3.1.6.~~4~~3	- NOTE - Not required to be met with less than or equal to four fuel assemblies adjacent to the SRNM and no other fuel assemblies in the associated core quadrant. Verify count rate is ≥ {3.0} cps {and if special movable detectors are being used in place of SRNM detectors verify} a signal to noise ratio ≥ {2:1}.	12 hours during CORE ALTERATIONS AND 24 hours
SR 3.3.1.6.~~5~~4	Perform CHANNEL FUNCTIONAL TEST.	~~7 days~~24 months
~~SR 3.3.1.6.6~~	~~Perform CHANNEL FUNCTIONAL TEST.~~	~~31 days~~
SR 3.3.1.6.~~7~~5	- NOTE - Neutron detectors may be excluded. Perform CHANNEL CALIBRATION.	24 months

Table 3.3.1.6-1 (page 1 of 1)
Startup Range Neutron Monitor Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS
1. Startup Range Neutron Monitor	3,4,5	2	SR 3.3.1.6.~~3~~1 SR 3.3.1.6.4~~3~~ SR 3.3.1.6.~~6~~4 SR 3.3.1.6.~~7~~5
	6	2[a][b]	SR 3.3.1.6.1 SR 3.3.1.6.2 SR 3.3.1.6.4~~3~~ SR 3.3.1.6.~~5~~4 SR 3.3.1.6.~~7~~5

(a) {Only one SRNM channel is required to be OPERABLE during spiral offload or reload when the fueled region includes only that SRNM detector.}

{(b) Special movable detectors may be used in place of SRNM if connected to normal SRNM circuits.}

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. One or more Reactor Mode Switch - Shutdown Position channels inoperable.	D.1	Suspend control rod withdrawal.	Immediately
	AND		
	D.2	Initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

- NOTES -

1. Refer to Table 3.3.2.1-1 to determine which SRs apply for each Control Rod Block Function.
2. When an ATLM or RWM channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the associated Function maintains control rod block capability.

SURVEILLANCE		FREQUENCY
SR 3.3.2.1.1	Perform CHANNEL CHECK.	24 hours
SR 3.3.2.1.~~1~~2	**- NOTE -** Not required to be performed until one hour after THERMAL POWER is ≥ {30}% RTP. Perform CHANNEL FUNCTIONAL TEST.	~~92 days~~24 months

SR 3.3.2.1.~~2~~3	- NOTE - Not required to be performed until one hour after any control rod is withdrawn in MODE 2. Perform CHANNEL FUNCTIONAL TEST.	~~92 days~~24 months
	SURVEILLANCE	FREQUENCY
SR 3.3.2.1.~~3~~4	- NOTE - Not required to be performed until one hour after THERMAL POWER is ≤ {10}% RTP. Perform CHANNEL FUNCTIONAL TEST.	~~92 days~~24 months
SR 3.3.2.1.~~4~~5	Verify the RWM channels are not bypassed when THERMAL POWER is ≤ {10}% RTP.	24 months
SR 3.3.2.1.~~5~~6	Verify the ATLM channels are not bypassed when THERMAL POWER is ≥ {30}% RTP.	24 months
SR 3.3.2.1.~~6~~7	- NOTE - Not required to be performed until one hour after reactor mode switch is in shutdown position. Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.2.1.~~7~~8	Verify the bypassing and movement of control rods required to be bypassed in the Rod Action Control Subsystem (RACS) cabinets by a second licensed operator or other qualified member of the technical staff.	Prior to and during the movement of control rods bypassed in RACS

Table 3.3.2.1-1 (page 1 of 1)
Control Rod Block Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS
1. Rod Control and Information System			
a. Automated Thermal Limit Monitor	(a)	2	SR 3.3.2.1.1 SR 3.3.2.1.~~1~~2 SR 3.3.2.1.~~5~~6
b. Rod Worth Minimizer	$1^{(b)}, 2^{(b)}$	2	SR 3.3.2.1.1 SR 3.3.2.1.~~2~~3 SR 3.3.2.1.~~3~~4 SR 3.3.2.1.~~4~~5 SR 3.3.2.1.~~7~~8
2. Reactor Mode Switch - Shutdown Position	(c)	2	SR 3.3.2.1.~~6~~7

(a) THERMAL POWER ≥ {30}% RTP.

(b) THERMAL POWER ≤ {10}% RTP.

(c) Reactor mode switch in the shutdown position.

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. Drywell fission product monitoring system particulate channel inoperable. AND Drywell air coolers condensate flow monitoring system inoperable.	D.1 OR D.2	Restore drywell fission product monitoring system particulate channel to OPERABLE status. Restore drywell air cooler condensate flow rate monitoring system to OPERABLE status.	30 days 30 days
E. Required Action and associated Completion Time not met. OR All required LEAKAGE detection systems inoperable.	E.1	Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.4.1.1	Perform CHANNEL CHECK on ~~drywell fission product monitoring system particulate channel~~ required leakage detection instrumentation.	~~12~~ 24 hours
SR 3.3.4.1.2	Perform CHANNEL FUNCTIONAL TEST on required leakage detection instrumentation.	~~31 days~~24 months
SR 3.3.4.1.3	Perform CHANNEL CALIBRATION on required leakage detection instrumentation.	24 months

SURVEILLANCE REQUIREMENTS

- NOTE -
Refer to Table 3.3.5.1-1 to determine which SRs apply for each ECCS Instrumentation Function.

	SURVEILLANCE	FREQUENCY
SR 3.3.5.1.1	Perform CHANNEL CHECK on each required channel.	24 hours
SR 3.3.5.1.2	Perform CHANNEL FUNCTIONAL TEST on each required channel.	~~184 days~~24 months
SR 3.3.5.1.3	Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months
SR 3.3.5.1.4	Verify ECCS RESPONSE TIME of each required channel is within limits.	24 months on a STAGGERED TEST BASIS for four channels

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.5.2.1	Perform CHANNEL CHECK on each required division.	24 hours
SR 3.3.5.2.2	Perform CHANNEL FUNCTIONAL TEST on each required division.	24 months
SR 3.3.5.2.~~1~~3	Perform LOGIC SYSTEM FUNCTIONAL TEST for each required division.	24 months on a STAGGERED TEST BASIS for four divisions
SR 3.3.5.2.~~2~~4	Verify the ECCS RESPONSE TIME of each required division is within limits.	24 months on a STAGGERED TEST BASIS for four divisions

SURVEILLANCE REQUIREMENTS

- NOTES -
Refer to Table 3.3.5.3-1 to determine which SRs apply for each ICS Function.

SURVEILLANCE		FREQUENCY
SR 3.3.5.3.1	Perform CHANNEL CHECK on each required channel.	24 hours
SR 3.3.5.3.2	Perform CHANNEL FUNCTIONAL TEST on each required channel.	~~184 days~~24 months
SR 3.3.5.3.3	Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months
SR 3.3.5.3.4	Perform ICS RESPONSE TIME TEST on each required channel.	24 months on a STAGGERED TEST BASIS for four channels

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.5.4.1	Perform CHANNEL CHECK on each required division.	24 hours
SR 3.3.5.4.2	Perform CHANNEL FUNCTIONAL TEST on each required division.	24 months
SR 3.3.5.4.~~1~~3	Perform LOGIC SYSTEM FUNCTIONAL TEST for each required division.	24 months on a STAGGERED TEST BASIS for four divisions
SR 3.3.5.4.~~2~~4	Verify the ICS RESPONSE TIME of each required division is within limits.	24 months on a STAGGERED TEST BASIS for four divisions

CONDITION	REQUIRED ACTION		COMPLETION TIME
E. As required by Required Action C.1 and referenced in Table 3.3.6.1-1.	E.1	Declare associated MSIV(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

- NOTE -
Refer to Table 3.3.6.1-1 to determine which SRs shall be performed for each isolation Function.

SURVEILLANCE		FREQUENCY
SR 3.3.6.1.1	Perform CHANNEL CHECK on each required channel.	24 hours
SR 3.3.6.1.2	Perform CHANNEL FUNCTIONAL TEST on each required channel.	~~184 days~~24 months
SR 3.3.6.1.3	Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months
SR 3.3.6.1.4	Verify the ISOLATION SYSTEM RESPONSE TIME for each required channel is within limits.	24 months on a STAGGERED TEST BASIS for four channels

3.3 INSTRUMENTATION

3.3.6.2 Main Steam Isolation Valve (MSIV) Actuation

LCO 3.3.6.2 Three MSIV actuation divisions associated with the DC and Uninterruptible AC Electrical Power Distribution Divisions required by LCO 3.8.6, "Distribution Systems - Operating," shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

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- NOTE -
Separate Condition entry is allowed for each MSIV actuation division.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One MSIV actuation division inoperable.	A.1	Verify MSIV actuation division in trip.	12 hours
B. MSIV actuation capability not maintained.	B.1	Declare associated MSIV(s) inoperable.	Immediately
C. Required Action and associated Completion Time of Condition A not met.	C.1	Declare associated MSIV(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.6.2.1	Perform CHANNEL CHECK on each required division.	24 hours

SR 3.3.6.2.2 Perform CHANNEL FUNCTIONAL TEST on each required division.	24 months
SR 3.3.6.2.~~1~~3 Perform LOGIC SYSTEM FUNCTIONAL TEST for each required division.	24 months on a STAGGERED TEST BASIS for four divisions
SURVEILLANCE	FREQUENCY
SR 3.3.6.2.~~2~~4 Verify the ISOLATION SYSTEM RESPONSE TIME for each required division is within limits.	24 months on a STAGGERED TEST BASIS for four divisions

SURVEILLANCE		FREQUENCY
SR 3.3.6.3.2	Perform CHANNEL FUNCTIONAL TEST on each required channel.	~~184 days~~24 months
SR 3.3.6.3.3	Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months
SR 3.3.6.3.4	------------------------------- **- NOTE -** Radiation detectors may be excluded. -------------------------------	
	Verify the ISOLATION SYSTEM RESPONSE TIME of each required channel is within limits.	24 months on a STAGGERED TEST BASIS for four channels

SURVEILLANCE REQUIREMENTS

- NOTE -
Refer to Table 3.3.6.4-1 to determine which SRs shall be performed for each isolation Function.

