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NLS2011071
September 16, 2011

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

Subject: Nebraska Public Power District - Cooper Nuclear Station
Docket No. 50-298, License No. DPR-46
License Amendment Request for Implementing a 24-Month Fuel Cycle and Adoption of TSTF-493, Revision 4, Option A

References:
1. Generic Letter 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle," dated April 2, 1991.
2. Letter from the Technical Specifications Task Force to U.S. Nuclear Regulatory Commission, dated July 31, 2009, "Transmittal of TSTF-493, Rev. 4, 'Clarify Application of Setpoint Methodology for LSSS Functions.'"

Dear Sir or Madam:

The purpose of this letter is for the Nebraska Public Power District (NPPD) to request from the Nuclear Regulatory Commission (NRC) an amendment to Facility Operating License DPR-46 under the provisions of 10 CFR 50.4 and 10 CFR 50.90 to revise the Cooper Nuclear Station (CNS) Technical Specifications (TS) to support operation with 24-month fuel cycles, in accordance with the guidance of Generic Letter 91-04 (Reference 1). Additionally, NPPD is including with this License Amendment Request an amendment to incorporate the NRC-approved TSTF-493, Revision 4, to be consistent with Option A (Reference 2). The availability of this TS improvement was announced in the *Federal Register* on May 11, 2010 (75 FR 26294).

The 24-month fuel cycle proposed changes largely consist of revising certain TS Surveillance Requirement frequencies from 18 months to 24 months. However, changes are also proposed for the TS Allowable Values of two instrument functions to support the longer surveillance interval. The TSTF-493, Revision 4, Option A proposed amendment would revise the TS by adding requirements to assess channel performance during testing that verifies instrument channel setting values established by the plant-specific setpoint methodology. NPPD has determined from the No Significant Hazards Consideration determination that these changes do not involve a significant hazard.

NPPD requests approval of the proposed amendment by September 16, 2012, to facilitate implementation during the Fall 2012 refueling outage, allowing for an approximate one year review by the NRC. Once approved, the amendment will be implemented within 60 days.

A001
NRR

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Attachment 1 provides a description of the TS changes, the basis for the amendment, the No Significant Hazards Consideration evaluation pursuant to 10 CFR 50.91(a)(1), and the Environmental Impact evaluation pursuant to 10 CFR 51.22. Attachment 2 provides the proposed changes to the current CNS TS in marked up format. For ease of review, they are grouped in two sections, those TS changes associated with a 24-month fuel cycle, and the TS changes accommodating TSTF-493, Revision 4, Option A. Attachment 3 provides the final typed TS pages to be issued with the amendment. Attachment 4 provides conforming changes to the TS Bases for information. Attachments 5 and 6, and Enclosure 1, are included in accordance with Reference 1. Attachment 5 provides the evaluation of the 24-month review findings. Attachment 6 provides a list of affected channels for 24-month fuel cycle changes by TS section, including instrument make, model, and range. Enclosure 1 provides a summary of the methodology and assumptions used to determine the rate of instrument drift with time, based upon historical plant calibration data.

The proposed TS changes have been reviewed by the necessary safety review committees (Station Operations Review Committee and Safety Review and Audit Board). Amendments to the CNS Facility Operating License through Amendment 238 issued July 27, 2011, have been incorporated into this request. This request is submitted under affirmation pursuant to 10 CFR 50.30(b).

By copy of this letter and its attachments, the appropriate State of Nebraska official is notified in accordance with 10 CFR 50.91(b)(1). Copies are also being provided to the NRC Region IV office and the CNS Senior Resident Inspector in accordance with 10 CFR 50.4(b)(1).

Should you have any questions concerning this matter, please contact Mike Boyce, CNS Strategic Initiatives Project Manager, at (402) 825-5100.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: September 16, 2011
(Date)

Sincerely,

Brian J. O'Grady
Vice President – Nuclear
and Chief Nuclear Officer

/wv

Attachments

Enclosure

cc: Regional Administrator w/Attachments and Enclosure
USNRC - Region IV

Cooper Project Manager w/Attachments and Enclosure
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/Attachments and Enclosure
USNRC - CNS

Nebraska Health and Human Services w/Attachments and Enclosure
Department of Regulation and Licensure

NPG Distribution w/o Attachments or Enclosure

CNS Records w/Attachments and Enclosure

ATTACHMENT 3 LIST OF REGULATORY COMMITMENTS©[4]

Correspondence Number: NLS2011071

The following table identifies those actions committed to by Nebraska Public Power District (NPPD) in this document. Any other actions discussed in the submittal represent intended or planned actions by NPPD. They are described for information only and are not regulatory commitments. Please notify the Licensing Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITMENT NUMBER	COMMITTED DATE OR OUTAGE
None		

Attachment 1

License Amendment Request for Implementing a 24-Month Fuel Cycle and Adoption of TSTF-493, Revision 4, Option A

Cooper Nuclear Station; Docket No. 50-298, DPR-46

1.0 SUMMARY DESCRIPTION

This letter is a request to the Nuclear Regulatory Commission (NRC) to amend Facility Operating License DPR-46 for Cooper Nuclear Station (CNS). The requested change affects certain Technical Specification (TS) Surveillance Requirement (SR) frequencies that are specified as "18 months" by revising them to "24 months" in accordance with the guidance of Generic Letter (GL) 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle," dated April 2, 1991 (Reference 6.1). As a result of these SR changes, the Nebraska Public Power District (NPPD) is proposing two changes to TS Allowable Values. Also consistent with this guidance, certain other Administrative Controls TS changes are made:

- TS 5.5.2, "Systems Integrity Monitoring Program," testing frequencies are changed from 18 months to 24 months for integrated leak test requirements and the applicability of SRs 3.0.2 and 3.0.3.
- TS 5.5.7, "Ventilation Filter Testing Program (VFTP)," testing frequencies are changed from 18 months to 24 months.
- TS 5.5.13, "Control Room Envelope Habitability Program," pressure measurements are changed from 18 months to 24 months.

Additionally, the proposed amendment would revise the Technical Specifications by applying additional testing requirements to applicable instrument Functions, listed in Technical Specifications Task Force (TSTF) Improved Standard Technical Specifications (STS) Change Traveler TSTF-493, Revision 4, "Clarify Application of Setpoint Methodology for LSSS [limiting safety system settings] Functions," Attachment A, "Identification of Functions to be Annotated with the TSTF-493 Footnotes" (Reference 6.2). Attachment A contains Functions related to those variables that have a significant safety function, as defined in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.36(c)(1)(ii)(A), thereby ensuring instrumentation will function as required to initiate protective systems or actuate mitigating systems at values equal to or more conservative than the point assumed in applicable safety analyses. These TS changes are made by the addition of individual surveillance Note requirements to applicable instrument Functions in accordance with Option A of TSTF-493, Revision 4. This change is consistent with Option A of NRC-approved Revision 4 to TSTF-493. The availability of this TS improvement was announced in the *Federal Register* on May 11, 2010 (75 FR 26294).

As demonstrated in this submittal, the proposed changes do not adversely impact safety. With respect to the 24-month fuel cycle changes, the proposed changes are similar to the license amendment issued for River Bend Station on August 31, 2010. NPPD is requesting approval of this change by September 16, 2012, allowing an approximate one year review by the NRC. Approval by this date will support scheduling and planning the subsequent refueling outage based on 24-month surveillance frequency requirements for SRs that must be performed during plant shutdown conditions. Once approved, NPPD will implement the amendment within 60 days.

2.0 DETAILED DESCRIPTION

2.1 Proposed Changes

2.1.1 Changes For 24-Month Fuel Cycle

To accommodate a 24-month fuel cycle for CNS, certain surveillance frequencies that are specified as "18 months" are being revised to "24 months." The proposed changes were evaluated in accordance with the guidance provided in NRC GL 91-04.

The following SR frequencies are being revised to 24 months:

<u>TS 3.1.7 SLC System</u>

SR 3.1.7.8	Verify flow through one SLC subsystem from pump into reactor pressure vessel.
SR 3.1.7.9	Verify all heat traced piping between storage tank and pump suction is unblocked.

<u>TS 3.1.8 SDV Vent and Drain Valves</u>

SR 3.1.8.3	Verify each SDV vent and drain valve: a. Closes in $\leq$ 30 seconds after receipt of an actual or simulated scram signal; and b. Opens when the actual or simulated scram signal is reset.

<u>TS 3.3.1.1 RPS Instrumentation</u>

SR 3.3.1.1.11	Perform CHANNEL FUNCTIONAL TEST.
SR 3.3.1.1.12	Perform CHANNEL CALIBRATION.
SR 3.3.1.1.13	Perform LOGIC SYSTEM FUNCTIONAL TEST.
SR 3.3.1.1.14	Verify Turbine Stop Valve - Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure - Low Functions are not bypassed when THERMAL POWER is $\geq$ 29.5% RTP.
SR 3.3.1.1.15	Verify the RPS RESPONSE TIME is within limits.

<u>TS 3.3.1.2 SRM Instrumentation</u>

SR 3.3.1.2.7	Perform CHANNEL CALIBRATION.

<u>TS 3.3.2.1 Control Rod Block Instrumentation</u>

SR 3.3.2.1.6	Verify the RWM is not bypassed when THERMAL POWER is $\leq$ 9.85% RTP.
SR 3.3.2.1.7	Perform CHANNEL FUNCTIONAL TEST.

TS 3.3.2.2 Feedwater and Main Turbine High Water Level Trip Instrumentation

SR 3.3.2.2.2 Perform CHANNEL CALIBRATION. The Allowable Value shall be ≤ 54.0 inches.

SR 3.3.2.2.3 Perform LOGIC SYSTEM FUNCITONAL TEST including valve actuation.

TS 3.3.3.1 PAM Instrumentation

SR 3.3.3.1.3 Perform CHANNEL CALIBRATION of each required PAM Instrumentation channel except for the Primary Containment H_2 and O_2 Analyzers.

TS 3.3.3.2 Alternate Shutdown System

SR 3.3.3.2.2 Verify each required control circuit and transfer switch is capable of performing the intended function.

SR 3.3.3.2.3 Perform CHANNEL CALIBRATION for each required instrumentation channel.

TS 3.3.4.1 ATWS-RPT Instrumentation

SR 3.3.4.1.2 Perform CHANNEL CALIBRATION. The Allowable Values shall be:

a. Reactor Vessel Water Level - Low Low (Level 2): ≥ -42 inches; and
b. Reactor Pressure - High: ≤ 1072 psig.

SR 3.3.4.1.3 Perform LOGIC SYSTEM FUNCTIONAL TEST including breaker actuation.

TS 3.3.5.1 ECCS Instrumentation

SR 3.3.5.1.4 Perform CHANNEL CALIBRATION.

SR 3.3.5.1.5 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.5.2 RCIC System Instrumentation

SR 3.3.5.2.4 Perform CHANNEL CALIBRATION.

SR 3.3.5.2.5 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.6.1 Primary Containment Isolation Instrumentation

SR 3.3.6.1.4 Perform CHANNEL CALIBRATION.

SR 3.3.6.1.5 Calibrate each radiation detector.

SR 3.3.6.1.6 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.6.2 Secondary Containment Isolation Instrumentation

SR 3.3.6.2.3 Perform CHANNEL CALIBRATION.

SR 3.3.6.2.4 Perform LOGIC SYSTEM FUNCTIONAL TEST.

<u>TS 3.3.6.3 LLS Instrumentation</u>

SR 3.3.6.3.4	Perform CHANNEL CALIBRATION.
SR 3.3.6.3.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.

<u>TS 3.3.7.1 CREF System Instrumentation</u>

SR 3.3.7.1.3	Perform CHANNEL CALIBRATION.
SR 3.3.7.1.4	Perform LOGIC SYSTEM FUNCTIONAL TEST.

<u>TS 3.3.8.1 LOP Instrumentation</u>

SR 3.3.8.1.2	Perform CHANNEL CALIBRATION.
SR 3.3.8.1.3	Perform LOGIC SYSTEM FUNCTIONAL TEST.

<u>TS 3.3.8.2 RPS Electric Power Monitoring</u>

SR 3.3.8.2.1	Perform CHANNEL CALIBRATION. The Allowable Values shall be: a. Overvoltage $\leq$ 131 V with time delay set to $\leq$ 3.8 seconds. b. Undervoltage $\geq$ 109 V, with time delay set to $\leq$ 3.8 seconds. c. Underfrequency $\geq$ 57.2 Hz, with time delay set to $\leq$ 3.8 seconds.
SR 3.3.8.2.2	Perform a system functional test.

<u>TS 3.4.3 SRVs and SVs</u>

SR 3.4.3.2	Verify each SRV opens when manually actuated.

<u>TS 3.5.1 ECCS – Operating</u>

SR 3.5.1.8	Verify, with reactor pressure $\leq$ 165 psig, the HPCI pump can develop a flow rate $\geq$ 4250 gpm against a system head corresponding to reactor pressure.
SR 3.5.1.9	Verify each ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.
SR 3.5.1.10	Verify the ADS actuates on an actual or simulated automatic initiation signal.
SR 3.5.1.11	Verify each ADS valve opens when manually actuated.

<u>TS 3.5.2 ECCS – Shutdown</u>

SR 3.5.2.5	Verify each required ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.

<u>TS 3.5.3 RCIC System</u>

SR 3.5.3.4	Verify, with reactor pressure $\leq$ 165 psig, the RCIC pump can develop a flow rate $\geq$ 400 gpm against a system head corresponding to reactor pressure.
SR 3.5.3.5	Verify the RCIC System actuates on an actual or simulated automatic initiation signal.

TS 3.6.1.1 Primary Containment

SR 3.6.1.1.2 Verify drywell to suppression chamber bypass leakage is equivalent to a hole < 1.0 inch in diameter.

TS 3.6.1.3 PCIVs

SR 3.6.1.3.7 Verify each automatic PCIV actuates to the isolation position on an actual or simulated isolation signal.

SR 3.6.1.3.8 Verify a representative sample of reactor instrumentation line EFCVs actuate to the isolation position on an actual or simulated instrument line break.

SR 3.6.1.3.9 Remove and test the explosive squib from each shear isolation valve of the TIP System.

SR 3.6.1.3.11 Verify each inboard 24 inch primary containment purge and vent valve is blocked to restrict the maximum valve opening angle to 60°.

TS 3.6.1.6 LLS Valves

SR 3.6.1.6.1 Verify each LLS valve opens when manually actuated.

SR 3.6.1.6.2 Verify the LLS System actuates on an actual or simulated automatic initiation signal.

TS 3.6.1.7 Reactor Building-to-Suppression Chamber Vacuum Breakers

SR 3.6.1.7.3 Verify the full open setpoint of each vacuum breaker is ≤ 0.5 psid.

TS 3.6.1.8 Suppression Chamber-to-Drywell Vacuum Breakers

SR 3.6.1.8.3 Verify the opening setpoint of each required vacuum breaker is ≤ 0.5 psid.

TS 3.6.4.1 Secondary Containment

SR 3.6.4.1.4 Verify each SGT subsystem can maintain ≥ 0.25 inch of vacuum water gauge in the secondary containment for 1 hour at a flow rate ≤ 1780 cfm.

TS 3.6.4.2 SCIVs

SR 3.6.4.2.3 Verify each automatic SCIV actuates to the isolation position on an actual or simulated actuation signal.

TS 3.6.4.3 SGT System

SR 3.6.4.3.3 Verify each SGT subsystem actuates on an actual or simulated initiation signal.

SR 3.6.4.3.4 Verify the SGT units cross tie damper is in the correct position, and each SGT room air supply check valve and SGT dilution air shutoff valve can be opened.

TS 3.7.2 SW System and UHS

SR 3.7.2.4 Verify each SW subsystem actuates on an actual or simulated initiation signal.

TS 3.7.3 REC System

SR 3.7.3.4 Verify each REC subsystem actuates on an actual or simulated initiation signal.

TS 3.7.4 CREF System

SR 3.7.4.3 Verify the CREF System actuates on an actual or simulated initiation signal.

TS 3.7.7 Main Turbine Bypass System

SR 3.7.7.2 Perform a system functional test.

SR 3.7.7.3 Verify the TURBINE BYPASS SYSTEM RESPONSE TIME is within limits.

TS 3.8.1 AC Sources – Operating

SR 3.8.1.8 Verify automatic and manual transfer of unit power supply from the normal offsite circuit to the alternate offsite circuit.

SR 3.8.1.9 Verify each DG operates for ≥ 8 hours:

a. For ≥ 2 hours loaded ≥ 4200 kW and ≤ 4400 kW; and
b. For the remaining hours of the test loaded ≥ 3600 kW and ≤ 4000 kW.

SR 3.8.1.10 Verify interval between each sequenced load is within ± 10% of nominal timer setpoint.

SR 3.8.1.11 Verify, on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ECCS initiation signal:

a. De-energization of emergency buses;
b. Load shedding from emergency buses; and
c. DG auto-starts from standby condition and:
    1. energizes permanently connected loads in ≤ 14 seconds,
    2. energizes auto-connected emergency loads through the timed logic sequence,
    3. maintains steady state voltage ≥ 3950 V and ≤ 4400 V,
    4. maintains steady state frequency ≥ 58.8 Hz and ≤ 61.2 Hz, and
    5. supplies permanently connected and auto-connected emergency loads for ≥ 5 minutes.

TS 3.8.4 DC Sources – Operating

SR 3.8.4.6 Verify:

a. Each required 125 V battery charger supplies ≥ 200 amps at ≥ 125 V for ≥ 4 hours; and
b. Each required 250 V battery charger supplies ≥ 200 amps at ≥ 250 V for ≥ 4 hours.

SR 3.8.4.7 Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.

The following additional TS changes are proposed to accommodate a 24-month fuel cycle:

TS 3.3.5.1 ECCS Instrumentation

Table 3.3.5.1-1 Function 2.d, Reactor Pressure – Low (Recirculation Discharge Valve Permissive), requires a change to the upper limit TS Allowable Value. The TS Allowable Value is being changed from "≤ 221 psig" to "≤ 246 psig."

TS 3.3.6.3 LLS Instrumentation

Table 3.3.6.3-1 Function 2, Low-Low Set Pressure Setpoints, require changes to the Low and High opening and closing TS Allowable Values. The Low opening pressure is changed from "≥ 995 psig and ≤ 1035 psig" to "≥ 996.5 psig and ≤ 1010 psig." The Low closing pressure is changed from "≥ 855 psig and ≤ 895 psig" to "≥ 835 psig and ≤ 875.5 psig." The High opening pressure is changed from "≥ 1005 psig and ≤ 1045 psig" to "≥ 996.5 psig and ≤ 1040 psig." The High closing pressure is changed from "≥ 855 psig and ≤ 895 psig" to "≥ 835 psig and ≤ 875.5 psig."

TS 5.5.2 Systems Integrity Monitoring Program

A change is proposed to Administrative Controls Section 5.5.2, "Systems Integrity Monitoring Program," to address changes to 18-month frequencies that are specified in that section. This change revises the following subsection to change "18 months" to "24 months":

The program shall include the following:

b. Integrated leak test requirements for each system at 18 month intervals or less.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable at the 18 month Frequency for performing system leak test activities.

TS 5.5.7 Ventilation Filter Testing Program (VFTP)

A change is proposed to Administrative Controls Section 5.5.7, "Ventilation Filter Testing Program (VFTP)," to address changes to 18-month frequencies that are specified in that section. This change revises the following subsections to change "18 months" to "24 months":

> The VFTP shall establish the required testing of Engineered Safety Feature (ESF) filter ventilation systems. Tests described in Specifications 5.5.7.a, 5.5.7.b, and 5.5.7.c shall be performed once per 18 months for standby service or after 720 hours of system operation; and, following significant painting, fire, or chemical release concurrent with system operation in any ventilation zone communicating with the system.
>
> Tests described in Specifications 5.5.7.d and 5.5.7.e shall be performed once per 18 months.

TS 5.5.13 Control Room Envelope Habitability Program

A change is proposed to Administrative Controls Section 5.5.13, "Control Room Envelope Habitability Program," to address changes to 18-month frequencies that are specified in that section. This change revises the following subsection to change "18 months" to "24 months":

> The program shall include the following elements:
>
> d. Measurement, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by the CREF System, operating at the flow rate required by the Ventilation Filter Testing Program, at a Frequency of 18 months. The results shall be trended and used as part of the periodic assessment of the CRE boundary.

2.1.2 TSTF-493, Revision 4, Option A Changes

NPPD proposes to add TSTF-493, Revision 4, Option A TS surveillance Notes with changes to setpoint values to CNS instrumentation Functions.

NPPD has reviewed the model safety evaluation (SE) referenced in the *Federal Register* Notice of Availability published on May 11, 2010 (75 FR 26294). As described herein, NPPD has concluded that the justifications presented in TSTF-493, Revision 4, Option A, and the model SE prepared by the NRC staff for Option A are applicable to CNS and support these changes to the CNS Technical Specifications.

NPPD is proposing variations or deviations from the TS changes described in TSTF-493, Revision 4, or the NRC staff's model SE referenced in the Notice of Availability. Specifically, because the CNS TS are based on an earlier version of NUREG-1433, "Standard Technical Specifications – General Electric Plants, BWR/4," the level of detail and content of the CNS Bases for TS 3.3.1 is different from that provided in NUREG-1433, Revision 3, requiring modification of the Bases changes in TSTF-493-A, Revision 4, Option A. NPPD also notes that the Model SE refers to ISA-S67.04-1994 Part 2. NPPD does not use this standard in calculating safety-related setpoints. Rather, NPPD uses the NRC-approved General Electric Instrument Setpoint Methodology, which is in general agreement with ISA-S67.04-1982. The Model SE also refers to compliance with 10 CFR 50 Appendix A, General Design Criteria (GDC) 13 and 20. CNS design predated the issuance of 10 CFR 50 Appendix A. The CNS licensing basis is to the analogous 1967 draft GDCs.

2.2 Need for Changes

The shift from an 18-month fuel cycle to a 24-month fuel cycle is a CNS strategic initiative. It is expected to increase the CNS capacity factor throughout the plant's operating life, and reduce cumulative radiological occupational exposure due to less frequent refueling outages.

At a pre-submittal public meeting with the NRC on October 19, 2010 regarding the 24-month fuel cycle License Amendment Request (LAR), it was determined that it would be appropriate for NPPD to combine the 24-month fuel cycle TS changes with a LAR implementing TSTF-493, Revision 4, Option A. The background for this application is adequately addressed by the NRC Notice of Availability published in the *Federal Register* on May 11, 2010 (75 FR 26294).

2.3 Technical Specification Bases Changes

Revised TS Bases are provided in Attachment 4 for NRC information. These Bases revisions will be part of LAR implementation pursuant to TS 5.5.10, "Technical Specifications (TS) Bases Control Program," following issuance of the amendment.

3.0 TECHNICAL EVALUATION

3.1 Generic Letter 91-04 Changes

In NRC GL 91-04, the NRC provided generic guidance for evaluating a 24-month surveillance test interval for TS SRs that are currently performed at 18-month intervals. This section defines each step outlined by the NRC in the GL and provides a description of the methodology used by NPPD to complete the evaluation for each specific TS SR frequency being extended from 18 months to 24 months. The methodology utilized in the CNS drift analysis, as summarized in Enclosure 1, is similar to the methodology used for previous plant submittals, such as the River Bend

Station, Perry Nuclear Power Plant, and Edwin I. Hatch Nuclear Power Plant LARs. There have been minor revisions incorporated into the CNS drift design guide based on NRC comments or Requests for Additional Information from previous 24-month fuel cycle extension submittals, such as the addition of the requirement that 30 samples are generally required to produce a statistically significant sample set.

The proposed TS changes based on the GL have been divided into two categories. The categories are: (1) changes to surveillances other than channel calibrations, identified as "Non-Calibration Changes"; and (2) changes involving the channel calibration frequency identified as "Calibration Changes." For each component having a surveillance interval extended, historical surveillance test data and associated maintenance records were reviewed in evaluating the effect on safety. In addition, the licensing basis was reviewed for functions associated with each revision to ensure it was not invalidated. Based on the results of these reviews, it is concluded that there is no adverse effect on plant safety due to increasing the surveillance test intervals from 18 months to 24 months, with the continued application of SR 3.0.2, which allows a 25% extension (i.e., grace period up to 30 months) to SR frequencies.

Additionally, to support the above channel calibration changes to a 24-month frequency, some setpoint analysis revisions were required. For two Instrument Functions, TS Allowable Value changes were required (see Sections 3.1.3 and 3.1.4).

Revisions to CNS setpoint calculations have been developed, and affected calibration and functional test procedures will be revised as part of implementation, to reflect the new 30-month drift values. The revised setpoint calculations were developed in accordance with NEDC-31336, "General Electric Instrument Setpoint Methodology" (Reference 6.3). These calculations determined the instrument uncertainties and setpoints for the affected function. The setpoints were determined in a manner suitable to establish limits for their application. As such, the setpoints ensure that sufficient margins are maintained in the applicable safety analyses to confirm the affected instruments are capable of performing their intended design function.

3.1.1 Non-Calibration Changes

GL 91-04 identifies three steps to evaluate non-calibration changes:

STEP 1: Licensees should evaluate the effect on safety of an increase in 18-month surveillance intervals to accommodate a 24-month fuel cycle. This evaluation should support a conclusion that the effect on safety is small.

EVALUATION

Each non-calibration SR frequency being changed has been evaluated with respect to the effect on plant safety. The methodology utilized to justify the conclusion that extending the testing interval has a minimal effect on safety was based on the fact that the function/feature is:

(1) Tested on a more frequent basis during the operating cycle by other plant programs;
(2) Designed to have redundant counterparts or be single failure proof; or
(3) Highly reliable.

A summary of the evaluation of the effect on safety for each non-calibration SR frequency being changed is presented in Attachment 5.

STEP 2: Licensees should confirm that historical plant maintenance and surveillance data support this conclusion.

EVALUATION

The surveillance test history of the affected SRs has been evaluated. This evaluation consisted of a review of available surveillance test results and associated maintenance records for at least five cycles of operation. This included SRs performed up to and including the Fall 2009 refueling outage; although in some cases SRs performed in 2010 and 2011 were also included in the evaluation when older records could not be readily retrieved. With the extension of the testing frequency to 24 months, there will be a longer period between each surveillance performance. If a failure that results in the loss of the associated safety function should occur during the operating cycle, and would only be detected by the performance of the 18-month TS SR, then the increase in the surveillance testing interval could reduce the associated function availability. In addition to evaluating these surveillance failures, potential common failures of similar components tested by different surveillances were also evaluated. This additional evaluation determined whether there is evidence of repetitive failures among similar plant components. These common component failures have been further evaluated to determine if there was an impact on plant reliability. The evaluation determined that current plant programs are adequate to ensure system reliability. The surveillance failures that are detailed in Attachment 5 exclude failures that:

(a) Did not impact a TS safety function or TS operability;
(b) Are detectable by required testing performed more frequently than the 18-month surveillance being extended; or
(c) The cause can be attributed to an associated event such as a preventative maintenance task, human error, previous modification, or previously existing design deficiency; or that were subsequently re-performed successfully with no intervening corrective maintenance (e.g., plant conditions or malfunctioning measurement and test equipment may have caused aborting the test performance).

These categories of failures are not related to potential unavailability due to testing interval extension, and are therefore not listed or further evaluated in this submittal. This review of surveillance test history validated the conclusion that the impact, if any, on system availability will be minimal as a result of the change to a 24-month testing frequency. Specific SR test failures, and justification for this conclusion, are discussed in Attachment 5.

STEP 3: Licensees should confirm that assumptions in the plant licensing basis would not be invalidated on the basis of performing any surveillance at the bounding surveillance interval limit provided to accommodate a 24-month fuel cycle.

EVALUATION

As part of the evaluation of each affected SR, the impact of the changes against the assumptions in the CNS licensing basis was reviewed. In general, testing interval changes have no impact on the plant licensing basis. In some cases, the change to a 24-month fuel cycle may require a change to licensing basis information as described in the Updated Safety Analysis Report (USAR). However, since no changes requiring NRC review and approval have been identified, the USAR changes associated with fuel cycle extension to 24 months will be drafted in accordance with CNS procedures that implement 10 CFR 50.59, "Changes, tests and experiments," and will be submitted in accordance with 10 CFR 50.71, "Maintenance of records, making of reports," paragraph (e).

The performance of surveillances extended for a 24-month fuel cycle will be trended as a part of the Maintenance Rule Program. Degradation in performance will be evaluated to verify that the degradation is not due to the extension of surveillance or maintenance activities.

3.1.2 Calibration Changes

GL 91-04 identifies seven steps for the evaluation of instrumentation calibration changes.

STEP 1: Confirm that instrument drift as determined by as-found and as-left calibration data from surveillance and maintenance records has not, except on rare occasions, exceeded acceptable limits for a calibration interval.

EVALUATION

The effect of longer calibration intervals on the TS instrumentation was evaluated by performing a review of the surveillance test history for the affected instrumentation including, where appropriate, an instrument drift study. In performing the historical evaluation, the recorded channel calibration data for associated instruments for at least five operating cycles were retrieved. This included SRs performed up to and including the Fall 2009 refueling outage; although in some cases SRs performed in 2010 and 2011 were also included in the evaluation when older records were not readily retrievable. By obtaining this past recorded calibration data, an acceptable basis for drawing conclusions about the expectation of satisfactory performance can be made.

The failure history evaluation described in Attachment 5 provides the instances where TS Allowable Values have been exceeded. Attachment 5 provides the basis for the conclusion that these failures are acceptable relative to this criterion.

STEP 2: Confirm that the values of drift for each instrument type (make, model, and range) and application have been determined with a high probability and a high degree of confidence. Provide a summary of the methodology and assumptions used to determine the rate of instrument drift with time based upon historical plant calibration data.

EVALUATION

A listing of the instrument make, model, and range affected by this submittal is provided in Attachment 6. The effect of longer calibration intervals on the TS instrumentation was evaluated by performing an instrument drift study. In performing the drift study, the recorded channel calibration data for associated instruments from at least five operating cycles prior to and including the Fall 2009 refueling outage was typically retrieved; although in some cases SRs performed in 2010 and 2011 were also included in the evaluation when older records were not readily retrievable. By obtaining this past recorded calibration data, analyses were performed to determine a statistically valid representation of instrument drift.

The methodology used to perform the drift analysis is consistent with the methodology utilized by other utilities requesting transition to a 24-month fuel cycle. The methodology is also based on Electric Power Research Institute (EPRI) TR-103335, "Statistical Analysis of Instrument Calibration Data," and is summarized in Enclosure 1.

STEP 3: Confirm that the magnitude of instrument drift has been determined with a high probability and a high degree of confidence for a bounding calibration interval of 30 months for each instrument type (make, model number, and range) and application that performs a safety function. Provide a list of the channels by TS section that identifies these instrument applications.

EVALUATION

In accordance with the methodology described in Enclosure 1, the magnitude of instrument drift has been determined with a high degree of confidence and a high degree of probability (at least 95/95) for a bounding calibration interval of 30 months for each instrument make, model, and range. For instruments not in service long enough to establish a projected drift value, or where an insufficient number of calibrations have been performed to utilize the statistical methods (i.e., fewer than 30 calibrations for any given group of instruments), the SR frequency is proposed to be extended to a 24-month interval based on justification obtained from analysis as presented in Enclosure 1. The list of affected channels by TS section, including instrument make, model, and range, is provided in Attachment 6.

STEP 4: Confirm that a comparison of the projected instrument drift errors has been made with the values of drift used in the setpoint analysis. If this results in revised setpoints to accommodate larger drift errors, provide proposed TS changes to update trip setpoints. If the drift errors result in revised safety analysis to support existing setpoints, provide a summary of the updated analysis conclusions to confirm that safety limits and safety analysis assumptions are not exceeded.

EVALUATION

The projected drift values were compared to the design allowances as calculated in the associated instrument setpoint analyses. Values were incorporated into the projected existing setpoint calculation design allowances, and the analysis of the setpoint, allowable value, and/or analytical limit was reviewed. Revised setpoint calculations were developed, as necessary, to accommodate appropriate drift values. In all but two cases, the 30-month projected drift value for an instrument function could be accommodated within the existing or revised setpoint analysis. In these cases, the SR frequencies were changed to "24 months," with no changes necessary to the TS Allowable Value or licensing basis analytical limit. However, for two TS Instrument Functions, changes were required to TS Allowable Values (see Sections 3.1.3 and 3.1.4).

As necessary, revised CNS setpoint calculations have been developed, and affected calibration and functional test procedures will be revised as part of implementation, to reflect the new 30-month drift values. The revised setpoint calculations were developed in accordance with NEDC-31336. These calculations determined the instrument loop uncertainty and setpoints for the affected function. The setpoints were determined in a manner suitable to establish limits for their application. As such, the revised setpoints ensure that sufficient margins are maintained in the applicable safety analyses to confirm the affected instruments are capable of performing their intended design function.

STEP 5: Confirm that the projected instrument errors caused by drift are acceptable for control of plant parameters to effect a safe shutdown with the associated instrumentation.

EVALUATION

As discussed in the previous sections, the calculated drift values have been compared to drift allowances in the CNS design basis. For instrument loops that provide process variable indication only, an evaluation was performed as described in Attachment 5 to verify that the instruments can still be effectively utilized to perform a plant safe shutdown. In no cases were changes to safe shutdown analyses required to support any change to a 24-month frequency.

STEP 6: Confirm that all conditions and assumptions of the setpoint and safety analyses have been checked and are appropriately reflected in the acceptance criteria of plant surveillance procedures for channel checks, channel functional tests, and channel calibrations.

EVALUATION

Applicable surveillance test procedures are being reviewed and acceptance criteria updated to incorporate the necessary changes resulting from any revision to setpoint calculations. Any necessary changes resulting from the reviews will be incorporated into the instrument surveillance procedures as part of implementation of the 24-month surveillance test frequency. Existing plant processes ensure that the conditions and assumptions of the setpoint and safety analyses have been checked and are appropriately reflected in the acceptance criteria of plant surveillance procedures for channel checks, channel functional tests, and channel calibrations.

STEP 7: Provide a summary description of the program for monitoring and assessing the effects of increased calibration surveillance intervals on instrument drift and its effect on safety.

EVALUATION

Instruments with TS calibration surveillance frequencies extended to 24 months will be monitored and trended. TS calibrations will be subject to TSTF-493 controls, either through direct application of the surveillance Notes, or as described in the TS Bases. Accordingly, these instrument channels will be monitored and trended as described in Section 3.2. This will identify occurrences of instruments found outside of their TS Allowable Value and instruments whose performance is not as assumed in the drift or setpoint analysis. When as-found conditions are outside the TS Allowable Value, an evaluation will be performed in accordance with the CNS corrective action program to determine if the assumptions made to extend the calibration frequency are still valid and to evaluate the effect on plant safety. Evaluations of mechanical components will be completed under the auspices of the Maintenance Rule, 10 CFR 50.65.

3.1.3 Emergency Core Cooling System (ECCS) Instrumentation

Criterion 44 of the 1967 draft GDC, to which NPPD is committed, specifies that at least two ECCS be provided, preferably of different design principles, that will limit the clad metal-water reaction to negligible amounts for all sizes of breaks in the reactor coolant pressure boundary, including the double-ended rupture of the largest pipe. The CNS ECCS is designed to limit clad temperature to below 2200°F over the entire credible spectrum of postulated design basis reactor coolant system breaks. This capability is available concurrently with the loss of all offsite AC power. The ECCS themselves are designed to various levels of component redundancy such that no single active component failure in addition to the accident can prevent adequate core cooling.

Low reactor pressure signals are used as permissives for Recirculation Discharge Valve closure. This ensures that the Low Pressure Coolant Injection (LPCI) subsystems inject into the proper location assumed in the safety analysis. The Reactor Pressure – Low is one of the Functions assumed to be operable and capable of closing the valve during a design basis Loss-of-Coolant Accident (LOCA). The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

There are minimum and maximum TS Allowable Values associated with the Recirculation Discharge Valve Permissive. The minimum TS Allowable Value is chosen to be high enough that the valves close prior to when LPCI injection flow into the core is required. The maximum TS Allowable Value is chosen to be low enough to avoid excessive differential pressures across the Recirculation Discharge Valve. The Reactor Pressure – Low signals are initiated from four pressure switches that sense the reactor dome pressure. The results of the drift analysis indicated that the projected 30-month drift values for these pressure switches exceeded the drift allowance provided in the current setpoint calculation and were outside the maximum TS Allowable Values of ≤ 221 psig. Accordingly, a revised TS Allowable Value of ≤ 246 psig is proposed. The upper analytical limit for this function is a maximum of 200 psid across the Recirculation Discharge Valve throughout the closing stroke following a LOCA. In consideration of the dynamic changes in reactor steam dome and drywell pressures during the valve stroke time, NPPD has analyzed that the valve differential pressure analytical limit is well bounded by reactor steam dome pressures of up to 263 psig. Accordingly, the revised TS Allowable Value of ≤ 246 psig remains bounded by the analytical limit of 200 psid across the Recirculation Discharge Valve when closing following a LOCA.

3.1.4 Low-Low Set (LLS) Instrumentation

NUREG-0737 Item II.K.3.16 observed that the most likely cause of a small break LOCA was from the opening of a Safety Relief Valve (SRV) where the SRV failed to reset. A reduction in this likelihood could be achieved by minimizing the number of times individual SRVs must recycle in performance of the system relief function. In addition, as part of the Mark I Containment Program, there was concern for potential high thrust loads on the discharge piping and the high frequency pressure loading on the containment. The LLS logic and instrumentation is designed to mitigate the above concerns. Upon initiation, the LLS logic will assign preset opening and closing setpoints to two preselected SRVs. These setpoints are selected such that the LLS SRVs will stay open longer (with a minimum blowdown range of 90 psi between SRV opening and closing); thus, releasing more steam to the suppression pool, and hence more energy (and time) will be required for repressurization and subsequent SRV openings.

One SRV is designated as the High LLS valve. Two pressure switches input into the LLS logic for this valve for opening and closing, respectively. A second SRV is designated as the Low LLS valve. Two different pressure switches similarly input into the LLS logic for opening and closing. The High LLS SRV is designed to open at a higher reactor pressure than the Low LLS SRV. Both SRVs are designed to close at the same pressure.

The results of the drift analysis indicated that the projected 30-month drift values for these pressure switches exceeded the drift allowance provided in the current setpoint calculation and were outside the current opening and closing TS Allowable Values for the High and Low LLS SRVs. Accordingly, revised TS Allowable Values are proposed as follows:

LLS SRV	Existing Opening Allowable Value (psig)	Revised Opening Allowable Value (psig)	Existing Closing Allowable Value (psig)	Revised Closing Allowable Value (psig)	Analytical Limit (psig)
High	≥ 1005 and ≤ 1045	≥ 996.5 and ≤ 1040	≥ 855 and ≤ 895	≥ 835 and ≤ 875.5	Open ≤ 1050 Close ≥ 825
Low	≥ 995 and ≤ 1035	≥ 996.5 and ≤ 1010	≥ 855 and ≤ 895	≥ 835 and ≤ 875.5	Open ≤ 1050 Close ≥ 825

As shown, these revised TS Allowable Values remain bounded by their respective Analytical Limits and the 90 psi blowdown criterion.

3.2 TSTF-493, Revision 4, Option A Changes

The Technical Analysis for this application is described in TSTF-493 as referenced in the NRC Notice of Availability published in the *Federal Register* on May 11, 2010 (75 FR 26294). Plant-specific information related to the Technical Analysis is described below to document that the content of TSTF-493, Revision 4, Option A, is applicable to CNS.

3.2.1 Use of the Term "Limiting Trip Setpoint"

The term "Limiting Trip Setpoint" (LTSP) is CNS terminology for the setpoint value calculated by means of the plant-specific setpoint methodology documented in the Updated Safety Analyses Report (USAR) or a document incorporated by reference into the USAR. The actual trip setpoint may be more conservative than the LTSP. The LTSP is the LSSS[1] which is required to be in the TSs by 10 CFR 50.36.

The LTSP is the least conservative value to which the instrument channel is adjusted to actuate. The Allowable Value[2] (AV) is derived from the LTSP. The LTSP is the limiting setting for an operable channel trip setpoint considering all credible instrument errors associated with the instrument channel. The LTSP is the least conservative value (with an as-left tolerance (ALT)) to which the channel must be reset at the conclusion of periodic testing to ensure that the analytical limit (AL) will not be exceeded during an anticipated operational occurrence or accident before the next periodic surveillance or calibration. It is impossible to set a physical instrument channel to an exact value, so a calibration tolerance is established around the LTSP. Therefore, an instrument adjustment is considered successful if the LTSP as-left instrument setting is within the setting tolerance (i.e., a range of values around the LTSP). The Nominal Trip Setpoint (NTSP) is the LTSP with margin added. The NTSP is as conservative as or more conservative than the LTSP.

3.2.2 Addition of Channel Performance Surveillance Notes to TS Instrumentation Functions

The determination to include surveillance Notes for specific Functions in the TS is based on these Functions being automatic protective devices related to variables having significant safety functions as delineated by 10 CFR 50.36(c)(1)(ii)(A). There are two surveillance Notes added to the TSs regarding the use of TS AVs for operability determinations and for assessing channel performance. Evaluation of Exclusion Criterion, (Section 3.2.3 below) discusses the principles applied to determine which Functions are to be annotated with the two surveillance Notes. The list of affected Functions is provided in Section 3.2.3.

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1. 10 CFR 50.36(c)(1(II)(a) states: "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions."
2. The instrument setting "Allowable Value" is a limiting value of an instrument's as-found trip setting used during surveillances. The AV is more conservative than the Analytical Limit (AL) to account for applicable instrument measurement errors consistent with the plant-specific setpoint methodology. If during testing, the actual instrumentation setting is less conservative than the AV, the channel is declared inoperable and actions must be taken consistent with the TS requirements.

Surveillance Note 1 states, "If the as-found channel setpoint is outside its predefined as-found tolerance, then the channel shall be evaluated to verify that it is functioning as required before returning the channel to service."

Surveillance Note 2 states:

> The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

Setpoint calculations establish an LTSP based on the AL of the Safety Analysis to ensure that trips or protective actions will occur prior to exceeding the process parameter value assumed by the Safety Analysis calculations. These setpoint calculations also calculate an allowed limit of expected change (i.e., the as-found tolerance (AFT)) between performances of the surveillance test for assessing the value of the setpoint setting. The least conservative as-found instrument setting value that a channel can have during calibration without requiring performing a TS remedial action is the setpoint AV. Discovering an instrument setting to be less conservative than the setting AV indicates that there may not be sufficient margin between the setting and the AL. TSs [channel calibrations, channel functional tests (with setpoint verification), and trip unit calibrations,] are performed to verify channels are operating within the assumptions of the setpoint methodology calculated LTSP and that channel settings have not exceeded the TS AVs. When the measured as-found setpoint is non-conservative with respect to the AV, the channel is inoperable and the actions identified in the TSs must be taken.

The first surveillance Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its AFT but conservative with respect to the AV. Evaluation of channel performance will verify that the channel will continue to perform in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service.

Verifying that a trip setting is conservative with respect to the AV when a surveillance test is performed does not by itself verify the instrument channel will operate properly in the future. Although the channel was operable during the previous surveillance interval, if it is discovered that channel performance is outside the performance predicted by the plant setpoint calculations for the test interval, then the design basis for the channel may not be met, and proper operation of the channel for a future demand cannot be assured. Surveillance Note 1 formalizes the establishment of the appropriate AFT for each channel. This AFT is applied about the LTSP or about any other more conservative setpoint. The AFT ensures that channel operation is consistent with the assumptions or design inputs used in the setpoint calculations and establishes a high confidence of acceptable channel performance in the future. Because the AFT allows for both conservative and non-conservative deviation from the LTSP, changes in channel performance that are conservative with respect to the LTSP will also be detected and evaluated for possible effects on expected performance.

To implement surveillance Note 2 the ALT for some instrumentation Function channels is established to ensure that realistic values are used that do not mask instrument performance. Setpoint calculations assume that the instrument setpoint is left at the LTSP within a specific ALT (e.g., 25 psig ± 2 psig). A Tolerance band is necessary because it is not possible to read and adjust a setting to an absolute value due to the readability and/or accuracy of the test instruments or the ability to adjust potentiometers. The ALT is normally as small as possible considering the tools and the objective to meet an as low as reasonably achievable calibration setting of the instruments. The ALT is considered in the setpoint calculation. Failure to set the actual plant trip setpoint to the LTSP (or more conservative than the LTSP), and within the ALT, would invalidate the assumptions in the setpoint calculation because any subsequent instrument drift would not start from the expected as-left setpoint.

It should be noted that TS Table 3.3.1.1-1 currently applies footnotes (c) and (d), similar to those proposed in this amendment request, to SR 3.3.1.1.10 and SR 3.3.1.1.12 for Function .b, "Average Power Range Monitors – Neutron Flux – High (Flow-Biased)." These footnotes are deleted and replaced with the TSTF-493 Note 1 and Note 2 as footnotes (a) and (b). The requirements specified in the current notes are encompassed in the proposed TSTF-493 notes.

3.2.3 Evaluation of Exclusion Criterion

Exclusion criteria are used to determine which Functions do not need to receive the proposed footnotes, as discussed in TSTF-493, Revision 4. Instruments are excluded from the additional requirements when their functional purpose can be described as (1) a manual actuation circuit, (2) an automatic actuation logic circuit, or (3) an instrument function that derives input from contacts which have no associated sensor or adjustable device. Many permissives or interlocks are excluded if they derive input from a sensor or adjustable device that is tested as part of another TS function. The list of affected Functions identified in the tables below was developed on the principle that all Functions in the affected TSs are included unless one or more of the exclusion criterion apply. If the excluded functions differ from the list of excluded functions in TSTF-493, Revision 4, a justification for deviation is provided in the Excluded Functions table.

The following tables provide the results of applying the three exclusion criteria (and other optional inclusions as allowed by the TSTF) by identifying instrumentation Functions, by TS Table, for which surveillance Notes 1 and 2 apply and for those instrumentation Functions which do not require the surveillance Notes.

Table 1
Functions Required To Be Annotated

Functions Required to be Annotated	
NUREG-1433	CNS TS
Table 3.3.1.1-1, "Reactor Protection System Instrumentation" Functions	Table 3.3.1.1-1, "Reactor Protection System Instrumentation" Functions
1. Intermediate Range Monitors a. Neutron Flux – High	1. Intermediate Range Monitors a. Neutron Flux – High
2. Average Power Range Monitors a. Neutron Flux – High, Setdown b. Flow Biased Simulated Thermal Power – High c. Fixed Neutron Flux – High d. Downscale	2. Average Power Range Monitors a. Neutron Flux – High (Startup) b. Neutron Flux – High (Flow Biased) c. Neutron Flux – High (Fixed) d. Downscale
3. Reactor Vessel Steam Dome Pressure - High	3. Reactor Vessel Pressure - High
4. Reactor Vessel Water Level – Low, Level 3	4. Reactor Vessel Water Level – Low (Level 3)
6. Drywell Pressure - High	6. Drywell Pressure - High
	7. Scram Discharge Volume Water Level - High a. Level Transmitter
9. Turbine Control Valve Fast Closure, Trip Oil Pressure - Low	9. Turbine Control Valve Fast Closure, DEH Trip Oil Pressure - Low
Table 3.3.2.1-1, "Control Rod Block Instrumentation" Functions	Table 3.3.2.1-1, "Control Rod Block Instrumentation" Functions
1. Rod Block Monitor a. Low Power Range – Upscale b. Intermediate Range – Upscale c. High Power Range – Upscale	1. Rod Block Monitor a. Low Power Range – Upscale b. Intermediate Power Range – Upscale c. High Power Range – Upscale
Specification 3.3.4.1, "EOC-RPT Instrumentation"	"EOC-RPT Instrumentation" not specified in CNS TS.
1. Trip Units	NA
3. Turbine Control Valve – Fast Closure, Trip Oil Pressure - Low	NA
Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation" Functions	Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation" Functions
1. Core Spray System a. Reactor Vessel Water Level – Low Low Low, Level 1 b. Drywell Pressure – High d. Core Spray Pump Discharge Flow - Low (Bypass) (If valve locked open, Function can be removed from TS)	1. Core Spray System a. Reactor Vessel Water Level – Low Low Low (Level 1) b. Drywell Pressure – High d. Core Spray Pump Discharge Flow – Low (Bypass)
2. Low Pressure Coolant Injection (LPCI) System a. Reactor Vessel Water Level – Low Low Low Level 1 b. Drywell Pressure - High g. Low Pressure Coolant Injection Pump Discharge Flow – Low (Bypass) *(If valve locked open, Function can be removed from TS)*	2. Low Pressure Coolant Injection (LPCI) System a. Reactor Vessel Water Level – Low Low Low (Level 1) b. Drywell Pressure - High g. Low Pressure Coolant Injection Pump Discharge Flow – Low (Bypass)

Functions Required to be Annotated	
NUREG-1433	CNS TS
3. High Pressure Coolant Injection (HPCI) System a. Reactor Vessel Water Level - Low Low, Level 2 b. Drywell Pressure – High c. Reactor Vessel Water Level - High, Level 8 (Optional to include surveillance Notes or not) d. Condensate Storage Tank Level – Low (If mechanical device, excluded from surveillance Notes) e. Suppression Pool Water Level – High (If mechanical device, excluded from surveillance Notes) f. High Pressure Coolant Injection Pump Discharge Flow - Low (Bypass) (If valve locked open, Function can be removed from TS)(If mechanical device, excluded from surveillance Notes)	3. High Pressure Coolant Injection (HPCI) System a. Reactor Vessel Water Level - Low Low (Level 2) b. Drywell Pressure – High c. Reactor Vessel Water Level - High (Level 8) (This Function is not assumed to function in the CNS Safety Analyses and is excluded from the surveillance Notes) d. Emergency Condensate Storage Tank (ECST) Level – Low (This is a mechanical device, and is excluded from surveillance Notes) e. Suppression Pool Water Level – High (This is a mechanical device, and is excluded from surveillance Notes) f. High Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)
4. Automatic Depressurization System (ADS) Trip System A a. Reactor Vessel Water Level - Low Low Low, Level 1 b. Drywell Pressure - High d. Reactor Vessel Water Level - Low, Level 3 (Confirmatory)	4. Automatic Depressurization System (ADS) Trip System A a. Reactor Vessel Water Level - Low Low Low (Level 1) NUREG-1433 Function 4.b. not specified in CNS TS c. Reactor Vessel Water Level – Low (Level 3) (Confirmatory)
5. ADS Trip System B a. Reactor Vessel Water Level - Low Low Low, Level 1 b. Drywell Pressure - High d. Reactor Vessel Water Level - Low, Level 3 (Confirmatory)	5. ADS Trip System B a. Reactor Vessel Water Level - Low Low Low (Level 1) NUREG-1433 Function 5.b. not specified in CNS TS) c. Reactor Vessel Water Level - Low, Level 3 (Confirmatory)
Table 3.3.5.2-1, "Reactor Core Isolation Cooling System Instrumentation" Functions	Table 3.3.5.2-1, "Reactor Core Isolation Cooling System Instrumentation" Functions
1. Reactor Vessel Water Level - Low Low, Level 2	1. Reactor Vessel Water Level - Low Low (Level 2)
2. Reactor Vessel Water Level - High, Level 8 - (Optional to include surveillance Notes or not)	2. Reactor Vessel Water Level - High (Level 8) (This Function is not assumed to function in the CNS Safety Analyses and is excluded from the surveillance Notes)
3. Condensate Storage Tank Level - Low (If mechanical device, excluded from surveillance Notes)	3. Emergency Condensate Storage Tank (ECST) Level - Low (This is a mechanical device, and is excluded from surveillance Notes)
4. Suppression Pool Water Level - High (If mechanical device, excluded from surveillance Notes)	NUREG-1433 Function 4 not specified in CNS TS

Table 2
Excluded Functions

Excluded Functions	
NUREG-1433	CNS TS
Table 3.3.1.1-1, "Reactor Protection System Instrumentation" Functions	Table 3.3.1.1-1, "Reactor Protection System Instrumentation" Functions
1. Intermediate Range Monitors b. Inop (Interlock excluded from surveillance Notes)	1. Intermediate Range Monitors b. Inop (Interlock excluded from surveillance Notes)
2. Average Power Range Monitors e. Inop (Interlock excluded from surveillance Notes)	2. Average Power Range Monitors e. Inop (Interlock excluded from surveillance Notes)
5. Main Steam Isolation Valve - Closure (Mechanical device excluded from surveillance Notes)	5. Main Steam Isolation Valve - Closure (Mechanical device excluded from surveillance Notes)

Excluded Functions	
NUREG-1433	CNS TS
7. Scram Discharge Volume Water Level - High a. Resistance Temperature Detector (Mechanical device excluded from surveillance Notes) b. Float Switch (Mechanical device excluded from surveillance Notes)	7. Scram Discharge Volume Water Level – High b. Level Switch (Mechanical device excluded from surveillance Notes) Note: CNS Function 7.a. requires the addition of the two Notes. CNS Function 7.a. uses a level transmitter. NUREG-1433 Function 7.a. not specified in CNS TS
8. Turbine Stop Valve - Closure (Mechanical device excluded from surveillance Notes)	8. Turbine Stop Valve - Closure (Mechanical device excluded from surveillance Notes)
10. Reactor Mode Switch - Shutdown Position (Manual actuation excluded from surveillance Notes)	10. Reactor Mode Switch - Shutdown Position (Manual actuation excluded from surveillance Notes)
11. Manual Scram (Manual actuation excluded from surveillance Notes)	11. Manual Scram (Manual actuation excluded from surveillance Notes)
Table 3.3.2.1-1, "Control Rod Block Instrumentation" Functions	Table 3.3.2.1-1, "Control Rod Block Instrumentation" Functions
1. Rod Block Monitor d. Inop (Interlock excluded from surveillance Notes) e. Downscale (Not part of RPS or ECCS excluded from surveillance Notes) f. Bypass Time Delay (Permissive or interlock excluded from surveillance Notes if it derives input from a sensor or adjustable device that is tested as part of another TS function.)	1. Rod Block Monitor d. Inop (Interlock excluded from surveillance Notes) e. Downscale (Not part of RPS or ECCS excluded from surveillance Notes) NUREG-1433 Function 1.f. not specified in CNS TS
2. Rod Worth Minimizer (Not part of RPS or ECCS excluded from surveillance Notes)	2. Rod Worth Minimizer (Not part of RPS or ECCS excluded from surveillance Notes)
3. Reactor Mode Switch - Shutdown Position (Manual actuation excluded from surveillance Notes)	3. Reactor Mode Switch - Shutdown Position (Manual actuation excluded from surveillance Notes)
Specification 3.3.4.1, "EOC-RPT Instrumentation"	"EOC-RPT Instrumentation" not specified in CNS TS.
2. Turbine Stop Valve - Closure (Mechanical component excluded from surveillance Notes)	NA
Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation" Functions	Table 3.3.5.1-1, "Emergency Core Cooling System Instrumentation" Functions
1. Core Spray System c. Reactor Steam Dome Pressure - Low (Injection Permissive) (Actuation logic excluded from surveillance Notes) e. Manual Initiation (Manual actuation excluded from surveillance Notes)	1. Core Spray System c. Reactor Pressure – Low (Injection Permissive) (Actuation logic excluded from surveillance Notes) e. Core Spray Pump Start - Time Delay Relay (Manual component excluded from surveillance Notes) NUREG-1433 Function 1.e. not specified in CNS TS

Excluded Functions	
NUREG-1433	CNS TS
2. Low Pressure Coolant Injection (LPCI) System c. Reactor Steam Dome Pressure - Low (Injection Permissive) (Actuation logic excluded from surveillance Notes) d. Reactor Steam Dome Pressure - Low (Recirculation Discharge Valve Permissive) (Actuation logic excluded from surveillance Notes) e. Reactor Vessel Shroud Level - Level 0 (Actuation logic excluded from surveillance Notes) f. Low Pressure Coolant Injection Pump Start - Time Delay Relay Pumps A,B,D (Permissive or interlock excluded from surveillance Notes if it derives input from a sensor or adjustable device that is tested as part of another TS function). Pump C (Permissive or interlock excluded from surveillance Notes if it derives input from a sensor or adjustable device that is tested as part of another TS function). h. Manual Initiation (Manual actuation excluded from surveillance Notes)	2. Low Pressure Coolant Injection (LPCI) System c. Reactor Pressure - Low (Injection Permissive) (Actuation logic excluded from surveillance Notes) d. Reactor Pressure - Low (Recirculation Discharge Valve Permissive) (Actuation logic excluded from surveillance Notes) e. Reactor Vessel Shroud Level - Level 0 (Actuation logic excluded from surveillance Notes) f. Low Pressure Coolant Injection Pump Start - Time Delay Relay Pumps B,C (Permissive or interlock excluded from surveillance Notes. It derives input from a sensor or adjustable device that is tested as part of another TS function). Pump A, D (Permissive or interlock excluded from surveillance Notes. It derives input from a sensor or adjustable device that is tested as part of another TS function). NUREG-1433 Function 2.h. not specified in CNS TS
3. High Pressure Coolant Injection (HPCI) System g. Manual Initiation (Manual actuation excluded from surveillance Notes)	3. High Pressure Coolant Injection (HPCI) System c. Reactor Vessel Water Level - High (Level 8) (This Function is not assumed to function in the CNS Safety Analyses and is excluded from the surveillance Notes) d. Emergency Condensate Storage Tank (ECST) Level – Low (This is a mechanical device, and is excluded from surveillance Notes) e. Suppression Pool Water Level – High (This is a mechanical device, and is excluded from surveillance Notes) NUREG-1433 Function 3.g. not specified in CNS TS
4. Automatic Depressurization System (ADS) Trip System A c. Automatic Depressurization System Initiation Timer (Actuation logic excluded from surveillance Notes) e. Core Spray Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) f. Low Pressure Coolant Injection Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) g. Automatic Depressurization System Low Water Level Actuation Timer (Actuation logic excluded from surveillance Notes) h. Manual Initiation (Manual actuation excluded from surveillance Notes)	4. Automatic Depressurization System (ADS) Trip System A b. Automatic Depressurization System Initiation Timer (Actuation logic excluded from surveillance Notes) d. Core Spray Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) e. Low Pressure Coolant Injection Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) NUREG-1433 Functions 4.g and 4.h not specified in CNS TS

Excluded Functions	
NUREG-1433	CNS TS
5. ADS Trip System B c. Automatic Depressurization System Initiation Timer (Actuation logic excluded from surveillance Notes) e. Core Spray Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) f. Low Pressure Coolant Injection Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) g. Automatic Depressurization System Low Water Level Actuation Timer (Actuation logic excluded from surveillance Notes) h. Manual Initiation (Manual actuation excluded from surveillance Notes)	5. ADS Trip System B b. Automatic Depressurization System Initiation Timer (Actuation logic excluded from surveillance Notes) d. Core Spray Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) e. Low Pressure Coolant Injection Pump Discharge Pressure – High (Actuation logic excluded from surveillance Notes) NUREG-1433 Functions 5.g and 5.h not specified in CNS TS
<u>Table 3.3.5.2-1, "Reactor Core Isolation Cooling System Instrumentation" Functions</u>	<u>Table 3.3.5.2-1, "Reactor Core Isolation Cooling System Instrumentation" Functions</u>
5. Manual Initiation (Manual actuation excluded from surveillance Notes)	2. Reactor Vessel Water Level - High (Level 8) (This Function is not assumed to function in the CNS Safety Analyses and is excluded from the surveillance Notes) 3. Emergency Condensate Storage Tank (ECST) Level - Low (This is a mechanical device, and is excluded from surveillance Notes) NUREG-1433 Function 5. not specified in CNS TS

3.3 Other 24-Month Fuel Cycle Considerations

3.3.1 Source Term

The reactor core source term is being re-evaluated to support the transition to 24-month fuel cycles. The current source term is based on the GE14 fuel with an 18-month fuel cycle. The new source term is based on GNF2 fuel with a 24-month fuel cycle. The new source term will affect the calculated doses of certain design basis accidents (LOCA and Fuel Handling Accident), and the radiation received by environmentally qualified electrical equipment. The effects on these analyses are being evaluated under the provisions of 10 CFR 50.59, and are not part of this application.

3.3.2 18-Month Surveillances Not Being Changed

During the evaluation of 18-month SRs it was determined that certain SRs were not eligible to be extended to 24 months. These SR frequencies will be maintained at 18 months as part of this submittal:

<u>TS 3.8.4 DC Sources – Operating</u>

SR 3.8.4.3 Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that degrades battery performance.

SR 3.8.4.4 Remove visible corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.

SR 3.8.4.5	Verify battery connection resistance meets the limits specified in Table 3.8.4-1.
SR 3.8.4.8	Verify battery capacity is $\geq$ 90% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test [when battery shows degradation, or has reached 85% of expected life with capacity of < 100% of manufacturer's rating].

4.0 REGULATORY SAFETY ANALYSIS

NRC GL 91-04 provides generic guidance for evaluating a 24-month surveillance test interval for TS SRs. This request for a license amendment provides the CNS-specific evaluation of each step outlined by the NRC in GL 91-04, including necessary changes to TS allowable Values, and provides a description of the methodology used by NPPD to complete the evaluation for each specific TS SR being revised. NPPD has determined that the proposed changes do not require any exemptions or relief from regulatory requirements, other than the TS, and do not affect conformance with any draft GDC differently than described in the CNS USAR, as described below.

With respect to TSTF-493, Revision 4, Option A, a description of the proposed TS change and its relationship to applicable regulatory requirements were published in the Federal Register Notice of Availability on May 11, 2010 (75 FR 26294). NPPD has reviewed the NRC staff's model SE published as part of the Notice of Availability and concluded that the regulatory evaluation section is applicable to CNS.

4.1 Applicable Regulatory Requirements/Criteria

Construction of CNS predated the 1971 issuance of 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants." CNS USAR Appendix F, "Conformance to AEC Proposed General Design Criteria," describes that CNS is designed to conform to the proposed GDC published in the July 11, 1967, *Federal Register*, except where commitments were made to specific 1971 GDC. It notes that the Atomic Energy Commission accepted CNS conformance with these proposed GDC.

The following is a discussion of the applicable regulations, the draft GDC from USAR Appendix F, and other applicable regulatory criteria, along with a discussion of continued conformance.

4.1.1 10 CFR 50.36, Technical Specifications

Regulatory requirement 10 CFR 50.36, "Technical Specifications," provides the content required in licensee TS. Specifically, 10 CFR 50.36(c)(3) requires that the TS include surveillance requirements. The proposed SR frequency changes and application of the TSTF-493 Notes continue to support the requirements of 10 CFR 50.36(c)(3) to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation are met.

4.1.2 Applicable Draft General Design Criteria

Draft GDC 25 – Demonstration of Functional Operability of Protection Systems

"Means shall be included for testing protection systems while the reactor is in operation to demonstrate that no failure or loss of redundancy has occurred."

Since the physical configuration, design, and TS Allowable Values of the reactor protection system instrumentation functions are not changed, the extension of certain surveillance frequencies to 24 months has no impact on this criterion, and it continues to be satisfied. Application of the TSTF-493 surveillance Notes provides conservative assurance of instrumentation functionality, so conformance with this draft GDC is not adversely affected.

Draft GDC 38 – Reliability and Testability of Engineered Safety Features

"All engineered safety features shall be designed to provide high functional reliability and ready testability. In determining the suitability of a facility for a proposed site, the degree of reliance upon and acceptance of the inherent and engineered safety afforded by the systems, including engineered safety features, will be influenced by the known and the demonstrated performance capability and reliability of the systems, and by the extent to which the operability of such systems can be tested and inspected where appropriate during the life of the plant."

Extending certain engineered safety feature SR frequencies to 24 months does not affect physical configuration, or design of the engineered safety features or associated instrumentation functions. Application of the TSTF-493 surveillance Notes provides conservative assurance of engineered safety feature instrumentation functionality. Accordingly, continued conformance to this draft GDC is maintained.

Draft GDC 46 – Testing of Emergency Core Cooling System Components

"Design provisions shall be made so that active components of the emergency core cooling systems, such as pumps and valves, can be tested periodically for operability and required functional performance."

Extending certain ECCS SR frequencies to 24 months does not affect physical configuration, or design of ECCS components. This draft GDC is not applicable to implementation of TSTF-493. Accordingly, continued conformance to this draft GDC is maintained.

Draft GDC 47 – Testing of Emergency Core Cooling Systems

"A capability shall be provided to test periodically the delivery capability of the emergency core cooling systems at a location as close to the core as is practical."

Extending certain ECCS SR frequencies to 24 months does not affect physical configuration, or design of the ECCS. This draft GDC is not applicable to implementation of TSTF-493. Accordingly, continued conformance to this draft GDC is maintained.

Draft GDC 48 – Testing of Operational Sequence of Emergency Core Cooling Systems

"A capability shall be provided to test under conditions as close to design as practical the full operational sequence that would bring the emergency core cooling systems into action, including the transfer to alternate power sources."

Extending certain ECCS SR frequencies to 24 months, including certain changes to TS Allowable Values, does not affect physical configuration, or design of the ECCS or associated instrumentation functions. Application of the TSTF-493 surveillance Notes provides conservative assurance of ECCS instrumentation functionality. Accordingly, continued conformance to this draft GDC is maintained.

Draft GDC 57 – Provisions for Testing of Isolation Valves

"Capability shall be provided for testing functional operability of valves and associated apparatus essential to the containment function for establishing that no failure has occurred and for determining that valve leakage does not exceed acceptable limits."

Extending certain Primary Containment Isolation Valves (PCIV) SR frequencies to 24 months does not affect physical configuration, or design of the PCIVs or associated Primary Containment isolation instrumentation functions. This draft GDC is not applicable to implementation of TSTF-493. Accordingly, continued conformance to this draft GDC is maintained.

Draft GDC 64 – Testing of Air Cleanup Systems

"A capability shall be provided for in situ periodic testing and surveillance of the air cleanup systems to ensure (a) filter bypass paths have not developed and (b) filter and trapping materials have not deteriorated beyond acceptable limits."

Extending certain air cleanup system testing frequencies to 24 months does not affect physical configuration, or design of these systems. The review of the surveillance history of the air cleanup systems has demonstrated the extension of the testing frequencies from 18 months to 24 months will not result in filter bypass paths during plant operation. This draft GDC is not applicable to implementation of TSTF-493. Accordingly, continued conformance to this draft GDC is maintained.

Draft GDC 65 – Testing of Operational Sequence of Air Cleanup Systems

"A capability shall be provided to test under conditions as close to design as practical the full operational sequence that would bring the air cleanup systems into action, including the transfer to alternate power sources and the design air flow delivery capability."

Extending certain air cleanup system testing frequencies to 24 months does not affect physical configuration, or design of the air cleanup systems or associated actuation instrumentation functions. This draft GDC is not applicable to implementation of TSTF-493. Accordingly, continued conformance to this draft GDC is maintained.

4.2 Precedent

In NRC GL 91-04, the NRC provided generic guidance for evaluating a 24-month surveillance test interval for TS SRs that are currently performed at 18-month intervals. The methodology utilized in the CNS drift analysis and scope of this License Amendment Request is similar to previously approved applications. There have been minor revisions incorporated into the CNS drift design guide based on NRC comments or Requests for Additional Information from previous 24-month fuel cycle extension submittals. The most recent applicable precedent is cited:

River Bend Station – License Amendment 168, dated August 31, 2010

There are no approved precedents for TSTF-493, Revision 4, Option A. However, the following submittal is currently under NRC review:

Vogtle Electric Generating Plant – Letter dated March 3, 2011 (ADAMS Accession Number ML110660458)

4.3 No Significant Hazards Consideration

10 CFR 50.91(a)(1) requires that licensee requests for operating license amendments be accompanied by an evaluation of no significant hazard posed by issuance of the amendment. Nebraska Public Power District (NPPD) has evaluated this proposed amendment with respect to the criteria given in 10 CFR 50.92(c). The following is the evaluation required by 10 CFR 50.91(a)(1).

NPPD is requesting an amendment of the Operating License for the Cooper Nuclear Station (CNS) to revise Technical Specification (TS) surveillance and testing requirements to accommodate a 24-month fuel cycle. Additionally, NPPD is requesting an amendment to adopt Technical Specifications Task Force (TSTF) 493, Revision 4, Option A.

4.3.1 Generic Letter 91-04 Changes (24-Month Fuel Cycle)

Nebraska Public Power District (NPPD) has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. **Do the proposed changes involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Response: No.

   The proposed TS changes involve a change in the surveillance testing intervals and certain TS Allowable Values to facilitate a change in the operating cycle length. The proposed TS changes do not physically impact the plant. The proposed TS changes do not degrade the performance of, or increase the challenges to, any safety systems assumed to function in the accident analysis. The proposed TS changes do not impact the usefulness of the surveillance and testing requirements in evaluating the operability of required systems and components, or the way in which the surveillances are performed. In addition, the frequency of surveillance testing and TS Allowable Values are not considered initiators of any analyzed accident, nor do revisions to the frequency or TS Allowable Values introduce any accident initiators. Therefore, the proposed change does not involve a significant increase in the probability of an accident previously evaluated.

   The consequences of a previously evaluated accident are not significantly increased. The proposed changes to surveillance frequencies do not affect the performance of any equipment credited to mitigate the radiological consequences of an accident. The changes to the TS Allowable Values remain bounded by their associated analytical limits. Evaluation of the proposed TS changes demonstrated that the availability of credited equipment is not significantly affected because of other more frequent testing that is performed, the availability of redundant systems and equipment, and the high reliability of the equipment. Historical review of surveillance test results and associated maintenance records did not find evidence of failures that would invalidate the above conclusions.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Do the proposed changes create the possibility of a new or different kind of accident from any accident previously evaluated?**

Response: No.

The proposed TS changes involve a change in the surveillance testing intervals and certain changes to TS Allowable Values to facilitate a change in the operating cycle length. The proposed TS changes do not introduce any failure mechanisms of a different type than those previously evaluated, since there are no physical configuration or design changes being made to the facility.

No new or different equipment is being installed. No installed equipment is being operated in a different manner. As a result, no new failure modes are being introduced. Although certain instrument setpoints and TS Allowable Values are being revised, the way surveillance tests are performed remains unchanged. The TS Allowable Values remain bounded by their associated analytical limits. A historical review of surveillance test results and associated maintenance records indicated there was no evidence of any failures that would invalidate the above conclusions.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Do the proposed changes involve a significant reduction in a margin of safety?**

Response: No.

The proposed TS changes involve a change in the surveillance testing intervals and certain TS Allowable Values to facilitate a change in the operating cycle length. The impact of these changes on system availability is not significant, based on other more frequent testing that is performed, the existence of redundant systems and equipment, and overall system reliability. The revised TS Allowable Values remain bounded by their associated analytical limits. Evaluations have shown there is no evidence of time dependent failures that would impact the availability of the systems. The proposed changes do not significantly impact the condition or performance of structures, systems, and components relied upon for accident mitigation. The proposed changes do not result in any hardware changes or in any changes to the analytical limits assumed in accident analyses. Existing operating margin between plant conditions and actual plant setpoints is not significantly reduced due to these changes. The proposed changes do not significantly impact any safety analysis assumptions or results.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the responses to the above questions, NPPD concludes that the proposed amendment with respect to GL 91-04-related changes presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c) and, accordingly, a finding of "no significant hazards consideration" is justified.

4.3.2 TSTF-493, Revision 4, Option A Changes

Nebraska Public Power District (NPPD) has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. **Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Response: No.

   The proposed change adds test requirements to TS instrument functions related to those variables that have a significant safety function to ensure that instruments will function as required to initiate protective systems or actuate mitigating systems at the point assumed in the applicable safety analysis. Surveillance tests are not an initiator to any accident previously evaluated. As a result, the probability of any accident previously evaluated is not significantly increased. The systems and components required by the TS for which surveillance tests are added are still required to be operable, meet the acceptance criteria for the surveillance requirements, and be capable of performing any mitigation function assumed in the accident analysis.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?**

   Response: No.

   The change does not involve a physical alteration of the plant, i.e., no new or different type of equipment will be installed. The change does not alter assumptions made in the safety analysis but ensures that the instruments perform as assumed in the accident analysis. The proposed change is consistent with the safety analysis assumptions.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. **Does the proposed amendment involve a significant reduction in a margin of safety?**

   Response: No.

   The proposed change adds test requirements that will assure that (1) technical specifications instrumentation Allowable Values will be limiting settings for assessing instrument channel operability and (2) will be conservatively determined so that evaluation of instrument performance history and the as-left tolerance (ALT) requirements of the calibration procedures will not have an adverse effect on equipment operability. The testing methods and acceptance criteria for systems, structures, and components, specified in applicable codes and standards (or alternatives approved for use by the NRC) will continue to be met as described in the plant licensing basis including the Updated Safety Analysis Report. There is no impact to safety analysis acceptance criteria as described in the plant licensing basis because no change is made to the accident analysis assumptions.

   Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, NPPD concludes that the proposed amendment to adopt TSTF-493, Revision 4, Option A presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusion

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5.0 ENVIRONMENTAL CONSIDERATION

The proposed change would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, and would change an inspection or surveillance requirement. However, the proposed change does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure.

Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed change.

6.0 REFERENCES

6.1 NRC Generic Letter 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle," dated April 2, 1991

6.2 Letter from the Technical Specifications Task Force to U.S. Nuclear Regulatory Commission, dated July 31, 2009, "Transmittal of TSTF-493, Rev. 4, 'Clarify Application of Setpoint Methodology for LSSS Functions.'"

6.3 NEDC-31336P-A, September 1996, "General Electric Instrument Setpoint Methodology."

Attachment 2

Proposed Technical Specification Revisions (Markup)

Cooper Nuclear Station, Docket No. 50-298, DPR-46

<u>Revised Technical Specification Pages Associated With a 24-Month Fuel Cycle</u>

3.1-22	3.3-60	3.6-24
3.1-26	3.3-62	3.6-33
3.3-5	3.3-65	3.6-37
3.3-12	3.3-68	3.6-40
3.3-18	3.4-7	3.7-5
3.3-21	3.5-5	3.7-7
3.3-24	3.5-6	3.7-10
3.3-27	3.5-10	3.7-15
3.3-30	3.5-12	3.8-7
3.3-36	3.5-13	3.8-8
3.3-38	3.6-2	3.8-9
3.3-45	3.6-14	3.8-17
3.3-50	3.6-15	3.8-18
3.3-56	3.6-19	5.0-7
3.3-59	3.6-22	5.0-11
		5.0-18

<u>Revised Technical Specification Pages Associated With TSTF-493, Revision 4, Option A</u>

3.3-6
3.3-7
3.3-8
3.3-19
3.3-37
3.3-38
3.3-39
3.3-40
3.3-41
3.3-42
3.3-46

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.7.6	Verify each SLC subsystem manual valve in the flow path that is not locked, sealed, or otherwise secured in position, is in the correct position or can be aligned to the correct position.	31 days
SR 3.1.7.7	Verify each pump develops a flow rate $\geq$ 38.2 gpm at a discharge pressure $\geq$ 1300 psig.	In accordance with the Inservice Testing Program
SR 3.1.7.8	Verify flow through one SLC subsystem from pump into reactor pressure vessel.	~~18~~ 24 months on a STAGGERED TEST BASIS
SR 3.1.7.9	Verify all heat traced piping between storage tank and pump suction is unblocked.	~~18~~ 24 months AND Once within 24 hours after solution temperature is restored within the limits of Figure 3.1.7-2

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1	-------------------NOTE------------------- Not required to be met on vent and drain valves closed during performance of SR 3.1.8.2. -- Verify each SDV vent and drain valve is open.	31 days
SR 3.1.8.2	Cycle each SDV vent and drain valve to the fully closed and fully open position.	92 days
SR 3.1.8.3	Verify each SDV vent and drain valve: a. Closes in ≤ 30 seconds after receipt of an actual or simulated scram signal; and b. Opens when the actual or simulated scram signal is reset.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.1.11	Perform CHANNEL FUNCTIONAL TEST.	~~18~~ months 24
SR 3.3.1.1.12	----------NOTES---------- 1. Neutron detectors are excluded. 2. For Function 1, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. -------------------- Perform CHANNEL CALIBRATION.	~~18~~ months 24
SR 3.3.1.1.13	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ months 24
SR 3.3.1.1.14	Verify Turbine Stop Valve — Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure — Low Functions are not bypassed when THERMAL POWER is ≥ 29.5% RTP.	~~18~~ months 24
SR 3.3.1.1.15	----------NOTE---------- Neutron detectors are excluded. -------------------- Verify the RPS RESPONSE TIME is within limits.	~~18~~ months 24

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.2.4	------------------NOTE------------------ Not required to be met with less than or equal to four fuel assemblies adjacent to the SRM and no other fuel assemblies in the associated core quadrant. -- Verify count rate is ≥ 3.0 cps with a signal to noise ratio ≥ 2:1.	12 hours during CORE ALTERATIONS AND 24 hours
SR 3.3.1.2.5	Perform CHANNEL FUNCTIONAL TEST and determination of signal to noise ratio.	7 days
SR 3.3.1.2.6	------------------NOTE------------------ Not required to be performed until 12 hours after IRMs on Range 2 or below. -- Perform CHANNEL FUNCTIONAL TEST and determination of signal to noise ratio.	31 days
SR 3.3.1.2.7	------------------NOTES------------------ 1. Neutron detectors are excluded. 2. Not required to be performed until 12 hours after IRMs on Range 2 or below. -- Perform CHANNEL CALIBRATION.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.2.1.5	---------------------------NOTE--------------------------- Neutron detectors are excluded. --- Perform CHANNEL CALIBRATION.	184 days
SR 3.3.2.1.6	Verify the RWM is not bypassed when THERMAL POWER is ≤ 9.85% RTP.	~~18~~ $\boxed{24}$ months
SR 3.3.2.1.7	---------------------------NOTE--------------------------- Not required to be performed until 1 hour after reactor mode switch is in the shutdown position. --- Perform CHANNEL FUNCTIONAL TEST.	~~18~~ $\boxed{24}$ months
SR 3.3.2.1.8	Verify control rod sequences input to the RWM are in conformance with BPWS.	Prior to declaring RWM OPERABLE following loading of sequence into RWM

SURVEILLANCE REQUIREMENTS

------------------------------------NOTE------------------------------------

When a 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 feedwater and main turbine high water level trip capability is maintained.

SURVEILLANCE		FREQUENCY
SR 3.3.2.2.1	Perform CHANNEL CHECK.	24 hours
SR 3.3.2.2.2	Perform CHANNEL CALIBRATION. The Allowable Value shall be ≤ 54.0 inches.	~~18~~ 24 months
SR 3.3.2.2.3	Perform LOGIC SYSTEM FUNCTIONAL TEST including valve actuation.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.3.1.1	Perform CHANNEL CHECK on each required PAM Instrumentation channel.	31 days
SR 3.3.3.1.2	Perform CHANNEL CALIBRATION of the Primary Containment H_2 and O_2 Analyzers.	92 days
SR 3.3.3.1.3	Perform CHANNEL CALIBRATION of each required PAM Instrumentation channel except for the Primary Containment H_2 and O_2 Analyzers.	~~18~~ months

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.3.3.2.2 Verify each required control circuit and transfer switch is capable of performing the intended function.	~~18~~ 24 months
SR 3.3.3.2.3 Perform CHANNEL CALIBRATION for each required instrumentation channel.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

------------------------------------NOTE------------------------------------
When a 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 ATWS-RPT trip capability.

SURVEILLANCE		FREQUENCY
SR 3.3.4.1.1	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.4.1.2	Perform CHANNEL CALIBRATION. The Allowable Values shall be: a. Reactor Vessel Water Level — Low Low (Level 2): ≥ -42 inches; and b. Reactor Pressure — High: ≤ 1072 psig.	~~18~~ 24 months
SR 3.3.4.1.3	Perform LOGIC SYSTEM FUNCTIONAL TEST including breaker actuation.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

NOTES

1. Refer to Table 3.3.5.1-1 to determine which SRs apply for each ECCS Function.
2. When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed as follows: (a) for up to 6 hours for Functions 3.c and 3.f; and (b) for up to 6 hours for Functions other than 3.c and 3.f provided the associated Function or the redundant Function maintains ECCS initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.5.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.5.1.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.5.1.3	Perform CHANNEL CALIBRATION.	92 days
SR 3.3.5.1.4	Perform CHANNEL CALIBRATION.	~~18~~ 24 months
SR 3.3.5.1.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ 24 months

Table 3.3.5.1-1 (page 2 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
b. Drywell Pressure - High	1,2,3	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 1.84 psig
c. Reactor Pressure - Low (Injection Permissive)	1,2,3	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
	4[a], 5[a]	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
d. Reactor Pressure - Low (Recirculation Discharge Valve Permissive)	1[c], 2[c], 3[c]	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 199 psig and ≤ ~~221~~ 246 psig
e. Reactor Vessel Shroud Level - Level 0	1,2,3	2	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ -193.19 inches
f. Low Pressure Coolant Injection Pump Start - Time Delay Relay	1,2,3, 4[a], 5[a]	1 per pump	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	
Pumps B,C					≥ 4.5 seconds and ≤ 5.5 seconds
Pumps A,D					≤ 0.5 second

(continued)

(a) When associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown.

(c) With associated recirculation pump discharge valve open.

SURVEILLANCE REQUIREMENTS

----------------------------------NOTES----------------------------------

1. Refer to Table 3.3.5.2-1 to determine which SRs apply for each RCIC Function.

2. When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed as follows: (a) for up to 6 hours for Function 2; and (b) for up to 6 hours for Functions 1 and 3 provided the associated Function maintains RCIC initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.5.2.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.5.2.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.5.2.3	Perform CHANNEL CALIBRATION.	92 days
SR 3.3.5.2.4	Perform CHANNEL CALIBRATION.	~~18~~ 24 months
SR 3.3.5.2.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

------------------------------------NOTES------------------------------------

1. Refer to Table 3.3.6.1-1 to determine which SRs apply for each Primary Containment Isolation Function.

2. When a 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 isolation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.6.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.6.1.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.6.1.3	Perform CHANNEL CALIBRATION.	92 days
SR 3.3.6.1.4	-------------------NOTE------------------ For Function 2.d, radiation detectors are excluded. --- Perform CHANNEL CALIBRATION.	~~18~~ 24 months
SR 3.3.6.1.5	Calibrate each radiation detector.	~~18~~ 24 months
SR 3.3.6.1.6	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.6.2.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.6.2.3	Perform CHANNEL CALIBRATION.	~~18~~ 24 months
SR 3.3.6.2.4	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

-----------------------------------NOTES-----------------------------------

1. Refer to Table 3.3.6.3-1 to determine which SRs apply for each Function.

2. When a 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 LLS initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.6.3.1	Perform CHANNEL FUNCTIONAL TEST for portion of the channel outside primary containment.	92 days
SR 3.3.6.3.2	------------------NOTE------------------ Only required to be performed prior to entering MODE 2 during each scheduled outage > 72 hours when entry is made into primary containment. --- Perform CHANNEL FUNCTIONAL TEST for portions of the channel inside primary containment.	92 days
SR 3.3.6.3.3	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.6.3.4	Perform CHANNEL CALIBRATION.	~~18~~ 24 months
SR 3.3.6.3.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ 24 months

Table 3.3.6.3-1 (page 1 of 1)
Low-Low Set Instrumentation

FUNCTION	REQUIRED CHANNELS PER FUNCTION	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Reactor Pressure—High	1 per LLS valve	SR 3.3.6.3.3 SR 3.3.6.3.4 SR 3.3.6.3.5	≤ 1050 psig
2. Low-Low Set Pressure Setpoints	2 per LLS valve	SR 3.3.6.3.3 SR 3.3.6.3.4 SR 3.3.6.3.5	Low: Open ≥ ~~995 psig~~ 996.5 psig and ≤ ~~1035 psig~~ 1010 psig Close ≥ ~~855 psig~~ 835 psig and ≤ ~~895 psig~~ 875.5 psig High: Open ≥ ~~1005 psig~~ 996.5 psig and ≤ ~~1045 psig~~ 1040 psig Close ≥ ~~855 psig~~ 835 psig and ≤ ~~895 psig~~ 875.5 psig
3. Discharge Line Pressure Switch	1 per SRV	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.4 SR 3.3.6.3.5	≥ 25 psig and ≤ 55 psig

SURVEILLANCE REQUIREMENTS

---NOTES---

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

2. When a 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 CREF initiation capability.

	SURVEILLANCE	FREQUENCY
SR 3.3.7.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.7.1.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.7.1.3	Perform CHANNEL CALIBRATION.	~~18~~ months 24
SR 3.3.7.1.4	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ months 24

SURVEILLANCE REQUIREMENTS

NOTES

1. Refer to Table 3.3.8.1-1 to determine which SRs apply for each LOP Function.

2. When a 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 2 hours provided the associated Function maintains DG initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.8.1.1	Perform CHANNEL FUNCTIONAL TEST.	31 days
SR 3.3.8.1.2	Perform CHANNEL CALIBRATION.	~~18~~ 24 months
SR 3.3.8.1.3	Perform LOGIC SYSTEM FUNCTIONAL TEST.	~~18~~ 24 months

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A or B not met in MODE 5 with any control rod withdrawn from a core cell containing one or more fuel assemblies.	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
SR 3.3.8.2.1	Perform CHANNEL CALIBRATION. The Allowable Values shall be: a. Overvoltage ≤ 131 V with time delay set to ≤ 3.8 seconds. b. Undervoltage ≥ 109 V, with time delay set to ≤ 3.8 seconds. c. Underfrequency ≥ 57.2 Hz, with time delay set to ≤ 3.8 seconds.	~~18~~ 24 months
SR 3.3.8.2.2	Perform a system functional test.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.3.1	Verify the safety function lift setpoints of the SRVs and SVs are as follows: Number of SRVs — Setpoint (psig) 2 — 1080 ± 32.4 3 — 1090 ± 32.7 3 — 1100 ± 33.0 Number of SVs — Setpoint (psig) 3 — 1240 ± 37.2 Following testing, lift settings shall be within ± 1%.	In accordance with the Inservice Testing Program
SR 3.4.3.2	-------------------NOTE------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. -- Verify each SRV opens when manually actuated.	24 ~~18~~ months

SURVEILLANCE REQUIREMENTS (continued)

<table>
<tr><th colspan="2">SURVEILLANCE</th><th>FREQUENCY</th></tr>
<tr><td>SR 3.5.1.6</td><td>Verify the following ECCS pumps develop the specified flow rate against a system head corresponding to the specified reactor pressure.
<table>
<tr><th>SYSTEM</th><th>FLOW RATE</th><th>NO. OF PUMPS</th><th>SYSTEM HEAD CORRESPONDING TO A REACTOR PRESSURE OF</th></tr>
<tr><td>Core Spray</td><td>≥ 4720 gpm</td><td>1</td><td>≥ 113 psig</td></tr>
<tr><td>LPCI</td><td>≥ 15,000 gpm</td><td>2</td><td>≥ 20 psig</td></tr>
</table></td><td>In accordance with the Inservice Testing Program</td></tr>
<tr><td>SR 3.5.1.7</td><td>------------------NOTE------------------
Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test.

Verify, with reactor pressure ≤ 1020 and ≥ 920 psig, the HPCI pump can develop a flow rate ≥ 4250 gpm against a system head corresponding to reactor pressure.</td><td>92 days</td></tr>
<tr><td>SR 3.5.1.8</td><td>------------------NOTE------------------
Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test.

Verify, with reactor pressure ≤ 165 psig, the HPCI pump can develop a flow rate ≥ 4250 gpm against a system head corresponding to reactor pressure.</td><td>24
~~18~~ months</td></tr>
</table>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.5.1.9	-----NOTES----- 1. For HPCI only, not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. 2. Vessel injection/spray may be excluded. ---------- Verify each ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.	~~18~~ months 24
SR 3.5.1.10	-----NOTE----- Valve actuation may be excluded. ---------- Verify the ADS actuates on an actual or simulated automatic initiation signal.	~~18~~ months 24
SR 3.5.1.11	-----NOTE----- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. ---------- Verify each ADS valve opens when manually actuated.	~~18~~ months 24

SURVEILLANCE REQUIREMENTS (continued)

<table>
<tr><th colspan="2">SURVEILLANCE</th><th>FREQUENCY</th></tr>
<tr><td>SR 3.5.2.4</td><td>Verify each required ECCS pump develops the specified flow rate against a system head corresponding to the specified reactor pressure.
<table>
<tr><th>SYSTEM</th><th>FLOW RATE</th><th>NO. OF PUMPS</th><th>SYSTEM HEAD CORRESPONDING TO A REACTOR PRESSURE OF</th></tr>
<tr><td>CS</td><td>≥ 4720 gpm</td><td>1</td><td>≥ 113 psig</td></tr>
<tr><td>LPCI</td><td>≥ 7700 gpm</td><td>1</td><td>≥ 20 psig</td></tr>
</table></td><td>In accordance with the Inservice Testing Program</td></tr>
<tr><td>SR 3.5.2.5</td><td>-----------------------------NOTE-----------------------------
Vessel injection/spray may be excluded.

Verify each required ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.</td><td>24 ~~18~~ months</td></tr>
</table>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.3.1	Verify the RCIC System piping is filled with water from the pump discharge valve to the injection valve.	31 days
SR 3.5.3.2	Verify each RCIC System manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.5.3.3	-------------------NOTE------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. -- Verify, with reactor pressure ≤ 1020 psig and ≥ 920 psig, the RCIC pump can develop a flow rate ≥ 400 gpm against a system head corresponding to reactor pressure.	92 days
SR 3.5.3.4	-------------------NOTE------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. -- Verify, with reactor pressure ≤ 165 psig, the RCIC pump can develop a flow rate ≥ 400 gpm against a system head corresponding to reactor pressure.	~~18~~ months 24

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.3.5	-------------------NOTES------------------ 1. Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. 2. Vessel injection may be excluded. -- Verify the RCIC System actuates on an actual or simulated automatic initiation signal.	~~18~~ months 24

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.1.1.1	Perform required visual examinations and leakage rate testing except for primary containment air lock testing, in accordance with the Primary Containment Leakage Rate Testing Program.	In accordance with the Primary Containment Leakage Rate Testing Program
SR 3.6.1.1.2	Verify drywell to suppression chamber bypass leakage is equivalent to a hole < 1.0 inch in diameter.	24 ~~18~~ months <u>AND</u> --------NOTE-------- Only required after two consecutive tests fail and continues until two consecutive tests pass ---------------------- 9 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.1.3.6	Verify the isolation time of each MSIV is ≥ 3 seconds and ≤ 5 seconds.	In accordance with the Inservice Testing Program
SR 3.6.1.3.7	Verify each automatic PCIV actuates to the isolation position on an actual or simulated isolation signal.	~~18~~ months 24
SR 3.6.1.3.8	Verify a representative sample of reactor instrumentation line EFCVs actuate to the isolation position on an actual or simulated instrument line break.	~~18~~ months 24
SR 3.6.1.3.9	Remove and test the explosive squib from each shear isolation valve of the TIP System.	~~18~~ months on a STAGGERED TEST BASIS 24
SR 3.6.1.3.10	Verify leakage rate through each Main Steam line is ≤ 106 scfh when tested at ≥ 29 psig.	In accordance with the Primary Containment Leakage Rate Testing Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.1.3.11	Verify each inboard 24 inch primary containment purge and vent valve is blocked to restrict the maximum valve opening angle to 60°.	~~18~~ 24 months
SR 3.6.1.3.12	Verify leakage rate through the Main Steam Pathway is ≤ 212 scfh when tested at ≥ 29 psig.	In accordance with the Primary Containment Leakage Rate Testing Program

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.1.6.1	-------------------NOTE------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. -- Verify each LLS valve opens when manually actuated.	~~18~~ 24 months
SR 3.6.1.6.2	-------------------NOTE------------------- Valve actuation may be excluded. -- Verify the LLS System actuates on an actual or simulated automatic initiation signal.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.1.7.3	Verify the full open setpoint of each vacuum breaker is ≤ 0.5 psid.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.1.8.1	-------------------NOTE------------------- Not required to be met for vacuum breakers that are open during Surveillances. -- Verify each vacuum breaker is closed.	14 days
SR 3.6.1.8.2	Perform a functional test of each required vacuum breaker.	31 days
SR 3.6.1.8.3	Verify the opening setpoint of each required vacuum breaker is ≤ 0.5 psid.	~~18~~ months 24

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. (continued)	C.2 Initiate action to suspend OPDRVs.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.4.1.1	Verify secondary containment vacuum is $\geq$ 0.25 inch of vacuum water gauge.	24 hours
SR 3.6.4.1.2	Verify all secondary containment equipment hatches are closed and sealed.	31 days
SR 3.6.4.1.3	Verify one secondary containment access door in each access opening is closed.	31 days
SR 3.6.4.1.4	Verify each SGT subsystem can maintain $\geq$ 0.25 inch of vacuum water gauge in the secondary containment for 1 hour at a flow rate $\leq$ 1780 cfm.	~~18~~ 24 months on a STAGGERED TEST BASIS

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.4.2.1	-----NOTES----- 1. Valves and blind flanges in high radiation areas may be verified by use of administrative means. 2. Not required to be met for SCIVs that are open under administrative controls. ----- Verify each secondary containment isolation manual valve and blind flange that is not locked, sealed, or otherwise secured and is required to be closed during accident conditions is closed.	31 days
SR 3.6.4.2.2	Verify the isolation time of each power operated automatic SCIV is within limits.	In accordance with the Inservice Testing Program
SR 3.6.4.2.3	Verify each automatic SCIV actuates to the isolation position on an actual or simulated actuation signal.	~~18~~ 24 months

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. (continued)	E.2 Initiate action to suspend OPDRVs.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.4.3.1	Operate each SGT subsystem for ≥ 10 continuous hours with heaters operating.	31 days
SR 3.6.4.3.2	Perform required SGT filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.6.4.3.3	Verify each SGT subsystem actuates on an actual or simulated initiation signal.	~~18~~ 24 months
SR 3.6.4.3.4	Verify the SGT units cross tie damper is in the correct position, and each SGT room air supply check valve and SGT dilution air shutoff valve can be opened.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.2.3	-------------------NOTE------------------- Isolation of flow to individual components does not render SW System inoperable. -- Verify each SW subsystem manual, power operated, and automatic valve in the flow paths servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.2.4	Verify each SW subsystem actuates on an actual or simulated initiation signal.	~~18~~ months $\boxed{24}$

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.3.1	-----NOTES----- 1. SR 3.0.1 is not applicable when both Service Water backup subsystems are OPERABLE. 2. REC system leakage beyond limits by itself is only a degradation of the REC system and does not result in the REC system being inoperable. ---------- Verify the REC system leakage is within limits.	24 hours
SR 3.7.3.2	Verify the temperature of the REC supply water is ≤ 100°F.	24 hours
SR 3.7.3.3	-----NOTE----- Isolation of flow to individual components does not render REC System inoperable. ---------- Verify each REC subsystem manual, power operated, and automatic valve in the flow paths servicing safety related cooling loads, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.3.4	Verify each REC subsystem actuates on an actual or simulated initiation signal.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.4.1	Operate the CREF System for $\geq$ 15 minutes.	31 days
SR 3.7.4.2	Perform required CREF filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP.
SR 3.7.4.3	Verify the CREF System actuates on an actual or simulated initiation signal.	~~18~~ 24 months
SR 3.7.4.4	Perform required CRE unfiltered air inleakage testing in accordance with the Control Room Envelope Habitability Program.	In accordance with the Control Room Envelope Habitability Program

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1	Verify operation of each main turbine bypass valve.	31 days
SR 3.7.7.2	Perform a system functional test.	~~18~~ 24 months
SR 3.7.7.3	Verify the TURBINE BYPASS SYSTEM RESPONSE TIME is within limits.	~~18~~ 24 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.7	------------------NOTE------------------ All DG starts may be preceded by an engine prelube period. --- Verify each DG starts from standby condition and achieves, in ≤ 14 seconds, voltage ≥ 3950 V and frequency ≥ 58.8 Hz, and after steady state conditions are reached, maintains voltage ≥ 3950 V and ≤ 4400 V and frequency ≥ 58.8 Hz and ≤ 61.2 Hz.	184 days
SR 3.8.1.8	------------------NOTE------------------ This Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR. --- Verify automatic and manual transfer of unit power supply from the normal offsite circuit to the alternate offsite circuit.	~~18~~ months 24

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.9	-------------------------NOTES------------------------- 1. Momentary transients outside the load and power factor ranges do not invalidate this test. 2. This Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR. 3. If performed with DG synchronized with offsite power, the surveillance shall be performed at a power factor ≤ 0.89. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. --- Verify each DG operates for ≥ 8 hours: a. For ≥ 2 hours loaded ≥ 4200 kW and ≤ 4400 kW; and b. For the remaining hours of the test loaded ≥ 3600 kW and ≤ 4000 kW.	24 ~~18~~ months
SR 3.8.1.10	-------------------------NOTES------------------------- This Surveillance shall not be performed in MODE 1, 2 or 3. However, credit may be taken for unplanned events that satisfy this SR. --- Verify interval between each sequenced load is within ± 10% of nominal timer setpoint.	24 ~~18~~ months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.11	------------------NOTES------------------ 1. All DG starts may be preceded by an engine prelube period. 2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. --- Verify, on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ECCS initiation signal: a. De-energization of emergency buses; b. Load shedding from emergency buses; and c. DG auto-starts from standby condition and: 1. energizes permanently connected loads in $\leq$ 14 seconds, 2. energizes auto-connected emergency loads through the timed logic sequence, 3. maintains steady state voltage $\geq$ 3950 V and $\leq$ 4400 V, 4. maintains steady state frequency $\geq$ 58.8 Hz and $\leq$ 61.2 Hz, and 5. supplies permanently connected and auto-connected emergency loads for $\geq$ 5 minutes.	24 ~~18~~ months

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage on float charge is: a. $\geq$ 125 V for the 125 V batteries; and b. $\geq$ 250 V for the 250 V batteries.	7 days
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. <u>OR</u> Verify battery connection resistance meets the limits specified in Table 3.8.4-1.	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that degrades battery performance.	18 months
SR 3.8.4.4	Remove visible corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.	18 months
SR 3.8.4.5	Verify battery connection resistance meets the limits specified in Table 3.8.4-1.	18 months
SR 3.8.4.6	Verify: a. Each required 125 V battery charger supplies $\geq$ 200 amps at $\geq$ 125 V for $\geq$ 4 hours; and b. Each required 250 V battery charger supplies $\geq$ 200 amps at $\geq$ 250 V for $\geq$ 4 hours.	~~18~~ months 24

(continued)

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.4.7	---NOTES--- 1. The modified performance discharge test in SR 3.8.4.8 may be performed in lieu of the service test in SR 3.8.4.7 once per 60 months. 2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 ~~18~~ months
SR 3.8.4.8	---NOTE--- This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. --- Verify battery capacity is ≥ 90% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months AND 18 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating AND 24 months when battery has reached 85% of the expected life with capacity ≥ 100% of manufacturer's rating

5.5 Programs and Manuals

5.5.1 <u>Offsite Dose Assessment Manual (ODAM)</u> (continued)

markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (i.e., month and year) the change was implemented.

5.5.2 <u>Systems Integrity Monitoring Program</u>

This program provides controls to minimize leakage from those portions of systems outside containment that could contain highly radioactive fluids during a serious transient or accident to levels as low as practicable. The systems include the Core Spray, High Pressure Coolant Injection, Residual Heat Removal, and Reactor Core Isolation Cooling. The program shall include the following:

a. Preventive maintenance and periodic visual inspection requirements; and

b. Integrated leak test requirements for each system at 24 ~~18~~ month intervals or less.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable at the 24 ~~18~~ month Frequency for performing system leak test activities.

5.5.3 <u>Post Accident Sampling</u>

This program provides controls that ensure the capability to obtain and analyze reactor coolant, radioactive gases, and particulates in plant gaseous effluents and containment atmosphere samples under accident conditions. The program shall include the following:

a. Training of personnel;

b. Procedures for sampling and analysis; and

c. Provisions for maintenance of sampling and analysis equipment.

(continued)

5.5 Programs and Manuals (continued)

5.5.7 Ventilation Filter Testing Program (VFTP)

The VFTP shall establish the required testing of Engineered Safety Feature (ESF) filter
24 ventilation systems. Tests described in Specifications 5.5.7.a, 5.5.7.b, and 5.5.7.c shall be performed once per ~~18~~ months for standby service or after 720 hours of system operation; and, following significant painting, fire, or chemical release concurrent with system operation in any ventilation zone communicating with the system.

Tests described in Specifications 5.5.7.a and 5.5.7.b shall be performed after each complete or partial replacement of the HEPA filter train or charcoal adsorber filter; and after any structural maintenance on the system housing.

Tests described in Specifications 5.5.7.d and 5.5.7.e shall be performed once per
24 ~~18~~ months.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the VFTP test frequencies.

a. Demonstrate for each of the ESF systems that an inplace test of the HEPA filters shows a penetration and system bypass < 1% when tested in accordance with Regulatory Guide 1.52, Revision 2, Section C.5.c, and ASME N510-1989 at the system conditions specified below.

ESF Ventilation System	Flowrate (cfm)
SGT System	1602 to 1958
Control Room Emergency Filter System	810 to 990

b. Demonstrate for each of the ESF systems that an inplace test of the charcoal adsorber shows a penetration and system bypass < 1% when tested in accordance with Regulatory Guide 1.52, Revision 2, Section C.5.d, and ASME N510-1989 at the system conditions specified below.

ESF Ventilation System	Flowrate (cfm)
SGT System	1602 to 1958
Control Room Emergency Filter System	810 to 990

(continued)

5.5 Programs and Manuals

5.5.13 <u>Control Room Envelope Habitability Program</u> (continued)

personnel receiving radiation exposures in excess of either (a) 5 rem whole body or its equivalent to any part of the body for the duration of the loss-of-coolant accident, or (b) 5 rem total effective dose equivalent (TEDE) for the duration of the fuel handling accident. The program shall include the following elements:

a. The definition of the CRE and CRE boundary.

b. Requirements for maintaining the CRE boundary in its design condition including configuration control and preventive maintenance.

c. Requirements for (i) determining the unfiltered air inleakage past the CRE boundary into the CRE in accordance with the testing methods and at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," Revision 0, May 2003, and (ii) assessing CRE habitability at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0. No exceptions to Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0, are proposed.

d. Measurement, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by the CREF System, operating at the flow rate required by the 24 Ventilation Filter Testing Program, at a Frequency of ~~18~~ months. The results shall be trended and used as part of the periodic assessment of the CRE boundary.

e. The quantitative limits on unfiltered air inleakage into the CRE. These limits shall be stated in a manner to allow direct comparison to the unfiltered air inleakage measured by the testing described in paragraph c. The unfiltered air inleakage limit for radiological challenges is the inleakage flow rate assumed in the licensing basis analyses of DBA consequences. Unfiltered air inleakage limits for hazardous chemicals must ensure that exposure of CRE occupants to these hazards will be within the assumptions in the licensing basis.

f. The provisions of SR 3.0.2 are applicable to the Frequencies for assessing CRE habitability, determining CRE unfiltered air inleakage, and measuring CRE pressure and assessing the CRE boundary as required by paragraphs c and d, respectively.

INSERTS

<INSERT 1>

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

<INSERT 2>

The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

Table 3.3.1.1-1 (page 1 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Intermediate Range Monitors					
a. Neutron Flux — High	2	3	G	SR 3.3.1.1.1 SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.5 SR 3.3.1.1.6 SR 3.3.1.1.12 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 121/125 divisions of full scale
	5~~(a)~~ (c)	3	H	SR 3.3.1.1.1 SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.12 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 121/125 divisions of full scale
b. Inop	2	3	G	SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.13	NA
	5~~(a)~~ (c)	3	H	SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.13	NA
2. Average Power Range Monitors					
a. Neutron Flux — High (Startup)	2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.6 SR 3.3.1.1.8 SR 3.3.1.1.10 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 14.5% RTP
b. Neutron Flux-High (Flow Biased)	1	2	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.4 SR 3.3.1.1.7 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.10~~(c,d)~~ (a)(b) SR 3.3.1.1.12~~(c,d)~~ (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 0.75 W + 62.0% RTP~~(b)~~ (d)

(continued)

(a) <INSERT 1>
(b) <INSERT 2>

(c) ~~(a)~~ With any control rod withdrawn from a core cell containing one or more fuel assemblies.

(d) ~~(b)~~ [0.75 W + 62.0% - 0.75 ΔW] RTP when reset for single loop operation per LCO 3.4.1, "Recirculation Loops Operating."

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

~~(d) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Nominal Trip Setpoint (NTSP) at the completion of the surveillance; otherwise the channel shall be declared inoperable. Setpoints more conservative than the NTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures to confirm the channel performance. The NTSP and the methodologies used to determine the as-found and as-left tolerances are specified in station procedures implementing the GE Setpoint Methodology per NEDC-31336P-A approved in TS Amendment 178 SER, Section III.G.2.~~

Table 3.3.1.1-1 (page 2 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. Average Power Range Monitors (continued)					
c. Neutron Flux —High (Fixed)	1	2	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.4 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.10 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 120.0% RTP
d. Downscale	1	2	F	SR 3.3.1.1.4 SR 3.3.1.1.8 SR 3.3.1.1.9 (a)(b) SR 3.3.1.1.13	≥ 3.0% RTP
e. Inop	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.13	NA
3. Reactor Vessel Pressure —High	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 1050 psig
4. Reactor Vessel Water Level —Low (Level 3)	1,2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≥ 3 inches
5. Main Steam Isolation Valve —Closure	1	4	F	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 10% closed
6. Drywell Pressure —High	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 1.84 psig

(continued)

(a) <INSERT 1>
(b) <INSERT 2>

Table 3.3.1.1-1 (page 3 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
7. Scram Discharge Volume Water Level - High					
a. Level Transmitter	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
	5~~(a)~~ (c)	2	H	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
b. Level Switch	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
	5~~(a)~~ (c)	2	H	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
8. Turbine Stop Valve — Closure	≥ 29.5% RTP	2	E	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.14 SR 3.3.1.1.15	≤ 10% closed
9. Turbine Control Valve Fast Closure, DEH Trip Oil Pressure — Low	≥ 29.5% RTP	2	E	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 (a)(b) SR 3.3.1.1.13 SR 3.3.1.1.14 SR 3.3.1.1.15	≥ 1018 psig
10. Reactor Mode Switch — Shutdown Position	1,2	1	G	SR 3.3.1.1.11 SR 3.3.1.1.13	NA
	5~~(a)~~ (c)	1	H	SR 3.3.1.1.11 SR 3.3.1.1.13	NA
11. Manual Scram	1,2	1	G	SR 3.3.1.1.9 SR 3.3.1.1.13	NA
	5~~(a)~~ (c)	1	H	SR 3.3.1.1.9 SR 3.3.1.1.13	NA

(a) <INSERT 1>
(b) <INSERT 2>

(c) ~~(a)~~ With any control rod withdrawn from a core cell containing one or more fuel assemblies.

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	ALLOWABLE VALUE
1. Rod Block Monitor				
a. Low Power Range — Upscale	(a)	2	SR 3.3.2.1.1 SR 3.3.2.1.4 SR 3.3.2.1.5 [(b)(c)]	~~(h)~~ [(j)]
b. Intermediate Power Range — Upscale	~~(b)~~ [(d)]	2	SR 3.3.2.1.1 SR 3.3.2.1.4 SR 3.3.2.1.5 [(b)(c)]	~~(h)~~ [(j)]
c. High Power Range — Upscale	~~(c),(d)~~ [(e)(f)]	2	SR 3.3.2.1.1 SR 3.3.2.1.4 SR 3.3.2.1.5 [(b)(c)]	~~(h)~~ [(j)]
d. Inop	~~(d),(e)~~ [(f)(g)]	2	SR 3.3.2.1.1	NA
e. Downscale	~~(d),(e)~~ [(f)(g)]	2	SR 3.3.2.1.1 SR 3.3.2.1.5	$\geq$ 92/125 divisions of full scale
2. Rod Worth Minimizer	1~~(f)~~,2~~(f)~~ [(h)]	1	SR 3.3.2.1.2 SR 3.3.2.1.3 SR 3.3.2.1.6 SR 3.3.2.1.8	NA
3. Reactor Mode Switch — Shutdown Position	~~(g)~~ [(i)]	2	SR 3.3.2.1.7	NA

(b) <INSERT 1>
(c) <INSERT 2>

(a) THERMAL POWER $\geq$ 27.5% and < 62.5% RTP and MCPR < 1.70 and no peripheral control rod selected.

[(d)] ~~(b)~~ THERMAL POWER $\geq$ 62.5% and < 82.5% RTP and MCPR < 1.70 and no peripheral control rod selected.

[(e)] ~~(c)~~ THERMAL POWER $\geq$ 82.5% and < 90% RTP and MCPR < 1.70 and no peripheral control rod selected.

[(f)] ~~(d)~~ THERMAL POWER $\geq$ 90% RTP and MCPR < 1.40 and no peripheral control rod selected.

[(g)] ~~(e)~~ THERMAL POWER $\geq$ 27.5% and < 90% RTP and MCPR < 1.70 and no peripheral control rod selected.

[(h)] ~~(f)~~ With THERMAL POWER $\leq$ 9.85% RTP.

[(i)] ~~(g)~~ Reactor mode switch in the shutdown position.

[(j)] ~~(h)~~ Less than or equal to the Allowable Value specified in the COLR.

Table 3.3.5.1-1 (page 1 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Core Spray System					
a. Reactor Vessel Water Level - Low Low Low (Level 1)	1,2,3, 4(a), 5(a)	4(b)	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ -113 inches (c)(d)
b. Drywell Pressure- High	1,2,3	4(b)	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 1.84 psig (c)(d)
c. Reactor Pressure- Low (Injection Permissive)	1,2,3	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
	4(a), 5(a)	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
d. Core Spray Pump Discharge Flow - Low (Bypass)	1,2,3, 4(a), 5(a)	1 per pump	E	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 1370 gpm (c)(d)
e. Core Spray Pump Start-Time Delay Relay	1,2,3, 4(a), 5(a)	1 per pump	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 9 seconds and ≤ 11 seconds
2. Low Pressure Coolant Injection (LPCI) System					
a. Reactor Vessel Water Level - Low Low Low (Level 1)	1,2,3, 4(a), 5(a)	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ -113 inches (c)(d)

(continued)

(a) When associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown.

(b) Also required to initiate the associated diesel generator (DG).

(c) <INSERT 1>
(d) <INSERT 2>

Table 3.3.5.1-1 (page 2 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
b. Drywell Pressure - High	1,2,3	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≤ 1.84 psig
c. Reactor Pressure - Low (Injection Permissive)	1,2,3	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
	4(a), 5(a)	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
d. Reactor Pressure - Low (Recirculation Discharge Valve Permissive)	1(c), 2(c), 3(c) (e)	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 199 psig and ≤ 221 psig
e. Reactor Vessel Shroud Level - Level 0	1,2,3	2	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ -193.19 inches
f. Low Pressure Coolant Injection Pump Start - Time Delay Relay	1,2,3, 4(a), 5(a)	1 per pump	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	
Pumps B,C					≥ 4.5 seconds and ≤ 5.5 seconds
Pumps A,D					≤ 0.5 second

(c) <INSERT 1>
(d) <INSERT 2>

(continued)

(a) When associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown.

~~(c)~~ (e) With associated recirculation pump discharge valve open.

Table 3.3.5.1-1 (page 3 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
g. Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)	1,2,3, 4(a), 5(a)	1 per subsystem	E	SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≥ 2107 gpm
3. High Pressure Coolant Injection (HPCI) System					
a. Reactor Vessel Water Level - Low Low (Level 2)	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≥ -42 inches
b. Drywell Pressure - High	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	4	B	SR 3.3.5.1.2 (c)(d) SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 1.84 psig
c. Reactor Vessel Water Level - High (Level 8)	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	2	C	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 54 inches
d. Emergency Condensate Storage Tank (ECST) Level - Low	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	2	D	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.5	≥ 23 inches
e. Suppression Pool Water Level - High	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	2	D	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 4 inches

(c) <INSERT 1>
(d) <INSERT 2>

(continued)

(a) When the associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown.

~~(d)~~ (f) With reactor steam dome pressure > 150 psig.

Table 3.3.5.1-1 (page 4 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
3. HPCI System (continued)					
f. High Pressure Coolant Injection Pump Discharge Flow—Low (Bypass)	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	1	E	SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≥ 490 gpm
4. Automatic Depressurization System (ADS) Trip System A					
a. Reactor Vessel Water Level—Low Low Low (Level 1)	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	2	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≥ -113 inches
b. Automatic Depressurization System Initiation Timer	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	1	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 109 seconds
c. Reactor Vessel Water Level—Low (Level 3) (Confirmatory)	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	1	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≥ 3 inches
d. Core Spray Pump Discharge Pressure—High	1, 2~~(d)~~ (f), 3~~(d)~~ (f)	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig

(c) <INSERT 1>
(d) <INSERT 2>

(continued)

~~(d)~~ (f) With reactor steam dome pressure > 150 psig.

Table 3.3.5.1-1 (page 5 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
4. ADS Trip System A (continued)					
e. Low Pressure Coolant Injection Pump Discharge Pressure —High	1, 2~~(d)~~(f), 3~~(d)~~(f)	4	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig
5. ADS Trip System B					
a. Reactor Vessel Water Level —Low Low Low (Level 1)	1, 2~~(d)~~(f), 3~~(d)~~(f)	2	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≥ -113 inches
b. Automatic Depressurization System Initiation Timer	1, 2~~(d)~~(f), 3~~(d)~~(f)	1	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 109 seconds
c. Reactor Vessel Water Level —Low, Level 3 (Confirmatory)	1, 2~~(d)~~(f), 3~~(d)~~(f)	1	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 (c)(d) SR 3.3.5.1.5	≥ 3 inches
d. Core Spray Pump Discharge Pressure —High	1, 2~~(d)~~(f), 3~~(d)~~(f)	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig

(c) <INSERT 1>
(d) <INSERT 2>

(continued)

~~(d)~~ (f) With reactor steam dome pressure > 150 psig.

Table 3.3.5.1-1 (page 6 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
5. ADS Trip System B (continued)					
e. Low Pressure Coolant Injection Pump Discharge Pressure —High	1, 2~~(d)~~, 3~~(d)~~ (f)	4	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig

~~(d)~~ (f) With reactor steam dome pressure > 150 psig.

Table 3.3.5.2-1 (page 1 of 1)
Reactor Core Isolation Cooling System Instrumentation

FUNCTION	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Reactor Vessel Water Level —Low Low (Level 2)	4	B	SR 3.3.5.2.1 SR 3.3.5.2.2 SR 3.3.5.2.4 (a)(b) SR 3.3.5.2.5	≥ -42 inches
2. Reactor Vessel Water Level —High (Level 8)	2	C	SR 3.3.5.2.1 SR 3.3.5.2.2 SR 3.3.5.2.4 SR 3.3.5.2.5	≤ 54 inches
3. Emergency Condensate Storage Tank (ECST) Level —Low	2	D	SR 3.3.5.2.2 SR 3.3.5.2.3 SR 3.3.5.2.5	≥ 23 inches

(a) <INSERT 1>
(b) <INSERT 2>

Attachment 3

Proposed Technical Specification Revisions
(Re-Typed)

Cooper Nuclear Station, Docket No. 50-298, DPR-46

Revised Technical Specification Pages

3.1-22	3.3-37	3.3-68	3.6-37
3.1-26	3.3-38	3.4-7	3.6-40
3.3-5	3.3-39	3.5-5	3.7-5
3.3-6	3.3-40	3.5-6	3.7-7
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3.3-21	3.3-56	3.6-15	3.8-17
3.3-24	3.3-59	3.6-19	3.8-18
3.3-27	3.3-60	3.6-22	5.0-7
3.3-30	3.3-62	3.6-24	5.0-11
3.3-36	3.3-65	3.6-33	5.0-18

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.7.6	Verify each SLC subsystem manual valve in the flow path that is not locked, sealed, or otherwise secured in position, is in the correct position or can be aligned to the correct position.	31 days
SR 3.1.7.7	Verify each pump develops a flow rate $\geq$ 38.2 gpm at a discharge pressure $\geq$ 1300 psig.	In accordance with the Inservice Testing Program
SR 3.1.7.8	Verify flow through one SLC subsystem from pump into reactor pressure vessel.	24 months on a STAGGERED TEST BASIS
SR 3.1.7.9	Verify all heat traced piping between storage tank and pump suction is unblocked.	24 months <u>AND</u> Once within 24 hours after solution temperature is restored within the limits of Figure 3.1.7-2

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1	------------------------------NOTE------------------------------ Not required to be met on vent and drain valves closed during performance of SR 3.1.8.2. --- Verify each SDV vent and drain valve is open.	31 days
SR 3.1.8.2	Cycle each SDV vent and drain valve to the fully closed and fully open position.	92 days
SR 3.1.8.3	Verify each SDV vent and drain valve: a. Closes in $\leq$ 30 seconds after receipt of an actual or simulated scram signal; and b. Opens when the actual or simulated scram signal is reset.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.1.11	Perform CHANNEL FUNCTIONAL TEST.	24 months
SR 3.3.1.1.12	---NOTES--- 1. Neutron detectors are excluded. 2. For Function 1, not required to be performed when entering MODE 2 from MODE 1 until 12 hours after entering MODE 2. --- Perform CHANNEL CALIBRATION.	24 months
SR 3.3.1.1.13	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months
SR 3.3.1.1.14	Verify Turbine Stop Valve — Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure — Low Functions are not bypassed when THERMAL POWER is $\geq$ 29.5% RTP.	24 months
SR 3.3.1.1.15	---NOTE--- Neutron detectors are excluded. --- Verify the RPS RESPONSE TIME is within limits.	24 months

Table 3.3.1.1-1 (page 1 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Intermediate Range Monitors					
a. Neutron Flux — High	2	3	G	SR 3.3.1.1.1 SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.5 SR 3.3.1.1.6 SR 3.3.1.1.12(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 121/125 divisions of full scale
	5(c)	3	H	SR 3.3.1.1.1 SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.12(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 121/125 divisions of full scale
b. Inop	2	3	G	SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.13	NA
	5(c)	3	H	SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.13	NA
2. Average Power Range Monitors					
a. Neutron Flux — High (Startup)	2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.3 SR 3.3.1.1.4 SR 3.3.1.1.6 SR 3.3.1.1.8 SR 3.3.1.1.10(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 14.5% RTP
b. Neutron Flux-High (Flow Biased)	1	2	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.4 SR 3.3.1.1.7 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.10(a,b) SR 3.3.1.1.12(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 0.75 W + 62.0% RTP(d)

(continued)

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

(b) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

(c) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

(d) [0.75 W + 62.0% - 0.75ΔW] RTP when reset for single loop operation per LCO 3.4.1, "Recirculation Loops Operating."

Table 3.3.1.1-1 (page 2 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. Average Power Range Monitors (continued)					
c. Neutron Flux - High (Fixed)	1	2	F	SR 3.3.1.1.1 SR 3.3.1.1.2 SR 3.3.1.1.4 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.10(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 120.0% RTP
d. Downscale	1	2	F	SR 3.3.1.1.4 SR 3.3.1.1.8 SR 3.3.1.1.9(a,b) SR 3.3.1.1.13	≥ 3.0% RTP
e. Inop	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.8 SR 3.3.1.1.9 SR 3.3.1.1.13	NA
3. Reactor Vessel Pressure — High	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 1050 psig
4. Reactor Vessel Water Level — Low (Level 3)	1,2	2	G	SR 3.3.1.1.1 SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≥ 3 inches
5. Main Steam Isolation Valve — Closure	1	4	F	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 10% closed
6. Drywell Pressure — High	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12(a,b) SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 1.84 psig

(continued)

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

(b) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

Table 3.3.1.1-1 (page 3 of 3)
Reactor Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER TRIP SYSTEM	CONDITIONS REFERENCED FROM REQUIRED ACTION D.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
7. Scram Discharge Volume Water Level - High					
a. Level Transmitter	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12[(a,b)] SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
	5[(c)]	2	H	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
b. Level Switch	1,2	2	G	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
	5[(c)]	2	H	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.15	≤ 90 inches
8. Turbine Stop Valve — Closure	≥ 29.5% RTP	2	E	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12 SR 3.3.1.1.13 SR 3.3.1.1.14 SR 3.3.1.1.15	≤ 10% closed
9. Turbine Control Valve Fast Closure, DEH Trip Oil Pressure — Low	≥ 29.5% RTP	2	E	SR 3.3.1.1.4 SR 3.3.1.1.9 SR 3.3.1.1.12[(a,b)] SR 3.3.1.1.13 SR 3.3.1.1.14 SR 3.3.1.1.15	≥ 1018 psig
10. Reactor Mode Switch — Shutdown Position	1,2	1	G	SR 3.3.1.1.11 SR 3.3.1.1.13	NA
	5[(c)]	1	H	SR 3.3.1.1.11 SR 3.3.1.1.13	NA
11. Manual Scram	1,2	1	G	SR 3.3.1.1.9 SR 3.3.1.1.13	NA
	5[(c)]	1	H	SR 3.3.1.1.9 SR 3.3.1.1.13	NA

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

(b) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

(c) With any control rod withdrawn from a core cell containing one or more fuel assemblies.

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.3.1.2.4	-----NOTE----- Not required to be met with less than or equal to four fuel assemblies adjacent to the SRM and no other fuel assemblies in the associated core quadrant. ----- Verify count rate is $\geq$ 3.0 cps with a signal to noise ratio $\geq$ 2:1.	12 hours during CORE ALTERATIONS AND 24 hours
SR 3.3.1.2.5	Perform CHANNEL FUNCTIONAL TEST and determination of signal to noise ratio.	7 days
SR 3.3.1.2.6	-----NOTE----- Not required to be performed until 12 hours after IRMs on Range 2 or below. ----- Perform CHANNEL FUNCTIONAL TEST and determination of signal to noise ratio.	31 days
SR 3.3.1.2.7	-----NOTES----- 1. Neutron detectors are excluded. 2. Not required to be performed until 12 hours after IRMs on Range 2 or below. ----- Perform CHANNEL CALIBRATION.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.2.1.5	-----NOTE----- Neutron detectors are excluded. ---------- Perform CHANNEL CALIBRATION.	 184 days
SR 3.3.2.1.6	Verify the RWM is not bypassed when THERMAL POWER is $\leq$ 9.85% RTP.	24 months
SR 3.3.2.1.7	-----NOTE----- Not required to be performed until 1 hour after reactor mode switch is in the shutdown position. ---------- Perform CHANNEL FUNCTIONAL TEST.	 24 months
SR 3.3.2.1.8	Verify control rod sequences input to the RWM are in conformance with BPWS.	Prior to declaring RWM OPERABLE following loading of sequence into RWM

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	ALLOWABLE VALUE
1. Rod Block Monitor				
a. Low Power Range — Upscale	(a)	2	SR 3.3.2.1.1 SR 3.3.2.1.4 SR 3.3.2.1.5(b)(c)	(j)
b. Intermediate Power Range — Upscale	(d)	2	SR 3.3.2.1.1 SR 3.3.2.1.4 SR 3.3.2.1.5(b)(c)	(j)
c. High Power Range — Upscale	(e),(f)	2	SR 3.3.2.1.1 SR 3.3.2.1.4 SR 3.3.2.1.5(b)(c)	(j)
d. Inop	(f),(g)	2	SR 3.3.2.1.1	NA
e. Downscale	(f),(g)	2	SR 3.3.2.1.1 SR 3.3.2.1.5	$\geq$ 92/125 divisions of full scale
2. Rod Worth Minimizer	1(h),2(h)	1	SR 3.3.2.1.2 SR 3.3.2.1.3 SR 3.3.2.1.6 SR 3.3.2.1.8	NA
3. Reactor Mode Switch — Shutdown Position	(i)	2	SR 3.3.2.1.7	NA

(a) THERMAL POWER $\geq$ 27.5% and < 62.5% RTP and MCPR < 1.70 and no peripheral control rod selected.

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

(c) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

(d) THERMAL POWER $\geq$ 62.5% and < 82.5% RTP and MCPR < 1.70 and no peripheral control rod selected.

(e) THERMAL POWER $\geq$ 82.5% and < 90% RTP and MCPR < 1.70 and no peripheral control rod selected.

(f) THERMAL POWER $\geq$ 90% RTP and MCPR < 1.40 and no peripheral control rod selected.

(g) THERMAL POWER $\geq$ 27.5% and < 90% RTP and MCPR < 1.70 and no peripheral control rod selected.

(h) With THERMAL POWER $\leq$ 9.85 RTP.

(i) Reactor mode switch in the shutdown position.

(j) Less than or equal to the Allowable Value specified in the COLR.

SURVEILLANCE REQUIREMENTS

---NOTE---
When a 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 feedwater and main turbine high water level trip capability is maintained.

SURVEILLANCE		FREQUENCY
SR 3.3.2.2.1	Perform CHANNEL CHECK.	24 hours
SR 3.3.2.2.2	Perform CHANNEL CALIBRATION. The Allowable Value shall be ≤ 54.0 inches.	24 months
SR 3.3.2.2.3	Perform LOGIC SYSTEM FUNCTIONAL TEST including valve actuation.	24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.3.1.1	Perform CHANNEL CHECK on each required PAM Instrumentation channel.	31 days
SR 3.3.3.1.2	Perform CHANNEL CALIBRATION of the Primary Containment H_2 and O_2 Analyzers.	92 days
SR 3.3.3.1.3	Perform CHANNEL CALIBRATION of each required PAM Instrumentation channel except for the Primary Containment H_2 and O_2 Analyzers.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.3.2.2	Verify each required control circuit and transfer switch is capable of performing the intended function.	24 months
SR 3.3.3.2.3	Perform CHANNEL CALIBRATION for each required instrumentation channel.	24 months

SURVEILLANCE REQUIREMENTS

--NOTE--
When a 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 ATWS-RPT trip capability.

SURVEILLANCE		FREQUENCY
SR 3.3.4.1.1	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.4.1.2	Perform CHANNEL CALIBRATION. The Allowable Values shall be: a. Reactor Vessel Water Level — Low Low (Level 2): $\geq$ -42 inches; and b. Reactor Pressure — High: $\leq$ 1072 psig.	24 months
SR 3.3.4.1.3	Perform LOGIC SYSTEM FUNCTIONAL TEST including breaker actuation.	24 months

SURVEILLANCE REQUIREMENTS

-----NOTES-----

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

2. When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed as follows: (a) for up to 6 hours for Functions 3.c and 3.f; and (b) for up to 6 hours for Functions other than 3.c and 3.f provided the associated Function or the redundant Function maintains ECCS initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.5.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.5.1.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.5.1.3	Perform CHANNEL CALIBRATION.	92 days
SR 3.3.5.1.4	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.5.1.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

Table 3.3.5.1-1 (page 1 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Core Spray System					
a. Reactor Vessel Water Level - Low Low Low (Level 1)	1,2,3, $4^{(a)}$, $5^{(a)}$	$4^{(b)}$	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	$\geq$ -113 inches
b. Drywell Pressure-High	1,2,3	$4^{(b)}$	B	SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	$\leq$ 1.84 psig
c. Reactor Pressure-Low (Injection Permissive)	1,2,3	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	$\geq$ 291 psig and $\leq$ 436 psig
	$4^{(a)}$, $5^{(a)}$	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	$\geq$ 291 psig and $\leq$ 436 psig
d. Core Spray Pump Discharge Flow - Low (Bypass)	1,2,3, $4^{(a)}$, $5^{(a)}$	1 per pump	E	SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	$\geq$ 1370 gpm
e. Core Spray Pump Start-Time Delay Relay	1,2,3, $4^{(a)}$, $5^{(a)}$	1 per pump	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	$\geq$ 9 seconds and $\leq$ 11 seconds
2. Low Pressure Coolant Injection (LPCI) System					
a. Reactor Vessel Water Level - Low Low Low (Level 1)	1,2,3, $4^{(a)}$, $5^{(a)}$	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	$\geq$ -113 inches

(continued)

(a) When associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown.

(b) Also required to initiate the associated diesel generator (DG).

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

(d) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

Table 3.3.5.1-1 (page 2 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
b. Drywell Pressure - High	1,2,3	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4[c][d] SR 3.3.5.1.5	≤ 1.84 psig
c. Reactor Pressure - Low (Injection Permissive)	1,2,3	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
	4[a], 5[a]	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 291 psig and ≤ 436 psig
d. Reactor Pressure - Low (Recirculation Discharge Valve Permissive)	1[e],2[e], 3[e]	4	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 199 psig and ≤ 246 psig
e. Reactor Vessel Shroud Level - Level 0	1,2,3	2	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ -193.19 inches
f. Low Pressure Coolant Injection Pump Start -Time Delay Relay	1,2,3, 4[a], 5[a]	1 per pump	C	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	
Pumps B,C					≥ 4.5 seconds and ≤ 5.5 seconds
Pumps A,D					≤ 0.5 second

(continued)

(a) When associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown.

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

(d) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

(e) With associated recirculation pump discharge valve open.

Table 3.3.5.1-1 (page 3 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
2. LPCI System (continued)					
g. Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)	1,2,3, 4(a), 5(a)	1 per subsystem	E	SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	≥ 2107 gpm
3. High Pressure Coolant Injection (HPCI) System					
a. Reactor Vessel Water Level - Low Low (Level 2)	1, 2(f), 3(f)	4	B	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	≥ -42 inches
b. Drywell Pressure - High	1, 2(f), 3(f)	4	B	SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	≤ 1.84 psig
c. Reactor Vessel Water Level - High (Level 8)	1, 2(f), 3(f)	2	C	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 54 inches
d. Emergency Condensate Storage Tank (ECST) Level - Low	1, 2(f), 3(f)	2	D	SR 3.3.5.1.2 SR 3.3.5.1.3 SR 3.3.5.1.5	≥ 23 inches
e. Suppression Pool Water Level - High	1, 2(f), 3(f)	2	D	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 4 inches

(continued)

(a) When the associated ECCS subsystem(s) are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown.

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

(d) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

(f) With reactor steam dome pressure > 150 psig.

Table 3.3.5.1-1 (page 4 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
3. HPCI System (continued)					
f. High Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)	1, 2$^{(f)}$, 3$^{(f)}$	1	E	SR 3.3.5.1.2 SR 3.3.5.1.4$^{(c)(d)}$ SR 3.3.5.1.5	≥ 490 gpm
4. Automatic Depressurization System (ADS) Trip System A					
a. Reactor Vessel Water Level - Low Low Low (Level 1)	1, 2$^{(f)}$, 3$^{(f)}$	2	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4$^{(c)(d)}$ SR 3.3.5.1.5	≥ -113 inches
b. Automatic Depressurization System Initiation Timer	1, 2$^{(f)}$, 3$^{(f)}$	1	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 109 seconds
c. Reactor Vessel Water Level - Low (Level 3) (Confirmatory)	1, 2$^{(f)}$, 3$^{(f)}$	1	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4$^{(c)(d)}$ SR 3.3.5.1.5	≥ 3 inches
d. Core Spray Pump Discharge Pressure- High	1, 2$^{(f)}$, 3$^{(f)}$	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig

(continued)

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

(d) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

(f) With reactor steam dome pressure > 150 psig.

Table 3.3.5.1-1 (page 5 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
4. ADS Trip System A (continued)					
e. Low Pressure Coolant Injection Pump Discharge Pressure - High	1, $2^{(f)}$, $3^{(f)}$	4	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig
5. ADS Trip System B					
a. Reactor Vessel Water Level - Low Low Low (Level 1)	1, $2^{(f)}$, $3^{(f)}$	2	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	≥ -113 inches
b. Automatic Depressurization System Initiation Timer	1, $2^{(f)}$, $3^{(f)}$	1	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≤ 109 seconds
c. Reactor Vessel Water Level - Low, Level 3 (Confirmatory)	1, $2^{(f)}$, $3^{(f)}$	1	F	SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4(c)(d) SR 3.3.5.1.5	≥ 3 inches
d. Core Spray Pump Discharge Pressure - High	1, $2^{(f)}$, $3^{(f)}$	2	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig

(continued)

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

(d) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

(f) With reactor steam dome pressure > 150 psig.

Table 3.3.5.1-1 (page 6 of 6)
Emergency Core Cooling System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
5. ADS Trip System B (continued)					
e. Low Pressure Coolant Injection Pump Discharge Pressure - High	1, $2^{(f)}$, $3^{(f)}$	4	G	SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.5	≥ 108 psig and ≤ 160 psig

(f) With reactor steam dome pressure > 150 psig.

SURVEILLANCE REQUIREMENTS

-----NOTES-----

1. Refer to Table 3.3.5.2-1 to determine which SRs apply for each RCIC Function.

2. When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed as follows: (a) for up to 6 hours for Function 2; and (b) for up to 6 hours for Functions 1 and 3 provided the associated Function maintains RCIC initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.5.2.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.5.2.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.5.2.3	Perform CHANNEL CALIBRATION.	92 days
SR 3.3.5.2.4	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.5.2.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

Table 3.3.5.2-1 (page 1 of 1)
Reactor Core Isolation Cooling System Instrumentation

FUNCTION	REQUIRED CHANNELS PER FUNCTION	CONDITIONS REFERENCED FROM REQUIRED ACTION A.1	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Reactor Vessel Water Level - Low Low (Level 2)	4	B	SR 3.3.5.2.1 SR 3.3.5.2.2 SR 3.3.5.2.4[(a)(b)] SR 3.3.5.2.5	≥ -42 inches
2. Reactor Vessel Water Level - High (Level 8)	2	C	SR 3.3.5.2.1 SR 3.3.5.2.2 SR 3.3.5.2.4 SR 3.3.5.2.5	≤ 54 inches
3. Emergency Condensate Storage Tank (ECST) Level - Low	2	D	SR 3.3.5.2.2 SR 3.3.5.2.3 SR 3.3.5.2.5	≥ 23 inches

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

(b) The instrument channel setpoint shall be reset to a value that is within the as-left tolerance around the Limiting Trip Setpoint (LTSP) at the completion of the surveillance; otherwise, the channel shall be declared inoperable. Setpoints more conservative than the LTSP are acceptable provided that the as-found and as-left tolerances apply to the actual setpoint implemented in the Surveillance procedures (Nominal Trip Setpoint) to confirm channel performance. The Limiting Trip Setpoint and the methodologies used to determine the as-found and the as-left tolerances are specified in the Technical Requirements Manual.

SURVEILLANCE REQUIREMENTS

--NOTES--

1. Refer to Table 3.3.6.1-1 to determine which SRs apply for each Primary Containment Isolation Function.

2. When a 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 isolation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.6.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.6.1.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.6.1.3	Perform CHANNEL CALIBRATION.	92 days
SR 3.3.6.1.4	--------------------------NOTE---------------------------- For Function 2.d, radiation detectors are excluded. --- Perform CHANNEL CALIBRATION.	24 months
SR 3.3.6.1.5	Calibrate each radiation detector.	24 months
SR 3.3.6.1.6	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.6.2.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.6.2.3	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.6.2.4	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

SURVEILLANCE REQUIREMENTS

--NOTES--

1. Refer to Table 3.3.6.3-1 to determine which SRs apply for each Function.

2. When a 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 LLS initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.6.3.1	Perform CHANNEL FUNCTIONAL TEST for portion of the channel outside primary containment.	92 days
SR 3.3.6.3.2	---------------------------NOTE--------------------------- Only required to be performed prior to entering MODE 2 during each scheduled outage > 72 hours when entry is made into primary containment. --- Perform CHANNEL FUNCTIONAL TEST for portions of the channel inside primary containment.	92 days
SR 3.3.6.3.3	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.6.3.4	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.6.3.5	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

Table 3.3.6.3-1 (page 1 of 1)
Low-Low Set Instrumentation

FUNCTION	REQUIRED CHANNELS PER FUNCTION	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE
1. Reactor Pressure - High	1 per LLS valve	SR 3.3.6.3.3 SR 3.3.6.3.4 SR 3.3.6.3.5	≤ 1050 psig
2. Low-Low Set Pressure Setpoints	2 per LLS valve	SR 3.3.6.3.3 SR 3.3.6.3.4 SR 3.3.6.3.5	Low: Open ≥ 996.5 psig and ≤ 1010 psig Close ≥ 835 psig and ≤ 875.5 psig High: Open ≥ 996.5 psig and ≤ 1040 psig Close ≥ 835 psig and ≤ 875.5 psig
3. Discharge Line Pressure Switch	1 per SRV	SR 3.3.6.3.1 SR 3.3.6.3.2 SR 3.3.6.3.4 SR 3.3.6.3.5	≥ 25 psig and ≤ 55 psig

SURVEILLANCE REQUIREMENTS

-----NOTES-----

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

2. When a 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 CREF initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.7.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.7.1.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.7.1.3	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.7.1.4	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

SURVEILLANCE REQUIREMENTS

---NOTES---

1. Refer to Table 3.3.8.1-1 to determine which SRs apply for each LOP Function.

2. When a 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 2 hours provided the associated Function maintains DG initiation capability.

SURVEILLANCE		FREQUENCY
SR 3.3.8.1.1	Perform CHANNEL FUNCTIONAL TEST.	31 days
SR 3.3.8.1.2	Perform CHANNEL CALIBRATION.	24 months
SR 3.3.8.1.3	Perform LOGIC SYSTEM FUNCTIONAL TEST.	24 months

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition A or B not met in MODE 5 with any control rod withdrawn from a core cell containing one or more fuel assemblies.	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
SR 3.3.8.2.1	Perform CHANNEL CALIBRATION. The Allowable Values shall be: a. Overvoltage $\leq$ 131 V with time delay set to $\leq$ 3.8 seconds. b. Undervoltage $\geq$ 109 V, with time delay set to $\leq$ 3.8 seconds. c. Underfrequency $\geq$ 57.2 Hz, with time delay set to $\leq$ 3.8 seconds.	24 months
SR 3.3.8.2.2	Perform a system functional test.	24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.3.1	Verify the safety function lift setpoints of the SRVs and SVs are as follows: Number of SRVs — Setpoint (psig) 2 — 1080 ± 32.4 3 — 1090 ± 32.7 3 — 1100 ± 33.0 Number of SVs — Setpoint (psig) 3 — 1240 ± 37.2 Following testing, lift settings shall be within ± 1%.	In accordance with the Inservice Testing Program
SR 3.4.3.2	-------------------------------NOTE----------------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. --- Verify each SRV opens when manually actuated.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.1.6	Verify the following ECCS pumps develop the specified flow rate against a system head corresponding to the specified reactor pressure. SYSTEM / FLOW RATE / NO. OF PUMPS / SYSTEM HEAD CORRESPONDING TO A REACTOR PRESSURE OF Core Spray / ≥ 4720 gpm / 1 / ≥ 113 psig LPCI / ≥ 15,000 gpm / 2 / ≥ 20 psig	In accordance with the Inservice Testing Program
SR 3.5.1.7	-------------------------------NOTE------------------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. --- Verify, with reactor pressure ≤ 1020 and ≥ 920 psig, the HPCI pump can develop a flow rate ≥ 4250 gpm against a system head corresponding to reactor pressure.	92 days
SR 3.5.1.8	-------------------------------NOTE------------------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. --- Verify, with reactor pressure ≤ 165 psig, the HPCI pump can develop a flow rate ≥ 4250 gpm against a system head corresponding to reactor pressure.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.1.9	------------------------------NOTES------------------------------ 1. For HPCI only, not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. 2. Vessel injection/spray may be excluded. --- Verify each ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.	24 months
SR 3.5.1.10	------------------------------NOTE------------------------------ Valve actuation may be excluded. --- Verify the ADS actuates on an actual or simulated automatic initiation signal.	24 months
SR 3.5.1.11	------------------------------NOTE------------------------------ Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. --- Verify each ADS valve opens when manually actuated.	24 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.5.2.4	Verify each required ECCS pump develops the specified flow rate against a system head corresponding to the specified reactor pressure. SYSTEM / FLOW RATE / NO. OF PUMPS / SYSTEM HEAD CORRESPONDING TO A REACTOR PRESSURE OF CS / ≥ 4720 gpm / 1 / ≥ 113 psig LPCI / ≥ 7700 gpm / 1 / ≥ 20 psig	In accordance with the Inservice Testing Program
SR 3.5.2.5	-------------------------------NOTE------------------------------ Vessel injection/spray may be excluded. --- Verify each required ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.	24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.3.1	Verify the RCIC System piping is filled with water from the pump discharge valve to the injection valve.	31 days
SR 3.5.3.2	Verify each RCIC System manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.5.3.3	-----------------------------NOTE----------------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. ---	
	Verify, with reactor pressure $\leq$ 1020 psig and $\geq$ 920 psig, the RCIC pump can develop a flow rate $\geq$ 400 gpm against a system head corresponding to reactor pressure.	92 days
SR 3.5.3.4	-----------------------------NOTE----------------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. ---	
	Verify, with reactor pressure $\leq$ 165 psig, the RCIC pump can develop a flow rate $\geq$ 400 gpm against a system head corresponding to reactor pressure.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.3.5	-----NOTES----- 1. Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. 2. Vessel injection may be excluded. ---------- Verify the RCIC System actuates on an actual or simulated automatic initiation signal.	 24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.1.1.1	Perform required visual examinations and leakage rate testing except for primary containment air lock testing, in accordance with the Primary Containment Leakage Rate Testing Program.	In accordance with the Primary Containment Leakage Rate Testing Program
SR 3.6.1.1.2	Verify drywell to suppression chamber bypass leakage is equivalent to a hole < 1.0 inch in diameter.	24 months AND --------NOTE-------- Only required after two consecutive tests fail and continues until two consecutive tests pass ----------------------- 9 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.1.3.6	Verify the isolation time of each MSIV is $\geq$ 3 seconds and $\leq$ 5 seconds.	In accordance with the Inservice Testing Program
SR 3.6.1.3.7	Verify each automatic PCIV actuates to the isolation position on an actual or simulated isolation signal.	24 months
SR 3.6.1.3.8	Verify a representative sample of reactor instrumentation line EFCVs actuate to the isolation position on an actual or simulated instrument line break.	24 months
SR 3.6.1.3.9	Remove and test the explosive squib from each shear isolation valve of the TIP System.	24 months on a STAGGERED TEST BASIS
SR 3.6.1.3.10	Verify leakage rate through each Main Steam line is $\leq$ 106 scfh when tested at $\geq$ 29 psig.	In accordance with the Primary Containment Leakage Rate Testing Program

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.1.3.11	Verify each inboard 24 inch primary containment purge and vent valve is blocked to restrict the maximum valve opening angle to 60°.	24 months
SR 3.6.1.3.12	Verify leakage rate through the Main Steam Pathway is $\leq$ 212 scfh when tested at $\geq$ 29 psig.	In accordance with the Primary Containment Leakage Rate Testing Program

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.1.6.1	-----------------------------NOTE----------------------------- Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. -- Verify each LLS valve opens when manually actuated.	24 months
SR 3.6.1.6.2	-----------------------------NOTE----------------------------- Valve actuation may be excluded. -- Verify the LLS System actuates on an actual or simulated automatic initiation signal.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.1.7.3	Verify the full open setpoint of each vacuum breaker is $\leq$ 0.5 psid.	24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.1.8.1	-----------------------------NOTE--------------------------- Not required to be met for vacuum breakers that are open during Surveillances. --- Verify each vacuum breaker is closed.	14 days
SR 3.6.1.8.2	Perform a functional test of each required vacuum breaker.	31 days
SR 3.6.1.8.3	Verify the opening setpoint of each required vacuum breaker is $\leq$ 0.5 psid.	24 months

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. (continued)	C.2 Initiate action to suspend OPDRVs.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.4.1.1	Verify secondary containment vacuum is $\geq$ 0.25 inch of vacuum water gauge.	24 hours
SR 3.6.4.1.2	Verify all secondary containment equipment hatches are closed and sealed.	31 days
SR 3.6.4.1.3	Verify one secondary containment access door in each access opening is closed.	31 days
SR 3.6.4.1.4	Verify each SGT subsystem can maintain $\geq$ 0.25 inch of vacuum water gauge in the secondary containment for 1 hour at a flow rate $\leq$ 1780 cfm.	24 months on a STAGGERED TEST BASIS

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.6.4.2.1	---NOTES--- 1. Valves and blind flanges in high radiation areas may be verified by use of administrative means. 2. Not required to be met for SCIVs that are open under administrative controls. --- Verify each secondary containment isolation manual valve and blind flange that is not locked, sealed, or otherwise secured and is required to be closed during accident conditions is closed.	31 days
SR 3.6.4.2.2	Verify the isolation time of each power operated automatic SCIV is within limits.	In accordance with the Inservice Testing Program
SR 3.6.4.2.3	Verify each automatic SCIV actuates to the isolation position on an actual or simulated actuation signal.	24 months

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. (continued)	E.2 Initiate action to suspend OPDRVs.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.4.3.1	Operate each SGT subsystem for $\geq$ 10 continuous hours with heaters operating.	31 days
SR 3.6.4.3.2	Perform required SGT filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.6.4.3.3	Verify each SGT subsystem actuates on an actual or simulated initiation signal.	24 months
SR 3.6.4.3.4	Verify the SGT units cross tie damper is in the correct position, and each SGT room air supply check valve and SGT dilution air shutoff valve can be opened.	24 months

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.7.2.3	-------------------------------NOTE---------------------------- Isolation of flow to individual components does not render SW System inoperable. -- Verify each SW subsystem manual, power operated, and automatic valve in the flow paths servicing safety related systems or components, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.2.4	Verify each SW subsystem actuates on an actual or simulated initiation signal.	24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.3.1	-----NOTES----- 1. SR 3.0.1 is not applicable when both Service Water backup subsystems are OPERABLE. 2. REC system leakage beyond limits by itself is only a degradation of the REC system and does not result in the REC system being inoperable. ---------- Verify the REC system leakage is within limits.	24 hours
SR 3.7.3.2	Verify the temperature of the REC supply water is $\leq$ 100°F.	24 hours
SR 3.7.3.3	-----NOTE----- Isolation of flow to individual components does not render REC System inoperable. ---------- Verify each REC subsystem manual, power operated, and automatic valve in the flow paths servicing safety related cooling loads, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.3.4	Verify each REC subsystem actuates on an actual or simulated initiation signal.	24 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.4.1	Operate the CREF System for ≥ 15 minutes.	31 days
SR 3.7.4.2	Perform required CREF filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP.
SR 3.7.4.3	Verify the CREF System actuates on an actual or simulated initiation signal.	24 months
SR 3.7.4.4	Perform required CRE unfiltered air inleakage testing in accordance with the Control Room Envelope Habitability Program.	In accordance with the Control Room Envelope Habitability Program

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1	Verify operation of each main turbine bypass valve.	31 days
SR 3.7.7.2	Perform a system functional test.	24 months
SR 3.7.7.3	Verify the TURBINE BYPASS SYSTEM RESPONSE TIME is within limits.	24 months

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.8.1.7	-------------------------------NOTE------------------------------ All DG starts may be preceded by an engine prelube period. --- Verify each DG starts from standby condition and achieves, in ≤ 14 seconds, voltage ≥ 3950 V and frequency ≥ 58.8 Hz, and after steady state conditions are reached, maintains voltage ≥ 3950 V and ≤ 4400 V and frequency ≥ 58.8 Hz and ≤ 61.2 Hz.	184 days
SR 3.8.1.8	-------------------------------NOTE------------------------------ This Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR. --- Verify automatic and manual transfer of unit power supply from the normal offsite circuit to the alternate offsite circuit.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.9	-------------------------------NOTES------------------------------- 1. Momentary transients outside the load and power factor ranges do not invalidate this test. 2. This Surveillance shall not be performed in MODE 1 or 2. However, credit may be taken for unplanned events that satisfy this SR. 3. If performed with DG synchronized with offsite power, the surveillance shall be performed at a power factor ≤ 0.89. However, if grid conditions do not permit, the power factor limit is not required to be met. Under this condition the power factor shall be maintained as close to the limit as practicable. --- Verify each DG operates for ≥ 8 hours: a. For ≥ 2 hours loaded ≥ 4200 kW and ≤ 4400 kW; and b. For the remaining hours of the test loaded ≥ 3600 kW and ≤ 4000 kW.	24 months
SR 3.8.1.10	-------------------------------NOTES------------------------------- This Surveillance shall not be performed in MODE 1, 2 or 3. However, credit may be taken for unplanned events that satisfy this SR. --- Verify interval between each sequenced load is within ± 10% of nominal timer setpoint.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.11	-------------------------------NOTES------------------------------- 1. All DG starts may be preceded by an engine prelube period. 2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. --	
	Verify, on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ECCS initiation signal: a. De-energization of emergency buses; b. Load shedding from emergency buses; and c. DG auto-starts from standby condition and: 1. energizes permanently connected loads in $\leq$ 14 seconds, 2. energizes auto-connected emergency loads through the timed logic sequence, 3. maintains steady state voltage $\geq$ 3950 V and $\leq$ 4400 V, 4. maintains steady state frequency $\geq$ 58.8 Hz and $\leq$ 61.2 Hz, and 5. supplies permanently connected and auto-connected emergency loads for $\geq$ 5 minutes.	24 months

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage on float charge is: a. ≥ 125 V for the 125 V batteries; and b. ≥ 250 V for the 250 V batteries.	7 days
SR 3.8.4.2	Verify no visible corrosion at battery terminals and connectors. OR Verify battery connection resistance meets the limits specified in Table 3.8.4-1.	92 days
SR 3.8.4.3	Verify battery cells, cell plates, and racks show no visual indication of physical damage or abnormal deterioration that degrades battery performance.	18 months
SR 3.8.4.4	Remove visible corrosion and verify battery cell to cell and terminal connections are coated with anti-corrosion material.	18 months
SR 3.8.4.5	Verify battery connection resistance meets the limits specified in Table 3.8.4-1.	18 months
SR 3.8.4.6	Verify: a. Each required 125 V battery charger supplies ≥ 200 amps at ≥ 125 V for ≥ 4 hours; and b. Each required 250 V battery charger supplies ≥ 200 amps at ≥ 250 V for ≥ 4 hours.	24 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.4.7	------------------------------NOTES------------------------------ 1. The modified performance discharge test in SR 3.8.4.8 may be performed in lieu of the service test in SR 3.8.4.7 once per 60 months. 2. This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.	24 months
SR 3.8.4.8	------------------------------NOTE------------------------------ This Surveillance shall not be performed in MODE 1, 2, or 3. However, credit may be taken for unplanned events that satisfy this SR. -- Verify battery capacity is $\geq$ 90% of the manufacturer's rating when subjected to a performance discharge test or a modified performance discharge test.	60 months <u>AND</u> 18 months when battery shows degradation or has reached 85% of expected life with capacity < 100% of manufacturer's rating <u>AND</u> 24 months when battery has reached 85% of the expected life with capacity $\geq$ 100% of manufacturer's rating

5.5 Programs and Manuals

5.5.1 Offsite Dose Assessment Manual (ODAM) (continued)

markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (i.e., month and year) the change was implemented.

