

ENCLOSURE 2

ROAD MAP FROM THE 1985 DRAFT TS TO PROPOSED DRAFT TS

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**WATTS BAR TECHNICAL SPECIFICATION RETENTION AND
RELOCATION SUMMARY TABLE
(ROAD MAP)**

August 1992, Revision 0

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

The following summary table lists the Watts Bar Technical Specifications (1985 draft) and the corresponding new Technical Specifications (08/92 draft) based on the Westinghouse Owners Group MERITS program. Specifications which have been relocated out of the Technical Specifications are identified with the destination for the relocated Technical Specification.

The table lists each of the 1985 Watts Bar specifications, in numerical order, and the disposition of the specification in the MERITS program. The relocated specifications will go to the Technical Requirements Manual and various plant controlled documents or programs, some of which are defined in the Administrative Controls section of the MERITS Technical Specifications. Some operating and surveillance requirements are relocated to plant procedures and surveillance procedures which can be updated to reflect changes in plant design and operating conditions through the 50.59 process.

This Table is intended to be used as a tool to assist procedure writers to make the conversion for the old TS to the new TS. It is not intended to identify all differences between the two Technical Specifications.

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
2.1 SAFETY LIMITS	2.1 SAFETY LIMITS
2.1.1 Reactor Core 2.1.2 RCS Pressure 2.1.1 & 2.1.2 Action	2.1 Safety Limits and 2.2 Safety Limit Violation retain all requirements. Safety Limit 2.1.1 & 2.1.2 violation reporting requirements have been moved from specification 6.7.1 to SL 2.2.
2.2 LIMITING SAFETY SYSTEM SETTINGS	
2.2.1 Reactor Trip System Instrumentation Setpoints	3.3.1 Reactor Trip System Instrumentation The entire specification 2.2.1 has been moved to 3.3.1 RTS Instrumentation.

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.1 <u>REACTIVITY CONTROL SYSTEMS</u>	3.1 <u>REACTIVITY CONTROL</u>
<p>3.1.1.1 Shutdown Margin - T_{avg} - >200°F.</p> <p>SR 4.1.1.1.1.a</p> <p>SR 4.1.1.1.1.b SR 4.1.1.1.1.c</p> <p>SR 4.1.1.1.1.d</p> <p>SR 4.1.1.1.1.e</p> <p>SR 4.1.1.1.2</p>	<p>3.1.1 Shutdown Margin (SDM) - T_{avg} >200°F.</p> <p>Surveillance Requirement 4.1.1.1.1.a has been included in MERITS LCO 3.1.5, Rod Group Alignment Limits, Actions</p> <p>SR 3.1.7.2 SR 3.1.7.1</p> <p>Confirmed during the performance of SR 3.1.3.1</p> <p>SR 3.1.1.1 but "Factors" are moved to the BASES.</p> <p>SR 3.1.3.1.</p>
<p>3.1.1.2 Shutdown Margin - T_{avg} \leq200°F</p> <p>SR 4.1.1.2.a</p> <p>SR 4.1.1.2.b</p>	<p>3.1.2 Shutdown Margin - T_{avg} \leq200°F</p> <p>Relocated to LCO 3.1.5</p> <p>SR 3.1.2.1, but shutdown margin "factors" were moved to the BASES.</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.1.1.3 Moderator Temperature Coefficient</p> <p>SR 4.1.1.3.a SR 4.1.1.3.b</p>	<p>3.1.4 Moderator Temperature Coefficient</p> <p>Moderator temperature coefficient limits have been relocated to the COLR.</p> <p>SR 3.1.4.1 SR 3.1.4.2 & 3.1.4.3</p>
<p>3.1.1.4 Minimum Temperature for Criticality</p> <p>SR 4.1.1.4</p>	<p>3.4.2 RCS Minimum Temperature for Criticality</p> <p>SR 3.4.2.1</p>
<p>3.1.2.1 Flow Paths - Shutdown</p>	<p>Relocated to the TRM, TR 3.1.1</p>
<p>3.1.2.2 Flow Paths - Operating</p>	<p>Relocated to the TRM, TR 3.1.2</p>
<p>3.1.2.3 Charging Pumps - Shutdown</p>	<p>Relocated to the TRM, TR 3.1.3</p> <p>Old SR 4.1.2.3.2 is addressed by LCO 3.4.12 and was not retained in the TRM. SR 4.1.2.3.1 was revised.</p>
<p>3.1.2.4 Charging Pumps - Operating</p>	<p>Relocated to the TRM, TR 3.1.4</p> <p>SR revised consistent with ECCS SR.</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.1.2.5 Borated Water Source - Shutdown	Relocated to the TRM, TR 3.1.5
3.1.2.6 Borated Water Source - Operating	Relocated to the TRM, TR 3.1.6
3.1.3.1 Moveable Control Assemblies - Group Height SR 4.1.3.1.1 SR 4.1.3.1.2 Table 3.1-1	3.1.5 Rod Group Alignment Limits SR 3.1.5.1 SR 3.1.5.2 Relocated to Bases text.
3.1.3.2 Position Indicating System - Operating SR 4.1.3.2	3.1.8 Rod Position Indication SR 3.1.5.1. SR 3.1.8.1 (added)
3.1.3.3 Position Indication System - Shutdown	Relocated to the TRM, TR 3.1.7
3.1.3.4 Rod Drop Time SR 4.1.3.4.a SR 4.1.3.4.b SR 4.1.3.4.c	LCO deleted as unnecessary, SR was retained in LCO 3.1.5. SR 3.1.5.3 Deleted, covered by post- maintenance testing requirements program. SR 3.1.5.3