SURVEILLANCE		FREQUENCY
SR 3.3.6.4.1	Perform CHANNEL CHECK on each required division.	24 hours
SR 3.3.6.4.2	Perform CHANNEL FUNCTIONAL TEST on each required division.	24 months
SR 3.3.6.4.~~1~~3	Perform LOGIC SYSTEM FUNCTIONAL TEST for each required division.	24 months on a STAGGERED TEST BASIS for four divisions
SR 3.3.6.4.~~2~~4	Verify the ISOLATION SYSTEM RESPONSE TIME of each required division is within limits.	24 months on a STAGGERED TEST BASIS for four divisions
SR 3.4.6.4.~~3~~5	Perform a system functional test.	24 months

Table 3.3.6.4-1 (page 1 of 2)
Isolation Actuation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS
1. Main Steam Line Drains	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
2. Reactor Water Cleanup/Shutdown Cooling System Lines	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
	5,6	I	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4 SR 3.3.6.4.~~3~~5
3. Isolation Condenser System Lines	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
4. Fission Product Sampling Lines	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
5. Drywell Low Conductivity Waste Sump Drain Line	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
6. Drywell High Conductivity Waste Sump Drain Line	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
7. Containment Purge and Vent Lines	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4

8. Chilled Water System Lines to the Drywell Air Coolers	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
9. Fuel and Auxiliary Pools Cooling System Process Lines	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
10. Reactor Building Boundary Isolation Dampers	1,2,3,4	E	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
11. Chilled Cooling Water System	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4

Table 3.3.6.4-1 (page 2 of 2)
Isolation Actuation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	CONDITIONS REFERENCED FROM REQUIRED ACTION B.1 or C.1	SURVEILLANCE REQUIREMENTS
12. Process Radiation Monitoring System	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
13. High Pressure Nitrogen Gas Supply System	1,2,3,4	D	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4
{14 Feedwater Isolation Valves	1,2,3,4	F	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4 SR 3.3.6.4.~~3~~5}

{15 Feedwater Pump Breakers	1,2,3,4	G	SR 3.3.6.4.1 SR 3.3.6.4.2 SR 3.3.6.4.~~1~~3 SR 3.3.6.4.~~2~~4 SR 3.3.6.4.~~3~~5}

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Required Action and associated Completion Time of Condition A not met.	C.1.1	Isolate control room habitability area (CRHA) boundary.	Immediately
		<u>AND</u>	
	C.1.2	Place OPERABLE CRHAVS train in isolation mode.	Immediately
	<u>OR</u>		
	C.2	Declare associated CRHAVS train(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

- NOTE -

Refer to Table 3.3.7.1-1 to determine which SRs apply for each CRHAVS Instrumentation Function.

SURVEILLANCE		FREQUENCY
SR 3.3.7.1.1	Perform CHANNEL CHECK on each required channel.	24 hours
SR 3.3.7.1.2	Perform CHANNEL FUNCTIONAL TEST on each required channel.	~~184 days~~<u>24 months</u>
SR 3.3.7.1.3	Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.11, "Setpoint Control Program (SCP)."	24 months

SURVEILLANCE		FREQUENCY
SR 3.3.7.1.4	- NOTE - Radiation detectors may be excluded. Verify the CRHAVS RESPONSE TIME of each required channel is within limits.	24 months on a STAGGERED TEST BASIS

Table 3.3.7.1-1 (page 1 of 1)
Control Room Habitability Area Heating, Ventilation, and Air Conditioning Subsystem (CRHAVS) Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	SURVEILLANCE REQUIREMENTS	SETTING BASIS
1. Control Room Air Intake Radiation – High (per train)	1,2,3,4,5[a],6[a]	SR 3.3.7.1.1 SR 3.3.7.1.2 ~~SR 3.3.7.1.3~~ $\boxed{\text{SR 3.3.7.1.4}}$	≤ { } Bq/hr ({ } mR/hr)
2. Emergency Filter Unit (EFU) Air Flow - Low (per train)	1,2,3,4,5[a],6[a]	SR 3.3.7.1.1 SR 3.3.7.1.2 ~~SR 3.3.7.1.3~~ $\boxed{\text{SR 3.3.7.1.4}}$	≥ { } l/s ({ } cfm)

(a) During operations with a potential for draining the reactor vessel (OPDRVs).

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A not met.	C.1.1 Isolate control room habitability area (CRHA) envelope. AND C.1.2 Place OPERABLE CRHAVS train in isolation mode.	Immediately Immediately
	OR C.2 Declare associated CRHAVS train(s) inoperable.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.7.2.1	Perform CHANNEL CHECK on each required division.	24 hours
SR 3.3.7.2.2	Perform CHANNEL FUNCTIONAL TEST on each required division.	24 months
SR 3.3.7.2.~~1~~3	Perform LOGIC SYSTEM FUNCTIONAL TEST for each required division.	24 months on a STAGGERED TEST BASIS for four divisions
SR 3.3.7.2.4	Verify the CRHAVS RESPONSE TIME of each required division is within limits.	24 months on a STAGGERED TEST BASIS

BASES

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, the SRs for each RPS instrumentation Function are located in the SRs column of Table 3.3.1.1-1.

SR 3.3.1.1.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. This test overlaps the testing required by SR 3.3.1.2.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.~~A CHANNEL CHECK is normally a comparison of the parameter indicated on one required channel to a similar parameter on other required channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious.~~

The RPS is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit.

The Frequency is based upon operating experience that demonstrates channel failure is rare and~~has been shown to be acceptable by Reference 13~~ the self-diagnostic features that monitor the channels for proper operation. The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SR 3.3.1.1.2

BASES

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. This test overlaps the testing required by SR 3.3.1.2.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

~~Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology as required by the SCP.~~

The Frequency of ~~184 days~~ 24 months is based on the reliability of the channels and ~~has been shown to be acceptable by Reference 13~~the self-diagnostic features that monitor the channels for proper operation.

SR 3.3.1.1.3

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the required channel responds to the measured parameter within the necessary range and accuracy.

SURVEILLANCE REQUIREMENTS (continued)

CHANNEL CALIBRATION leaves the required channel adjusted to the NTSP within the "leave alone" tolerance to account for instrument drifts between successive calibrations consistent with the SCP.

The Frequency is based upon the assumption of a 24-month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis and has been shown to be acceptable by Reference 13.

For selected Functions, the SCP provides additional requirements for the evaluation of the performance of required channels. The selected Functions are those Functions whose instruments are not totally mechanical devices. Mechanical devices (e.g., devices which have an "on" or "off" output or an open/close position such as limit switches, float switches, and proximity detectors) are not calibrated in the traditional sense and do not have as-left or as-found conditions that would indicate drift of the component setpoint. These devices are considered not trendable and the requirements of TS 5.5.11.c.1 and TS 5.5.11.c.2 are not applicable to these mechanical components. Where a non-trendable component provides signal input to other channel components that can be trended, the remaining components must be evaluated in accordance with the SCP. As indicated in TS 5.5.11.c.1 evaluation of channel performance is required for the condition where the "as-found" setting for the channel is outside its "as-found" tolerance but conservative with respect to the Allowable Value. For digital channel components, the "as-

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found" tolerance may be identical to the "leave alone" tolerance because drift may not be an expected error. In these cases, a channel "as-found" value outside the "leave alone" tolerance may be cause for component assessment. Evaluation of instrument performance will verify that the instrument will continue to behave in accordance with design-basis assumptions. The purpose of the assessment is to ensure confidence in the instrument performance prior to returning the instrument to service. These channels will also be identified in the Corrective Action Program.

Entry into the Corrective Action Program will ensure required review and documentation of the condition for OPERABILITY. TS 5.5.11.a requires that the Allowable Values and the methodology for calculating the "as-found" tolerances be in the SCP. As indicated in TS 5.5.11.c.2, the as-left setting for the instrument is required to be returned to within the "leave alone" tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in plant surveillance procedures, the "leave alone" and "as-found" tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Analytical / Design Limit is maintained. If the as-left instrument setting

SURVEILLANCE REQUIREMENTS (continued)

cannot be returned to a setting within the "leave alone" tolerance, then the instrument channel shall be declared inoperable. TS 5.5.11.a requires that the NTSP and the methodology for calculating the "leave alone" and the "as-found" tolerances be in the SCP.

SR 3.3.1.1.4

This SR ensures that the individual required channel response times are less than or equal to the maximum values assumed in the accident analysis. The RPS RESPONSE TIME acceptance criteria are included in Reference 14.