5.5.2 Systems Integrity Monitoring Program

This program provides controls to minimize leakage from those portions of systems outside containment that could contain highly radioactive fluids during a serious transient or accident to levels as low as practicable. The systems include the Core Spray, High Pressure Coolant Injection, Residual Heat Removal, and Reactor Core Isolation Cooling. The program shall include the following:

a. Preventive maintenance and periodic visual inspection requirements; and

b. Integrated leak test requirements for each system at 24 month intervals or less.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable at the 24 month Frequency for performing system leak test activities.

5.5.3 Post Accident Sampling

This program provides controls that ensure the capability to obtain and analyze reactor coolant, radioactive gases, and particulates in plant gaseous effluents and containment atmosphere samples under accident conditions. The program shall include the following:

a. Training of personnel;

b. Procedures for sampling and analysis; and

c. Provisions for maintenance of sampling and analysis equipment.

(continued)

5.5 Programs and Manuals (continued)

5.5.7 Ventilation Filter Testing Program (VFTP)

The VFTP shall establish the required testing of Engineered Safety Feature (ESF) filter ventilation systems. Tests described in Specifications 5.5.7.a, 5.5.7.b, and 5.5.7.c shall be performed once per 24 months for standby service or after 720 hours of system operation; and, following significant painting, fire, or chemical release concurrent with system operation in any ventilation zone communicating with the system.

Tests described in Specifications 5.5.7.a and 5.5.7.b shall be performed after each complete or partial replacement of the HEPA filter train or charcoal adsorber filter; and after any structural maintenance on the system housing.

Tests described in Specifications 5.5.7.d and 5.5.7.e shall be performed once per 24 months.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the VFTP test frequencies.

a. Demonstrate for each of the ESF systems that an inplace test of the HEPA filters shows a penetration and system bypass < 1% when tested in accordance with Regulatory Guide 1.52, Revision 2, Section C.5.c, and ASME N510-1989 at the system conditions specified below.

ESF Ventilation System	Flowrate (cfm)
SGT System	1602 to 1958
Control Room Emergency Filter System	810 to 990

b. Demonstrate for each of the ESF systems that an inplace test of the charcoal adsorber shows a penetration and system bypass < 1% when tested in accordance with Regulatory Guide 1.52, Revision 2, Section C.5.d, and ASME N510-1989 at the system conditions specified below.

ESF Ventilation System	Flowrate (cfm)
SGT System	1602 to 1958
Control Room Emergency Filter System	810 to 990

(continued)

5.5 Programs and Manuals

5.5.13 Control Room Envelope Habitability Program (continued)

personnel receiving radiation exposures in excess of either (a) 5 rem whole body or its equivalent to any part of the body for the duration of the loss-of-coolant accident, or (b) 5 rem total effective dose equivalent (TEDE) for the duration of the fuel handling accident. The program shall include the following elements:

a. The definition of the CRE and CRE boundary.

b. Requirements for maintaining the CRE boundary in its design condition including configuration control and preventive maintenance.

c. Requirements for (i) determining the unfiltered air inleakage past the CRE boundary into the CRE in accordance with the testing methods and at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, "Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors," Revision 0, May 2003, and (ii) assessing CRE habitability at the Frequencies specified in Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0. No exceptions to Sections C.1 and C.2 of Regulatory Guide 1.197, Revision 0, are proposed.

d. Measurement, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by the CREF System, operating at the flow rate required by the Ventilation Filter Testing Program, at a Frequency of 24 months. The results shall be trended and used as part of the periodic assessment of the CRE boundary.

e. The quantitative limits on unfiltered air inleakage into the CRE. These limits shall be stated in a manner to allow direct comparison to the unfiltered air inleakage measured by the testing described in paragraph c. The unfiltered air inleakage limit for radiological challenges is the inleakage flow rate assumed in the licensing basis analyses of DBA consequences. Unfiltered air inleakage limits for hazardous chemicals must ensure that exposure of CRE occupants to these hazards will be within the assumptions in the licensing basis.

f. The provisions of SR 3.0.2 are applicable to the Frequencies for assessing CRE habitability, determining CRE unfiltered air inleakage, and measuring CRE pressure and assessing the CRE boundary as required by paragraphs c and d, respectively.

Attachment 4

**Proposed Technical Specification Bases Revisions
(Information Only)**

Cooper Nuclear Station, Docket No. 50-298, DPR-46

Revised Technical Specification Bases Pages

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BASES INSERTS

<INSERT 1>

The Limiting Trip Setpoint (LTSP) is a predetermined setting for a protection channel chosen to ensure automatic actuation prior to the process variable reaching the Analytical Limit and thus ensuring that the Safety Limit (SL) would not be exceeded. As such, the LTSP accounts for uncertainties in setting the channel (e.g., calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the LTSP ensures that SLs are not exceeded. Therefore, the LTSP meets the definition of an LSSS (Ref. 1).

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. Operable is defined in Technical Specifications as "...being capable of performing its safety function(s)." Relying solely on the LTSP to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as-found" value of a protection channel setting during a Surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protective protection channel with a setting that has been found to be different from the LTSP due to some drift of the setting may still be OPERABLE because drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the LTSP and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as-found" setting of the protection channel. Therefore, the channel would still be OPERABLE because it would have performed its safety function and the only corrective action required would be to reset the channel within the established as-left tolerance around the LTSP to account for further drift during the next surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria). However, there is also some point beyond which the channel may not be able to perform its function due to, for example, greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the channels and is designated as the Allowable Value.

If the actual setting (as-found setpoint) of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE but degraded. The degraded condition will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the LTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

<INSERT 2>

Permissive and interlock setpoints allow the blocking of trips during plant startups, and restoration of trips when the permissive conditions are not satisfied, but they are not explicitly modeled in the Safety Analyses. These permissives and interlocks ensure that the starting conditions are consistent with the safety analysis, before preventive or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values without regard to measurement accuracy.

<INSERT 3>

SR 3.3.1.1.9 for Function 3.3.1.1-1.2.d is modified by two Notes as identified in Table 3.3.1.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. For channels determined to be OPERABLE but degraded, after returning the channel to service the performance of these channels will be evaluated under the plant Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition. The second Note requires that the as-left setting for the channel be within the as-left tolerance of the LTSP. Where a setpoint more conservative than the LTSP is used in the plant surveillance procedures (NTSP), the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the LTSP, then the channel shall be declared inoperable. The second Note also requires that LTSPs and the methodologies for calculating the as-left and the as-found tolerances be in the Technical Requirements Manual.

<INSERT 4>

Numerous SR 3.3.1.1.10 and 12 functions are modified by two Notes as identified in Table 3.3.1.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. For channels determined to be OPERABLE but degraded, after returning the channel to service the performance of these channels will be evaluated under the plant Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition. The second Note requires that the as-left setting for the channel be within the as-left tolerance of the LTSP. Where a setpoint more conservative than the LTSP is used in the plant surveillance procedures (NTSP), the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the LTSP, then the channel shall be declared inoperable. The second Note also requires that LTSPs and the methodologies for calculating the as-left and the as-found tolerances be in the Technical Requirements Manual.

<INSERT 5>

The protection and monitoring functions of the control rod block instrumentation have been designed to ensure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RPS, as well as LCOs on other reactor system parameters and equipment performance.

Technical Specifications are required by 10 CFR 50.36 to include LSSS for variables that have significant safety functions. LSSS are defined by the regulation as "Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that automatic protective actions will correct the abnormal situation before a Safety Limit (SL) is exceeded." The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a Safety Limit (SL) is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protection channels must be chosen to be more conservative than the Analytical Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur.

The Limiting Trip Setpoint (LTSP) is a predetermined setting for a protection channel chosen to ensure automatic actuation prior to the process variable reaching the Analytical Limit and thus ensuring that the SL would not be exceeded. As such, the LTSP accounts for uncertainties in setting the channel (e.g., calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the LTSP ensures that SLs are not exceeded. Therefore, the LTSP meets the definition of an LSSS (Ref. 1).

The Allowable Values specified in Table 3.3.2.1-1 serves as the LSSS such that a channel is OPERABLE if the trip setpoint is found not to exceed the Allowable Value. As such, the Allowable Value differs from the trip setpoint by an amount primarily equal to the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a SL is not exceeded at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval.

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. Operable is defined in Technical Specifications as "...being capable of performing its safety function(s)." Relying solely on the LTSP to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as found" value of a protection channel setting during a Surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel with a setting that has been found to be different from the LTSP due to some drift of the setting may still be OPERABLE because drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the LTSP and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as found" setting of the protection channel. Therefore, the channel would still be OPERABLE because it would have performed its safety function and the only corrective action required would be to reset the channel within the established as-left tolerance around LTSP to account for further drift during the next surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria).

However, there is also some point beyond which the channel would have not been able to perform its function due to, for example, greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the channels and is designated as the Allowable Value.

If the actual setting (as-found setpoint) of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE, but degraded. The degraded condition will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the LTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

<INSERT 6>

Permissive and interlock setpoints allow the blocking of trips during plant startups, and restoration of trips when the permissive conditions are not satisfied, but they are not explicitly modeled in the Safety Analyses. These permissives and interlocks ensure that the starting conditions are consistent with the safety analysis, before preventive or mitigating actions occur. Because these permissives or interlocks are only one of multiple conservative starting assumptions for the accident analysis, they are generally considered as nominal values without regard to measurement accuracy.

<INSERT 7>

Allowable Values are specified for each Rod Block Function specified in SR 3.3.2.1.5. LTSPs and the methodologies for calculation of the as-left and as-found tolerances are described in the Technical Requirements Manual. The LTSPs are selected to ensure that the actual setpoints remain conservative with respect to the as-found tolerance band between successive CHANNEL CALIBRATIONS. After each calibration the trip setpoint shall be left within the as-left band around the LTSP.

LTSPs are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g., trip unit) changes state. The analytical limits are derived from the limiting values of the process parameters obtained from the safety analysis. The Allowable Values are derived from the analytical limits, corrected for calibration, process, and some of the instrument errors. The LTSPs are then determined accounting for the remaining instrument errors (e.g., drift). The LTSPs derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

<INSERT 8>

SR 3.3.2.1.5 for Functions 3.3.2.1-1.1.a, 3.3.2.1-1.1.b and 3.3.2.1-1.1.c is modified by two Notes as identified in Table 3.3.2.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. For channels determined to be OPERABLE but degraded, after returning the channel to service the performance of these channels will be evaluated under the plant Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition. The second Note requires that the as-left setting for the channel be within the as-left tolerance of the LTSP. Where a setpoint more conservative than the LTSP is used in the plant surveillance procedures (NTSP), the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the LTSP, then the channel shall be declared inoperable. The second Note also requires that LTSPs and the methodologies for calculating the as-left and the as-found tolerances be in the Technical Requirements Manual.

<INSERT 9>

This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the ECCS, as well as LCOs on other reactor system parameters and equipment performance.

Technical Specifications are required by 10 CFR 50.36 to include LSSS for variables that have significant safety functions. LSSS are defined by the regulation as "Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that automatic protective actions will correct the abnormal situation before a Safety Limit (SL) is exceeded." The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a Safety Limit (SL) is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protection channels must be chosen to be more conservative than the Analytical Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur.

The Limiting Trip Setpoint (LTSP) is a predetermined setting for a protection channel chosen to ensure automatic actuation prior to the process variable reaching the Analytical Limit and thus ensuring that the SL would not be exceeded. As such, the LTSP accounts for uncertainties in setting the channel (e.g., calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the LTSP ensures that SLs are not exceeded. Therefore, the LTSP meets the definition of an LSSS (Ref. 1).

The Allowable Values specified in Table 3.3.5.1-1 serves as the LSSS such that a channel is OPERABLE if the trip setpoint is found not to exceed the Allowable Value. As such, the Allowable Value differs from the trip setpoint by an amount primarily equal to the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a SL is not exceeded at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval.

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. Operable is defined in Technical Specifications as "...being capable of performing its safety function(s)." Relying solely on the LTSP to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as found" value of a protection channel setting during a Surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel with a setting that has been found to be different from the LTSP due to some drift of the setting may still be OPERABLE because drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the LTSP and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as found" setting of the protection channel. Therefore, the channel would still be OPERABLE because it would have performed its safety function and the only corrective action required would be to reset the channel within the established as-left tolerance around LTSP to account for further drift during the next surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria).

However, there is also some point beyond which the channel would have not been able to perform its function due to, for example, greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the channels and is designated as the Allowable Value.

If the actual setting (as-found setpoint) of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE, but degraded. The degraded condition will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the LTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

<INSERT 10>

SR 3.3.5.1.4 for selected functions is modified by two Notes as identified in Table 3.3.5.1-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. For channels determined to be OPERABLE but degraded, after returning the channel to service the performance of these channels will be evaluated under the plant Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition. The second Note requires that the as-left setting for the channel be within the as-left tolerance of the LTSP. Where a setpoint more conservative than the LTSP is used in the plant surveillance procedures (NTSP), the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the LTSP, then the channel shall be declared inoperable. The second Note also requires that LTSPs and the methodologies for calculating the as-left and the as-found tolerances be in the Technical Requirements Manual.

<INSERT 11>

This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RCIC, as well as LCOs on other reactor system parameters and equipment performance.

Technical Specifications are required by 10 CFR 50.36 to include LSSS for variables that have significant safety functions. LSSS are defined by the regulation as "Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that automatic protective actions will correct the abnormal situation before a Safety Limit (SL) is exceeded." The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a Safety Limit (SL) is not exceeded. Any automatic protection action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protection channels must be chosen to be more conservative than the Analytical Limit to account for instrument loop uncertainties related to the setting at which the automatic protective action would actually occur.

The Limiting Trip Setpoint (LTSP) is a predetermined setting for a protection channel chosen to ensure automatic actuation prior to the process variable reaching the Analytical Limit and thus ensuring that the SL would not be exceeded. As such, the LTSP accounts for uncertainties in setting the channel (e.g., calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the LTSP ensures that SLs are not exceeded. Therefore, the LTSP meets the definition of an LSSS (Ref. 1).

The Allowable Values specified in Table 3.3.5.2-1 serve as the LSSS such that a channel is OPERABLE if the trip setpoint is found not to exceed the Allowable Value. As such, the Allowable Value differs from the trip setpoint by an amount primarily equal to the expected instrument loop uncertainties, such as drift, during the surveillance interval. In this manner, the actual setting of the device will still meet the LSSS definition and ensure that a SL is not exceeded at any given point of time as long as the device has not drifted beyond that expected during the surveillance interval.

Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. Operable is defined in Technical Specifications as "...being capable of performing its safety function(s)." Relying solely on the LTSP to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as found" value of a protection channel setting during a Surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel with a setting that has been found to be different from the LTSP due to some drift of the setting may still be OPERABLE because drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the LTSP and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as found" setting of the protection channel. Therefore, the channel would still be OPERABLE because it would have performed its safety function and the only corrective action required would be to reset the channel within the established as-left tolerance around LTSP to account for further drift during the next surveillance interval. Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria).

However, there is also some point beyond which the channel would have not been able to perform its function due to, for example, greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the channels and is designated as the Allowable Value.

If the actual setting (as-found setpoint) of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE, but degraded. The degraded condition will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the LTSP (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

<INSERT 12>

SR 3.3.5.2.3 and SR 3.3.5.2.4 are modified by two Notes as identified in Table 3.3.5.2-1. The first Note requires evaluation of channel performance for the condition where the as-found setting for the channel setpoint is outside its as-found tolerance but conservative with respect to the Allowable Value. Evaluation of channel performance will verify that the channel will continue to behave in accordance with safety analysis assumptions and the channel performance assumptions in the setpoint methodology. The purpose of the assessment is to ensure confidence in the channel performance prior to returning the channel to service. For channels determined to be OPERABLE but degraded, after returning the channel to service the performance of these channels will be evaluated under the plant Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition. The second Note requires that the as-left setting for the channel be within the as-left tolerance of the LTSP. Where a setpoint more conservative than the LTSP is used in the plant surveillance procedures (NTSP), the as-left and as-found tolerances, as applicable, will be applied to the surveillance procedure setpoint. This will ensure that sufficient margin to the Safety Limit and/or Analytical Limit is maintained. If the as-left channel setting cannot be returned to a setting within the as-left tolerance of the LTSP, then the channel shall be declared inoperable. The second Note also requires that LTSPs and the methodologies for calculating the as-left and the as-found tolerances be in the Technical Requirements Manual.

SURVEILLANCE REQUIREMENTS (continued)

positive reactivity effects encountered during power reduction, cooldown of the moderator, and xenon decay. This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice tests confirm component OPERABILITY, and detect incipient failures by indicating abnormal performance. The Frequency of this Surveillance is in accordance with the Inservice Testing Program.

SR 3.1.7.8 and SR 3.1.7.9

These Surveillances ensure that there is a functioning flow path from the boron solution storage tank to the RPV, including the firing of an explosive valve. The replacement charge for the explosive valve shall be from the same manufactured batch as the one fired or from another batch that has been certified by having one of that batch successfully fired. The pump and explosive valve tested should be alternated such 48
that both complete flow paths are tested every ~~36~~ months at alternating
~~18~~ month intervals. The Surveillance may be performed in separate
24 steps to prevent injecting boron into the RPV. An acceptable method for verifying flow from the pump to the RPV is to pump demineralized water from a test tank through one SLC subsystem and into the RPV. The ~~18~~ 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 these components 24
usually pass the Surveillance when performed at the ~~18~~ month Frequency; therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

Demonstrating that all heat traced piping between the boron solution storage tank and the suction inlet to the injection pumps is unblocked ensures that there is a functioning flow path for injecting the sodium pentaborate solution. An acceptable method for verifying that the suction piping is unblocked is to manually initiate the system, except the explosive valves, and pump from the storage tank to the test tank. Upon completion of this verification, the pump suction piping must be flushed
24 with demineralized water to ensure piping between the storage tank and pump suction is unblocked. The ~~18~~ month Frequency is acceptable since there is a low probability that the subject piping will be blocked due to precipitation of the boron from solution in the heat traced piping. This is especially true in light of the temperature verification of this piping

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.1.8.2

During a scram, the SDV vent and drain valves should close to contain the reactor water discharged to the SDV piping. Cycling each valve through its complete range of motion (closed and open) ensures that the valve will function properly during a scram. The 92 day Frequency is based on operating experience and takes into account the level of redundancy in the system design.

SR 3.1.8.3

24

SR 3.1.8.3 is an integrated test of the SDV vent and drain valves to verify total system performance. After receipt of a simulated or actual scram signal, the closure of the automatic SDV vent and drain valves is verified. The closure time of 30 seconds after receipt of a scram signal is based on the bounding leakage case evaluated in the accident analysis. Similarly, after receipt of a simulated or actual scram reset signal, the opening of the SDV vent and drain valves is verified. The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.1.1 and the scram time testing of control rods in LCO 3.1.3, "Control Rod Operability," overlap this Surveillance to provide complete testing of the assumed safety function. The ~~18~~ 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 these components usually pass the Surveillance when performed at the ~~18~~ month Frequency; therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

(continued)

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B 3.3 INSTRUMENTATION

B 3.3.1.1 Reactor Protection System (RPS) Instrumentation

BASES

BACKGROUND

The RPS initiates a reactor scram when one or more monitored parameters exceed their specified limits to preserve the integrity of the fuel cladding and the reactor coolant pressure boundary (RCPB) and minimize the energy that must be absorbed following a loss of coolant accident (LOCA). This can be accomplished either automatically or manually.

The protection and monitoring functions of the RPS have been designed to ensure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RPS, as well as LCOs on other reactor system parameters and equipment performance. ~~The LSSS are defined in this Specification as the Allowable Values, which, in conjunction with the LCOs, establish the threshold for protective system action to prevent exceeding acceptable limits, including Safety Limits (SLs) during Design Basis Accidents (DBAs).~~

<INSERT 1>

2

The RPS, as described in the USAR, Section VII-2 (Ref. ~~1~~), includes sensors, relays, bypass circuits, and switches that are necessary to cause initiation of a reactor scram. Functional diversity is provided by monitoring a wide range of dependent and independent parameters. The input parameters to the scram logic are from instrumentation that monitors reactor vessel water level, reactor vessel pressure, neutron flux, main steam line isolation valve position, turbine control valve (TCV) fast closure, trip oil pressure, turbine stop valve (TSV) position, drywell pressure, and scram discharge volume (SDV) water level, as well as reactor mode switch in shutdown position and manual scram signals. There are at least four redundant sensor input signals from each of these parameters (with the exception of the manual scram signal and the reactor mode switch in shutdown scram signal). Most channels include instrumentation that compares measured input signals with pre-established setpoints. When the setpoint is exceeded, the channel outputs an RPS trip signal to the trip logic.

(continued)

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BASES

BACKGROUND (continued)

The RPS is comprised of two independent trip systems (A and B) with three logic channels in each trip system (logic channels A1, A2, and A3, B1, B2, and B3) as shown in Reference ~~1~~ 2. Logic channels A1, A2, B1 and B2 contain automatic logic. The above mentioned parameters are represented by at least one input to each of these logic channels. The outputs of the logic channels in a trip system are combined in a one-out-of-two logic so that either channel can trip the associated trip system. The tripping of both trip systems will produce a reactor scram. This logic arrangement is referred to as a one-out-of-two taken twice logic. In addition to the automatic logic channels, logic channels A3 and B3 (one logic channel per trip system) are provided for manual scram. Both channel push buttons must be depressed to initiate the manual trip function. Each trip system can be reset by use of a reset switch. If a full scram occurs (both trip systems trip), a relay prevents reset of the trip systems for 10 seconds after the full scram signal is received. This 10 second delay on reset ensures that the scram function will be completed.

Two scram pilot valves are located in the hydraulic control unit for each control rod drive (CRD). Each scram pilot valve is solenoid operated, with the solenoids normally energized. The scram pilot valves control the air supply to the scram inlet and outlet valves for the associated CRD. When either scram pilot valve solenoid is energized, air pressure holds the scram valves closed and, therefore, both scram pilot valve solenoids must be de-energized to cause a control rod to scram. The scram valves control the supply and discharge paths for the CRD water during a scram. One of the scram pilot valve solenoids for each CRD is controlled by trip system A, and the other solenoid is controlled by trip system B. Any trip of trip system A in conjunction with any trip in trip system B results in de-energizing both solenoids, air bleeding off, scram valves opening, and control rod scram.

The backup scram valves, which energize on a scram signal to depressurize the scram air header, are also controlled by the RPS. Additionally, the RPS System controls the SDV vent and drain valves such that when both trip systems trip, the SDV vent and drain valves close to isolate the SDV.

(continued)

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BASES (continued)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The actions of the RPS are assumed in the safety analyses of References 2, 3, 4, and 5 ~~1, 2, 3, and 4~~. The RPS is required to initiate a reactor scram when monitored parameter values are exceeded ~~exceed the Allowable Values, specified by the setpoint methodology and listed in Table 3.3.1.1-1~~ to preserve the integrity of the fuel cladding, the reactor coolant pressure boundary (RCPB), and the containment by minimizing the energy that must be absorbed following a LOCA.

RPS instrumentation satisfies Criterion 3 of 10 CFR 50.36 (c)(2)(ii) (Ref. 6 ~~5~~). Functions not specifically credited in the accident analysis are retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

<INSERT 2>

The OPERABILITY of the RPS is dependent on the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.1.1-1. Each Function must have a set ~~required number of~~ OPERABLE channels per RPS trip system, with their setpoints within the setting tolerance of the LTSPs ~~specified Allowable Value~~, where appropriate. The actual setpoint is calibrated consistent with applicable setpoint methodology assumptions. Each channel must also respond within its assumed response time, where appropriate.

Allowable Values ~~are specified, as appropriate,~~ for RPS Instrumentation Functions specified in Table 3.3.1.1-1. Limiting Trip Setpoints and the methodologies for calculation of the as-left and as-found tolerances are described in the Technical Requirements Manual. ~~the Table. Nominal trip setpoints are specified in the setpoint calculations. The setpoint calculations are performed using methodology described in NEDC-31336P-A, "General Electric Instrument Setpoint Methodology," dated September 1996.~~ The LTSPs ~~nominal setpoints~~ are selected to ensure that the actual setpoints remain conservative with respect to the as-found tolerance band ~~do not exceed the Allowable Value~~ between successive CHANNEL CALIBRATIONS. After each calibration the trip setpoint shall be left within the as-left band around the LTSP. ~~Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value.~~

LTSPs ~~Trip setpoints~~ are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device changes state. The analytical ~~analytic~~ limits are derived from

(continued)

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BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

the limiting values of the process parameters obtained from the safety analysis or other appropriate documents. The Allowable Values are derived from the ~~analytic~~ analytical limits, corrected for calibration, process, and some of the instrument errors. The LTSPs ~~trip setpoints~~ are then determined accounting for the remaining instrument errors (e.g., drift). The LTSPs ~~trip setpoints~~ derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for.

The OPERABILITY of scram pilot valves and associated solenoids, backup scram valves, and SDV valves, described in the Background section, are not addressed by this LCO.

The individual Functions are required to be OPERABLE in the MODES or other Conditions specified in the table, which may require an RPS trip to mitigate the consequences of a design basis accident or transient. To ensure a reliable scram function, a combination of ~~Functions~~ are required in each MODE to provide primary and diverse functions initiation signals.

The only MODES specified in Table 3.3.1.1-1 are MODES 1 and 2 and MODE 5 with any control rod withdrawn from a core cell containing one or more fuel assemblies. No RPS Function is required in MODES 3 and 4 since, all control rods are fully inserted and the Reactor Mode Switch Shutdown Position control rod withdrawal block (LCO 3.3.2.1) does not allow any control rod to be withdrawn. In MODE 5, control rods withdrawn from a core cell containing no fuel assemblies do not affect the reactivity of the core and, therefore, are not required to have the capability to scram. Provided all other control rods remain inserted, no RPS Function is required. In this condition, the required SDM (LCO 3.1.1) and refuel position one-rod-out interlock (LCO 3.9.2) ensure that no event requiring RPS will occur.

The trip that results from the removal of a circuit card is a basic design feature of selected circuits. This feature is excluded from periodic testing in order to minimize component wear and damage.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

Intermediate Range Monitor (IRM)

1.a. Intermediate Range Monitor Neutron Flux - High

The IRMs monitor neutron flux levels from the upper range of the source range monitor (SRM) to the lower range of the average power range monitors (APRMs). The IRMs are capable of generating trip signals that can be used to prevent fuel damage resulting from abnormal operating transients in the intermediate power range. In this power range, the most significant source of reactivity change is due to control rod withdrawal. The IRM provides diverse protection from the rod worth minimizer (RWM), which monitors and controls the movement of control rods at low power. The RWM prevents the withdrawal of an out of sequence control rod during startup that could result in an unacceptable neutron flux excursion (Ref. ~~2~~). The IRM provides mitigation of the neutron flux excursion. To demonstrate the capability of the IRM System to mitigate control rod withdrawal events, generic analyses have been performed (Ref. ~~3~~) to evaluate the consequences of control rod withdrawal events during startup that are mitigated only by the IRM. The continuous rod withdrawal during reactor startup analysis (Refs. ~~2~~ and ~~3~~), which assumes that one IRM channel in each trip system is bypassed, demonstrates that the IRMs provide protection against local control rod withdrawal errors and results in peak fuel enthalpy below the 170 cal/gm fuel failure threshold criterion.

The IRMs are also capable of limiting other reactivity excursions during startup, such as cold water injection events, although no credit is specifically assumed.

The IRM System is divided into two groups of IRM channels, with four IRM channels inputting to each trip system. The analysis of Reference ~~3~~ assumes that one channel in each trip system is bypassed. Therefore, six channels with three channels in each trip system are required for IRM OPERABILITY to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. This

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1.a. Intermediate Range Monitor Neutron Flux-High (continued)

trip is active in each of the 9 ranges of the IRM, which must be selected by the operator to maintain the neutron flux within the monitored level of an IRM range.

The analysis of Reference ~~3~~ 4 has adequate conservatism to permit an IRM Allowable Value of 121 divisions of a 125 division scale.

The Intermediate Range Monitor Neutron Flux-High Function must be OPERABLE during MODE 2 when control rods may be withdrawn and the potential for criticality exists. In MODE 5, when a cell with fuel has its control rod withdrawn, the IRMs provide monitoring for and protection against unexpected reactivity excursions. In MODE 1, the APRM System and the RWM provide protection against control rod withdrawal error events and the IRMs are not required. An IRM is automatically bypassed when the mode switch is in the "Run" position and its companion APRM is above its downscale trip setpoint.

1.b. Intermediate Range Monitor-Inop

This trip signal provides assurance that a minimum number of IRMs are OPERABLE. Anytime an IRM mode switch is moved to any position other than "Operate," the detector voltage drops below a preset level, loss of the negative or positive DC voltages, or when a module is not plugged in, an inoperative trip signal will be received by the RPS unless the IRM is bypassed. Since only one IRM in each trip system may be bypassed, only one IRM in each RPS trip system may be inoperable without resulting in an RPS trip signal.

This Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

Six channels of Intermediate Range Monitor-Inop with three channels in each trip system are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal.

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.b. Average Power Range Monitor Neutron Flux-High (Flow Biased) (continued)

The Average Power Range Monitor Neutron Flux-High (Flow Biased) Function is required to be OPERABLE in MODE 1 when there is the possibility of generating excessive THERMAL POWER and potentially exceeding the SL applicable to high pressure and core flow conditions (MCPR SL). During MODES 2 and 5, other IRM and APRM Functions provide protection for fuel cladding integrity.

2.c. Average Power Range Monitor Neutron Flux-High (Fixed)

The APRM channels provide the primary indication of neutron flux within the core and respond almost instantaneously to neutron flux increases. The Average Power Range Monitor Neutron Flux-High (Fixed) Function is capable of generating a trip signal to prevent fuel damage or excessive Reactor Coolant System (RCS) pressure. For the overpressurization protection analysis of Reference ~~6~~ 7, the Average Power Range Monitor Neutron Flux-High (Fixed) Function is assumed to terminate the main steam isolation valve (MSIV) closure event and, along with the safety/relief valves (SRVs), limits the peak reactor pressure vessel (RPV) pressure to less than the ASME Code limits. The control rod drop accident (CRDA) analysis (Ref. ~~7~~ 8) takes credit for the Average Power Range Monitor Neutron Flux-High (Fixed) Function to terminate the CRDA.

The APRM System is divided into two groups of channels with three APRM channels inputting to each trip system. The system is designed to allow one channel in each trip system to be bypassed. Any one APRM channel in a trip system can cause the associated trip system to trip. Four channels of Average Power Range Monitor Neutron Flux-High (Fixed) with two channels in each trip system arranged in a one-out-of-

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

2.c. Average Power Range Monitor Neutron Flux-High (Fixed) (continued)

two logic are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. In addition, to provide adequate coverage of the entire core, at least 11 LPRM inputs are required for each APRM channel, with at least two LPRM inputs from each of the four axial levels at which the LPRMs are located.

The Allowable Value is based on the Analytical Limit assumed in the CRDA analyses.

The Average Power Range Monitor Neutron Flux-High (Fixed) Function is required to be OPERABLE in MODE 1 where the potential consequences of the analyzed transients could result in the SLs (e.g., MCPR and RCS pressure) being exceeded. Although the Average Power Range Monitor Neutron Flux-High (Fixed) Function is assumed in the CRDA analysis (Ref. ~~7~~ 8), which is applicable in MODE 2, the Average Power Range Monitor Neutron Flux-High, (Startup) Function conservatively bounds the assumed trip and, together with the assumed IRM trips, provides adequate protection. Therefore, the Average Power Range Monitor Neutron Flux-High (Fixed) Function is not required in MODE 2.

2.d. Average Power Range Monitor-Downscale

This signal ensures that there is adequate Neutron Monitoring System protection if the reactor mode switch is placed in the run position prior to the APRMs coming on scale. With the reactor mode switch in run, an APRM downscale signal coincident with an associated Intermediate Range Monitor Neutron Flux-High or Inop signal generates a trip signal. This Function was not specifically credited in the accident analysis but it is retained for the overall redundancy and diversity of the RPS as required by the NRC approved licensing basis.

The APRM System is divided into two groups of channels with three inputs into each trip system. The system is designed to allow one channel in each trip system to be bypassed. Four channels of Average Power Range Monitor-Downscale with two channels in each trip system arranged in a one-out-of-two logic are required to be OPERABLE to ensure that no

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2.e. Average Power Range Monitor-Inop (continued)

This Function is required to be OPERABLE in the MODES where the APRM Functions are required.

3. Reactor Vessel Pressure-High

An increase in the RPV pressure during reactor operation compresses the steam voids and results in a positive reactivity insertion. This causes the neutron flux and THERMAL POWER transferred to the reactor coolant to increase, which could challenge the integrity of the fuel cladding and the RCPB. No specific safety analysis takes direct credit for this Function. However, the Reactor Vessel Pressure-High Function initiates a scram for transients that result in a pressure increase, counteracting the pressure increase by rapidly reducing core power. For the overpressurization protection analysis of Reference ~~6~~ 7, reactor scram (the analyses conservatively assume scram on the Average Power Range Monitor Neutron Flux-High (Fixed) signal, not the Reactor Vessel Pressure - High signal), along with the SRVs, limits the peak RPV pressure to less than the ASME Section III Code limits.

High reactor pressure signals are initiated from four pressure switches that sense reactor pressure. The Reactor Vessel Pressure-High Allowable Value is chosen to provide a sufficient margin to the ASME Section III Code limits during the event.

Four channels of Reactor Vessel Pressure-High Function, with two channels in each trip system arranged in a one-out-of-two logic, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal. The Function is required to be OPERABLE in MODES 1 and 2 when the RCS is pressurized and the potential for pressure increase exists.

4. Reactor Vessel Water Level-Low (Level 3)

Low RPV water level indicates the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, a reactor scram is initiated at Level 3 to substantially reduce the heat

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

4. Reactor Vessel Water Level-Low, Level 3 (continued)

generated in the fuel from fission. The Reactor Vessel Water Level-Low (Level 3) Function is assumed in the analysis of a loss of feedwater flow (Ref. ~~8~~ 9). The reactor scram reduces the amount of energy required to be absorbed and, along with the actions of the Emergency Core Cooling Systems (ECCS), ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Reactor Vessel Water Level-Low (Level 3) signals are initiated from four level switches that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

Four channels of Reactor Vessel Water Level-Low (Level 3) Function, with two channels in each trip system arranged in a one-out-of-two logic, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function on a valid signal.

The Reactor Vessel Water Level-Low (Level 3) Allowable Value is selected to ensure that during normal operation the separator skirts are not uncovered (this protects available recirculation pump net positive suction head (NPSH) from significant carryunder) and, for transients involving loss of all normal feedwater flow, initiation of the low pressure ECCS subsystems at Reactor Vessel Water-Low Low Low (Level 1) will not be required.

The Function is required in MODES 1 and 2 where considerable energy exists in the RCS resulting in the limiting transients and accidents. ECCS initiations at Reactor Vessel Water Level-Low Low (Level 2) and Low Low Low (Level 1) provide sufficient protection for level transients in all other MODES.

5. Main Steam Isolation Valve-Closure

MSIV closure results in loss of the main turbine and the condenser as a heat sink for the nuclear steam supply system and indicates a need to shut down the reactor to reduce heat generation. Therefore, a reactor scram is initiated on a Main Steam Isolation Valve-Closure signal before the MSIVs

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

5. Main Steam Isolation Valve-Closure (continued)

are completely closed in anticipation of the complete loss of the normal heat sink and subsequent overpressurization transient. However, for the overpressurization protection analysis of Reference 7 ~~6~~, the Average Power Range Monitor Neutron Flux-High (Fixed) Function, along with the SRVs, limits the peak RPV pressure to less than the ASME Code limits. That is, the direct scram on position switches for MSIV closure events is not assumed in the overpressurization analysis.

The reactor scram reduces the amount of energy required to be absorbed and, along with the actions of the ECCS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

MSIV closure signals are initiated from position switches located on each of the eight MSIVs. Each MSIV has two position switches; one inputs to RPS trip system A while the other inputs to RPS trip system B. Each RPS trip system receives an input from four Main Steam Isolation Valve-Closure channels, each consisting of two position switches (one for the inboard MSIV and one for the outboard MSIV in the same steam line) in series with a sensor relay. The logic for the Main Steam Isolation Valve-Closure Function is arranged such that either the inboard or outboard valve on three or more of the main steam lines must close in order for a scram to occur. The design permits closure of any two lines without a full scram being initiated.

The Main Steam Isolation Valve-Closure Allowable Value is specified to ensure that a scram occurs prior to a significant reduction in steam flow, thereby reducing the severity of the subsequent pressure transient.

Eight channels of the Main Steam Isolation Valve-Closure Function, with four channels in each trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude the scram from this Function on a valid signal. This Function is only required in MODE 1 since, with the MSIVs open and the heat generation rate high, a pressurization transient can occur if the MSIVs close. In MODE 2, the heat generation rate is low enough so that the other diverse RPS functions provide sufficient protection.

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APPLICABLE, SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

system from each SDV. The level measurement instrumentation satisfies the recommendations of Reference ~~9~~. 10

The Allowable Value is chosen low enough to ensure that there is sufficient volume in each SDV to accommodate the water from a full scram.

For each Scram Discharge Volume Water Level-High Function (i.e., for each SDV), there is one channel of each type (type 7.a and 7.b) in each trip system. Since Table 3.3.1.1-1 provides the total number of required channels per trip system for both SDVs, a total of two required channels of each type per trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from these Functions on a valid signal. These Functions are required in MODES 1 and 2, and in MODE 5 with any control rod withdrawn from a core cell containing one or more fuel assemblies, since these are the MODES and other specified conditions when control rods are withdrawn. At all other times, this Function may be bypassed.

8. Turbine Stop Valve-Closure

Closure of the TSVs results in the loss of a heat sink that produces reactor pressure, neutron flux, and heat flux transients that must be limited. Therefore, a reactor scram is initiated at the start of TSV closure in anticipation of the transients that would result from the closure of these valves. The Turbine Stop Valve-Closure Function is the primary scram signal for the turbine trip and feedwater controller failure maximum demand events analyzed in Reference ~~2~~ 3. For this event, the reactor scram reduces the amount of energy required to be absorbed and ensures that the MCPR SL is not exceeded.

Turbine Stop Valve-Closure signals are initiated from position switches located on each of the two TSVs. Two independent position switches are associated with each stop valve. Both of the switches from one TSV provide input to RPS trip system A; the two switches from the other TSV provide input to RPS trip system B. Thus, each RPS trip system receives two Turbine Stop Valve-Closure channel inputs from a TSV, each consisting of one position switch assembly with two contacts, each inputting to a relay. The relays provide a parallel logic input to an RPS trip logic channel. The logic for the Turbine Stop Valve-Closure Function is such that both TSVs must be closed to produce a scram. Single valve

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APPLICABLE, SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

closure will produce a half scram. This Function must be enabled at THERMAL POWER ≥ 29.5% RTP as measured by turbine first stage pressure. This is accomplished automatically by pressure switches sensing turbine first stage pressure; therefore, opening the turbine bypass valves may affect this Function.

The Turbine Stop Valve-Closure Allowable Value is selected to detect imminent TSV closure, thereby reducing the severity of the subsequent pressure transient.

Four channels of Turbine Stop Valve-Closure Function, with two channels in each trip system, are required to be OPERABLE to ensure that no single instrument failure will preclude a scram from this Function if both TSVs should close. This Function is required, consistent with analysis assumptions, whenever THERMAL POWER is ≥ 29.5% RTP. This Function is not required when THERMAL POWER is < 29.5% RTP since the Reactor Vessel Pressure-High and the Average Power Range Monitor Neutron Flux-High (Fixed) Functions are adequate to maintain the necessary safety margins.

<u>9. Turbine Control Valve Fast Closure, DEH Trip Oil Pressure-Low</u>

Fast closure of the TCVs results in the loss of a heat sink that produces reactor pressure, neutron flux, and heat flux transients that must be limited. Therefore, a reactor scram is initiated on TCV fast closure in anticipation of the transients that would result from the closure of these valves. The Turbine Control Valve Fast Closure, DEH Trip Oil Pressure-Low Function is the primary scram signal for the generator load rejection event analyzed in Reference ~~2~~ 3.. For this event, the reactor scram reduces the amount of energy required to be absorbed and ensures that the MCPR SL is not exceeded.

Turbine Control Valve Fast Closure, DEH Trip Oil Pressure-Low signals are initiated by low digital-electrohydraulic control (DEHC) fluid pressure in the emergency trip header for the control valves. There are four pressure switches which sense off the common header, with one pressure switch assigned to each separate RPS logic channel. This Function must be enabled at THERMAL POWER ≥ 29.5% RTP as measured by turbine first stage pressure. This is accomplished automatically by pressure switches sensing turbine first stage pressure; therefore, opening the turbine bypass valves may affect this Function.

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ACTIONS (continued)

A.1 and A.2

Because of the diversity of sensors available to provide trip signals and the redundancy of the RPS design, an allowable out of service ~~time of~~ 11 12 hours has been shown to be acceptable (Ref. ~~10~~) to permit restoration of any inoperable channel to OPERABLE status. However, this out of service time is only acceptable provided the associated Function's inoperable channel is in one trip system and the Function still maintains RPS trip capability (refer to Required Actions B.1, B.2, and C.1 Bases). If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel or the associated trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable channel in trip (or the associated trip system in trip) would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternatively, if it is not desired to place the channel (or trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), Condition D must be entered and its Required Action taken.

B.1 and B.2

Condition B exists when, for any one or more Functions, at least one required channel is inoperable in each trip system. In this condition, provided at least one channel per trip system is OPERABLE, the RPS still maintains trip capability for that Function, but cannot accommodate a single failure in either trip system. For Items 7.a and 7.b (Scram Discharge Volume Water Level - High, Level Transmitter and Level Switch), entry into Condition B is required when at least one channel (either an Item 7.a or 7.b channel) is inoperable in each trip system associated with one SDV.

Required Actions B.1 and B.2 limit the time the RPS scram logic, for any Function, would not accommodate single failure in both trip systems (e.g., one-out-of-one and one-out-of-one arrangement for a typical four channel 11 Function). The reduced reliability of this logic arrangement was not evaluated in Reference ~~10~~ for the 12 hour Completion Time. Within the 6 hour allowance, the associated Function will have all required channels OPERABLE or in trip (or any combination) in one trip system.

Completing one of these Required Actions restores RPS to a reliability level equivalent to that evaluated in Reference ~~10~~, which justified a
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ACTIONS (continued)

H.1

If the channel(s) is not restored to OPERABLE status or placed in trip (or the associated trip system placed in trip) 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 immediately initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are, therefore, not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

SURVEILLANCE REQUIREMENTS

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

The Surveillances are modified by a Note to indicate that when a 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 RPS trip 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. This Note is based on the reliability analysis (Ref. ~~10~~ 11) assumption of the average time required to perform channel Surveillances. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RPS will trip when necessary.

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other 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~~ on one of the channels or something even more serious. 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. 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 3.3.1.1.2

To ensure that 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 changes in LPRM sensitivity, which could affect the APRM reading between performances of SR 3.3.1.1.8.

A restriction to satisfying this SR when < 25% RTP is provided that requires the SR to be met only at ≥ 25% RTP because it is difficult to accurately maintain APRM indication of core THERMAL POWER consistent with 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 and APLHGR). At ≥ 25% RTP, the

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BASES

SURVEILLANCE REQUIREMENTS (continued)

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. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

SR 3.3.1.1.3

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. 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. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

As noted, SR 3.3.1.1.3 is not required to be performed when entering MODE 2 from MODE 1, since testing of the MODE 2 required IRM and APRM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads, or movable links. This allows entry into MODE 2 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 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 Frequency of 7 days provides an acceptable level of system average unavailability over the Frequency interval and is based on reliability analysis (Ref. ~~10~~). 11

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.4

There are four RPS channel test switches, one associated with each of the four automatic scram logic channels (A1, A2, B1, and B2). These keylock switches allow the operator to test the OPERABILITY of each individual logic channel (i.e., test through the K14 relay) without the necessity of using a scram function trip. This is accomplished by placing the RPS channel test switch in test, which will input a trip signal into the associated RPS logic channel. The RPS channel test switches are not specifically credited in the accident analysis. However, because the Manual Scram Functions at CNS were not configured the same as the generic model in Reference ~~10~~ 11, the RPS channel test switches were included in the analysis in Reference ~~11~~ 12. Reference ~~11~~ 12 concluded that the Surveillance Frequency extensions for RPS Functions, described in Reference ~~10~~ 11, were not affected by the difference in configuration, since each automatic RPS channel has a test switch which is functionally the same as the manual scram switches in the generic model. As such, a functional test of each RPS channel test switch is required to be performed once every 7 days. The Frequency of 7 days is based on the reliability analysis of Reference ~~11~~ 12.

SR 3.3.1.1.5 and SR 3.3.1.1.6

These Surveillances are established to ensure that no gaps in neutron flux indication exist from subcritical to power operation for monitoring core reactivity status.

The overlap between SRMs and IRMs is required to be demonstrated to ensure that reactor power will not be increased into a neutron flux region without adequate indication. This is required prior to withdrawing SRMs from the fully inserted position since indication is being transitioned from the SRMs to the IRMs.

The overlap between IRMs and APRMs is of concern when reducing power into the IRM range. On power increases, the system design will prevent further increases (by initiating a rod block) if adequate overlap is not maintained. Overlap between IRMs and APRMs exists when sufficient IRMs and APRMs concurrently have onscale readings such that the transition between MODE 1 and MODE 2 can be made without either APRM downscale rod block, or IRM upscale rod block. On controlled shutdowns, the IRM reading 121/125 of full scale will be set equal to or less than 45% of rated power. All range scales above that scale on

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.9 and SR 3.3.1.1.11

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. 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. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The 92 day Frequency of SR 3.3.1.1.9 is based on the reliability analysis of Reference ~~10~~. 11

24

The ~~18~~ month Frequency of SR 3.3.1.1.11 is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Testing of Function 10 requires placing the mode switch in "Shutdown". Operating experience has shown that these components usually pass the Surveillance when performed at the ~~18~~ month Frequency.

<INSERT> 3

SR 3.3.1.1.10 and SR 3.3.1.1.12

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to the LTSP within the as-left tolerance to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. Physical inspection of the position switches is performed in conjunction with SR 3.3.1.1.12 for Functions 5, 7.b, and 8 to ensure that the switches are not corroded or otherwise degraded.

Note 1 of SR 3.3.1.1.10 and SR 3.3.1.1.12 states that neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 7 day calorimetric calibration (SR 3.3.1.1.2) and the 1000 MWD/T LPRM calibration against the TIPs

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SURVEILLANCE REQUIREMENTS (continued)

(SR 3.3.1.1.8). Note 1 of SR 3.3.1.1.10 states that recirculation loop flow transmitters are excluded from CHANNEL CALIBRATION. This exclusion is based on calculation results and site-specific instrument setpoint drift data, which alternately supports ~~an 18~~ a 24 month calibration interval for the recirculation loop flow transmitters. As such, the flow transmitters are calibrated on ~~an 18~~ a 24 month frequency as required by SR 3.3.1.1.12 for Function 2b.

A second Note to SR 3.3.1.1.12 is provided that requires the APRM and IRM SRs to be performed within 12 hours of entering MODE 2 from MODE 1. Testing of the MODE 2 APRM and IRM Functions cannot be performed in MODE 1 without utilizing jumpers, lifted leads, or movable links. This Note allows entry into MODE 2 from MODE 1 if the associated Frequency is not met per SR 3.0.2. Twelve hours is based on operating experience and in consideration of providing a reasonable time in which to complete the SR.

The Frequency of SR 3.3.1.1.10 is based upon the assumption of a 184 day calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis. The Frequency of SR 3.3.1.1.12 is based upon the assumption of ~~an 18~~ a 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

<INSERT> 4

SR 3.3.1.1.13

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods (LCO 3.1.3), and SDV vent and drain valves (LCO 3.1.8), overlaps this Surveillance to provide complete testing of the assumed safety function.

The ~~18~~ 24 month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the ~~18~~ 24 month Frequency.

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.1.14

This SR ensures that scrams initiated from the Turbine Stop Valve-Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure-Low Functions will not be inadvertently bypassed when THERMAL POWER is ≥ 29.5% RTP. This involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodologies are incorporated into the actual setpoint. Because main turbine bypass flow can affect this setpoint nonconservatively (THERMAL POWER is derived from turbine first stage pressure), the main turbine bypass valves must remain closed during an in-service calibration at THERMAL POWER ≥ 29.5% RTP to ensure that the calibration is valid.

If any bypass channel's setpoint is nonconservative (i.e., the Functions are bypassed at ≥ 29.5% RTP, then the affected Turbine Stop Valve-Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure-Low Functions are considered inoperable. Open main turbine bypass valve(s) can also affect these two functions. Alternatively, the bypass channel can be placed in the conservative condition (nonbypass). If placed in the nonbypass condition, this SR is met and the channel is considered OPERABLE.

24

The Frequency ~~of 18~~ months is based on engineering judgment and reliability of the components.

SR 3.3.1.1.15

This SR ensures that the individual channel response times are less than or equal to the maximum values assumed in the accident analysis. This test may be performed in one measurement or in overlapping segments, with verification that all components are tested. The RPS RESPONSE TIME acceptance criteria are included in Reference ~~12.~~ 13

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

24

The ~~18~~ month Frequency is consistent with the typical industry refueling cycle and is based upon plant operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

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REFERENCES

1. Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3.

2. ~~1.~~ USAR, Section VII-2.

3. ~~2.~~ USAR, Chapter XIV.

4. ~~3.~~ NEDO-23842, "Continuous Control Rod Withdrawal in the Startup Range," April 18, 1978.

5. ~~4.~~ USAR, Section VI-5.

6. ~~5.~~ 10 CFR 50.36(c)(2)(ii).

7. ~~6.~~ USAR, Section IV-4.9.

8. ~~7.~~ USAR, Section XIV-6.2.

9. ~~8.~~ USAR, Section XIV-5.4.3.

10. ~~9.~~ P. Check (NRC) letter to G. Lainas (NRC), "BWR Scram Discharge System Safety Evaluation," December 1, 1980.

11. ~~10.~~ NEDO-30851-P-A , "Technical Specification Improvement Analyses for BWR Reactor Protection System," March 1988.

12. ~~11.~~ MDE-94-0485, "Technical Specification Improvement Analysis for the Reactor Protection System for Cooper Nuclear Station," April 1985.

13. ~~12.~~ USAR, VII-2.3.9.10.

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SURVEILLANCE REQUIREMENTS (continued)

CHANNEL CHECK), that ensure proper functioning between CHANNEL FUNCTIONAL TESTS.

SR 3.3.1.2.6 is required in MODE 2 with IRMs on Range 2 or below, and in MODES 3 and 4. Since core reactivity changes do not normally take place in MODES 3 and 4, and core reactivity changes are due only to control rod movement in MODE 2, the Frequency has been extended from 7 days to 31 days. The 31 day Frequency is based on operating experience and on other Surveillances (such as CHANNEL CHECK) that ensure proper functioning between CHANNEL FUNCTIONAL TESTS.

Verification of the signal to noise ratio also ensures that the detectors are inserted to an acceptable operating level. In a fully withdrawn condition, the detectors are sufficiently removed from the fueled region of the core to essentially eliminate neutrons from reaching the detector. Any count rate obtained while the detectors are fully withdrawn is assumed to be "noise" only. An alternative to fully withdrawing the detector is to configure the assembly cabling such that only the noise signal is observed.

The Note to SR 3.3.1.2.6 allows the Surveillance to be delayed until entry into the specified condition of the Applicability (THERMAL POWER decreased to IRM Range 2 or below). The SR must be performed within 12 hours after IRMs are on Range 2 or below. The allowance to enter the Applicability with the 31 day Frequency not met is reasonable, based on the limited time of 12 hours allowed after entering the Applicability and the inability to perform the Surveillance while at higher power levels. Although the Surveillance could be performed while on IRM Range 3, the plant would not be expected to maintain steady state operation at this power level. In this event, the 12 hour Frequency is reasonable, based on the SRMs being otherwise verified to be OPERABLE (i.e., satisfactorily performing the CHANNEL CHECK) and the time required to perform the Surveillances.

<u>SR 3.3.1.2.7</u>

24

Performance of a CHANNEL CALIBRATION at a Frequency of ~~18~~ months verifies the performance of the SRM detectors and associated circuitry. The Frequency considers the plant conditions required to perform the test, the ease of performing the test, and the likelihood of a change in the system or component status. The neutron detectors are excluded from the CHANNEL CALIBRATION (Note 1) because they cannot readily be adjusted. The detectors are fission chambers that are

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SURVEILLANCE REQUIREMENTS (continued)

designed to have a relatively constant sensitivity over the range and with an accuracy specified for a fixed useful life.

Note 2 to the Surveillance allows the Surveillance to be delayed until entry into the specified condition of the Applicability. The SR must be performed in MODE 2 within 12 hours of entering MODE 2 with IRMs on Range 2 or below. The allowance to enter the Applicability with the ~~18~~ 24 month Frequency not met is reasonable, based on the limited time of 12 hours allowed after entering the Applicability and the inability to perform the Surveillance while at higher power levels. Although the Surveillance could be performed while on IRM Range 3, the plant would not be expected to maintain steady state operation at this power level. In this event, the 12 hour Frequency is reasonable, based on the SRMs being otherwise verified to be OPERABLE (i.e., satisfactorily performing the CHANNEL CHECK) and the time required to perform the Surveillances.

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

REFERENCES None.

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B 3.3 INSTRUMENTATION

B 3.3.2.1 Control Rod Block Instrumentation

BASES

BACKGROUND

Control rods provide the primary means for control of reactivity changes. Control rod block instrumentation includes channel sensors, logic circuitry, switches, and relays that are designed to ensure that specified fuel design limits are not exceeded for postulated transients and accidents. During high power operation, the rod block monitor (RBM) provides protection for control rod withdrawal error events. During low power operations, control rod blocks from the rod worth minimizer (RWM) enforce specific control rod sequences designed to mitigate the consequences of the control rod drop accident (CRDA). During shutdown conditions, control rod blocks from the Reactor Mode Switch—Shutdown Position Function ensure that all control rods remain inserted to prevent inadvertent criticalities.

<INSERT 5>

The purpose of the RBM is to limit control rod withdrawal if localized neutron flux exceeds a predetermined setpoint 2 during control rod manipulations (Ref. ~~1~~). It is assumed to function to block further control rod withdrawal to preclude a MCPR Safety Limit (SL) violation. One set of power referenced RBM upscale trip settings (Low Trip Set Point, LTSP; Intermediate Trip Set Point, ITSP; and High Trip Set Point, HTSP) is applied based on the Lowest Rated MCPR Limit given in the COLR. The RBM supplies a trip signal to the Reactor Manual Control System (RMCS) to appropriately inhibit control rod withdrawal during power operation above the low power range setpoint. The RBM has two channels, either of which can initiate a control rod block when the channel output exceeds the control rod block setpoint. One RBM channel inputs into one RMCS rod block circuit and the other RBM channel inputs into the second RMCS rod block circuit. The RBM channel signal is generated by averaging a set of local power range monitor (LPRM) signals at various core heights surrounding the control rod being withdrawn. Upon selection of a certain rod for withdrawal or insertion, the conditioned LPRM signals around that rod are automatically fed into the two RBM channels. Each channel averages two B-position, two D-position and the same four C-position LPRM inputs. The RBM Channel A is powered by the RPS power bus "A" and the RMB Channel B is powered by the RPS power bus "B". A-position LPRMs are not included in the

(continued)

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BASES

BACKGROUND (continued)

RBM averaging but remain in the display and LPRM alarm logic. Assignment of power range detector assemblies to be used in RBM averaging is controlled by the selection of control rods. The minimum number of LPRM inputs required to each RBM channel to prevent an instrument inoperative alarm is four when using eight LPRM assemblies, three when using six LPRM assemblies, and two when using four LPRM assemblies. The RBM is automatically bypassed and the output set to zero if a peripheral control rod is selected since the RBM function is not required for these rods. In addition, any one of the two RBM channels can be manually bypassed. If any LPRM detector assigned to a RBM is bypassed, the computed average signal is adjusted automatically to compensate for the number of LPRM input signals to average. When a control rod is selected, the signal conditioner gain is automatically adjusted so that the output level of the signal conditioner always corresponds to a constant level (relative to the initialization reference signal of 100/125 of full scale). The gain set will be held constant during the movement of that rod, thus providing an indication of the change in the relative local power level. Whenever the reactor power level is below the lowest RBM operating range, the RBM is zeroed and RBM outputs are bypassed. If the indicated power increases above the preset limit, a rod block will occur. In addition, to preclude rod movement with an inoperable RBM, a downscale trip and an inoperative trip are provided. A rod block signal is generated if an RBM downscale trip or an inoperable trip occurs, since this could indicate a problem with the RBM channel. The downscale trip will occur if the RBM channel signal decreases below the downscale trip setpoint after the RBM channel signal has been normalized. The inoperable trip will occur during the nulling (normalization) sequence, if the RBM channel fails to null, too few LPRM inputs are available, a module is not plugged in, or the function switch is moved to any position other than "Operate."

The purpose of the RWM is to control rod patterns during startup and shutdown, such that only specified control rod sequences and relative positions are allowed over the operating range from all control rods inserted to 9.85% RTP. The sequences effectively limit the potential amount and rate of reactivity increase during a CRDA. Prescribed control rod sequences are stored in the RWM, which will initiate control rod withdrawal and insert blocks when the

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BASES

BACKGROUND (continued)

actual sequence deviates beyond allowances from the stored sequence. The RWM determines the actual sequence based position indication for each control rod. The RWM also uses feedwater flow and steam flow signals to determine when the reactor power is above the preset power level at which the RWM is automatically bypassed (Ref. ~~2~~). The RWM is a single channel system that provides input into both RMCS rod block circuits. 3

With the reactor mode switch in the shutdown position, a control rod withdrawal block is applied to all control rods to ensure that the shutdown condition is maintained. This Function prevents inadvertent criticality as the result of a control rod withdrawal during MODE 3 or 4, or during MODE 5 when the reactor mode switch is required to be in the shutdown position. The reactor mode switch has two channels, each inputting into a separate RMCS rod block circuit. A rod block in either RMCS circuit will provide a control rod block to all control rods.

<INSERT 6>

<INSERT 7>

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

1. Rod Block Monitor

The RBM is designed to prevent violation of the MCPR SL and the cladding 1% plastic strain fuel design limit that may result from a single control rod withdrawal error (RWE) event. The analytical methods and assumptions used in evaluating the RWE event are summarized in Reference ~~3~~. 4 A statistical analysis of RWE events was performed to determine the RBM response for both channels for each event. From these responses, the fuel thermal performance as a function of RBM Allowable Value was determined. The Allowable Values are chosen as a function of power level. Based on the specified Allowable Values, operating limits are established.

The RBM Function satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii) (Ref. ~~4~~). 5

Two channels of the RBM are required to be OPERABLE, with their setpoints within the appropriate Allowable Values, to ensure that no single instrument failure can preclude a rod block from this Function. The actual setpoints are calibrated consistent with applicable setpoint methodology.

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

~~Nominal trip setpoints are specified in the setpoint calculations. The setpoint calculations are performed using methodology described in NEDC-31336P-A, "General Electric Instrument Setpoint Methodology," dated September 1996. The nominal setpoints are selected to ensure that the setpoints do not exceed the Allowable Values between successive CHANNEL CALIBRATIONS. Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable. Trip setpoints are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor power), and when the measured output value of the process parameter exceeds the setpoint, the associated device changes state. The analytic limits are derived from the limiting values of the process parameters obtained from the safety analysis. The Allowable Values are derived from the analytic limits, corrected for calibration, process, and some of the instrument errors. The trip setpoints are then determined accounting for the remaining instrument errors (e.g., drift). The trip setpoints derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for.~~

The RBM is assumed to mitigate the consequences of an RWE event when operating ≥ 30% RTP (analytical limit) and a peripheral control rod is not selected. Below this power level or if a peripheral control rod is selected, the consequences of an RWE event will not exceed the MCPR SL and, therefore, the RBM is not required to be OPERABLE (Ref. ~~3~~ 4). When operating < 90% RTP, analyses (Ref. ~~3~~ 4) have shown that with an initial MCPR ≥ 1.70, no RWE event will result in exceeding the MCPR SL. Also, the analyses demonstrate that when operating at ≥ 90% RTP with MCPR ≥ 1.40, no RWE event will result in exceeding the MCPR SL (Ref. ~~3~~ 4). Therefore, under these conditions, the RBM is also not required to be OPERABLE.

2. Rod Worth Minimizer

The RWM is a backup to operator control of the rod sequences. The RWM enforces the banked position withdrawal sequence (BPWS) by alerting the operator when the rod pattern is not in accordance with BPWS. Compliance with BPWS ensures that the initial conditions of the CRDA analysis are not violated.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

6 and 7 The analytical methods and assumptions used in evaluating the CRDA are summarized in References ~~5 and 6~~. The BPWS requires that control rods be moved in groups, with all control rods assigned to a specific group required to be within specified banked positions. Requirements that the control rod sequence is in compliance with the BPWS are specified in LCO 3.1.6, "Rod Pattern Control."

8 When performing a shutdown of the plant, an optional BPWS control rod sequence (Ref. ~~7~~) may be used if the coupling of each withdrawn control rod has been confirmed. The rods may be inserted without the need to 8 stop at intermediate positions. When using the Reference ~~7~~ control rod insertion sequence for shutdown, the rod worth minimizer may be reprogrammed to enforce the requirements of the improved BPWS control rod insertion, or may be bypassed and the improved BPWS shutdown sequence implemented under the controls in Condition D.

The RWM Function satisfies Criterion 3 of Reference ~~4~~. 5

Since the RWM is a system designed to act as a backup to operator
8 control of the rod sequences, only one channel of the RWM is available and required to be OPERABLE (Ref. ~~7~~). Special circumstances provided for in the Required Action of LCO 3.1.3, "Control Rod OPERABILITY," and LCO 3.1.6 may necessitate bypassing the RWM to allow continued operation with inoperable control rods, or to allow correction of a control rod pattern not in compliance with the BPWS. The RWM may be bypassed as required by these conditions, but then it must be considered inoperable and the Required Actions of this LCO followed.

Compliance with the BPWS, and therefore OPERABILITY of the RWM, is required in MODES 1 and 2 when THERMAL POWER is $\leq$ 9.85% RTP. When THERMAL POWER is > 9.85% RTP, there is no possible control rod configuration that results in a control rod worth that could exceed the 6
280 cal/gm fuel damage limit during a CRDA (Ref. ~~5~~). In MODES 3 and 4, all control rods are required to be inserted into the core; therefore, a CRDA cannot occur. In MODE 5, since only a single control rod can be withdrawn from a core cell containing fuel assemblies, adequate SDM ensures that the consequences of a CRDA are acceptable, since the reactor will be subcritical.

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APPLICABLE SAFETY ANALYSIS LCO, AND APPLICABILITY

3. Reactor Mode Switch-Shutdown Position

During MODES 3 and 4, and during MODE 5 when the reactor mode switch is required to be in the shutdown position, the core is assumed to be subcritical; therefore, no positive reactivity insertion events are analyzed. The Reactor Mode Switch — Shutdown Position control rod withdrawal block ensures that the reactor remains subcritical by blocking control rod withdrawal, thereby preserving the assumptions of the safety analysis.

5 The Reactor Mode Switch — Shutdown Position Function satisfies Criterion 3 of Reference 4. Two channels are required to be OPERABLE to ensure that no single channel failure will preclude a rod block when required. There is no Allowable Value for this Function since the channels are mechanically actuated based solely on reactor mode switch position.

During shutdown conditions (MODE 3, 4, or 5), no positive reactivity insertion events are analyzed because assumptions are that control rod withdrawal blocks are provided to prevent criticality. Therefore, when the reactor mode switch is in the shutdown position, the control rod withdrawal block is required to be OPERABLE. During MODE 5 with the reactor mode switch in the refueling position, the refuel position one-rod-out interlock (LCO 3.9.2, "Refuel Position One-Rod-Out Interlock") provides the required control rod withdrawal blocks.

ACTIONS

A.1

With one RBM channel inoperable, the remaining OPERABLE channel is adequate to perform the control rod block function; however, overall reliability is reduced because a single failure in the remaining OPERABLE channel can result in no control rod block capability for the RBM. For this reason, Required Action A.1 requires restoration of the inoperable channel to OPERABLE status. The Completion Time of 24 hours is based on the low probability of an event occurring coincident with a failure in the remaining OPERABLE channel.

B.1

If Required Action A.1 is not met and the associated Completion Time has expired, the inoperable channel must be placed in trip within 1 hour. If both RBM channels are inoperable, the RBM is not capable of performing its intended function; thus, one channel must also be placed

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ACTIONS (continued)

D.1

With the RWM inoperable during a reactor shutdown, the operator is still capable of enforcing the prescribed control rod sequence. Required Action D.1 allows for the RWM Function to be performed manually and requires a double check of compliance with the prescribed rod sequence by a second licensed operator (Reactor Operator or Senior Reactor Operator) or other qualified member of the technical staff. The RWM may be bypassed under these conditions to allow the reactor shutdown to continue.

E.1 and E.2

With one Reactor Mode Switch — Shutdown Position control rod withdrawal block channel inoperable, the remaining OPERABLE channel is adequate to perform the control rod withdrawal block function. However, since the Required Actions are consistent with the normal action of an OPERABLE Reactor Mode Switch — Shutdown Position Function (i.e., maintaining all control rods inserted), there is no distinction between having one or two channels inoperable.

In both cases (one or both channels inoperable), suspending all control rod withdrawal and initiating action to fully insert all insertable control rods in core cells containing one or more fuel assemblies will ensure that the core is subcritical with adequate SDM ensured by LCO 3.1.1. Control rods in core cells containing no fuel assemblies do not affect the reactivity of the core and are therefore not required to be inserted. Action must continue until all insertable control rods in core cells containing one or more fuel assemblies are fully inserted.

SURVEILLANCE REQUIREMENTS

As noted at the beginning of the SRs, 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 second Note to indicate that when an RBM 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. 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

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SURVEILLANCE REQUIREMENTS (continued)

Required Actions taken. This Note is based on the reliability analysis (Ref. ~~9~~ 10) assumption of the average time required to perform channel Surveillance. 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

A CHANNEL FUNCTIONAL TEST is performed for each RBM channel to ensure that the channel will perform the intended function. It includes the Reactor Manual Control System input. It also includes the local alarm lights representing upscale and downscale trips, but no rod block will be produced at this time. 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.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology. The Frequency of 92 days is based on reliability analyses (Ref. ~~10~~ 11).

SR 3.3.2.1.2 and SR 3.3.2.1.3

A CHANNEL FUNCTIONAL TEST is performed for the RWM to ensure that the system will perform the intended function. 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 CHANNEL FUNCTIONAL TEST for the RWM includes performing the RWM computer on line diagnostic test satisfactorily, attempting to withdraw a control rod not in compliance with the prescribed sequence and verifying a control rod block occurs. For SR 3.3.2.1.2, the CHANNEL FUNCTIONAL TEST also includes attempting to select a control rod not in compliance with the prescribed sequence and verifying a selection error occurs. As noted in the SRs, SR 3.3.2.1.2 is not required to be performed until 1 hour after any control rod is withdrawn in MODE 2. As noted, SR 3.3.2.1.3 is not required to be performed until 1 hour after THERMAL POWER is ≤ 9.85% RTP in MODE 1. This allows

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SURVEILLANCE REQUIREMENTS (continued)

entry into MODE 2 for SR 3.3.2.1.2, and entry into MODE 1 when THERMAL POWER is ≤ 9.85% RTP for SR 3.3.2.1.3, to perform the required Surveillance if the 92 day 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 are based on reliability analysis (Ref. ~~10~~ 11).

