

### 3/4.3 INSTRUMENTATION

#### BASES

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##### 3/4.3.1 and 3/4.3.2 PROTECTIVE AND ENGINEERED SAFETY FEATURES (ESF) INSTRUMENTATION

The OPERABILITY of the protective and ESF instrumentation systems and interlocks ensure that 1) the associated ESF action and/or reactor trip will be initiated when the parameter monitored by each channel or combination thereof exceeds its setpoint, 2) the specified coincidence logic and sufficient redundancy is maintained to permit a channel to be out of service for testing or maintenance consistent with maintaining an appropriate level of reliability of the Reactor Protection and Engineered Safety Features instrumentation and, 3) sufficient system functional capability is available from diverse parameters.

The OPERABILITY of these systems is required to provide the overall reliability, redundancy and diversity assumed available in the facility design for the protection and mitigation of accident and transient conditions. The integrated operation of each of these systems is consistent with the assumptions used in the accident analyses.

The Trip Setpoints are the nominal values at which the bistables are set. Any bistable is considered to be properly adjusted when the "as-left" value is within the band for CHANNEL CALIBRATION accuracy (i.e.,  $\pm$  rack calibration + comparator setting accuracy).

The Trip Setpoints used in the bistables are based on the analytical limits stated in the UFSAR. The selection of these Trip Setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those Reactor Protection System (RPS) channels that must function in harsh environments as defined by 10 CFR 50.49, the Trip Setpoints and Allowable Values specified in the Technical Specification Limiting Conditions for Operation (LCO's) are conservatively adjusted with respect to the analytical limits. The methodology used to calculate the Trip Setpoints is consistent with Instrument Society of America standard ISA-S67.04-1982, which is endorsed via NRC Regulatory Guide 1.105, Rev. 2. The actual nominal Trip Setpoint entered into the bistable is more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a CHANNEL FUNCTIONAL TEST. One example of such a change in measurement error is drift during the surveillance interval. If the measured setpoint does not exceed the Allowable Value, the bistable is considered OPERABLE.

Setpoints in accordance with the Allowable Value ensure that the safety analyses which demonstrate that safety limits are not violated remain valid (provided the unit is operated within the LCO's at the onset of any design basis event and the equipment functions as designed).

The Trip Setpoints and Allowable Values listed in the LCO's incorporate all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each Trip Setpoint. All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes.

The surveillance requirements specified for these systems ensure that the overall system functional capability is maintained comparable to the original design standards. The periodic surveillance tests are sufficient to demonstrate this capability. Two footnotes are added to the

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CHANNEL FUNCTIONAL TEST and CHANNEL CALIBRATION for Functional Units 5 and 6 of Table 4.3-1. These footnotes are consistent with Technical Specification Task Force (TSTF) Change Traveler TSTF-493, "Clarify Application of Setpoint Methodology for LSSS Functions." The first footnote 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. The channel evaluation verifies that channel performance continues to satisfy analysis assumptions and channel performance assumptions within the setpoint methodology. The purpose of the assessment is to ensure confidence in 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 Corrective Action Program. Entry into the Corrective Action Program will ensure required review and documentation of the condition. The second footnote requires that the as-left setting for the channel be returned to within the as-left tolerance of the nominal Trip Setpoint. This ensures that sufficient margin is maintained to the safety limit and/or analytical limit. If the as-left channel setting cannot be returned to within the as-left tolerance of the nominal Trip Setpoint, then the channel shall be declared inoperable. The as-found tolerance for this function is calculated using the square root sum of the squares combination of uncertainty terms (rack calibration accuracy, rack measurement and test equipment accuracy, rack comparator setting accuracy, and rack drift). The as-left tolerance for this function is calculated using the square root sum of the squares combination of uncertainty terms (rack calibration accuracy, rack measurement and test equipment accuracy, and rack comparator setting accuracy). The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. Specified surveillance and maintenance outage times have been determined in accordance with WCAP-10271, "Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System," and Supplements to that report. WCAP-14333-P-A, Revision 1, "Probabilistic Risk Analysis of the RPS and ESFAS Test Times and Completion Times," and WCAP-15376-P-A, Revision 1, "Risk-Informed Assessment of the RTS and ESFAS Surveillance Test Intervals and Reactor Trip Breaker Test and Completion Times" increased the completion times and bypass test times. Out of service times were determined based on maintaining an appropriate level of reliability of the Reactor Protection System and Engineered Safety Features instrumentation.