RPS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the sensor channels up through the DTMs and overlaps the testing required by SR 3.3.1.2.~~2~~4 to ensure complete testing of instrument channels and actuation circuitry.

However, some sensors for Functions are allowed to be excluded from specific RPS RESPONSE TIME measurement if the conditions of Reference 15 are satisfied. If these conditions are satisfied, sensor response time may be allocated based on either assumed design sensor response time or the manufacturer's stated design response time. When the requirements of Reference 15 are not satisfied, sensor response time

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ACTIONS (continued)

D.1

With automatic actuation capability not maintained in MODE 6 or if any Required Action and associated Completion Time of Condition A is not met in MODE 6, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must immediately initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Action must continue until all such control rods are fully inserted. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and, therefore, do not have to be inserted.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of a required actuation division has not occurred. This test overlaps the testing required by SR 3.3.1.1.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The RPS is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross actuation division failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency is based upon operating experience that demonstrates actuation division failure is rare and the self-diagnostic features that monitor the divisions for proper operation.

The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of divisions during normal operational use of the displays associated with the actuation divisions required by the LCO.

SR 3.3.1.2.2

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A CHANNEL FUNCTIONAL TEST is performed on each required division to ensure that the entire division will perform the intended function. This test overlaps the testing required by SR 3.3.1.1.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The Frequency of 24 months is based on the reliability of the divisions and the self-diagnostic features that monitor the divisions for proper operation.

SR 3.3.1.2.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the RPS Actuation divisions, including the two-out-of-four function of the Trip Logic Unit (TLU), Output Logic Unit (OLU), and Load Drivers (LDs) for a specific division.

LOGIC SYSTEM FUNCTIONAL tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The functional testing of control rods, in LCO 3.1.3, overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power and has been shown to be acceptable by Reference 2. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.1.2.~~2~~4

This SR ensures that the individual required division response times are less than or equal to the maximum values assumed in the accident analysis. The RPS RESPONSE TIME acceptance criteria are included in Reference 3.

SURVEILLANCE REQUIREMENTS (continued)

RPS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the RPS actuation circuitry that

BASES

ACTIONS (continued)

immediately. In this Condition, both required manual actuation Functions are inoperable.

Alternatively, if it is not desired to place the inoperable channels in trip (e.g., as in the case where placing the inoperable channels in trip would result in a scram, Condition D or E, as appropriate, must be entered and its Required Action taken.

D.1

If any Required Action and associated Completion Time of Condition A, B, or C is not met in MODE 1 or 2, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 within 12 hours. The allowed Completion Time are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant safety systems.

E.1

If any Required Action and associated Completion Time of Condition A, B, or C is not met in MODE 6, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must immediately initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Action must continue until all such control rods are fully inserted. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and, therefore, do not have to be inserted.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.1

A CHANNEL FUNCTIONAL TEST is performed on ~~the manual scram channels~~ each RPS manual actuation channel to ensure that ~~the~~ each channel~~s~~ will perform the intended Function. The Frequency of ~~92 days~~24 months is based on the reliability of the RPS actuation logic and controls~~ and has been found to be acceptable by Reference 1~~.

~~SR 3.3.1.3.2~~

~~A CHANNEL FUNCTIONAL TEST is performed on the Reactor Mode Switch - Shutdown position channels to ensure that the channels will~~

BASES

~~perform the intended Function. The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a~~

~~SURVEILLANCE REQUIREMENTS (continued)~~

~~plant outage. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 month Frequency.~~

REFERENCES 1. {NEDO-33201, "ESBWR Design Certification Probabilistic Risk Assessment."}

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.4.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. This test overlaps the testing required by SR 3.3.1.5.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output. ~~A CHANNEL CHECK is a comparison of the parameter indicated on one required channel to the same parameter on other required channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift on one of the channels or even something more serious.~~

The NMS is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus, it is the key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff based on a combination of the channel instrument uncertainties, including indication, and readability. If a channel is outside the match criteria, it may be an indication that the instrument has drifted outside its limit.

The Surveillance Frequency is based upon operating experience that demonstrates channel failure is rare and ~~has been shown to be acceptable by Reference 6~~ the self-diagnostic features that monitor the channels for proper operation. The CHANNEL CHECKS every 24 hours supplement less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SR 3.3.1.4.2

To ensure the APRMs are accurately indicating the true core average power, the APRMs are calibrated to the reactor power calculated from a heat balance. The Frequency of once per 7 days is based on minor

BASES

changes in LPRM sensitivity, which could affect the APRM reading between performances of SR 3.3.1.4.4 (LPRM calibrations) and has been shown to be acceptable by Reference 6.

A Note is provided which only requires performance of the SR to be met at ≥ {25%} RTP because it is difficult to accurately determine core THERMAL POWER from a heat balance when < {25%} RTP. At low power levels, a high degree of accuracy is unnecessary because of the large, inherent margin to thermal limits (MCPR). At ≥ {25%} RTP, the surveillance is required to have been satisfactorily performed within the last 7 days in accordance with SR 3.0.2. A Note is provided which allows an increase in THERMAL POWER above {25%} if the 7-day Frequency is not met per SR 3.0.2. In this event, the SR must be performed within 12 hours after reaching or exceeding {25%} RTP. The 12 hours is based on

SURVEILLANCE REQUIREMENTS (continued)

operating experience and in consideration of providing a reasonable time in which to complete the SR.

SR 3.3.1.4.3

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function when required. This test overlaps the testing required by SR 3.3.1.5.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

~~Any setpoint adjustment shall be consistent with the assumptions of the current plant setpoint methodology as required by the SCP.~~

As noted, for Functions 1.a, 1.b, 1.c, and 2.a, SR 3.3.1.4.3 is not required to be performed when entering MODE 2 from MODE 1 because testing of the MODE 2 required SRNM and APRM Functions cannot be performed in MODE 1. This allows entry into MODE 2 if the ~~92 day~~24-month Frequency is not met per SR 3.0.2. In this event, the SR must be performed within 12 hours after entering MODE 2 from MODE 1. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

A Surveillance Frequency of ~~92 days~~24 months provides an acceptable level of system average unavailability over the Surveillance Frequency interval and ~~has been shown to be acceptable by Reference 6~~the self-diagnostic features that monitor the channels for proper operation.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.4.7

This SR ensures that the individual required channel response times are less than or equal to the maximum values assumed in the accident analysis. The RPS RESPONSE TIME acceptance criteria are included in Reference 7. RPS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the SRNM channels from the sensors to the NMS Digital Trip Modules and up to each of the SRNM Trip Logic Units and the APRM and OPRM channels from the sensors (LPRMs) to the NMS Digital Trip Modules and up to each of the NMS Trip Logic Units, which house the APRM/OPRM logic. This test overlaps the testing required by SR 3.3.1.5.~~2~~4 to ensure complete testing of instrument channels and actuation circuitry.

However, some sensors are allowed to be excluded from specific RPS RESPONSE TIME measurement if the conditions of Reference 8 are satisfied. If these conditions are satisfied, sensor response time may be allocated based on either assumed design sensor response time or the manufacturer's stated design response time. When the requirements of Reference 8 are not satisfied, sensor response time must be measured. Furthermore, measurement of the instrument loops response times for some sensors is not required if the conditions of Reference 9 are satisfied.

As noted, neutron detectors are excluded from RPS RESPONSE TIME testing because the principles of detector operation virtually ensure an instantaneous response time.

RPS RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for four channels. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The 24 month test Frequency is consistent with the typical refueling cycle and has been shown to be acceptable by Reference 6.

REFERENCES

1. Chapter 7, Figure 7.2-1.
2. Chapter 15.
3. Subsection 5.2.2.

BASES

ACTIONS (continued)

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The 1 hour Completion Time is acceptable because it minimizes risk while allowing time for restoration or tripping of divisions.

C.1

If the Required Actions and Associated Completion Times of Condition A or B are not met, Required Action C.1 directs entry into the appropriate Condition referenced in Table 3.3.1.5-1. The applicable Condition specified in the Table is Function and MODE or other specified condition dependent and may change as the Required Action of a previous Condition is completed. Each time an inoperable division has not met any Required Action of Condition A and the associated Completion Time has expired, Condition C will be entered for that division and provides for transfer to the appropriate subsequent Condition.

D.1 and E.1

If the affected actuation division is not restored to OPERABLE status, is not in trip, or if NMS actuation capability is not restored, within the allowed Completion Time(s), the plant must be placed in a MODE or other specified condition in which the LCO does not apply. The Completion Times are reasonable, based on operating experience, to reach the specified condition from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.5.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of a required actuation division has not occurred. This test overlaps the testing required by SR 3.3.1.4.1 to ensure complete testing of required instrument channels and actuation divisions from the sensor input to the logic contact output.

The NMS is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross actuation division failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency is based upon operating experience that demonstrates actuation division failure is rare and the self-diagnostic features that monitor the divisions for proper operation.

The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of divisions during normal operational use of the displays associated with the actuation divisions required by the LCO.

SR 3.3.1.5.2

A CHANNEL FUNCTIONAL TEST is performed on each required division to ensure that the entire division will perform the intended function. This test overlaps the testing required by SR 3.3.1.4.3 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The Frequency of 24 months is based on the reliability of the divisions and the self-diagnostic features that monitor the divisions for proper operation.