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.1.3.5 Shutdown Rod Insertion Limits</p> <p>SR 4.1.3.5</p>	<p>3.1.6 Shutdown Bank Insertion Limits</p> <p>SR 3.1.6.1</p>
<p>3.1.3.6 Control Rod Insertion Limits</p> <p>Figure 3.1-1</p> <p>SR 4.1.3.6</p>	<p>3.1.7 Control Bank Insertion Limits</p> <p>The actual insertion limits have been relocated to the COLR.</p> <p>SR 3.1.7.2</p> <p>SR 3.1.7.3 added</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.2 <u>POWER DISTRIBUTION LIMITS</u>	3.2 <u>POWER DISTRIBUTION LIMITS</u>
<p>3.2.1 Axial Flux Difference (CAOC Methodology)</p> <p> Figure 3.2-1</p> <p>SR 4.2.1.1</p> <p>SR 4.2.1.2</p> <p>SR 4.2.1.3</p> <p>SR 4.2.1.4</p>	<p>3.2.3 Axial Flux Difference (AFD) (RAOC Methodology)</p> <p>The Watts Bar specific AFD target band has been relocated to the COLR.</p> <p>A <u>generic</u> AFD target band can be found in Figure B 3.2.3-1.</p> <p>SR 3.2.3.1</p> <p>Only one Surveillance exists due to the change in methodology (CAOC to RAOC).</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

<p>WATTS BAR Draft, Title (LCO and Surveillance)</p>	<p>WATTS BAR MERITS, Title or Disposition</p>
<p>3.2.2 Heat Flux Hot Channel Factor - $F_Q(Z)$</p> <p>SR 4.2.2.1</p> <p>SR 4.2.2.2</p> <p>SR 4.2.2.3</p> <p>Figure 3.2-2</p>	<p>3.2.1 Heat Flux Hot Channel Factor - $F_Q(Z)$</p> <p>Allowable $F_Q(Z)$ vs. Power has been relocated to the COLR.</p> <p>Replaced with NOTE defining plant conditions for performing SRs.</p> <p>SR 3.2.1.1 & 3.2.1.2</p> <p>Detailed $F_Q^W(Z)$ and $F_Q^C(Z)$ measurement limitations have been moved to the BASES.</p> <p>Measurement uncertainty requirements have been moved to the BASES.</p> <p>Relocated to the BASES.</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.2.3 RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor</p> <p>SR 4.2.3.1</p> <p>SR 4.2.3.2</p> <p>SR 4.2.3.3</p> <p>SR 4.2.3.4</p> <p>SR 4.2.3.5</p>	<p>3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}$)</p> <p>3.4.1 RCS Pressure, Temperature, and Flow DNB Limits</p> <p>The $F_{\Delta H}$ limits have been relocated to the COLR.</p> <p>Total flow vs. R has been deleted to reflect the latest methodology which reduces the available DNBR margin to offset rod bow penalty.</p> <p>SR 4.2.3.1 is included as a NOTE</p> <p>SR 3.2.2.1</p> <p>SR 3.4.1.3</p> <p>SR is captured by LCO 3.3.1 (RTS)</p> <p>SR 3.4.1.4</p>
<p>3.2.4 Quadrant Power Tilt Ratio</p> <p>SR 4.2.4.1</p> <p>SR 4.2.4.2</p>	<p>3.2.4 Quadrant Power Tilt Ratio (QPTR)</p> <p>SR 3.2.4.1</p> <p>SR 3.2.4.2</p>
<p>3.2.5 DNB Parameters</p> <p>SR 4.2.5</p>	<p>3.4.1 RCS Pressure, Temperature, and Flow DNB Limits</p> <p>SR 3.4.1.1 and 3.4.1.2</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.3 <u>INSTRUMENTATION</u>	3.3 <u>INSTRUMENTATION</u>
<p>3.3.1 Reactor Trip System Instrumentation</p> <p>Table 3.3-2 Reactor Trip System Instrumentation Response Times</p> <p>SR 4.3.1.1</p> <p>SR 4.3.1.2</p>	<p>3.3.1 Reactor Trip System (RTS) Instrumentation</p> <p>Relocated to the TRM, TR 3.3.1</p> <p>SR 3.3.1.1 thru 3.3.1.13</p> <p>SR 3.3.1.14</p>