SR 3.3.2.1.4

The RBM power range setpoints control the enforcement of the appropriate upscale trips over the proper core thermal power range of the Applicability Notes (a), (b), (c), (d), and (e) of ITS Table 3.3.2.1-1. The RBM Upscale Trip Function setpoints are automatically varied as a function of power. Three Allowable Values are specified in the COLR as denoted in Table 3.3.2.1-1, each within a specific power range. The power at which the control rod block Allowable Values automatically change are based on the reference APRM signal's input to each RBM channel. Below the minimum power setpoint of 27.5% RTP or when a peripheral control rod is selected, the RBM is automatically bypassed. These power Allowable Values must be verified periodically by determining that the power level setpoints are less than or equal to the specified values. If any power range setpoint is nonconservative, then the affected RBM channel is considered inoperable. Alternatively, the power range channel can be placed in the conservative condition (i.e., enabling the proper RBM setpoint). If placed in this condition, the SR is met and the RBM channel is not considered inoperable. As noted, neutron detectors are excluded from the Surveillance because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Neutron detectors are adequately tested in SR 3.3.1.1.2 and SR 3.3.1.1.8. The 184 day Frequency is based on the actual trip setpoint methodology utilized for these channels.

SR 3.3.2.1.5

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

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SURVEILLANCE REQUIREMENTS (continued)

As noted, neutron detectors are excluded from the CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Neutron detectors are adequately tested in SR 3.3.1.1.2 and SR 3.3.1.1.8.

The Frequency is based upon the assumption of a 184 day calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

<INSERT 8>

SR 3.3.2.1.6

The RWM is automatically bypassed when power is above a specified value. The power level is determined from feedwater flow and steam flow signals. The setpoint where the automatic bypass feature is unbypassed must be verified periodically to be > 9.85% RTP. If the RWM low power setpoint is nonconservative, then the RWM is considered inoperable. Alternately, the low power setpoint channel can be placed in the conservative condition (nonbypass). If placed in the nonbypassed condition, the SR is met and the RWM is not considered inoperable. The Frequency is based on the trip setpoint methodology utilized for the low power setpoint channel.

SR 3.3.2.1.7

A CHANNEL FUNCTIONAL TEST is performed for the Reactor Mode Switch — Shutdown Position Function to ensure that the channel will perform the intended function. 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 CHANNEL FUNCTIONAL TEST for the Reactor Mode Switch — Shutdown Position Function is performed by attempting to withdraw any control rod with the reactor mode switch in the shutdown position and verifying a control rod block occurs.

As noted in the SR, the Surveillance is not 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 movable links. This allows entry into MODES 3 and 4 if the ~~18~~ 24 month Frequency

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SURVEILLANCE REQUIREMENTS (continued)

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.

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the ~~18~~ month Frequency.

24

SR 3.3.2.1.8

The RWM will only enforce the proper control rod sequence if the rod sequence is properly input into the RWM computer. This SR ensures that the proper sequence is loaded into the RWM so that it can perform its intended function. The Surveillance is performed once prior to declaring RWM OPERABLE following loading of sequence into RWM, since this is when rod sequence input errors are possible.

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REFERENCES

1. Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3.

2. ~~1.~~ USAR, Section VII-7.

3. ~~2.~~ USAR, Section VII-16.3.3.

4. ~~3.~~ NEDC-31892P, "Extended Load Line Limit and ARTS Improvement Program Analyses for Cooper Nuclear Station," Rev. 1, May 1991.

5. ~~4.~~ 10 CFR 50.36(c)(2)(ii).

6. ~~5.~~ USAR, Section XIV-6.2.

7. ~~6.~~ NEDO-21231, "Banked Position Withdrawal Sequence," January 1977.

8. ~~7.~~ NEDO 33091, Revision 2, "Improved BPWS Control Rod Insertion Process," April 2003.

9. ~~8.~~ NRC SER, "Acceptance of Referencing of Licensing Topical Report NEDE-24011-P-A," "General Electric Standard Application for Reactor Fuel, Revision 8, Amendment 17," December 27, 2987.

10. ~~9.~~ GENE-770-06-1, "Addendum to Bases for Changes to Surveillance Test Intervals and Allowed Out-of-Service Times for Selected Instrumentation Technical Specifications," February 1991.

11. ~~10.~~ NEDC-30851-P-A, "Technical Specification Improvement Analysis for BWR Control Rod Block Instrumentation," October 1988.

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SURVEILLANCE REQUIREMENTS

SR 3.3.2.2.1 (continued)

indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between 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 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 limits.

The Frequency is based on operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel status during normal operational use of the displays associated with the channels required by the LCO.

SR 3.3.2.2.2

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

a 24

The Frequency is based upon the assumption of ~~an 18~~ month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.2.2.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The system functional test of the feedwater and

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

main turbine valves is included as part of this Surveillance and overlaps the LOGIC SYSTEM FUNCTIONAL TEST to provide complete testing of the assumed safety function. Therefore, if a valve is incapable of operating, the associated instrumentation would also be inoperable. The 24 ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the ~~18~~ 24 month Frequency.

REFERENCES

1. USAR, Section XIV-5.8.1.

2. 10 CFR 50.36(c)(2)(ii).

3. GENE-770-06-1, "Bases for Changes to Surveillance Test Intervals and Allowed Out-Of-Service Times for Selected Instrumentation Technical Specifications," February 1991.

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SURVEILLANCE REQUIREMENTS

SR 3.3.3.1.1 (continued)

CHANNEL CHECK is normally a comparison of the parameter indicated on one channel against a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between 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 the instrumentation continues to operate properly between each CHANNEL CALIBRATION. The high radiation instrumentation should be compared to similar plant instruments located throughout the plant. The CHANNEL CHECK does not apply to the primary containment H_2 and O_2 analyzer that is in a normal standby configuration.

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

The Frequency of 31 days is based upon plant operating experience, with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 31 day interval is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of those displays associated with the channels required by the LCO.

SR 3.3.3.1.2 and SR 3.3.3.1.3

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

These SRs require a CHANNEL CALIBRATION to be performed. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies the channel responds to measured parameter with the necessary range and accuracy. For the Primary Containment Gross Radiation Monitors, the CHANNEL CALIBRATION consists of an electronic calibration of the channel, excluding the detector, for range decades ≥ 10 R/hour and a one point calibration check of the detector with an installed or portable gamma source

(continued)

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SURVEILLANCE REQUIREMENTS

SR 3.3.3.1.2 and SR 3.3.3.1.3 (continued)

for range decades < 10 R/hour. For the PCIV Position Function, the CHANNEL CALIBRATION consists of verifying the remote indication conforms to actual value position.

The 92 day Frequency for CHANNEL CALIBRATION of the Primary Containment Hydrogen and Oxygen Analyzers is based on vendor recommendations. The 24 ~~18~~ month Frequency for CHANNEL CALIBRATION of all other PAM instrumentation of Table 3.3.3.1-1 is based on operating experience and consistency with the CNS refueling cycles.

REFERENCES

1. Regulatory Guide 1.97, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, Revision 3," May 1985.

2. Letter from G. A. Trevors (NPPD) to U.S. NRC dated April 12, 1990, "NUREG-0737, Supplement 1-Regulatory Guide 1.97 Response, Revision IX."

3. Letter from W. O. Long (NRC) to J. M. Pilant (NPPD) dated October 27, 1986, "Emergency Response Capability-Conformance to Regulatory Guide 1.97, Revision 2."

4. 10 CFR 50.36(c)(2)(ii).

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SURVEILLANCE REQUIREMENTS (continued)

The Frequency is based upon plant operating experience that demonstrates channel failure is rare.

SR 3.3.3.2.2

SR 3.3.3.2.2 verifies each required Alternate Shutdown System transfer switch and control circuit performs the intended function. This verification is performed from the alternate shutdown panel and locally, as appropriate. Operation of the equipment from the alternate shutdown panel is not necessary. The Surveillance can be satisfied by performance of a continuity check. This will ensure that if the control room becomes inaccessible, the plant can be placed and maintained in a safe shutdown condition from the alternate shutdown panel and the local control stations. However, this Surveillance is not required to be performed only during a plant outage. Operating experience demonstrates that Alternate Shutdown System control channels usually pass the Surveillance when performed at the ~~18~~ 24 month Frequency.

SR 3.3.3.2.3

CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. The test verifies the channel responds to measured parameter values with the necessary range and accuracy. There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

The ~~18~~ 24 month Frequency is based upon operating experience and consistency with the typical industry refueling cycle.

REFERENCES

1. USAR, Section VII-18.0.
2. USAR, Section XIV-5.9.
3. 10 CFR 50.36(c)(2)(ii).

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.4.1.1

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. 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.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

The Frequency of 92 days is based on the reliability analysis of Reference 3.

SR 3.3.4.1.2

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

The Frequency is based upon the assumption of a 24 ~~an 18~~ month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.4.1.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. For the Reactor Vessel Water Level-Low Low (Level 2) logic, this shall include the nominal 9 second time delay of the RRMG field breaker trip. The system functional test of the RRMG field breakers is included as part of this Surveillance and overlaps the LOGIC SYSTEM FUNCTIONAL TEST to provide complete testing of the assumed safety function. Therefore, if

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an RRMG field breaker is incapable of operating, the associated instrument channel(s) would be inoperable.

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The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the ~~18~~ month Frequency.

24

REFERENCES

1. USAR, Section VII-9.4.4.2.

2. 10 CFR 50.36(c)(2)(ii).

3. GENE-770-06-1, "Bases for Changes To Surveillance Test Intervals and Allowed Out-of-Service Times For Selected Instrumentation Technical Specifications," February 1991.

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B 3.3 INSTRUMENTATION

B 3.3.5.1 Emergency Core Cooling System (ECCS) Instrumentation

BASES

BACKGROUND

The purpose of the ECCS instrumentation is to initiate appropriate responses from the systems to ensure that the fuel is adequately cooled in the event of a design basis accident or transient.

<INSERT 9>

For most abnormal operational transients and Design Basis Accidents (DBAs), a wide range of dependent and independent parameters are monitored.

The ECCS instrumentation actuates core spray (CS), low pressure coolant injection (LPCI), high pressure coolant injection (HPCI), Automatic Depressurization System (ADS), and the diesel generators (DGs). The equipment involved with each of these systems is described in the Bases for LCO 3.5.1, "ECCS—Operating."

<u>Core Spray System</u>

The CS System may be initiated by either automatic or manual means. Automatic initiation occurs for conditions of Reactor Vessel Water Level—Low Low Low (Level 1) or Drywell Pressure—High. Each of these diverse variables is monitored by four redundant switches, which are connected to relays which send signals to two trip systems, with each trip system arranged in a one-out-of-two taken twice logic. Each trip system initiates one of the two CS pumps.

Upon receipt of an initiation signal, if normal AC power is available, both CS pumps start after an approximate 10 second time delay. If a core spray initiation signal is received when normal AC power is not available, the CS pumps start approximately 10 seconds after the bus is energized by the DGs.

The CS test line isolation valve, which is also a primary containment isolation valve (PCIV), is closed on a CS initiation signal to allow full system flow assumed in the

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Core Spray System (continued)

accident analyses and maintain primary containment isolated in the event CS is not operating.

The CS pump discharge flow is monitored by a flow transmitter and trip unit. When the pump is running and discharge flow is low enough so that pump overheating may occur, the minimum flow return line valve is opened. The valve is automatically closed if flow is above the minimum flow setpoint. It is not necessary for the minimum flow valve to close to achieve adequate system flow assumed in the accident analysis (Ref. ~~1~~) $\boxed{2}$

The CS System also monitors the pressure in the reactor to ensure that, before the injection valves open, the reactor pressure has fallen to a value below the CS System's maximum design pressure. The variable is monitored by four redundant pressure switches. The outputs of the switches are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic.

Low Pressure Coolant Injection System

The LPCI is an operating mode of the Residual Heat Removal (RHR) System, with two LPCI subsystems. The LPCI subsystems may be initiated by automatic or manual means. Automatic initiation occurs for conditions of Reactor Vessel Water Level—Low Low Low (Level 1); Drywell Pressure—High; or both. Each of these diverse variables is monitored by four redundant switches, which are connected to relays which send signals to two trip systems, with each trip system arranged in a one-out-of-two taken twice logic. Each trip system initiates two of the four LPCI pumps. Once an initiation signal is received by the LPCI control circuitry, the signal is sealed in until manually reset.

Upon receipt of an initiation signal if normal AC power is available, the LPCI A and D pumps start in approximately 0.5 seconds when power is available. The LPCI B and C pumps are started after an approximate 5 second delay to limit the loading of the standby power sources. With a loss of off-site power LPCI pumps A and D start within approximately 0.5 seconds on restoration of power, and pumps B and C start approximately 5 seconds after the restoration of power.

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Low Pressure Coolant Injection System (continued)

Each LPCI subsystem's discharge flow is monitored by a differential pressure switch. When a pump is running and discharge flow is low enough so that pump overheating may occur, the respective minimum flow return line valve is opened. If flow is above the minimum flow setpoint, the valve is automatically closed. It is not necessary for the minimum flow valve to close to achieve adequate system flow assumed in the analyses (Ref. ~~2~~) 3

The containment cooling return valves, suppression pool spray isolation valves, and containment spray isolation valves (which are also PCIVs) are also closed on a LPCI initiation signal to allow the full system flow assumed in the accident analyses and maintain primary containment isolated in the event LPCI is not operating.

The LPCI System monitors the pressure in the reactor to ensure that, before an injection valve opens, the reactor pressure has fallen to a value below the LPCI System's maximum design pressure. The variable is monitored by four redundant pressure switches, which are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic. Additionally, instruments are provided to close the recirculation pump discharge valves to ensure that LPCI flow does not bypass the core when it injects into the recirculation lines. The variable is monitored by four redundant pressure switches, which are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic.

Low reactor water level in the shroud is detected by two additional instruments. When level is greater than the low level setpoint, LPCI may no longer be required, therefore other modes of RHR (e.g., suppression pool cooling) are allowed. Manual overrides for the isolations below the low level setpoint are provided.

High Pressure Coolant Injection System

The HPCI System may be initiated by either automatic or manual means. Automatic initiation occurs for conditions of Reactor Vessel Water Level—Low Low (Level 2) or Drywell

(continued)

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High Pressure Coolant Injection System (continued)

Pressure—High. Each of these variables is monitored by four redundant switches, which are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic for each Function.

The HPCI pump discharge flow is monitored by a flow switch (only one trip system). When the pump is running and discharge flow is low enough so that pump overheating may occur, the minimum flow return line valve is opened. The valve is automatically closed if flow is above the minimum flow setpoint. It is not necessary for the minimum flow valve to close to achieve adequate system flow assumed in the accident analysis (Ref. ~~3~~) $\boxed{4}$

The HPCI test line isolation valves are closed upon receipt of a HPCI initiation signal to allow the full system flow assumed in the accident analysis and maintain primary containment isolated in the event HPCI is not operating.

The HPCI System also monitors the water levels in the emergency condensate storage tanks (ECSTs) and the suppression pool because these are the two sources of water for HPCI operation. Reactor grade water in the ECSTs is the normal source. The ECST suction source consists of two ECSTs connected in parallel to the HPCI pump suction. Upon receipt of a HPCI initiation signal, the ECST suction valve is automatically signaled to open (it is normally in the open position) unless the suppression pool suction valve is open. If the water level in the ECSTs falls below a preselected level, first the suppression pool suction valve automatically opens, and then the ECST suction valve automatically closes. Two level switches are used to detect low water level in the ECST. Either switch can cause the suppression pool suction valve to open and the ECST suction valve to close. The suppression pool suction valve also automatically opens and the ECST suction valve closes if high water level is detected in the suppression pool. Two level switches monitor the suppression pool water level. To prevent losing suction to the pump, the suction valves are interlocked so that one suction path must be full open before the other automatically closes.

The HPCI provides makeup water to the reactor until the reactor vessel water level reaches the Reactor Vessel Water

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in approximately 14 seconds, and will run in standby conditions (rated voltage and speed, with the DG output breaker open). The DGs will only energize their respective Engineered Safety Feature buses if a loss of offsite power occurs. (Refer to Bases for LCO 3.3.8.1.)

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

6, 7, and 8

The actions of the ECCS are explicitly assumed in the safety analyses of References ~~5, 6, and 7~~. The ECCS is initiated to preserve the integrity of the fuel cladding by limiting the post LOCA peak cladding temperature to less than the 10 CFR 50.46 limits.

5

ECCS instrumentation satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii) (Ref. ~~4~~). Certain instrumentation Functions are retained for other reasons and are described below in the individual Functions discussion.

<INSERT 2>

set within the setting tolerance of the specified LTSPs

The OPERABILITY of the ECCS instrumentation is dependent upon the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.5.1-1. Each Function must have a required number of OPERABLE channels, with their setpoints ~~within the specified Allowable Values~~, where appropriate. The actual setpoint is calibrated consistent with applicable setpoint methodology assumptions. Table 3.3.5.1-1 contains several footnotes. Footnote (a) clarifies that the associated functions are required to be OPERABLE in MODES 4 and 5 only when their supported ECCS are required to be OPERABLE per LCO 3.5.2, ECCS - Shutdown. Footnote (b), is added to show that certain ECCS instrumentation Functions also perform DG initiation.

Table 3.3.5.1-1

LTSPs and the methodologies for calculation of the as-found and as-left tolerances are described in the Technical Requirements Manual. The LTSPs

remain conservative with respect to the as-found tolerance band

After each calibration the trip setpoint shall be left within the as-left band around the LTSP. LTSPs

Allowable Values are specified for each ECCS Function specified in ~~the table~~. ~~Nominal trip setpoints are specified in the setpoint calculations. The setpoint calculations are performed using methodology described in NEDC-31336P-A, "General Electric Instrument Setpoint Methodology," dated September 1996. The nominal setpoints~~ are selected to ensure that the setpoints ~~do not exceed the Allowable Value~~ between CHANNEL CALIBRATIONS. ~~Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable. A channel is inoperable if its actual trip setpoint is not within its required Allowable Value. Trip setpoints~~ are those predetermined values of output at which an action should take place. The setpoints are compared to the actual

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g., switch) changes state. The ~~analytic~~ analytical limits are derived from the limiting values of the process parameters obtained from the safety analysis or other appropriate document. The Allowable Values are derived from the ~~analytic~~ analytical limits, corrected for calibration, process, and some of the instrument errors. The ~~trip setpoints~~ LTSPs are then determined, accounting for the remaining instrument errors (e.g., drift). The ~~trip setpoints~~ LTSPs derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for. For some Functions, the Allowable Values and the ~~trip setpoints~~ LTSPs are determined from historically accepted practice relative to the intended functions of the channels. Such is the case for the Core Spray Pump Start-Time Delay Relay and for the LPCI Pump Start-Time Delay Relay.

In general, the individual Functions are required to be OPERABLE in the MODES or other specified conditions that may require ECCS (or DG) initiation to mitigate the consequences of a design basis transient or accident. To ensure reliable ECCS and DG function, a combination of Functions is required to provide primary and secondary initiation signals.

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

<u>Core Spray and Low Pressure Coolant Injection Systems</u>

<u>1.a, 2.a. Reactor Vessel Water Level-Low Low Low (Level 1)</u>

Low reactor pressure vessel (RPV) water level indicates that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. The low pressure ECCS and associated DGs are initiated at Reactor Vessel Water Level—Low Low Low (Level 1) to ensure that core spray and flooding functions are available to prevent or minimize fuel damage. The DGs are initiated from

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Function 1.a signals. The Reactor Vessel Water Level — Low Low Low (Level 1) is one of the Functions assumed to be OPERABLE and capable of initiating the ECCS during the transients analyzed in References ~~5 and 7~~ 6 and 8. In addition, the Reactor Vessel Water Level — Low Low Low (Level 1) Function is directly assumed in the analysis of the recirculation line break (Ref. ~~6~~ 7). The core cooling function of the ECCS, along with the scram action of the Reactor Protection System (RPS), ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Reactor Vessel Water Level — Low Low Low (Level 1) signals are initiated from four level switches that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

The Reactor Vessel Water Level — Low Low Low (Level 1) Allowable Value is chosen to allow time for the low pressure core flooding systems to activate and provide adequate cooling.

Four channels of Reactor Vessel Water Level — Low Low Low (Level 1) Function are only required to be OPERABLE when the ECCS are required to be OPERABLE to ensure that no single instrument failure can preclude ECCS initiation. Per Footnote (a) to Table 3.3.5.1-1, this ECCS function is only required to be OPERABLE in MODES 4 and 5 whenever the associated ECCS is required to be OPERABLE per LCO 3.5.2. Refer to LCO 3.5.1 and LCO 3.5.2, "ECCS — Shutdown," for Applicability Bases for the low pressure ECCS subsystems; LCO 3.8.1, "AC Sources — Operating"; and LCO 3.8.2, "AC Sources — Shutdown," for Applicability Bases for the DGs.

1.b, 2.b. Drywell Pressure-High

High pressure in the drywell could indicate a break in the reactor coolant pressure boundary (RCPB). The low pressure ECCS and associated DGs are initiated upon receipt of the Drywell Pressure — High Function in order to minimize the possibility of fuel damage. The DGs are initiated from Function 1.b signals. The Drywell Pressure — High Function, along with the Reactor Water Level — Low Low Low (Level 1) Function, is directly assumed in the analysis of the

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

<u>1.b, 2.b. Drywell Pressure-High</u> (continued) $\boxed{8}$

recirculation line break (Ref. ~~7~~). The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

High drywell pressure signals are initiated from four pressure switches that sense drywell pressure. The Allowable Value was selected to be as low as possible and be indicative of a LOCA inside primary containment.

The Drywell Pressure—High Function is required to be OPERABLE when the ECCS or DG is required to be OPERABLE in conjunction with times when the primary containment is required to be OPERABLE. Thus, four channels of the CS and LPCI Drywell Pressure—High Function are required to be OPERABLE in MODES 1, 2, and 3 to ensure that no single instrument failure can preclude ECCS and DG initiation. In MODES 4 and 5, the Drywell Pressure—High Function is not required, since there is insufficient energy in the reactor to pressurize the primary containment to Drywell Pressure—High setpoint. Refer to LCO 3.5.1 for Applicability Bases for the low pressure ECCS subsystems and to LCO 3.8.1 for Applicability Bases for the DGs.

<u>1.c, 2.c. Reactor Pressure-Low (Injection Permissive)</u>

Low reactor pressure signals are used as permissives for the low pressure ECCS subsystems. This ensures that, prior to opening the injection valves of the low pressure ECCS subsystems, the reactor pressure has fallen to a value below these subsystems' maximum design pressure and a break in the RCPB has occurred, respectively. The Reactor Pressure—Low is one of the Functions assumed to be OPERABLE and capable $\boxed{6 \text{ and } 8}$ of permitting initiation of the ECCS during the transients analyzed in References ~~5 and 7~~. In addition, the Reactor Pressure—Low Function is directly assumed in the analysis of the recirculation line break (Ref. ~~6~~). The core cooling $\boxed{7}$ function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

The Reactor Pressure—Low signals are initiated from four pressure switches that sense the reactor dome pressure.

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The Allowable Value is low enough to prevent overpressuring the equipment in the low pressure ECCS, but high enough to ensure that the ECCS injection prevents the fuel peak cladding temperature from exceeding the limits of 10 CFR 50.46.

Four channels of Reactor Pressure — Low Function are only required to be OPERABLE when the ECCS is required to be OPERABLE to ensure that no single instrument failure can preclude ECCS initiation. Per Footnote (a) to Table 3.3.5.1-1, this ECCS function is only required to be OPERABLE in MODES 4 and 5 whenever the associated ECCS is required to be OPERABLE per LCO 3.5.2. Refer to LCO 3.5.1 and LCO 3.5.2 for Applicability Bases for the low pressure ECCS subsystems.

1.d, 2.g. Core Spray and Low Pressure Coolant Injection Pump Discharge Flow-Low (Bypass)

The minimum flow instruments are provided to protect the associated low pressure ECCS pump from overheating when the pump is operating and the associated injection valve is not fully open. The minimum flow line valve is opened when low flow is sensed, and the valve is automatically closed when the flow rate is adequate to protect the pump. The LPCI and CS Pump Discharge Flow — Low Functions are assumed to be OPERABLE. The minimum flow valves for CS and LPCI are not required to close to ensure that the low pressure ECCS flows assumed during the transients and accidents analyzed in References ~~5, 6, and 7~~ 6, 7, and 8 are met. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

One flow transmitter per CS pump and one differential pressure switch per LPCI subsystem are used to detect the associated subsystems' flow rates. The logic is arranged such that each switch or transmitter causes its associated minimum flow valve to open. The logic will close the minimum flow valve once the closure setpoint is exceeded. The LPCI minimum flow valves are time delayed such that the valves will not open for approximately 3.5 seconds after the switches detect low flow. The time delay is provided to limit reactor vessel inventory loss during the startup of the RHR shutdown cooling mode. The Pump Discharge Flow — Low Allowable Values are high enough to ensure that the pump

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2.d. Reactor Pressure-Low (Recirculation Discharge Valve Permissive)

Low reactor pressure signals are used as permissives for recirculation discharge valve closure. This ensures that the LPCI subsystems inject into the proper RPV location assumed in the safety analysis. The Reactor Pressure—Low is one of the Functions assumed to be OPERABLE and capable of closing the valve during the transients analyzed in References 6 and 8 ~~5 and 7~~. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46. The Reactor Pressure—Low Function is directly assumed in the analysis of the recirculation line break (Ref. ~~6~~ 7).

The Reactor Pressure—Low signals are initiated from four pressure switches that sense the reactor dome pressure.

The Allowable Value is chosen high enough that the valves close prior to when LPCI injection flow into the core is required (as assumed in the safety analysis) and low enough to avoid excessive differential pressures.

Four channels of the Reactor Pressure—Low Function are only required to be OPERABLE in MODES 1, 2, and 3 with the associated recirculation pump discharge valve open. With the valve(s) closed, the function of the instrumentation has been performed; thus, the Function is not required. In MODES 4 and 5, the loop injection location is not critical since LPCI injection through the recirculation loop in either direction will still ensure that LPCI flow reaches the core (i.e., there is no significant reactor steam dome back pressure).

2.e. Reactor Vessel Shroud Level-Level 0

The Reactor Vessel Shroud Level—Level 0 Function is provided as a permissive to allow the RHR System to be manually aligned from the LPCI mode to the suppression pool cooling/spray or drywell spray modes. The reactor vessel shroud level permissive ensures that water in the vessel is approximately two thirds core height before the manual transfer is allowed. This ensures that LPCI is available to prevent or minimize fuel damage. This function may be

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2.e. Reactor Vessel Shroud Level-Level 0 (continued)

overridden during accident conditions as allowed by plant procedures. Reactor Vessel Shroud Level — Level 0 Function is implicitly assumed in the analysis of the recirculation line break (Ref. 6) since the analysis assumes that no LPCI flow diversion occurs when reactor water level is below Level 0. 7

Reactor Vessel Shroud Level — Level 0 signals are initiated from two level transmitters that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. The Reactor Vessel Shroud Level — Level 0 Allowable Value of - 193.19 inches referenced to instrument zero (which is equivalent to 35 inches below FZZ) is chosen to allow the low pressure core flooding systems to activate and provide adequate cooling before allowing a manual transfer.

Two channels of the Reactor Vessel Shroud Level — Level 0 Function are only required to be OPERABLE in MODES 1, 2, and 3. In MODES 4 and 5, the specified initiation time of the LPCI subsystems is not assumed, and other administrative controls are adequate to control the valves associated with this Function (since the systems that the valves are opened for are not required to be OPERABLE in MODES 4 and 5 and are normally not used).

2.f. Low Pressure Coolant Injection Pump Start-Time Delay Relay

The purpose of this time delay is to stagger the start of the LPCI pumps that are in each of Divisions 1 and 2, thus limiting the starting transients on the 4.16 kV emergency buses. This Function is only necessary when power is being supplied from the standby power sources (DG). However, since the time delay does not degrade ECCS operation, it remains in the pump start logic at all times. The LPCI Pump Start — Time Delay Relays are assumed to be OPERABLE in the accident analyses requiring ECCS initiation. That is, the analyses assume that the pumps will initiate when required and excess loading will not cause failure of the power sources.

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There are four LPCI Pump Start — Time Delay Relays, one in each of the RHR pump start logic circuits. While each time delay relay is dedicated to a single pump start logic, a single failure of a LPCI Pump Start — Time Delay Relay could result in the failure of the two low pressure ECCS pumps, powered for the same ESF bus, to perform their intended function (e.g., as in the case where both ECCS pumps on one ESF bus start simultaneously due to an inoperable time delay relay). This still leaves four of the six low pressure ECCS pumps OPERABLE; thus, the single failure criterion is met (i.e., loss of one instrument does not preclude ECCS initiation). The Allowable Value for the LPCI Pump Start — Time Delay Relays is chosen to be long enough so that most of the starting transient of the first pump is complete before starting the second pump on the same 4.16 kV emergency bus and short enough so that ECCS operation is not degraded.

Each LPCI Pump Start — Time Delay Relay Function is required to be OPERABLE only when the associated LPCI subsystem is required to be OPERABLE. Per Footnote (a) to Table 3.3.5.1-1, this ECCS function is only required to be OPERABLE in MODES 4 and 5 whenever the associated ECCS is required to be OPERABLE per LCO 3.5.2. Refer to LCO 3.5.1 and LCO 3.5.2 for Applicability Bases for the LPCI subsystems.

High Pressure Coolant Injection (HPCI) System

3.a. Reactor Vessel Water Level-Low Low (Level 2)

Low RPV water level indicates that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, the HPCI System is initiated at Level 2 to maintain level above fuel zone zero. The Reactor Vessel Water Level — Low Low (Level 2) is one of the Functions assumed to be OPERABLE and capable of initiating HPCI during the transients analyzed in References ~~5 and 7~~ 6 and 8. Additionally, the Reactor Vessel Water Level — Low Low (Level 2) Function associated with HPCI is directly assumed in the analysis of the recirculation line break (Ref. ~~6~~ 7). The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

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3.a. Reactor Vessel Water Level-Low Low (Level 2) (continued)

Reactor Vessel Water Level—Low Low (Level 2) signals are initiated from four level switches that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel.

The Reactor Vessel Water Level—Low Low (Level 2) Allowable Value is high enough such that for complete loss of feedwater flow, the Reactor Core Isolation Cooling (RCIC) System flow with HPCI assumed to fail will be sufficient to avoid initiation of low pressure ECCS at Reactor Vessel Water Level—Low Low Low (Level 1).

Four channels of Reactor Vessel Water Level—Low Low (Level 2) Function are required to be OPERABLE only when HPCI is required to be OPERABLE to ensure that no single instrument failure can preclude HPCI initiation. Refer to LCO 3.5.1 for HPCI Applicability Bases.

3.b. Drywell Pressure-High

High pressure in the drywell could indicate a break in the RCPB. The HPCI System is initiated upon receipt of the Drywell Pressure—High Function in order to minimize the possibility of fuel damage. While HPCI is not assumed to be OPERABLE in any DBA or transient analysis, the Drywell Pressure—High Function, along with the Reactor Water Level—Low Low (Level 2) Function, is capable of initiating HPCI during a LOCA (Ref. 8 ~~7~~). The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

High drywell pressure signals are initiated from four pressure switches that sense drywell pressure. The Allowable Value was selected to be as low as possible to be indicative of a LOCA inside primary containment.

Four channels of the Drywell Pressure—High Function are required to be OPERABLE when HPCI is required to be OPERABLE to ensure that no single instrument failure can preclude HPCI initiation. Refer to LCO 3.5.1 for the Applicability Bases for the HPCI System.

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABLITY

3.e. Suppression Pool Water Level-High (continued)

OPERABLE to ensure that no single instrument failure can preclude HPCI swap to suppression pool source. Refer to LCO 3.5.1 for HPCI Applicability Bases.

3.f. High Pressure Coolant Injection Pump Discharge Flow-Low (Bypass)

The minimum flow instrument is provided to protect the HPCI pump from overheating when the pump is operating at reduced flow. The minimum flow line valve is opened when low flow is sensed and either 1) the pump is on, or 2) the system has initiated; and the valve is automatically closed when the flow rate is adequate to protect the pump. The High Pressure Coolant Injection Pump Discharge Flow — Low Function is assumed to be OPERABLE. The minimum flow valve for HPCI is not required to close to ensure that the ECCS flow assumed during the transients analyzed in References 6, 7, and 8 ~~5, 6, and 7~~ are met. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

One flow switch is used to detect the HPCI System's flow rate. The logic is arranged such that the switch causes the minimum flow valve to open. The logic will close the minimum flow valve once the closure setpoint is exceeded.

The High Pressure Coolant Injection Pump Discharge Flow — Low Allowable Value is high enough to ensure that pump flow rate is sufficient to protect the pump.

One channel is required to be OPERABLE when the HPCI is required to be OPERABLE. Refer to LCO 3.5.1 for HPCI Applicability Bases.

Automatic Depressurization System

4.a, 5.a. Reactor Vessel Water Level-Low Low Low (Level 1)

Low RPV water level indicates that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, ADS receives one of the signals necessary for initiation from this

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

4.a, 5.a. Reactor Vessel Water Level-Low Low Low, Level 1 (continued)

Function. The Reactor Vessel Water Level—Low Low Low (Level 1) is one of the Functions assumed to be OPERABLE and capable of initiating the ADS during the accident analyzed in Reference ~~6~~ 7. The core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Reactor Vessel Water Level—Low Low Low (Level 1) signals are initiated from four level switches that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. Four channels of Reactor Vessel Water Level—Low Low Low (Level 1) Function are required to be OPERABLE only when ADS is required to be OPERABLE to ensure that no single instrument failure can preclude ADS initiation. Two channels input to ADS trip system A, while the other two channels input to ADS trip system B. Refer to LCO 3.5.1 for ADS Applicability Bases.

The Reactor Vessel Water Level—Low Low Low (Level 1) Allowable Value is chosen to allow time for the low pressure core flooding systems to initiate and provide adequate cooling.

4.b, 5.b. Automatic Depressurization System Initiation Timer

The purpose of the Automatic Depressurization System Initiation Timer is to delay depressurization of the reactor vessel to allow the HPCI System time to maintain reactor vessel water level. Since the rapid depressurization caused by ADS operation is one of the most severe transients on the reactor vessel, its occurrence should be limited. By delaying initiation of the ADS Function, the operator is given the chance to monitor the success or failure of the HPCI System to maintain water level, and then to decide whether or not to allow ADS to initiate, to delay initiation further by recycling the timer, or to inhibit initiation permanently. The Automatic Depressurization System Initiation Timer Function is assumed to be OPERABLE for the

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4.b, 5.b. Automatic Depressurization System Initiation Timer (continued)

accident analysis of Reference ~~6~~ 7 that requires ECCS initiation and assumes failure of the HPCI System.

There are two Automatic Depressurization System Initiation Timer relays, one in each of the two ADS trip systems. The Allowable Value for the Automatic Depressurization System Initiation Timer is chosen so that there is still time after depressurization for the low pressure ECCS subsystems to provide adequate core cooling.

Two channels of the Automatic Depressurization System Initiation Timer Function are only required to be OPERABLE when the ADS is required to be OPERABLE to ensure that no single instrument failure can preclude ADS initiation. (One channel inputs to ADS trip system A, while the other channel inputs to ADS trip system B. Refer to LCO 3.5.1 for ADS Applicability Bases.

4.c, 5.c. Reactor Vessel Water Level-Low (Level 3)

The Reactor Vessel Water Level—Low (Level 3) Function is used by the ADS only as a confirmatory low water level signal. ADS receives one of the signals necessary for initiation from Reactor Vessel Water Level—Low Low Low (Level 1) signals. In order to prevent spurious initiation of the ADS due to spurious Level 1 signals, a Level 3 signal must also be received before ADS initiation commences.

Reactor Vessel Water Level—Low (Level 3) signals are initiated from two level switches that sense the difference between the pressure due to a constant column of water (reference leg) and the pressure due to the actual water level (variable leg) in the vessel. The Allowable Value for Reactor Vessel Water Level—Low (Level 3) is selected to be above the RPS Level 3 scram Allowable Value for convenience. Refer to LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," for the Bases discussion of this Function.

Two channels of Reactor Vessel Water Level—Low (Level 3) Function are only required to be OPERABLE when the ADS is required to be OPERABLE to ensure that no single instrument failure can preclude ADS initiation. One channel inputs to ADS trip system A, while the other channel inputs to ADS

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4.c, 5.c. Reactor Vessel Water Level-Low (Level 3) (continued)

trip system B. Refer to LCO 3.5.1 for ADS Applicability Bases.

4.d, 4.e, 5.d, 5.e. Core Spray and Low Pressure Coolant Injection Pump Discharge Pressure-High

The Pump Discharge Pressure—High signals from the CS and LPCI pumps are used as permissives for ADS initiation, indicating that there is a source of low pressure cooling water available once the ADS has depressurized the vessel. Pump Discharge Pressure—High is one of the Functions assumed to be OPERABLE and capable of permitting ADS initiation during the events analyzed in Reference ~~6~~ 7 with an assumed HPCI failure. For these events the ADS depressurizes the reactor vessel so that the low pressure ECCS can perform the core cooling functions. This core cooling function of the ECCS, along with the scram action of the RPS, ensures that the fuel peak cladding temperature remains below the limits of 10 CFR 50.46.

Pump discharge pressure signals are initiated from twelve pressure switches, two on the discharge side of each of the six low pressure ECCS pumps. In order to generate an ADS permissive in one trip system, it is necessary that only one pump (both channels for the pump) indicate the high discharge pressure condition. The Pump Discharge Pressure—High Allowable Value is less than the pump discharge pressure when the pump is operating in a full flow mode and high enough to avoid any condition that results in a discharge pressure permissive when the CS and LPCI pumps are aligned for injection and the pumps are not running. The actual operating point of this function is not assumed in any transient or accident analysis. However, this function is indirectly assumed to operate (in Reference ~~5~~ 6) to provide the ADS permissive to depressurize the RCS to allow the ECCS low pressure systems to operate.

Twelve channels of Core Spray and Low Pressure Coolant Injection Pump Discharge Pressure—High Function are only required to be OPERABLE when the ADS is required to be OPERABLE to ensure that no single instrument failure can preclude ADS initiation. Two CS channels associated with CS

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<u>B.1, B.2, and B.3</u> (continued)

into Condition B if an associated channel is inoperable. This ensures that the proper loss of initiation capability check is performed. Required Action B.1 (the Required Action for certain inoperable channels in the low pressure ECCS subsystems) is not applicable to Function 2.e, since this Function provides backup to administrative controls ensuring that operators do not divert LPCI flow from injecting into the core when needed. Thus, a total loss of Function 2.e capability for 24 hours is allowed, since the LPCI subsystems remain capable of performing their intended function.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." For Required Action B.1, the Completion Time only begins upon discovery that a redundant feature in the same system (e.g., both CS subsystems) cannot be automatically initiated due to inoperable, untripped channels within the same Function as described in the paragraph above. For Required Action B.2, the Completion Time only begins upon discovery that the HPCI System cannot be automatically initiated due to two inoperable, untripped channels for the associated Function in the same trip system. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an 9 allowable out of service time of 24 hours has been shown to be acceptable (Ref. ~~8~~) to permit restoration of any inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel must be placed in the tripped condition per Required Action B.3. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an initiation), Condition H must be entered and its Required Action taken.

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ACTIONS (continued)

C.1 and C.2

Required Action C.1 is intended to ensure that appropriate actions are taken if multiple, inoperable channels within the same Function result in redundant automatic initiation capability being lost for the feature(s). Required Action C.1 features would be those that are initiated by Functions 1.c, 1.e, 2.c, 2.d, and 2.f (i.e., low pressure ECCS). Redundant automatic initiation capability is lost if either (a) two Function 1.c channels are inoperable such that both trip systems lose initiation capability, (b) two Function 1.e channels are inoperable, (c) two Function 2.c channels are inoperable such that both trip systems lose initiation capability, (d) two Function 2.d channels are inoperable such that both trip systems lose initiation capability, or (e) two or more Function 2.f channels are inoperable. In this situation (loss of redundant automatic initiation capability), the 24 hour allowance of Required Action C.2 is not appropriate and the feature(s) associated with the inoperable channels must be declared inoperable within 1 hour. Since each inoperable channel would have Required Action C.1 applied separately (refer to ACTIONS Note), each inoperable channel would only require the affected portion of the associated system to be declared inoperable. However, since channels for both low pressure ECCS subsystems are inoperable (e.g., both CS subsystems), and the Completion Times started concurrently for the channels in both subsystems, this results in the affected portions in both subsystems being concurrently declared inoperable. For Functions 1.c, 1.e, 2.d, and 2.f, the affected portions are the associated low pressure ECCS pumps. As noted (Note 1), Required Action C.1 is only applicable in MODES 1, 2, and 3. In MODES 4 and 5, the specific initiation time of the ECCS is not assumed and the probability of a LOCA is lower. Thus, a total loss of automatic initiation capability for 24 hours (as allowed by Required Action C.2) is allowed during MODES 4 and 5.

Note 2 states that Required Action C.1 is only applicable for Functions 1.c, 1.e, 2.c, 2.d, and 2.f. Required Action C.1 is not applicable to Function 3.c (which also requires entry into this Condition if a channel in this Function is inoperable), since the loss of one channel results in a loss of the Function (two-out-of-two logic). This loss was considered during the development of Reference 8 and considered acceptable for the 24 hours allowed by Required Action C.2. 9

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C.1 and C.2 (continued)

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." For Required Action C.1, the Completion Time only begins upon discovery that the same feature in both subsystems (e.g., both CS subsystems) cannot be automatically initiated due to inoperable channels within the same Function as described in the paragraph above. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration of channels.

9 Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. ~~8~~) to permit restoration of any inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, Condition H must be entered and its Required Action taken. The Required Actions do not allow placing the channel in trip since this action would either cause the initiation or it would not necessarily result in a safe state for the channel in all events.

D.1, D.2.1, and D.2.2

Required Action D.1 is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Function result in a complete loss of automatic component initiation capability for the HPCI System. Automatic component initiation capability is lost if two Function 3.d channels or two Function 3.e channels are inoperable and untripped. In this situation (loss of automatic suction swap), the 24 hour allowance of Required Actions D.2.1 and D.2.2 is not appropriate and the HPCI System must be declared inoperable within 1 hour after discovery of loss of HPCI initiation capability. As noted, Required Action D.1 is only applicable if the HPCI pump suction is not aligned to the suppression pool, since, if aligned, the Function is already performed.

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D.1, D.2.1, and D.2.2 (continued)

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." For Required Action D.1, the Completion Time only begins upon discovery that the HPCI System cannot be automatically aligned to the suppression pool due to two inoperable, untripped channels in the same Function. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 24 hours has been shown to be acceptable (Ref. ~~8~~ 9) to permit restoration of any inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel must be placed in the tripped condition per Required Action D.2.1 or the suction source must be aligned to the suppression pool per Required Action D.2.2. Placing the inoperable channel in trip performs the intended function of the channel (shifting the suction source to the suppression pool). Performance of either of these two Required Actions will allow operation to continue. If Required Action D.2.1 or D.2.2 is performed, measures should be taken to ensure that the HPCI System piping remains filled with water. Alternately, if it is not desired to perform Required Actions D.2.1 and D.2.2 (e.g., as in the case where shifting the suction source could drain down the HPCI suction piping), Condition H must be entered and its Required Action taken.

E.1 and E.2

Required Action E.1 is intended to ensure that appropriate actions are taken if multiple, inoperable channels within the Core Spray and Low Pressure Coolant Injection Pump Discharge Flow—Low Bypass Functions result in redundant automatic initiation capability being lost for the feature(s). For Required Action E.1, the features would be those that are initiated by Functions 1.d and 2.g (e.g., low pressure ECCS). Redundant automatic initiation capability

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E.1 and E.2 (continued)

is lost if (a) two Function 1.d channels are inoperable or (b) two Function 2.g channels are inoperable. Since each inoperable channel would have Required Action E.1 applied separately (refer to ACTIONS Note), each inoperable channel would only require the affected low pressure ECCS pump to be declared inoperable. However, since channels for more than one low pressure ECCS pump are inoperable, and the Completion Times started concurrently for the channels of the low pressure ECCS pumps, this results in the affected low pressure ECCS pumps being concurrently declared inoperable.

In this situation (loss of redundant automatic initiation capability), the 7 day allowance of Required Action E.2 is not appropriate and the subsystem associated with each inoperable channel must be declared inoperable within 1 hour. As noted (Note 1 to Required Action E.1), Required Action E.1 is only applicable in MODES 1, 2, and 3. In MODES 4 and 5, the specific initiation time of the ECCS is not assumed and the probability of a LOCA is lower. Thus, a total loss of initiation capability for 7 days (as allowed by Required Action E.2) is allowed during MODES 4 and 5. A Note is also provided (Note 2 to Required Action E.1) to delineate that Required Action E.1 is only applicable to low pressure ECCS Functions. Required Action E.1 is not applicable to HPCI Function 3.f since the loss of one channel results in a loss of the Function (one-out-of-one logic). This loss was considered during the development of
9 Reference ~~8~~ and considered acceptable for the 7 days allowed by Required Action E.2.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock."

For Required Action E.1, the Completion Time only begins upon discovery that a redundant feature in the same system (e.g., both CS subsystems) cannot be automatically initiated due to inoperable channels within the same Function as described in the paragraph above. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration of channels.

(continued)

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F.1 and F.2 (continued)

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." For Required Action F.1, the Completion Time only begins upon discovery that the ADS cannot be automatically initiated due to inoperable, untripped channels within similar ADS trip system Functions as described in the paragraph above. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an allowable out of service time of 8 days has been shown to be 9 acceptable (Ref. 8) to permit restoration of any inoperable channel to OPERABLE status if both HPCI and RCIC are OPERABLE. If either HPCI or RCIC is inoperable, the time is shortened to 96 hours. If the status of HPCI or RCIC changes such that the Completion Time changes from 8 days to 96 hours, the 96 hours begins upon discovery of HPCI or RCIC inoperability. However, the total time for an inoperable, untripped channel cannot exceed 8 days. If the status of HPCI or RCIC changes such that the Completion Time changes from 96 hours to 8 days, the "time zero" for beginning the 8 day "clock" begins upon discovery of the inoperable, untripped channel. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel must be placed in the tripped condition per Required Action F.2. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an initiation), Condition H must be entered and its Required Action taken.

G.1 and G.2

Required Action G.1 is intended to ensure that appropriate actions are taken if multiple, inoperable channels within

(continued)

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ACTIONS

G.1 and G.2 (continued)

similar ADS trip system Functions result in automatic initiation capability being lost for the ADS. Automatic initiation capability is lost if either (a) one Function 4.b channel and one Function 5.b channel are inoperable, (b) a combination of Function 4.d, 4.e, 5.d, and 5.e channels are inoperable such that channels associated with five or more low pressure ECCS pumps are inoperable. In this situation (loss of automatic initiation capability), the 96 hour or 8 day allowance, as applicable, of Required Action G.2 is not appropriate, and all ADS valves must be declared inoperable within 1 hour after discovery of loss of ADS initiation capability.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." For Required Action G.1, the Completion Time only begins upon discovery that the ADS cannot be automatically initiated due to inoperable channels within similar ADS trip system Functions as described in the paragraph above. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the diversity of sensors available to provide initiation signals and the redundancy of the ECCS design, an
9 allowable out of service time of 8 days has been shown to be acceptable (Ref. 8) to permit restoration of any inoperable channel to OPERABLE status if both HPCI and RCIC are OPERABLE (Required Action G.2). If either HPCI or RCIC is inoperable, the time shortens to 96 hours. If the status of HPCI or RCIC changes such that the Completion Time changes from 8 days to 96 hours, the 96 hours begins upon discovery of HPCI or RCIC inoperability. However, the total time for an inoperable channel cannot exceed 8 days. If the status of HPCI or RCIC changes such that the Completion Time changes from 96 hours to 8 days, the "time zero" for beginning the 8 day "clock" begins upon discovery of the inoperable channel. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, Condition H must be entered and its Required Action taken. The Required Actions do not allow placing the

(continued)

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G.1 and G.2 (continued)

channel in trip since this action would not necessarily result in a safe state for the channel in all events.

H.1

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

SURVEILLANCE REQUIREMENTS

As noted in the beginning of the SRs, the SRs for each ECCS instrument~~ation~~ Function are found in the SRs column of Table 3.3.5.1-1.

The Surveillances are modified by a Note to indicate that when a 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 as follows: (a) for Functions 3.c and 3.f; and (b) for Functions other than 3.c and 3.f provided the associated Function or redundant Function maintains ECCS initiation 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. This Note is based on the reliability analysis (Ref. 9 ~~8~~) assumption of the average time required to perform channel surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the ECCS will initiate when necessary.

SR 3.3.5.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that instrument channels monitoring the same parameter should read

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

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 guarantees that undetected outright channel failure is limited to 12 hours; 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. 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 3.3.5.1.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. 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.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

The Frequency of 92 days is based on the reliability analyses of Reference ~~8~~. $\boxed{9}$

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.5.1.3 and SR 3.3.5.1.4

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

The Frequency of SR 3.3.5.1.3 is based upon the assumption of a 92 day calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

The Frequency of SR 3.3.5.1.4 is based upon the assumption of ~~an~~ a 24 ~~18~~ month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

<INSERT 10>

SR 3.3.5.1.5

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required initiation logic and simulated automatic actuation for a specific channel. The system functional testing performed in LCO 3.5.1, LCO 3.5.2, LCO 3.8.1, and LCO 3.8.2 overlaps this Surveillance to complete testing of the assumed safety function.

The 24 ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the ~~18~~ 24 month Frequency.

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REFERENCES

1. Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3.

2. ~~1.~~ Amendment No. 7 to Facility License No DPR-46 for the Cooper Nuclear Station, February 6, 1975.

3. ~~2.~~ Cooper Nuclear Station Design Change 94-332, December 1994.

4. ~~3.~~ NEDC 97-023, "HPCI Minimum Flow Line Analysis."

5. ~~4.~~ 10 CFR 50.36(c)(2)(ii).

6. ~~5.~~ USAR, Section V-2.4.

7. ~~6.~~ USAR, Section VI-5.0.

8. ~~7.~~ USAR, Chapter XIV.

9. ~~8.~~ NEDC-30936-P-A, "BWR Owners' Group Technical Specification Improvement Analyses for ECCS Actuation Instrumentation, Part 2," December 1988.

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B 3.3 INSTRUMENTATION

B 3.3.5.2 Reactor Core Isolation Cooling (RCIC) System Instrumentation

BASES

BACKGROUND

The purpose of the RCIC System instrumentation is to initiate actions to ensure adequate core cooling when the reactor vessel is isolated from its primary heat sink (the main condenser) and normal coolant makeup flow from the Reactor Feedwater System is insufficient or unavailable, such that RCIC System initiation occurs and maintains sufficient reactor water level such that an initiation of the low pressure Emergency Core Cooling Systems (ECCS) pumps does not occur. A more complete discussion of RCIC System operation is provided in the Bases of LCO 3.5.3, "RCIC System."

<INSERT 11>

The RCIC System may be initiated by either automatic or manual means. Automatic initiation occurs for conditions of Reactor Vessel Water Level—Low Low (Level 2). The variable is monitored by four level switches that are connected to relays whose contacts are arranged in a one-out-of-two taken twice logic arrangement. Once initiated, the RCIC logic seals in and can be reset by the operator only when the reactor vessel water level signals have cleared.

The RCIC test line isolation valves are closed on a RCIC initiation signal to allow full system flow.

The RCIC System also monitors the water level in the emergency condensate storage tanks (ECST) since this is the initial source of water for RCIC operation. Reactor grade water in the ECSTs is the normal source. The ECST suction source consists of two ECSTs connected in parallel to the RCIC pump suction. Upon receipt of a RCIC initiation signal, the ECSTs suction valve is automatically signaled to open (it is normally in the open position) unless the pump suction from the suppression pool valve is open. If the water level in the ECSTs falls below a preselected level, first the suppression pool suction valve automatically opens, and then the ECSTs suction valve automatically closes. Two level switches are used to detect low water level in the ECSTs. Either switch can cause the suppression pool suction valve to open. The opening of the suppression pool suction valve causes the ECSTs suction valve to close.

(continued)

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BACKGROUND (continued)

To prevent losing suction to the pump when automatically transferring suction from the ECSTs to the suppression pool on low ECST level, the suction valves are interlocked so that the suppression pool suction path must be open before the ECST suction path automatically closes.

The RCIC System provides makeup water to the reactor until the reactor vessel water level reaches the high water level (Level 8) setting (two-out-of-two logic), at which time the RCIC turbine trip-throttle valve closes. The RCIC System restarts if vessel level again drops to the low level initiation point (Level 2).

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY

The function of the RCIC System is to respond to transient events by providing makeup coolant to the reactor. The RCIC System is not an Engineered Safety Feature System and no credit is taken in the safety analyses for RCIC System operation. Based on its contribution to the reduction of overall plant risk, however, the system, and therefore its instrumentation meets Criterion 4 of 10 CFR 50.36(c)(2)(ii) (Ref. ~~1~~). 2

<INSERT 2>

The OPERABILITY of the RCIC System instrumentation is dependent upon the OPERABILITY of the individual instrumentation channel Functions specified in Table 3.3.5.2-1. Each Function must have a required number of OPERABLE channels with their setpoints ~~within the specified Allowable Values~~, where appropriate. The actual setpoint is calibrated consistent with applicable setpoint methodology assumptions.

set within the setting tolerance of the LTSPs

Each channel must also respond within its assumed response time.

Allowable Values are specified for each RCIC System instrumentation Function specified in ~~the Table. Nominal trip setpoints are specified in the setpoint calculations. The setpoint calculations are performed using methodology described in NEDC-31336P-A, "General Electric Instrument Setpoint Methodology," dated September 1996. The nominal setpoints~~ are selected to ensure that the setpoints ~~do not exceed the Allowable Value~~ between CHANNEL CALIBRATIONS.

Table 3.3.5.2-1. LTSPs and the methodologies for calculation of the as-left and as-found tolerances are described in the Technical Requirements Manual. The LTSPs

remain conservative to the as-left tolerance band

After each calibration the trip setpoint shall be left within the as-left band around the LTSP.

(continued)

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APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

LTSPs

~~Operation with a trip setpoint less conservative than the nominal trip setpoint, but within its Allowable Value, is acceptable. A channel is inoperable if its actual trip setpoint is not within its required Allowable Values. Trip setpoints~~ are those predetermined values of output at which an action should take place. The setpoints are compared to the actual process parameter (e.g., reactor vessel water level), and when the measured output value of the process parameter exceeds the setpoint, the associated device (e.g., switch) changes state. The ~~analytic~~ analytical limits are derived from the limiting values of the process parameters obtained from the safety analysis. The Allowable Values are derived from the ~~analytic~~ analytical limits, corrected for calibration, process, and some of the instrument errors. The ~~trip setpoints~~ LTSPs are then determined, accounting for the remaining instrument errors (e.g., drift). The ~~trip setpoints~~ LTSPs derived in this manner provide adequate protection because instrumentation uncertainties, process effects, calibration tolerances, instrument drift, and severe environment errors (for channels that must function in harsh environments as defined by 10 CFR 50.49) are accounted for.

The individual Functions are required to be OPERABLE in MODE 1, and in MODES 2 and 3 with reactor steam dome pressure > 150 psig since this is when RCIC is required to be OPERABLE. (Refer to LCO 3.5.3 for Applicability Bases for the RCIC System.)

The specific Applicable Safety Analyses, LCO, and Applicability discussions are listed below on a Function by Function basis.

1. Reactor Vessel Water Level - Low Low (Level 2)

Low reactor pressure vessel (RPV) water level indicates that normal feedwater flow is insufficient to maintain reactor vessel water level and that the capability to cool the fuel may be threatened. Should RPV water level decrease too far, fuel damage could result. Therefore, the RCIC System is initiated at Level 2 to assist in maintaining water level above fuel zone zero.

Reactor Vessel Water Level — Low Low (Level 2) signals are initiated from four level switches that sense the difference

(continued)

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B.1 and B.2 (continued)

Because of the redundancy of sensors available to provide initiation signals and the fact that the RCIC System is not assumed in any accident or transient analysis, an allowable 3 out of service time of 24 hours has been shown to be acceptable (Ref. ~~2~~) to permit restoration of any inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel must be placed in the tripped condition per Required Action B.2. Placing the inoperable channel in trip would conservatively compensate for the inoperability, restore capability to accommodate a single failure, and allow operation to continue. Alternately, if it is not desired to place the channel in trip (e.g., as in the case where placing the inoperable channel in trip would result in an initiation), Condition E must be entered and its Required Action taken.

C.1

A risk based analysis was performed and determined that an 3 allowable out of service time of 24 hours (Ref. ~~2~~) is acceptable to permit restoration of any inoperable channel to OPERABLE status (Required Action C.1). A Required Action (similar to Required Action B.1) limiting the allowable out of service time, if a loss of automatic RCIC initiation capability exists, is not required. This Condition applies to the Reactor Vessel Water Level—High (Level 8) Function whose logic is arranged such that any inoperable channel will result in a loss of automatic RCIC initiation capability (closure of the turbine trip-throttle valve). As stated above, this loss of automatic RCIC initiation capability was analyzed and determined to be acceptable. The Required Action does not allow placing a channel in trip since this action would not necessarily result in a safe state for the channel in all events.

D.1, D.2.1, and D.2.2

Required Action D.1 is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped channels within the same Function result in automatic component initiation capability being lost for the

(continued)

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<u>D.1, D.2.1, and D.2.2</u> (continued)

feature(s). For Required Action D.1, the RCIC System is the only associated feature. In this case, automatic initiation capability is lost if two Function 3 channels are inoperable and untripped. In this situation (loss of automatic suction swap), the 24 hour allowance of Required Actions D.2.1 and D.2.2 is not appropriate, and the RCIC System must be declared inoperable within 1 hour from discovery of loss of RCIC initiation capability. As noted, Required Action D.1 is only applicable if the RCIC pump suction is not aligned to the suppression pool since, if aligned, the Function is already performed.

The Completion Time is intended to allow the operator time to evaluate and repair any discovered inoperabilities. This Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." For Required Action D.1, the Completion Time only begins upon discovery that the RCIC System cannot be automatically aligned to the suppression pool due to two inoperable, untripped channels in the same Function. The 1 hour Completion Time from discovery of loss of initiation capability is acceptable because it minimizes risk while allowing time for restoration or tripping of channels.

Because of the redundancy of sensors available to provide initiation signals and the fact that the RCIC System is not assumed in any accident or transient analysis, an allowable
3 out of service time of 24 hours has been shown to be
acceptable (Ref. ~~2~~) to permit restoration of any inoperable channel to OPERABLE status. If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the channel must be placed in the tripped condition per Required Action D.2.1, which performs the intended function of the channel (shifting the suction source to the suppression pool). Alternatively, Required Action D.2.2 allows the manual alignment of the RCIC suction to the suppression pool, which also performs the intended function. If Required Action D.2.1 or D.2.2 is performed, measures should be taken to ensure that the RCIC System piping remains filled with water. If it is not desired to perform Required Actions D.2.1 and D.2.2 (e.g., as in the case where shifting the suction source could drain down the RCIC suction piping), Condition E must be entered and its Required Action taken.

(continued)

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ACTIONS (continued)

E.1

With any Required Action and associated Completion Time not met, the RCIC System may be incapable of performing the intended function, and the RCIC System must be declared inoperable immediately.

SURVEILLANCE REQUIREMENTS

As noted in the beginning of the SRs, the SRs for each RCIC System instrument~~ation~~ Function are found in the SRs column of Table 3.3.5.2-1.

The Surveillances are modified by a Note to indicate that when a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed as follows: (a) for up to 6 hours for Function 2; and (b) for up to 6 hours for Functions 1 and 3, provided the associated Function maintains trip 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. 3
This Note is based on the reliability analysis (Ref. ~~2)~~) assumption of the average time required to perform channel surveillance. That analysis demonstrated that the 6 hour testing allowance does not significantly reduce the probability that the RCIC will initiate when necessary.

SR 3.3.5.2.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a parameter 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 instrument channels could be an indication of excessive instrument drift in one of the channels or

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

something even more serious. 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. 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 3.3.5.2.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. 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.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

The Frequency of 92 days is based on the reliability analysis of Reference ~~2.~~ $\boxed{3}$

SR 3.3.5.2.3 and SR 3.3.5.2.4

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

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SURVEILLANCE REQUIREMENTS (continued)

The Frequency of SR 3.3.5.2.3 is based upon the assumption of a 92 day calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

a 24

The Frequency of SR 3.3.5.2.4 is based upon the assumption of ~~an~~ ~~18~~ month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

<INSERT 12>

SR 3.3.5.2.5

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required initiation logic for a specific channel. The system functional testing performed in LCO 3.5.3 overlaps this Surveillance to provide complete testing of the safety function. Simulated automatic actuation is performed each operating cycle.

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the ~~18~~ month Frequency.

24

REFERENCES

1. Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," Revision 3.

2.

~~1.~~ 10 CFR 50.36(c)(2)(ii).

3.

~~2.~~ GENE-770-06-2, "Addendum to Bases for Changes to Surveillance Test Intervals and Allowed Out-of-Service Times for Selected Instrumentation Technical Specifications," February 1991.

BASES

SURVEILLANCE REQUIREMENTS (continued)

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. 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.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

The 92 day Frequency of SR 3.3.6.1.2 is based on the reliability analysis described in References 10 and 11.

SR 3.3.6.1.3, SR 3.3.6.1.4 and SR 3.3.6.1.5

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology. SR 3.3.6.1.5, however, is only a calibration of the radiation detectors using a standard radiation source.

As noted for SR 3.3.6.1.4, the main steam line radiation detectors (Function 2.d) are excluded from CHANNEL CALIBRATION due to ALARA reasons (when the plant is operating, the radiation detectors are generally in a high radiation area; the steam tunnel). This exclusion is acceptable because the radiation detectors are passive devices, with minimal drift. The radiation detectors are calibrated in accordance with SR 3.3.6.1.5 on a 24 ~~an 18~~ month Frequency using a standard current source and radiation source. The CHANNEL CALIBRATION of the remaining portions of the channel (SR 3.3.6.1.4) are performed using a standard current source.

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SURVEILLANCE REQUIREMENTS (continued)

The Frequency of SR 3.3.6.1.3 is based on the assumption of a 92 day calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis. The Frequency of SR 3.3.6.1.4 and SR 3.3.6.1.5 is based on the assumption of ~~an 18~~ a 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.6.1.6

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required isolation logic for a specific channel. The system functional testing performed on PCIVs in LCO 3.6.1.3 overlaps this Surveillance to provide complete testing of the assumed safety function. Simulated automatic actuation is performed each operating cycle. The ~~18~~ 24 month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the ~~18~~ 24 month Frequency.

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SURVEILLANCE REQUIREMENTS (continued)

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

SR 3.3.6.2.3

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

The Frequency of SR 3.3.6.2.3 is based on the assumption of ~~an~~ a 24 ~~18~~ month calibration interval, respectively, in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.6.2.4

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required isolation logic for a specific channel. The system functional testing performed on SCIVs and the SGT System in LCO 3.6.4.2 and LCO 3.6.4.3, respectively, overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 24 ~~18~~ month Frequency.

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SURVEILLANCE REQUIREMENTS (continued)

The 92 day Frequency is based on the reliability analysis of Reference 3.

A portion of the SRV discharge line pressure switch instrument channels are located inside the primary containment. The Note for SR 3.3.6.3.2, "Only required to be performed prior to entering MODE 2 during each scheduled outage > 72 hours when entry is made into primary containment," is based on the location of these instruments and ALARA considerations.

SR 3.3.6.3.4

CHANNEL CALIBRATION is a complete check of the instrument loop and sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

The Frequency of once every ~~18~~ 24 months for SR 3.3.6.3.4 is based on the assumption of ~~an 18~~ a 24 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.6.3.5

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required actuation logic for a specified channel. The system functional testing performed in LCO 3.4.3, "Safety/Relief Valves (SRVs) and Safety Valves (SVs)" and LCO 3.6.1.6, "Low-Low Set (LLS) Safety/Relief Valves (SRVs)," for SRVs overlaps this test to provide complete testing of the assumed safety function.

The Frequency of once every ~~18~~ 24 months for SR 3.3.6.3.5 is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the ~~18~~ 24 month Frequency.

BASES

SURVEILLANCE REQUIREMENTS (continued)

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

SR 3.3.7.1.2

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. 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.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

The Frequency of 92 days is based on the reliability analyses of References 5, 6, and 7.

SR 3.3.7.1.3

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

BASES

SURVEILLANCE REQUIREMENTS (continued)

The Frequency is based upon the assumption of a 24 ~~an 18~~ month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.7.1.4

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required initiation logic for a specific channel. The system functional testing performed in LCO 3.7.4, "Control Room Emergency Filter (CREF) System," overlaps this Surveillance to provide complete testing of the assumed safety function.

The 24 ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the 24 ~~18~~ month Frequency.

REFERENCES

1. USAR, Section X-10.4.
2. USAR, Section XIV-6.3.
3. USAR, Section XIV-6.4.
4. 10 CFR 50.36(c)(2)(ii).
5. GENE-770-06-1, "Bases for Changes to Surveillance Test Intervals and Allowed Out-of-Service Times for Selected Instrumentation Technical Specifications," February 1991.
6. NEDC-31677P-A, "Technical Specification Improvement Analysis for BWR Isolation Actuation Instrumentation," July 1990.
7. NEDC-30851P-A Supplement 2, "Technical Specifications Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation," March 1989.

INFORMATION ONLY

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.8.1.1

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the channel will perform the intended function. 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. Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

The Frequency of 31 days is based on operating experience with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel of a given Function in any 31 day interval is a rare event.

SR 3.3.8.1.2

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

A CHANNEL CALIBRATION is a complete check of the relay circuitry and associated time delay relays. This test verifies the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

Any setpoint adjustment shall be consistent with the assumptions of the current plant specific setpoint methodology.

a 24

The Frequency is based upon the assumption of ~~an 18~~ month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

SR 3.3.8.1.3

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required actuation logic for a specific channel. The system functional testing performed in LCO 3.8.1 and LCO 3.8.2 overlaps this Surveillance to provide complete testing of the assumed safety functions.

INFORMATION ONLY

BASES

SURVEILLANCE REQUIREMENTS (continued)

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed at the ~~18~~ month Frequency.

24

REFERENCES

1. USAR, Section VIII-4.6.
2. USAR, Chapter XIV.
3. 10 CFR 50.36(c)(2)(ii)

BASES

ACTIONS

C.1 (continued)

This places the plant in a condition where minimal equipment, powered through the inoperable RPS electric power monitoring assembly(s), is required and ensures that the safety function of the RPS (e.g., scram of control rods) is not required. The plant shutdown is accomplished by placing the plant in MODE 3 within 12 hours. The allowed Completion Time is reasonable, based on operating experience, to reach the required plant conditions from full power condition in an orderly manner and without challenging plant systems.

D.1

If any Required Action and associated Completion Time of Condition A or B are not met in MODE 5, with any control rod withdrawn from a core cell containing one or more fuel assemblies, the operator must immediately initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies. Required Action D.1 results in the least reactive condition for the reactor core and ensures that the safety function of the RPS (e.g., scram of control rods) is not required. Action must continue until the Required Action is completed.

SURVEILLANCE REQUIREMENTS

There is a plant specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology.

SR 3.3.8.2.1

CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor. This test verifies that the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations consistent with the plant specific setpoint methodology.

The Frequency is based on the assumption of a 24 ~~an 18~~ month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.8.2.2

Performance of a system functional test demonstrates that, with a required system actuation (simulated or actual) signal, the logic of the system will automatically trip open the associated power monitoring assembly. The system functional test shall include actuation of the protective relays, tripping logic, and output circuit breakers. Only one signal per power monitoring assembly is required to be tested. This Surveillance overlaps with the CHANNEL CALIBRATION to provide complete testing of the safety function. The system functional test of the Class 1E circuit breakers is included as part of this test to provide complete testing of the safety function. If the breakers are incapable of operating, the associated electric power monitoring assembly would be inoperable.

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the ~~18~~ month Frequency.

24

REFERENCES

1. USAR, Section VII-2.3.
2. 10 CFR 50.36(c)(2)(ii).

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.3.2

A manual actuation of each SRV (until the main turbine bypass valves have closed to compensate for SRV opening) is performed to verify that, mechanically, the valve is functioning properly and no blockage exists in the valve discharge line. This can also be demonstrated by the response of the turbine control valves or bypass valves, by a change in the measured steam flow, or by any other method suitable to verify steam flow. Adequate reactor steam dome pressure must be available to perform this test to avoid damaging the valve. Also, adequate steam flow must be passing through the main turbine or turbine bypass valves to continue to control reactor pressure and steam flow when the SRVs divert steam flow upon opening. Sufficient time is therefore allowed after the required pressure and flow are achieved to perform this test. Adequate pressure at which this test is to be performed is ≥ 500 psig, consistent with the recommendations of the vendor. Adequate steam flow is represented by turbine bypass valves at least 30% open, or total steam flow ≥ 10^6 lb/hr. Plant startup is allowed prior to performing this test because valve OPERABILITY and the setpoints for overpressure protection are verified, per ASME Code requirements, prior to valve installation. Therefore, this SR is modified by a Note that states the Surveillance is not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. The 12 hours allowed for manual actuation after the required pressure and steam flow are reached is sufficient to achieve stable conditions for testing and provides a reasonable time to complete the SR. If a valve fails to actuate due only to the failure of the solenoid but is capable of opening on overpressure, the safety function of the SRV is not considered inoperable.

24

The ~~18~~ month Frequency was developed based on the SRV tests required by the ASME Code for Operation and Maintenance of Nuclear Power Plants (Ref. 6). Operating experience has shown that these components usually pass the Surveillance when performed at the ~~18~~ 24
month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

should overcome the RPV pressure and associated discharge line losses. Adequate reactor pressure must be available to perform these tests. Additionally, adequate steam flow must be passing through the main turbine or turbine bypass valves to continue to control reactor pressure when the HPCI System diverts steam flow. Therefore, sufficient time is allowed after adequate pressure and flow are achieved to perform these tests. Adequate reactor steam pressure must be ≥ 920 psig to perform SR 3.5.1.7 and ≥ 145 psig to perform SR 3.5.1.8. Adequate steam flow is represented by turbine bypass valves at least 30% open, or total steam flow ≥ 10^6 lb/hr. Reactor startup is allowed prior to performing the low pressure Surveillance test because the reactor pressure is low and the time allowed to satisfactorily perform the Surveillance test is short. The reactor pressure is allowed to be increased to normal operating pressure since it is assumed that the low pressure test has been satisfactorily completed and there is no indication or reason to believe that HPCI is inoperable.

Therefore, SR 3.5.1.7 and SR 3.5.1.8 are modified by Notes that state the Surveillances are not required to be performed until 12 hours after the reactor steam pressure and flow are adequate to perform the test. The 12 hours allowed for the flow tests after required pressure and flow are reached are sufficient to achieve stable conditions for testing and provides a reasonable time to complete the SRs. For SR 3.5.1.8, while adequate pressure can be reached prior to the required Applicability for HPCI, the 12 hour allowance of the Note would not apply until entering the Applicability (>150 psig) with adequate steam flow.

The Frequency for SR 3.5.1.6 and SR 3.5.1.7 is in accordance with the Inservice Testing Program requirements. The ~~18~~ month Frequency for SR 3.5.1.8 is based on the need to perform the Surveillance under the conditions that apply just prior to or during a startup from a plant outage. Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint. 24

24

INFORMATION ONLY

SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.9

The ECCS subsystems are required to actuate automatically to perform their design functions. This Surveillance verifies that, with a required system initiation signal (actual or simulated), the automatic initiation logic of HPCI, CS, and LPCI will cause the systems or subsystems to operate as designed, including actuation of the system throughout its emergency operating sequence, automatic pump startup and actuation of all automatic valves to their required positions. This SR also ensures that the HPCI System will automatically restart on an RPV low water level (Level 2) signal received subsequent to an RPV high water level (Level 8) trip and that the suction is automatically transferred from the ECSTs to the suppression pool. The LOGIC SYSTEM FUNCTIONAL TEST performed in LCO 3.3.5.1 overlaps this Surveillance to provide complete testing of the assumed safety function.

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power.

Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint. 24

This SR is modified by Note 1 that says for HPCI only the Surveillance is not required to be performed until 12 hours after the reactor steam pressure and flow are adequate to perform the test. The time allowed for this test after required pressure and flow are reached is sufficient to achieve stable conditions for testing and provides a reasonable time to complete the SR. Adequate reactor pressure must be available to perform this test. Additionally, adequate steam flow must be passing through the main turbine or turbine bypass valves to continue to control reactor pressure when the HPCI System diverts steam flow. Thus, sufficient time is allowed after adequate pressure and flow are achieved to perform this test. Adequate reactor steam pressure is > 145 psig. Adequate steam flow is represented by turbine bypass valves at least

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SURVEILLANCE REQUIREMENTS (continued)

30% open, or a total steam flow of 10^6 lb/hr. Reactor startup is allowed prior to performing this test because the reactor pressure is low and the time allowed to satisfactorily perform the test is short. For SR 3.5.1.9, while adequate pressure can be reached prior to the required Applicability for HPCI, the 12 hour allowance of the Note would not apply until entering the Applicability (>150 psig) with adequate steam flow.

This SR is modified by Note 2 that excludes vessel injection/spray during the Surveillance. Since all active components are testable and full flow can be demonstrated by recirculation through the test line, coolant injection into the RPV is not required during the Surveillance.

<u>SR 3.5.1.10</u>

The ADS designated SRVs are required to actuate automatically upon receipt of specific initiation signals. A system functional test is performed to demonstrate that the mechanical portions of the ADS function (i.e., solenoids) operate as designed when initiated either by an actual or simulated initiation signal, causing proper actuation of all the required components. SR 3.5.1.11 and the LOGIC SYSTEM FUNCTIONAL TEST performed in LCO 3.3.5.1 overlap this Surveillance to provide complete testing of the assumed safety function.

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

24

This SR is modified by a Note that excludes valve actuation since the valves are individually tested in accordance with SR 3.5.1.11. This also prevents an RPV pressure blowdown.

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.11

A manual actuation of each ADS valve is performed to verify that the valve and solenoid are functioning properly and that no blockage exists in the SRV discharge lines. This is demonstrated by the response of the turbine control or bypass valve or by a change in the measured flow or by any other method suitable to verify steam flow. Adequate reactor steam dome pressure must be available to perform this test to avoid damaging the valve. Also, adequate steam flow must be passing through the main turbine or turbine bypass valves to continue to control reactor pressure when the ADS valves divert steam flow upon opening. Sufficient time is therefore allowed after the required pressure and flow are achieved to perform this SR. Adequate pressure at which this SR is to be performed is ≥ 500 psig (consistent with the recommendations of the vendor). Adequate steam flow is represented by turbine bypass valves at least 30% open, or total steam flow ≥ 10^6 lb/hr. Reactor startup is allowed prior to performing this SR because valve OPERABILITY and the setpoints for overpressure protection are verified, per ASME requirements, prior to valve installation. Therefore, this SR is modified by a Note that states the Surveillance is not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test. The 12 hours allowed for manual actuation after the required pressure is reached is sufficient to achieve stable conditions and provides adequate time to complete the Surveillance. SR 3.5.1.10 and the LOGIC SYSTEM FUNCTIONAL TEST performed in LCO 3.3.5.1 overlap this Surveillance to provide complete testing of the assumed safety function.

24 The Frequency is based on the need to perform the Surveillance under the conditions that apply just prior to or during a startup from a plant outage. Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. USAR, Section VI-4.3.
2. USAR, Section VI-4.4.

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

adequate to perform the test. The 12 hours allowed for the flow tests after the required pressure and flow are reached are sufficient to achieve stable conditions for testing and provides a reasonable time to complete the SRs. For SR 3.5.3.4, while adequate pressure can be reached prior to the required Applicability for RCIC, the 12 hour allowance of the Note would not apply until entering the Applicability (>150 psig) with adequate steam flow.

A 92 day Frequency for SR 3.5.3.3 is consistent with the Inservice Testing Program requirements. The ~~18~~ month Frequency for SR 3.5.3.4 is based on the need to perform the Surveillance under conditions that apply just prior to or during a startup from a plant outage. Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint. 24

24

SR 3.5.3.5

The RCIC System is required to actuate automatically in order to verify its design function satisfactorily. This Surveillance verifies that, with a required system initiation signal (actual or simulated), the automatic initiation logic of the RCIC System will cause the system to operate as designed, including actuation of the system throughout its emergency operating sequence; that is, automatic pump startup and actuation of all automatic valves to their required positions. This test also ensures the RCIC System will automatically restart on an RPV low water level (Level 2) signal received subsequent to an RPV high water level (Level 8) trip and that the suction is automatically transferred from the ECST to the suppression pool. The LOGIC SYSTEM FUNCTIONAL TEST performed in LCO 3.3.5.2 overlaps this Surveillance to provide complete testing of the assumed design function.

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

24

BASES

SURVEILLANCE REQUIREMENTS (continued)

does not change by more than the calculated amount per minute over a 10 minute period. The leakage test is performed every ~~18~~ months. The ~~18~~ month Frequency was developed considering it is prudent that this Surveillance be performed during a unit outage and also in view of the fact that component failures that might have affected this test are identified by other primary containment SRs. Two consecutive test failures, however, would indicate unexpected primary containment degradation; in this event, as the Note indicates, increasing the Frequency to once every 9 months is required until the situation is remedied as evidenced by passing two consecutive tests.

24

24

REFERENCES

1. USAR, Section V-2.4.
2. USAR, Section XIV-6.3.
3. 10 CFR 50, Appendix J, Option B.
4. 10 CFR 50.36(c)(2)(ii).
5. Safety Evaluation Report by U.S. Atomic Energy Commission dated February 14, 1973 (Section 6.2.1).

SR 3.6.1.3.6 (continued)

calculated radiological consequences of these events remain within 10 CFR 100 limits. The Frequency of this SR is in accordance with the requirements of the Inservice Testing Program.

SR 3.6.1.3.7

Automatic PCIVs close on a primary containment isolation signal to prevent leakage of radioactive material from primary containment following a DBA. This SR ensures that each automatic PCIV will actuate to its isolation position on a primary containment isolation signal. The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.6.1, "Primary Containment Isolation Instrumentation," overlaps this SR to provide 24
complete testing of the safety function. The ~~18~~ month Frequency was developed considering it is prudent that this Surveillance be performed only during a unit outage since isolation of penetrations would disrupt the normal operation of many critical components. Operating experience has
24 shown that these components usually pass this Surveillance when performed at the ~~18~~ month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.1.3.8

This SR requires a demonstration that a representative sample of reactor instrumentation line excess flow check valves (EFCVs) are OPERABLE by verifying that each valve actuates to the isolation position on an actual or simulated instrument line break. The representative sample consists of an approximately equal number of EFCVs, such that each EFCV is tested at least once every 10 years (nominal). This SR provides assurance that the instrumentation line EFCVs will perform so that predicted radiological
24 consequences will not be exceeded during the postulated instrument line break event. The ~~18~~ month Frequency is based on the need to perform the 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.

The nominal 10 year interval is based on other performance-based testing programs, such as Inservice Testing (snubbers) and Option B to 10 CFR 50, Appendix J. Furthermore, any EFCV failures will be evaluated to determine if additional testing in that test interval is warranted to ensure overall reliability is maintained. Operating experience has demonstrated that these components are highly reliable and that failures to isolate are very infrequent. Therefore, testing of a representative sample was concluded to be acceptable from a reliability standpoint.

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.1.3.9

The TIP shear isolation valves are actuated by explosive charges. An in place functional test is not possible with this design. The explosive squib is removed and tested to provide assurance that the valves will actuate when required. The replacement charge for the explosive squib shall be from the same manufactured batch as the one fired or from another
24 batch that has been certified by having one of the batch successfully fired. The Frequency of ~~18~~ months on a STAGGERED TEST BASIS is considered adequate given the administrative controls on replacement charges and the frequent checks of circuit continuity (SR 3.6.1.3.4).

SR 3.6.1.3.10

The analyses in References 8 and 9 are based on leakage that is less than the specified leakage rate. A leakage rate of 150 scfh per Main Steam line at $\geq P_a$ (58 psig) was assumed in the LOCA analyses. The equivalent leakage rate at $\geq P_t$ (29 psig) is 106 scfh. An "MSIV line" is each one of the four Main Steam lines with an inboard and an outboard Main Steam Isolation Valve (MSIV). The leakage rate to be measured is the Main Steam line "minimum path" leakage (the lesser actual pathway leakage of the two MSIVs in the Main Steam Line). The leakage limit is based on the analyses of References 11 and 12. The Frequency is in accordance with the Primary Containment Leakage Rate Testing Program.

SR 3.6.1.3.11

Verifying each inboard 24 inch primary containment purge and vent valve (PC-230 MV, PC-231 MV, PC-232 MV, and PC-233 MV) is blocked to restrict the maximum opening angle to 60° is required to ensure that the valves can close under DBA conditions within the times assumed in the analysis of References 7 and 8. If a LOCA occurs, the purge and vent valves must close to maintain containment leakage within the values assumed in the accident analysis. At other times, pressurization
24 concerns are not present, thus the purge valves can be fully open. The ~~18~~ month Frequency is appropriate because the blocking devices may be removed during a refueling outage.

SR 3.6.1.3.12

The Main Steam Pathway is the analyzed leakage path from the four Main Steam lines and the inboard Main Steam drain line to and including the condenser. The leakage limit imposed on the Main Steam Pathway with this surveillance requirement applies to the total (aggregate) leakage for the Main Steam Pathway. The Main Steam Pathway leakage includes the total leakage of all four Main Steam line penetrations plus

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ACTIONS (continued)

Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.1.6.1

A manual actuation of each LLS valve is performed to verify that the valve and solenoids are functioning properly and no blockage exists in the valve discharge line. This can be demonstrated by the response of the turbine control or bypass valve, by a change in the measured steam flow, or by any other method that is suitable to verify steam flow. Adequate reactor steam dome pressure must be available to perform this test to avoid damaging the valve. Adequate pressure at which this test is to be performed is ≥ 500 psig (consistent with the recommendations of the vendor). Also, adequate steam flow must be passing through the main turbine or turbine bypass valves to continue to control reactor pressure when the LLS valves divert steam flow upon opening. Adequate steam flow is represented by turbine bypass valves at least 30% open, or total steam flow ≥ 10^6 lb/hr. The 24 ~~18~~ month Frequency was based on the SRV tests required by the ASME Code for Operation and Maintenance of Nuclear Power Plants (Ref. 3). Operating experience has shown that these components usually pass the Surveillance when performed at the 24 ~~18~~ month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

Since steam pressure is required to perform the Surveillance, however, and steam may not be available during a unit outage, the Surveillance may be performed during the startup following a unit outage. Unit startup is allowed prior to performing the test because valve OPERABILITY and the setpoints for overpressure protection are verified by Reference 3 prior to valve installation. After adequate reactor steam dome pressure and flow are reached, 12 hours is allowed to prepare for and perform the test.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.1.6.2

The LLS designated SRVs are required to actuate automatically upon receipt of specific initiation signals. A system functional test is performed to verify that the mechanical portions (i.e., solenoids) of the LLS function operate as designed when initiated either by an actual or simulated automatic initiation signal. The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.6.3, "Low—Low Set (LLS) Instrumentation," overlaps this SR to provide complete testing of the safety function.

24

The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power.
24 Operating experience has shown these components usually pass the Surveillance when performed at the ~~18~~ month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

This SR is modified by a Note that excludes valve actuation. This prevents a reactor pressure vessel pressure blowdown.

REFERENCES

1. 10 CFR 50.36(c)(2)(ii).
2. NEDE-22197, Safety Relief Valve Low Low Set System and Lower MSIV Water Level Trip for Cooper Nuclear Station, Unit 1, December 1982.
3. ASME Code for Operation and Maintenance of Nuclear Power Plants.

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.1.7.2

Each vacuum breaker must be cycled to ensure that it opens properly to perform its design function and returns to its fully closed position. This ensures that the safety analysis assumptions are valid. The 92 day Frequency of this SR was developed based upon Inservice Testing Program requirements to perform valve testing at least once every 92 days.

SR 3.6.1.7.3

Demonstration of vacuum breaker opening setpoint is necessary to ensure that the safety analysis assumption regarding vacuum breaker full open differential pressure of $\leq$ 0.5 psid is valid. The ~~18~~ month Frequency is based on the need to perform some of the surveillance procedures which satisfy this SR under the conditions that apply during a plant outage and the potential for an unplanned transient if those particular procedures were performed with the reactor at power. For this unit, the ~~18~~ month Frequency has been shown to be acceptable, based on operating experience, and is further justified because of other Surveillances performed at shorter Frequencies that convey the proper functioning status of each vacuum breaker. 24 24

REFERENCES

1. Bodega Bay Preliminary Hazards Summary Report, Appendix I, Docket 50-205, December 28, 1962.

2. USAR, Section V-2.3.6.

3. 10 CFR 50.36(c)(2)(ii).

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.1.8.2 (continued)

requirements to perform valve testing at least once every 92 days. A 31 day Frequency was chosen to provide additional assurance that the vacuum breakers are OPERABLE, since they are located in a harsh environment (the suppression chamber airspace).

SR 3.6.1.8.3

Verification of the vacuum breaker setpoint for opening is necessary to ensure that the safety analysis assumption regarding vacuum breaker full open differential pressure of 0.5 psid is valid. The ~~18~~ month Frequency is 24 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. The
24 ~~18~~ month Frequency has been shown to be acceptable, based on operating experience, and is further justified because of other surveillances performed at shorter Frequencies that convey the proper functioning status of each vacuum breaker.

REFERENCES

1. Bodega Bay Preliminary Hazards Summary Report, Appendix I, Docket 50-205, December 28, 1962.
2. USAR, Section XIV-6.3.
3. Deleted
4. USAR, Section V-2.3.6.
5. 10 CFR 50.36(c)(2)(ii).
6. FSAR Question No. 5.17.

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.4.1.4

The SGT System exhausts the secondary containment atmosphere to the environment through appropriate treatment equipment. SR 3.6.4.1.4 demonstrates that one SGT subsystem can maintain ≥ 0.25 inches of vacuum water gauge for 1 hour at a flow rate ≤ 1780 cfm. The 1 hour test period allows secondary containment to be in thermal equilibrium at steady state conditions. Therefore, this test is used to ensure secondary containment boundary integrity. Since this SR is a secondary containment test, it need not be performed with each SGT subsystem. The SGT subsystems are tested on a STAGGERED TEST BASIS, however, to ensure that in addition to the requirements of LCO 3.6.4.3, either SGT subsystem will perform this test. Operating experience has shown these components usually pass the Surveillance when performed at the 24 ~~18~~ month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. USAR, Section XIV-6.3.
2. USAR, Section XIV-6.4.
3. 10 CFR 50.36(c)(2)(ii).

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.4.2.3

Verifying that each automatic SCIV closes on a secondary containment isolation signal is required to minimize leakage of radioactive material from secondary containment following a DBA or other accidents. This SR ensures that each automatic SCIV will actuate to the isolation position on a secondary containment isolation signal. The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.6.2, "Secondary Containment Isolation
24 Instrumentation," overlaps this SR to provide complete testing of the
safety function. The ~~18~~ 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
24 shown these components usually pass the Surveillance when performed
at the ~~18~~ month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. USAR, Section V-3.0.
2. USAR, Section XIV-6.0.
3. USAR, Section XIV-6.3.
4. USAR, Section XIV-6.4
5. 10 CFR 50.36(c)(2)(ii).
6. Technical Requirements Manual.

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.4.3.1 (continued)

fan motors and controls and the redundancy available in the system.

SR 3.6.4.3.2

This SR verifies that the required SGT filter testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The VFTP includes testing HEPA filter performance, charcoal adsorber efficiency, minimum system flow rate, and the physical properties of the activated charcoal (general use and following specific operations). Specific test frequencies and additional information are discussed in detail in the VFTP.

SR 3.6.4.3.3

This SR verifies that each SGT subsystem starts on receipt of an actual or simulated initiation signal. While this Surveillance can be performed with the reactor at power, operating experience has shown that these components will pass the Surveillance when performed at the ~~18~~ month Frequency. The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.6.2, "Secondary Containment Isolation Instrumentation," overlaps this SR to provide complete testing of the safety function. Therefore, the Frequency was found to be acceptable from a reliability standpoint. 24

SR 3.6.4.3.4

This SR verifies that the SGT units cross tie damper is in the correct position, and that each SGT room air supply check valve and each air operated SGT dilution air shutoff valve open when required. This ensures that the decay heat removal function of SGT System operation is available. While this Surveillance can be performed with the reactor at
24 power, operating experience has shown that these components will pass the Surveillance when performed at the ~~18~~ month Frequency, which is based on the refueling cycle. Therefore, the Frequency was found to be acceptable from a reliability standpoint.

REFERENCES

1. (Deleted)
2. USAR, Section V-3.3.4.
3. 10 CFR 50.36(c)(2)(ii).

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BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.2.4

This SR verifies that the automatic isolation valves of the SW System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety related equipment during an accident event. This is demonstrated by the use of an actual or simulated initiation signal. The initiation signal is caused by low SW header pressure (approximately 20 psig). This SR also verifies the automatic start capability of one of the two SW pumps in each subsystem.

24 Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

REFERENCES

1. NEDC 94-255, "Hydraulic Evaluation of Opening in Intake Structure Guide Wall," June 14, 1995.
2. USAR, Chapter V.
3. USAR, Chapter XIV.
4. 10 CFR 50.36(c)(2)(ii).
5. NEDC 00-095E, "CNS Reactor Building Post-LOCA Heating Analysis," May 28, 2010.

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.3.2

Verification of the REC System temperature ensures that the heat removal capability of the REC System is within the assumptions of the DBA analysis. The 24 hour Frequency is based on operating experience related to trending of the parameter variations during the applicable MODES.

SR 3.7.3.3

Verifying the correct alignment for each manual, power operated, and automatic valve in each REC subsystem flow path provides assurance that the proper flow paths will exist for REC operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. A valve is also allowed to be in the nonaccident position, and yet considered in the correct position, provided it can be automatically realigned to its accident position within the required time. This SR does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position. This SR does not apply to valves that cannot be inadvertently misaligned, such as check valves.

This SR is modified by a Note indicating that isolation of the REC System to components or systems may render those components or systems inoperable, but does not affect the OPERABILITY of the REC System. As such, when all REC pumps, valves, and piping are OPERABLE, but a branch connection off the main header is isolated, the REC System is still OPERABLE.

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.3.4

This SR verifies that the automatic isolation valves of the REC System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety related equipment during an accident event. This is demonstrated by the use of an actual or simulated initiation signal. The initiation signal is caused by low REC heat exchanger outlet pressure (which has an analytically determined limit of 55 psig decreasing). Also, a Group VI isolation signal will open

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BASES

SURVEILLANCE REQUIREMENTS (continued)

the REC heat exchanger service water outlet valves and the REC critical loop supply valves to provide cooling water to essential components.

24 Operating experience has shown that these components usually pass the SR when performed at the ~~18~~ month Frequency. Therefore, this Frequency is concluded to be acceptable from a reliability standpoint.

REFERENCES

1. USAR, Section X-6.
2. 10 CFR 50.36(c)(2)(ii).
3. DC 93-057
4. NEDC 92-050X and NEDC 97-087

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.4.3

This SR verifies that on an actual or simulated initiation signal, the CREF System starts and operates. The LOGIC SYSTEM FUNCTIONAL TEST in LCO 3.3.7.1, "Control Room Emergency Filter (CREF) System Instrumentation," overlaps this SR to provide complete testing of the safety function. The Frequency of ~~18~~ months is based on industry operating experience and is consistent with the typical refueling cycle.

24

SR 3.7.4.4

This SR verifies the OPERABILITY of the CRE boundary by testing for unfiltered air inleakage past the CRE boundary and into the CRE. The details of this testing are specified in the Control Room Envelope Habitability Program.

The CRE is considered habitable when the radiological dose to CRE occupants calculated in the licensing basis analyses of DBA consequences is no more than 5 rem whole body or its equivalent to any part of the body following a LOCA or 5 rem TEDE following a FHA and the CRE occupants are protected from hazardous chemicals and smoke. This SR verifies that the unfiltered air inleakage into the CRE is no greater than the flow rate assumed in the licensing basis analyses of DBA consequences. When unfiltered air inleakage is greater than the assumed flow rate, Condition B must be entered. Required Action B.3 allows time to restore the CRE boundary to OPERABLE status provided mitigating actions can ensure that the CRE remains within the licensing basis habitability limits for the occupants following an accident. Compensatory measures are discussed in Regulatory Guide 1.196, Section C.2.7.3, (Ref. 4) which endorses, with exceptions, NEI 99-03, Section 8.4 and Appendix F (Ref. 6). These compensatory measures may also be used as mitigating actions as required by Required Action B.2. Temporary analytical methods may also be used as compensatory measures to restore OPERABILITY (Ref. 7). Options for restoring the CRE boundary to OPERABLE status include changing the licensing basis DBA consequence analysis, repairing the CRE boundary, or a combination of these actions. Depending upon the nature of the problem and the corrective action, a full scope inleakage test may not be necessary to establish that the CRE boundary has been restored to OPERABLE status.

BASES

ACTIONS (continued)

B.1

If the inoperable Main Turbine Bypass Valve cannot be restored to OPERABLE status and the MCPR operating limits for one inoperable Main Turbine Bypass Valve are not applied within 2 hours, or two or more Main Turbine Bypass Valves are inoperable, THERMAL POWER must be reduced to < 25% RTP. As discussed in the Applicability section, operation at < 25% RTP results in sufficient margin to the required limits, and the Main Turbine Bypass System is not required to protect fuel integrity during the Applicable Safety Analyses transients. The 4 hour Completion Time is reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE REQUIREMENTS

SR 3.7.7.1

Cycling each main turbine bypass valve through at least half of one cycle of full travel (50% open) demonstrates that the valves are mechanically OPERABLE and will function when required. The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions. Operating experience has shown that these components usually pass the SR when performed at the 31 day Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.7.7.2

The Main Turbine Bypass System is required to actuate automatically to perform its design function. This SR demonstrates that, with the required system initiation signals, the valves will actuate to their required position.
24 The ~~18~~ month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has
24 shown the ~~18~~ month Frequency, which is based on the refueling cycle, is acceptable from a reliability standpoint.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Cycling open a bypass valve at slightly above 29.5 RTP may affect the RPS Turbine Stop and Control Valve functions.

SR 3.7.7.3

This SR ensures that the TURBINE BYPASS SYSTEM RESPONSE TIME is in compliance with the assumptions of the appropriate safety analyses. The response time limits are specified in the COLR. The 24 ~~18~~ month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown the 24 ~~18~~ month Frequency, which is based on the refueling cycle, is acceptable from a reliability standpoint.

REFERENCES

1. USAR, Section VII-11.3.
2. Amendment 25 to the FSAR.
3. NEDC 96-006, "Estimate of Steam Tunnel's HELB," March 3, 1996.
4. USAR, Section XIV-5.8.1.
5. 10 CFR 50.36(c)(2)(ii).

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SURVEILLANCE REQUIREMENTS (continued)

SR 3.8.1.8

Transfer of each 4.16 kV critical bus power supply from the normal offsite circuit to the alternate offsite circuit demonstrates the 24 OPERABILITY of the alternate circuit distribution network to power the shutdown loads. The ~~18~~ month Frequency of the Surveillance is based on engineering judgment taking into consideration the plant conditions required to perform the Surveillance, and is intended to be consistent with expected fuel cycle lengths. Operating experience has shown that these components usually pass the SR when performed on the 24 ~~18~~ month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

This SR is modified by a Note. The reason for the Note is that, during operation with the reactor critical, performance of this SR could cause perturbations to the electrical distribution systems that could challenge continued steady state operation and, as a result, plant safety systems. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.9

24 Consistent with IEEE 387-1995 (Ref. 15), Section 7.5.9 and Table 3, this SR requires demonstration once per ~~18~~ months that the DGs can start and run continuously at full load capability for an interval of not less than 8 hours —6 hours of which is at a load equivalent to 90-100% of the continuous rating of the DG, and 2 hours of which is at a load equivalent to 105% to 110% of the continuous duty rating of the DG. The DG starts for this Surveillance can be performed either from standby or hot conditions. The provisions for prelube and warmup, discussed in SR 3.8.1.2, and for gradual loading, discussed in SR 3.8.1.3, are applicable to this SR.

A load band of 90-100% accident load is provided to avoid routine overloading of the DG. Routine overloading may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY. Generator loadings less than 90% occurring during the first 10 seconds of accident loading are bounded by the test conditions of 90 to 100% load and are well within the generator capability curves.

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SURVEILLANCE REQUIREMENTS (continued)

The ~~18~~ 24 month Frequency is ~~conservative~~ consistent with ~~respect to the recommendations of IEEE 387-1995 (Ref. 15).~~ IEEE 387-1995 (Ref. 15), Section 7.5.9 and Table 3, which require this SR to be performed during refueling outages once per 24 months. The 24 ~~18~~ month Frequency takes into consideration plant conditions required to perform the Surveillance; and is intended to be consistent with expected fuel cycle lengths.

This Surveillance has been modified by three Notes. Note 1 states that momentary transients due to changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the limit do not invalidate the test. The reason for Note 2 is that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that would challenge continued steady state operation and, as a result, plant safety systems. Note 3 ensures that the DG is tested under load conditions that are as close to worst case design basis conditions as possible. When synchronized with offsite power, testing should be performed at a power factor of ≤ 0.89. This power factor is representative of the actual inductive loading a DG would see under design basis accident conditions. Under certain conditions, however, Note 3 allows the surveillance to be conducted at a power factor other than ≤ 0.89. These conditions occur when grid voltage is high, and the additional field excitation needed to obtain a power factor of ≤ 0.89 results in voltages on the emergency busses that are too high. Under these conditions, the power factor should be maintained as close as practicable to 0.89 while still maintaining acceptable voltage limits on the emergency busses. In other circumstances, the grid voltage may be such that the DG excitation levels needed to obtain a power factor of 0.89 may not cause unacceptable voltages on the emergency busses, but the excitation levels are in excess of those recommended for the DG. In such cases, the power factor shall be maintained as close as practicable to 0.89 without exceeding the DG excitation limits. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.10

Under LOCA conditions and loss of offsite power, loads are sequentially connected to the bus by a timed logic sequence. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading of the DGs due to high motor starting currents. The 10% load sequence time interval tolerance ensures that sufficient time exists for the DG to restore frequency and voltage prior to applying the next

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SURVEILLANCE REQUIREMENTS (continued)

load and that safety analysis assumptions regarding ESF equipment time delays are not violated. Reference 2 provides a summary of the automatic loading of ESF buses.

The Frequency of ~~18~~ 24 months is consistent with the intent of the recommendations of Regulatory Guide 1.108 (Ref. 10), paragraph 2.a.(2); takes into consideration plant conditions required to perform the Surveillance; and is intended to be consistent with expected fuel cycle lengths.

This SR is modified by a Note. The reason for the Note is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.11

In the event of a DBA coincident with a loss of offsite power, the DGs are required to supply the necessary power to ESF systems so that the fuel, RCS, and containment design limits are not exceeded.

This Surveillance demonstrates DG operation during a loss of offsite power actuation test signal in conjunction with an ECCS initiation signal. This test verifies all actions encountered from the loss of offsite power and loss of coolant accident, including shedding of the nonessential loads and energization of the emergency buses and respective loads from the DG. It further demonstrates the capability of the DG to automatically maintain the required voltage and frequency.

The DG auto-start time of 14 seconds is derived from requirements of the accident analysis for responding to a design basis large break LOCA. The Surveillance should be continued for a minimum of 5 minutes in order to demonstrate that all starting transients have decayed and stability has been achieved.

The requirement to verify the connection and power supply of permanent and auto-connected loads is intended to satisfactorily show the relationship of these loads to the DG loading logic. In certain circumstances, many of these loads cannot actually be connected or loaded without undue hardship or potential for undesired operation. For instance, Emergency Core Cooling Systems (ECCS) injection valves are not desired to be stroked open, or systems are not capable of being operated at full flow. In lieu of actual demonstration of connection and

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loading of loads, testing that adequately shows the capability of the DG system to perform these functions is acceptable. This testing may include any series of sequential, overlapping, or total steps so that the entire connection and loading sequence is verified.

The Frequency of ~~18~~ 24 months takes into consideration plant conditions required to perform the Surveillance and is intended to be consistent with an expected fuel cycle length of ~~18~~ 24 months.

This SR is modified by two Notes. The reason for Note 1 is to minimize wear and tear on the DGs during testing. For the purpose of this testing, the DGs must be started from standby conditions, that is, with the engine coolant and oil being periodically circulated and temperature maintained consistent with manufacturer recommendations. The reason for Note 2 is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution system, and challenge safety systems. Credit may be taken for unplanned events that satisfy this SR.

REFERENCES

1. USAR, Section VIII-1.0.
2. USAR, Section VIII-2.0 and VIII-3.0.
3. Safety Guide 9, Revision 0, March 1971.
4. USAR, Chapter VI.
5. USAR, Chapter XIV.
6. 10 CFR 50.36(c)(2)(ii).
7. Generic Letter 84-15.
8. Regulatory Guide 1.93.
9. Regulatory Guide 1.9, Revision 3, July 1993.
10. Regulatory Guide 1.108.
11. Regulatory Guide 1.137.

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SURVEILLANCE REQUIREMENTS (continued)

The 18 month Frequency for the Surveillances is based on engineering judgment. Operating experience has shown that these components usually pass the SR when performed at the 18 month Frequency. Therefore, the Frequency has been concluded to be acceptable from a reliability standpoint.

SR 3.8.4.6

Battery charger capability requirements are based on the design capacity of the chargers (Ref. 3). According to Regulatory Guide 1.32 (Ref. 8), the battery charger supply is required to be based on the largest combined demands of the various steady state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the unit during these demand occurrences. The minimum required amperes and duration ensures that these requirements can be satisfied.

The Frequency is acceptable, given the unit conditions required to perform the test and the other administrative controls existing to ensure adequate charger performance during these 24 ~~18~~ month intervals. In addition, this Frequency is intended to be consistent with expected fuel cycle lengths.

SR 3.8.4.7

A battery service test is a special test of the battery's capability, as found, to satisfy the design requirements (battery duty cycle) of the DC electrical power system. The discharge rate and test length corresponds to the design duty cycle requirements as specified in design calculations.

The Frequency of 24 ~~18~~ months is consistent with the intent of the recommendations of Regulatory Guide 1.32 (Ref. 8) and Regulatory Guide 1.129 (Ref. 9), which state that the battery service test should be performed during refueling operations or at some other outage~~, with intervals between tests not to exceed 18 months~~.

This SR is modified by two Notes. Note 1 allows the performance of a modified performance discharge test in lieu of a service test once per 60 months. The substitution is acceptable because a modified performance discharge test represents a more severe test of battery capacity than SR 3.8.4.7.

Attachment 5

GL 91-04 Review

Cooper Nuclear Station, Docket No. 50-298, DPR-46

1. BACKGROUND

Technical Specification (TS) Surveillance Requirement (SR) frequency changes are required to accommodate a 24-month fuel cycle for Cooper Nuclear Station (CNS). The Nebraska Public Power District (NPPD) is proposing changes in this submittal that were evaluated in accordance with the guidance provided in Nuclear Regulatory Commission (NRC) Generic Letter (GL) 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle," dated April 2, 1991. GL 91-04 provides NRC Staff guidance that identifies the types of information that must be addressed when proposing extensions of TS SR frequency intervals from 18 months to 24 months.

Historical surveillance test data and associated maintenance records were reviewed in evaluating the effect of these changes on safety. In addition, the licensing basis was reviewed to ensure it was not invalidated. Based on the results of these reviews, it is concluded that there is no adverse effect on plant safety due to increasing the surveillance test intervals from 18 to 24 months with the continued application of the 25% grace period allowed by SR 3.0.2.

GL 91-04 addressed steam generator inspections, which are not applicable to CNS, and are therefore not discussed in this submittal. Additionally, the GL addressed interval extensions to leak rate testing pursuant to 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors." This is also not discussed in this submittal because NPPD has adopted 10 CFR 50, Appendix J, Option B, as implemented by TS 5.5.12, "Primary Containment Leakage Rate Testing Program," which negates the need for 10 CFR 50 Appendix J exemptions.

2. EVALUATION

In GL 91-04, the NRC provided generic guidance for evaluating a 24-month surveillance test interval for TS SRs. Attachment 1 of this submittal defines each step outlined by the NRC in GL 91-04, and provides a description of the methodology used by NPPD to complete the evaluation for each specific TS SR line item. The methodology utilized in the CNS drift analysis is similar to the methodology used for previous plant submittals such as the River Bend Station, Perry Nuclear Power Plant, and Edwin I. Hatch Nuclear Plant submittals. There have been minor revisions incorporated into the CNS drift design guide based on NRC comments or Requests for Additional Information from previous 24-month fuel cycle extension submittals; e.g., NPPD added the requirement that 30 samples were generally required to produce a statistically significant sample set.

For each of the identified surveillances, at least five operating cycles SR performances were retrieved. In most cases, this included SRs performed during the Fall 2009 refueling outage. In some cases, SRs performed in 2010 and 2011 were included in the evaluation if older records were not readily retrievable. This provided approximately three 30-month surveillance periods of data to identify any repetitive problems. It has been concluded, based on engineering judgment, that three 30-month periods provide adequate performance test history. In some instances, additional surveillance performances were included when insufficient data was available for adequate statistical analysis of instrument drift. Further references to performance history reflect evaluations of the five most recent performances available through the Fall 2009 outage, unless otherwise specified.

In addition to evaluating the historical drift associated with current 18-month calibrations, the failure history of each 18-month surveillance was also evaluated. With the extension of the testing frequency to 24 months, there will be a longer period between each surveillance performance. If a failure that results in the loss of the associated safety function should occur during the operating cycle that would only be detected by the performance of the 18-month TS SR, then the increase in the surveillance testing interval might result in a decrease in the associated function's availability. Furthermore, potential common failures of similar components tested by different surveillances were also evaluated. This additional evaluation determined whether there is evidence of repetitive failures among similar plant components.

The surveillance failures detailed with each SR exclude failures that:

(a) Did not impact a TS safety function or TS operability;
(b) Are detectable by required testing performed more frequently than the 18-month surveillance being extended; or
(c) The cause can be attributed to an associated event such as a preventative maintenance task, human error, previous modification or previously existing design deficiency, or that were subsequently re-performed successfully with no intervening corrective maintenance (e.g., plant conditions or malfunctioning measurement and test equipment may have caused aborting the test performance).

These categories of failures are not related to potential unavailability due to testing interval extension, and are therefore not listed or further evaluated in this submittal.

The following sections summarize the results of the failure history evaluation. The evaluation confirmed that the impact on system availability, if any, would be small as a result of the change to a 24-month testing frequency.

The proposed TS changes related to GL 91-04 test interval extensions have been divided into two categories. The categories are: (A) changes to surveillances other than channel calibrations, identified as "Non-Calibration Changes," and (B) changes involving the channel calibration frequency, identified as "Calibration Changes."

A. Non-Calibration Changes

For the non-calibration 18-month surveillances, GL 91-04 requires the following information to support conversion to a 24-month frequency:

1) Licensees should evaluate the effect on safety of an increase in 18-month surveillance intervals to accommodate a 24-month fuel cycle. This evaluation should support a conclusion that the effect on safety is small.

2) Licensees should confirm that historical plant maintenance and surveillance support this conclusion.
3) Licensees should confirm that the assumptions in the plant licensing basis would not be invalidated on the basis of performing any surveillance at the bounding surveillance interval limit provided to accommodate a 24-month fuel cycle.

In consideration of these confirmations, GL 91-04 provides that licensees need not quantify the effect of the change in surveillance intervals on the availability of individual systems or components.

The following non-calibration TS SRs are proposed for revision to a 24-month frequency. The associated qualitative evaluation is provided for each of these changes, which concludes that the effect on plant safety is small, that the change does not invalidate any assumption in the plant licensing basis, and that the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. These conclusions have been validated by a review of the surveillance test history at CNS as summarized below for each SR.

<u>TS 3.1.7 Standby Liquid Control (SLC) System</u>

SR 3.1.7.8	Verify flow through one SLC subsystem from pump into reactor pressure vessel.
SR 3.1.7.9	Verify all heat traced piping between storage tank and pump suction is unblocked.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

The flow path through one SLC subsystem is verified per SR 3.1.7.8 during every refueling outage on a STAGGERED TEST BASIS and per SR 3.1.7.9 every refueling outage. These tests could inadvertently cause a reactor transient if performed with the unit operating. Therefore, to decrease the potential impact of the tests, they are performed during outage conditions.

The SLC pumps and valves are powered and controlled from separate buses and circuits so that a single electrical failure will not prevent system operation. The SLC pumps are tested quarterly in accordance with the Inservice Testing (IST) Program per SR 3.1.7.7 to verify operability. The available volume of the sodium pentaborate solution is verified every 24 hours per SR 3.1.7.1. Similarly, the temperature of the sodium pentaborate solution in the storage tank and the temperature of the pump suction piping are verified to be within limits every 24 hours, per SR 3.1.7.2 and SR 3.1.7.3, to preclude precipitation of the boron solution. Additionally, an installed backup heater (automatically controlled) is used to maintain solution temperature above the saturation point (51°F to 63°F). In addition, SR 3.1.7.4 verifies the continuity of the charge in the explosive valves monthly. These more frequent tests ensure that the SLC system remains operable during the operating cycle.

A review of the surveillance history verified that this subsystem had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the inherent system and component reliability as shown by the failure history, and the more frequent testing performed during the operating cycle, the impact of this change on safety, if any, is small.

TS 3.1.8 Scram Discharge Volume (SDV) Vent and Drain Valves

SR 3.1.8.3 Verify each SDV vent and drain valve:

a. Closes in ≤ 30 seconds after receipt of an actual or simulated scram signal; and
b. Opens when the actual or simulated scram signal is reset.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This SR ensures that the SDV vent and drain valves close in ≤ 30 seconds after receipt of an actual or simulated scram signal and open when the actual or simulated scram signal is reset. SR 3.1.8.2 requires that the SDV vent and drain valves be cycled fully closed and fully open every 92 days during the operating cycle, which ensures that the mechanical components and a portion of the valve logic remain operable. It has been previously accepted that the failure rate of components is dominated by the mechanical components, not by the logic systems (refer to specific discussion in the Logic System Functional Test (LSFT) section below).

A review of the applicable CNS surveillance history demonstrated that the logic subsystem for the SDV vent and drain valves had no previous failures of the TS function that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the manual cycling of the valves to ensure that the valves are operable, as required by SR 3.1.8.2, and the history of logic subsystem performance, the impact of this change on safety, if any, is small.

LOGIC SYSTEM FUNCTIONAL TESTS and SELECTED CHANNEL FUNCTIONAL TESTS

TS 3.3.1.1 Reactor Protection System (RPS) Instrumentation

SR 3.3.1.1.11 Perform CHANNEL FUNCTIONAL TEST.

(This test is essentially an LSFT for the Reactor Mode Switch scram circuit. The justification for extending LSFTs is also valid for the extension of this SR).

SR 3.3.1.1.13 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.2.1 Control Rod Block Instrumentation

SR 3.3.2.1.7 Perform CHANNEL FUNCTIONAL TEST.

(This test is essentially an LSFT for the Reactor Mode Switch rod block circuit. The justification for extending LSFTs is also valid for the extension of this SR).

TS 3.3.2.2 Feedwater and Main Turbine High Water Level Trip Instrumentation

SR 3.3.2.2.3 Perform LOGIC SYSTEM FUNCTIONAL TEST including valve actuation.

TS 3.3.3.2 Alternate Shutdown System

SR 3.3.3.2.2 Verify each required control circuit and transfer switch is capable of performing the intended functions.

(This test is essentially an LSFT for the transfer circuits associated with shifting indication and control from the control room to the remote shutdown panel. The justification for extending LSFTs is also valid for the extension of this SR).

TS 3.3.4.1 Anticipated Transient Without Scram Recirculation Pump Trip (ATWS-RPT) Instrumentation

SR 3.3.4.1.3 Perform LOGIC SYSTEM FUNCTIONAL TEST including breaker actuation.

TS 3.3.5.1 Emergency Core Cooling System (ECCS) Instrumentation

SR 3.3.5.1.5 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.5.2 Reactor Core Isolation Cooling (RCIC) System Instrumentation

SR 3.3.5.2.5 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.6.1 Primary Containment Isolation Instrumentation

SR 3.3.6.1.6 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.6.2 Secondary Containment Isolation Instrumentation

SR 3.3.6.2.4 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.6.3 Low-Low Set (LLS) Instrumentation

SR 3.3.6.3.5 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.7.1 Control Room Emergency Filter (CREF) System Instrumentation

SR 3.3.7.1.4 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.8.1 Loss of Power (LOP) Instrumentation

SR 3.3.8.1.3 Perform LOGIC SYSTEM FUNCTIONAL TEST.

TS 3.3.8.2 Reactor Protection System (RPS) Electric Power Monitoring

SR 3.3.8.2.2 Perform a system functional test.

(This test is essentially an LSFT for the RPS Electric Power Monitor circuits. The justification for extending LSFTs is also valid for this SR).

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

Extending the surveillance test interval for the LSFTs and selected functional tests is acceptable because the functions are verified to be operating properly by the performance of more frequent Channel Checks, Channel Functional Tests, analog trip module calibration, and visual confirmation of satisfactory operation (as applicable). This more frequent testing ensures that a major portion of the circuitry is operating properly and will detect significant failures within the instrument loop. Additionally, the above actuation instrumentation and logic, controls, monitoring capabilities, and protection systems, are designed to meet applicable reliability, redundancy, single failure, and qualification standards and regulations as described in the CNS Updated Safety Analysis Report (USAR). As such, these functions are designed to be highly reliable. Furthermore, as stated in the August 2, 1993 NRC Safety Evaluation Report relating to extension of the Peach Bottom Atomic Power Station, Units 2 and 3, surveillance intervals from 18 to 24 months:

> Industry reliability studies for boiling water reactors (BWRs), prepared by the BWR Owners Group (NEDC-30936P) show that the overall safety systems' reliabilities are not dominated by the reliabilities of the logic systems, but by that of the mechanical components, (e.g., pumps and valves), which are consequently tested on a more frequent basis. Since the probability of a relay or contact failure is small relative to the probability of mechanical component failure, increasing the logic system functional test interval represents no significant change in the overall safety system unavailability.

A review of the applicable CNS surveillance history demonstrated that the logic systems for these functions had 30 failures of the TS functions that would have been detected solely by the periodic performance of one of the above SRs.

a) On January 4, 2010, the Temperature Switch RCIC-TS-79B Trip Setpoint exceeded the TS limit. CR-CNS-2010-00064 was written to document the issue with RCIC-TS-79B. The Trip Setpoints were adjusted to within proper limits. (SR 3.3.6.1.6)

b) On November 19, 2009, the as-found Trip Setpoint for MS-DPIS-119D exceeded instrument and TS limits. CR-CNS-2009-09839 was written to document the issue. Work Order (WO) 4731278 replaced the switch. (SR 3.3.6.1.6)

c) June 25, 2009, Intermediate Range Monitor (IRM) C as-found voltages were out-of-tolerance. The pre-regulator was found out-of-calibration and could not adjust per the surveillance procedure. CR-CNS-2009-02867 was written to document condition. All as-left values were adjusted in tolerance satisfactorily. (SR 3.3.1.1.13)

d) On December 26, 2008, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limits. The CR-CNS-2008-09500 apparent cause evaluation concluded the failure was due to equipment excessive drift and equipment malfunction. Corrective actions replaced the pressure switch with new Static O-Ring Model 9N-AA45-P1-F1ATTX3 and adjusted the calibration frequency to quarterly for next two cycles. (SR 3.3.4.1.3)

e) On May 4, 2008, MS-LMS-AO86A(A) RPS/Green Light was found out-of-tolerance and outside the TS limit. The switch was adjusted to within satisfactory limits. (SR 3.3.1.1.13)

f) On August 15, 2007, the RPS logic failed to initiate and reset as expected. CR-CNS-2007-05545 stated that IRM D did not have an INOP or UPSCALE TRIP as expected. WO 4583315 replaced relays K1B, K4B and K19B. (SR 3.3.1.1.13)

g) On November 18, 2006, a contact on a time-delay relay (TDR) for Service Water Pump B did not properly close. This prevented Service Water Pump B restart. CR-CNS-2006-09360 stated that the pump breaker was realigned. (SR 3.3.5.1.5 and SR 3.3.8.1.3)

h) On February 8, 2006, three of the Average Power Range Monitor (APRM) C Flow Trip Setpoint values were found to be out-of-tolerance high exceeding the instrument, Technical Requirements Manual (TRM), and TS limits. CR-CNS-2006-00994 documented the issue and the values were adjusted in tolerance. (SR 3.3.1.1.13)

i) On December 29, 2005, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limits. CR-CNS-2005-09596 was written to document the issue. The pressure switch was replaced per WO 4478791. (SR 3.3.4.1.3)

j) On March 31, 2005, Temperature Switch RWCU-TS-81C Trip Setpoint exceeded TS limits. CR-CNS-2005-02202 was written to document the issue. The Trip Setpoint was adjusted to within proper limits. (SR 3.3.6.1.6)

k) On March 31, 2005, Temperature Switch RWCU-TS-81G Trip Setpoint exceeded TS limits. CR-CNS-2005-02202 was written to document the issue. The Trip Setpoint was adjusted to within proper limits. (SR 3.3.6.1.6)

l) On February 15, 2005, Diesel Generator (DG)-1 tripped during testing. Per CR-CNS-2005-01360, field troubleshooting determined that the failure occurred due to a short circuit in transient voltage suppression (TVS) network diodes installed in parallel with the coil of solenoid valve 20F01 "Non-Emergency Trips Bypass Valve." The short circuit allowed excessive current flow and caused two fuses in DG-1 control power circuit 4 to blow (one in the positive lead and the other in the negative lead). WO 4426786 replaced a blown fuse, fused disconnect, diode assembly, and Relay 4EMX1. (SR 3.3.5.1.5 and SR 3.3.8.1.3)

m) On January 30, 2005, testing indicated that a resistance reading was out-of-specification at ∞ ohms. Notification 10366727, written to document this issue, stated that the contacts appeared to be open with relay 27X-1GB actuated, and concluded that the relay contacts be inspected, and cleaned or repaired. WO 4424836 burnished the contacts and retested relay contact resistance satisfactorily. (SR 3.3.5.1.5 and SR 3.3.8.1.3)

n) On January 25, 2005, Square Root Converter Board 1 (Z8) (NMF-SQRT-152A) was found out-of-tolerance. The Square Root Converter Card was replaced by WO 4423227 with as-left values satisfactory. (SR 3.3.1.1.13)

o) On June 18, 2004, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limits. Notification 10322133 stated that the pressure switch was recalibrated to within tolerance. (SR 3.3.4.1.3)

p) On April 6, 2004, three of the APRM E Flow Trip Setpoint values were found to be out-of-tolerance high exceeding the instrument limits. Notification 10306116 stated that the values were adjusted in tolerance. (SR 3.3.1.1.13)

q) On June 28, 2003, Temperature Switch HPCI-TS-125A would not trip at required values. RCR 2003-1181 documented the Trip Setpoint being found in excess of TS limits. The Condition Report cited the apparent cause as a possible equipment end-of-life condition. The switch was replaced per WO 4315747. (SR 3.3.6.1.6)

r) On June 28, 2003, the Temperature Switch HPCI-TS-126C as-found Trip Setpoint exceeded the TS limit. Notification 10248902 documented the Trip Setpoint being found in excess of TS limits, and cited the apparent cause as instrument drift. The switch was replaced per WO 4315747. (SR 3.3.6.1.6)

s) On June 28, 2003, the Temperature Switch RHR-TS-151D Trip Setpoint exceeded TS limits. Notification 10248194 documented the Trip Setpoint being found in excess of TS limits and cited the apparent cause as instrument drift. The switch was adjusted to within proper limits. (SR 3.3.6.1.6)

t) On June 28, 2003, the Temperature Switch HPCI-TS-103D Trip Setpoint exceeded TS limits. Notification 10249606 documented the Trip Setpoint being found in excess of TS limits and cited the apparent cause as instrument drift. The switches were adjusted to within proper limits. (SR 3.3.6.1.6)

u) On April 4, 2003, transmitter RR-FT-110C could not be adjusted, which caused numerous readings to be out-of-tolerance. Notification 10236953 was written to document the issue. The resolution to the Notification was that the amplifier module was sent off to be repaired. The procedure was completed with the repaired module, and all as-left values were satisfactory. (SR 3.3.1.1.13)

v) On April 1, 2003, DG-1 could not be unloaded to 1000 kW. When the governor control lowered to just below 2000 kW, load immediately dropped to 0 kW. Notification 10237864 stated that DG-1 was secured and declared inoperable. WO 4303040 performed troubleshooting and repair. The Digital Reference Unit (DRU) was replaced per vendor procedure under the WO. (SR 3.3.5.1.5 and SR 3.3.8.1.3)

w) On March 3, 2003, testing found IRM H High Voltage Power Supply module had excessive ripple. Notification 10229873 was written to document the issue. The High Voltage Power Supply was replaced under WO 4297574. (SR 3.3.1.1.13)

x) On February 21, 2003, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limit. Notification 10228318 was written to document the issue. WO 4296657 replaced the pressure switch. (SR 3.3.4.1.3)

y) On January 9, 2003, the as-found Trip Setpoint for MS-DPIS-117D exceeded instrument and TS limits. Notification 10219156 stated that the investigation of the calibration history determined the differential pressure switch was drifting excessively. The switch was adjusted back within limits. (SR 3.3.6.1.6)

z) On November 20, 2002, APRM C did not perform correctly. A half-scram occurred during performance of the surveillance when it was not supposed to occur. Notification 10209105 was written to document the issue. Troubleshooting per WO 4279450 resulted in the replacement of a faulty relay. (SR 3.3.1.1.13)

aa) On December 23, 2001, MS-LMS-AO86A(A) RPS/Green Light was found out-of-tolerance and outside the TS Limit. The switch was adjusted to within limits. (SR 3.3.1.1.13)

bb) On December 12, 2001, NMF-SQRT-152D was found out-of-tolerance and would not hold its adjustment. Notification 10129473 was written to document the issue. WO 4213392 replaced NMF-SQRT-152D. (SR 3.3.1.1.13)

cc) On November 21, 2001, Under-Frequency Time Delay RPS-EPA-1A2 was found out-of-tolerance. Notification 10125175 was written to document the issue. WO 4170624 replaced RPS-EPA-1A2.

dd) On October 4, 2001, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding the instrument and TS limits. RCR 2001-1005 was written to document the issue, stating that the switch was recalibrated in tolerance and declared operable. (SR 3.3.4.1.3)

For the above issues:

The January 4, 2010, March 31, 2005, and all four June 28, 2003 issues deal with Patel Engineering Model 01-170020-090 Temperature Switches. There are a total of seven failures identified relative to Patel Engineering Model 01-170020-090 Temperature Switches over the review period. In all seven of the instances, TS limits were exceeded. In two of the seven instances, the temperature switches were replaced, and in five cases the switches were recalibrated and returned to service. No time-based mechanisms are apparent. When considering that a total of 1216 temperature switch tests (152 times a total of 8 surveillance procedure performances) were conducted over the review period, a total of seven failures resulting in two switch replacements is a very small percentage of the total population tested. Therefore, an increase in the surveillance test interval will not result in a significant impact on system/component availability.

The November 19, 2009, and January 9, 2003 issues related to problems with ITT Barton Model 288A Differential Pressure Switches. There were a total of two failures identified relative to ITT Barton Model 288A Differential Pressure Switches over the review period. These switches were in the Reactor Protection and Primary Containment Isolation Systems. In one case, a microswitch was replaced, and in the other case the switch was recalibrated and returned to service. No time-based failure mechanisms are apparent. Therefore, these failures were unique, and so subsequent failures would not be expected to result in a significant impact on system/ component availability.

The December 26, 2008, December 29, 2005, June 18, 2004, February 21, 2003, and October 4, 2001 issues involve Static O-Ring Model 9N-AA45 pressure switches. There are a total of five failures identified relative to Static O-Ring Model 9N-AA45 pressure switches over the review period. In three cases, the switches were replaced and two were recalibrated and returned to service. There does not appear to be a time-based degradation or other condition which would affect the operation or accuracy of this device. The findings of apparent cause evaluation CR-CNS-2008-09500 rule out the possibility that the failures are related to environmental effects based on location. NBI-PS-102A and NBI-PS-102B are located next to each other at R-931-NW on Rack 25-5, and there have been no performance issues with NBI-PS-102B over the review period. Furthermore, there has been no evidence of performance issues with any of the redundant pressure switches (NBI-PS-102B, NBI-PS-102C, and NBI-PS-102D). CR-CNS-2011-8278 was initiated to continue monitoring the switch. Switch performance, since replacement in 2009, has been stable. Continued monitoring of NBI-PS-102A and the satisfactory performance of the other switches provides the basis for extension to 24 months for both the Channel Calibration and LSFT. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

In regards to the May 4, 2008, and December 23, 2001 issues, there are a total of two failures identified relative to Namco EA180-32302 over the review period. In each case, the as-found closure time exceeded the TS limit. However, no time-based mechanisms are apparent. Therefore, these failures are unique, and so subsequent failures would not be expected to result in a significant impact on system/component availability.

In regards to the August 15, 2007, February 8, 2006, and April 6, 2004 events, there are a total of three failures identified relative to the APRM system over the review period. In each case, the as-found flow data value exceeded the instrument and/or TS limit. However, no time-based mechanisms are apparent. Therefore, these failures are unique and so subsequent failures would not be expected to result in a significant impact on system/component availability.

In regards to the June 25, 2009, November 18, 2006, February 15, 2005, January 30, 2005, January 25, 2005, April 4, 2003, April 1, 2003, March 3, 2003, November 20, 2002, December 12, 2001, and November 21, 2001 events, no similar failures are identified. Therefore, the failures were not repetitive in nature. No time-based mechanisms are apparent. Therefore, these failures are unique, and so subsequent failures would not be expected to result in a significant impact on system/component availability.

Based on the above discussions, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of portions of the circuits, and the history of logic system performance, and the corrective action for the failures, the impact of this change on safety, if any, is small.

<u>RESPONSE TIME TESTS</u>

<u>TS 3.3.1.1 Reactor Protection System (RPS) Instrumentation</u>
SR 3.3.1.1.15 Verify the RPS RESPONSE TIME is within limits.

<u>TS 3.7.7 The Main Turbine Bypass System</u>
SR 3.7.7.3 Verify the TURBINE BYPASS SYSTEM RESPONSE TIME is within limits.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

Extending the interval between response time tests is acceptable because the functions are verified to be operating properly throughout the operating cycle by the performance of Channel Checks and Channel Functional Tests (for SR 3.3.1.1.15) or by verifying proper operation of each bypass valve (for SR 3.7.7.3). This testing ensures that a significant portion of the circuitry is operating properly and will detect significant failures of this circuitry. Additional justification for extending the surveillance test interval is that these functions, including the actuating logic, are designed to be single failure proof and, therefore, are highly reliable. Moreover, the CNS TS Bases (as well as NUREG-1433, "Standard Technical Specifications BWR/4,") states that the frequency of response time testing is based in part "upon plant operating experience, which shows that random failures of instrumentation components causing serious time degradation, but not channel failure, are infrequent occurrences."

A review of the applicable CNS surveillance history demonstrated that the logic systems for these functions had nine failures of TS required system response times that would have been detected solely by the periodic performance of these SRs.

a) On May 4, 2008, MS-LMS-AO86A(A) RPS/Green Light was found out-of-tolerance and outside the TS limit. The switch was adjusted to within satisfactory limits. SR 3.3.1.1.15)

b) On August 15, 2007, the RPS logic failed to initiate and reset as expected. CR-CNS-2007-05545 stated that IRM D did not have an INOP or UPSCALE TRIP as expected. WO 4583315 replaced relays K1B, K4B and K19B. (SR 3.3.1.1.15)

c) On February 8, 2006, three of the APRM C Flow Trip Setpoint values were found to be out-of-tolerance high exceeding the instrument, TRM, and TS limits. CR-CNS-2006-00994 documented the issue and the values were adjusted in tolerance. (SR 3.3.1.1.15)

d) On January 25, 2005, Square Root Converter Board 1 (Z8) (NMF-SQRT-152A) was found out-of-tolerance. The Square Root Converter Card was replaced by WO 4423227 with as-left values satisfactorily. (SR 3.3.1.1.15)

e) On April 6, 2004, three of the APRM E Flow Trip Setpoint values were found to be out-of-tolerance high exceeding the instrument limits. Notification 10306116 stated that the values were adjusted in tolerance. (SR 3.3.1.1.15)

f) On April 4, 2003, transmitter RR-FT-110C could not be adjusted, causing numerous readings to be out-of-tolerance. Notification 10236953 was written to document the issue. The resolution to the Notification documented that the module was repaired. (SR 3.3.1.1.15)

g) On November 20, 2002, APRM C did not perform correctly. A half-scram occurred during performance of the surveillance when it was not supposed to occur. Notification 10209105 was written to document the issue. Troubleshooting per WO 4279450 resulted in the replacement of a faulty relay. (SR 3.3.1.1.15)

h) On December 23, 2001, MS-LMS-AO86A(A) RPS/Green Light was found out-of-tolerance and outside the TS Limit. The switch was adjusted to within limits. (SR 3.3.1.1.15)

i) On December 12, 2001, NMF-SQRT-152D was found out-of-tolerance and would not hold its adjustment. Notification 10129473 was written to document the issue. WO 4213392 replaced NMF-SQRT-152D. (SR 3.3.1.1.15)

For the above issues:

The May 4, 2008, and December 23, 2001 issues involved Namco EA180-32302 switches. There were a total of two failures identified relative to Namco EA180-32302 over the review period. In each case, the as-found closure time exceeded the TS limit. No time-based mechanisms are apparent. Therefore, these failures are unique, and so subsequent failures would not be expected to result in a significant impact on system/component availability.

The August 15, 2007, February 8, 2006, and April 6, 2004 issues involved APRM system events. There were a total of three failures identified relative to the APRM system over the review period. In each case, the as-found flow data values exceeded the instrument and/or TS limit. No time-based mechanisms are apparent. Therefore, these failures are unique, and so subsequent failures would not be expected to result in a significant impact on system/component availability.

In regards to the January 25, 2005, April 4, 2003, November 20, 2002, and December 12, 2001 events, no similar failures are identified. Therefore, the failures were not repetitive in nature. No time-based mechanisms are apparent. Therefore, these failures are unique, and so subsequent failures would not be expected to result in a significant impact on system/component availability.

In summary, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency, and the impact of this change on safety, if any, is small.

TS 3.3.2.1 Control Rod Block Instrumentation

SR 3.3.2.1.6 Verify the RWM is not bypassed when THERMAL POWER is ≤ 9.85% RTP.

The surveillance test interval this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

The purpose of the Rod Worth Minimizer (RWM) is to control rod patterns during startup and shutdown, such that only specified control rod sequences and relative positions are allowed over the operating range from all control rods inserted to 9.85% Rated Thermal Power (RTP).

For this function, no revisions to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical as-found minus as-left (AFAL) data will be completed as part of License Amendment implementation.

A review of the applicable CNS surveillance history for these Functions demonstrated that the as-found trip setpoint had no previous failure of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.4.3 Safety/Relief Valves (SRVs) and Safety Valves (SVs)

SR 3.4.3.2 Verify each SRV opens when manually actuated.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

SRVs are required to actuate automatically upon receipt of specific initiation signals. A manual actuation of each required SRV per SR 3.4.3.2 is performed to verify that the valve is functioning properly, and no blockage exists in the valve discharge line.

A review of the applicable CNS surveillance history demonstrated that the SRVs had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.5.1 / 3.5.2 ECCS - Operating / ECCS - Shutdown

SR 3.5.1.8	Verify, with reactor pressure $\leq$ 165 psig, the HPCI pump can develop a flow rate $\geq$ 4250 gpm against a system head corresponding to reactor pressure.
SR 3.5.1.9	Verify each ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.
SR 3.5.1.10	Verify the ADS actuates on an actual or simulated automatic initiation signal.
SR 3.5.1.11	Verify each ADS valve opens when manually actuated.
SR 3.5.2.5	Verify each required ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

The flow tests for the High Pressure Coolant Injection (HPCI) System are performed at two different pressure ranges such that system capability to provide rated flow against a system head corresponding to reactor pressure is tested at both the higher and lower operating ranges of the system. The required system head should overcome the Reactor Pressure Vessel (RPV) pressure and associated discharge line losses. Adequate reactor pressure must be available to perform these tests. Additionally, adequate steam flow must be passing through the main turbine or turbine bypass valves to continue to control reactor pressure when the HPCI System diverts steam flow. Therefore, sufficient time is allowed after adequate pressure and flow are achieved to perform these tests. Adequate reactor steam pressure must be $\geq$145 psig to perform SR 3.5.1.8. Adequate steam flow is represented by turbine bypass valves at least 30% open, or total steam flow $\geq 10^6$ lb/hr. Reactor startup is allowed prior to performing the low pressure surveillance test because the reactor pressure is low and the time allowed to satisfactorily perform the surveillance test is short.

The Emergency Core Cooling System (ECCS) and Automatic Depressurization System (ADS) functional tests ensure that a system initiation signal (actual or simulated) to the automatic initiation logic will cause the systems or subsystems to operate as designed. The ECCS network has built-in redundancy so that no single active failure prevents accomplishing the safety function of the ECCS. The pumps associated with ECCS are tested quarterly in accordance with the IST Program and SR 3.5.1.6 (some valves may have independent IST relief justifying less frequent testing). This testing ensures that the major components of the systems are capable of performing their design function. The tests proposed to be extended need to be performed during outage conditions since they have the potential to initiate an unplanned transient if performed during operating conditions.

A review of the applicable CNS surveillance history demonstrated that ECCS had five previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs.

a) On November 18, 2006, a contact on a TDR for Service Water Pump B did not properly close. This prevented Service Water Pump B restart. CR-CNS-2006-09360 stated that the pump breaker was realigned. (SR 3.5.1.9)

b) On February 15, 2005, DG-1 tripped during testing. Per CR-CNS-2005-01360, field troubleshooting determined that the failure occurred due to a short circuit in TVS network diodes installed in parallel with the coil of solenoid valve 20F01 "Non-Emergency Trips Bypass Valve." The short circuit allowed excessive current flow and caused two fuses in DG-1 control power circuit 4 to blow (one in the positive lead and the other in the negative lead). WO 4426786 replaced a blown fuse, fused disconnect, diode assembly, and Relay 4EMX1. (SR 3.5.1.9)

c) On January 30, 2005, testing indicated that a resistance reading was out-of-specification at ∞ ohms. Notification 10366727, written to document this issue, stated that the contacts appeared to be open with relay 27X-1GB actuated, and concluded that the relay contacts be inspected, and cleaned or repaired. WO 4424836 burnished the contacts and retested relay contact resistance satisfactorily. (SR 3.5.1.9)

d) On April 10, 2003, testing indicated that resistance readings were above acceptance criteria values for Terminal Block YW points 4 and 5. Notification 10240332 was written to document this issue. Resistance was re-measured as satisfactorily. (SR 3.5.1.9)

e) On April 1, 2003, DG-1 could not be unloaded to 1000 kW. When the governor control lowered to just below 2000 kW, load immediately dropped to 0 kW. Notification 10237864 stated that DG-1 was secured and declared inoperable. WO 4303040 performed troubleshooting and repair. The DRU was replaced per vendor procedure under the WO. (SR 3.5.1.9)

For the above issues no similar failures are identified. Therefore, the failures were not repetitive in nature. No time-based mechanisms are apparent. Accordingly, these failures are unique, and subsequent failures would not be expected to result in a significant impact on system/component availability.

As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.5.3 RCIC System

SR 3.5.3.4 Verify, with reactor pressure ≤ 165 psig, the RCIC pump can develop a flow rate ≥ 400 gpm against a system head corresponding to reactor pressure.

SR 3.5.3.5 Verify the RCIC System actuates on an actual or simulated automatic initiation signal.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

These Reactor Core Isolation Cooling (RCIC) functional tests ensure that the system will operate as designed. The pumps and valves associated with RCIC system are tested quarterly in accordance with the IST Program (some valves may have independent relief justifying less frequent testing). This testing ensures that the major components of the systems are capable of performing their design function.

A review of the applicable CNS surveillance history demonstrated that RCIC had no previous failures of these TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.6.1.1 Primary Containment

SR 3.6.1.1.2 Verify drywell to suppression chamber bypass leakage is equivalent to a hole < 1.0 inch in diameter.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months including the 25% grace period afforded by TS SR 3.0.2.

This SR ensures that the drywell to suppression chamber bypass leakage is limited to an equivalent to a hole < 1.0 inch in diameter. The frequency was developed considering it is prudent that this surveillance be performed during a unit outage and also in view of the fact that component failures that might have affected this test are identified by other primary containment SRs.

A review of surveillance test history verified that the drywell-to-suppression chamber bypass leakage test had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency and the history of system performance. Therefore the impact of this change on safety, if any, is small.

TS 3.6.1.3 Primary Containment Isolation Valves (PCIVs)

SR 3.6.1.3.7 Verify each automatic PCIV actuates to the isolation position on an actual or simulated isolation signal.

SR 3.6.1.3.8 Verify a representative sample of reactor instrumentation line EFCVs actuate to the isolation position on an actual or simulated instrument line break.

SR 3.6.1.3.9 Remove and test the explosive squib from each shear isolation valve of the TIP System.

SR 3.6.1.3.11 Verify each inboard 24 inch primary containment purge and vent valve is blocked to restrict the maximum valve opening angle to 60°.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months (on a STAGGERED TEST BASES for SR 3.6.1.3.9), for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

During the operating cycle, SR 3.6.1.3.5 requires automatic PCIV isolation times to be verified in accordance with the IST Program. Stroke testing of PCIVs tests a significant portion of the PCIV circuitry as well as the mechanical function, which will detect failures of this circuitry or failures with valve movement. The frequency of this testing is typically quarterly, unless approved relief has been granted justifying less frequent testing. For the excess flow check valves (EFCV) the frequency is based on the need to perform the 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. The test consists of testing a representative sample such that the total population is tested every 10 years. Therefore, each valve is tested every 10 years. For the Traversing Incore Probe (TIP) System explosive squib, SR 3.6.1.3.4 verifies continuity of the TIP shear isolation valve explosive charge on a 31-day frequency. For the 24-inch primary containment purge and vent valve, SR 3.6.1.3.11 is scheduled to be performed on a refueling outage frequency, because the valves may have been unblocked as part of the refueling outage, so the SR verifies that the blocks have been re-installed prior to operation.

A review of surveillance test history verified that no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.6.1.6 Low-Low Set (LLS) Valves

SR 3.6.1.6.1 Verify each LLS valve opens when manually actuated.

SR 3.6.1.6.2 Verify the LLS System actuates on an actual or simulated automatic initiation signal.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

The frequency for SR 3.6.1.6.1 is based on the SRV tests required by the ASME Boiler and Pressure Vessel Code, Section XI. Operating experience has shown that these components usually pass the surveillance when performed at this frequency. Therefore, the frequency was concluded to be acceptable from a reliability standpoint. Extending the surveillance test interval for SR 3.6.1.6.2 is acceptable because the functions are verified to be operating properly by the performance of more frequent Channel Functional Tests per SR 3.3.6.3.3. This more frequent testing ensures that a major portion of the circuitry is operating properly and will detect significant failures within the instrument loop. Additionally, the LLS valves (i.e., SRVs assigned to the LLS logic) are designed to meet applicable reliability, redundancy, single failure, and qualification standards and regulations as described in the CNS USAR. As such, these functions are designed to be highly reliable.

A review of surveillance test history verified that the LLS valves had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.6.1.7 Reactor Building-to-Suppression Chamber Vacuum Breakers

SR 3.6.1.7.3 Verify the full open setpoint of each vacuum breaker is ≤ 0.5 psid.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This SR ensures that the vacuum breaker opening setpoint safety analysis assumption regarding vacuum breaker full open differential pressure of ≤ 0.5 psid is valid. SR 3.6.1.7.1 and SR 3.6.1.7.2 are performed at shorter intervals (14 days and 92 days, respectively) that convey the proper functioning status of each vacuum breaker.

A review of surveillance test history verified that the Reactor Building-to-Suppression Chamber Vacuum Breakers had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.6.1.8 Suppression Chamber-to-Drywell Vacuum Breakers

SR 3.6.1.8.3 Verify the opening setpoint of each required vacuum breaker is ≤ 0.5 psid.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This SR ensures that the vacuum breaker opening setpoint safety analysis assumption regarding vacuum breaker full open differential pressure of ≤ 0.5 psid is valid. SR 3.6.1.8.1 and SR 3.6.1.8.2 are performed at shorter intervals (14 days and 31 days, respectively) that convey the proper functioning status of each vacuum breaker.

A review of surveillance test history verified that the Suppression Chamber-to-Drywell Vacuum Breakers had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

<u>TS 3.6.4.1 Secondary Containment</u>

SR 3.6.4.1.4 Verify each SGT subsystem can maintain ≥ 0.25 inch of vacuum water gauge in the secondary containment for 1 hour at a flow rate ≤ 1780 cfm.

The surveillance test interval of these SRs is being increased from once every 18 months on a STAGGERED TEST BASIS to once every 24 months on a STAGGERED TEST BASIS, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

To ensure that all fission products are treated, the test required per SR 3.6.4.1.4 is performed utilizing one Standby Gas Treatment (SGT) subsystem (on a staggered test basis) to ensure secondary containment boundary integrity. SRs 3.6.4.1.1 (every 24 hours), 3.6.4.1.2 (every 31 days), and 3.6.4.1.3 (every 31 days) provide more frequent assurance that no significant boundary degradation has occurred.

A review of the applicable CNS surveillance history demonstrated that the secondary containment had one previous failure of the TS functions that would have been detected solely by the periodic performance of these SRs.

a) On January 30, 2005, the differential pressure value for HV-DPR-835 was found out-of-tolerance and outside the operability limit with all motor-operated valves closed. CR-CNS-2005-00996 was written to document the issue, and determined that the motor-operated valves were leaking. The test was reperformed satisfactorily.

The identified failure is unique and does not occur on a repetitive basis and is not associated with a time-based failure mechanism. Therefore, this failure will have no impact on an extension to a 24-month surveillance interval. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.6.4.2 Secondary Containment Isolation Valves (SCIVs)

SR 3.6.4.2.3 Verify each automatic SCIV actuates to the isolation position on an actual or simulated actuation signal.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

During the operating cycle, SR 3.6.4.2.2 requires that each power-operated automatic SCIV isolation times to be tested (i.e., stroke timed to the closed position) in accordance with the IST Program. The stroke testing of these SCIVs tests a portion of the circuitry and the mechanical function, and provides more frequent testing to detect failures.

A review of surveillance test history verified that SCIVs had no previous failures of the TS function that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.6.4.3 Standby Gas Treatment (SGT) System

SR 3.6.4.3.3 Verify each SGT subsystem actuates on an actual or simulated initiation signal.

SR 3.6.4.3.4 Verify the SGT units cross tie damper is in the correct position, and each SGT room air supply check valve and SGT dilution air shutoff valve can be opened.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

These SGT functional tests ensure that subsystems operate as designed. The SGT subsystems are redundant so that following initial draw-down of post-Loss-of-Coolant Accident (LOCA) Reactor Building pressure, no single-failure prevents accomplishing the safety functions of filtering the discharge from secondary containment and directing the discharge to the Elevated Release Point, and are therefore reliable. More frequent verification of portions of the SGT function are accomplished by operating each SGT subsystem and heaters every 31 days per SR 3.6.4.3.1.

A review of the applicable CNS surveillance history demonstrated that the SGT System had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.7.2 Service Water (SW) System and Ultimate Heat Sink (UHS)

SR 3.7.2.4 Verify each SW subsystem actuates on an actual or simulated initiation signal.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This SR verifies that the automatic isolation valves of the SW System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety-related equipment during an accident event. This SR also verifies the automatic start capability of one of the two SW pumps in each subsystem. The SW subsystems are redundant so that no single-failure prevents accomplishing the safety function of providing the required cooling. The SW system pumps and valves are tested quarterly in accordance with the IST Program (some valves may have independent relief justifying less frequent testing). This testing ensures that the major components of the systems are capable of performing their design function. Additionally, valves in the flow path are verified to be in the correct position every 31 days by SR 3.7.2.3. Since most of the components and associated circuits are tested on a more frequent basis, this testing would indicate any degradation to the SW System which would result in an inability to start based on a demand signal.

A review of the applicable CNS surveillance history demonstrated that the SW System had no previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.7.3 Reactor Equipment Cooling (REC) System

SR 3.7.3.4 Verify each REC subsystem actuates on an actual or simulated initiation signal.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This SR verifies that the automatic isolation valves of the REC System will automatically switch to the safety or emergency position to provide cooling water exclusively to the safety-related equipment during an accident event. The REC system is designed with sufficient redundancy so that no single-active system component failure prevents accomplishing the safety function of providing the required cooling. The REC system pumps and valves are tested quarterly in accordance with the IST Program (some valves may have independent relief justifying less frequent testing). This testing ensures that the major components of the systems are capable of performing their design function. Additionally, valves in the flow path are verified to be in the correct position every 31 days by SR 3.7.3.3. Since most of the components and associated circuits are tested on a more frequent basis, this testing would indicate any degradation to the REC System which would result in an inability to start based on a demand signal.