SR 3.3.1.5.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the NMS automatic actuation divisions.

LOGIC SYSTEM FUNCTIONAL tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The testing in LCO 3.3.1.1, 3.3.1.2, LCO 3.3.1.4, and the functional testing of control rods, in LCO 3.1.3, overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these

SURVEILLANCE REQUIREMENTS (continued)

components usually pass the Surveillance when performed at the 24 month Frequency and has been shown to be acceptable by Reference 2.

BASES

SR 3.3.1.5.24

This SR ensures that the individual required division response times are less than or equal to the maximum values assumed in the accident analysis. The RPS RESPONSE TIME acceptance criteria are included in Reference 3.

RPS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the NMS automatic actuation divisions that include the SRNM Trip Logic Units, the APRM Trip Logic Units, which house the OPRM logic, and the associated output to RPS. This test overlaps the testing required by SR 3.3.1.4.7 to ensure complete testing of instrument channels and actuation circuitry.

RPS RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that each division is alternately tested. The 24 month test Frequency is consistent with the refueling cycle and has been found to be acceptable by Reference 2.

REFERENCES

1. Chapter 15.
2. {NEDO-33201, "ESBWR Design Certification Probabilistic Risk Assessment."}
3. {Reference for RPS RESPONSE TIME acceptance criteria}.

BASES

SURVEILLANCE REQUIREMENTS

The SRs for each SRNM Applicable MODE or other specified condition are found in the SRs column of Table 3.3.1.6-1.

SR 3.3.1.6.1 ~~and SR 3.3.1.6.3~~

Performance of the CHANNEL CHECK ensures that a gross failure of instrumentation has not occurred. ~~A CHANNEL CHECK is a comparison of the parameter indicated on one channel to the same parameter indicated on other similar channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or even something more serious.~~

The NMS is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus; it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the instrument has drifted outside its limit.

The Frequency of once every ~~12~~24 hours ~~for SR 3.3.1.6.1~~ is based on operating experience that demonstrates channel failure is rare and the self-diagnostic features that monitor the channels for proper operation. ~~While in MODES 3, 4, and 5, reactivity changes are not expected and, therefore, the 12 hour Frequency is relaxed to 24 hours for SR 3.3.1.6.3.~~ The CHANNEL CHECK supplements less formal, but more frequent checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SR 3.3.1.6.2

{To provide adequate coverage of potential reactivity changes in the core, one SRNM is required to be OPERABLE in the quadrant where CORE ALTERATIONS are being performed and the other OPERABLE SRNM must be in an adjacent quadrant.} Note 1 states that this SR is required to be met only during CORE ALTERATIONS. It is not required to be met at other times in MODE 6 since core reactivity changes are not occurring. This Surveillance consists of a review of plant logs to ensure that SRNMs required OPERABLE for given CORE ALTERATIONS are in fact OPERABLE. In the event that only one SRNM is required to be OPERABLE per Table 3.3.1.6-1, footnote (a), only the part 'a' portion of this SR is required. Note 2 clarifies that the three requirements can be met by the same or different OPERABLE SRNMs. The 12 hour Surveillance Frequency is based upon operating experience and

SURVEILLANCE REQUIREMENTS (continued)

supplements operational controls over refueling activities, which include steps to ensure the SRNMs required by the LCO are in the proper quadrant.

SR 3.3.1.6.43

This Surveillance consists of a verification of the plant SRNM instrument readout to ensure that the SRNM reading is greater than a specified minimum count rate. This ensures that the detectors are indicating count rates indicative of neutron flux levels within the core. {Verification of the signal-to-noise-ratio also ensures that the movable detectors, if used, are inserted in the core. In a fully withdrawn condition, these movable detectors are sufficiently removed from the fueled region of the core to essentially eliminate neutrons from reaching the detector. Any count rate obtained while fully withdrawn is assumed to be "noise" only.} With few fuel assemblies loaded, the SRNMs will not have a high enough count rate to satisfy the Surveillance Requirement. Therefore allowances are made for loading sufficient "source" material, in the form of irradiated fuel assemblies, to establish the minimum count rate.

To accomplish this, the SR is modified by a Note which states that the count rate is not required to be met on an SRNM that has less than or equal to four fuel assemblies adjacent to the SRNM and no other fuel assemblies are in the associated core quadrant. With four or less fuel assemblies loaded around each SRNM and no other fuel assemblies in the associated quadrant, even with a control rod withdrawn, the configuration will not be critical.

The Frequency is based upon channel redundancy and other information available in the control room and ensures the required channels are frequently monitored while core reactivity changes are occurring. When no reactivity changes are in progress, the Frequency is relaxed from 12 hours to 24 hours.

BASES

SR 3.3.1.6.~~5~~ 4~~and SR 3.3.1.6.6~~

Performance of a CHANNEL FUNCTIONAL TEST demonstrates that the associated channel will function properly. ~~SR 3.3.1.6.5 is required in MODE 6, and the 7-day Frequency is to ensure that the channels are OPERABLE while core reactivity changes could be in progress. This 7 day Frequency is reasonable, based on operating experience and other Surveillances, such as a CHANNEL CHECK, that provide assurance of proper functioning between CHANNEL FUNCTIONAL TESTS.~~

SURVEILLANCE REQUIREMENTS (continued)

~~SR 3.3.1.6.6 is required in MODES 3, 4, and 5. Since core reactivity changes do not normally take place, the Frequency has been extended from 7 days to 31 days.~~ The ~~31-day~~24-month Frequency is based on operating experience and on other Surveillances (such as CHANNEL CHECK) that ensure proper functioning between CHANNEL FUNCTIONAL TESTS and the self-diagnostic features that monitor the channels for proper operation.

SR 3.3.1.6.~~7~~5

Performance of a CHANNEL CALIBRATION verifies the performance of the SRNM detectors and associated circuitry. The 24 month Frequency considers the unit conditions required to perform the test, the ease of performing the test, the likelihood of a change in the system or component status and has been shown to be acceptable by Reference 1. The neutron detectors may be excluded from the CHANNEL CALIBRATION because they cannot readily be adjusted. The detectors are regenerative fission chambers that are designed to have a relatively constant sensitivity over the range, and with an accuracy specified for a fixed useful life.

REFERENCES

1. {NEDO-33201, "ESBWR Design Certification Probabilistic Risk Assessment."}

BASES

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the Surveillance Requirements, the SRs for each Control Rod Block instrumentation Function are found in the SRs column of Table 3.3.2.1-1.

The Surveillances are modified by a Note to indicate that an ATLM or a RWM channel may be placed in an inoperable status solely for performance of required Surveillances and entry into associated Conditions and Required Actions may be delayed up to 6 hours provided the associated Function maintains control rod block capability. Upon completion of the Surveillance, or expiration of the 6 hour allowance, the channel must be returned to OPERABLE status or the applicable Condition entered and Required Actions taken. The allowance of this Note is based on the reliability of the channels and the average time required to perform the channel Surveillance, and has been shown to be acceptable by Reference 4. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that a control rod block will be initiated when necessary.

SR 3.3.2.1.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. The associated controllers, displays, monitoring and input/output (I/O) communication interfaces continuously function during normal power operation. Abnormal operation of these components is detected and alarmed. In addition, the associated controllers are equipped with on-line diagnostic capabilities for cyclically monitoring the functionality of I/O signals, buses, power supplies, processors, and inter-processor communications.

A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency is based upon operating experience that demonstrates channel failure is rare and the online-diagnostics that monitor the channels for proper operation. The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SR 3.3.2.1.~~1~~2

A CHANNEL FUNCTIONAL TEST is performed for each ATLM channel to ensure that the entire channel will perform the intended function. It includes the RC&IS inputs. The Frequency of ~~92 days~~24 months is

BASES

based on the reliability of the channels and ~~has been shown to be acceptable by Reference 4~~ the online-diagnostic features that monitor the channels for proper operation.

As noted in the SR, SR 3.3.2.1.~~1~~2 is not required to be performed until 1 hour after THERMAL POWER is ≥ {30}% RTP. This allows THERMAL POWER to be increased to ≥ {30}% RTP to perform the required Surveillance if the ~~92 day~~24-month Frequency is not met per SR 3.0.2. The 1 hour allowance is based on operating experience and in consideration of providing a reasonable time in which to complete the SRs.

SR 3.3.2.1.~~2~~3 and SR 3.3.2.1.~~3~~4

A CHANNEL FUNCTIONAL TEST is performed for the RWM to ensure that the entire system will perform the intended function. The CHANNEL FUNCTIONAL TEST for the RWM is performed by attempting to withdraw a control rod not in compliance with the prescribed sequence and verifying a control rod block occurs. As noted in the SR, SR 3.3.2.1.~~2~~3 is not required to be performed until 1 hour after any control rod is withdrawn in MODE 2. As noted in the SR, SR 3.3.2.1.~~3~~4 is not required to be performed until 1 hour after THERMAL POWER is ≤ {10}% RTP. This allows entry into MODE 2 for SR 3.3.2.1.~~2~~3, and THERMAL POWER to be decreased to ≤ {10}% for SR 3.3.2.1.~~3~~4, to perform the required

Surveillance if the ~~92 day~~24-month Frequency is not met per SR 3.0.2. The 1 hour allowance is based on operating experience and in consideration of providing a reasonable time in which to complete the SRs. The Frequencies of ~~92 days~~24 months are based on the reliability of the channels and ~~has been shown to be acceptable by Reference 4~~ the online-diagnostic features that monitor the channels for proper operation.