<p>3.3.2 Engineered Safety Features Actuation System Instrumentation</p> <p>Table 3.3-3, Item 3C, Containment Ventilation Isolation</p> <p>Table 3.3-3, Item 8, 6.9 kV Shutdown Board</p> <p>Table 3.3-5 Engineered Safety Features Response Times</p> <p>SR 4.3.2.1</p> <p>SR 4.3.2.2</p>	<p>3.3.2 Engineered Safety Features Actuation System (ESFAS) Instrumentation</p> <p>Relocated to LCO 3.3.6 Containment Vent Isolation Instrumentation</p> <p>Relocated to LCO 3.3.5</p> <p>Relocated to the TRM, TR 3.3.2</p> <p>SR 3.3.2.1 thru 3.3.2.9 & 3.3.2.11</p> <p>SR 3.3.2.10</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.3.3.1 Radiation Monitoring for Plant Operations</p> <p>SR 4.3.3.1</p>	<p>3.4.15 RCS Leakage Detection Instrumentation</p> <p>3.3.7 Control Room Emergency Ventilation System (CREVS) Actuation Instrumentation</p> <p>3.3.8 Auxiliary Building Gas Treatment System (ABGTS) Actuation Instrumentation</p> <p>Containment Atmosphere Radiation Monitors replaced by Containment Purge Exhaust Radiation Monitors</p> <p>SR 3.4.15.1, 3.4.15.2 and 3.4.15.4 SR 3.3.7.1, 3.3.7.2 and 3.3.7.4 SR 3.3.8.1, 3.3.8.2 and 3.3.8.4 Added SR 3.4.15.3, 3.3.7.3, and 3.3.8.3 to perform TADOT.</p>
<p>3.3.3.2 Movable Incore Detectors</p>	<p>Relocated to the TRM, TR 3.3.3</p>
<p>3.3.3.3 Seismic Instrumentation</p>	<p>Relocated to the TRM, TR 3.3.4</p>
<p>3.3.3.4 Meteorological Instrumentation</p>	<p>Relocated to the Offsite Dose Calculation Manual (ODCM)</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.3.3.5 Remote Shutdown Instrumentation</p> <p>SR 4.3.3.5</p> <p>Table 3.3-9</p>	<p>3.3.4 Remote Shutdown System</p> <p>SR 3.3.4.1 thru 3.3.4.4</p> <p>Relocated to LCO 3.3.4 Table 3.3.4-1.</p>
<p>3.3.3.6 Accident Monitoring Instrumentation</p> <p>SR 4.3.3.6</p>	<p>3.3.3 Post-Accident Monitoring (PAM) Instrumentation</p> <p>SR 3.3.3.1 and 3.3.3.2</p>
<p>3.3.3.7 Fire Detection Instrumentation</p>	<p>Relocated to the TRM, TR 3.3.6</p>
<p>3.3.3.8 Radioactive Liquid Effluent Monitoring Instrumentation</p>	<p>Relocated to the ODCM</p>
<p>3.3.3.9 Radioactive Gaseous Effluent Monitoring Instrumentation</p>	<p>Relocated to the ODCM</p>
<p>3.3.3.10 Loose-Part Detection System</p>	<p>Relocated to the TRM, TR 3.3.7</p>
<p>3.3.4 Turbine Overspeed Protection</p>	<p>Relocated to the TRM, TR 3.3.5</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.4 <u>REACTOR COOLANT SYSTEM</u>	3.4 <u>REACTOR COOLANT SYSTEM</u> <u>(RCS)</u>
3.4.1.1 RCS Startup and Power Operation SR 4.4.1.1	3.4.4 RCS Loops - MODES 1 and 2 SR 3.4.4.1
3.4.1.2 RCS Hot Standby SR 4.4.1.2.1 SR 4.4.1.2.2 SR 4.4.1.2.3	3.4.5 RCS Loops - MODE 3 SR 3.4.5.3 SR 3.4.5.2 SR 3.4.5.1
3.4.1.3 RCS Hot Shutdown SR 4.4.1.3.1 SR 4.4.1.3.2 SR 4.4.1.3.3	3.4.6 RCS Loops - MODE 4 SR 3.4.6.3 SR 3.4.6.2 SR 3.4.6.1
3.4.1.4.1 RCS Cold Shutdown - Loops Filled SR 4.4.1.4.1.1 SR 4.4.1.4.1.2	3.4.7 RCS Loops - MODE 5, Loops Filled SR 3.4.7.2 SR 3.4.7.1 SR 3.4.7.3 added for RHR pump breaker alignment and power