A review of the applicable CNS surveillance history demonstrated that the REC System had no previous failure of the TS functions that would have been detected solely by the periodic performance of these SRs. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

<u>TS 3.7.4 Control Room Emergency Filter (CREF) System</u>

SR 3.7.4.3 Verify the CREF System actuates on an actual or simulated initiation signal.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

The CREF System maintains the habitability of the Control Room Envelope from which occupants can control the unit following an uncontrolled release of radioactivity during certain design basis accidents. More frequent verification of portions of the CREF System function is accomplished by operating the CREF System every 31 days per SR 3.7.4.1.

A review of the applicable CNS surveillance history demonstrated that the CREF System had no previous failures of the TS function that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, system design, and the history of system performance, the impact of this change on safety, if any, is small.

<u>TS 3.7.7 The Main Turbine Bypass System</u>

SR 3.7.7.2 Perform a system functional test.

The surveillance test interval of this SR is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This test ensures that on increasing main steam line pressure events, the main turbine bypass system will operate as designed. More frequent verification of portions of the main turbine bypass system is accomplished by SR 3.7.7.1, which requires that each main turbine bypass valve be cycled through at least half of one cycle of full travel once every 31 days. This test demonstrates that the valves are mechanically operable, and detects significant failures affecting system operation.

A review of the applicable CNS surveillance history demonstrated that the main turbine bypass system had one previous failure of the TS functions that would have been detected solely by the periodic performance of these SRs.

a) On March 7, 2009, as-found voltage values for TG-XD/MW Loop Data - Rack 01K2, Slot R, TP-13 & TP-14, Rack 01K6, Slot R, TP-38, and A Panel Display were out-of-tolerance. The values were adjusted to within acceptable limits.

The identified failure is unique and does not occur on a repetitive basis and is not associated with a time-based failure mechanism. Therefore, this failure will have no impact on an extension to a 24-month surveillance interval. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, and the history of system performance, the impact of this change on safety, if any, is small.

<u>TS 3.8.1 AC Sources - Operating</u>

SR 3.8.1.8	Verify automatic and manual transfer of unit power supply from the normal offsite circuit to the alternate offsite circuit.
SR 3.8.1.9	Verify each DG operates for $\geq$ 8 hours: a. For $\geq$ 2 hours loaded $\geq$ 4200 kW and $\leq$ 4400 kW; and b. For the remaining hours of the test loaded $\geq$ 3600 kW and $\leq$ 4000 kW.
SR 3.8.1.10	Verify interval between each sequenced load is within ± 10% of nominal timer setpoint.
SR 3.8.1.11	Verify, on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ECCS initiation signal: a. De-energization of emergency buses; b. Load shedding from emergency buses; and c. DG auto-starts from standby condition and: 1. energizes permanently connected loads in $\leq$ 14 seconds, 2. energizes auto-connected emergency loads through the timed logic sequence, 3. maintains steady state voltage $\geq$ 3950 V and $\leq$ 4400 V, 4. maintains steady state frequency $\geq$ 58.8 Hz and $\leq$ 61.2 Hz, and 5. supplies permanently connected and auto-connected emergency loads for $\geq$ 5 minutes.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

The CNS Class 1E AC distribution system supplies electrical power to two divisional load groups, with each division powered by an independent Class 1E 4.16 kV Engineered Safety Feature (ESF) bus. Each ESF bus has connections to two qualified offsite power sources and a single dedicated onsite DG. The ESF systems of one of the two divisions provide for the minimum safety functions necessary to shut down the unit and maintain it in a safe shutdown condition. This design provides substantial redundancy in AC power sources. The DGs are infrequently operated; therefore, the risk of wear-related degradation is minimal. Historical testing and surveillance testing during operation prove the ability of the diesel engines to start and operate under various load conditions. DG loading is listed on USAR Table VIII-5-1. Through the normal engineering design process, load additions and deletions are tracked and changes to loading are verified to be well within the capacity of their power sources. More frequent testing of the AC sources is also required as follows:

- Verifying correct breaker alignment and indicated power availability for each required offsite circuit every 7 days (SR 3.8.1.1);
- Verifying the DG starting and load carrying capability is demonstrated every 31 days (SRs 3.8.1.2 and 3.8.1.3), and ability to continuously supply makeup fuel oil is also demonstrated every 92 days per (SR 3.8.1.6);
- Verifying the ability of each DG to reach rated voltage and frequency within required time limits every 184 days (SR 3.8.1.7) will provide prompt identification of any substantial DG degradation or failure;
- Verifying the necessary support for DG start and operation (SRs 3.8.1.4, 3.8.1.5, 3.8.3.1, 3.8.3.2, 3.8.3.4 and 3.8.3.4.5) are required every 31 days.
- Verifying fuel oil properties of new and stored fuel oil are tested in accordance with, and maintained within the limits of, the Diesel Fuel Oil Testing Program.

A review of the applicable CNS surveillance history demonstrated that the AC power sources had five previous failures of the TS functions that would have been detected solely by the periodic performance of these SRs.

a) On November 18, 2006, a contact on a TDR for Service Water Pump B did not properly close. This prevented Service Water Pump B restart. CR-CNS-2006-09360 stated that the pump breaker was realigned. (SR 3.8.1.8, SR 3.8.1.9, SR 3.8.1.10, and SR 3.8.1.11)

b) On February 15, 2005, DG-1 tripped during testing. Per CR-CNS-2005-01360, field troubleshooting determined that the failure occurred due to a short circuit in TVS network diodes installed in parallel with the coil of solenoid valve 20F01 "Non-Emergency Trips Bypass Valve." The short circuit allowed excessive current flow and caused two fuses in DG-1 control power circuit 4 to blow (one in the positive lead and the other in the negative lead). WO 4426786 replaced a blown fuse, fused disconnect, diode assembly, and Relay 4EMX1. (SR 3.8.1.8, SR 3.8.1.9, SR 3.8.1.10, and SR 3.8.1.11)

c) On January 30, 2005, testing indicated that a resistance reading was out-of-specification at ∞ ohms. Notification 10366727, written to document this issue, stated that the contacts appeared to be open with relay 27X-1GB actuated, and concluded that the relay contacts be inspected, and cleaned or repaired. WO 4424836 burnished the contacts and retested relay contact resistance satisfactorily. (SR 3.8.1.8, SR 3.8.1.9, SR 3.8.1.10, and SR 3.8.1.11)

d) On April 10, 2003, testing indicated that resistance readings were above acceptance criteria values for Terminal Block YW points 4 and 5. Notification 10240332 was written to document this issue. Resistance was re-measured as satisfactory. (SR 3.8.1.8, SR 3.8.1.9, SR 3.8.1.10, and SR 3.8.1.11)

e) On April 1, 2003, DG-1 could not be unloaded to 1000 kW. When the governor control lowered to just below 2000 kW, load immediately dropped to 0 kW. Notification 10237864 stated that DG-1 was secured and declared inoperable. WO 4303040 performed troubleshooting and repair. The DRU was replaced per vendor procedure under the WO. (SR 3.8.1.8, SR 3.8.1.9, SR 3.8.1.10, and SR 3.8.1.11)

For the above issues no similar failures are identified. Therefore, the failures were not repetitive in nature. No time-based mechanisms are apparent. Accordingly, these failures are unique, and subsequent failures would not be expected to result in a significant impact on system/component availability.

As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.8.4 DC Sources - Operating

SR 3.8.4.6 Verify:

a. Each required 125 V battery charger supplies ≥ 200 amps at ≥ 125 V for ≥ 4 hours; and
b. Each required 250 V battery charger supplies ≥ 200 amps at ≥ 250 V for ≥ 4 hours.

SR 3.8.4.7 Verify battery capacity is adequate to supply, and maintain in OPERABLE status, the required emergency loads for the design duty cycle when subjected to a battery service test.

The surveillance test interval of these SRs is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

SR 3.8.4.1 and SR 3.8.6.1 are performed every 7 days to verify 125 V and 250 V battery terminal voltage, and battery pilot cell electrolyte level, float voltage, and specific gravity, respectively. SR 3.8.6.2 and SR 3.8.6.3 are performed every 92 days to verify connected cell electrolyte level, float voltage, and specific gravity, and average electrolyte temperature for representative cells. SR 3.8.4.2 is performed every 92 days to verify no visible battery terminal/connector corrosion or high resistance. These more frequent surveillances will provide prompt identification of substantial degradation or failure of the battery and/or battery chargers.

A review of the applicable CNS surveillance history demonstrated that the DC electric power subsystem had one previous failure of the TS functions that would have been detected solely by the periodic performance of these SRs.

a) On December 23, 2003, a test on battery charger EE-CHG-250 (1B) was aborted when the charger tripped when the automatic mode was starting the last ramp. This test was part of post-work testing following replacement of a current limiter card. RCR 2003-2033 was written to document this issue. Another current limiter card was installed and retested satisfactorily.

The identified failure is unique and does not occur on a repetitive basis and is not associated with a time-based failure mechanism. Therefore, this failure will have no impact on an extension to a 24-month surveillance interval. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on other more frequent testing of the system, and the history of system performance, the impact of this change on safety, if any, is small.

TS 5.5.2. Systems Integrity Monitoring Program

The program shall include the following:

b. Integrated leak test requirements for each system at 18 month intervals or less.

The test interval of this TS is being increased from once every 18 months to once every 24 months for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This requirement establishes a program to reduce leakage from those portions of systems outside containment that could contain highly radioactive fluids during a serious transient or accident to as low as practical levels. Specifically, the program requires an "Integrated leak test requirement for each system at 18 month intervals or less." The surveillance history review did not find any cases where the required integrated leak tests were not performed within the 18-month interval (including the 25% grace period). The change to 24-month operating cycles will increase the testing interval. This change to the testing requirement has been evaluated and determined that the impact, if any, on safety is small. This conclusion is based on the fact that most portions of the subject systems included in this program are visually walked down, while the plant is operating, during plant testing and/or operator/system engineer walkdowns. In addition, housekeeping/safety walkdowns also serve to detect any gross leakage. If leakage is observed from these systems, corrective actions will be taken to repair the leakage. Finally, the plant radiological surveys will also identify any potential sources of leakage. Based on more frequent inspections previously described, and the ability to readily detect system leakage performance deficiencies, the impact of this change on safety, if any, is small.

TS 5.5.7 Ventilation Filter Testing Program (VFTP)

The VFTP shall establish the required testing of Engineered Safety Feature (ESF) filter ventilation systems. Tests described in Specifications 5.5.7.a, 5.5.7.b, and 5.5.7.c shall be performed once per 18 months for standby service or after 720 hours of system operation;

and, following significant painting, fire, or chemical release concurrent with system operation in any ventilation zone communicating with the system.

Tests described in Specifications 5.5.7.a and 5.5.7.b shall be performed after each complete or partial replacement of the HEPA filter train or charcoal adsorber filter; and after any structural maintenance on the system housing.

Tests described in Specifications 5.5.7.d and 5.5.7.e shall be performed once per 18 months.

With this change, the testing interval is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This proposed change constitutes a change in conformance to RG 1.52, "Design, Testing and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants," for the 18-month test requirements. In addition to the 24-month testing, ventilation filter (HEPA and charcoal) testing will continue to be performed in accordance with the other frequencies specified in TS 5.5.7 and RG 1.52. This proposed amendment request will not change the performance of these required tests.

A review of the applicable CNS surveillance history demonstrated that the ESF ventilation systems had one previous failure of the TS functions that would have been detected solely by the periodic performance of SRs that reference performance of the VFTP of TS 5.5.7.

a) A test report dated February 7, 2003, documented the results of filter testing on the CREF System for a test completed on January 30, 2003. The test indicated a radio-iodine penetration which exceeded the allowed limit. Notification 10223376 confirmed that the charcoal filter exceeded limits due to age-related degradation. The charcoal was replaced under WO 4292592 on January 31, 2003.

The identified failure is unique and did not occur on a repetitive basis, and is associated with a time-based failure mechanism due to the degradation of the charcoal over time. This is an isolated occurrence and the charcoal is typically replaced prior to reaching the point where the charcoal degradation exceeds the allowed limit. Therefore, this failure will have no impact on an extension to a 24-month surveillance interval. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 5.5.13 Control Room Envelope Habitability Program

The program shall include the following elements:

d. Measurement, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by the CREF System, operating at the flow rate required by the Ventilation Filter Testing Program, at a Frequency of 18 months. The results shall be trended and used as part of the periodic assessment of the CRE boundary.

With this change, the testing interval is being increased from once every 18 months to once every 24 months, for a maximum interval of 30 months, including the 25% grace period afforded by TS SR 3.0.2.

This program was placed in the TS as part of Amendment 230 dated May 12, 2008, which adopted Technical Specifications Task Force (TSTF)-448, Revision 3, "Control Room Habitability" using the consolidated line item improvement process. This TSTF contained proposed TS wording. For the frequency of the above portion of the program the TSTF proposed a frequency of [18] months in brackets. The brackets are provided to permit each plant to place the correct frequency in their proposed change. The TSTF stated:

> Paragraph d requires measurement, at designated locations, of the CRE pressure relative to all external areas adjacent to the CRE boundary during the pressurization mode of operation by one train of the CREFS, operating at the flow rate required by the Ventilation Filter Test Program, at a Frequency of [18] months on a STAGGERED TEST BASIS. The test data is to be trended and used as part of the [18] month assessment of the CRE boundary required by Paragraph c. The measurement of the differential pressure between the CRE and adjacent areas provides a gross indication of barrier integrity and is useful in monitoring the health of the CRE barrier between performances of inleakage testing. NEI 99-03, Section 9.3, "Periodic Evaluations," recommends periodic evaluation of the CRE boundary integrity, including comparison to previous assessments, to examine the performance history. However, as pointed out in Generic Letter 2003-01, the usefulness of differential pressure measurements is very limited and the importance of data from these measurements should not be overemphasized. Therefore, the Control Room Envelope Habitability Program requires measuring differential pressure every [18] months on a STAGGERED TEST BASIS in a manner similar to the current requirement in the Technical Specifications. The results will be trended and compared to positive pressure measurements taken, or to be taken, during CRE inleakage testing. These evaluations will be used as part of an assessment of CRE boundary integrity between CRE boundary inleakage tests. This approach balances the desire to assess CRE habitability between the performances of inleakage tests with the complexities inherent in the interpretation of differential pressure measurements."

For this facility, the testing is not done on a STAGGERED TEST BASIS due to the unique plant design of the CREF System. Reviewing other BWR/4 plants that have implemented both the 24-month cycle and the TSTF-448 line item improvement show that both have frequencies of 24 months for this program requirement. Based on the above, the impact of this change on safety, if any, is small.

B. Calibration Changes

NRC GL 91-04 requires that licensees address instrument drift when proposing an increase in the surveillance interval for calibrating instruments that perform safety functions including providing the capability for safe shutdown. The effect of the increased calibration interval on instrument errors must be addressed because instrument errors caused by drift were considered when determining safety system setpoints and when performing safety analyses. NRC GL 91-04 identifies seven steps for the evaluation of instrumentation calibration changes. These seven steps are discussed in Attachment 1 to this submittal. In that discussion, a description of the methodology used by NPPD for each step is summarized. The detailed methodology is provided in Enclosure 1.

The following are the calibration-related TS SRs being proposed for revision from 18 months to 24 months, for a maximum interval of 30 months (considering the 25% grace period allowed by TS SR 3.0.2). The methodology used to perform the drift analysis is consistent with the methodology utilized by other utilities requesting transition to a 24-month fuel cycle. The methodology is also based on Electric Power Research Institute (EPRI) TR-103335, "Statistical Analysis of Instrument Calibration Data" and is summarized in Enclosure 1.

The projected 30-month drift values for many of the instruments analyzed from the historical as-found/as-left evaluation shows sufficient margin between the current plant setpoint and the allowable value to compensate for the 30-month drift. For each instrument function that has a channel calibration proposed frequency change to 24 months, the associated setpoint calculation assumes a consistent or conservative drift value appropriate for a 24-month calibration interval. As necessary, revisions to CNS setpoint calculations have been developed, and affected calibration and functional test procedures will be revised as part of implementation, to reflect the new 30-month drift values. The revised setpoint calculations were developed in accordance with NEDC-31336. These calculations determined the instrument loop uncertainty, setpoint, and allowable value for the affected function. The allowable values were determined in a manner suitable to establish limits for their application. The TS Allowable Values were compared against the allowable values developed in the setpoint calculations for the affected functions, and in all but two cases were determined to remain conservative (see Attachment 1, Sections 3.1.3 and 3.1.4). The TS Allowable Values have been determined in a manner suitable to establish limits for their application, and thus will continue to ensure that sufficient margins are maintained in the applicable safety analyses, and the affected instruments are capable of performing their intended design function. A review of the applicable safety analysis concluded that the setpoints, allowable values, and projected 30-month drift confirmed the safety limits and safety analysis assumptions remain bounding.

Below is a summary of the specific application of this methodology to the CNS 24-Month Fuel Cycle Project, as well as any required TS Allowable Value changes. Where optional methods are presented in Enclosure 1, and where other alternate engineering justifications are allowed, the rationale for the selected method and alternate justification is summarized with the associated instrument calibration surveillance affected (e.g., for channel groupings having less than 30 calibrations, which is required to qualify for valid statistical evaluations).

TS 3.3.1.1 Reactor Protection System (RPS) Instrumentation

The RPS initiates a reactor scram when one or more monitored parameters exceed their specified limit, to preserve the integrity of the fuel cladding and the Reactor Coolant Pressure Boundary, and minimize the energy that must be absorbed following a LOCA.

SR 3.3.1.1.12 Perform CHANNEL CALIBRATION.
- Function 3, Reactor Vessel Pressure - High
- Function 4, Reactor Vessel Water Level - Low (Level 3)
- Function 6, Drywell Pressure - High
- Function 7.a, Scram Discharge Volume Water Level - High, Level Transmitter
- Function 9, Turbine Control Valve Fast Closure, DEH Trip Oil Pressure - Low

For these functions, no revisions to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these Functions demonstrated that the as-found trip setpoint had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

SR 3.3.1.1.12 Perform CHANNEL CALIBRATION.
- Function 1.a, Intermediate Range Monitors, Neutron Flux - High
- Function 2.b, Average Power Range Monitors, Neutron Flux - High (Flow Biased)

No revisions to TS Allowable Values or safety analyses result from the required evaluations. Drift evaluations were not performed for TS Table 3.3.1.1-1 Function 1.a, Intermediate Range Monitors, Neutron Flux - High and Function 2.b, Average Power Range Monitors, Neutron Flux - High (Flow Biased). This is acceptable because of the design requirements for the instruments and more frequent functional testing (once per 7 days per SRs 3.3.1.1.3 and 3.3.1.1.4, as applicable). Before the IRM detectors are used for operation, an overlap check is performed to determine if the instruments are reading and tracking with the power range per SR 3.3.1.1.6, or the source range neutron detectors per SR 3.3.1.1.5, as applicable. Furthermore, when the IRM trip is required to be operable, a Channel Functional Test is performed on the IRM trip function every 7 days per SR 3.3.1.1.4. Before the APRM detectors are used for operation, an overlap check is performed per SR 3.3.1.1.6 to determine if the instruments are reading and tracking with the intermediate range. Furthermore, when the APRM trip is required to be operable, a Channel Functional Test is performed on the APRM trip function every 7 days per SR 3.3.1.1.4.

A review of the applicable CNS surveillance history for the IRM and APRM channels demonstrated that the as-found trip setpoint for these functions had nine previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR.

a) On June 25, 2009, IRM C as-found voltages were out-of-tolerance. The pre-regulator was found out-of-calibration and could not adjust per the surveillance procedure. CR-CNS-2009-02867 was written to document condition. All as-left values were adjusted in tolerance satisfactorily.

b) On August 15, 2007, the RPS logic failed to initiate and reset as expected. CR-CNS-2007-05545 stated that IRM D did not have an INOP or UPSCALE TRIP as expected. WO 4583315 replaced relays K1B, K4B and K19B.

c) On February 8, 2006, three of the APRM C Flow Trip Setpoint values were found to be out-of-tolerance high exceeding the instrument and TS limits. CR-CNS-2006-00994 documented the issue and the values were adjusted in tolerance.

d) On January 25, 2005, Square Root Converter Board 1 (Z8) (NMF-SQRT-152A) was found out-of-tolerance. The Square Root Converter Card was replaced by WO 4423227 with as-left values satisfactory.

e) On April 6, 2004, three of the APRM E Flow Trip Setpoint values were found to be out-of-tolerance high exceeding the instrument limits. Notification 10306116 stated that the values were adjusted in tolerance.

f) On April 4, 2003, transmitter RR-FT-110C could not be adjusted, which caused numerous reading to be out-of-tolerance. Notification 10236953 was written to document the issue. The resolution to the Notification was that the amplifier module was sent off to be repaired. The procedure was completed with the repaired module, and all as-left values were satisfactory.

g) On March 3, 2003, testing found IRM H High Voltage Power Supply module had excessive ripple. Notification 10229873 was written to document the issue. The High Voltage Power Supply was replaced under WO 4297574.

h) On November 20, 2002, APRM C did not perform correctly. A half-scram occurred during performance of the surveillance when it was not supposed to occur. Notification 10209105 was written to document the issue. Troubleshooting per WO 4279450 resulted in the replacement of a faulty relay.

i) On December 12, 2001, NMF-SQRT-152D was found out-of-tolerance and would not hold its adjustment. Notification 10129473 was written to document the issue. WO 4213392 replaced NMF-SQRT-152D.

For the above issues:

The August 15, 2007, February 8, 2006 and April 6, 2004 issues involved APRM system events. There are a total of 3 failures identified relative to the APRM system over the review period. In each case, the as-found flow data value exceeded the instrument and/or TS limits. No time-based mechanisms are apparent. Therefore, these failures are unique, and subsequent failures would not be expected to result in a significant impact on system/component availability.

For the remaining issues identified above, the identified failures are unique and do not occur on a repetitive basis and are not associated with time-based failure mechanisms. Therefore, these failures will have no impact on an extension to a 24-month surveillance interval.

Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

<u>SR 3.3.1.1.12</u> Perform CHANNEL CALIBRATION.
- Function 5, Main Steam Isolation Valve - Closure
- Function 7.b, Scram Discharge Volume Water Level - High, Level Switch
- Function 8, Turbine Stop Valve - Closure

No revisions to TS Allowable Values or safety analyses result from the required evaluations. Drift evaluations were not performed for TS Table 3.3.1.1-1 Functions 5 (Main Steam Isolation Valve limit switches), 7.b (Scram Discharge Volume float switches), and 8 (Turbine Stop Valve limit switches). The limit and float switches that perform these functions are mechanical devices that require mechanical adjustment only; drift is not applicable to these devices. The limit switches are functionally tested every 92 days by SR 3.3.1.1.9 to verify operation.

A review of the applicable CNS surveillance history for these limit switch channels demonstrated that the as-found trip setpoint for these functions had two previous failures of TS required allowable values that would have been detected solely by the periodic performance of this SR.

a) On May 4, 2008, MS-LMS-AO86A(A) RPS/Green Light was found out-of-tolerance and outside the TS limit. The switch was adjusted to within satisfactory limits.

b) On December 23, 2001, MS-LMS-AO86A(A) RPS/Green Light was found out-of-tolerance and outside the TS limit. The switch was adjusted to within limits.

These two events were the only failures identified relative to the Namco EA180-32302 Limit Switch over the review period. In each case, the as-found closure time exceeded the TS limit. No time-based mechanisms are apparent. Therefore, these failures are unique and any subsequent failure would not result in a significant impact on system/component availability. Therefore, these failures will have no impact on an extension to a 24-month surveillance interval. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

<u>SR 3.3.1.1.14</u> Verify Turbine Stop Valve – Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure – Low Functions are not bypassed when THERMAL POWER is ≥ 29.5% RTP.

This SR ensures that scrams initiated from the Turbine Stop Valve Closure and Turbine Control Valve Fast Closure, Trip Oil Pressure–Low Functions will not be inadvertently bypassed when THERMAL POWER is ≥ 29.5% RTP. This involves calibration of the bypass channels.

No revisions to TS Allowable Values or safety analyses resulted from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for this function demonstrated that the as-found trip setpoint had no previous failures of the TS Allowable Value that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

<u>TS 3.3.1.2 Source Range Monitor (SRM) Instrumentation</u>

The SRMs provide the operator with information relative to the neutron flux levels at very low neutron flux levels in the core. Specifically, the SRM indication is used by the operator to monitor the approach to criticality and to determine when criticality is achieved. During refueling, shutdown, and low power operations, the primary indication of neutron flux levels is provided by the SRMs to monitor reactivity changes during fuel or control rod movement and give the control room operator early indication of unexpected subcritical multiplication that could be indicative of an approach to criticality.

<u>SR 3.3.1.2.7</u> Perform CHANNEL CALIBRATION.

There are no TS Allowable Values associated with this SR, and no changes to the safety analyses resulted from the required evaluations. Drift evaluations were not performed for

SRMs. This is acceptable because there are no trip setpoints or allowable values specified by the TS or credited in accident or safe shutdown analyses. There are also more frequent Channel Checks (SR 3.3.1.2.1 and SR 3.3.1.2.3) and Channel Functional Tests (SR 3.3.1.2.5 and SR 3.3.1.2.6).

Extending the SRM calibration interval from 18 months to 24 months is acceptable if the calibration is sufficient to ensure the neutron level is observable when the reactor is shutdown. This is verified at least every 24 hours when the reactor is shutdown per SR 3.3.1.2.4. SR 3.3.1.1.5 verifies sufficient SRM/IRM overlap exists during startup operations, which provides an indication of proper SRM operation and calibration. Additionally, SRM response to reactivity changes is distinctive and well known to plant operators and SRM response is closely monitored during these reactivity changes. Therefore, any substantial degradation of the SRMs will be evident prior to the scheduled performance of Channel Calibrations. Based on the above discussion, there will be no significant adverse impact from the surveillance test frequency increase on system reliability.

A review of the applicable CNS surveillance history for this function demonstrated that there were no previous failures of TS required channel calibrations that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.2.2 Feedwater and Main Turbine High Water Level Trip Instrumentation

The Feedwater and Main Turbine High Water Level Trip Instrumentation is designed to detect a potential failure of the Feedwater Level Control System that causes excessive feedwater flow.

SR 3.3.2.2.2 Perform CHANNEL CALIBRATION. The Allowable Value shall be ≤ 54.0 inches.

For this function, no revisions to TS Allowable Values or safety analyses resulted from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these Functions demonstrated that the as-found trip setpoint had one previous failure of TS Allowable Values that would have been detected solely by the periodic performance of this SR.

a) On April 11, 2003, Relay 6A-K1A contacts 11/12 and 13/14 indicated open when they should have been closed. Notification 10241011 was written to document the issue. WO 4300253 indicated that the contacts were burnished, and the adder block was replaced, as was the coil for GE Model CR120A relay. Post-maintenance testing was performed satisfactorily.

The identified failure is unique and did not occur on a repetitive basis, and is not associated with a time-based failure mechanism. Therefore, this failure will have no impact on an extension to a 24-month surveillance interval. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.3.1 Post Accident Monitoring (PAM) Instrumentation

The primary purpose of the PAM instrumentation is to display plant variables that provide information required by the control room operators during accident situations. This information provides the necessary support for the operators to take the manual actions for which no automatic control is provided.

SR 3.3.3.1.3 Perform CHANNEL CALIBRATION of each required PAM Instrumentation channel except for the Primary Containment H_2 and O_2 Analyzers.

No TS Allowable Value is applicable to these functions. A separate drift evaluation has not been performed for the PAM instruments based on the design of the PAM instruments and equipment history. The PAM function is supported by a combination of process transmitters, indicators, and recorders. These components differ from other TS instruments in that they are not associated with a function trip, but indication only to the control room operator. As such, these instruments are not expected to function with the same high degree of accuracy demanded of functions with assumed trip actuations for accident detection and mitigation. The PAM devices are expected to maintain sufficient accuracy to detect trends or the existence or non-existence of a condition. The PAM functions require at least two operable channels (except for Steam Nozzle Reactor Vessel Water Level and some PCIV indications) to ensure no single failure prevents the operators from being presented with the information. The functioning status of the PAM instruments is also required more frequently by a Channel Check every 31 days per SR 3.3.3.1.1.

A review of the applicable CNS surveillance history for these Functions demonstrated that there were two previous failures that would have been detected solely by the periodic performance of this SR.

a) On October 31, 2009, RR-AO-741 failed to indicate full closed. CR-CNS-2009-08330 was written to document the issue. The Condition Report described that local observation indicated that the valve had traveled to the full closed position, and that the open limit switch appeared to be dropped out. WO 4649130 replaced the lower limit switch.

b) On November 24, 2001, PC-AO-NRV29 did not fully close. Notification 10125777 was written to document the issues. WO 4210478 replaced the actuator.

For these events, the identified failures are unique and did not occur on a repetitive basis, and are not associated with a time-based failure mechanism. Therefore, these failures will have no impact on an extension to a 24-month surveillance interval. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.3.2 Alternate Shutdown System

The Alternate Shutdown System provides the control room operator with sufficient instrumentation and controls to place and maintain the plant in a safe shutdown condition from a location other than the control room.

SR 3.3.3.2.3 Perform CHANNEL CALIBRATION for each required instrumentation channel.

No TS Allowable Values are applicable to these functions. A separate drift evaluation has not been performed for the Alternate Shutdown System instrument channels based on the design function and equipment history.

The Alternate Shutdown System instrument channels differ from other TS instruments in that they are not associated with an automatic protective action or trip. As such, these instruments are not expected to function with the same high degree of accuracy demanded of functions with assumed trip actuations for accident detection and mitigation. The normally energized Alternate Shutdown System instrument channels also require more frequent verification of the functioning status, as required by SR 3.3.3.2.1 every 31 days.

A review of the applicable CNS surveillance history for these Functions demonstrated that there was one previous failure that would have been detected solely by the periodic performance of this SR. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.4.1 Anticipated Transient Without Scram Recirculation Pump Trip (ATWS-RPT) Instrumentation

The ATWS-RPT System initiates a recirculation pump trip, adding negative reactivity, following events in which a scram does not (but should) occur, to lessen the effects of an ATWS event. Tripping the recirculation pumps adds negative reactivity from the increase in steam voiding in the core area as core flow decreases. When Reactor Vessel Water Level-Low Low (Level 2) or Reactor Pressure-High setpoint is reached, the Reactor Recirculation Motor Generator field breakers trip.

<u>SR 3.3.4.1.2</u> Perform CHANNEL CALIBRATION. The Allowable Values shall be:
- a. Reactor Vessel Water Level – Low Low (Level 2): ≥ -42 inches; and
- b. Reactor Pressure - High: ≤ 1072 psig.

For these functions, no revision to TS Allowable Values or safety analyses resulted from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these functions demonstrated that the as-found trip setpoints had five previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR.

a) On December 26, 2008, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limits. The CR-CNS-2008-09500 apparent cause evaluation concluded the failure was due to equipment excessive drift and equipment malfunction. Corrective actions replaced the pressure switch with new SOR Model 9N-AA45-P1-F1ATTX3 and adjusted the calibration frequency to quarterly for next two cycles.

b) On December 29, 2005, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limits. CR-CNS-2005-09596 was written to document the issue. The pressure switch was replaced per WO 4478791.

c) On June 18, 2004, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limits. Notification 10322133 stated that the pressure switch was recalibrated to within tolerance.

d) On February 21, 2003, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding instrument and TS limit. Notification 10228318 was written to document the issue. WO 4296657 replaced the pressure switch.

e) On October 4, 2001, the as-found Trip Setpoint for NBI-PS-102A was out-of-tolerance exceeding the instrument and TS limits. RCR 2001-1005 was written to document the issue, stating that the switch was recalibrated in tolerance and declared operable.

The December 26, 2008, December 29, 2005, June 18, 2004, February 21, 2003, and October 4, 2001 issues involve Static O-Ring Model 9N-AA45 pressure switches. There are a total of five failures identified relative to Static O-Ring Model 9N-AA45 pressure switches over the review period. In three cases, the switches were replaced and two were recalibrated and returned to service. There does not appear to be a time-based degradation or other condition which would affect the operation or accuracy of this device. The findings of apparent cause evaluation CR-CNS-2008-9500 rule out the possibility that the failures are related to environmental effects based on location. NBI-PS-102A and NBI-PS-

102B are located next to each other at R-931-NW on Rack 25-5, and there have been no performance issues with NBI-PS-102B over the review period. Furthermore, there has been no evidence of performance issues with any of the redundant pressure switches (NBI-PS-102B, NBI-PS-102C, and NBI-PS-102D). CR-CNS-2011-8278 was initiated to continue monitoring the switch. Switch performance, since replacement in 2009, has been stable. Continued monitoring of NBI-PS-102A and the satisfactory performance of the other switches provides the basis for extension to 24 months for both the Channel Calibration and LSFT. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.5.1 ECCS Instrumentation

The purpose of the ECCS instrumentation is to initiate appropriate responses from the systems to ensure that fuel is adequately cooled in the event of a design basis accident or transient.

SR 3.3.5.1.4 Perform CHANNEL CALIBRATION.
- Function 1.a, 2.a, 4.a, 5.a, Reactor Vessel Water Level - Low Low Low (Level 1)
- Function 1.b, 2.b, 3.b, Drywell Pressure - High
- Function 1.c, 2.c, Reactor Pressure - Low (Injection Permissive)
- Function 1.d, Core Spray Pump Discharge Flow - Low (Bypass)
- Function 1.e, Core Spray Pump Start - Time Delay Relay
- Function 2.d, Reactor Pressure - Low (Recirculation Discharge Valve Permissive)
- Function 2.e, Reactor Vessel Shroud Level - Level 0
- Function 2.f, Low Pressure Coolant Injection Pump Start - Time Delay Relay
- Function 2.g, Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)
- Function 3.a, Reactor Vessel Water Level - Low Low (Level 2)
- Function 3.c, Reactor Vessel Water Level - High (Level 8)
- Function 3.e, Suppression Pool Water Level - High
- Function 3.f, High Pressure Coolant Injection Pump Discharge Flow - Low (Bypass)
- Function 4.b, 5.b, Automatic Depressurization System Initiation Timer
- Function 4.c, 5.c, Reactor Vessel Water Level - Low (Level 3) (Confirmatory)
- Function 4.d, 5.d, Core Spray Pump Discharge Pressure - High
- Function 4.e, 5.e, Low Pressure Coolant Injection Pump Discharge Pressure - High

With the exception of Function 2.d, no revisions to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). The Function 2.d TS Allowable Value change is described in Attachment 1, Section 3.1.3. Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.5.2 Reactor Core Isolation Cooling (RCIC) System Instrumentation

The purpose of the RCIC System instrumentation is to initiate actions to ensure adequate core cooling when the reactor vessel is isolated from its primary heat sink (the main condenser) and normal coolant makeup flow from the Reactor Feedwater System is insufficient or unavailable, such that the RCIC System initiation occurs and maintains sufficient reactor water level such that an initiation of the low pressure ECCS pumps does not occur.

SR 3.3.5.2.4 Perform CHANNEL CALIBRATION.
- Function 1, Reactor Vessel Water Level - Low Low (Level 2)
- Function 2, Reactor Vessel Water Level - High (Level 8)

For these functions, no revision to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these functions demonstrated that the as-found trip setpoint had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.6.1 Primary Containment Isolation Instrumentation

The primary containment isolation instrumentation automatically initiates closure of appropriate primary containment isolation valves (PCIVs).

SR 3.3.6.1.4 Perform CHANNEL CALIBRATION.
- Function 1.a, 2.e, Reactor Vessel Water Level - Low Low Low (Level 1)
- Function 1.c, Main Steam Line Flow - High
- Function 2.a, 6.b, Reactor Vessel Water Level - Low (Level 3)
- Function 2.b, Drywell Pressure - High
- Function 3.a, HPCI Steam Line Flow - High
- Function 3.b, HPCI Steam Line Flow - Time Delay Relays
- Function 3.c, HPCI Steam Supply Line Pressure - Low
- Function 4.a, RCIC Steam Line Flow - High
- Function 4.b, RCIC Steam Line Flow - Time Delay Relays
- Function 4.c, RCIC Steam Supply Line Pressure - Low

- Function 5.a, RWCU Flow - High
- Function 5.d, Reactor Vessel Water Level - Low Low (Level 2)
- Function 6.a, Reactor Pressure - High

For these functions, no revision to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had two previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR.

a) On November 19, 2009, the as-found Trip Setpoint for MS-DPIS-119D exceeded instrument and TS limits. CR-CNS-2009-09839 was written to document the issue. WO 4731278 replaced the switch.

b) On January 9, 2003, the as-found Trip Setpoint for MS-DPIS-117D exceeded instrument and TS limits. Notification 10219156 stated that the investigation of the calibration history determined the differential pressure switch was drifting excessively. The switch was adjusted back within limits.

For these events there are a total of two failures identified relative to ITT Barton Model 288A Differential Pressure Switches over the review period. In one case a microswitch was replaced, and in the other case the switch was re-calibrated and returned to service. No time-based failure mechanisms are apparent. Therefore, these failures are unique, and accordingly, subsequent failures would not be expected to result in a significant impact on system/component availability. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on system design and the history of system performance, the impact of this change on safety, if any, is small.

<u>SR 3.3.6.1.4</u> Perform CHANNEL CALIBRATION.
- Function 1.e, Main Steam Tunnel Temperature - High
- Function 3.d, HPCI Steam Line Space Temperature - High
- Function 4.d, RCIC Steam Line Space Temperature - High
- Function 5.b, RWCU System Space Temperature - High

For this function, no revision to TS Allowable Values or safety analyses resulted from the required evaluations. The temperature elements are not required to be calibrated, therefore, no drift evaluation was performed. Extending the surveillance test interval for calibration of these functions is acceptable because the functions are verified to be operating properly by the performance of more frequent Channel Checks (SR 3.3.6.1.1 every 12 hours) and Channel Functional Tests (SR 3.3.6.1.2 every 92 days). Additionally, each of the above functions is provided with sufficient channels to ensure that no single instrument failure can preclude the isolation function.

Because the other components in the instrument loop are calibrated together, it was only possible to perform a qualitative evaluation of these devices. This was performed by reviewing the as-found, as-left history.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had seven previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR.

a) On January 4, 2010, the Temperature Switch RCIC-TS-79B Trip Setpoint exceeded the TS limit. CR-CNS-2010-00064 was written to document the issue with RCIC-TS-79B. The Trip Setpoints were adjusted to within proper limits.

b) On March 31, 2005, Temperature Switch RWCU-TS-81C Trip Setpoint exceeded TS limits. CR-CNS-2005-02202 was written to document issue. The Trip Setpoint was adjusted to within proper limits.

c) On March 31, 2005, Temperature Switch RWCU-TS-81G Trip Setpoint exceeded TS limits. CR-CNS-2005-02202 was written to document issue. The Trip Setpoint was adjusted to within proper limits.

d) On June 28, 2003, Temperature Switch HPCI-TS-125A would not trip at required values. RCR 2003-1181 documented the Trip Setpoint being found in excess of TS limits. The Condition Report cited the apparent cause as a possible equipment end-of-life condition. The switch was replaced per WO 4315747.

e) On June 28, 2003, the Temperature Switch HPCI-TS-126C as-found Trip Setpoint exceeded the TS limit. Notification 10248902 documented the Trip Setpoint being found in excess of TS limits, and cited the apparent cause as instrument drift. The switch was replaced per WO 4315747.

f) On June 28, 2003, the Temperature Switch RHR-TS-151D Trip Setpoint exceeded TS limits. Notification 10248194 documented the Trip Setpoint being found in excess of TS limits and cited the apparent cause as instrument drift. The switch was adjusted to within proper limits.

g) On June 28, 2003, the Temperature Switch HPCI-TS-103D Trip Setpoint exceeded TS limits. Notification 10249606 documented the Trip Setpoint being found in excess of TS limits and cited the apparent cause as instrument drift. The switches were adjusted to within proper limits.

For these events, there are a total of seven failures identified relative to Patel Engineering Model 01-170020-090 Temperature Switches over the review period. In seven of the seven instances, a TS Setpoint was found to exceed its limit, and in two of the seven instances, the temperature switch was replaced. In five of seven cases, the switches were re-calibrated and returned to service. No time-based mechanisms are apparent. When considering that a total of 1216 (152 times a total of 8 surveillance procedure performances) different temperature switches were tested over the review period, a total of seven failures resulting in two switch replacements is a very small percentage of the total population tested. Therefore, an increase in the surveillance test interval will not result in a significant impact on system/component availability. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on system design and the history of system performance, the impact of this change on safety, if any, is small.

SR 3.3.6.1.4 Perform CHANNEL CALIBRATION.
- Function 2.c, Reactor Building Ventilation Exhaust Plenum Radiation - High
- Function 2.d, Main Steam Line Radiation - High

For these functions, no revision to TS Allowable Values or safety analyses results from the required evaluations. Drift evaluations were not performed for radiation monitors. For the Reactor Building Ventilation Exhaust Plenum Radiation – High Function, the radiation detectors are calibrated using a calibrated source as an input signal to the detector. The source check is performed by exposing the sensor-converter to a known source in a constant geometry. Source checks of radiation monitors are subject to far more uncertainties than electronic calibration checks because of source decay, positioning of the sources, signal strength, and the sensor response curves of that particular monitoring system. The radiation detectors for the Main Steam Line Radiation – High Function are excluded from the channel calibration per a note to SR 3.3.6.1.4.

Extending the surveillance test interval for calibration of these functions is acceptable because the functions are verified to be operating properly by the performance of more frequent Channel Checks (SR 3.3.6.1.1 every 12 hours) and Channel Functional Tests (SR 3.3.6.1.2 every 92 days).

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on system design and the history of system performance, the impact of this change on safety, if any, is small.

SR 3.3.6.1.5 Calibrate each radiation detector.
- Function 2.d, Main Steam Line Radiation - High

For these functions, no revision to TS Allowable Values or safety analyses results from the required evaluations. Drift evaluations were not performed for radiation monitors. The above radiation detectors are calibrated using a calibrated source as an input signal to the detector. The source check is performed by exposing the sensor-converter to a known source in a constant geometry. Source checks of radiation monitors are subject to far more uncertainties than electronic calibration checks because of source decay, positioning of the sources, signal strength, and the sensor response curves of that particular monitoring system. Because of the uncertainties associated with the calibration methods for these devices, any AFAL evaluation would provide no true indication of the instrument performance over time.

Extending the surveillance test interval for calibration of these functions is acceptable because the functions are verified to be operating properly by the performance of more frequent Channel Checks (SR 3.3.6.1.1 every 12 hours) and Channel Functional Tests (SR 3.3.6.1.2 every 92 days).

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR.
As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on system design and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.6.2 Secondary Containment Isolation Instrumentation

The secondary containment isolation instrumentation automatically initiates closure of appropriate secondary containment isolation valves (SCIVs) and starts the Standby Gas Treatment (SGT) System.

SR 3.3.6.2.3 Perform CHANNEL CALIBRATION.
- Function 1, Reactor Vessel Water Level - Low Low (Level 2)
- Function 2, Drywell Pressure - High

For this function, no revision to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

SR 3.3.6.2.3 Perform CHANNEL CALIBRATION.
- Function 3, Reactor Building Ventilation Exhaust Plenum Radiation - High

For this function, no revision to TS Allowable Values or safety analyses result from the required evaluations. Drift evaluations were not performed for radiation monitors. The above radiation detectors are calibrated using a calibrated source as an input signal to the detector. The source check is performed by exposing the sensor-converter to a known source in a constant geometry. Source checks of radiation monitors are subject to far more uncertainties than electronic calibration checks because of source decay, positioning of the sources, signal strength, and the sensor response curves of that particular monitoring system. Because of the uncertainties associated with the calibration methods for these devices, any AFAL evaluation would provide no true indication of the overall instrument performance over time.

Extending the surveillance test interval for calibration of these functions is acceptable because the functions are verified to be operating properly by the performance of more frequent Channel Checks (SR 3.3.6.2.1 every 12 hours) and Channel Functional Tests (SR 3.3.6.2.2 every 92 days). Furthermore, the ongoing drift trend program will monitor these channels for operation within the assumptions of the setpoint analysis.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on system design and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.6.3 Low-Low Set (LLS) Instrumentation

The LLS logic and instrumentation is designed to mitigate the effects of postulated thrust loads on the safety/relief valve (SRV) discharge lines by preventing subsequent actuations with an elevated water leg in the SRV discharge line. It also mitigates the effects of postulated pressure loads on suppression chamber structural components by preventing multiple actuations in rapid succession of the SRVs subsequent to their initial actuation.

SR 3.3.6.3.4 Perform CHANNEL CALIBRATION.
- Function 1, Reactor Pressure – High
- Function 2, Low-Low Set Pressure Setpoints
- Function 3, Discharge Line Pressure Switch

With the exception of Function 2, no revision to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). The Function 2 TS Allowable Value change is described in Attachment 1, Section 3.1.4. Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

<u>TS 3.3.7.1 Control Room Emergency Filter (CREF) System Instrumentation</u>

The CREF System is designed to provide a radiologically controlled environment to ensure the habitability of the control room for the safety of control room operators under all plant conditions. The instrumentation and controls for the CREF System automatically isolates the normal ventilation intake and initiate action to pressurize the main control room and filter incoming air to minimize the infiltration of radioactive material in the control room environment.

<u>SR 3.3.7.1.3</u> Perform CHANNEL CALIBRATION.
- Function 1, Reactor Vessel Water Level – Low Low (Level 2)
- Function 2, Drywell Pressure – High

For these functions, no revision to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

<u>SR 3.3.7.1.3</u> Perform CHANNEL CALIBRATION.
- Function 3, Reactor Building Ventilation Exhaust Plenum Radiation - High

For this function, no revision to TS Allowable Values or safety analyses result from the required evaluations. Drift evaluations were not performed for radiation monitors. The above radiation detectors are calibrated using a calibrated source as an input signal to the detector. The source check is performed by exposing the sensor-converter to a known source in a constant geometry. Source checks of radiation monitors are subject to far more uncertainties than electronic calibration checks because of source decay, positioning of the sources, signal strength, and the sensor response curves of that particular monitoring system. Because of the uncertainties associated with the calibration methods for these devices, any AFAL evaluation would provide no true indication of the overall instrument performance over time.

Extending the surveillance test interval for calibration of these functions is acceptable because the functions are verified to be operating properly by the performance of more frequent Channel Checks (SR 3.3.7.1.1 every 12 hours) and Channel Functional Tests (SR 3.3.7.1.2 every 92 days). Furthermore, the ongoing drift trend program will monitor these channels for operation within the assumptions of the setpoint analysis.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. As such, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on system design and the history of system performance, the impact of this change on safety, if any, is small.

TS 3.3.8.1 Loss of Power (LOP) Instrumentation

Successful operation of the required safety functions of the Emergency Core Cooling Systems (ECCS) is dependent upon the availability of adequate power sources for energizing the various components such as pump motors, motor operated valves, and the associated control components. The LOP instrumentation monitors the 4.16 kV emergency buses and the power to the buses. Offsite power is the preferred source of power for the 4.16 kV emergency buses. If the monitors determine that insufficient power is available, the buses are disconnected from the offsite power sources and connected to the onsite DG power sources.

SR 3.3.8.1.2 Perform CHANNEL CALIBRATION.
- Function 1.a, 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) - Bus Undervoltage
- Function 1.b, 4.16 kV Emergency Bus Undervoltage (Loss of Voltage) - Time Delay
- Function 2.a, 4.16 kV Emergency Bus Normal Supply Undervoltage (Loss of Voltage) Bus - Tie Undervoltage
- Function 2.b, 4.16 kV Emergency Bus Normal Supply Undervoltage (Loss of Voltage) - Time Delay
- Function 3.a, 4.16 kV Emergency Bus ESST Supply Undervoltage (Loss of Voltage) Bus - Tie Undervoltage
- Function 3.b, 4.16 kV Emergency Bus ESST Supply Undervoltage (Loss of Voltage) - Time Delay
- Function 4.a, 4.16 kV Emergency Bus Undervoltage (Degraded Voltage) - Bus Undervoltage
- Function 4.b. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage) - Time Delay (LOCA)
- Function 4.c. 4.16 kV Emergency Bus Undervoltage (Degraded Voltage) - Time Delay (Non-LOCA)

- Function 5.a, 4.16 kV Emergency Bus ESST Supply Undervoltage (Degraded Voltage) - Bus Undervoltage
- Function 5.b. 4.16 kV Emergency Bus ESST Supply Undervoltage (Degraded Voltage) - Time Delay

For these functions, no revision to TS Allowable Values or safety analyses result from the GL 91-04 evaluations (e.g., statistical evaluation of historical drift factored into setpoint calculations). Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had no previous failures of TS Allowable Values that would have been detected solely by the periodic performance of this SR. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

<u>TS 3.3.8.2 Reactor Protection System (RPS) Electric Power Monitoring</u>

The RPS Electric Power Monitoring System is provided to isolate the RPS bus from the motor generator (MG) set or alternate power supply in the event of overvoltage, undervoltage, or underfrequency. This system protects the loads connected to the RPS bus against unacceptable voltage and frequency conditions.

<u>SR 3.3.8.2.1</u> Perform CHANNEL CALIBRATION.

- Function a, Overvoltage
- Function b, Undervoltage
- Function c, Underfrequency

For these functions, no revision to TS Allowable Values or safety analyses result from the required evaluations. Any necessary revisions to setpoint calculations have been developed, and calibration procedures to incorporate results of the statistical analysis of the historical AFAL data will be completed as part of implementation.

A review of the applicable CNS surveillance history for these channels demonstrated that the as-found trip setpoint for these functions had one previous failure of TS Allowable Values that would have been detected solely by the periodic performance of this SR.

a) On November 21, 2001, Under-Frequency Time Delay RPS-EPA-1A2 was found out-of-tolerance. Notification 10125175 was written to document the issue. WO 4170624 replaced RPS-EPA-1A2.

For this event, no time-based mechanisms are apparent. Therefore, this failure is unique, and subsequent failures would not be expected to result in a significant impact on system/component availability. Accordingly, the impact, if any, on system availability is minimal from the proposed change to a 24-month testing frequency. Based on the history of system performance, the impact of this change on safety, if any, is small.

Attachment 6

Applicable Instrumentation

Cooper Nuclear Station, Docket No. 50-298, DPR-46

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-1-NMI-NAM-41A	NMI-NAM-41A	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-2-NMI-NAM-41B	NMI-NAM-41B	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-1-NMI-NAM-41C	NMI-NAM-41C	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-2-NMI-NAM-41D	NMI-NAM-41D	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-1-NMI-NAM-41E	NMI-NAM-41E	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-2-NMI-NAM-41F	NMI-NAM-41F	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-1-NMI-NAM-41G	NMI-NAM-41G	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-1A	CNS-2-NMI-NAM-41H	NMI-NAM-41H	NPPD047-CALC-025	General Electric	K601 (194X672G8)	Range: 0 to 125 Divisions
SR 3.3.1.1.12	3.3.1.1-1-2B	CNS-1-RR-FT-110A	RR-FT-110A	NPPD047-CALC-022	General Electric	555	na
SR 3.3.1.1.12	3.3.1.1-1-2B	CNS-1-RR-FT-110B	RR-FT-110B	NPPD047-CALC-022	General Electric	555	na
SR 3.3.1.1.12	3.3.1.1-1-2B	CNS-1-RR-FT-110C	RR-FT-110C	NPPD047-CALC-022	General Electric	555	na
SR 3.3.1.1.12	3.3.1.1-1-2B	CNS-1-RR-FT-110D	RR-FT-110D	NPPD047-CALC-022	General Electric	555	na
SR 3.3.1.1.12	3.3.1.1-1-3	CNS-1-NBI-PS-55A	NBI-PS-55A	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.1.1.12	3.3.1.1-1-3	CNS-2-NBI-PS-55B	NBI-PS-55B	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.1.1.12	3.3.1.1-1-3	CNS-1-NBI-PS-55C	NBI-PS-55C	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.1.1.12	3.3.1.1-1-3	CNS-2-NBI-PS-55D	NBI-PS-55D	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.1.1.12	3.3.1.1-1-4	CNS-1-NBI-LIS-101A [L3]	NBI-LIS-101A	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.1.1.12	3.3.1.1-1-4	CNS-2-NBI-LIS-101B [L3]	NBI-LIS-101B	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.1.1.12	3.3.1.1-1-4	CNS-1-NBI-LIS-101C [L3]	NBI-LIS-101C	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.1.1.12	3.3.1.1-1-4	CNS-2-NBI-LIS-101D [L3]	NBI-LIS-101D	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.1.1.12	3.3.1.1-1-6	CNS-1-PC-PS-12A	PC-PS-12A	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.1.1.12	3.3.1.1-1-6	CNS-2-PC-PS-12B	PC-PS-12B	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.1.1.12	3.3.1.1-1-6	CNS-1-PC-PS-12C	PC-PS-12C	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.1.1.12	3.3.1.1-1-6	CNS-2-PC-PS-12D	PC-PS-12D	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.1.1.12	3.3.1.1-1-7A	CNS-1-CRD-LT-231C	CRD-LT-231C	NPPD047-CALC-029	ITT Barton	764	Input Range: 0 to 100 Inches
SR 3.3.1.1.12	3.3.1.1-1-7A	CNS-2-CRD-LT-231D	CRD-LT-231D	NPPD047-CALC-029	ITT Barton	764	Input Range: 0 to 100 Inches
SR 3.3.1.1.12	3.3.1.1-1-7A	CNS-1-CRD-LT-234C	CRD-LT-234C	NPPD047-CALC-029	ITT Barton	764	Input Range: 0 to 100 Inches
SR 3.3.1.1.12	3.3.1.1-1-7A	CNS-2-CRD-LT-234D	CRD-LT-234D	NPPD047-CALC-029	ITT Barton	764	Input Range: 0 to 100 Inches
SR 3.3.1.1.12	3.3.1.1-1-7A	CRD-IE-1A	CRD-IE-1A	NPPD047-CALC-029	Foxboro	N-2AI-I2V	In: 4 to 20 mA and Out: 0 to 10 Vdc
SR 3.3.1.1.12	3.3.1.1-1-7A	CRD-IE-1B	CRD-IE-1B	NPPD047-CALC-029	Foxboro	N-2AI-I2V	In: 4 to 20 mA and Out: 0 to 10 Vdc
SR 3.3.1.1.12	3.3.1.1-1-7A	CRD-AM-1A	CRD-AM-1A	NPPD047-CALC-029	Foxboro	N-2AP+ALM-AR	Input Range: 0 to 10 Vdc
SR 3.3.1.1.12	3.3.1.1-1-7A	CRD-AM-1B	CRD-AM-1B	NPPD047-CALC-029	Foxboro	N-2AP+ALM-AR	Input Range: 0 to 10 Vdc
SR 3.3.1.1.12	3.3.1.1-1-7A	CRD-AM-2A	CRD-AM-2A	NPPD047-CALC-029	Foxboro	N-2AP+ALM-AR	Input Range: 0 to 10 Vdc
SR 3.3.1.1.12	3.3.1.1-1-7A	CRD-AM-2B	CRD-AM-2B	NPPD047-CALC-029	Foxboro	N-2AP+ALM-AR	Input Range: 0 to 10 Vdc
SR 3.3.1.1.12	3.3.1.1-1-9	CNS-1-TGF-PS-63OPC1	TGF-PS-63OPC1	NPPD047-CALC-032	Static O-Ring	9N6-BB45-NX-C1A-JJTTX12	Calibrated Span: 200-1750psig
SR 3.3.1.1.12	3.3.1.1-1-9	CNS-1-TGF-PS-63OPC3	TGF-PS-63OPC3	NPPD047-CALC-032	Static O-Ring	9N6-BB45-NX-C1A-JJTTX12	Calibrated Span: 200-1750psig
SR 3.3.1.1.12	3.3.1.1-1-9	CNS-2-TGF-PS-63OPC2	TGF-PS-63OPC2	NPPD047-CALC-032	Static O-Ring	9N6-BB45-NX-C1A-JJTTX12	Calibrated Span: 200-1750psig
SR 3.3.1.1.12	3.3.1.1-1-9	CNS-2-TGF-PS-63OPC4	TGF-PS-63OPC4	NPPD047-CALC-032	Static O-Ring	9N6-BB45-NX-C1A-JJTTX12	Calibrated Span: 200-1750psig
SR 3.3.3.2.3	N/A	CNS-2-HPCI-FT-82	HPCI-FT-82	NPPD047-CALC-035	Rosemount	1153DB5PC	URL: 750" H2O
SR 3.3.3.2.3	N/A	CNS-2-RHR-FT-109B	RHR-FT-109B	NPPD047-CALC-035	Rosemount	1153DB5PC	URL: 750" H2O
SR 3.3.4.1.2a	N/A	CNS-1-NBI-LIS-57A [L2]	NBI-LIS-57A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.4.1.2a	N/A	CNS-1-NBI-LIS-58A [L2]	NBI-LIS-58A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.4.1.2a	N/A	CNS-2-NBI-LIS-57B [L2]	NBI-LIS-57B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.4.1.2a	N/A	CNS-2-NBI-LIS-58B [L2]	NBI-LIS-58B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.4.1.2b	N/A	CNS-1-NBI-PS-102A	NBI-PS-102A	NPPD047-CALC-030	Static O-Ring	9N-AA45-P1-F1A-TTC1C4X	Calibrated Span: 200-1750psig
SR 3.3.4.1.2b	N/A	CNS-2-NBI-PS-102B	NBI-PS-102B	NPPD047-CALC-030	Static O-Ring	9N-AA45-X9TT	Calibrated Span: 200-1500psig
SR 3.3.4.1.2b	N/A	CNS-1-NBI-PS-102C	NBI-PS-102C	NPPD047-CALC-030	Static O-Ring	9N-AA45-P1-F1A-TTX3	Calibrated Span: 200-1750psig
SR 3.3.4.1.2b	N/A	CNS-2-NBI-PS-102D	NBI-PS-102D	NPPD047-CALC-030	Static O-Ring	9N-AA45-X10TT	Calibrated Span: 200-1500psig
SR 3.3.5.1.4	3.3.5.1-1-1A	CNS-1-NBI-LIS-72A [L1]	NBI-LIS-72A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-1A	CNS-2-NBI-LIS-72B [L1]	NBI-LIS-72B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-1A	CNS-1-NBI-LIS-72C [L1]	NBI-LIS-72C	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-1A	CNS-2-NBI-LIS-72D [L1]	NBI-LIS-72D	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-1B	CNS-1-PC-PS-101A	PC-PS-101A	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-1B	CNS-2-PC-PS-101B	PC-PS-101B	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-1B	CNS-1-PC-PS-101C	PC-PS-101C	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-1B	CNS-2-PC-PS-101D	PC-PS-101D	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-1C	CNS-2-NBI-PIS-52B [S2]	NBI-PIS-52B	NPPD047-CALC-015	ITT Barton	288A	IR: 0 to 500 psig
SR 3.3.5.1.4	3.3.5.1-1-1C	CNS-2-NBI-PIS-52D [S2]	NBI-PIS-52D	NPPD047-CALC-015	ITT Barton	288A	IR: 0 to 500 psig
SR 3.3.5.1.4	3.3.5.1-1-1C	CNS-1-NBI-PS-52A2	NBI-PS-52A2	NPPD047-CALC-036	Static O-Ring	9TA-B4-U8-C1A-JJTTNQ	Adjustable Range: 100 to 500 psi
SR 3.3.5.1.4	3.3.5.1-1-1C	CNS-1-NBI-PS-52C2	NBI-PS-52C2	NPPD047-CALC-036	Static O-Ring	9TA-B4-U8-C1A-JJTTNQ	Adjustable Range: 100 to 500 psi
SR 3.3.5.1.4	3.3.5.1-1-1D	CNS-1-CS-AM-45A	CS-AM-45A	NPPD047-CALC-011	General Electric	560	Span: 4 to 20 mA
SR 3.3.5.1.4	3.3.5.1-1-1D	CNS-2-CS-AM-45B	CS-AM-45B	NPPD047-CALC-011	General Electric	560	Span: 4 to 20 mA
SR 3.3.5.1.4	3.3.5.1-1-1D	CNS-1-CS-FT-40A	CS-FT-40A	NPPD047-CALC-035	Rosemount	1153DB5PC	URL: 750" H2O
SR 3.3.5.1.4	3.3.5.1-1-1D	CNS-2-CS-FT-40B	CS-FT-40B	NPPD047-CALC-035	Rosemount	1153DB5PC	URL: 750" H2O
SR 3.3.5.1.4	3.3.5.1-1-1E	CNS-1-CS-REL-K16A	CS-REL-K16A	NPPD047-CALC-009	Agastsat	ETR14D3B004	URL: 15 sec
SR 3.3.5.1.4	3.3.5.1-1-1E	CNS-2-CS-REL-K16B	CS-REL-K16B	NPPD047-CALC-009	Agastsat	ETR14D3B004	URL: 15 sec

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.5.1.4	3.3.5.1-1-2A	CNS-1-NBI-LIS-72A [L1]	NBI-LIS-72A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-2A	CNS-2-NBI-LIS-72B [L1]	NBI-LIS-72B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-2A	CNS-1-NBI-LIS-72C [L1]	NBI-LIS-72C	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-2A	CNS-2-NBI-LIS-72D [L1]	NBI-LIS-72D	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-2B	CNS-1-PC-PS-101A	PC-PS-101A	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-2B	CNS-2-PC-PS-101B	PC-PS-101B	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-2B	CNS-1-PC-PS-101C	PC-PS-101C	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-2B	CNS-2-PC-PS-101D	PC-PS-101D	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-2C	CNS-2-NBI-PIS-52B [S2]	NBI-PIS-52B	NPPD047-CALC-015	ITT Barton	288A	IR: 0 to 500 psig
SR 3.3.5.1.4	3.3.5.1-1-2C	CNS-2-NBI-PIS-52D [S2]	NBI-PIS-52D	NPPD047-CALC-015	ITT Barton	288A	IR: 0 to 500 psig
SR 3.3.5.1.4	3.3.5.1-1-2C	CNS-1-NBI-PS-52A2	NBI-PS-52A2	NPPD047-CALC-036	Static O-Ring	9TA-B4-U8-C1A-JJTTNQ	Adjustable Range: 100 to 500 psi
SR 3.3.5.1.4	3.3.5.1-1-2C	CNS-1-NBI-PS-52C2	NBI-PS-52C2	NPPD047-CALC-036	Static O-Ring	9TA-B4-U8-C1A-JJTTNQ	Adjustable Range: 100 to 500 psi
SR 3.3.5.1.4	3.3.5.1-1-2D	CNS-2-NBI-PIS-52B [S1]	NBI-PIS-52B	NPPD047-CALC-015	ITT Barton	288A	IR: 0 to 500 psig
SR 3.3.5.1.4	3.3.5.1-1-2D	CNS-2-NBI-PIS-52D [S1]	NBI-PIS-52D	NPPD047-CALC-015	ITT Barton	288A	IR: 0 to 500 psig
SR 3.3.5.1.4	3.3.5.1-1-2D	CNS-1-NBI-PS-52A1	NBI-PS-52A1	NPPD047-CALC-036	Static O-Ring	9TA-B4-U8-C1A-JJTTNQ	Adjustable Range: 100 to 500 psi
SR 3.3.5.1.4	3.3.5.1-1-2D	CNS-1-NBI-PS-52C1	NBI-PS-52C1	NPPD047-CALC-036	Static O-Ring	9TA-B4-U8-C1A-JJTTNQ	Adjustable Range: 100 to 500 psi
SR 3.3.5.1.4	3.3.5.1-1-2E	CNS-1-NBI-LITS-73A	NBI-LITS-73A	NPPD047-CALC-003	Yarway	4418C	IR: -260 to +40 inches
SR 3.3.5.1.4	3.3.5.1-1-2E	CNS-2-NBI-LITS-73B	NBI-LITS-73B	NPPD047-CALC-003	Yarway	4418C	IR: -260 to +40 inches
SR 3.3.5.1.4	3.3.5.1-1-2G	CNS-1-RHR-DPIS-125A	RHR-DPIS-125A	NPPD047-CALC-017	ITT Barton	289A	IR: 0 to 10 in WC
SR 3.3.5.1.4	3.3.5.1-1-2G	CNS-2-RHR-DPIS-125B	RHR-DPIS-125B	NPPD047-CALC-017	ITT Barton	581A	IR: 0 to 10 in WC
SR 3.3.5.1.4	3.3.5.1-1-3A	CNS-1-NBI-LIS-72A [L2]	NBI-LIS-72A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-3A	CNS-2-NBI-LIS-72B [L2]	NBI-LIS-72B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.5.1.4	3.3.5.1-1-3A	CNS-1-NBI-LIS-72C [L2]	NBI-LIS-72C	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-3A	CNS-2-NBI-LIS-72D [L2]	NBI-LIS-72D	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-3B	CNS-1-PC-PS-101A	PC-PS-101A	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-3B	CNS-2-PC-PS-101B	PC-PS-101B	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-3B	CNS-1-PC-PS-101C	PC-PS-101C	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-3B	CNS-2-PC-PS-101D	PC-PS-101D	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.5.1.4	3.3.5.1-1-3C	CNS-2-NBI-LIS-101B [L8]	NBI-LIS-101B	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.5.1.4	3.3.5.1-1-3C	CNS-2-NBI-LIS-101D [L8]	NBI-LIS-101D	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.5.1.4	3.3.5.1-1-3F	CNS-2-HPCI-FIS-78	HPCI-FIS-78	NPPD047-CALC-018	ITT Barton	289A	IR: 0 to 14 in WC
SR 3.3.5.1.4	3.3.5.1-1-4A	CNS-1-NBI-LIS-72A [L1]	NBI-LIS-72A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-4A	CNS-1-NBI-LIS-72C [L1]	NBI-LIS-72C	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-4C	CNS-1-NBI-LIS-83A	NBI-LIS-83A	NPPD047-CALC-002	Yarway	4418C	IR: 0 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-4D	CNS-1-CS-PS-37A	CS-PS-37A	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-4D	CNS-1-CS-PS-44A	CS-PS-44A	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-4E	CNS-1-RHR-PS-105A	RHR-PS-105A	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-4E	CNS-1-RHR-PS-105C	RHR-PS-105C	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-4E	CNS-1-RHR-PS-120A	RHR-PS-120A	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-4E	CNS-1-RHR-PS-120C	RHR-PS-120C	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-5A	CNS-2-NBI-LIS-72B [L1]	NBI-LIS-72B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-5A	CNS-2-NBI-LIS-72D [L1]	NBI-LIS-72D	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-5C	CNS-2-NBI-LIS-83B	NBI-LIS-83B	NPPD047-CALC-002	Yarway	4418C	IR: 0 to +60 inches
SR 3.3.5.1.4	3.3.5.1-1-5D	CNS-2-CS-PS-37B	CS-PS-37B	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.5.1.4	3.3.5.1-1-5D	CNS-2-CS-PS-44B	CS-PS-44B	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-5E	CNS-2-RHR-PS-105B	RHR-PS-105B	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-5E	CNS-2-RHR-PS-105D	RHR-PS-105D	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-5E	CNS-2-RHR-PS-120B	RHR-PS-120B	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.1.4	3.3.5.1-1-5E	CNS-2-RHR-PS-120D	RHR-PS-120D	NPPD047-CALC-033	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.5.2.4	3.3.5.2-1-1	CNS-1-NBI-LIS-72A [L2]	NBI-LIS-72A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.2.4	3.3.5.2-1-1	CNS-2-NBI-LIS-72B [L2]	NBI-LIS-72B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.2.4	3.3.5.2-1-1	CNS-1-NBI-LIS-72C [L2]	NBI-LIS-72C	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.2.4	3.3.5.2-1-1	CNS-2-NBI-LIS-72D [L2]	NBI-LIS-72D	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.5.2.4	3.3.5.2-1-2	CNS-1-NBI-LIS-101A [L8]	NBI-LIS-101A	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.5.2.4	3.3.5.2-1-2	CNS-1-NBI-LIS-101C [L8]	NBI-LIS-101C	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-1A	CNS-1-NBI-LIS-57A [L1]	NBI-LIS-57A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-1A	CNS-2-NBI-LIS-57B [L1]	NBI-LIS-57B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-1A	CNS-1-NBI-LIS-58A [L1]	NBI-LIS-58A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-1A	CNS-2-NBI-LIS-58B [L1]	NBI-LIS-58B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-116A	MS-DPIS-116A	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-116B	MS-DPIS-116B	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-116C	MS-DPIS-116C	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-116D	MS-DPIS-116D	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-117A	MS-DPIS-117A	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-117B	MS-DPIS-117B	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-117C	MS-DPIS-117C	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-117D	MS-DPIS-117D	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-118A	MS-DPIS-118A	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-118B	MS-DPIS-118B	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-118C	MS-DPIS-118C	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-118D	MS-DPIS-118D	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-119A	MS-DPIS-119A	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-119B	MS-DPIS-119B	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-1-MS-DPIS-119C	MS-DPIS-119C	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1C	CNS-2-MS-DPIS-119D	MS-DPIS-119D	NPPD047-CALC-013	ITT Barton	288A	IR: 0 to 150 psid
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-121A	MS-TS-121A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-121B	MS-TS-121B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-121C	MS-TS-121C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-121D	MS-TS-121D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-122A	MS-TS-122A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-122B	MS-TS-122B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-122C	MS-TS-122C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-122D	MS-TS-122D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-123A	MS-TS-123A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-123B	MS-TS-123B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-123C	MS-TS-123C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-123D	MS-TS-123D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-124A	MS-TS-124A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-124B	MS-TS-124B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-124C	MS-TS-124C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-124D	MS-TS-124D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-143A	MS-TS-143A	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-143B	MS-TS-143B	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-143C	MS-TS-143C	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-143D	MS-TS-143D	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-144A	MS-TS-144A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-144B	MS-TS-144B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-144C	MS-TS-144C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-144D	MS-TS-144D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-145A	MS-TS-145A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-145B	MS-TS-145B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-145C	MS-TS-145C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-145D	MS-TS-145D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-146A	MS-TS-146A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-146B	MS-TS-146B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-146C	MS-TS-146C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-146D	MS-TS-146D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-147A	MS-TS-147A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-147B	MS-TS-147B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-147C	MS-TS-147C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-147D	MS-TS-147D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-148A	MS-TS-148A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-148B	MS-TS-148B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-148C	MS-TS-148C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-148D	MS-TS-148D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-149A	MS-TS-149A	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-149B	MS-TS-149B	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-149C	MS-TS-149C	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-149D	MS-TS-149D	NPPD047-CALC-010	Patel Engineering	01-170020-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-150A	MS-TS-150A	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-150B	MS-TS-150B	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-150C	MS-TS-150C	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-1E	CNS-0-MS-TS-150D	MS-TS-150D	NPPD047-CALC-010	Fenwal	17002-40	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-2A	CNS-1-NBI-LIS-101A [L3]	NBI-LIS-101A	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-2A	CNS-2-NBI-LIS-101B [L3]	NBI-LIS-101B	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-2A	CNS-1-NBI-LIS-101C [L3]	NBI-LIS-101C	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-2A	CNS-2-NBI-LIS-101D [L3]	NBI-LIS-101D	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-2B	CNS-1-PC-PS-12A	PC-PS-12A	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.6.1.4	3.3.6.1-1-2B	CNS-2-PC-PS-12B	PC-PS-12B	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.6.1.4	3.3.6.1-1-2B	CNS-1-PC-PS-12C	PC-PS-12C	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.6.1.4	3.3.6.1-1-2B	CNS-2-PC-PS-12D	PC-PS-12D	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.6.1.4	3.3.6.1-1-2E	CNS-1-NBI-LIS-57A [L1]	NBI-LIS-57A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-2E	CNS-2-NBI-LIS-57B [L1]	NBI-LIS-57B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-2E	CNS-1-NBI-LIS-58A [L1]	NBI-LIS-58A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-2E	CNS-2-NBI-LIS-58B [L1]	NBI-LIS-58B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-3A	CNS-2-HPCI-DPIS-76	HPCI-DPIS-76	NPPD047-CALC-012	ITT Barton	580A	IR: -300 to +300 in WC
SR 3.3.6.1.4	3.3.6.1-1-3A	CNS-2-HPCI-DPIS-77	HPCI-DPIS-77	NPPD047-CALC-012	ITT Barton	580A	IR: -300 to +300 in WC
SR 3.3.6.1.4	3.3.6.1-1-3B	CNS-2-HPCI-REL-K33	HPCI-REL-K33	NPPD047-CALC-021	Allen Bradley	700-RTC-11110U1	Adjustable Range: 0.2 to 8 sec
SR 3.3.6.1.4	3.3.6.1-1-3B	CNS-2-HPCI-REL-K43	HPCI-REL-K43	NPPD047-CALC-021	Allen Bradley	700-RTC-11110U1	Adjustable Range: 0.2 to 8 sec
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-101A	HPCI-TS-101A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-101B	HPCI-TS-101B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-101C	HPCI-TS-101C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-101D	HPCI-TS-101D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-102A	HPCI-TS-102A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-102B	HPCI-TS-102B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-102C	HPCI-TS-102C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-102D	HPCI-TS-102D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-103A	HPCI-TS-103A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-103B	HPCI-TS-103B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-103C	HPCI-TS-103C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-103D	HPCI-TS-103D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-104A	HPCI-TS-104A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-104B	HPCI-TS-104B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-104C	HPCI-TS-104C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-104D	HPCI-TS-104D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-125A	HPCI-TS-125A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-125B	HPCI-TS-125B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-125C	HPCI-TS-125C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-125D	HPCI-TS-125D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-126A	HPCI-TS-126A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-126B	HPCI-TS-126B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-126C	HPCI-TS-126C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-126D	HPCI-TS-126D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-127A	HPCI-TS-127A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-127B	HPCI-TS-127B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-127C	HPCI-TS-127C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-127D	HPCI-TS-127D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-128A	HPCI-TS-128A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-128B	HPCI-TS-128B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-128C	HPCI-TS-128C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-3D	CNS-2-HPCI-TS-128D	HPCI-TS-128D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4A	CNS-1-RCIC-DPIS-83	RCIC-DPIS-83	NPPD047-CALC-016	ITT Barton	288	IR: -500 to 500 in WC
SR 3.3.6.1.4	3.3.6.1-1-4A	CNS-2-RCIC-DPIS-84	RCIC-DPIS-84	NPPD047-CALC-016	ITT Barton	288	IR: -500 to 500 in WC
SR 3.3.6.1.4	3.3.6.1-1-4B	CNS-1-RCIC-REL-K12	RCIC-REL-K12	NPPD047-CALC-021	Allen Bradley	700-RTC-11110U1	Adjustable Range: 0.2 to 8 sec
SR 3.3.6.1.4	3.3.6.1-1-4B	CNS-2-RCIC-REL-K32	RCIC-REL-K32	NPPD047-CALC-021	Allen Bradley	700-RTC-11110U1	Adjustable Range: 0.2 to 8 sec
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-79A	RCIC-TS-79A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-79C	RCIC-TS-79C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-80A	RCIC-TS-80A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-80C	RCIC-TS-80C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-81A	RCIC-TS-81A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-81C	RCIC-TS-81C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-82A	RCIC-TS-82A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-1-RCIC-TS-82C	RCIC-TS-82C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-79B	RCIC-TS-79B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-79D	RCIC-TS-79D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-80B	RCIC-TS-80B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-80D	RCIC-TS-80D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-81B	RCIC-TS-81B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-81D	RCIC-TS-81D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-82B	RCIC-TS-82B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-4D	CNS-2-RCIC-TS-82D	RCIC-TS-82D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5A	CNS-1-RWCU-DPIS-170A	RWCU-DPIS-170A	NPPD047-CALC-019	ITT Barton	289A	Range: 0 to 24 in WC
SR 3.3.6.1.4	3.3.6.1-1-5A	CNS-2-RWCU-DPIS-170B	RWCU-DPIS-170B	NPPD047-CALC-019	ITT Barton	289A	Range: 0 to 24 in WC
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-150A	RWCU-TS-150A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-150C	RWCU-TS-150C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-151A	RWCU-TS-151A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-151C	RWCU-TS-151C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-152A	RWCU-TS-152A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-152C	RWCU-TS-152C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-153A	RWCU-TS-153A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-153C	RWCU-TS-153C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-154A	RWCU-TS-154A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-154C	RWCU-TS-154C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-155A	RWCU-TS-155A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-155C	RWCU-TS-155C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-156A	RWCU-TS-156A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-156C	RWCU-TS-156C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-157A	RWCU-TS-157A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-157C	RWCU-TS-157C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-158A	RWCU-TS-158A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-158C	RWCU-TS-158C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-159A	RWCU-TS-159A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-159C	RWCU-TS-159C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-81A	RWCU-TS-81A	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-81C	RWCU-TS-81C	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-81E	RWCU-TS-81E	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-1-RWCU-TS-81G	RWCU-TS-81G	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-150B	RWCU-TS-150B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-150D	RWCU-TS-150D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-151B	RWCU-TS-151B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-151D	RWCU-TS-151D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-152B	RWCU-TS-152B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-152D	RWCU-TS-152D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-153B	RWCU-TS-153B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-153D	RWCU-TS-153D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-154B	RWCU-TS-154B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-154D	RWCU-TS-154D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-155B	RWCU-TS-155B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-155D	RWCU-TS-155D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-156B	RWCU-TS-156B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-156D	RWCU-TS-156D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-157B	RWCU-TS-157B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-157D	RWCU-TS-157D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-158B	RWCU-TS-158B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-158D	RWCU-TS-158D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-159B	RWCU-TS-159B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-159D	RWCU-TS-159D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-81B	RWCU-TS-81B	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-81D	RWCU-TS-81D	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-81F	RWCU-TS-81F	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5B	CNS-2-RWCU-TS-81H	RWCU-TS-81H	NPPD047-CALC-010	Patel Engineering	01-170230-090	URL: 600°F
SR 3.3.6.1.4	3.3.6.1-1-5D	CNS-1-NBI-LIS-57A [L2]	NBI-LIS-57A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.1.4	3.3.6.1-1-5D	CNS-2-NBI-LIS-57B [L2]	NBI-LIS-57B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-5D	CNS-1-NBI-LIS-58A [L2]	NBI-LIS-58A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-5D	CNS-2-NBI-LIS-58B [L2]	NBI-LIS-58B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.1.4	3.3.6.1-1-6A	CNS-0-RR-PS-128A	RR-PS-128A	NPPD047-CALC-034	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.6.1.4	3.3.6.1-1-6A	CNS-0-RR-PS-128B	RR-PS-128B	NPPD047-CALC-034	Static O-Ring	5TA-BB3-U8-C1A-JJTTNQ	Adjustable Range: 25 to 240 psig
SR 3.3.6.1.4	3.3.6.1-1-6B	CNS-1-NBI-LIS-101A [L3]	NBI-LIS-101A	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-6B	CNS-2-NBI-LIS-101B [L3]	NBI-LIS-101B	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-6B	CNS-1-NBI-LIS-101C [L3]	NBI-LIS-101C	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.1.4	3.3.6.1-1-6B	CNS-2-NBI-LIS-101D [L3]	NBI-LIS-101D	NPPD047-CALC-014	ITT Barton	288A	IR: 69.3 to 27 in WC
SR 3.3.6.2.3	3.3.6.2-1-1	CNS-1-NBI-LIS-57A [L2]	NBI-LIS-57A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.2.3	3.3.6.2-1-1	CNS-2-NBI-LIS-57B [L2]	NBI-LIS-57B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.2.3	3.3.6.2-1-1	CNS-1-NBI-LIS-58A [L2]	NBI-LIS-58A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.2.3	3.3.6.2-1-1	CNS-2-NBI-LIS-58B [L2]	NBI-LIS-58B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.6.2.3	3.3.6.2-1-2	CNS-1-PC-PS-12A	PC-PS-12A	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.6.2.3	3.3.6.2-1-2	CNS-2-PC-PS-12B	PC-PS-12B	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.6.2.3	3.3.6.2-1-2	CNS-1-PC-PS-12C	PC-PS-12C	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.6.2.3	3.3.6.2-1-2	CNS-2-PC-PS-12D	PC-PS-12D	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.6.3.4	3.3.6.3-1-1	CNS-1-NBI-PS-55A	NBI-PS-55A	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.6.3.4	3.3.6.3-1-1	CNS-2-NBI-PS-55B	NBI-PS-55B	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.6.3.4	3.3.6.3-1-1	CNS-1-NBI-PS-55C	NBI-PS-55C	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.6.3.4	3.3.6.3-1-1	CNS-2-NBI-PS-55D	NBI-PS-55D	NPPD047-CALC-026	Barksdale	B2T-M12SS	Adjustable Range: 0 to 1200 psi
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300A	MS-PS-300A	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300B	MS-PS-300B	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300C	MS-PS-300C	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300D	MS-PS-300D	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300E	MS-PS-300E	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300F	MS-PS-300F	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300G	MS-PS-300G	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig
SR 3.3.6.3.4	3.3.6.3-1-3	CNS-0-MS-PS-300H	MS-PS-300H	NPPD047-CALC-008	Pressure Controls	A171P	URL: 200 psig
SR 3.3.7.1.3	3.3.7.1-1-1	CNS-1-NBI-LIS-57A [L2]	NBI-LIS-57A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.7.1.3	3.3.7.1-1-1	CNS-2-NBI-LIS-57B [L2]	NBI-LIS-57B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.7.1.3	3.3.7.1-1-1	CNS-1-NBI-LIS-58A [L2]	NBI-LIS-58A	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.7.1.3	3.3.7.1-1-1	CNS-2-NBI-LIS-58B [L2]	NBI-LIS-58B	NPPD047-CALC-001	Yarway	4418C	IR: -150 to +60 inches
SR 3.3.7.1.3	3.3.7.1-1-2	CNS-1-PC-PS-12A	PC-PS-12A	NPPD047-CALC-031	Static O-Ring	12TA-BB4-NX-C1A-JJTTX6	Adjustable Range: 0.5 to 6 psig
SR 3.3.7.1.3	3.3.7.1-1-2	CNS-2-PC-PS-12B	PC-PS-12B	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.7.1.3	3.3.7.1-1-2	CNS-1-PC-PS-12C	PC-PS-12C	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.7.1.3	3.3.7.1-1-2	CNS-2-PC-PS-12D	PC-PS-12D	NPPD047-CALC-037	Static O-Ring	12TA-BB5-NX-C1A-JJTTX6	Adjustable Range: 0.75 to 12 psig
SR 3.3.8.1.2	3.3.8.1-1-1A	CNS-1-EE-REL- 27-1F1	EE-REL-27-1F1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-1A	CNS-1-EE-REL- 27-1FA1	EE-REL-27-1FA1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-1A	CNS-3-EE-REL- 27-ET1	EE-REL-27-ET1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-1A	CNS-2-EE-REL- 27-1G1	EE-REL-27-1G1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-1A	CNS-2-EE-REL- 27-1GB1	EE-REL-27-1GB1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-1A	CNS-3-EE-REL- 27-ET2	EE-REL-27-ET2	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-1B	CNS-1-EE-REL- 27-1F1	EE-REL-27-1F1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 10