SR 3.3.2.1.~~4~~5

The RWM channels are automatically bypassed when power is above a specified value (LPSP). The power level is determined from the APRM signals. The RWM {automatic} bypass setpoint must be verified periodically to be > {10}% RTP (i.e., the RWM is not bypassed at or below the LPSP). If the RWM LPSP is nonconservative, then the affected RWM channel is considered inoperable. Alternately, each RWM channel associated with a nonconservative RWM LPSP can be placed in the conservative condition (manually enabled). If manually enabled, the SR is met and the affected RWM channel is not considered inoperable.

BASES

SR 3.3.2.1.~~5~~6

The ATLM are {automatically} bypassed when power is below a specified value (LPSP). The power level is determined from the APRM signals. The ATLM automatic bypass setpoint must be verified periodically to be < {30}% RTP (i.e., the ATLM is not bypassed at or above the LPSP). If the ATLM LPSP is nonconservative, then the affected ATLM channel is considered inoperable. Alternately, each ATLM channel associated with a nonconservative ATLM LPSP can be placed in the conservative condition (manually enabled). If manually enabled, the SR is met and the affected ATLM channel is not considered inoperable.

SR 3.3.2.1.~~6~~7

The CHANNEL FUNCTIONAL TEST for the Reactor Mode Switch - Shutdown Position control rod withdrawal block is performed by attempting to withdraw any control rod with the reactor mode switch in the shutdown position and verifying that a control rod block occurs.

As noted in the SR, the Surveillance is only required to be performed until 1 hour after the reactor mode switch is in the shutdown position, since testing of this interlock with the reactor mode switch in any other position cannot be performed without using jumpers, lifted leads or moveable links. This allows entry into MODES 3, 4, 5, and 6 if the 24 month Frequency is not met per SR 3.0.2. The 1 hour allowance is based on

operating experience and in consideration of providing a reasonable time in which to complete the SRs.

The 24 month Surveillance Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown these components usually pass the surveillance when performed at the 24 month Frequency.

SR 3.3.2.1.~~7~~8

LCO 3.1.3 and LCO 3.1.6 may require individual control rods to be bypassed in the RC&IS cabinets to allow insertion of an inoperable control rod or correction of a control rod pattern not in compliance with GWSR. With the control rods bypassed in the RC&IS cabinets, the RWM will not control the movement of these bypassed control rods. To ensure the proper bypassing and movement of those affected control rods, a

B 3.3 INSTRUMENTATION

B 3.3.4.1 Reactor Coolant System (RCS) Leakage Detection Instrumentation

BASES

BACKGROUND

GDC 30 of 10 CFR 50, Appendix A (Ref. 1), requires means for detecting and, to the extent practical, identifying the location of the source of RCS LEAKAGE. Regulatory Guide 1.45 (Ref. 2) describes acceptable methods for selecting leakage detection systems.

Limits on LEAKAGE from the reactor coolant pressure boundary (RCPB) are required so that appropriate action can be taken before the integrity of the RCPB is impaired (Ref. 2). Leakage detection systems for the RCS are provided to alert the operators when leakage rates above normal background levels are detected and also to supply quantitative measurement of rates. The Bases for LCO 3.4.2, "RCS Operational LEAKAGE," discuss the limits on RCS LEAKAGE rates.

Systems for separating the LEAKAGE of an identified source from an unidentified source are necessary to provide prompt and quantitative information to the operators to permit them to take immediate corrective action.

LEAKAGE from the RCPB inside the drywell is detected by the drywell floor drain high conductivity water (HCW) sump monitoring system, the drywell air cooler condensate flow monitoring, and the particulate channel of the drywell fission product monitoring system. The primary means of quantifying LEAKAGE in the drywell is the HCW sump monitoring system.

The drywell floor drain HCW sump collects unidentified leakage from such sources as floor drains, valve flanges, closed component cooling water for reactor equipment, condensate from the drywell air coolers and from any leakage not connected to the drywell equipment drain sump. The sump is equipped with two pumps and special monitoring instrumentation that measures the pump's operating frequency, the sump level and flow rates. These measurements are provided on a continuous basis to the main control room. The sump instrumentation is designed with the sensitivity to detect ~~reactor coolant~~a leakage step-change (increase) of 3.8 liters/min (1.0 gpm) within one hour and alarm at flow rates in excess of 19 liters/min (5 gpm).

The condensate flow rate from the drywell air coolers is monitored for high drain flow, which could be indicative of leaks from piping or the equipment within the drywell. This flow is monitored by one instrumented channel using a bucket type flow transmitter located in the drywell. The

BASES

ACTIONS (continued)

D.1 and D.2

With both the drywell fission product monitoring system particulate channel and the drywell air cooler condensate flow rate monitor inoperable, the only means of detecting LEAKAGE is the drywell floor drain HCW sump monitoring system. This Condition does not provide the required diverse means of leakage detection. The Required Action is to restore either of the inoperable monitors to OPERABLE status within 30 days to regain the intended leakage detection diversity. The 30 day Completion Time ensures that the plant will not be operated in a degraded configuration for a lengthy time period.

E.1

If any Required Action and associated Completion Time of Condition A, B, C, or D cannot be met or if all required monitors are inoperable the plant must be placed in a MODE in which overall plant risk is minimized. This is accomplished by placing the plant in at least MODE 3 within 12 hours (operation in MODE 4 also satisfies this requirement). The Completion Time is reasonable, based on plant design, to reach required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

Remaining in the Applicability of the LCO is acceptable because the plant risk in MODE 3 and MODE 4 is similar to or lower than the risk in MODE 5 (Ref. 4) and because the time spent in MODE 3 or MODE 4 to perform the necessary repairs to restore the system to OPERABLE status will be short. However, voluntary entry into MODE 5 may be made, as it is also an acceptable low-risk state. When remaining in MODE 3 or MODE 4, the implementation guidance of Reference 5 is followed.

SURVEILLANCE REQUIREMENTS

SR 3.3.4.1

~~This SR requires the performance of a CHANNEL CHECK of the drywell fission product monitoring system particulate channel~~ Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. The associated controllers, displays, monitoring and input/output (I/O) communication interfaces continuously function during normal power operation. Abnormal operation of these components is detected and alarmed. In addition, the associated controllers are equipped with on-line diagnostic capabilities for cyclically

BASES

monitoring the functionality of I/O signals, buses, power supplies, processors, and inter-processor communications.

~~The check gives reasonable confidence that the channel is operating properly~~A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency ~~of 12 hours is based on instrument reliability~~is based upon operating experience that demonstrates channel failure is rare and the online-diagnostics that monitor the channels for proper operation ~~and is reasonable for detecting off normal conditions~~. The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.4.2

This SR requires the performance of a CHANNEL FUNCTIONAL TEST of the required RCS leakage detection instrumentation. The test ensures that the ~~monitors~~ required channels can perform their intended function ~~in the desired manner~~. ~~The test also verifies the alarm setpoint and relative accuracy of the instrument string. A successful test of the required contact(s) of a channel relay may be performed by the verification of the change of state of a single contact of the relay. This clarifies what is an acceptable CHANNEL FUNCTIONAL TEST of a relay. This is acceptable because all of the other required contacts of the relay are verified by other Technical Specifications and non-Technical Specifications tests at least once per refueling interval with applicable extensions.~~

The Frequency of ~~31 days~~24 months ~~considers~~ is based on instrument reliability~~,~~ and ~~operating experience has shown it proper for detecting degradation~~the online-diagnostic features that monitor the channels for proper operation.

SR 3.3.4.3

This SR requires the performance of a CHANNEL CALIBRATION of the required RCS leakage detection instrumentation channels. The calibration verifies the accuracy of the instrument string, including the instruments located inside the drywell. The Frequency of 24 months is a typical refueling cycle and considers channel reliability. Operating experience has proven this Frequency is acceptable.

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SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, The SRs for each ECCS instrumentation Function are found in the SRs column of Table 3.3.5.1-1.

SR 3.3.5.1.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. ~~Performance of this check provides confidence that a gross failure of a device in a sensor channel has not occurred.~~ This test overlaps the testing required by SR 3.3.5.2.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

~~A CHANNEL CHECK is a comparison of the parameter indicated on one required channel to a similar parameter on other required channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious.~~ A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the instrument has drifted outside its limit.

The Surveillance Frequency is based upon operating experience that demonstrates channel failure is rare and the self-diagnostic features that monitor the channels for proper operation. The CHANNEL CHECK every 24 hours supplements less formal, but more frequent checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SR 3.3.5.1.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure the entire channel will perform the intended function. This test overlaps the testing required by SR 3.3.5.2.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

~~Any setpoint adjustments shall be consistent with the assumptions of the current plant-specific setpoint methodology as required by the SCP.~~

The Frequency of ~~184 days~~ 24 months is based on the reliability of the ECCS instrumentation channels and ~~the self monitoring capability of the SSLC System~~the self-diagnostic features that monitor the channels for proper operation.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.1.3

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the required channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the required channel adjusted to the NTSP within the "leave alone" tolerance to account for instrument drifts between successive calibrations consistent with the SCP.

The Frequency is based upon the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis and has been shown to be acceptable by Reference 4.