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

<p>WATTS BAR Draft, Title (LCO and Surveillance)</p>	<p>WATTS BAR MERITS, Title or Disposition</p>
<p>3.4.1.4.2 RCS Cold Shutdown - Loops Not Filled SR 4.4.1.4.2</p>	<p>3.4.8 RCS Loops - MODE 5, Loops Not Filled SR 3.4.8.1 SR 3.4.8.2 added for RHR pump breaker alignment and power for the non-operating pump.</p>
<p>3.4.2.1 Safety Valves - Shutdown</p>	<p>Relocated to TRM, TR 3.4.1 for MODE 4 \leq 310 °F and MODE 5. For MODE 4 $>$ 310 °F, See MERITS LCO 3.4.10</p>
<p>3.4.2.2 Safety Valves - Operating SR 4.4.2.2</p>	<p>3.4.10 Pressurizer Safety Valves SR 3.4.10.1</p>
<p>3.4.3 Pressurizer SR 4.4.3.1 SR 4.4.3.2 SR 4.4.3.3</p>	<p>3.4.9 Pressurizer SR 3.4.9.1 SR 3.4.9.2 Deleted, not required since normally powered by 1E power</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.4.4 Relief Valves</p> <p>SR 4.4.4.1 SR 4.4.4.2 SR 4.4.4.3</p>	<p>3.4.11 Pressurizer Power-Operated Relief Valves (PORVs)</p> <p>SR 3.4.11.3 SR 3.4.11.1 Deleted, not required since normally powered by 1E power SR 3.4.11.2 Deleted per RSTS P&R review meeting July 1992.</p>
<p>3.4.5 Steam Generators</p> <p>SR 4.4.5.0 thru 4.4.5.5</p>	<p>LCO deleted, SG operability required in SR 3.4.4.2.</p> <p>Relocated to Steam Generator Tube, Surveillance Program Specification 5.7.2.12.</p>
<p>3.4.6.1 Leakage Detection Systems</p> <p>SR 4.4.6.1</p>	<p>3.4.15 RCS Leakage Detection Instrumentation</p> <p>SR 3.4.15.1 thru 3.4.15.4</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.4.6.2 Operational Leakage</p> <p>SR 4.4.6.2.1.a SR 4.4.6.2.1.b SR 4.4.6.2.1.c SR 4.4.6.2.1.d SR 4.4.6.2.1.e</p> <p>SR 4.4.6.2.2.a SR 4.4.6.2.2.b</p> <p>SR 4.4.6.2.2.c</p> <p>SR 4.4.6.2.2.d</p>	<p>3.4.13 RCS Operational Leakage 3.5.5 Seal Injection Flow 3.4.14 RCS Pressure Isolation Valve (PIV) Leakage</p> <p>Deleted Deleted Relocated to LCO 3.5.5 SR 3.4.13.1 Deleted</p> <p>SR 3.4.14.1, Table 3.4-1 from 1985 Draft TS must be relocated to surveillance procedures</p> <p>Deleted, covered by post-maintenance test program requirements.</p> <p>SR 3.4.14.1, Table 3.4-1 from 1985 Draft TS must be relocated to surveillance procedures</p>
<p>3.4.7 Chemistry</p>	<p>Relocated to TRM, TR 3.4.4</p>
<p>3.4.8 Specific Activity</p> <p>SR 4.4.8</p>	<p>3.4.16 RCS Specific Activity</p> <p>SR 3.4.16.1 thru 3.4.16.3</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.4.9.1 Pressure/Temperature Limits</p> <p>RCS heatup and cooldown curves (Figures 3.4-2 and 3.4-3)</p> <p>Reactor Vessel Material Surveillance Program - Withdrawal Schedule (Table 4.4-5)</p> <p>SR 4.4.9.1.1</p> <p>SR 4.4.9.1.2</p>	<p>3.4.3 RCS Pressure and Temperature (P/T) Limits</p> <p>Relocated to RCS Pressure and Temperature Limits Report per specification 5.9.1.7</p> <p>Deleted, details provided directly by 10CFR50, Appendix H</p> <p>SR 3.4.3.1</p> <p>Deleted, satisfied directly by 10CFR50, Appendix H requirements</p>
<p>3.4.9.2 Pressurizer Pressure/Temperature Limits</p>	<p>Relocated to the TRM, TR 3.4.2</p>
<p>3.4.9.3 Overpressure Protection Systems</p> <p>SR 4.4.9.3.1</p> <p>SR 4.4.9.3.2</p>	<p>3.4.12 Cold Overpressure Mitigation System (COMS)</p> <p>SR 3.4.12.5, 3.4.12.6, 3.4.12.4, and 3.4.12.7</p> <p>SR 3.4.12.3</p>
<p>3.4.10 Structural Integrity</p>	<p>Relocated to TRM, TR 3.4.5</p>
<p>3.4.11 Reactor Coolant System Vents</p>	<p>Relocated to the TRM, TR 3.4.3</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.5 <u>EMERGENCY CORE COOLING SYSTEMS</u>	3.5 <u>EMERGENCY CORE COOLING SYSTEMS (ECCS)</u>
3.5.1.1 Accumulators Cold Leg Injection SR 4.5.1.1.1 SR 4.5.1.1.2	3.5.1 Accumulators SR 3.5.1.1 thru 3.5.1.5 Deleted, per NRC agreement
3.5.1.2 Upper Head Injection	UHI System deleted

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.5.2 ECCS Subsystems - $T_{avg} \geq 350^{\circ}F$</p> <p>Action B</p> <p>SR 4.5.2.a SR 4.5.2.b SR 4.5.2.c</p> <p>SR 4.5.2.d.1.a</p> <p>SR 4.5.2.d.1.b</p> <p>SR 4.5.2.d.2 SR 4.5.2.e SR 4.5.2.f</p> <p>SR 4.5.2.g</p> <p>SR 4.5.2.h</p>	<p>3.5.2 ECCS - Operating Reporting requirements per specification 5.9.2.a.</p> <p>SR 3.5.2.1 SR 3.5.2.2 and 3.5.2.3</p> <p>Must be incorporated into procedures to establish CONTAINMENT INTEGRITY</p> <p>Deleted, due to implementation of Auto Closure Interlock (ACI) elimination.</p> <p>Deleted, due to implementation of ACI elimination. SR 3.5.2.8 SR 3.5.2.5 and 3.5.2.6 SR 3.5.2.4, actual pump heads are specified per Inservice testing Program per specification 5.7.2.12</p> <p>SR 3.5.2.7, the 4 hour requirement was deleted since the requirement was actually a maintenance activity</p> <p>Deleted, this is a Post Mod Test requirement</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.5.3 ECCS Subsystems - T_{avg} < 350°F</p> <p>Action C</p> <p>SR 4.5.3.1</p> <p>SR 4.5.3.2</p>	<p>3.5.3 ECCS - Shutdown</p> <p>Reporting requirements defined in Administrative Controls, specification 5.9.2.a</p> <p>SR 3.5.3.1</p> <p>SR 3.4.12.1</p>
<p>3.5.4 Refueling Water Storage Tank</p> <p>SR 4.5.4.a</p> <p>SR 4.5.4.b</p>	<p>3.5.4 Refueling Water Storage Tank (RWST)</p> <p>SR 3.5.4.2 and 3.5.4.3</p> <p>SR 3.5.4.1</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.6 <u>CONTAINMENT SYSTEMS</u>	3.6 <u>CONTAINMENT SYSTEMS</u>
3.6.1.1 Containment Integrity SR 4.6.1.1.a SR 4.6.1.1.b SR 4.6.1.1.c	3.6.1 Containment SR 3.6.3.3 and 3.6.3.4 LCO 3.6.2 SR 3.6.1.1 and 10CFR50, Appendix J requirements.
3.6.1.2 Containment Leakage	LCO deleted because requirements addressed by LCO 3.6.1 and LCO 3.6.3, SR 3.6.1.1, SR 3.6.3.8 and 10CFR50 Appendix J.
3.6.1.3 Containment Air Locks SR 4.6.1.3.a SR 4.6.1.3.b SR 4.6.1.3.c	3.6.2 Containment Air Locks SR 3.6.2.1 SR 3.6.2.2 and 10CFR50, Appendix J.
3.6.1.4 Internal Pressure SR 4.6.1.4	3.6.4 Containment Pressure SR 3.6.4.1