The verification of response time provides assurance that the reactor trip and the engineered safety features actuation associated with each channel is completed within the time limit assumed in the safety analysis. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk and is controlled under the Surveillance Frequency Control Program. Response time acceptance criteria have been relocated to UFSAR Section 7.2 tables and 7.3 tables. No credit is taken in the analysis for those channels with response times indicated as not applicable (i.e., N.A.). The Note 8 response times for feedwater isolation are based on WCAP-16503, "Salem Unit 1 and Unit 2 Containment Response to LOCA and MSLB for Containment Fan Cooler Unit (CFCU) Margin Recovery Project," Revision 3, (LCR S06-10). SGFP trip and FIV closure are credited in the containment analyses for LOCA and MSLB in case an FRV fails open.

Response time may be verified by actual response time tests in any series of sequential, overlapping or total channel measurements, or by the summation of allocated sensor response times with actual response time tests on the remainder of the channel. Allocations for sensor response times may be obtained from: (1) historical records based on acceptable response time tests (hydraulic, noise, or power interrupt tests), (2) inplace, onsite, or offsite (e.g. vendor) test

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measurements, or (3) utilizing vendor engineering specifications. WCAP-13632-P-A, Revision 2, "Elimination of Pressure Sensor Response Time Testing Requirements" provides the basis and methodology for using allocated sensor response times in the overall verification of the channel response time for specific sensors identified in the WCAP. Response time verification for other sensor types, must be demonstrated by test.

The allocation for sensor response times must be verified prior to placing the component in operational service and re-verified following maintenance that may adversely affect response time. In general, electrical repair work does not impact response time provided the parts used for repair are of the same type and value. One example where response time could be affected is replacing the sensing assembly of a transmitter. The response time may be verified for components that replace the components that were previously evaluated in Rev. 2 of WCAP-13632-P-A provided that the components have been evaluated in accordance with the NRC approved methodology as discussed in Attachment 1 to TSTF-569, "Methodology to Eliminate Pressure Sensor and Protection Channel (for Westinghouse Plants Only) Response Time Testing."

Channel testing in a bypassed condition shall be performed without lifting leads or jumpering bistables.

The CHANNEL CALIBRATION surveillance for the Power Range Neutron Flux Function instrumentation is modified by Note 17. Note 17 states that in MODES 1 and 2 the SSPS input relays are excluded from this surveillance when the installed bypass test capability is used to perform this surveillance. When the installed bypass test capability is used, the channel is tested in bypass versus tripped condition. To preclude placing the channel in a tripped condition, the SSPS input relays are excluded from this surveillance. The exclusion of the SSPS input relays from this test is intended to reduce the potential for an inadvertent reactor trip during surveillance testing. Therefore, the exclusion of the SSPS input relays from the surveillance is only applicable in MODES 1 and 2. The SSPS input relays must be included in the CHANNEL CALIBRATION surveillance at least once every 18 months.

The CHANNEL FUNCTIONAL TEST surveillances for the Power Range Neutron Flux and Power Range Neutron Flux High Positive Rate Function Instrumentation are modified by Note 18. Note 18 states that the SSPS input relays are excluded from this surveillance when the installed bypass test capability is used to perform this surveillance. When the installed bypass test capability is used, the channel is tested in a bypassed versus tripped condition. To preclude placing the channel in a tripped condition, the SSPS input relays are excluded from this surveillance. The exclusion of the SSPS input relays from this test is intended to reduce the potential for an inadvertent reactor trip during surveillance testing. The SSPS input relays must be included in the CHANNEL CALIBRATION surveillance at least once every 18 months.

The Intermediate Range (IR) Neutron Flux trip Function ensures that protection is provided against an uncontrolled RCCA bank rod withdrawal accident from a subcritical condition during startup. This trip Function provides redundant protection to the Power Range (PR) Neutron Flux - Low Setting trip Function. In MODE 1 below the P-10 setpoint, and in MODE 2 above the P-6 setpoint, when there is a potential for an uncontrolled RCCA bank rod withdrawal accident during reactor startup, the IR Neutron Flux trip must be OPERABLE. Above the P-10 setpoint, the PR Neutron Flux - High Setpoint trip function provides core protection for a rod withdrawal accident. In MODE 2 below the P-6 setpoint, the Source Range (SR) Neutron Flux Trip provides core protection for reactivity accidents. In MODE 3, 4, or 5, the IR Neutron Flux trip does not have to be OPERABLE because the control rods must be fully inserted and only the shutdown rods may be withdrawn. The reactor cannot be started up in this condition.

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The 24 hour Action times for one inoperable IR channel allow for a slow and controlled power adjustment above P-10 or below P-6 and take into account the redundant capability afforded by the OPERABLE IR channel and its low probability of failure during this period.