For selected Functions, the SCP provides additional requirements for the evaluation of the performance of required channels. The selected Functions are those Functions whose instruments are not totally mechanical devices. Mechanical devices (e.g., devices which have an "on" or "off" output or an open/close position such as limit switches, float switches, and proximity detectors) are not calibrated in the traditional sense and do not have as-left or as-found conditions that would indicate drift of the component setpoint. These devices are considered not trendable and the requirements of TS 5.5.11.c.1 and TS 5.5.11.c.2 are not applicable to these mechanical components. Where a non-trendable component provides signal input to other channel components that can be trended, the remaining components must be evaluated in accordance with the SCP. As indicated in TS 5.5.11.c.1 evaluation of channel performance is required for the condition where the "as-found" setting for the channel is outside its "as-found" tolerance but conservative with

BASES

ACTIONS (continued)

Alternately, if it is not desired to restore the required actuation division to OPERABLE status, Condition C would be entered and its Required Action taken when the Completion Time of Required Action A.1 expires.

B.1

Condition B exists when two or more required actuation divisions are inoperable. In this Condition, a loss of ECCS actuation capability occurs to numerous ECCS components. ECCS automatic actuation capability is considered to be maintained when sufficient actuation divisions are OPERABLE or in trip such that the ECCS logic will generate an actuation signal on a valid signal. In this Condition, the associated feature(s) may be incapable of performing the intended function and the supported feature(s) associated with the inoperable divisions must be declared inoperable immediately.

C.1

If the Required Actions and associated Completion Times of Condition A are not met, the associated ECCS components must be declared inoperable immediately.

SURVEILLANCE REQUIREMENTS

SR 3.3.5.2.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of a required actuation division has not occurred. This test overlaps the testing required by SR 3.3.5.1.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross actuation division failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

BASES

The Frequency is based upon operating experience that demonstrates actuation division failure is rare and the self-diagnostic features that monitor the divisions for proper operation.

The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of divisions during normal operational use of the displays associated with the actuation divisions required by the LCO.

SR 3.3.5.2.2

A CHANNEL FUNCTIONAL TEST is performed on each required division to ensure that the entire division will perform the intended function. This test overlaps the testing required by SR 3.3.5.1.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The Frequency of 24 months is based on the reliability of the divisions and the self-diagnostic features that monitor the divisions for proper operation.

SR 3.3.5.2.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required ECCS logic for a specific channel.

LOGIC SYSTEM FUNCTIONAL tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that each division is alternately tested.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power and has been shown to be acceptable by Reference 3. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 month Frequency.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.2.~~2~~4

This SR ensures that the individual required division response times are less than or equal to the maximum values assumed in the accident

BASES

ACTIONS (continued)

In this Condition, the associated feature(s) may be incapable of performing the intended function and the supported feature(s) associated with the inoperable channels must be declared inoperable immediately.

C.1

With any Required Action and associated Completion Time of Condition A not met, the associated feature(s) may be incapable of performing the intended function and the supported feature(s) associated with the inoperable channels must be declared inoperable immediately.

SURVEILLANCE REQUIREMENTS

The Surveillance Requirements are modified by a Note. The Note directs the reader to Table 3.3.5.3-1 to determine the correct SRs to perform for each ICS Instrumentation Function.

SR 3.3.5.3.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. This test overlaps the testing required by SR 3.3.5.4.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output. ~~A CHANNEL CHECK is normally a comparison of the parameter indicated on one required channel to a similar parameter on other required channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious.~~

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the plant staff, based on a combination of the channel instrument uncertainties, including indication

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and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit.

The Frequency is based upon operating experience that demonstrates channel failure is rare and ~~has been shown to be acceptable by Reference 2~~ the self-diagnostic features that monitor the channels for proper operation. The CHANNEL CHECK every 24 hours supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.3.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. This test overlaps the testing required by SR 3.3.5.4.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output. ~~Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology as required by the SCP.~~

The Frequency of ~~184 days~~24 months is based on the reliability of the channels and ~~has been shown to be acceptable by Reference 2~~ the self-diagnostic features that monitor the channels for proper operation.

SR 3.3.5.3.3

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the required channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the required channel adjusted to the NTSP within the "leave alone" tolerance to account for instrument drifts between successive calibrations consistent with the SCP.

The Frequency is based upon the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis and has been shown to be acceptable by Reference 2.

For selected Functions, the SCP provides additional requirements for the evaluation of the performance of required channels. The selected Functions are those Functions whose instruments are not totally mechanical devices. Mechanical devices (e.g., devices which have an "on" or "off" output or an open/close position such as limit switches, float

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SURVEILLANCE REQUIREMENTS

SR 3.3.5.4.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of a required actuation division has not occurred. This test overlaps the testing required by SR 3.3.5.3.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross actuation division failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency is based upon operating experience that demonstrates actuation division failure is rare and the self-diagnostic features that monitor the divisions for proper operation.

The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of divisions during normal operational use of the displays associated with the actuation divisions required by the LCO.

SR 3.3.5.4.2

A CHANNEL FUNCTIONAL TEST is performed on each required division to ensure that the entire division will perform the intended function. This test overlaps the testing required by SR 3.3.5.3.2 to ensure complete testing of required instrument channels and actuation divisions from the sensor input to the logic contact output.

The Frequency of 24 months is based on the reliability of the divisions and the self-diagnostic features that monitor the divisions for proper operation.

SR 3.3.5.4.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required ICS logic for a specific channel.

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LOGIC SYSTEM FUNCTIONAL tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that each division is alternately tested.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power and has been shown to be acceptable by Reference 2. Operating experience has shown these components usually pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.5.4.~~2~~4

This SR ensures that the individual required division response times are less than or equal to the maximum values assumed in the accident analysis. The ICS RESPONSE TIME acceptance criteria are included in Reference 3.

ICS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total division measurements. This test encompasses the ICS actuation circuitry from the outputs of the DTMs through the LDs that consists of VLUs, the timers and the LDs associated with the ICS. This test overlaps the testing required by SR 3.3.5.3.4 to ensure complete testing of instrument channels and actuation circuitry.

ICS RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that each division is alternately tested.

The 24 month test Frequency is consistent with the typical industry refueling cycle and has been shown to be acceptable by Reference 2.

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ACTIONS (continued)

D.1

If the required channel(s) is not restored to OPERABLE status, or verified to be in trip, or if MSIV isolation capability is not restored within the allowed Completion Time, the plant must be placed in a MODE or other specified condition in which the LCO does not apply. This is done by placing the plant in at least MODE 2 within 6 hours.

The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 2 from full power conditions in an orderly manner and without challenging plant systems and has been shown to be acceptable by Reference 9.

E.1

If the required channel(s) is not restored to OPERABLE status, or verified to be in trip, or if MSIV isolation capability is not restored within the allowed Completion Time, plant operations may continue if the associated MSIV(s) is declared inoperable. Because this Function is required to ensure that the MSIVs perform their intended function, sufficient remedial measures are provided by declaring the associated MSIV(s) inoperable immediately.

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the Surveillance Requirements, the SRs for each isolation instrumentation Function are located in the SRs column of Table 3.3.6.1-1.

SR 3.3.6.1.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. This test overlaps the testing required by SR 3.3.6.2.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.~~A CHANNEL CHECK is a comparison of the parameter indicated on one required channel to a similar parameter in other required channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or even something more serious.~~

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The RTIF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

SURVEILLANCE REQUIREMENTS (continued)

Agreement criteria are determined by the unit staff, based on a combination of the channel instrument uncertainties, including indication, and readability. If a channel is outside the match criteria, it may be an indication that the instrument has drifted outside its limit.

The Surveillance Frequency is based on operating experience that demonstrates channel failure is rare and ~~has been shown to be acceptable by Reference 9~~ the self-diagnostic features that monitor the channels for proper operation. ~~Thus, performance of the CHANNEL CHECK ensures that undetected outright channel failure is limited to 24 hours.~~

The CHANNEL CHECK supplements less formal, but more frequent checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.6.1.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. This test overlaps the testing required by SR 3.3.6.2.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

~~Any setpoint adjustment shall be consistent with the assumptions of the current plant-specific setpoint methodology as required by the SCP.~~

The Frequency of ~~184 days~~24 months is based on the reliability of the Isolation Instrumentation channels and ~~has been shown to be acceptable by Reference 9~~ the self-diagnostic features that monitor the channels for proper operation.

BASES

alone" tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in plant surveillance procedures, the "leave alone" and "as-found" tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Analytical / Design Limit is maintained. If the as-left instrument setting cannot be returned to a setting within the "leave alone" tolerance, then the instrument channel shall be declared inoperable. TS 5.5.11.a requires that the NTSP and the methodology for calculating the "leave alone" and the "as-found" tolerances be in the SCP.

SR 3.3.6.1.4

This SR ensures that the individual required channel response times are less than or equal to the maximum values assumed in the accident analysis. The instrument response times must be added to the associated closure times to obtain the ISOLATION SYSTEM RESPONSE

TIME. ISOLATION SYSTEM RESPONSE TIME acceptance criteria are included in Reference 10. ISOLATION SYSTEM RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the MSIV isolation instrumentation from the input variable sensors through the DTM digital trip function. This test overlaps the testing required by SR 3.3.6.2.~~2~~4 to ensure complete testing of instrumentation channels and actuation circuitry.