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.6.1.5 Air Temperature</p> <p>SR 4.6.1.5.1</p> <p>SR 4.6.1.5.2</p>	<p>3.6.5 Containment Air Temperature</p> <p>SR 3.6.5.1</p> <p>SR 3.6.5.2</p>
<p>3.6.1.6 Containment Vessel Structural Integrity</p>	<p>Addressed by SR 3.6.1.1</p>
<p>3.6.1.7 Shield Building Structural Integrity</p> <p>SR 4.6.1.7</p>	<p>3.6.15 Shield Building</p> <p>SR 3.6.15.2</p> <p>SR 3.6.15.1 added for verification of shield building door closure</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.6.1.8 Emergency Gas Treatment System</p> <p>SR 4.6.1.8.1.a</p> <p>SR 4.6.1.8.1.b</p> <p>SR 4.6.1.8.1.c</p> <p>SR 4.6.1.8.1.d.1</p> <p>SR 4.6.1.8.1.d.5</p> <p>SR 4.6.1.8.1.e</p> <p>SR 4.6.1.8.1.f</p> <p>SR 4.6.1.8.1.d.2</p> <p>SR 4.6.1.8.1.d.3</p> <p>SR 4.6.1.8.1.d.4</p> <p>SR 4.6.1.8.2</p>	<p>3.6.9 Emergency Gas Treatment System (EGTS)</p> <p>SR 3.6.9.1</p> <p>SR 3.6.9.2 and Ventilation Filter Testing Program per specification 5.7.2.14</p> <p>SR 3.6.9.3</p> <p>Open - Maybe relocated to plant surveillance</p> <p>SR 3.6.9.4</p> <p>SR 3.6.9.5</p>
<p>3.6.1.9 Containment Ventilation System</p> <p>SR 4.6.1.9.1</p> <p>SR 4.6.1.9.2</p> <p>SR 4.6.1.9.3</p>	<p>Specification Deleted</p> <p>SR 3.6.3.1</p> <p>Deleted per NRC agreement</p> <p>SR 3.6.3.6 changed frequency to 184 days and within 92 days after opening valve.</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.6.2 Containment Spray System</p> <p>SR 4.6.2a</p> <p>SR 4.6.2.b</p> <p>SR 4.6.2.c</p> <p>SR 4.6.2.d</p>	<p>3.6.6 Containment Spray System (CSS)</p> <p>SR 3.6.6.1</p> <p>SR 3.6.6.2 and Inservice Testing Program per specification 5.7.2.11</p> <p>SR 3.6.6.3 and SR 3.6.6.4</p> <p>SR 3.6.6.5</p> <p>Added SR 3.6.6.6 to perform SR 3.5.2.2 and SR 3.5.2.4 for the RHR spray system.</p>
<p>3.6.3 Containment Isolation Valves</p> <p>SR 4.6.3.1</p> <p>SR 4.6.3.2</p> <p>SR 4.6.3.3</p> <p>Table 3.6-2</p>	<p>3.6.3 Containment Isolation Valves</p> <p>Deleted</p> <p>SR 3.6.3.7</p> <p>SR 3.6.3.5</p> <p>Covered by FSAR 6.2.4-1</p>
<p>3.6.4.1 Hydrogen Monitors</p>	<p>Relocated to LCO 3.3.3</p>
<p>3.6.4.2 Electric Hydrogen Recombiners</p> <p>SR 4.6.4.2.a</p> <p>SR 4.6.4.2.b.1</p> <p>SR 4.6.4.2.b.2</p> <p>SR 4.6.4.2.b.3</p>	<p>3.6.7 Hydrogen Recombiners - MODES 1 & 2</p> <p>SR 3.6.7.1</p> <p>Deleted</p> <p>SR 3.6.7.2</p> <p>SR 3.6.7.3</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.6.4.3 Hydrogen Mitigation System</p> <p>SR 4.6.4.3</p>	<p>3.6.8 Hydrogen Ignition System (HIS)</p> <p>SR 3.6.8.1 and 3.6.8.3 Added SR 3.6.8.2 to verify \geq one ignitor OPERABLE in each region.</p>
<p>3.6.5.1 Ice Bed</p> <p>SR 4.6.5.1</p>	<p>3.6.11 Ice Bed</p> <p>SR 3.6.11.1 thru 3.6.11.6</p>
<p>3.6.5.2 Ice Bed Temperature Monitoring System</p>	<p>Relocated to the TRM, TR 3.6.1</p>
<p>3.6.5.3 Ice Condenser Doors</p> <p>SR 4.6.5.3.1.a</p> <p>SR 4.6.5.3.1.b.1</p> <p>SR 4.6.5.3.1.b.2</p> <p>SR 4.6.5.3.1.b.3</p> <p>SR 4.6.5.3.1.b.4</p> <p>SR 4.6.5.3.1.b.5</p> <p>SR 4.6.5.3.2</p> <p>SR 4.6.5.3.3</p>	<p>3.6.12 Ice Condenser Doors</p> <p>SR 3.6.12.1 Frequency changed from continuously to 12 hours.</p> <p>SR 3.6.12.4 Frequency changed from 9 months to 18 months.</p> <p>SR 3.6.12.3 Frequency changed from 9 months to 18 months.</p> <p>SR 3.6.12.5, detailed acceptance criteria relocated to the Bases. Frequency changed from 9 months to 18 months.</p> <p>SR 3.6.12.2 and 3.6.12.6, detailed acceptance criteria relocated to the Bases.</p> <p>SR 3.6.12.7</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.6.5.4 Inlet Door Position Monitoring System	Relocated to the TRM, TR 3.6.2
	New TR 3.6.3 Lower Compartment Cooling System added to be consistent with SNP.
3.6.5.5 Divider Barrier, Personnel Access Doors and Equipment Hatches SR 4.6.5.5.1 SR 4.6.5.5.2	3.6.13 Divider Barrier Integrity SR 3.6.13.1 and 3.6.13.3 SR 3.6.13.2
3.6.5.6 Containment Air Return Fan Systems SR 4.6.5.6	3.6.10 Air Return System (ARS) SR 3.6.10.1 thru 3.6.10.3
3.6.5.7 Floor Drains SR 4.6.5.7	3.6.14 Containment Recirculation Drains SR 3.6.14.2
3.6.5.8 Refueling Canal Drains SR 4.6.5.8	3.6.14 Containment Recirculation Drains SR 3.6.14.1