If both IR channels are inoperable with THERMAL POWER between P-6 and P-10, immediate suspension of operations involving positive reactivity additions is required due to loss of all IR trip protection. Normal plant control operations that individually add limited positive reactivity (e.g. temperature or boron fluctuations associated with RCS inventory management or temperature control) are allowed by this Action provided they are accounted for in the calculated SHUTDOWN MARGIN. THERMAL POWER must also be reduced to below P-6 within two hours. This Action time will allow a slow and controlled power reduction to less than the P-6 setpoint and takes into account the low probability of occurrence of an event during this period that may require the protection afforded by the IR Neutron Flux trip.

The LCO requirements for the SR Neutron Flux trip Function in Mode 2 ensure that protection is provided against an uncontrolled RCCA bank rod withdrawal accident from a subcritical condition during startup. This trip Function provides redundant protection to the Power Range Neutron Flux – Low Setting trip Function. In MODE 2 when below the P-6 setpoint, the SR Neutron Flux trip must be OPERABLE. Two OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function. If one SR channel is inoperable, immediate suspension of operations involving positive reactivity additions is required due to loss of redundancy in the SR trip function. Normal plant control operations that individually add limited positive reactivity (e.g. temperature or boron fluctuations associated with RCS inventory management or temperature control) are allowed by this Action provided they are accounted for in the calculated SHUTDOWN MARGIN. If both SR channels are inoperable, trip protection from reactivity events is compromised and the Reactor Trip Breakers (RTBs) must immediately be opened to place the core in a stable, shutdown condition.

The SR trip function is redundant to the PR Neutron Flux - Low Setting trip Function for over power protection in MODE 3, when RTBs are closed and the Control Rod Drive System (CRDS) is capable of rod withdrawal. In Modes 4 and 5 with RTBs closed and CRDS capable of rod withdrawal, only the SR trip function provides over power protection. These Neutron Flux trip functions provide over power protection for control rod withdrawal from subcritical. If one SR channel is inoperable, within 48 hours either restore the inoperable SR channel to OPERABLE status or initiate actions to fully insert all control rods and place the CRDS in a condition incapable of rod withdrawal within the following hour. If both SR channels are inoperable, the RTBs must immediately be opened to place the core in a stable, shutdown condition. In MODES 3, 4, and 5 with RTBs open and the CRDS incapable of rod withdrawal, the trip function of the SR or PR channels are not required to be OPERABLE and the SR channels provide flux monitoring functions only.

### 3/4.3.3 MONITORING INSTRUMENTATION

#### 3/4.3.3.1 RADIATION MONITORING INSTRUMENTATION

The OPERABILITY of the radiation monitoring channels ensures that 1) the radiation levels are continually measured in the areas served by the individual channels and 2) the alarm or automatic action is initiated when the radiation level trip setpoint is exceeded.

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#### 3/4.3.3.1 RADIATION MONITORING INSTRUMENTATION (Continued)

In the postulated Fuel Handling Accident, the revised dose calculations, performed using 10 CFR 50.67 and Regulatory Guide 1.183, Alternative Source Term, do not take credit for automatic containment purge isolation thus allowing for continuous monitoring of containment activity until containment closure is achieved. If required, containment purge isolation can be initiated manually from the control room.

#### CROSS REFERENCE - TABLE 3.3-6

<b>T/S Table Item No.</b>	<b>Instrument Description</b>	<b>Acceptable RMS Channels</b>
1a	Fuel Storage Area	2R5 or 2R9
1b	DELETED	
2a1a	Containment Gaseous Activity Purge & Pressure/Vacuum Relief Isolation	2R12A or 2R41A, B and D <sup>(1)</sup> <sup>(2)</sup>
2a1b	Containment Gaseous Activity RCS Leakage Detection	2R12A
2a2a	(NOT USED)	
2a2b	Containment Air Particulate Activity RCS Leakage Detection	2R11A
2b1	Noble Gas Effluent Medium Range Auxiliary Building Exhaust System (Plant Vent)	2R41B & D <sup>(1)</sup> <sup>(3)</sup> <sup>(5)</sup>
2b2	Noble Gas Effluent High Range Auxiliary Building Exhaust System (Plant Vent)	2R41C & D <sup>(1)</sup> <sup>(4)</sup> <sup>(5)</sup>
2b3	Noble Gas Effluent Condenser Exhaust System	2R15
3a	Unit 2 Control Room Intake Channel 1 (to Unit 2 Monitor) Unit 2 Control Room Intake Channel 2 (to Unit 1 Monitor)	2R1B-1 1R1B-2
	Unit 1 Control Room Intake Channel 1 (to Unit 1 Monitor) Unit 1 Control Room Intake Channel 2 (to Unit 2 Monitor)	1R1B-1 2R1B-2

- (1) The channels listed are required to be operable to meet a single operable channel for the Technical Specification's "Minimum Channels Operable" requirement.
- (2) For Modes 1, 2, 3, 4 & 5, the setpoint applies to 2R41D per Specification 3.3.3.9. The measurement range applies to 2R41A and B which display in  $\mu\text{Ci/cc}$  using the appropriate channel conversion factor from cpm to  $\mu\text{Ci/cc}$ .
- (3) 2R41D is the setpoint channel; 2R41B is the measurement channel.
- (4) 2R41D is the setpoint channel; 2R41C is the measurement channel
- (5) The release rate channel 2R41D setpoint value of  $2\text{E}4 \text{ uCi/sec}$  is within the bounds of the concentration setpoint values listed in Table 3.3-6 for normal and accident plant vent flow rates.