However, some sensors are allowed to be excluded from specific ISOLATION SYSTEM RESPONSE TIME measurement if the conditions of Reference 11 are satisfied. If these conditions are satisfied, sensor response time may be allocated based on either assumed design sensor response time or the manufacturer's stated design response time. When the requirements of Reference 11 are not satisfied, sensor response time must be measured. Furthermore, measurement of the instrument loops response time for some Functions is not required if the conditions of Reference 12 are satisfied. For all other Functions, the measurement of instrument loop response times may be excluded if the conditions of Reference 11 are satisfied.

ISOLATION SYSTEM RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for four channels. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The 24 month test Frequency is consistent with the refueling cycle and has been shown to be acceptable by Reference 9.

BASES

ACTIONS (continued)

B.1

Required Action B.1 is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped required MSIV actuation divisions result in not maintaining MSIV actuation capability. MSIV actuation capability is considered to be maintained when sufficient required actuation divisions will generate an isolation from a given Function on a valid signal so that at least one valve in the associated penetration flow path is isolated.

In this Condition, the associated MSIV(s) may be incapable of performing the intended function. Sufficient remedial measures are provided by declaring the associated MSIVs inoperable.

C.1

If the required division is not restored to OPERABLE status within the allowed Completion Time of Condition A, the associated MSIV(s) must be declared inoperable immediately. Because MSIV actuation is required to ensure that the MSIV(s) performs its intended function, sufficient remedial measures are provided by declaring the associated MSIV(s) inoperable.

SURVEILLANCE REQUIREMENTS

SR 3.3.6.2.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of a required actuation division has not occurred. This test overlaps the testing required by SR 3.3.6.1.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The RTIF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross actuation division failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency is based upon operating experience that demonstrates actuation division failure is rare and the self-diagnostic features that monitor the divisions for proper operation.

The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of divisions during normal operational use of the displays associated with the actuation divisions required by the LCO.

SR 3.3.6.2.2

A CHANNEL FUNCTIONAL TEST is performed on each required division to ensure that the entire division will perform the intended function. This test overlaps the testing required by SR 3.3.6.1.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and actuation divisions from the sensor input to the logic contact output.

The Frequency of 24 months is based on the reliability of the divisions and the self-diagnostic features that monitor the divisions for proper operation.

SR 3.3.6.2.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the MSIV actuation divisions, including the two-out-of-four function of the Trip Logic Unit (TLU), Output Logic Unit (OLU), and Load Drivers (LDs) for a specific division.

LOGIC SYSTEM FUNCTIONAL tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The testing in LCO 3.3.6.1 and LCO 3.6.1.3 overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power and has been shown to be acceptable by Reference 3. Operating experience has shown that these components

usually pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.6.2.~~2~~4

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ACTIONS (continued)

from full power conditions in an orderly manner and without challenging plant systems.

H.1 and H.2

If the affected instrumentation channel cannot be verified to be in trip within the specified Completion Time or if isolation capability cannot be restored within the specified Completion Time, the associated flow path should be isolated. However, if the RWCU/SDC function is needed to provide core cooling, these Required Actions allow the flow path to remain unisolated provided action is immediately initiated to restore the channel to OPERABLE status or to isolate the RWCU/SDC system (i.e., provide alternate decay heat removal capabilities so the flow path can be isolated). ACTIONS must continue until the channel is restored to OPERABLE status or the RWCU/SDC system is isolated.

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the Surveillance Requirements, the SRs for each isolation instrumentation Function are located in the SRs column of Table 3.3.6.3-1.

SR 3.3.6.3.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. This test overlaps the testing required by SR 3.3.6.4.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output. ~~A CHANNEL CHECK is a comparison of the parameter indicated on one required channel to a similar parameter in other required channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or even something more serious.~~

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the unit staff, based on a combination of the channel instrument uncertainties, including indication, and readability. If a channel is outside the match criteria, it may be an indication that the instrument has drifted outside its limit.

The Surveillance Frequency is based on operating experience that demonstrates channel failure is rare and ~~has been shown to be acceptable by Reference 3~~ the self-diagnostic features that monitor the channels for proper operation. ~~Thus, performance of the CHANNEL~~

~~CHECK ensures that undetected outright channel failure is limited to 24 hours.~~

The CHANNEL CHECK supplements less formal, but more frequent checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.6.3.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. This test overlaps the testing required by SR 3.3.6.4.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

~~Any setpoint adjustment shall be consistent with the assumptions of the current plant-specific setpoint methodology as specified in the SCP.~~

The Frequency of ~~184 days~~24 months is based on the reliability of the Isolation Instrumentation channels and ~~has been shown to be acceptable by Reference 3~~ the self-diagnostic features that monitor the channels for proper operation.

SR 3.3.6.3.3

CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that the required channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the required channel adjusted to the

the instrument channel shall be declared inoperable. TS 5.5.11.a requires that the NTSP and the methodology for calculating the "leave alone" and the "as-found" tolerances be in the SCP.

SR 3.3.6.3.4

This SR ensures that the individual required channel response times are less than or equal to the maximum values assumed in the accident analysis. The instrument response times must be added to the associated closure times to obtain the ISOLATION SYSTEM RESPONSE TIME. ISOLATION SYSTEM RESPONSE TIME acceptance criteria are included in Reference 10.

ISOLATION SYSTEM RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the isolation instrumentation from the input variable sensors through the DTM function.

SURVEILLANCE REQUIREMENTS (continued)

This test overlaps the testing required by SR 3.3.6.4.~~2~~4 to ensure complete testing of instrumentation channels and actuation circuitry.

A Note to the Surveillance states that the radiation detectors may be excluded from ISOLATION SYSTEM RESPONSE TIME testing. This Note is necessary because of the difficulty of generating an appropriate detector input signal and because the principles of detector operation virtually ensure an instantaneous response time. Response Time for radiation detection channels shall be measured from detector output or the input of the first electronic component in the channel.

However, some sensors are allowed to be excluded from specific ISOLATION SYSTEM RESPONSE TIME measurement if the conditions of Reference 11 are satisfied. If these conditions are satisfied, sensor response time may be allocated based on either assumed design sensor response time or the manufacturer's stated design response time. When the requirements of Reference 11 are not satisfied, sensor response time must be measured. Furthermore, measurement of the instrument loops response time for some Functions is not required if the conditions of Reference 11 are satisfied. For all other Functions, the measurement of instrument loop response times may be excluded if the conditions of Reference 12 are satisfied.

ISOLATION SYSTEM RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for four channels. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels

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ACTIONS (continued)

The allowed Completion Time of 8 hours is intended to allow the operator time to evaluate and repair any discovered inoperabilities and has been shown to be acceptable by Reference 3.

H.1 and H.2

If feedwater flow through the affected feedwater isolation valve(s) cannot be isolated within the specified Completion Time or if the affected feedwater pump breaker cannot be placed in trip within the specified Completion Time, the plant must be placed in a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours and to MODE 5 within 36 hours The Completion Time is reasonable, based on plant design, to reach required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

I.1 and I.2

If the affected actuation division cannot be verified to be in trip within the specified Completion Time or if isolation capability cannot be restored within the specified Completion Time, the associated flow path should be isolated. However, if the RWCU/SDC function is needed to provide core cooling, these Required Actions allow the flow path to remain unisolated provided action is immediately initiated to restore the division to OPERABLE status or to isolate the RWCU/SDC system (i.e., provide alternate decay heat removal capabilities so the flow path can be isolated). ACTIONS must continue until the division is restored to OPERABLE status or the RWCU/SDC system is isolated.

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, the SRs for each isolation actuation Function are located in the SRs column of Table 3.3.6.4-1.

SR 3.3.6.4.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of a required actuation division has not occurred. This test overlaps the testing required by SR 3.3.6.3.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross actuation division failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency is based upon operating experience that demonstrates actuation division failure is rare and the self-diagnostic features that monitor the divisions for proper operation.

The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of divisions during normal operational use of the displays associated with the actuation divisions required by the LCO.

SR 3.3.6.4.2

A CHANNEL FUNCTIONAL TEST is performed on each required division to ensure that the entire division will perform the intended function. This test overlaps the testing required by SR 3.3.6.3.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The Frequency of 24 months is based on the reliability of the divisions and the self-diagnostic features that monitor the divisions for proper operation.

SR 3.3.6.4.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the isolation actuation divisions.

LOGIC SYSTEM FUNCTIONAL tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The testing in LCO

3.3.6.3, LCO 3.6.1.3, and LCO 3.6.3.1 overlaps this Surveillance to provide complete testing of the assumed safety function.

BASES

The 24-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power and has been shown to be acceptable by Reference 3. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.6.4.~~2~~4

This SR ensures that the individual required division response times are less than or equal to the maximum values assumed in the accident analysis. The instrument response times must be added to the associated closure times to obtain the ISOLATION SYSTEM RESPONSE TIME. ISOLATION SYSTEM RESPONSE TIME acceptance criteria are included in Reference 4.

ISOLATION SYSTEM RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the isolation actuation circuitry consisting of timers, VLUs, and load drivers. This test overlaps the testing required by SR 3.3.6.3.4 to ensure complete testing of instrumentation channels and actuation divisions.

ISOLATION SYSTEM RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for four divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The 24 month test Frequency is consistent with the refueling cycle and has been shown to be acceptable by Reference 3.