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.6.5.9 Divider Barrier Seal</p> <p>SR 4.6.5.9</p> <p>Table 3.6-3</p>	<p>3.6.13 Divider Barrier Integrity</p> <p>SR 3.6.13.4 and 3.6.13.5</p> <p>Included in SR 3.6.13.4</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.7 <u>PLANT SYSTEMS</u>	3.7 <u>PLANT SYSTEMS</u>
3.7.1.1 Turbine Cycle Safety Valves SR 4.7.1.1	3.7.1 Main Steam Safety Valves (MSSVs) SR 3.7.1.1
3.7.1.2 Auxiliary Feedwater System SR 4.7.1.2.1.a.1 SR 4.7.1.2.1.a.2 SR 4.7.1.2.1.a.3 SR 4.7.1.2.1.a.4 SR 4.7.1.2.1.b.1 SR 4.7.1.2.1.b.2 SR 4.7.1.2.2	3.7.5 Auxiliary Feedwater (AFW) System SR 3.7.5.2 and Inservice Testing Program, per specification 5.7.2.11 SR 3.7.5.1 SR 3.7.5.5 SR 3.7.5.3 SR 3.7.5.4 SR 3.7.5.5
3.7.1.3 Condensate Storage Tank SR 4.7.1.3.1 SR 4.7.1.3.2	3.7.6 Condensate Storage Tank (CST) SR 3.7.6.1 Deleted
3.7.1.4 Specific Activity SR 4.7.1.4 Table 4.7-1	3.7.14 Secondary Specific Activity 3.7.14.1 Frequency changed to 31 days from requirements of Table 4.7-1. Deleted

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.7.1.5 Main Steam Line Isolation Valves</p> <p>SR 4.7.1.5</p>	<p>3.7.2 Main Steam Line Isolation Valves (MSIVs)</p> <p>SR 3.7.2.1 and Inservice Testing Program per specification 5.7.2.11</p>
<p>3.7.2 Steam Generator Pressure/ Temperature Limitation</p>	<p>Relocated to the TRM, TR 3.7.1</p>
<p>3.7.3 Component Cooling Water System</p> <p>SR 4.7.3.a SR 4.7.3.b SR 4.7.3.c</p>	<p>3.7.7 Component Cooling Water System (CCS)</p> <p>SR 3.7.7.1 SR 3.7.7.3 SR 3.7.7.4</p> <p>SR 3.7.7.2 added to verify automatic valve actuation.</p>
<p>3.7.4 Essential Raw Cooling Water System</p> <p>SR 4.7.4</p>	<p>3.7.8 Essential Raw Cooling Water System (ERCW)</p> <p>SR 3.7.8.1 thru 3.7.8.3</p>
<p>3.7.5 Ultimate Heat Sink</p> <p>SR 4.7.5</p>	<p>3.7.9 Ultimate Heat Sink (UHS)</p> <p>SR 3.7.9.1</p>
<p>3.7.6 Flood Protection Plan</p>	<p>Relocated to the TRM, TR 3.7.2</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.7.7 Control Room Emergency Ventilation System</p> <p>SR 4.7.7.a</p> <p>SR 4.7.7.b</p> <p>SR 4.7.7.c</p> <p>SR 4.7.7.d</p> <p>SR 4.7.7.e.1</p> <p>SR 4.7.7.f</p> <p>SR 4.7.7.g</p> <p>SR 4.7.7.e.2</p> <p>SR 4.7.7.e.3</p>	<p>3.7.10 Control Room Emergency Filtration System (CREFS)</p> <p>3.7.11 Control Room Emergency Air Temperature Control System (CREATCS)</p> <p>Covered by TRM 3.7.10, Area Temperature Monitoring</p> <p>SR 3.7.10.1</p> <p>SR 3.7.10.2 and Ventilation Filter Testing Program per specification 5.7.2.14</p> <p>SR 3.7.10.3</p> <p>SR 3.7.10.4</p>
<p>3.7.8 Auxiliary Building Gas Treatment System</p> <p>SR 4.7.8.a</p> <p>SR 4.7.8.b</p> <p>SR 4.7.8.c</p> <p>SR 4.7.8.d.1</p> <p>SR 4.7.8.d.4</p> <p>SR 4.7.8.e</p> <p>SR 4.7.8.f</p> <p>SR 4.7.8.d.2</p> <p>SR 4.7.8.d.3</p>	<p>3.7.12 Auxiliary Building Gas Treatment System (ABGTS)</p> <p>SR 3.7.12.1</p> <p>SR 3.7.12.2 and Ventilation Filter Testing Program per specification 5.7.2.14</p> <p>SR 3.7.12.3</p> <p>SR 3.7.12.4</p>
<p>3.7.9 Snubbers</p>	<p>Relocated to the TRM, TR 3.7.3</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.7.10 Sealed Source Contamination	Relocated to the TRM, TR 3.7.4
3.7.11.1 Fire Suppression Water System	Relocated to the TRM, TR 3.7.5
3.7.11.2 Spray and/or Sprinkler Systems	Relocated to the TRM, TR 3.7.6
3.7.11.3 CO ₂ Systems	Relocated to the TRM, TR 3.7.7
3.7.11.4 Fire Hose Stations	Relocated to the TRM, TR 3.7.8
3.7.12 Fire Related Assemblies	Relocated to the TRM, TR 3.7.9
3.7.13 Area Temperature Monitoring	Relocated to the TRM, TR 3.7.10
	<p>3.7.3 Main Feedwater Isolation and Regulation Valves (MFIVs and MFRVs) and Associated Bypass Valves</p> <p>LCO added since Main Feed isolation is assumed in the safety analyses.</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
	3.7.4 Atmospheric Dump Valves (ADV) LCO added since ADVs are assumed in the safety analysis for SGTR.