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.8.1.2	3.3.8.1-1-1B	CNS-1-EE-REL- 27-1FA1	EE-REL-27-1FA1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 11
SR 3.3.8.1.2	3.3.8.1-1-1B	CNS-3-EE-REL- 27-ET1	EE-REL-27-ET1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 12
SR 3.3.8.1.2	3.3.8.1-1-1B	CNS-2-EE-REL- 27-1G1	EE-REL-27-1G1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 13
SR 3.3.8.1.2	3.3.8.1-1-1B	CNS-2-EE-REL- 27-1GB1	EE-REL-27-1GB1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 14
SR 3.3.8.1.2	3.3.8.1-1-1B	CNS-3-EE-REL- 27-ET2	EE-REL-27-ET2	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 15
SR 3.3.8.1.2	3.3.8.1-1-2A	CNS-1-EE-REL- 27-1F1	EE-REL-27-1F1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-2A	CNS-1-EE-REL- 27-1FA1	EE-REL-27-1FA1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-2A	CNS-3-EE-REL- 27-ET1	EE-REL-27-ET1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-2A	CNS-2-EE-REL- 27-1G1	EE-REL-27-1G1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-2A	CNS-2-EE-REL- 27-1GB1	EE-REL-27-1GB1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-2A	CNS-3-EE-REL- 27-ET2	EE-REL-27-ET2	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-2B	CNS-1-EE-REL- 27-1F1	EE-REL-27-1F1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 16
SR 3.3.8.1.2	3.3.8.1-1-2B	CNS-1-EE-REL- 27-1FA1	EE-REL-27-1FA1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 17
SR 3.3.8.1.2	3.3.8.1-1-2B	CNS-3-EE-REL- 27-ET1	EE-REL-27-ET1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 18
SR 3.3.8.1.2	3.3.8.1-1-2B	CNS-2-EE-REL- 27-1G1	EE-REL-27-1G1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 19
SR 3.3.8.1.2	3.3.8.1-1-2B	CNS-2-EE-REL- 27-1GB1	EE-REL-27-1GB1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 20
SR 3.3.8.1.2	3.3.8.1-1-2B	CNS-3-EE-REL- 27-ET2	EE-REL-27-ET2	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 21
SR 3.3.8.1.2	3.3.8.1-1-3A	CNS-1-EE-REL- 27-1F1	EE-REL-27-1F1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-3A	CNS-1-EE-REL- 27-1FA1	EE-REL-27-1FA1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-3A	CNS-3-EE-REL- 27-ET1	EE-REL-27-ET1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-3A	CNS-2-EE-REL- 27-1G1	EE-REL-27-1G1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-3A	CNS-2-EE-REL- 27-1GB1	EE-REL-27-1GB1	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.8.1.2	3.3.8.1-1-3A	CNS-3-EE-REL- 27-ET2	EE-REL-27-ET2	NPPD047-CALC-027	General Electric	IAV-54E	Adjustable Range: 55 to140VAC
SR 3.3.8.1.2	3.3.8.1-1-3B	CNS-1-EE-REL- 27-1F1	EE-REL-27-1F1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 22
SR 3.3.8.1.2	3.3.8.1-1-3B	CNS-1-EE-REL- 27-1FA1	EE-REL-27-1FA1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 23
SR 3.3.8.1.2	3.3.8.1-1-3B	CNS-3-EE-REL- 27-ET1	EE-REL-27-ET1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 24
SR 3.3.8.1.2	3.3.8.1-1-3B	CNS-2-EE-REL- 27-1G1	EE-REL-27-1G1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 25
SR 3.3.8.1.2	3.3.8.1-1-3B	CNS-2-EE-REL- 27-1GB1	EE-REL-27-1GB1	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 26
SR 3.3.8.1.2	3.3.8.1-1-3B	CNS-3-EE-REL- 27-ET2	EE-REL-27-ET2	NPPD047-CALC-028	General Electric	IAV-54E	Adjustable Time Delay: .5 to 27
SR 3.3.8.1.2	3.3.8.1-1-4A	CNS-1-EE-REL- 27-1F2	EE-REL-27-1F2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-4A	CNS-1-EE-REL- 27-1FA2	EE-REL-27-1FA2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-4A	CNS-2-EE-REL- 27-1G2	EE-REL-27-1G2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-4A	CNS-2-EE-REL- 27-1GB2	EE-REL-27-1GB2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-4B	CNS-1-EE-REL- 27-1F2	EE-REL-27-1F2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-4B	CNS-1-EE-REL- 27-1FA2	EE-REL-27-1FA2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-4B	CNS-2-EE-REL- 27-1G2	EE-REL-27-1G2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-4B	CNS-2-EE-REL- 27-1GB2	EE-REL-27-1GB2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-4C	CNS-1-EE-REL- 27-1F2	EE-REL-27-1F2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-4C	CNS-1-EE-REL- 27-1FA2	EE-REL-27-1FA2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-4C	CNS-2-EE-REL- 27-1G2	EE-REL-27-1G2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.8.1.2	3.3.8.1-1-4C	CNS-2-EE-REL- 27-1GB2	EE-REL-27-1GB2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-5A	CNS-1-EE-REL- 27-1F2	EE-REL-27-1F2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-5A	CNS-1-EE-REL- 27-1FA2	EE-REL-27-1FA2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-5A	CNS-2-EE-REL- 27-1G2	EE-REL-27-1G2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-5A	CNS-2-EE-REL- 27-1GB2	EE-REL-27-1GB2	NPPD047-CALC-023	ABB	27N	Pickup Range: 60 to 110 VAC Dropout Range: 70 to 99%
SR 3.3.8.1.2	3.3.8.1-1-5B	CNS-1-EE-REL- 27-1F2	EE-REL-27-1F2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-5B	CNS-1-EE-REL- 27-1FA2	EE-REL-27-1FA2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-5B	CNS-2-EE-REL- 27-1G2	EE-REL-27-1G2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.1.2	3.3.8.1-1-5B	CNS-2-EE-REL- 27-1GB2	EE-REL-27-1GB2	NPPD047-CALC-024	ABB	27N	Time Delay Range: 1 to 10 sec
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A1 (OV)	RPS-EPA-1A1	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A2 (OV)	RPS-EPA-1A2	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A3 (OV)	RPS-EPA-1A3	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A4 (OV)	RPS-EPA-1A4	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B1 (OV)	RPS-EPA-1B1	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B2 (OV)	RPS-EPA-1B2	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B3 (OV)	RPS-EPA-1B3	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B4 (OV)	RPS-EPA-1B4	NPPD047-CALC-006	General Electric	914E175	na
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A1 (TD)	RPS-EPA-1A1	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A2 (TD)	RPS-EPA-1A2	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A3 (TD)	RPS-EPA-1A3	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1A	N/A	CNS-1-RPS-EPA-1A4 (TD)	RPS-EPA-1A4	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B1 (TD)	RPS-EPA-1B1	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B2 (TD)	RPS-EPA-1B2	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B3 (TD)	RPS-EPA-1B3	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1A	N/A	CNS-2-RPS-EPA-1B4 (TD)	RPS-EPA-1B4	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A1 (UV)	RPS-EPA-1A1	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A2 (UV)	RPS-EPA-1A2	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A3 (UV)	RPS-EPA-1A3	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A4 (UV)	RPS-EPA-1A4	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B1 (UV)	RPS-EPA-1B1	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B2 (UV)	RPS-EPA-1B2	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B3 (UV)	RPS-EPA-1B3	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B4 (UV)	RPS-EPA-1B4	NPPD047-CALC-005	General Electric	914E175	na
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A1 (TD)	RPS-EPA-1A1	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A2 (TD)	RPS-EPA-1A2	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A3 (TD)	RPS-EPA-1A3	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1B	N/A	CNS-1-RPS-EPA-1A4 (TD)	RPS-EPA-1A4	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B1 (TD)	RPS-EPA-1B1	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B2 (TD)	RPS-EPA-1B2	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B3 (TD)	RPS-EPA-1B3	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec

TS Surveillance	TS Function	Functional Location (1)	Functional Location (2)	Calculation	Manufacturer	Model No.	Range
SR 3.3.8.2.1B	N/A	CNS-2-RPS-EPA-1B4 (TD)	RPS-EPA-1B4	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A1 (UF)	RPS-EPA-1A1	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A2 (UF)	RPS-EPA-1A2	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A3 (UF)	RPS-EPA-1A3	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A4 (UF)	RPS-EPA-1A4	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B1 (UF)	RPS-EPA-1B1	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B2 (UF)	RPS-EPA-1B2	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B3 (UF)	RPS-EPA-1B3	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B4 (UF)	RPS-EPA-1B4	NPPD047-CALC-004	General Electric	914E175	na
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A1 (TD)	RPS-EPA-1A1	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A2 (TD)	RPS-EPA-1A2	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A3 (TD)	RPS-EPA-1A3	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-1-RPS-EPA-1A4 (TD)	RPS-EPA-1A4	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B1 (TD)	RPS-EPA-1B1	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B2 (TD)	RPS-EPA-1B2	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B3 (TD)	RPS-EPA-1B3	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.3.8.2.1C	N/A	CNS-2-RPS-EPA-1B4 (TD)	RPS-EPA-1B4	NPPD047-CALC-007	General Electric	914E175	Timer Adj Range: .1 to 4 sec
SR 3.6.1.7.3	N/A	CNS-1-PC-DPIS-516A	PC-DPIS-516A	NPPD047-CALC-020	ITT Barton	289A	Range: -2 to 2 psid

Enclosure 1

Instrument Drift Analysis Design Guide

Cooper Nuclear Station, Docket No. 50-298, DPR-46

COOPER NUCLEAR STATION

ENGINEERING EVALUATION No. 10-045

INSTRUMENT DRIFT ANALYSIS DESIGN GUIDE

IN SUPPORT OF

24-MONTH FUEL CYCLE EXTENSION PROJECT

Revision 1

Prepared by:

EXCEL Services Corporation
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Prepared By: Kirk R. Melson *Kirk R. Melson* Date: 9-6-2011

Reviewed By: Jerry D. Voss *Jerry D. Voss* Date: [illegible]

Approved By: *K B Thomas* Date: 9/7/11

TABLE OF CONTENTS

Record of Revision

Rev. No.	Description
0	Initial Issue
1	Removed second paragraph on page 58, regarding implementation of TSTF-493, to comply with current project direction.

1. OBJECTIVE/PURPOSE

The objective of this Design Guide is to provide the necessary detail and guidance to perform drift analyses using past calibration history data for the purposes of:

- Quantifying component/loop drift characteristics within defined probability limits to gain an understanding of the expected behavior for the component/loop by evaluating past performance
- Estimating component/loop drift for integration into setpoint calculations
- Analysis aid for reliability centered maintenance practices (e.g., optimizing calibration frequency)
- Establishing a technical basis for extending calibration and surveillance intervals using historical calibration data
- Trending device performance based on extended surveillance intervals

2. DRIFT ANALYSIS SCOPE

The scope of this design guide is limited to the calculation of the expected performance for a component, group of components or loop, utilizing past calibration data. Drift Calculations are the final product of the data analysis. The output from the Drift Calculations may be used directly as input to setpoint or loop accuracy calculations. However, if desired, the output may be compared to the design values used within setpoint and loop accuracy calculations to show that the existing design approach is conservative.

The approaches described within this design guide can be applied to all devices that are surveilled or calibrated where As-Found and As-Left data is recorded. The scope of this design guide includes, but is not limited to, the following list of devices:

- Transmitters (Differential Pressure, Flow, Level, Pressure, Temperature, etc.)
- Bistables (Master & Slave Trip Units, Alarm Units, etc.)
- Indicators (Analog, Digital)
- Switches (Differential Pressure, Flow, Level, Position, Pressure, Temperature, etc.)
- Signal Conditioners/Converters (Summers, E/P Converters, Square Root Converters, etc.)
- Recorders (Temperature, Pressure, Flow, Level, etc.)
- Monitors & Modules (Radiation, Neutron, H_2O_2, Pre-Amplifiers, etc.)
- Relays (Time Delay, Undervoltage, Overvoltage, etc.)

Note that a given device or device type may be justified not to require drift analysis in accordance with this design guide, if appropriate.

3. DISCUSSION/METHODOLOGY

3.1. Methodology Options

This design guide is written to provide the methodology necessary for the analysis of As-Found versus As-Left calibration data, as a means of characterizing the performance of a component or group of components via the following methods:

3.1.1. Electric Power Research Institute (EPRI) has developed a guideline to provide nuclear plants with practical methods for analyzing historic component calibration data to predict component performance via a simple spreadsheet program (e.g., Excel, Lotus 1-2-3). This design guide is written in close adherence to this guideline, Reference 7.1.1. The Nuclear Regulatory Commission reviewed Revision 0 of Reference 7.1.1 and had a list of concerns documented in Reference 7.1.7. These concerns prompted the issuance of Revision 1 to Reference 7.1.1. In addition, Appendix A to this design guide addresses each concern individually and provides the Cooper Nuclear Station (CNS) resolution.

3.1.2. Commercial Grade Software programs other than Microsoft Excel (e.g. Quattro Pro, Lotus 1-2-3, Mathcad, etc.), that perform the functions necessary to evaluate drift, may be utilized providing:

- the intent of this design guide is met as outlined in Reference 7.1.1, and
- software is used only as a tool to produce hard copy outputs which are to be independently verified.

3.1.3. The final products of the data analyses are hard copy Drift Calculations. The electronic files of the Drift Calculations are an intermediate step from raw data to final product and are not controlled as QA files. The Drift Calculation is independently verified using different software than that used to create the Drift Calculation. The documentation of the review of the Drift Calculation will include a summary tabulation of results from each program used in the review process to provide visual evidence of the acceptability of the results of the review.

3.2. Data Analysis Discussion

The following data analysis methods were evaluated for use at CNS: 1) As-Found Versus Setpoint, 2) Worst Case As-Found Versus As-Left, 3) Combined Calibration Data Points Analysis, and 4) As-Found Versus As-Left. The evaluation concluded that the As-Found versus As-Left methodology provided results that were more representative of the data and has been chosen for use by this Design Guide. Statistical tests not covered by this design guide may be utilized, provided the Engineer performing the analysis adequately justifies the use of the tests.

3.2.1. As-Found Versus As-Left Calibration Data Analysis

The As-Found versus As-Left calibration data analysis is based on calculating drift by subtracting the previous As-Left component setting from the current As-Found setting. Each calibration point is treated as an independent set of data for purposes of characterizing drift across the full, calibrated span of the component/loop. By evaluating As-Found versus As-Left data for a component/loop or a similar group of components/loops, the following information may be obtained:

- The typical component/loop drift between calibrations (Random in nature)
- Any tendency for the component/loop to drift in a particular direction (Bias)
- Any tendency for the component/loop drift to increase in magnitude over time (Time Dependency)

- Confirmation that the selected setting or calibration tolerance is appropriate or achievable for the component/loop

3.2.1.1. General Features of As-Found Versus As-Left Analysis

- The methodology evaluates historical calibration data only. The method does not monitor on-line component output; data is obtained from component calibration records.
- Present and future performance is predicted based on statistical analysis of past performance.
- Data is readily available from component calibration records. Data can be analyzed from plant startup to the present or only more recent data can be evaluated.
- Since only historical data is evaluated, the method is not intended as a tool to identify individual faulty components, although it can be used to demonstrate that a particular component model or application historically performs poorly.
- A similar class of components, i.e., same make, model, or application, is evaluated. For example, the method can determine the drift of all analog indicators of a certain type installed in the control room.
- The methodology is less suitable for evaluating the drift of a single component over time, due to statistical analysis penalties that occur with smaller sample sizes.
- The methodology obtains a value of drift for a particular model, loop, or function that can be used in component or loop uncertainty and setpoint calculations.
- The methodology is designed to support the analysis of longer calibration intervals and is consistent with the NRC expectations described in Reference 7.3.3. Values for instrument drift developed in accordance with this Design Guide are to be applied in accordance with References 7.2.2 and 7.2.3, as appropriate.

3.2.1.2. Error and Uncertainty Content in As-Found Versus As-Left Calibration Data

The As-Found versus the As-Left data includes several sources of uncertainty over and above component drift. The difference between As-Found and previous As-Left data encompasses a number of instrument uncertainty terms in addition to drift, as defined by References 7.2.2 and 7.2.3, the setpoint calculation methodologies for CNS. The drift is <u>not</u> assumed to encompass the errors associated with temperature effect, since the temperature difference between the two calibrations is not quantified, and is not anticipated to be significant. Additional instruction for the use of As-Found and As-Left data may be found in Reference 7.1.2. The following possible contributors could be included within the measured variation, but are not necessarily considered as such.

- Accuracy errors present between any two consecutive calibrations
- Measurement and test equipment error between any two consecutive calibrations
- Personnel-induced or human-related variation or error between any two consecutive calibrations

- Normal temperature effects due to a difference in ambient temperature between any two consecutive calibrations
- Power Supply variations between any two consecutive calibrations
- Environmental effects on component performance, e.g., radiation, humidity, vibration, etc., between any two consecutive calibrations that cause a shift in component output
- Misapplication, improper installation, or other operating effects that affect component calibration between any two consecutive calibrations
- True drift representing a change, time-dependent or otherwise, in component/loop output over the time period between any two consecutive calibrations

3.2.1.3. Potential Impacts of As-Found Versus As-Left Data Analysis

Many of the bulleted items listed in step 3.2.1.2 are not expected to have a significant effect on the measured As-Found and As-Left settings. Because there are so many independent parameters contributing to the possible variance in calibration data, they are all considered together and termed the component's Analyzed Drift (DA) uncertainty. This approach has the following potential impacts on an analysis of the component's calibration data:

- The magnitude of the calculated variation may exceed any assumptions or manufacturer predictions regarding drift. Attempts to validate manufacturer's performance claims should consider the possible contributors listed in step 3.2.1.2 to the calculated drift.

- The magnitude of the calculated variation that includes all of the above sources of uncertainty may mask any "true" time-dependent drift. In other words, the analysis of As-Found versus As-Left data may not demonstrate any time dependency. This does not mean that time-dependent drift does not exist, only that it could be so small that it is negligible in the cumulative effects of component uncertainty, when all of the above sources of uncertainty are combined.

3.3. Tolerance Interval

This Design Guide recommends a single confidence interval level to be used for performing data analyses and the associated calculations.

NOTE: The default Tolerance Interval Factor (TIF) for all Drift Calculations, performed using this Design Guide, is chosen for a 95%/95% probability and confidence, although this is not specifically required in every situation. This term means that the results have a 95% confidence (γ) that at least 95% of the population lies between the stated interval (P) for a sample size (n). Extrapolating the drift value for the extended time between surveillance is based on the assumption that future drift values will also be within the calculated drift interval 95% of the time. Components that perform functions that support a specific Technical Specification value, Technical Requirements Manual (TRM) value or are associated with the safety analysis assumptions or inputs are always analyzed at a 95%/95% tolerance interval. Components/loops that fall into this level must:

- be included in the data group (or be justified to apply the results per the guidance of Reference 7.1.1) if the analyzed drift value is to be applied to the component/loop in a Setpoint/Uncertainty Calculation,
- use the 95/95% TIF for determination of the Analyzed Drift term, and (see step 3.4.2 and Table 1 – 95%/95%Tolerance Interval Factors)

- be evaluated in the Setpoint/Uncertainty Calculation for application of the Analyzed Drift term. (For example, the DA term may include the normal temperature effects for a given device, but due to the impossibility of separating out that specific term, an additional temperature uncertainty may be included in the Setpoint/Uncertainty Calculation.)

3.4. Calibration Data Collection

3.4.1. Sources of Data

The sources of data to perform a drift analysis are Surveillance Tests, Calibration Procedures and other calibration processes (calibration files, calibration sheets for Balance of Plant devices, Preventative Maintenance, etc.).

3.4.2. How Much Data to Collect

3.4.2.1. The goal is to collect enough data for the instrument or group of instruments to make a statistically valid pool. There is no hard fast number that must be attained for any given pool, but a minimum of 30 drift values must be attained before the drift analysis can be performed without additional justification. As a general rule, drift analyses should not be performed for sample sizes of less than 20 drift values. Table 1 provides the 95%/95% TIF for various sample pool sizes; it should be noted that the smaller the pool the larger the penalty. A tolerance interval is a statement of confidence that a certain proportion of the total population is contained within a defined set of bounds. For example, a 95%/95% TIF indicates a 95% level of confidence that 95% of the population is contained within the stated interval.

Table 1 – 95%/95%Tolerance Interval Factors (Per Table VII(a) of Ref 7.3.2)

Sample Size	95%/95%	Sample Size	95%/95%	Sample Size	95%/95%
≥ 2	37.674	≥ 23	2.673	≥ 120	2.205
≥ 3	9.916	≥ 24	2.651	≥ 130	2.194
≥ 4	6.370	≥ 25	2.631	≥ 140	2.184
≥ 5	5.079	≥ 26	2.612	≥ 150	2.175
≥ 6	4.414	≥ 27	2.595	≥ 160	2.167
≥ 7	4.007	≥ 30	2.549	≥ 170	2.160
≥ 8	3.732	≥ 35	2.490	≥ 180	2.154
≥ 9	3.532	≥ 40	2.445	≥ 190	2.148
≥ 10	3.379	≥ 45	2.408	≥ 200	2.143
≥ 11	3.259	≥ 50	2.379	≥ 250	2.121
≥ 12	3.162	≥ 55	2.354	≥ 300	2.106
≥ 13	3.081	≥ 60	2.333	≥ 400	2.084
≥ 14	3.012	≥ 65	2.315	≥ 500	2.070
≥ 15	2.954	≥ 70	2.299	≥ 600	2.060
≥ 16	2.903	≥ 75	2.285	≥ 700	2.052
≥ 17	2.858	≥ 80	2.272	≥ 800	2.046
≥ 18	2.819	≥ 85	2.261	≥ 900	2.040
≥ 19	2.784	≥ 90	2.251	1000	2.036
≥ 20	2.752	≥ 95	2.241	∞	1.960
≥ 21	2.723	≥ 100	2.233		
≥ 22	2.697	≥ 110	2.218		

3.4.2.2. Different information may be needed, depending on the analysis purpose, therefore, the total population of components - all makes, models, and applications that are to be analyzed must be known (e.g., all Rosemount transmitters).

3.4.2.3. Once the total population of components is known, the components should be separated into functionally equivalent groups. Each grouping is treated as a separate population for analysis purposes. For example, start with all Rosemount Differential Pressure Transmitters as the initial group and break them down into various sub-groups - Different Range Codes, Large vs. Small Turn Down Factors (TDF), Level vs. Flow Applications, etc. Note that TDF is a significant quantity, since drift is specified as a percent of Upper Range Limit for Rosemount transmitters.

3.4.2.4. Not all components or available calibration data points need to be analyzed within each group in order to establish statistical performance limits for the group. Acquisition of data should be considered from different perspectives.

- For each grouping, a large enough sample of components should be randomly selected from the population, so there is assurance that the evaluated components are representative of the entire population. By randomly selecting the components and confirming that the behavior of the randomly selected components is similar, a basis for not evaluating the entire population can be established. For sensors, a random sample from the population should include representation of all desired component spans and functions.
- For each selected component in the sample, enough historic calibration data should be provided to ensure that the component's performance over time is understood.
- Due to the difficulty of determining the total sample set, developing specific sampling criteria is difficult. A sampling method must be used which ensures that various instruments calibrated at different frequencies are included. The sampling method must also ensure that the different component types, operating conditions and other influences on drift are included. Because of the difficulty in developing a valid sampling program, it is often simpler to evaluate all available data for the required instrumentation within the chosen time period. This eliminates changing sample methods, should groups be combined or split, based on plant conditions or performance. For the purposes of this guide, specific justification in the Drift Calculation is required to document any sampling plan.

3.5. Categorizing Calibration Data

3.5.1. Grouping Calibration Data

One analysis goal should be to combine functionally equivalent components (components with similar design and performance characteristics) into a single group. In some cases, all components of a particular manufacturer make and model can be combined into a single sample. In other cases, virtually no grouping of data beyond a particular component make, model, and specific span or application may be possible. Some examples of possible groupings include, but are not limited to, the following:

3.5.1.1. Small Groupings

- All devices of same manufacturer, model and range, covered by the same Surveillance Test

- All trip units used to monitor a specific parameter (assuming that all trip units are the same manufacturer, model and range)

3.5.1.2. Larger Groupings

- All transmitters of a specific manufacturer, model that have similar spans and performance requirements
- All Foxboro Spec 200 isolators with functionally equivalent model numbers
- All control room analog indicators of a specific manufacturer and model

3.5.2. Rationale for Grouping Components into a Larger Sample

- A single component analysis may result in too few data points to make statistically meaningful performance predictions.
- Smaller sample sizes associated with a single component may unduly penalize performance predictions by applying a larger TIF to account for the smaller data set. Larger sample sizes reflect a greater understanding and assurance of representative data that in turn, reduces the uncertainty factor.
- Large groupings of components into a sample set for a single population ultimately allows the user to state the plant-specific performance for a particular make and model of component. For example, the user may state, "Main Steam Flow Transmitters have historically drifted by less than 1%", or "All control room indicators of a particular make and model have historically drifted by less than 1.5%".
- An analysis of smaller sample sizes is more likely to be influenced by non-representative variations of a single component (outliers).
- Grouping similar components together, rather than analyzing them separately, is more efficient and minimizes the number of separate calculations that must be maintained.

3.5.3. Considerations When Combining Components into a Single Group

Grouping components together into a sample set for a single population does not have to become a complicated effort. Most components can be categorized readily into the appropriate population. Consider the following guidelines when grouping functionally equivalent components together.

- If performed on a type-of-component basis, component groupings should usually be established down to the manufacturer make and model, as a minimum. For example, data from Rosemount and Foxboro transmitters should not be combined in the same drift analysis. The principles of operation are different for the various manufacturers, and combining the data could mask some trend for one type of component. This said; it might be desirable to combine groups of components for certain calculations. If dissimilar component types are combined, a separate analysis of each component type should still be completed to ensure analysis results of the mixed population are not misinterpreted or misapplied.
- Sensors of the same manufacturer make and model, but with different calibrated spans or elevated zero points, can possibly still be combined into a single group. For example, a single analysis that determines the drift for all Rosemount pressure transmitters installed onsite might simplify the application of the results. Note that some manufacturers provide a predicted accuracy and drift value for a given component model, regardless of its span. However, the validity of combining components with a variation of span, ranging from tens of pounds to several thousand pounds, should be confirmed. As part of the analysis, the performance of components within each span should be compared to the

performance of the other devices to determine if any differences are evident between components with different spans.

- Components combined into a single group should be exposed to similar calibration or surveillance conditions, as applicable. Note that the term operating condition was not used in this case. Although it is desirable that the grouped components perform similar functions, the method by which the data is obtained for this analysis is also significant. If half the components are calibrated in the summer at 90°F and the other half in the winter at 40°F, a difference in observed drift between the data for the two sets of components might exist. In many cases, ambient temperature variations are not expected to have a large effect, since the components are located in environmentally controlled areas.

3.5.4. Verification That Data Grouping Is Appropriate

- Combining functionally equivalent components into a single group for analysis purposes may simplify the scope of work; however, some level of verification should be performed to confirm that the selected component grouping is appropriate. As an example, the manufacturer may claim the same accuracy and drift specifications for two components of the same model, but with different ranges, e.g., 0-5 PSIG and 0-3000 PSIG. However, in actual application, components of one range may perform differently than components of another range.
- Standard statistics texts provide methods that can be used to determine if data from similar types of components can be pooled into a single group. If different groups of components have essentially equal variances and means at the desired statistical level, the data for the groups can be pooled into a single group.
- When evaluating groupings, care must be taken not to split instrument groups only because they are calibrated on a different time frequency. Differences in variances may be indicative of a time dependent component to the device drift. The separation of these groups may mask a time-dependency for the component drift.
- A t-Test (two samples assuming unequal variances) should also be performed on the proposed components to be grouped. The t-Test returns the probability associated with a Student's t-Test to determine whether two samples are likely to have come from the same two underlying populations that have unequal variances. If for example, the proposed group contains 5 sub-groups, the t-Tests should be performed on all possible combinations for the groupings. However, if there is no plausible engineering explanation for the two sets of data being incompatible, the groups should be combined, despite the results of the t-Test. The following formula is used to determine the test statistic value t.

$$t = \frac{\bar{x}_1 - \bar{x}_2 - \Delta_0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$ (Ref. 7.3.1)

Where ;

t - test statistic

n - Total number of data points

x - Mean of the samples

s^2 - Pooled variance

Δ_0 - Hypothesized mean difference

The following formula is used to estimate the degrees of freedom (df) for the test statistic.

$$df = \frac{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2 - 1}}$$

Where;

Values are as previously defined.

The t-Test may be performed using the t-Test: Two-Sample Assuming Unequal Variances analysis tool within Microsoft Excel. The Microsoft Excel output will look similar to the following:

t-Test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	-0.017045	0.08413462
Variance	0.1008523	0.31185697
Observations	11	26
Hypothesized Mean Difference	0	
df	32	
t Stat	-0.695517	
P(T<=t) one-tail	0.245876	
t Critical one-tail	1.6938887	
P(T<=t) two-tail	0.4917521	
t Critical two-tail	2.0369333	

A comparison is made to determine whether the proposed groups of data can be combined for analysis. The t distribution is two-sided in this case, and therefore the t Critical two-tail is used as the criterion. If the absolute value of the t statistic (t Stat) is less than the t Critical two-tail value, then the data can be considered to have very similar means, and can be considered acceptable for combination on that basis.

3.5.5. Examples of Proven Groupings:

- All control room indicators receiving a 4-20mAdc (or 1-5Vdc) signal. Notice that a combined grouping may be possible even though the indicators have different indication spans. For example, a 12 mAdc signal should move the indicator pointer to the 50% of span position on each indicator scale, regardless of the span indicated on the face plate (exceptions are non-linear meter scales).
- All control room bistables of similar make or model tested quarterly for Technical Specification surveillance. Note that this assumes that all bistables are tested in a similar manner and have the same input range, e.g., a 1-5Vdc or 4-20mAdc spans.
- A specific type of pressure transmitter used for similar applications in the plant in which the operating and calibration environment does not vary significantly between applications or location.

- A group of transmitters of the same make and model, but with different spans, given that a review confirms that the transmitters of different spans have similar performance characteristics.

3.5.6. Using Data from Other Nuclear Power Plants:

- It is acceptable, although not recommended, to pool CNS specific data with data obtained from other nuclear power plants, providing the data can be verified to be of high quality. In this case the data must also be verified to be acceptable for grouping. Acceptability may be defined by verification of grouping, and an evaluation of calibration procedure methods, Measurement and Test Equipment used, and defined setting tolerances. Where there is agreement in calibration method (for instance, starting at zero increasing to 100 percent and decreasing to zero, taking data every 25%), calibration equipment, and area environment (if performance is affected by the temperature), there is a good possibility that the groups may be combined. Previously collected industry data may not have sufficient information about the manner of collection to allow combination with plant specific data.

3.6. Outlier Analysis

An outlier is a data point significantly different in value from the rest of the sample. The presence of an outlier or multiple outliers in the sample of component or group data may result in the calculation of a larger than expected sample standard deviation and tolerance interval. Calibration data can contain outliers for several reasons. Outlier analyses can be used in the initial analysis process to help to identify problems with data that require correction. Examples include:

- *Data Transcription Errors* - Calibration data can be recorded incorrectly either on the original calibration data sheet or in the spreadsheet program used to analyze the data.
- *Calibration Errors* - Improper setting of a device at the time of calibration would indicate larger than normal drift during the subsequent calibration.
- *Measuring & Test Equipment Errors* - Improperly selected or mis-calibrated test equipment could indicate drift, when little or no drift was actually present.
- *Scaling or Setpoint Changes* - Changes in scaling or setpoints can appear in the data as larger than actual drift points unless the change is detected during the data entry or screening process.
- *Failed Instruments* - Calibrations are occasionally performed to verify proper operation due to erratic indications, spurious alarms, etc. These calibrations may be indicative of component failure (not drift), which would introduce errors that are not representative of the device performance during routine conditions.
- *Design or Application Deficiencies* - An analysis of calibration data may indicate a particular component that always tends to drift significantly more than all other similar components installed in the plant. In this case, the component may need an evaluation for the possibility of a design, application, or installation problem. Including this particular component in the same population as the other similar components may skew the drift analysis results.

3.6.1. Detection of Outliers

There are several methods for determining the presence of outliers. This design guide utilizes the Critical Values for t-Test (Extreme Studentized Deviate). The t-Test utilizes the values listed in Table 2 with an upper significance level of 5% to compare a given data point against. Note that the critical value of t increases as the sample size increases. This signifies that as the sample size grows, it is more likely that the sample is truly representative of the population. The t-Test assumes that the data is normally distributed.

Table 2 - Critical Values for t-Test

Sample Size	Upper 5% Significance Level	Sample Size	Upper 5% Significance Level
≤ 3	1.15	22	2.60
4	1.46	23	2.62
5	1.67	24	2.64
6	1.82	25	2.66
7	1.94	≤ 30	2.75
8	2.03	≤ 35	2.82
9	2.11	≤ 40	2.87
10	2.18	≤ 45	2.92
11	2.23	≤ 50	2.96
12	2.29	≤ 60	3.03
13	2.33	≤ 70	3.09
14	2.37	≤ 75	3.10
15	2.41	≤ 80	3.14
16	2.44	≤ 90	3.18
17	2.47	≤ 100	3.21
18	2.50	≤ 125	3.28
19	2.53	≤ 150	3.33
20	2.56	>150	4.00
21	2.58		

3.6.2. t-Test Outlier Detection Equation

$$t = \frac{|x_i - \bar{x}|}{s}$$ (Ref. 7.1.1)

Where;

X_i - An individual sample data point

$\overline{X}$ - Mean of all sample data points

s - Standard deviation of all sample data points

t - Calculated value of extreme studentized deviate that is compared to the critical value of t for the sample size.

3.6.3. Outlier Expulsion

This design guide does not permit multiple outlier tests or passes. The removal of poor quality data as listed in Section 3.6 is not considered removal of outliers, since it is merely assisting in identifying data errors. However, after removal of poor quality data as listed in Section 3.6, certain data points can still appear as outliers when the outlier analysis is performed. These "unique outliers" are not consistent with the other data collected; and could be judged as erroneous points, which tend to skew the representation of the distribution of the data. However, for the general case, since these outliers may accurately represent instrument performance, only one (1) additional unique outlier (as indicated by the t-Test), may be removed from the drift data. After removal of poor quality data and the removal of the unique outlier (if necessary), the remaining drift data is known as the Final Data Set.

For transmitters or other devices with multiple calibration points, the general process is to use the calibration point with the worst-case drift values. This is determined by comparing the different calibration points and using the one with the largest error, determined by adding the absolute value of the drift mean to 2 times the drift standard deviation. The data set with the largest of those terms is used throughout the rest of the analysis, after outlier removal, as the Final Data Set. (Note that it is possible to use a specific calibration point and neglect the others, only if that is the single point of concern for application of the results of the Drift Calculation. If so, this fact should be stated boldly in the results / conclusions of the calculation.)

The data set basic statistics (i.e., the Mean, Median, Standard Deviation, Variance, Minimum, Maximum, Kurtosis, Skewness, Count and Average Time Interval between Calibrations) should be computed and displayed for the data set prior to removal of the unique outlier and for the Final Data Set, if different.

3.7. Methods for Verifying Normality

A test for normality can be important because many frequently used statistical methods are based upon an assumption that the data is normally distributed. This assumption applies to the analysis of component calibration data also. For example, the following analyses may rely on an assumption that the data is normally distributed:

- Determination of a tolerance interval that bounds a stated proportion of the population based on calculation of mean and standard deviation
- Identification of outliers
- Pooling of data from different samples into a single population

The normal distribution occurs frequently and is an excellent approximation to describe many processes. Testing the assumption of normality is important to confirm that the data appears to fit the model of a normal distribution, but the tests do not prove that the normal distribution is a correct model for the data. At best, it can only be found that the data is reasonably consistent with the characteristics of a normal distribution, and that the treatment of a distribution as normal is conservative. For example, some tests for normality only allow the rejection of the hypothesis that the data is normally distributed. A group of data passing the test does not mean the data is normally distributed; it only means that there is no evidence to say that it is not normally distributed. However, because of the wealth of industry evidence that drift can be conservatively represented by a normal distribution, a group of data passing these tests is considered as normally distributed without adjustments to the standard deviation of the data set.

Distribution-free techniques are available when the data is not normally distributed; however, these techniques are not as well known and often result in penalizing the results by calculating tolerance intervals that are substantially larger than the normal distribution equivalent. Because of this fact, there is a good reason to demonstrate that the data is normally distributed or can be bounded by the assumption of normality.

Analytically verifying that a sample appears to be normally distributed usually invokes a form of statistics known as hypothesis testing. In general, a hypothesis test includes the following steps:

1) Statement of the hypothesis to be tested and any assumptions
2) Statement of a level of significance to use as the basis for acceptance or rejection of the hypothesis
3) Determination of a test statistic and a critical region
4) Calculation of the appropriate statistics to compare against the test statistic
5) Statement of conclusions

The following sections discuss various ways in which the assumption of normality can be verified to be consistent with the data or can be claimed to be a conservative representation of the actual data. Analytical hypothesis testing and subjective graphical analyses are discussed. If the analytical hypothesis test (either Chi-Squared or D Prime / W Test) are passed, the coverage analysis and additional graphical analyses are not required. Generally, only a single hypothesis test should be performed on a given data set. Because of the consistent approach given for the D Prime and W tests from Reference 7.1.4, these tests are recommended. However, use of the Chi-Squared test is allowed in place of the D Prime or W Test, if desired. The following are descriptions of the methods for assessing normality.

3.7.1. Chi-Squared, x^2, Goodness of Fit Test

This well-known test is stated as a method for assessing normality in References 7.1.1 and 7.1.2. The x^2 test compares the actual distribution of sample values to the expected distribution. The expected values are calculated by using the normal mean and standard deviation for the sample. If the distribution is normally or approximately normally distributed, the difference between the actual versus expected values should be very small. And, if the distribution is not normally distributed, the differences should be significant.

3.7.1.1. Equations to Perform the x^2 Test

1) First calculate the mean for the sample group

$$\overline{X} = \frac{\sum X_i}{n} \qquad \text{(Ref. 7.1.1)}$$

Where;

X_i - An individual sample data point

$\overline{X}$ - Mean of all sample data points

n - Total number of data points

2) Second calculate the standard deviation for the sample group

$$s = \sqrt{\frac{n\sum x^2 - (\sum x)^2}{n(n-1)}} \qquad \text{(Ref. 7.1.1)}$$

Where;

x - Sample data values (x1, x2, x3, ...)

s - Standard deviation of all sample data points

n - Total number of data points

3) Third the data must be divided into bins to aid in determination of a normal distribution. The number of bins selected is up to the individual performing the analysis. Refer to Reference 7.1.1 for further guidance. For most applications, a 12-bin analysis is performed on the drift data. See Section 4.4.

4) Fourth calculate the x^2 value for the sample group

$$x^2 = \sum \frac{(O_i - E_i)^2}{E_i} \qquad E_i = NP_i \qquad \text{(Ref. 7.1.1)}$$

Where;

E_i - Expected values for the sample
N - Total number of samples in the population
P_i - Probability that a given sample is contained in a bin
O_i - Observed sample values (O_1, O_2, O_3, ...)
x^2 - Chi squared result

5) Fifth, calculate the degrees of freedom. The degrees of freedom term is computed as the number of bins used for the chi-square computation minus the constraints. In all cases for these Drift Calculations, since the count, mean and standard deviation are computed, the constraints term is equal to three.

6) Sixth, compute the Chi squared per degree of freedom term (X_0^2). This term is merely the Chi squared term computed in step 4 above, divided by the degrees of freedom.

7) Finally, evaluate the results. The results are evaluated in the following manner, as prescribed in Reference 7.1.1. If the Chi squared result computed in step 4 is less than or equal to the degrees of freedom, the assumption that the distribution is normal is not rejected. If the value from step 4 is greater than the degrees of freedom, then one final check is made. The degrees of freedom and X_0^2 are used to look up the probability of obtaining a X_0^2 term greater than the observed value, in percent. (See Table C-3 of Reference 7.1.1.) If the lookup value is greater than or equal to 5%, then the assumption of normality is not rejected. However, if the lookup value is less than 5%, the assumption of normality is rejected.

3.7.2. W Test

Reference 7.1.4 recommends this test for sample sizes less than or equal to 50. The W Test calculates a test statistic value for the sample population and compares the calculated value to the critical values for W, which are tabulated in Reference 7.1.4. The W Test is a lower-tailed test. Thus if the calculated value of W is less than the critical value of W, the assumption of normality would be rejected at the stated significance level. If the calculated value of W is larger than the critical value of W, there is no evidence to reject the assumption of normality. Reference 7.1.4 establishes the methods and equations required for performing a W Test.

3.7.3. D-Prime Test

Reference 7.1.4 recommends this test for moderate to large sample sizes, greater than 50. The D′ Test calculates a test statistic value for the sample population and compares the calculated value to the values for the D′ percentage points of the distribution, which are tabulated in Reference 7.1.4. The D′ Test is two-sided, which means that the two-sided percentage limits at the stated level of significance must envelop the calculated D′ value. For the given sample size, the calculated value of D′ must lie within the two values provided in the Reference 7.1.4 table in order to accept the hypothesis of normality.

3.7.3.1. Equations to Perform the D′ Test

1) First, calculate the linear combination of the sample group. (Note: Data must be placed in ascending order of magnitude, prior to the application of this formula.)

$$T = \Sigma\left[\left(i - \frac{n+1}{2}\right) \times x_i\right] \qquad \text{(Ref. 7.1.4)}$$

Where;

T - Linear combination

x_i - An individual sample data point

i - The number of the sample point

n - Total number of data points

2) Second, calculate the S^2 for the sample group.

$$S^2 = (n-1)s^2 \qquad \text{(Ref. 7.1.4)}$$

Where;

S^2 - Sum of the Squares about the mean

s^2 - Unbiased estimate of the sample population variance

n - Total number of data points

3) Third, calculate the D′ value for the sample group.

$$D' = \frac{T}{S} \qquad \text{(Ref. 7.1.4)}$$

4) Finally, evaluate the results. If the D' value lies within the acceptable range of results (for the given data count) per Table 5 of Reference 7.1.4, for columns showing Probability (P) = 0.025 and 0.975, then the assumption of normality is not rejected. (These values of P were chosen to obtain a 5% significance, α, for the test.) (If the exact data count is not contained within the tables, the critical value limits for the D' value should be linearly interpolated to the correct data count.) If however, the value lies outside that range, the assumption of normality is rejected.

3.7.4. Probability Plots

For most Drift Calculations performed per this methodology, probability plots will not be included, since numerical methods or coverage analyses are recommended. However, probability plots are discussed, since a graphical presentation of the data can sometimes reveal possible reasons for why the data is or is not normal. A probability plot is a graph of the sample data with the axes scaled for a normal distribution. If the data is normal, the data tends to follow a straight line. If the data is non-normal, a nonlinear shape should be evident from the graph. This method of normality determination is subjective, and is not required if the numerical method shows the data to be normal, or if a coverage analysis is used. The types of probability plots used by this design guide are as follows:

- *Cumulative Probability Plot* - an XY scatter plot of the Final Data Set plotted against the percent probability (P_i) for a normal distribution. P_i is calculated using the following equation:

$$P_i = \frac{100 \times \left(i - \frac{1}{2}\right)}{n} \qquad \text{(Ref. 7.1.1)}$$

where; i = sample number i.e. 1,2,...
n = sample size

NOTE: Refer, as necessary, to Appendix C Section C.4 of Reference 7.1.1.

- *Normalized Probability Plot* - an XY scatter plot of the Final Data Set plotted against the probability for a normal distribution, expressed in multiples of the standard deviation.

3.7.5. Coverage Analysis

A coverage analysis is recommended for cases in which the hypothesis tests reject the assumption of normality, but the assumption of normality is still a conservative representation of the data. The coverage analysis involves the use of a histogram of the Final Data Set, overlaid with the equivalent probability distribution curve for the normal distribution, based on the data sample's mean and standard deviation.

Visual examination of the plot is used to determine if the distribution of the data is near normal, or if a normal distribution model for the data would adequately cover the data within the 2 sigma limits. Another measure of the conservatism in the use of a normal distribution as a model is the kurtosis of the data. Reference 7.1.1 states that samples that have a large value of kurtosis are the most likely candidates for a coverage analysis. Kurtosis characterizes the relative peakedness or flatness of the distribution compared to the normal distribution, and is readily calculated within statistical and spreadsheet programs. As shown in Reference 7.1.1, a positive kurtosis indicates a relatively high peaked distribution, and a negative kurtosis indicates a relatively flat distribution, with respect to the normal distribution.

If the data is near normal or is more peaked than a normal distribution (positive kurtosis), then a normal distribution model is derived, which adequately covers the set of drift data, as observed. This normal distribution is used as the model for the drift of the device. Sample counting is used to determine an acceptable normal distribution model. The Standard Deviation of the group is computed. The number of samples that are within ± two Standard Deviations of the mean is computed. The count is divided by the total number of samples in the group to determine a percentage. The following table provides the percentage that should fall within the two Standard Deviation values for a normal distribution.

Table 3 – Population Percentage for a Normal Distribution

	Percentage for a Normal Distribution
2 Standard Deviations	95.45%

If the percentage of data within the two standard deviations tolerance is greater than the value in Table 3 for a given data set, the existing standard deviation is acceptable to be used for the encompassing normal distribution model. However, if the percentage is less than required, the standard deviation of the model is enlarged, such that greater than or equal to the required percentage falls within the ± two Standard Deviations bounds. The required multiplier for the standard deviation in order to provide this coverage is termed the Normality Adjustment Factor (NAF). If no adjustment is required, the NAF is equal to one (1).

3.8. Binomial Pass/Fail Analysis For Distributions Considered Not To Be Normal

A pass/fail criteria for component performance simply compares the As-Found versus As-Left surveillance drift data against a pre-defined acceptable value of drift. If the drift value is less than the pass/fail criteria, that data point passes; if it is larger than the pass/fail criteria, it fails. By comparing the total number of passes to the number of failures, a probability can be computed for the expected number of component passes in the population. Note that the term failure in this instance does not mean that the component actually failed, only that it exceeded the selected pass/fail criteria for the analysis. Often the pass/fail criteria will be established at a point that clearly demonstrates acceptable component performance. The equations used to determine the Failure Proportion, Normal, Minimum and Maximum Probabilities are as follows:

Failure Proportion

P_f = x/n where;

x = Number of values exceeding the pass/fail criteria (Failures) (Ref. 7.1.1)

n = Total number of drift values in the sample

Normal Probability that a value will pass

P = 1-P_f (Ref. 7.1.1)

Minimum Probability that a value will pass

$$P_l = 1 - \frac{x}{n} - z \times \sqrt{\left(\frac{1}{n}\right) \times \left(\frac{x}{n}\right) \times \left(1 - \frac{x}{n}\right)}$$ (Ref. 7.1.1)

Maximum Probability that a value will pass

$$P_u = 1 - \frac{x}{n} + z \times \sqrt{\left(\frac{1}{n}\right) \times \left(\frac{x}{n}\right) \times \left(1 - \frac{x}{n}\right)}$$ (Ref. 7.1.1)

where;

P_l = the minimum probability that a value will pass

P_u = the maximum probability that a value will pass

z = the standardized normal distribution value corresponding to the desired confidence level, e.g., z = 1.96 for a 95% confidence level.

The Binomial Pass/Fail Analysis is a good tool for verifying that drift values calculated for calibration extensions are appropriate for the interval. See Reference 7.1.1 for the necessary detail to perform a pass/fail analysis.

3.9. Time-Dependent Drift Analysis

The component/loop drift calculated in the previous sections represented a predicted performance limit, without any consideration of whether the drift may vary with time between calibrations or component age. This section discusses the importance of understanding the time-related performance and the impact of any time-dependency on an analysis. Understanding the time dependency can be either important or unimportant, depending on the application. A time dependency analysis is important whenever the drift analysis results are intended to support an extension of calibration intervals.

3.9.1. Limitations of Time Dependency Analyses

Reference 7.1.1 performed drift analysis for numerous components at several nuclear plants as part of the project. The data evaluated did not demonstrate any significant time-dependent or age-dependent trends. Time dependency may have existed in all of the cases analyzed, but was insignificant in comparison to other uncertainty contributors. Because time dependency cannot be completely ruled out, there should be an ongoing evaluation to verify that component drift continues to meet expectations whenever calibration intervals are extended.

3.9.2. Scatter (Drift Interval) Plot

A drift interval plot is an XY scatter plot that shows the Final Data Set plotted against the time interval between tests for the data points. This plot method relies upon the human eye to discriminate the plot for any trend in the data to exhibit time dependency. A prediction line can be added to this plot which shows a "least squares" fit of the data over time. This can provide visual evidence of an increasing or decreasing mean over time, considering all drift data. An increasing standard deviation is indicated by a trend towards increasing "scatter" over the increased calibration intervals.

3.9.3. Standard Deviations and Means at Different Calibration Intervals (Binning Analysis)

This analysis technique is the most recommended method of determining time dependent tendencies in a given sample pool. (See Reference 7.1.1.) The test consists simply of segregating the drift data into different groups (Bins) corresponding to different ranges of calibration or surveillance intervals and comparing the standard deviations and means for the data in the various groups. The purpose of this type of analysis is to determine if the standard deviation or mean tends to become larger as the time interval between calibrations increases.

3.9.3.1. The available data is placed in interval bins. The intervals normally used at CNS coincide with Technical Specification calibration intervals plus the allowed tolerance as follows:

a. 0 to 45 days (covers most weekly and monthly calibrations)

b. 46 to 135 days (covers most quarterly calibrations)

c. 136 to 230 days (covers most semi-annual calibrations)

d. 231 to 460 days (covers most annual calibrations)

e. 461 to 690 days (covers most 18 month refuel cycle calibrations)

f. 691 to 915 days (covers most extended refuel cycle calibrations)

g. > 915 days covers missed and forced outage refueling cycle calibrations.

Data will naturally fall into these time interval bins based on the calibration requirements for the subject instrument loops. Only on occasion will a device be calibrated on a much longer or shorter interval than that of the rest of the population within its calibration requirement group. Therefore, the data will naturally separate into groups for analysis.

3.9.3.2. Although not generally recommended, different bin splits could be used, but must be evaluated for data coverage, significant diversity in calibration intervals, and acceptable data groupings.

3.9.3.3. For each bin where there is data, the mean (average), standard deviation, average time interval and data count will be computed.

3.9.3.4. To determine if time dependency does or does not exist, the data must be distributed across multiple bins, with a sufficient population of data in each of two or more bins, to consider the statistical results for those bins to be valid. Normally the minimum expected distribution that would allow evaluation is defined below.

a. A bin is considered valid in the final analysis if it holds more than five data points and more than ten percent of the total data count.
b. At least two bins, including the bin with the most data, must be left for evaluation to occur.

The distribution percentages listed in these criteria are somewhat arbitrary, and thus engineering evaluation can modify them for a given situation.

The mean and standard deviations of the valid bins are plotted versus average time interval on a diagram. This diagram can give a good visual indication of whether or not the mean or standard deviation of a data set is increasing significantly over time interval between calibrations.

If the binning analysis plot shows an increase in standard deviation over time, the critical value of the F-distribution is compared to the ratio of the smallest and largest variances for the evaluated bins. If the ratio of variances exceeds the critical value, this result is indicative of time dependency for the random portion of drift. Likewise, a ratio of variances not exceeding the critical value is not indicative of significant time dependency.

NOTE: If multiple valid bins do NOT exist for a given data set, then the plot is not to be shown, and the regression analyses are not to be performed. The reasoning is that there is not enough diversity in the calibration intervals analyzed to make meaningful conclusions about time dependency from the existing data. Unless overwhelming evidence to the contrary exists in the scatter plot, the single bin data set is treated as moderately time dependent for the purposes of extrapolation of the drift value.

3.9.4. Regression Analyses and Plots

Regression Analyses can often provide very valuable data for the determination of time dependency. A standard regression analysis within an EXCEL spreadsheet can plot the drift data versus time, with a prediction line showing the trend. It can also provide Analysis of Variance (ANOVA) table printouts, which contain information required for various numerical tests to determine level of dependency between two parameters (time and drift value). Note that regression analyses are only to be performed if multiple valid bins are determined from the binning analysis.

Regression Analyses are to be performed on the Final Data Set drift values and on the Absolute Value of the Final Data Set drift values. The Final Data Set drift values show trends for the mean of drift, and the Absolute Values show trends for the standard deviation over time.

Regression Plots

The following are descriptions of the two plots generated by these regressions.

- *Drift Regression* - an XY scatter plot that fits a line through the final drift data, plotted against the time interval between tests for the data points, using the "least squares" method to predict values for the given data set. The predicted line is plotted through the actual data for use in predicting drift over time. It is important to note that statistical outliers can have a dramatic effect upon the regression line.
- *Absolute Value Drift Regression* - an XY scatter plot that fits a line through the Absolute Value of the final drift data, plotted against the time interval between tests for the data points, using the "least squares" method to predict values for the given data set. The predicted line is plotted through the actual data for use in predicting drift, in either direction, over time. It is important to note that statistical outliers can have a dramatic effect upon the regression line.

Regression Time Dependency Analytical Tests

Typical spreadsheet software includes capabilities to include ANOVA tables with regression analyses. ANOVA tables give various statistical data, which can allow certain numerical tests to be employed, to search for time dependency. For each of the two regressions (drift regression and absolute value drift regression), the following ANOVA parameters are used to determine if time dependency of the drift data is evident. All tests listed should be evaluated, and if time dependency is indicated by any of the tests, the data should be considered as time dependent.

- *R Squared Test* - The R Squared value, printed out in the ANOVA table, is a relatively good indicator of time dependency. If the value is greater than 0.09 (thereby indicating the R value greater than 0.3), then it appears that the data closely conforms to a linear function, and therefore, should be considered time dependent.
- *P Value Test* - A P Value for X Variable 1 (as indicated by the ANOVA table for an EXCEL spreadsheet) less than 0.05 is indicative of time dependency.
- *Significance of F Test* - An ANOVA table F value greater than the critical F-table value would indicate a time dependency. In an EXCEL spreadsheet, the FINV function can be used to return critical values from the F distribution. To return the critical value of F, use the significance level (in this case 0.05 or 5.0%) as the probability argument to FINV, 2 as the numerator degrees of freedom, and the data count minus two as the denominator. If the F value in the ANOVA table exceeds the critical value of F, then the drift is considered time dependent.

NOTE: For each of these tests, if time dependency is indicated, the plots should be observed to determine the reasonableness of the result. The tests above generally assess the possibility that the function of drift is linear over time, not necessarily that the function is significantly increasing over time. Time dependency can be indicated even when the plot shows the drift to remain approximately the same or decrease over time. Generally, a decreasing drift over time is not expected for instrumentation, nor is a case where the drift function crosses zero. Under these conditions, the extrapolation of the drift term would normally be established assuming no time dependency, if extrapolation of the results is required beyond the analyzed time intervals between calibrations.

3.9.5. Additional Time Dependency Analyses

- *Instrument Resetting Evaluation* - For data sets that consist of a single calibration interval the time dependency determination may be accomplished simply by evaluating the frequency at which instruments require resetting. This type of analysis is particularly useful when applied to extend quarterly Technical Specification surveillances to semi-annual. However, this type of analysis is less useful for instruments such as sensors or relays that may be reset at each calibration interval, regardless of whether the instrument was already in calibration.

  The Instrument Resetting Evaluation may be performed only if the devices in the sample pool are shown to be stable, not requiring adjustment (i.e. less than 5% of the data shows that adjustments were made). Care also must be taken when mechanical connections or flex points may be exercised by the act of checking calibration (actuation of a bellows or switch movement), where the act of checking the actuation point may have an effect on the next reading. Methodology for calculating the drift is as follows:

  Quarterly As-Found/As-Left

  (As-Found Current Calibration - As-Left Previous Calibration) or $AF_1 - AL_2$ (Ref. 7.1.1)

  Semi-Annual As-Found/As-Left using Monthly Data

  $(AF_1 - AL_2) + (AF_2 - AL_3)$ (Ref. 7.1.1)

3.9.6. Age-Dependent Drift Considerations

Age-dependency is the tendency for a component's drift to increase in magnitude as the component ages. This can be assessed by plotting the As-Found value for each calibration minus the previous calibration As-Left value of each component over the period of time for which data is available. Random fluctuations around zero may obscure any age-dependent drift trends. By plotting the absolute values of the As-Found versus As-Left calibration data, the tendency for the magnitude of drift to increase with time can be assessed. This analysis is generally not performed as a part of a standard Drift Calculation, but can be used, if desired, when establishing maintenance practices.

3.10. Calibration Point Drift

For devices with multiple calibration points (e.g., transmitters, indicators, etc.) the Drift-Calibration Point Plot is a useful tool for comparing the amount of drift exhibited by the group of devices at the different calibration points. The plot consists of a line graph of tolerance interval as a function of calibration point. This is useful to understand the operation of an instrument, but is not normally included as a part of a standard Drift Calculation.

3.11. Drift Bias Determination

If an instrument or group of instruments consistently drifts predominately in one direction, the drift is assumed to have a bias. The application of a significant bias must be considered separately, so that the overall treatment of the analyzed drift remains conservative. Based on Sections 3.5 and 3.5.2 of Reference 7.3.2, a method is used to assess whether or not a significant bias exists for the drift data, based on the relative magnitudes of the mean and standard deviation and the sample size. Specifically, when the absolute value of the calculated average for the sample pool exceeds a critical value (x_{crit}), the average is treated as a bias to the drift term. Otherwise, the drift bias term is considered insignificant and is not considered further in the drift analysis.

The critical value (x_{crit}) for a given standard deviation (s) and sample size (n) is calculated using the following formula:

$$x_{crit} = t_{0.025,df} \times \frac{s}{\sqrt{n}} \qquad \text{(Ref. 7.3.2)}$$

Where;

X_{crit} = Maximum value of non-biased mean for a given s & n

$t_{.025,df}$ = Normal Deviate for a single-sided t-distribution @ 0.025 for 95% Confidence (See Table 4)

s = Standard Deviation of sample pool

n = Sample pool size

df = Degrees of Freedom = n – 1

The normal deviate (t) can be looked up for a given value of degrees of freedom, or it can be generated automatically, utilizing the TINV function within Microsoft Excel, as follows.

$t_{.025,df}$ = TINV (0.05, df)

Note that the probability listed within the parentheses is 0.05 instead of 0.025 because the function returns the normal deviate for a double-sided distribution. In order to attain the value for a single-sided distribution, the probability is doubled, per the description of the function within Microsoft Excel.

The following are excerpts from the Microsoft Excel "Help" function:

> TINV(probability,degrees_freedom)
>
> Probability is the probability associated with the two-tailed Student's t-distribution.
>
> Degrees_freedom is the number of degrees of freedom with which to characterize the distribution.
>
> A one-tailed t-value can be returned by replacing probability with 2*probability. For a probability of 0.05 and degrees of freedom of 10, the two-tailed value is calculated with TINV(0.05,10), which returns 2.28139. The one-tailed value for the same probability and degrees of freedom can be calculated with TINV(2*0.05,10), which returns 1.812462.

The values within Table 4 were generated from the TINV function within Microsoft Excel and have been verified to be consistent with the values from Table V of Reference 7.3.2. Therefore, they are acceptable for use in drift analyses.

Table 4 – Percentiles of the t Distribution ($t_{0.025,df}$)

Degrees of Freedom (df)	Normal Deviate (t) @ 0.025 for 95% Confidence	Degrees of Freedom (df)	Normal Deviate (t) @ 0.025 for 95% Confidence	Degrees of Freedom (df)	Normal Deviate (t) @ 0.025 for 95% Confidence
1	12.706	42	2.018	83	1.989
2	4.303	43	2.017	84	1.989
3	3.182	44	2.015	85	1.988
4	2.776	45	2.014	86	1.988
5	2.571	46	2.013	87	1.988
6	2.447	47	2.012	88	1.987
7	2.365	48	2.011	89	1.987
8	2.306	49	2.010	90	1.987
9	2.262	50	2.009	91	1.986
10	2.228	51	2.008	92	1.986
11	2.201	52	2.007	93	1.986
12	2.179	53	2.006	94	1.986
13	2.160	54	2.005	95	1.985
14	2.145	55	2.004	96	1.985
15	2.131	56	2.003	97	1.985
16	2.120	57	2.002	98	1.984
17	2.110	58	2.002	99	1.984
18	2.101	59	2.001	100	1.984
19	2.093	60	2.000	101	1.984
20	2.086	61	2.000	102	1.983
21	2.080	62	1.999	103	1.983
22	2.074	63	1.998	104	1.983
23	2.069	64	1.998	105	1.983
24	2.064	65	1.997	106	1.983
25	2.060	66	1.997	107	1.982
26	2.056	67	1.996	108	1.982
27	2.052	68	1.995	109	1.982
28	2.048	69	1.995	110	1.982
29	2.045	70	1.994	111	1.982
30	2.042	71	1.994	112	1.981
31	2.040	72	1.993	113	1.981
32	2.037	73	1.993	114	1.981
33	2.035	74	1.993	115	1.981
34	2.032	75	1.992	116	1.981
35	2.030	76	1.992	117	1.980
36	2.028	77	1.991	118	1.980
37	2.026	78	1.991	119	1.980
38	2.024	79	1.990	120	1.980
39	2.023	80	1.990	>120	1.960
40	2.021	81	1.990		
41	2.020	82	1.989		

Examples of determining and applying bias to the analyzed drift term:

1) Transmitter Group With a Biased Mean - A group of transmitters are calculated to have a standard deviation of 1.150%, mean of - 0.355% with a count of 47. The degrees of freedom are 46. From Table 4, the t value is 2.013. Therefore, x_{crit} is computed as:

$$x_{crit} = t \times \frac{s}{\sqrt{n}} = 2.013 \times \frac{1.150\%}{\sqrt{47}} = 0.338\%$$

Therefore, the mean value is significant because the absolute value of it is larger than x_{crit}, and the bias must be considered. The analyzed drift term for a 95%/95% tolerance interval level is shown as follows.

DA = - 0.355% ± 1.150% x 2.408 (TIF from Table 1 for 47 samples)
DA = - 0.355% ± 2.769%

For conservatism, the DA term for the positive direction is not reduced by the bias value where as the negative direction is summed with the bias value.

DA = + 2.769%, - 3.124%.