SR 3.4.6.4.~~3~~5

A system functional test is performed to verify that the mechanical portions of the actuation function operate as designed when demanded. This includes verifying that RWCU/SDC isolation valves and feedwater isolation valves automatically close and that feedwater pump breakers automatically trip. The LOGIC SYSTEM FUNCTIONAL TEST in SR 3.3.6.4.~~1~~3 overlaps this SR to provide complete testing of the safety function.

SURVEILLANCE REQUIREMENTS (continued)

The 24-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed

BASES

ACTIONS (continued)

Required Action C.1.1 and Required Action C.1.2 require manual isolation of the CRHA boundary and placing an OPERABLE CRHAVS train in the isolation mode, respectively, which accomplishes the safety function of the inoperable channel by ensuring radiological protection of the occupants within the CRHA boundary.

Alternatively, Required Action C.2 requires declaring the associated CRHAVS train(s) inoperable in accordance with LCO 3.7.2. Declaring the associated CRHAVS train(s) inoperable is acceptable, since the Required Actions of LCO 3.7.2 provide appropriate actions for the inoperable components.

SURVEILLANCE REQUIREMENTS

The SRs are modified by a Note. The Note directs the reader to Table 3.3.7.1-1 to determine the correct SRs to perform for each CRHAVS Function.

SR 3.3.7.1.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of instrumentation has not occurred. This test overlaps the testing required by SR 3.3.7.2.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.~~A CHANNEL CHECK is normally a comparison of the parameter indicated on one required channel to a similar parameter on other required channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the instrument channels could be an indication of excessive instrument drift in one of the channels or something even more serious.~~

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks and communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

BASES

Agreement criteria are determined by the plant staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the criteria, it may be an indication that the instrument has drifted outside its limit.

The Frequency is based upon operating experience that demonstrates channel failure is rare and ~~has been shown to be acceptable by Reference 4~~ the self-diagnostic features that monitor the channels for proper operation. The CHANNEL CHECK every 24 hours supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the channels required by the LCO.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.7.1.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. This test overlaps the testing required by SR 3.3.7.2.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

~~Any setpoint adjustment shall be consistent with the assumptions of the current plant-specific setpoint methodology as specified in the SCP.~~

The Frequency of ~~184 days~~24 months is based on the reliability of the CRHAVS instrumentation channels and ~~has been shown to be acceptable by Reference 4~~the self-diagnostic features that monitor the channels for proper operation.

SR 3.3.7.1.3

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the required channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the required channel adjusted to the NTSP within the "leave alone" tolerance to account for instrument drifts between successive calibrations consistent with the SCP.

The Frequency is based upon the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis and has been shown to be acceptable by Reference 4.

BASES

For selected Functions, the SCP provides additional requirements for the evaluation of the performance of required channels. The selected Functions are those Functions whose instruments are not totally mechanical devices. Mechanical devices (e.g., devices which have an "on" or "off" output or an open/close position such as limit switches, float switches, and proximity detectors) are not calibrated in the traditional sense and do not have as-left or as-found conditions that would indicate drift of the component setpoint. These devices are considered not trendable and the requirements of TS 5.5.11.c.1 and TS 5.5.11.c.2 are not applicable to these mechanical components. Where a non-trendable component provides signal input to other channel components that can be trended, the remaining components must be evaluated in accordance with the SCP. As indicated in TS 5.5.11.c.1 evaluation of channel performance is required for the condition where the "as-found" setting for the channel is outside its "as-found" tolerance but conservative with respect to the Allowable Value. For digital channel components, the "as-found" tolerance may be identical to the "leave alone" tolerance

because drift may not be an expected error. In these cases, a channel "as-found" value outside the "leave alone" tolerance may be cause for component assessment. Evaluation of instrument performance will verify that the instrument will continue to behave in accordance with design basis assumptions. The purpose of the assessment is to ensure confidence in the instrument performance prior to returning the instrument to service. These channels will also be identified in the Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition for OPERABILITY.

TS 5.5.11.a requires that the Allowable Values and the methodology for calculating the "as-found" tolerances be in the SCP. As indicated in TS 5.5.11.c.2, the as-left setting for the instrument is required to be returned to within the "leave alone" tolerance of the NTSP. Where a setpoint more conservative than the NTSP is used in plant surveillance procedures, the "leave alone" and "as-found" tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Analytical / Design Limit is maintained. If the as-left instrument setting cannot be returned to a setting within the "leave alone" tolerance, then the instrument channel shall be declared inoperable. TS 5.5.11.a requires that the NTSP and the methodology for calculating the "leave alone" and the "as-found" tolerances be in the SCP.

$\boxed{\underline{\text{SR 3.3.7.1.4}}}$

BASES

This SR ensures that the individual required channel response times are less than or equal to the maximum values assumed in the accident analysis. The instrument response times must be added to the associated closure times to obtain the CRHAVS RESPONSE TIME. CRHAVS RESPONSE TIME acceptance criteria are included in Reference 5.

CRHAVS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the isolation instrumentation from the input variable sensors through the DTM function.

This test overlaps the testing required by SR 3.3.7.2.4 to ensure complete testing of instrumentation channels and actuation circuitry.

A Note to the Surveillance states that the radiation detectors may be excluded from CRHAVS RESPONSE TIME testing. This Note is necessary because of the difficulty of generating an appropriate detector input signal and because the principles of detector operation virtually ensure an instantaneous response time. Response Time for radiation detection channels shall be measured from detector output or the input of the first electronic component in the channel.

[However, some sensors are allowed to be excluded from specific CRHAVS RESPONSE TIME measurement if the conditions of Reference XX are satisfied. If these conditions are satisfied, sensor response time may be allocated based on either assumed design sensor response time or the manufacturer's stated design response time. When the requirements of Reference XX are not satisfied, sensor response time must be measured. Furthermore, measurement of the instrument loops response time for some Functions is not required if the conditions of Reference XX are satisfied.]

CRHAVS RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for three channels. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The 24 month test Frequency is consistent with the refueling cycle and with operating experience that shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent.

REFERENCES

1. Section 6.4.

BASES

2. Section 9.4.1.

3. Section 15.4.

4. {NEDO-33201, "ESBWR Design Certification Probabilistic Risk Assessment."}

5. Chapter 15.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.7.2.1

Performance of the CHANNEL CHECK once every 24 hours ensures that a gross failure of a required actuation division has not occurred. This test overlaps the testing required by SR 3.3.7.1.1 to ensure a complete CHANNEL CHECK of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The SSLC/ESF is cyclically tested from the sensor input point to the logic contact output by online self-diagnostics. The self-diagnostic capabilities include microprocessor checks, system initialization, watchdog timers, memory integrity checks, input/output (I/O) data integrity checks, communication bus interface checks, and checks on the application program (checksum).

A CHANNEL CHECK will detect gross actuation division failure; thus, it is key to verifying the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

The Frequency is based upon operating experience that demonstrates actuation division failure is rare and the self-diagnostic features that monitor the divisions for proper operation.

The CHANNEL CHECKs every 24 hours supplement less formal, but more frequent, checks of divisions during normal operational use of the displays associated with the actuation divisions required by the LCO.

SR 3.3.7.2.2

A CHANNEL FUNCTIONAL TEST is performed on each required division to ensure that the entire division will perform the intended function. This test overlaps the testing required by SR 3.3.7.1.2 to ensure a complete CHANNEL FUNCTIONAL TEST of required instrument channels and required actuation divisions from the sensor input to the logic contact output.

The Frequency of 24 months is based on the reliability of the divisions and the diagnostic self-test features that monitor the divisions for proper operation.

SR 3.3.7.2.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required CRHAVS logic for a specific channel.

BASES

The Frequency of 24 months on a STAGGERED TEST BASIS for four divisions alternates between the combinations for actuation of the load drivers over 4 refueling intervals.

The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power and has been shown to be acceptable by Reference 3. Operating experience has shown these components usually pass the Surveillance when performed at the 24 month Frequency.

SR 3.3.7.2.4

This SR ensures that the individual required division response times are less than or equal to the maximum values assumed in the accident analysis. The instrument response times must be added to the associated closure times to obtain the CRHAVS RESPONSE TIME. CRHAVS RESPONSE TIME acceptance criteria are included in Reference 4.

CRHAVS RESPONSE TIME may be verified by actual response time measurements in any series of sequential, overlapping, or total channel measurements. This test encompasses the isolation actuation circuitry consisting of timers, VLUs, and load drivers. This test overlaps the testing required by SR 3.3.7.1.4 to ensure complete testing of instrumentation channels and actuation divisions.

[However, some portions of the isolation actuation circuitry are allowed to be excluded from specific CRHAVS RESPONSE TIME measurement if the conditions of Reference XX are satisfied. Furthermore, measurement of the instrument loops response time for some Functions is not required if the conditions of Reference XX are satisfied.]

CRHAVS RESPONSE TIME tests are conducted on a 24 month STAGGERED TEST BASIS for three divisions. The Frequency of 24 months on a STAGGERED TEST BASIS ensures that the channels associated with each division are alternately tested. The 24 month test Frequency is consistent with the refueling cycle and with operating experience that shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent.

BASES

REFERENCES

1. Section 6.4.

2. Section 15.4.

3. {NEDO-33201, "ESBWR Design Certification Probabilistic Risk Assessment."}

4. Chapter 15.