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.8 <u>ELECTRICAL POWER SYSTEMS</u>	3.8 <u>ELECTRICAL POWER SYSTEMS</u>
<p>3.8.1.1 A.C. Sources Operating</p> <p>SR 4.8.1.1.1.a SR 4.8.1.1.1.b SR 4.8.1.1.2.a.1 SR 4.8.1.1.2.a.2 SR 4.8.1.1.2.a.3 SR 4.8.1.1.2.a.4</p> <p>SR 4.8.1.1.2.a.5 SR 4.8.1.1.2.a.6</p> <p>SR 4.8.1.1.2.b SR 4.8.1.1.2.c</p> <p>SR 4.8.1.1.2.d.1 SR 4.8.1.1.2.d.2 SR 4.8.1.1.2.e</p> <p>SR 4.8.1.1.2.f.1</p> <p>SR 4.8.1.1.2.f.2 SR 4.8.1.1.2.f.3 SR 4.8.1.1.2.f.4 SR 4.8.1.1.2.f.5 SR 4.8.1.1.2.f.6.a,b</p> <p>SR 4.8.1.1.2.f.6.c SR 4.8.1.1.2.f.7</p>	<p>3.8.1 AC Sources - Operating 3.8.3 Diesel Fuel and Lubricating Oil</p> <p>SR 3.8.1.1 SR 3.8.1.8 SR 3.8.1.4 SR 3.8.3.1 SR 3.8.1.6 SR 3.8.1.2 with voltage/frequency values relaxed to steady-state limits, and SR 3.8.1.7 at reduced frequency requirements SR 3.8.1.3, response time deleted Covered by definition of operability SR 3.8.1.6 SR 3.8.3.6</p> <p>SR 3.8.3.3 and the Diesel Fuel Oil Testing Program Specification 5.7.2.16.</p> <p>Deleted, required in Preventive Maintenance program SR 3.8.1.9 SR 3.8.1.10 SR 3.8.1.11 SR 3.8.1.12 SR 3.8.1.18 SR 3.8.1.13 SR 3.8.1.14 and 3.8.1.15</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>SR 4.8.1.1.2.f.8</p> <p>SR 4.8.1.1.2.f.9</p> <p>SR 4.8.1.1.2.f.10</p> <p>SR 4.8.1.1.2.f.11</p> <p>SR 4.8.1.1.2.f.12</p> <p>SR 4.8.1.1.2.g</p> <p>SR 4.8.1.1.2.h</p> <p>SR 4.8.1.1.3</p> <p>SR 4.8.1.1.4</p>	<p>Must be relocated to surveillance program</p> <p>SR 3.8.1.16</p> <p>SR 3.8.1.17</p> <p>Deleted</p> <p>Deleted</p> <p>SR 3.8.1.19</p> <p>SR 3.8.3.7</p> <p>SR 3.8.1.20 thru 27</p> <p>Reports relocated to specification 5.9.2.b</p> <p>SR 3.8.3.2, 3.8.3.4, and 3.8.3.6 added.</p>
<p>3.8.1.2 A.C. Sources Shutdown</p> <p>SR 4.8.1.2</p>	<p>3.8.3 AC Sources - Shutdown</p> <p>SR 3.8.2.1</p>
<p>3.8.2.1 D.C. Sources Operating</p> <p>SR 4.8.2.1.a.1</p> <p>SR 4.8.2.1.a.2</p> <p>SR 4.8.2.1.b.1</p> <p>SR 4.8.2.1.b.2</p> <p>SR 4.8.2.1.b.3</p> <p>SR 4.8.2.1.c.1</p> <p>SR 4.8.2.1.c.2</p> <p>SR 4.8.2.1.c.3</p> <p>SR 4.8.2.1.c.4</p> <p>SR 4.8.2.1.d</p> <p>SR 4.8.2.1.e</p> <p>SR 4.8.2.1.f</p>	<p>3.8.4 DC Sources - Operating</p> <p>3.8.6 Battery Cell Parameters</p> <p>SR 3.8.6.1</p> <p>SR 3.8.4.1</p> <p>SR 3.8.6.2</p> <p>SR 3.8.4.3</p> <p>SR 3.8.6.3</p> <p>SR 3.8.4.4</p> <p>SR 3.8.4.5</p> <p>SR 3.8.4.6</p> <p>SR 3.8.4.7</p> <p>SR 3.8.4.8</p> <p>SR 3.8.4.9</p> <p>SR 3.8.4.9</p> <p>SR 3.8.4.2 added to verify that the alternate feeder breaker to battery charger is open.</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.8.2.2 D.C. Sources Shutdown SR 4.8.2.2	3.8.5 DC Sources - Shutdown SR 3.8.5.1
3.8.3.1 Onsite Power Distribution Operating SR 4.8.3.1.1 SR 4.8.3.1.2	3.8.9 Distribution Systems - Operating 3.8.7 Inverters - Operating SR 3.8.9.1, 3.8.7.1 Deleted
3.8.3.2 Onsite Power Distribution Shutdown SR 4.8.3.2	3.8.10 Distribution Systems - Shutdown 3.8.8 Inverters - Shutdown SR 3.8.10.1, 3.8.8.1
3.8.3.3 Isolation Devices	Relocated to the TRM, TR 3.8.1
3.8.4.1 Containment Penetration Conductor Overcurrent Protective Devices	Relocated to the TRM, TR 3.8.2
3.8.4.2 Motor-Operated Valves Thermal Overload Bypass Devices	Relocated to the TRM, TR 3.8.3
3.8.4.3 Submerged Component Circuit Protection	Relocated to the TRM, TR 3.8.4