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Immediate action(s), in accordance with the LCO Action Statements, means that the required action should be pursued without delay and in a controlled manner.

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#### 3/4.3.3.3

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#### 3/4.3.3.4

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#### 3/4.3.3.5 REMOTE SHUTDOWN INSTRUMENTATION

The OPERABILITY of the remote shutdown instrumentation ensures that sufficient capability is available to permit shutdown and maintenance of HOT STANDBY of the facility from locations outside of the control room. This capability is required in the event control room habitability is lost and is consistent with General Design Criterion 19 of 10 CFR 50.

#### 3/4.3.3.6

THIS SECTION DELETED

#### 3/4.3.3.7 ACCIDENT MONITORING INSTRUMENTATION

The OPERABILITY of the accident monitoring instrumentation ensures that sufficient information is available on selected plant parameters to monitor and assess these variables following an accident. This capability is consistent with the Recommendations of Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," December 1975 and NUREG-0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations."

The Wide Range Neutron Flux Monitors are the Gamma-Metrics Post-Accident Neutron Monitors.

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#### 3/4.3.3.8 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The purpose of tank level indicating devices is to assure the detection and control of leaks that if not controlled could potentially result in the transport of radioactive materials to unrestricted areas.

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#### 3/4.3.3.13

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### 3/4.3.4 Deleted

#### 3/4.3.3.14 POWER DISTRIBUTION MONITORING SYSTEM (PDMS)

The Power Distribution Monitoring System (PDMS) provides core monitoring of the limiting parameters. The PDMS continuous core power distribution measurement methodology begins with the periodic generation of a highly accurate 3-D nodal simulation of the current reactor power distribution. The simulated reactor power distribution is then continuously adjusted by nodal and thermocouple calibration factors derived from an incore power distribution measurement obtained using the incore movable detectors to produce a highly accurate power distribution measurement. The nodal calibration factors are updated in accordance with the Surveillance Frequency Control Program. Between calibrations, the fidelity of the measured power distribution is maintained via adjustment to the calibrated power distribution provided by continuously input plant and core condition information. The plant and core condition data utilized by the PDMS is cross checked using redundant information to provide a robust basis for continued operation. The loop inlet temperature is generated by averaging the respective temperatures from each of the loops, excluding any bad data. The core exit thermocouples provide many readings across the core and by the nature of their usage with the PDMS, smoothing of the measured data and elimination of bad data is performed with the Surface Spline fit. PDMS uses the NIS Power Range excore detectors to provide information on the axial power distribution. Hence, the PDMS averages the data from the four Power Range excore detectors and eliminates any bad excore detector data.

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The bases for the operability requirements of the PDMS is to provide assurance of the accuracy and reliability of the core parameters measured and calculated by the PDMS core power distribution monitor function. These requirements fall under four categories:

1. Assure an adequate number of operable critical sensors.
2. Assure sufficiently accurate calibration of these sensors.
3. Assure an adequate calibration database regarding the number of data sets.
4. Assure the overall accuracy of the calibration.

The minimum number of required plant and core condition inputs include the following:

1. Control Bank Positions.
2. At least 50% of the cold leg temperatures.
3. At least 75% of the signals from the power range excore detector channels (comprised of top and bottom detector section).
4. Reactor Power Level.
5. A minimum number and distribution of operable core exit thermocouples.
6. A minimum number and distribution of measured fuel assembly power distribution information obtained using the incore movable detectors is incorporated in the nodal model calibration information.

The sensor calibration of Items 1, 2, 3, and 4 above are covered under other specifications. Calibration of the core exit thermocouples is accomplished in two parts. The first being a sensor specific correction to K-type thermocouple temperature indications based on data from a cross calibration of the thermocouple temperature indications to the average RCS temperature measured via the RTDs under isothermal RCS conditions. The second part of the thermocouple calibration is the generation of thermocouple flow mixing factors that cause the radial power distribution measured via the thermocouples to agree with the radial power distribution from a full core flux map measured using the incore movable detectors. This calibration is updated in accordance with the Surveillance Frequency Control Program. |

The operability requirements previously contained in Specification 3.3.3.2 have been moved to UFSAR Section 7.7.2.8 as part of Amendment 265.