2) Transmitter Group With a Non-Biased Mean - A group of transmitters are calculated to have a standard deviation of 1.150%, mean of 0.100% with a count of 47. The degrees of freedom are 46. From Table 4, the t value is 2.013. Therefore, x_{crit} is computed as:

$$x_{crit} = t \times \frac{s}{\sqrt{n}} = 2.013 \times \frac{1.150\%}{\sqrt{47}} = 0.338\%$$

Therefore, the absolute value of the mean value is less than x_{crit}. Therefore, the bias is insignificant, and can be neglected. The analyzed drift term for a 95%/95% tolerance interval level is shown as follows.

DA = ± 1.150% x 2.408 (TIF from Table 1 for 47 samples)
DA = ± 2.769%

3.12. Time Dependent Drift Uncertainty

When calibration intervals are extended beyond the range for which historical data is available, the statistical confidence in the ability to predict drift is reduced. The bias and the random portions of the drift are extrapolated separately, but in the same manner. Where the analysis shows slight to moderate time dependency or time dependency is indeterminate, drift is extrapolated using the Square Root of the Sum of the Squares (SRSS) method per Section 6.2.7 of Reference 7.1.2. This method assumes that the drift to time relationship is not linear. The formula below is used.

$$DA_{Extended} = DA \times \sqrt{\frac{Rqd\_Calibration\_Interval}{Avg\_Bin\_Time\_Interval}}$$

Where: $DA_{Extended}$ = the newly determined, extrapolated Drift Bias or Random Term

DA = the bias or random drift term from the Final Data Set or of the longest-interval, valid time bin from the binning analysis (see note)

Avg_ Bin_Time_Interval = the average observed time interval within the longest-interval, valid time bin from the binning analysis (see note)

Rqd_Calibration_Interval = the worst case calibration interval, once the calibration interval requirement is changed

Note: For conservatism, the largest drift value (DA) of either the Final Data Set or the longest-interval, valid time bin from the binning analysis is used as a starting point for the drift extrapolation. For those cases where no time dependency is apparent from the drift analysis, it is also acceptable to use the maximum observed time interval from the longest-interval, valid time bin from the binning analysis, as a starting point in the extrapolation, as opposed to the average observed time interval. This can be used to reduce over-conservatisms in determining an extrapolated analyzed drift value.

Where there is indication of a strong relationship between drift and time, drift is extrapolated using the linear method per Section 6.2.7 of Reference 7.1.2. The following formula may be used.

$$DA_{Extended} = DA \times \left[\frac{Rqd\_Calibration\_Interval}{Avg\_Bin\_Time\_Interval} \right]$$

Where the terms are the same as defined above.

Where it can be shown that there is no relationship between surveillance interval and drift, the drift value determined may be used for other time intervals, without change. However, for conservatism, due to the uncertainty involved in extrapolation to time intervals outside of the analysis period, drift values that show minimal or no particular time dependency are generally treated as moderately time dependent, for the purposes of the extrapolation.

3.13. Methods of Drift Assessment for Very Low Sample Sizes

Per Section 3.4.2.1, "There is no hard fast number that must be attained for any given pool, but a minimum of 30 drift values must be attained before the drift analysis can be performed without additional justification." When it has been determined that the sample size is small for an instrument group, the first thing which should be considered is increasing the sample size. In order to increase the sample size, more historical data should be collected on the subject devices if possible. Also, other similar devices can be added to the analysis, if they can be shown to be maintained with similar QA control of the calibration processes, and if they meet the requirements to properly pool the drift data, per Section 3.5. It is possible that after obtaining all data possible on certain device types, less than 30 samples will be available for analysis. The following paragraphs provide guidance for assessment of the drift in those circumstances.

Rigorous drift analysis as described in the sections above may be performed for sample sizes as low as 20 data values, with additional justification. The justification is generally based on engineering judgment, which would conclude that the drift analysis would provide a reasonably accurate, but conservative estimate for future performance for the subject devices. The following types of arguments can be made for this engineering judgment; but not all of these are required, and other similar arguments could be made in support of this position.

- All data possible is analyzed from the device type with the level of Quality Assurance treatment.
- The small number of devices in the study limits the AF/AL data available.
- Preliminary analysis of the drift values shows the data to be relatively consistent.
- The data distribution is similar to a normal distribution, per a Histogram plot, as would be expected.

- The method of determining the Analyzed Drift for 20 data values uses a high Tolerance Interval Factor (TIF) for 95/95 confidence, providing the required conservatism for use in setpoint calculations.

The rigorous drift analysis would be comprised of the same components as the others with data counts ≥ 30, but would have the additional justification stated in the assumptions / engineering judgments section of the calculation.

For cases where there is no drift data, manufacturer drift specifications may be extrapolated to a maximum calibration interval of 30 months for use in the setpoint calculations, in accordance with the requirements of References 7.2.2 and 7.2.3. This encompasses the cases where the devices will be replaced prior to, or concurrent with, project implementation; or where the devices have been recently replaced, such that two calibrations have not yet been performed for any of the subject devices.

For those cases where there is a very small sample size (i.e., ≤ 20 drift data values or 20-29 where the data does not appear to be reasonably uniform), a drift assessment should be prepared, based on engineering judgment. The assessment would not include any normality or time dependency evaluations. Within the assessment, all possible drift values from the available AF/AL data are computed. The magnitude of the largest computed drift value is compared to the Square Root of the Sum of the Squares (SRSS) combination of the following terms:

1. Manufacturer Specification for drift,
2. Manufacturer Specification for Reference Accuracy, and
3. Calibration Term, comprised of Measurement & Test Equipment (M&TE), M&TE Standard, and Setting Tolerance

If all of the computed drift values are encompassed by the combined total, the conclusion should be made that the manufacturer specifications are conservative with respect to the observed drift values. For this case, the manufacturer specification for drift should be extrapolated to a maximum calibration interval of 30 months for use in the setpoint calculations, in accordance with the requirements of References 7.2.2 and 7.2.3.

If the comparison within the assessment shows any of the computed drift values to exceed the combined total, an Analyzed Drift value should be derived for use in setpoint calculations, based on engineering judgment. If the device has multiple calibration points, such as a transmitter, the data from the worst case calibration point should be used in the assessment, unless that calibration point has significantly less data values than the other calibration points. (See Section 4.3.4 for the determination of the worst case calibration point.)

Because of the low data count, unless significant evidence to the contrary exists; the drift should be considered random in nature. The drift value chosen for the current calibration interval should be equal to or larger than the following:

1. The magnitude of the worst case drift value observed, and
2. The magnitude of the mean + 2 standard deviations.

The random portion of the drift value chosen for the current calibration interval should be extrapolated to the maximum proposed interval via the equation below.

$$DA_{Extended.random} = DA_{Current.random} \times \sqrt{\frac{Max\_Rqd\_Time\_Interval}{Avg\_Observed\_Time\_Interval}}$$

If the mean value is very large in comparison to the standard deviation, with a significant enough data count (per engineering judgment), then a bias should be used as a portion of the Analyzed Drift. The bias should be set equal to the mean for the current calibration interval.

The bias portion of the drift value chosen for the current calibration interval should be extrapolated to the maximum proposed interval via the equation below.

$$DA_{Extended.bias} = DA_{Current.bias} \times \frac{Max\_Rqd\_Time\_Interval}{Avg\_Observed\_Time\_Interval}$$

3.14. Shelf Life of Analysis Results

Any analysis result based on performance of existing components has a shelf life. In this case, the term "shelf life" is used to describe a period of time extending from the present into the future during which the analysis results are considered valid. Predictions for future component/loop performance are based upon our knowledge of past calibration performance. This approach assumes that changes in component/loop performance occur slowly or not at all over time. For example, if evaluation of the last ten years of data shows the component/loop drift is stable with no observable trend, there is little reason to expect a dramatic change in performance during the next year. However, it is also difficult to claim that an analysis completed today is still a valid indicator of component/loop performance ten years from now. For this reason, the analysis results should be re-verified periodically through an instrument trending program in accordance with Reference 7.1.1. The Analyzed Drift values from the Drift Calculations are to be used by the trending program as thresholds, which will require further investigation if exceeded.

Depending on the type of component/loop, the analysis results are also dependent on the method of calibration, the component/loop span, and the M&TE accuracy. Any of the following program or component/loop changes should be evaluated to determine if they affect the analysis results.

- Changes to M&TE accuracy
- Changes to the component or loop (e.g. span, environment, manufacturer, model, etc.)
- Calibration procedure changes that alter the calibration method

4. PERFORMING AN ANALYSIS

As Found and As Left calibration data for the subject instrumentation is collected from historical calibration records. The collected data is entered into Microsoft Excel spreadsheets, grouped by manufacturer and model number. All data is also entered into an independent software program (such as Quattro Pro, Lotus 1-2-3, or Mathcad), for independent review of certain of the drift analysis functions. The drift analysis is generally performed using EXCEL spreadsheets, but can be performed using other software packages. The discussion provided in this section is to assist in setting up an EXCEL spreadsheet for producing a Drift Calculation.

Microsoft Excel spreadsheets generally compute values to an approximate 15 decimal resolution, which is well beyond any required rounding for engineering analyses. However, for printing and display purposes, most values are displayed to lesser resolution. It is possible that hand computations would produce slightly different results, because of using rounded numbers in initial and intermediate steps, but the Excel computed values are considered highly accurate in comparison. Values with significant differences between the original computations and the computations of the independent verifier are to be investigated to ensure that the Excel spreadsheet is properly computing the required values.

4.1. Populating the Spreadsheet

4.1.1. For a New Analysis

4.1.1.1. The Responsible Engineer determines the component group to be analyzed (e.g., all Rosemount pressure transmitters). The Responsible Engineer should determine the possible sub-groups within the large groupings, which from an engineering perspective, might show different drift characteristics; and therefore, may warrant separation into smaller groups. This determination would involve the manufacturer, model, calibration span, setpoints, time intervals, specifications, locations, environment, etc., as necessary.

4.1.1.2. The Responsible Engineer develops a list of component numbers, manufacturers, models, component types, brief descriptions, surveillance tests, calibration procedures and calibration information (spans, setpoints, etc.).

4.1.1.3. The Responsible Engineer determines the data to be collected, following the guidance of Sections 3.4 through 3.6 of this Design Guide.

4.1.1.4. The Data Entry Person identifies, locates and collects data for the component group to be analyzed (e.g., all Surveillance Tests for the Rosemount pressure transmitters completed to present).

4.1.1.5. The Data Entry Person sorts the data by surveillance test or calibration procedure if more than one test/procedure is involved.

4.1.1.6. The Data Entry Person sequentially sorts the surveillance or calibration sheets descending, by date, starting with the most recent date.

4.1.1.7. The Data Entry Person enters the Surveillance or Calibration Procedure Number, Tag Numbers, Required Trips, Indications or Outputs, Date, As-Found values and As-Left values on the appropriate data entry sheet.

4.1.1.8. The Responsible Engineer verifies the data entered.

4.1.1.9. The Responsible Engineer reviews the notes on each calibration data sheet to determine possible contributors for excluding data. The notes should be condensed and entered onto the EXCEL spreadsheet for the applicable calibration points. Where appropriate and obvious, the Responsible Engineer should remove the data that is invalid for calculating drift for the device.

4.1.1.10.The Responsible Engineer (via the spreadsheet) calculates the time interval for each drift point by subtracting the date from the previous calibration from the date of the subject calibration. (If the measured value is not valid for the As-Left or As-Found calibration information, then the time interval is not required to be computed for this data point.)

4.1.1.11.The Responsible Engineer (via the spreadsheet) calculates the Drift value for each calibration by subtracting the As-Left value from the previous calibration from the As-Found value of the subject calibration. (If the measured value is not valid for the As-Left or As-Found calibration information, then the Drift value is not computed for this data point.)

4.2. Spreadsheet Performance of Basic Statistics

Separate data columns are created for each calibration point within the calibrated span of the device. The % Span of each calibration point should closely match from device to device within a given analysis. Basic statistics include, at a minimum, determining the number of data points in the sample, the average drift, the average time interval between calibrations, standard deviation of the drift, variance of the drift, minimum drift value, maximum drift value, kurtosis, and skewness contained in each data column. This section provides the specific details for using Microsoft Excel. Other spreadsheet, statistical or Math programs that are similar in function, are acceptable for use to perform the data analysis, provided all analysis requirements are met.

4.2.1. Determine the number of data points contained in each column for each initial group by using the "COUNT" function. Example cell format = **COUNT(C2:C133)**. The Count function returns the number of all populated cells within the range of cells C2 through C133.

4.2.2. Determine the average for the data points contained in each column for each initial group by using the "AVERAGE" function. Example cell format = **AVERAGE(C2:C133)**. The Average function returns the average of the data contained within the range of cells C2 through C133. This average is also known as the mean of the data. This same method should be used to determine the average time interval between calibrations.

4.2.3. Determine the standard deviation for the data points contained in each column for each initial group by using the "STDEV" function. Example cell format **=STDEV(C2:C133)**. The Standard Deviation function returns the measure of how widely values are dispersed from the mean of the data contained within the range of cells C2 through C133. Formula used by Microsoft Excel to determine the standard deviation:

STD (Standard Deviation of the sample population): (Ref. 7.3.1)

$$s = \sqrt{\frac{n\sum x^2 - (\sum x)^2}{n(n-1)}}$$

Where;

x - Sample data values (x_1, x_2, x_3, ...)
s - Standard deviation of all sample data points
n - Total number of data points

4.2.4. Determine the variance for the data points contained in each column for each initial group by using the "VAR" function. Example cell format **=VAR(C2:C133)**. The Variance function returns the measure of how widely values are dispersed from the mean of the data contained within the range of cells C2 through C133. Formula used by Microsoft Excel to determine the variance:

VAR (Variance of the sample population): (Ref. 7.3.1)

$$s^2 = \frac{n\sum x^2 - (\sum x)^2}{n(n-1)}$$

Where;

x - Sample data values (x_1, x_2, x_3, ...)
s^2 - Variance of the sample population
n - Total number of data points

4.2.5. Determine the kurtosis for the data points contained in each column for each initial group by using the "KURT" function. Example cell format **=KURT(C2:C133)**. The Kurtosis function returns the relative peakedness or flatness of the distribution within the range of cells C2 through C133. Formula used by Microsoft Excel to determine the kurtosis:

$$KURT = \left\{ \frac{n(n+1)}{(n-1)(n-2)(n-3)} \sum \left(\frac{x_i - \bar{x}}{s} \right)^4 \right\} - \frac{3(n-1)^2}{(n-2)(n-3)} \qquad \text{(Ref. 7.3.1)}$$

Where ;

x - Sample data values (x_1, x_2, x_3, ...)

n - Total number of data points

s - Sample Standard Deviation

4.2.6. Determine the skewness for the data points contained in each column for each initial group by using the "SKEW" function. Example cell format **=SKEW(C2:C133)**. The Skewness function returns the degree of symmetry around the mean of the cells contained within the range of cells C2 through C133. Formula used by Microsoft Excel to determine the skewness:

$$SKEW = \frac{n(n+1)}{(n-1)(n-2)} \sum \left(\frac{x_i - \bar{x}}{s} \right)^3 \qquad \text{(Ref. 7.3.1)}$$

Where;

x - Sample data values (x_1, x_2, x_3, ...)

n - Total number of data points

s - Sample Standard Deviation

4.2.7. Determine the maximum value for the data points contained in each column for each initial group by using the "MAX" function. Example cell format **=MAX(C2:C133)**. The Maximum function returns the largest value of the cells contained within the range of cells C2 through C133.

4.2.8. Determine the minimum value for the data points contained in each column for each initial group by using the "MIN" function. Example cell format **=MIN(C2:C133)**. The Minimum function returns the smallest value of the cells contained within the range of cells C2 through C133.

4.2.9. Determine the median value for the data points contained in each column for each initial group by using the "MEDIAN" function. Example cell format **=MEDIAN(C2:C133)**. The median is the number in the middle of a set of numbers; that is, half the numbers have values that are greater than the median, and half have values that are less. If there is an even number of data points in the set, then MEDIAN calculates the average of the two numbers in the middle.

4.2.10. Where sub-groups have been combined in a data set, and where engineering reasons exist for the possibility that the data should be separated, analyze the statistics and component data of the sub-groups to determine the acceptability for combination.

4.2.11. Perform a t-Test in accordance with step 3.5.4 on each possible sub-group combination to test for the acceptability of combining the data.

Acceptability for combining the data is indicated when the absolute value of the Test Statistic [t Stat] is greater than the [t Critical two-tail]. Example: t Stat for combining sub-group A & B may be 0.703, which is larger than the t Critical two-tail of 0.485. However, as a part of this process, the Responsible Engineer should ensure that the apparent unacceptability for combination does not mask time dependency. In other words, if the only difference in the groupings is that of the calibration interval, the differences in the data characteristics could exist because of time dependent drift. If this is the only difference, the data should be combined, even though the tests show that it may not be appropriate.

4.3. Outlier Detection and Expulsion

Refer to Section 3.6 for a detailed explanation of Outliers.

4.3.1. Obtain the Critical Values for the t-Test from Table 2, which is based on the sample size of the data contained within the specified range of cells. Use the COUNT value to determine the sample size.

4.3.2. Perform the outlier test for all the samples. For any values that show up as outliers, analyze the initial input data to determine if the data is erroneous. If so, remove the data in the earlier pages of the spreadsheet, and re-run all of the analysis up to this point. Continue this process until all erroneous data has been removed.

4.3.3. If appropriate, if any outliers are still displayed, remove the worst-case outlier as a statistical outlier, per step 3.6.3. Once this outlier has been removed (if applicable), the remaining data set is the Final Data Set.

4.3.4. For transmitters, or other devices with multiple calibration points, the general process is to use the calibration point with the worst case drift values. This is determined by comparing the different calibration points and using the one with the largest error, determined by adding the absolute value of the mean to 2 times the standard deviation. The data set with the largest of those terms is used throughout the rest of the analysis, after outlier removal, as the Final Data Set. (Note that it is possible to use a specific calibration point and neglect the others, <u>only</u> if that is the single point of concern for application of the results of the Drift Calculation. If so, this fact should be stated boldly in the results / conclusions of the calculation.)

4.3.5. Recalculate the Average, Median, Standard Deviation, Variance, Minimum, Maximum, Kurtosis, Skewness, Count and Average Time Interval Between Calibrations for the Final Data Set.

4.4. Normality Tests

To test for normality of the Final Data Set, the first step is to perform the required hypothesis testing. For Final Data Sets with more than 50 data points, the hypothesis testing can be performed with either the Chi-Square (Section 3.7.1) or the D-Prime Test (Section 3.7.3). The D-Prime Test is recommended. If the Final Data Set has less than or equal to 50 data points, the W Test (Section 3.7.2) or Chi-Square Test may be used. The W Test is recommended.

If used, the Chi Square test should generally be performed with 12 bins of data, starting from [-∞ to (mean-2.5σ)], and bin increments of 0.5σ, ending at [(mean+2.5σ) to +∞]. (Since the same bins are to be used for the histogram in the coverage analysis, the work for these two tasks may be combined.)

If the assumption of normality is rejected by the numerical test, then a coverage analysis should generally be performed as described in Section 3.7.5. As explained above the for Chi Square test, the coverage analysis and histogram are established with a 12 bin approach unless inappropriate for the application.

If an adjustment is required to the standard deviation to provide a normal distribution that adequately covers the data set, then the required multiplier to the standard deviation (Normality Adjustment Factor (NAF)) is determined iteratively in the coverage analysis. This multiplier produces a normal distribution model for the drift, which shows adequate data population from the Final Data Set within the $\pm$ 2σ bounds of the model.

4.5. Time Dependency Testing

Time dependency testing is only required for instruments for which the calibration intervals are being extended; however, the scatter plot is recommended for information in all Drift Calculations. Time dependency is evaluated through the use of a scatter (drift interval) plot, binning analysis, and regression analyses. The methods for each of these are detailed below.

4.5.1. Scatter Plot

The scatter plot is performed under a new page to the spreadsheet entitled "Scatter Plot" or "Drift Interval Plot". The chart function of EXCEL is used to merely chart the data with the x axis being the calibration interval and the y axis being the drift value for the Final Data Set. The prediction line should be added to the chart, along with the equation of the prediction line. This plot provides visual indication of the trend of the mean, and somewhat obscurely, of any increases in the scatter of the data over time. Note: The trend line should NOT be forced to have a y-intercept value of 0, but should be plotted for the actual drift data only.

4.5.2. Binning Analysis

The binning analysis is performed under a separate page of the EXCEL spreadsheet. The Final Data Set is split by bins 1 through 8 into the time intervals as defined in Section 3.9.3.1. A table is set up to compute the standard deviation, mean, average time interval, and count of the data in each time bin. Similar equation methods are used here as described in Section 4.2, when characterizing the drift data set. Another table is used to evaluate the validity of the bins, based on population per the criteria of Section 3.9.3.4. If multiple valid bins are not established, the time dependency analysis stops here, and no regression analyses are performed.

If multiple valid bins are established, the standard deviations, means and average time intervals are tabulated, and a plot is generated to show the variation of the bin averages and standard deviations versus average time interval. This plot can be used to determine whether standard deviations and means are significantly increasing over time between calibrations.

If the plot shows an increase in standard deviation over time, compare the critical value of the F-distribution of the ratio of the smallest and largest variances for the required bins.

$$F_{calc} = \frac{s_1^{\ 2}}{s_2^{\ 2}}$$

where:

S_1 = largest drift standard deviation value

S_2 = smallest drift standard deviation value

The critical value of F-distribution can be found, using the FINV function in Microsoft Excel:

F_{crit} = FINV (0.05, V_1, V_2)

V_1 = number of samples minus 1 in bin with largest standard deviation

V_2 = number of samples minus 1 in bin with smallest standard deviation

If the ratio of variances exceeds the critical value, this result is indicative of time dependency for the random portion of drift. Likewise, a ratio of variances not exceeding the critical value is not indicative of significant time dependency.

4.5.3. Regression Analyses

The regression analyses are performed in accordance with the requirements of Section 3.9.4, given that multiple valid time bins were established in the binning analysis. New pages should be created for the Drift Regression and the Absolute Value Drift Regression.

For each of the two Regression Analyses, use the following steps to produce the regression analysis output. Using the "Data Analysis" package under "Tools" in Microsoft EXCEL, the Regression option should be chosen. The Y range is established as the Drift (or Absolute Value of Drift) data range, and the X range should be the calibration time intervals. The output range should be established on the Regression Analysis page of the spreadsheet. The option for the residuals should be established as "Line Fit Plots". The regression computation should then be performed. The output of the regression routine is a list of residuals, an ANOVA table listing, and a plot of the Drift (or Absolute Value of Drift) versus the Time Interval between Calibrations. A prediction line is included on the plot.

Add a cell close to the ANOVA table listing which establishes the Critical Value of F, using the guidance of Section 3.9.4 for the Significance of F Test. This utilizes the FINV function of Microsoft EXCEL.

Analyze the results in the Drift Regression ANOVA table for R Square, P Value, and F Value, using the guidance of Section 3.9.4. If any of these analytical methods shows time dependency in the Drift Regression, the mean of the data set should be established as strongly time dependent if the slope of the prediction line significantly increases over time from an initially positive value (or decreases over time from an initially negative value), without crossing zero within the time interval of the regression analysis. This increase can also be validated by observing the results of the binning analysis plot for the mean of the bins and by observing the scatter plot and regression analysis prediction lines.

Analyze the results in the Absolute Value of Drift Regression ANOVA table for R Square, P Value, and F Value, using the guidance of Section 3.9.4. If any of these analytical means shows time dependency, the standard deviation of the data set should be established as strongly time dependent if the slope of the prediction line significantly increases over time. This increase can also be validated by observing the results of the binning analysis plot for the standard deviation of the bins, by observation of the results from the F distribution comparison within the binning plot, and by observing any discernible increases in data scatter, as time increases, on the scatter plot.

Regardless of the results of the analytical regression tests, if the plots tend to indicate significant increases in either the mean or standard deviation over time, those parameters should be judged to be strongly time dependent. Otherwise, for conservatism, the data is always considered to be moderately time dependent if extrapolation of the data is necessary, to accommodate the uncertainty involved in the extrapolation process, since no data has generally been observed at time intervals as large as those proposed.

4.6. Calculate the Analyzed Drift (DA) Value

The first step in determining the Analyzed Drift Value is to determine the required time interval for which the value must be computed. For the majority of the cases for instruments calibrated on a refueling basis, the required nominal calibration time interval is 24 months, or a maximum of 30 months. Since the average time intervals are generally computed in days, the most conservative value for a 30-Month calibration interval is established as 915 days.

The Analyzed Drift Value generally consists of two separate components - a random term and a bias term. If the mean of the Final Data Set is significant per the criteria in Section 3.11, a bias term is considered. If no extrapolation is necessary, the bias term is set equal to the mean of the Final Data Set. If extrapolation is necessary, it is performed in one of two methods, as determined by the degree of time dependency established in the time dependency analysis. If the mean is determined to be strongly time dependent, the following equation is used, which extrapolates the value in a linear fashion.

$$DA_{Extended.bias} = \bar{x} \times \frac{Max\_Rqd\_Time\_Interval}{Avg\_Bin\_Time\_Interval}$$

If the mean is determined to be moderately time dependent, the following equation is used to extrapolate the mean. (Note that this equation is also generally used for cases where no time dependency is evident, because of the uncertainty in defining a drift value beyond analysis limits.)

$$DA_{Extended.bias} = \bar{x} \times \sqrt{\frac{Max\_Rqd\_Time\_Interval}{Avg\_Bin\_Time\_Interval}}$$

Where: $\bar{x}$ = Mean of the Final Data Set or of the longest-interval, valid time bin from the binning analysis (see note)

Avg_Bin_Time_Interval = the average observed time interval within the longest-interval, valid time bin from the binning analysis (see note)

Max_Rqd_Time_Interval = the maximum time interval for desired calibration interval. For instance, 915 days for a desired 24 month nominal calibration interval.

Note: For conservatism, the largest drift value (DA) of either the Final Data Set or the longest-interval, valid time bin from the binning analysis is used as a starting point for the drift extrapolation. For those cases where no time dependency is apparent from the drift analysis, it is also acceptable to use the maximum observed time interval from the longest-interval, valid time bin from the binning analysis, as a starting point in the extrapolation, as opposed to the average observed time interval. This can be used to reduce over-conservatisms in determining an extrapolated analyzed drift value.

The random portion of the Analyzed Drift is calculated by multiplying the standard deviation of the Final Data Set by the Tolerance Interval Factor for the sample size and by the Normality Adjustment Factor (if required from the Coverage Analysis). If extrapolation is necessary, it is performed in one of two methods, similar to the methods shown above for the bias term, depending on the degree of time dependency observed. Use the following procedure to perform the operation.

4.6.1. Use the COUNT value of the Final Data Set to determine the sample size.

4.6.2. Obtain the appropriate Tolerance Interval Factor (TIF) for the size of the sample set. Table 1 lists the 95%/95% TIFs; refer to Standard statistical texts for other TIF multipliers. Note: TIFs other than 95%/95% must be specifically justified.

4.6.3. For a generic data analysis, multiple Tolerance Interval Factors may be used, providing a clear tabulation of results is included in the analysis, showing each value for the multiple levels of TIF.

4.6.4. Multiply the Tolerance Interval Factor by the standard deviation for the data points contained in the Final Data Set and by the Normality Adjustment Factor determined in the Coverage Analysis (if applicable).

4.6.5. If the analyzed drift term calculated above is applied to the existing calibration interval, application of additional drift uncertainty is not necessary.

4.6.6. When calculating drift for calibration intervals that exceed the historical calibration intervals, use the following equations, depending on whether the data is shown to be strongly time dependent or moderately time dependent.

For a Strongly Time Dependent random term, use the following equation.

$$DA_{Extended.random} = \sigma \times TIF \times NAF \times \frac{Max\_Rqd\_Time\_Interval}{Avg\_Bin\_Time\_Interval}$$

For a Moderately Time Dependent random term, use the following equation. (Note that this equation is also generally used for cases where no time dependency is evident, because of the uncertainty in defining a drift value beyond analysis limits.)

$$DA_{Extended.random} = \sigma \times TIF \times NAF \times \sqrt{\frac{Max\_Rqd\_Time\_Interval}{Avg\_Bin\_Time\_Interval}}$$

Where: σ = Standard Deviation of the Final Data Set or of the longest-interval, valid time bin from the binning analysis (see note)

TIF = Tolerance Interval Factor from Table 1

NAF = Normality Adjustment Factor from the Coverage Analysis (If Applicable)

Avg_Bin_Time_Interval = the average observed time interval within the longest-interval, valid time bin from the binning analysis (see note)

Max_Rqd_Time_Interval = the maximum time interval for desired calibration interval. For instance, 915 days for a desired 24 month nominal calibration interval.

Note: For conservatism, the largest drift value (DA) of either the Final Data Set or the longest-interval, valid time bin from the binning analysis is used as a starting point for the drift extrapolation. For those cases where no time dependency is apparent from the drift analysis, it is also acceptable to use the maximum observed time interval from the longest-interval, valid time bin from the binning analysis, as a starting point in the extrapolation, as opposed to the average observed time interval. This can be used to reduce over-conservatisms in determining an extrapolated analyzed drift value.

4.6.7. Since random errors are always expressed as ± errors, specific consideration of directionality is not generally a concern. However, for bistables and switches, the directionality of any bias error must be carefully considered. Because of the fact that the As-Found and As-Left setpoints are recorded during calibration, the drift values determined up to this point in the Drift Calculation are representative of a drift in the setpoint, not in the indicated value.

Per Reference 7.1.2, error is defined as the algebraic difference between the indication and the ideal value of the measured signal. In other words,

Error = indicated value - ideal value (actual value)

For devices with analog outputs, a positive error means that the indicated value exceeds the actual value, which would mean that if a bistable or switching mechanism used that signal to produce an actuation on an increasing trend, the actuation would take place **prior to** the actual variable reaching the value of the intended setpoint. As analyzed so far in the Drift Calculation for bistables and switches, the drift causes the opposite effect. A positive Analyzed Drift would mean that the **setpoint** is higher than intended; thereby causing actuation to occur **after** the actual variable has exceeded the intended setpoint.

A bistable or switch can be considered to be a black box, which contains a sensing element or circuit and an ideal switching mechanism. At the time of actuation, the switch or bistable can be considered an indication of the process variable. Therefore, a positive shift of the setpoint can be considered to be a negative error. In other words, if the switch setting was intended to be 500 psig, but actually switched at 510 psig, at the time of the actuation, the switch "indicated" that the process value was 500 psig when the process value was actually 510 psig. Thus,

error = indicated value (500 psig) - actual value (510 psig) = -10 psig

Therefore, a positive shift of the setpoint on a switch or bistable is equivalent to a negative error, as defined by Reference 7.1.2. **Therefore, for clarity and consistency with the treatment of other bias error terms, the sign of the bias errors of a bistable or switch should be reversed, in order to comply with the convention established by Reference 7.1.2. In either case, the conclusions of the Drift Calculation should be clear enough for proper application to setpoint computations.**

5. CALCULATIONS

5.1. Drift Calculations

The Drift Calculations should be performed in accordance with the methodology described above, with the following documentation requirements.

5.1.1. The title includes the Manufacturer/Model number of the component group analyzed.

5.1.2. The calculation objective must:

5.1.2.1. describe, at a minimum, that the objective of the calculation is to document the drift analysis results for the component group, and extrapolate the drift value to the required calibration period (if applicable), 5.1.2.2. provide a list for the group of all pertinent information in tabular form (e.g. Tag Numbers, Manufacturer, Model Numbers, ranges and calibration spans), and

5.1.2.3. describe any limitations on the application of the results. For instance, if the analysis only applies to a certain range code, the objective should state this fact.

5.1.3. The method of solution should describe, at a minimum, a summary of the methodology used to perform the drift analysis outlined by this Design Guide. Exceptions taken to this Design Guide are to be included in this section including basis and references for any exceptions.

5.1.4. The actual calculation/analysis should provide:

5.1.4.1. A listing of data which was removed and the justification for removal

5.1.4.2. List of references

5.1.4.3. A narrative discussion of the specific activities performed for this calculation

5.1.4.4. Results and conclusions, including

- Manufacturer and model number analyzed
- Bias and random Analyzed Drift values, as applicable
- The applicable Tolerance Interval Factors (provide detailed discussion and justification if other than 95%/95%)
- Applicable drift time interval for application
- Normality conclusion
- Statement of time dependency observed, as applicable
- Limitations on the use of this value in application to uncertainty calculations, as applicable
- Limitations on the application if the results to similar instruments, as applicable

5.1.5. Attachment(s) should be provided, including the following information:

5.1.5.1. Input data with notes on removal and validity

5.1.5.2. Computation of drift data and calibration time intervals

5.1.5.3. Outlier summary, including Final Data Set and basic statistical summaries

5.1.5.4. Chi Square Test Results (As Applicable)

5.1.5.5. W Test or D' Test Results (As Applicable)

5.1.5.6. Coverage Analysis, Including Histogram, Percentages in the Required Sigma Band, and Normality Adjustment Factor (As Applicable)

5.1.5.7. Scatter Plot with Prediction Line and Equation

5.1.5.8. Binning Analysis Summaries for Bins and Plots (As Applicable)

5.1.5.9. Regression Plots, ANOVA Tables, and Critical F Values (As Applicable)

5.1.5.10. Derivation of the Analyzed Drift Values, With Summary of Conclusions

5.2. Setpoint/Uncertainty Calculations

To apply the results of the drift analyses to a specific device or loop, a setpoint or loop accuracy calculation must be performed, revised or evaluated in accordance with References 7.2.2 and 7.2.3, as appropriate. Per Section 3.2.1.2, the Analyzed Drift term characterizes various instrument uncertainty terms for the analyzed device, loop, or function. In order to save time, a comparison between these terms in an existing setpoint calculation to the Analyzed Drift can be made. If the terms within the existing calculation bound the Analyzed Drift term, then the existing calculation is conservative as is, and does not specifically require revision. If revision to the calculation is necessary, the Analyzed Drift term may be incorporated into the calculation, by replacing the appropriate terms for the analyzed devices with the Analyzed Drift term.

When comparing the results to setpoint calculations that have more than one device in the instrument loop that was analyzed for drift, comparisons can be made between the DA terms and the original terms on a device-by-device basis, or on a total loop basis. Care should be taken to properly combine terms for comparison in accordance with References 7.2.2 and 7.2.3, as appropriate.

When applying the Drift Calculation results of bistables or switches to a setpoint calculation, the preparer should fully understand the directionality of any bias terms within DA and apply the bias terms accordingly. (See Section 4.6.7.)

6. DEFINITIONS

95%/95%	Standard statistics term meaning that the results have a 95% confidence (γ) that at least 95% of the population will lie between the stated interval (P) for a sample size (n).	Ref. 7.1.1
Analyzed Drift (DA)	A term representing the errors determined by a completed drift analysis for a group. Uncertainties that ***may*** be represented by the analyzed drift term are component reference accuracy, input and output M&TE errors, personnel-induced or human related errors, ambient temperature and other environmental effects, power supply effects, misapplication errors and true component drift.	Section 4.6
As-Found (AF)	The condition in which a channel, or portion of a channel, is found after a period of operation and before recalibration.	Ref. 7.1.3
As-Left (AL)	The condition in which a channel, or portion of a channel, is left after calibration or final setpoint device verification.	Ref. 7.1.3
Bias (B)	A shift in the signal zero point by some amount.	Ref. 7.1.1
Calibrated Span (CS)	The maximum calibrated upper range value less the minimum calibrated lower range value.	Ref. 7.1.1
Calibration Interval	The elapsed time between the initiation or successful completion of calibrations or calibration checks on the same instrument, channel, instrument loop, or other specified system or device.	Ref. 7.1.1
Chi-Square Test	A test to determine if a sample appears to follow a given probability distribution. This test is used as one method for assessing whether a sample follows a normal distribution.	Ref. 7.1.1
Confidence Interval	An interval that contains the population mean to a given probability.	Ref. 7.1.1
Coverage Analysis	An analysis to determine whether the assumption of a normal distribution effectively bounds the data. A histogram is used to graphically portray the coverage analysis.	Ref. 7.1.1
Cumulative Distribution	An expression of the total probability contained within an interval from $-\infty$ to some value, x.	Ref. 7.1.1
D-Prime Test	A test to verify the assumption of normality for moderate to large sample sizes (greater than 50 samples).	Ref. 7.1.1, 7.1.4
Dependent	In statistics, dependent events are those for which the probability of all occurring at once is different than the product of the probabilities of each occurring separately. In setpoint determination, dependent uncertainties are those uncertainties for which the sign or magnitude of one uncertainty affects the sign or magnitude of another uncertainty.	Ref. 7.1.1
Drift	An undesired change in output over a period of time where change is unrelated to the input, environment, or load.	Ref. 7.1.2
Error	The algebraic difference between the indication and the ideal value of the measured signal.	Ref. 7.1.2
Final Data Set (FDS)	The set of data that is analyzed for normality, time dependence, and used to determine the drift value. This data has all outliers and erroneous data removed, as allowed.	Section 3.6.3
Functionally Equivalent	Components with similar design and performance characteristics that can be combined to form a single population for analysis purposes.	Ref. 7.1.1
Histogram	A graph of a frequency distribution.	Ref. 7.1.1

Independent	In statistics, independent events are those in which the probability of all occurring at once is the same as the product of the probabilities of each occurring separately. In setpoint determination, independent uncertainties are those for which the sign or magnitude of one uncertainty does not affect the sign or magnitude of any other uncertainty.	Ref. 7.1.1
Instrument Channel	An arrangement of components and modules as required to generate a single protective action signal when required by a plant condition. A channel loses its identity where single protective action signals are combined.	Ref. 7.1.2
Instrument Range	The region between the limits within which a quantity is measured, received or transmitted, expressed by stating the lower and upper range values.	Ref. 7.1.2
Kurtosis	A characterization of the relative peakedness or flatness of a distribution compared to a normal distribution. A large kurtosis indicates a relatively peaked distribution and a small kurtosis indicates a relatively flat distribution.	Ref. 7.1.1
M&TE	Measurement and Test Equipment.	Ref. 7.1.1
Maximum Span	The component's maximum upper range limit less the maximum lower range limit.	Ref. 7.1.1
Mean	The average value of a random sample or population.	Ref. 7.1.1
Median	The value of the middle number in an ordered set of numbers. Half the numbers have values that are greater than the median and half have values that are less than the median. If the data set has an even number of values, the median is the average of the two middle values.	Ref. 7.1.1
Module	Any assembly of interconnected components that constitutes an identifiable device, instrument or piece of equipment. A module can be removed as a unit and replaced with a spare. It has definable performance characteristics that permit it to be tested as a unit.	Ref. 7.1.2
Normality Adjustment Factor	A multiplier to be used for the standard deviation of the Final Data Set to provide a drift model that adequately covers the population of drift points in the Final Data Set.	Section 3.7.5
Normality Test	A statistics test to determine if a sample is normally distributed.	Ref. 7.1.1
Outlier	A data point significantly different in value from the rest of the sample.	Ref. 7.1.1
Population	The totality of the observations with which we are concerned. A true population consists of all values, past, present and future.	Ref. 7.1.1
Probability	The branch of mathematics which deals with the assignment of relative frequencies of occurrence (confidence) of the possible outcomes of a process or experiment according to some mathematical function.	Ref. 7.3.2
Prob. Density Function	An expression of the distribution of probability for a continuous function.	Ref. 7.1.1
Probability Plot	A type of graph scaled for a particular distribution in which the sample data plots as approximately a straight line if the data follows that distribution. For example, normally distributed data plots as a straight line on a probability plot scaled for a normal distribution; the data may not appear as a straight line on a graph scaled for a different type of distribution.	Ref. 7.1.1
Proportion	A segment of a population that is contained by an upper and lower limit. Tolerance intervals determine the bounds or limits of a proportion of the population, not just the sampled data. The proportion (P) is the second term in the tolerance interval value (e.g. 95%/99%).	Ref. 7.3.2
Random	Describing a variable whose value at a particular future instant cannot be predicted exactly, but can only be estimated by a probability distribution function.	Ref. 7.1.1

Raw Data	As found minus As-Left calibration data used to characterize the performance of a functionally equivalent group of components.	Ref. 7.1.1
Reference Accuracy (AC)	A number or quantity that defines a limit that errors will not exceed when a device is used under specified operating conditions.	Ref. 7.1.2, 7.2.1, 7.2.2, 7.2.3
Sample	A subset of a population.	Ref. 7.1.1
Sensor	The portion of an instrument channel that responds to changes in a plant variable or condition and converts the measured process variable into a signal; e.g., electric or pneumatic.	Ref. 7.1.2
Signal Conditioning	One or more modules that perform signal conversion, buffering, isolation or mathematical operations on the signal as needed.	Ref. 7.1.2
Skewness	A measure of the degree of symmetry around the mean.	Ref. 7.1.1
Span	The algebraic difference between the upper and lower values of a calibrated range.	Ref. 7.1.2
Standard Deviation	A measure of how widely values are dispersed from the population mean.	Ref. 7.1.1
Surveillance Interval	The elapsed time between the initiation or successful completion of a surveillance or surveillance check on the same component, channel, instrument loop, or other specified system or device.	Ref. 7.1.1
Time-Dependent Drift	The tendency for the magnitude of component drift to vary with time.	Ref. 7.1.1
Time-Dependent Drift Uncertainty	The uncertainty associated with extending calibration intervals beyond the range of available historical data for a given instrument or group of instruments.	Ref. 7.1.1
Time-Independent Drift	The tendency for the magnitude of component drift to show no specific trend with time.	Ref. 7.1.1
Tolerance	The allowable variation from a specified or true value.	Ref. 7.1.2
Tolerance Interval	An interval that contains a defined proportion of the population to a given probability.	Ref. 7.1.1
Trip Setpoint	A predetermined value for actuation of the final actuation device to initiate protective action.	Ref. 7.1.2
Turndown Factor (TDF)	The upper range limit divided by the calibrated span of the device.	Ref. 7.1.2
t-Test	For this Design Guide the t-Test is used to determine: 1) if a sample is an outlier of a sample pool, and 2) if two groups of data originate from the same pool.	Ref. 7.1.1
Uncertainty	The amount to which an instrument channel's output is in doubt (or the allowance made therefore) due to possible errors either random or systematic which have not been corrected for. The uncertainty is generally identified within a probability and confidence level.	Ref. 7.1.1
Variance	A measure of how widely values are dispersed from the population mean.	Ref. 7.1.1
W Test	A test to verify the assumption of normality for sample sizes less than or equal to 50.	Ref. 7.1.1, 7.1.4

7. REFERENCES

7.1. Industry Standards and Correspondence

7.1.1. EPRI TR-103335R1, "Statistical Analysis of Instrument Calibration Data - Guidelines for Instrument Calibration Extension/Reduction Programs," October, 1998

7.1.2. ISA-RP67.04.02-2000, "Recommended Practice, Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation"

7.1.3. ANSI/ISA-S67.04.01-2000, "American National Standard, Setpoints for Nuclear Safety-Related Instrumentation"

7.1.4. ANSI N15.15-1974, "Assessment of the Assumption of Normality (Employing Individual Observed Values)"

7.1.5. NRC to EPRI Letter, "Status Report on the Staff Review of EPRI Technical Report TR-103335, "Guidelines for Instrument Calibration Extension/Reduction Program"," Dated March 1994

7.1.6. REGULATORY GUIDE 1.105, Rev. 2, "Instrument Setpoints"

7.1.7. US Nuclear Regulatory Commission Letter from Mr. Thomas H. Essig to Mr. R. W. James of Electric Power Research Institute, Dated December 1, 1997, "Status Report on the Staff Review of EPRI Technical Report TR-103335, 'Guidelines for Instrument Calibration Extension / Reduction Programs,' Dated March 1994"

7.2. Calculations and Programs

7.2.1. GE NEDC 31336P-A "General Electric Instrument Setpoint Methodology" (Included within Reference 7.2.2)

7.2.2. CNS Procedure 3.26.3, Instrument Setpoint and Channel Error Calculation Methodology

7.2.3. CNS Procedure 3.26.4, Instrument Indication Uncertainty Program and Calculation Methodology

7.3. Miscellaneous

7.3.1. Microsoft Excel for Microsoft Office 2003 (or Later Versions), Spreadsheet Program

7.3.2. Statistics for Nuclear Engineers and Scientists Part 1: Basic Statistical Inference, William J. Beggs; February, 1981

7.3.3. NRC Generic Letter 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate a 24-Month Fuel Cycle"

Appendix A

Evaluation of the NRC Status Report on the Staff Review of EPRI Technical Report-103335, "Guidelines for Instrument Calibration Extension/Reduction Programs"

The following are excerpts or paraphrases from the NRC Status Report on the Staff review of EPRI Technical Report (TR)-103335, "Guidelines for Instrument Calibration Extension /Reduction Programs", dated March, 1994 (Reference 7.1.7). These excerpts are followed by the Cooper Nuclear Station (CNS) evaluation of how the Instrument Drift Analysis Design Guide for CNS addresses the concern, as a part of the 24 Month Cycle Extension projects.

<u>STATUS REPORT</u>

Item 4.1, Section 1, "Introduction", Second Paragraph:

"The staff has issued guidance on the second objective (evaluating extended surveillance intervals in support of longer fuel cycles) only for 18-month to 24-month refueling cycle extensions (GL 91-04). Significant unresolved issues remain concerning the applicability of 18 month (or less) historical calibration data to extended intervals longer than 24 months (maximum 30 months), and instrument failure modes or conditions that may be present in instruments that are unattended for periods longer than 24 months."

<u>CNS EVALUATION</u>

Extensions for longer than 24 months (maximum of 30 months, including 25% grace period) are not to be requested via drift analysis in accordance with the Instrument Drift Analysis Design Guide.

<u>STATUS REPORT</u>

Item 4.2, Section 2, "Principles of Calibration Data Analysis", First Paragraph:

"This section describes the general relation between the as-found and as-left calibration values, and instrument drift. The term 'time dependent drift' is used. This should be clarified to mean time dependence of drift uncertainty, or in other words, time dependence of the standard deviation of drift of a sample or a population of instruments."

<u>CNS EVALUATION</u>

Both the EPRI TR, Revisions 0 and 1 failed to adequately determine if there existed a relationship between the magnitude of drift and the time interval between calibrations. The drift analysis performed for CNS looked at the time to magnitude relationship using several different statistical and non-statistical methods. First, during the evaluation of data for grouping, data was grouped for the same or similar manufacturer, model number, and application combinations even though the t' statistical test may have shown that the groups were not necessarily from the same population if the groups were performed on significantly different frequencies. This test grouping was made to ensure that the analysis did not cover-up a significant time dependent bias or random element magnitude shift.

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After the standard deviation and other simple statistics are calculated, the data is evaluated for the time to magnitude relationship. If adequately time-diverse data is available, a time-binning analysis is performed on the data. Data is divided into time bins, based on the time between calibrations. Statistics are computed for those bins, such as mean and standard deviation. These values are then plotted to expose any significant increases in the magnitude of the mean or standard deviation over time.

Regression analysis is performed, based on the scatter of the raw "drift" values and a second regression analysis is performed on the absolute values of the "drift." For each of these regression analyses, statistical tests are performed to determine if time dependency is evident. These statistical tests are the R^2, F, and P value tests.

Finally, visual examination of the plots generated as a result of the scatter plot, binning analysis, regression analysis of drift, and the regression analysis of the absolute value of drift are used to make a final judgment on whether or not the random or mean values of drift are time dependent. Therefore, the mean and random aspects of drift are evaluated for time dependency.

STATUS REPORT

Item 4.2, Section 2, "Principles of Calibration Data Analysis", Second Paragraph:

"Drift is defined as as-found – as-left. As mentioned in the TR this quantity unavoidably contains uncertainty contributions from sources other than drift. These uncertainties account for variability in calibration equipment and personnel, instrument accuracy, and environmental effects. It may be difficult to separate these influences from drift uncertainty when attempting to estimate drift uncertainty but this is not sufficient reason to group these allowances with a drift allowance. Their purpose is to provide sufficient margin to account for differences between the instrument calibration environment and its operating environment see Section 4.7 of this report for a discussion of combining other uncertainties into a 'drift' term."

CNS EVALUATION

The drift determined by analysis is compared to the equivalent set of variables in the setpoint calculation. Per Section 3.2.1.2 of the CNS Instrument Drift Analysis Design Guide, "The As-Found versus the As-Left data includes several sources of uncertainty over and above component drift. The difference between As-Found and previous As-Left data encompasses a number of instrument uncertainty terms in addition to drift, as defined by Reference 7.2.2, the setpoint calculation methodology for CNS. The drift is not assumed to encompass the errors associated with temperature effect, since the temperature difference between the two calibrations is not quantified, and is not anticipated to be significant. Additional instruction for the use of As-Found and As-Left data may be found in Reference 7.1.2." Therefore, the errors associated with the environment are not considered in the comparison of the Analyzed Drift values to the setpoint calculation values. The environmental effects are considered separately from the Analyzed Drift term, within the setpoint calculations.

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STATUS REPORT

Item 4.2, Section 2, "Principles of Calibration Data Analysis", Third Paragraph:

"The guidance of Section 2 is acceptable provided that time dependency of drift for a sample or population is understood to be time dependent [sic] of the uncertainty statistic describing the sample or population; e.g., the standard deviation of drift. A combination of other uncertainties with drift uncertainty may obscure any existing time dependency of drift uncertainty, and should not be done before time-dependency analysis is done."

CNS EVALUATION

Time dependency evaluations are performed on the basic as-left/as-found data. Obviously other error contributors are contained in this data, but it is impossible to separate the contribution due to drift from the contribution due to Measurement and Test Equipment and Reference Accuracy. All of these terms fully contribute to the observed errors. Using the raw values appears to give the most reliable interpretation of the time dependency for the calibration process, which is the true value of interest. No other uncertainties are combined with the basic as-left/as-found data for time dependency determination.

STATUS REPORT

Item 4.3, Section 3, "Calibration Data Collection", Second Paragraph:

"When grouping instruments, as well as manufacturer make and model, care should be taken to group only instruments that experience similar environments and process effects. Also, changes in manufacturing method, sensor element design, or the quality assurance program under which the instrument was manufactured should be considered as reasons for separating instruments into different groups. Instrument groups may be divided into subgroups on the basis of instrument age, for the purpose of investigating whether instrument age is a factor in drift uncertainty."

CNS EVALUATION

Instruments are originally grouped based on manufacturer make, model number, and specific range of setpoint or operation. The groups are then evaluated and combined based on Sections 3.5.1 through 3.5.4 of the design guide. The appropriateness of the grouping is then tested based on a t-Test (two samples assuming unequal variances). The t-Test defines the probability, associated with a Student's t-Test; that two samples are likely to have come from the same underlying population. Instrument groups are not divided into subgroups based on age.

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STATUS REPORT

Item 4.3, Section 3, "Calibration Data Collection", Second Paragraph (continued):

"Instrument groups should also be evaluated for historical instrument anomalies or failure modes that may not be evident in a simple compilation of calibration data. This evaluation should confirm that almost all instruments in a group performed reliably and almost all required only calibration attendance."

CNS EVALUATION

A separate surveillance test failure evaluation is performed for the procedures implementing the surveillance requirements. This evaluation identifies calibration-related and non-calibration-related failures for single instruments, and groups of instruments supporting a specific function. After all relevant device and multiple device failures are identified, a cross-check of failures across manufacturer make and model number is also performed to determine if common mode failures could present a problem for the cycle extension. This evaluation confirms that almost all instruments in a group (associated with extended Technical Specification line items) performed reliably and most failures are detected by more frequent testing.

STATUS REPORT

Item 4.3, Section 3, "Calibration Data Collection", Third Paragraph:

"Instruments within a group should be investigated for factors that may cause correlation between calibrations. Common factors may cause data to be correlated, including common calibration equipment, same personnel performing calibrations, and calibrations occurring in the same conditions. The group, not individual instruments within the group, should be tested for trends."

CNS EVALUATION

Instruments are only investigated for correlation factors where multiple instruments appeared to have been driven out of tolerance by a single factor. Correlation may exist between the specific type of test equipment (e.g., Fluke 863 on the 0-200 mV range) and the personnel performing calibrations for each plant. This correlation would only affect the measurement if it caused the instrument performance to be outside expected boundaries, e.g., where additional errors should be considered in the setpoint analysis or where it showed a defined bias. Because Measurement and Test Equipment (M&TE) is calibrated more frequently than most process components being monitored, the effect of test equipment between calibrations is considered to be negligible and random. The setting tolerance, readability, and other factors which are more personnel-based, would only affect the performance if there was a predisposition to leave or read settings in a particular direction (e.g., always in the more conservative direction). Plant training and evaluation programs are designed to eliminate this type of predisposition. Therefore, the correlation between M&TE and instrument performance; or between personnel and instrument performance is not evaluated. Observed as-found values outside the Allowable Value are treated as unique failures and are evaluated to determine if a common cause exists as a part of the failure analysis.

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STATUS REPORT

Item 4.3, Section 3, "Calibration Data Collection", Fourth Paragraph:

"TR-103335, Section 3.3, advises that older data may be excluded from analysis. It should be emphasized that when selecting data for drift uncertainty time dependency analysis it is unacceptable to exclude data simply because it is old data. When selecting data for drift uncertainty time dependency analysis, the objective should be to include data for time spans at least as long as the proposed extended calibration interval, and preferably, several times as long, including calibration intervals as long as the proposed interval. For limited extensions (e.g., a GL 91-04 extension), acceptable ways to obtain this longer interval data include obtaining data from other nuclear-plants or from other industries for identical or close-to-identical instruments, or combining intervals between which the instrument was not reset or adjusted. If data from other sources is used, the source should be analyzed for similarity to the target plant in procedures, process, environment methodology, test equipment, maintenance schedules and personnel training. An appropriate conclusion of the data collection process may be that there is insufficient data of appropriate time span for a sufficient number of instruments to support statistical analysis of drift uncertainty time dependency."

CNS EVALUATION

Data is selected for the last 90 months (5 cycles). This allows for the evaluation of data with various different calibration spans over several calibration intervals to provide representative information for each type of instrument. Data from outside the CNS data set is not used to provide longer interval data. In most cases the time dependency determination is based on calibrations performed at or near 18 months and data performed at shorter intervals (monthly, quarterly, or semiannually). There did not appear to be any time based factors that would be present from 18 to 24 months that would not have been present between 1, 3, 6, or 12 and 18 months. It could be determined that there is insufficient data to support statistical analysis of drift time dependency. For these cases, a correlation between drift magnitude and time is assumed and the calculation reflects time dependent drift values.

STATUS REPORT

Item 4.3, Section 3, "Calibration Data Collection", Fifth Paragraph:

"TR-103335, Section 3.3 provides guidance on the amount of data to collect. As a general rule, it is unacceptable to reject applicable data, because biases in the data selection process may introduce biases in the calculated statistics. There are only two acceptable reasons for reducing the amount of data selected: enormity, and statistical dependence. When the number of data points is so enormous that the data acquisition task would be prohibitively expensive, a randomized selection process, not dependent upon engineering judgment, should be used. This selection process should have three steps. In the first step, all data is screened for applicability, meaning that all data for the chosen instrument grouping is selected, regardless of the age of the data. In the second step, a proportion of the applicable data is chosen by automated random selection, ensuring that the data records for single instruments are complete, and enough individual instruments are included to constitute a statistically diverse sample. In the third step, the first two steps are documented. Data points should be combined when there is indication that they are statistically dependent on each other, although alternate

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approaches may be acceptable. See Section 4.5, below, on 'combined point' data selection and Section 4.4.1 on '0%, 25%, 50%, 75%, and 100% calibration span points'."

CNS EVALUATION

A time interval of 90 months is selected as representative, based on CNS operating history. No data points are rejected from this time interval, and no sampling techniques are used.

STATUS REPORT

Item 4.4, Section 4, "Analysis of Calibration Data":

Sub-item, 4.4.1, Sections 4.3 and 4.4, Data Setup and Spreadsheet Statistics, First Paragraph:

"The use of spreadsheets, databases, or other commercial software is acceptable for data analysis provided that the software, and the operating system used on the analysis computer, is under effective configuration control. Care should be exercised in the use of Windows or similar operating systems because of the dependence on shared libraries. Installation of other application software on the analysis machine can overwrite shared libraries with older versions or versions that are inconsistent with the software being used for analysis."

CNS EVALUATION

The project uses Microsoft EXCEL spreadsheets to perform the drift analysis. This software is not treated as QA software. Therefore, computations are verified using hand verification and alternate software on different computers, such as Lotus 1-2-3 or Quattro Pro spreadsheets.

STATUS REPORT

Item 4.4, Section 4, "Analysis of Calibration Data":

Sub-item, 4.4.1, Sections 4.3 and 4.4, Data Setup and Spreadsheet Statistics, Second Paragraph:

"Using either engineering units or per-unit (percent of span) quantities is acceptable. The simple statistic calculations (mean, sample standard deviation, sample size) are acceptable. Data should be examined for correlation or dependence to eliminate over-optimistic tolerance interval estimates. For example, if the standard deviation of drift can be fitted with a regression line through the 0%, 25%, 50%, 75%, and 100% calibration span points, there is reason to believe that drift uncertainty is correlated over the five (or nine, if the data includes a repeatability sweep) calibration data points. An example is shown in TR-103335, Figure 5.4, and a related discussion is given in TR-103335 Section 5.1.3. Confidence/tolerance estimates are based on (a) an assumption of normality (b) the number of points in the data set, and (c) the standard deviation of the sample. Increasing the number of points (utilizing each calibration span point) when data is statistically dependent decreases the tolerance factor k, which may falsely enhance the confidence in the predicted tolerance interval. To retain the information, but achieve a reasonable point count for confidence/tolerance estimates, the statistically dependent data points should be combined into a composite data point. This retains the information but cuts the point count. For drift

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uncertainty estimates with data similar to that in the TR example, an acceptable method requires that the number of independent data points should be one-fifth (or one ninth) of the total number of data points in the example and a combined data point for each set of five span points should be selected that is representative of instrument performance at or near the span point most important to the purpose of the analysis (i.e., trip or normal operation point)."

CNS EVALUATION

The analysis for CNS uses either engineering units or percent of calibrated span, as appropriate to the calibration process. As an example, for switches that do not have a realistic span value, the engineering units are used in the analyses; for analog devices, normally percent of span is used. Typically, dependence is found between calibration points (0%, 25%, 50%, 75%, and 100%) for a single calibration. However, due to the changes in M&TE and personnel performing the calibrations, independence is generally found between calibrations of the same component on different dates. To ensure conservatism, the most conservative simple statistic values for the points closest to the point of interest are selected, or the most conservative values for any data point are selected. The multiplier is determined based on the number of actual calibrations associated with the worst-case value selected. Selection of the actual number of calibrations is equivalent to the determination of independent points (e.g., one fifth or one ninth of the total data point count). Selection of the worst-case point is also more conservative than the development of a combined data point.

STATUS REPORT

Item 4.4, Section 4, "Analysis of Calibration Data":

Sub-item 4.4.2, Section 4.5, Outlier Analysis:

"Rejection of outliers is acceptable only if a specific, direct reason can be documented for each outlier rejected. For example, a documented tester failure would be cause for rejecting a calibration point taken with the tester when it had failed. It is not acceptable to reject outliers on the basis of statistical tests alone. Multiple passes of outlier statistical criterion are not acceptable. An outlier test should only be used to direct attention to data points, which are then investigated for cause. Five acceptable reasons for outlier rejection provided that they can be demonstrated, are given in the TR: data transcription errors, calibration errors, calibration equipment errors, failed instruments, and design deficiencies. Scaling or setpoint changes that are not annotated in the data record indicate unreliable data, and detection of unreliable data is not cause for outlier rejection, but may be cause for rejection of the entire data set and the filing of a licensee event report. The usual engineering technique of annotating the raw data record with the reason for rejecting it, but not obliterating the value, should be followed. The rejection of outliers typically has cosmetic effects: if sufficient data exists, it makes the results look slightly better; if insufficient data exists, it may mask a real trend. Consequently, rejection of outliers should be done with extreme caution and should be viewed with considerable suspicion by a reviewer."

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CNS EVALUATION

It is acceptable to remove one outlier from an analysis based on statistical means, other than those using the engineering judgments mentioned in the EPRI document. The Design Guide is written with this as a general rule. This does not reduce the amount of scrutiny that the preparer and reviewer use in the entry and evaluation of the calibration data. The intent is to properly model device performance after completion of this project. No more than one outlier is removed from the drift population on the basis of statistics alone. Given very large sample sizes or complicated calibration processes, specific diagnosis of problems when reviewing procedure data is sometimes not possible. However, the data can contain errors which are very likely to be unrelated to drift or device performance, which should be removed, given an appropriate consideration from both the preparer and reviewer. For this project, rejection of outliers is performed with extreme caution and is viewed with considerable suspicion by the reviewer.

Significant conservatisms exist in the assumptions for extrapolation of drift values as computed per this Design Guide, which provide additional margin for the devices to drift. Additionally, if the removal of the data reduces the computed extrapolated drift to a value that is not consistent with the capability of the device (which is not to be expected), the improved drift-monitoring program would detect the problem and implement design activity, maintenance activity, or both to correct the problem.

STATUS REPORT

Item 4.4, Section 4, "Analysis of Calibration Data":

Sub-item 4.4.3, Section 4.6, "Verifying the Assumption of Normality":

"The methods described are acceptable in that they are used to demonstrate that calibration data or results are calculated as if the calibration data were a sample of a normally distributed random variable. For example, a tolerance interval which states that there is a 95% probability that 95% of a sample drawn from a population will fall within tolerance bounds is based on an assumption of normality, or that the population distribution is a normal distribution. Because the unwarranted removal of outliers can have a significant effect on the normality test, removal of significant numbers of, or sometimes any (in small populations), outliers may invalidate this test."

CNS EVALUATION

The methods that were found acceptable are used for the CNS analysis. All drift studies involve the removal of one or less outliers. Therefore, the normality tests are valid. Coverage analysis is used where the normality tests reject the assumption of normality. This produces a conservative model of the drift data by expanding the standard deviation to provide adequate coverage.

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STATUS REPORT

Item 4.4, Section 4, "Analysis of Calibration Data":

Sub-item 4.4.4, Section 4.7, "Time-Dependent Drift Considerations", First through Ninth Paragraphs:

"This section of the TR discusses a number of methods for detecting a time dependency in drift data, and one method of evaluating drift uncertainty time dependency. None of the methods uses a formal statistical model for instrument drift uncertainty, and all but one of them focus on drift rather than drift uncertainty. Two conclusions are inescapable: regression analysis cannot distinguish drift uncertainty time dependency, and the slope and intercept of regression lines may be artifacts of sample size, rather than being statistically significant. Using the results of a regression analysis to rule out time dependency of drift uncertainty is circular reasoning: i.e., regression analysis eliminates time dependency of uncertainty; no time dependency is found; therefore, there is no time dependency."

CNS EVALUATION

Several different methods of evaluation for time dependency of the data are used for the analysis. One method, the binning analysis, is to evaluate the standard deviations at different calibration intervals. This analysis technique is the most recommended method of determining time-dependent tendencies in a given sample pool. The test consists simply of segregating the drift data into different groups (bins) corresponding to different ranges of calibration or surveillance intervals, and comparing the standard deviations for the data in the various groups. The purpose of this type of analysis is to determine if the standard deviation or mean tends to become larger as the time between calibration increases. Simple regression lines, regression of the absolute value of drift, as well as R^2, F, and P tests are also generated and reviewed. Finally visual examinations of the scatter plot, binning plot, and both regression plots are used to assess or corroborate results. Where there is not sufficient data to perform the detailed evaluation, the data is assumed moderately time dependent. Whenever extrapolation of the drift value is required, in ALL cases, drift is conservatively assumed to be at least moderately time dependent for the purpose of extrapolation, even though many of the test results may show that the drift is time independent.

STATUS REPORT

Item 4.4, Section 4, "Analysis of Calibration Data":

Sub-item 4.4.4, Section 4.7, "Time-Dependent Drift Considerations", Thirteenth and Fourteenth Paragraphs:

"A model can be used either to bound or project future values for the quantity in question (drift uncertainty) for extended intervals. An acceptable method would use standard statistical methods to show that a hypothesis (that the instruments under study have drift uncertainties bounded by the drift uncertainty predicted by a chosen model) is true with high probability. Ideally, the method should use data that include instruments that were un-reset for at least as long as the intended extended interval, or similar data from other sources for instruments of like construction and environmental usage. The use of data of appropriate time span is preferable; however, if this data is unavailable, model projection may be

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used provided the total projected interval is no greater than 30 months and the use of the model is justified. A follow-up program of drift monitoring should confirm that model projections of uncertainty bounded the actual estimated uncertainty. If it is necessary to use generic instrument data or constructed intervals, the chosen data should be grouped with similar grouping criteria as are applied to instruments of the plant in question, and Student's "t" test should be used to verify that the generic or constructed data mean appears to come from the same population. The "F" test should be used on the estimate of sample variance. For a target surveillance interval constructed of shorter intervals where instrument reset did not occur, the longer intervals are statistically dependent upon the shorter intervals; hence, either the constructed longer-interval data or the shorter-interval data should be used, but not both. In a constructed interval, drift = as-left$_{(0)}$ – as found$_{(LAST)}$, the intermediate values are not used.

When using samples acquired from generic instrument drift analyses or constructed intervals, the variances are not simply summed, but are combined weighted by the degrees of freedom in each sample."

<u>CNS EVALUATION</u>

The General Electric interval extension process is used because CNS is committed to the General Electric Setpoint Methodology. Where the drift can be proven to be time independent for the analysis period, or shown to be only slightly or moderately time dependent, the calculated drift value is extended based on the formula:

$$\text{Drift}_{30} = \text{Drift calculated} * (30/\text{calculated drift time interval})^{1/2}.$$

Where there is a strong indication of time dependent drift, the following formula is used:

$$\text{Drift}_{30} = \text{Drift calculated} * (30/\text{calculated drift time interval}).$$

<u>STATUS REPORT</u>

Item 4.4, Section 4, "Analysis of Calibration Data":

Sub-item 4.4.5, Section 4.8, "Shelf Life of Analysis Results":

"The TR gives guidance on how long analysis results remain valid. The guidance given is acceptable with the addition that once adequate analysis and documentation is presented and the calibration interval extended, a strong feedback loop must be put into place to ensure drift, tolerance and operability of affected components are not negatively impacted. An analysis should be re-performed if its predictions turn out to exceed predetermined limits set during the calibration interval extension study. A goal during the re-performance should be to discover why the analysis results were incorrect The establishment of a review and monitoring program, as indicated in GL 91-04, Enclosure 2, Item 7 is crucial to determining that the assumptions made during the calibration interval extension study were true. The methodology for obtaining reasonable and timely feedback must be documented."

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CNS EVALUATION

CNS is committed to establish a trending program to provide feedback on the acceptability of the drift error extension. This program will perform a detailed analysis of as-found values outside the calculated As Found Tolerance (AFT). The drift analysis will be re-performed when the root cause analysis indicates drift is a probable cause for the performance problems. The trending program will be combined with the program used to meet the calibration requirements for Technical Specification Task Force (TSTF)-493.

STATUS REPORT

Item 4.5, Section 5, "Alternative Methods of Data Collection and Analysis":

"Section 5 discusses two alternatives to as-found/as-left (AFAL) analysis, combining the 0%, 25%, 50%, 75% and 100% span calibration points, and the EPRI Instrument Calibration Reduction Program (ICRP).

Two alternatives to AFAL are mentioned: as-found/setpoint (AFSP) analysis and worst case as-found/as-left (WCAFAL). Both AFSP and WCAFAL are more conservative than the AFAL method because they produce higher estimates of drift. Therefore, they are acceptable alternatives to AFAL drift estimation.

The combined-point method is acceptable, and in some cases preferable, if the combined value of interest is taken at the point important to the purpose of the analysis. That is, if the instrument being evaluated is used to control the plant in an operating range, the instrument should be evaluated near its operating point. If the instrument being evaluated is employed to trip the reactor, the instrument should be evaluated near the trip point. The combined-point method should be used if the statistic of interest shows a correlation between calibration span points, thus inflating the apparent number of data points and causing an overstatement of confidence in the results. The method by which the points are combined (e.g., nearest point interpolation, averaging) should be justified and documented."

CNS EVALUATION

Per Section 4.3.4 of the CNS Instrument Drift Analysis Design Guide, "For transmitters, or other devices with multiple calibration points, the general process is to use the calibration point with the worst case drift values." Therefore, the method at CNS is conservative, no matter which point on the calibration curve is most important for a given application.

STATUS REPORT

Item 4.6, Section 6, "Guidelines for Calibration and Surveillance Interval Extension Programs":

"This section presents an example analysis in support of extending the surveillance interval of reactor trip bistables from monthly to quarterly. Because these bistables exhibit little or no bias, and very small drift, the analysis example does not challenge the methodology presented in TR-103335 Section 4, and thus raises no acceptability issues related to drift analysis that have not already been covered. The bistables are also rack instruments, and thus not representative of process instruments, for which drift is a greater concern. Bistables do not produce a variable output signal that can be compared to redundant device readings by operations personnel, or during trending programs, and cannot be compared during channel checks, as redundant process instruments are. For these reasons the data presented in Section 6 have very little relationship to use in the TR methodology for calibration interval extensions for process instruments. The binomial pass/fail methodology of Section 6.3 is acceptable as a method of complying with GL 91-04, Enclosure 2, item 1 for bistables, "Confirm that acceptable limiting values of drift have not been exceeded except in rare instances." This method provides guidance for the definition of "rare" instances by describing how to compute expected numbers of exceedances for an assumed instrument confidence / tolerance criterion (e.g., 95/95) for a large set of bistable data. There are other methods that would be acceptable, in particular, the X^2 test for significance.

This test can be used to determine if the exceedance-of-allowable-limits frequency in the sample is probably due to chance or probably not due to chance, for a given nominal frequency (e.g., 95% of drifts do not exceed allowable limits). This provides an acceptable method of complying with GL 91-04, Enclosure 2, item 1 in the general case."

<u>CNS EVALUATION</u>

CNS does not plan to extend any bistables from monthly to quarterly. Therefore, this section is not evaluated for the 24-Month cycle extension project.

<u>STATUS REPORT</u>

Item 4.7, Section 7, "Application to Instrument Setpoint Programs":

"Section 7 is a short tutorial on combining uncertainties in instrument Setpoint calculations. Figure 7-1 of this section is inconsistent with ANSI/ISA-S67.04-1994, Part 1, Figure 1. Rack uncertainty is not combined with sensor uncertainty in the computation of the allowable value in the standard. The purpose of the allowable value is to set a limit beyond which there is reasonable probability that the assumptions used in the setpoint calculation were in error. For channel functional tests, these assumptions normally do not include an allowance for sensor uncertainty (quarterly interval, sensor normally excluded). If a few instruments exceed the allowable value, this is probably due to instrument malfunction. If it happens frequently, the assumptions in the setpoint analysis may be wrong. Since the terminology used in Figure 7-1 is inconsistent with ANSI/ISA-S67.04-1994, Part I, Figure 1, the following correspondences are suggested: the 'Nominal Trip Setpoint' is the ANSI/ISA trip setpoint; ANSI/ISA value 'A' is the difference between TR 'Analytical Limit' and 'Nominal Trip Setpoint' [sic]; 'Sensor Uncertainty' is generally not included in the 'Allowable Value Uncertainty' and would require justification, the difference between 'Allowable Value' and 'Nominal Trip Setpoint' is ANSI/ISA value 'B'; the 'Leave-Alone-Zone' is equivalent to the ANSI/ISA value 'E' and the difference between 'System Shutdown' and 'Nominal Trip Setpoint' is the ANSI/ISA value 'D'. Equation 7-5 (page 7-7 of the TR) combines a number of uncertainties into a drift term, D. If this is done, the reasons and the method of combination should be justified and documented. The justification should include an analysis of the differences between operational and calibration environments, including accident environments in which the instrument is expected to perform."

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CNS EVALUATION

Application of the drift values to plant setpoints is performed in accordance with CNS Procedure 3.26.3, the CNS setpoint methodology document, which includes the GE Setpoint Methodology, NEDC 31336P-A. The Allowable Value defined for the GE Setpoint Methodology is defined as the operability limit when performing the channel calibration. Therefore, the Allowable Value includes the sensor drift for the refueling cycle and the trip unit drift (for transmitter/trip unit combinations) for the quarter (or other surveillance interval at which the trip unit is calibrated). No environmental terms are considered to be included in the drift term.

STATUS REPORT

Item 4.8, Section 8, "Guidelines for Fuel Cycle Extensions":

"The TR repeats the provisions of Enclosure 2, GL 91-04, and provides direct guidance, by reference to preceding sections of the TR, on some of them."

CNS EVALUATION

A specific discussion of how the CNS evaluations meet the guidance of GL 91-04 will be provided in the licensing submittal for the 24 Month Cycle Extension project.