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.9 <u>REFUELING OPERATIONS</u>	3.9 <u>REFUELING OPERATIONS</u>
<p>3.9.1 Boron Concentration</p> <p>SR 4.9.1.1 SR 4.9.1.2</p> <p>SR 4.9.1.3</p>	<p>3.9.1 Boron Concentration 3.9.2 Unborated Water Source Isolation Valves</p> <p>SR 3.9.1.1 The required boron concentration and sampling conditions relocated to the COLR.</p> <p>The K_{eff} requirement has been deleted because the boron concentration requirement is more restrictive and, if met, guarantees that the K_{eff} requirement is met.</p> <p>SR 3.9.2.1, valve list relocated to surveillance program (1-SI-62-1)</p>
<p>3.9.2 Instrumentation</p> <p>SR 4.9.2.a SR 4.9.2.b SR 4.9.2.c</p>	<p>3.9.3 Nuclear Instrumentation</p> <p>SR 3.9.3.1 Deleted SR 3.9.3.2</p>
<p>3.9.3 Decay Time</p>	<p>Relocated to TRM, TR 3.9.1</p>
<p>3.9.4 Containment Building Penetrations</p> <p>SR 4.9.4.a SR 4.9.4.b</p>	<p>3.9.4 Containment Building Penetrations</p> <p>SR 3.9.4.1 SR 3.9.4.2</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.9.5 Communications	Relocated to TRM, TR 3.9.2
3.9.6 Refueling Machine	Relocated to TRM, TR 3.9.3
3.9.7 Crane Travel - Spent Fuel Storage Pool Building	Relocated to TRM, TR 3.9.4
3.9.8.1 RHR and Coolant Circulation High Water Level SR 4.9.8.1	3.9.5 Residual Heat Removal (RHR) and Coolant Circulation - High Water Level SR 3.9.5.1
3.9.8.2 RHR and Coolant Circulation Low Water Level SR 4.9.8.2	3.9.6 Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level SR 3.9.6.1
3.9.9 Containment Ventilation Isolation System	Relocated to LCO 3.9.4 Containment Penetrations.
3.9.10 Water Level - Reactor Vessel SR 4.9.10	3.9.7 Refueling Cavity Water Level SR 3.9.7.1

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.9.11 Water Level - Storage Pool</p>	<p>3.7.13 Fuel Storage Pool Water Level.</p> <p>Applicability changed to during movement of irradiated fuel assemblies.</p>
<p>3.9.12 Auxiliary Building Gas Treatment System</p>	<p>3.7.12 Auxiliary Building Gas Treatment System.</p> <p>Applicability changed to MODES 1, 2, 3, and 4 and during movement of irradiated fuel assemblies.</p>
<p>3.9.13 Reactor Building Purge Ventilation System</p> <p>SR 4.9.13.a</p>	<p>3.9.8 Reactor Building Purge Air Cleanup Units</p> <p>This Surveillance has been moved to the Ventilation Filter Testing Program 5.7.2.14.</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.10 <u>SPECIAL TEST EXCEPTIONS</u>	
3.10.1 Shutdown Margin SR 4.10.1.1 SR 4.10.1.2	3.1.11 Shutdown Margin (SDM) Test Exceptions SR 3.1.11.1 SR 3.1.11.2
3.10.2 Group Height, Insertion, and Power Distribution Limits SR 4.10.2.1 SR 4.10.2.2	3.1.9 Mode 1 Physics Test Exceptions SR 3.1.9.1 SR 3.1.9.3 SR 3.1.9.2 added to verify Power Range Neutron Flux--High trip setpoints. Added SR 3.1.9.4 to verify SDM \geq 1.6. $\Delta k/k$.
3.10.3 Physics Tests SR 4.10.3.1 SR 4.10.3.2 SR 4.10.3.3	3.1.10 Mode 2 Physics Test Exceptions Deleted SR 3.1.10.1 SR 3.1.10.2 Added SR 3.1.10.3 to verify SDM \geq 1.6. $\Delta k/k$.

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
<p>3.10.4 Reactor Coolant Loops</p> <p>SR 4.10.4.1 SR 4.10.4.2</p>	<p>3.4.17 RCS Loops -- Test Exceptions</p> <p>SR 3.4.17.1 SR 3.4.17.2</p>

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.11 <u>RADIOACTIVE EFFLUENTS</u>	
3.11.1.1 Liquid Effluents	Relocated to the ODCM.
3.11.1.2 Dose	Relocated to the ODCM.
3.11.1.3 Liquid Radwaste Treatment System	Relocated to the ODCM.
3.11.1.4 Liquid Holdup Tanks	Relocated to the ODCM.
3.11.2.1 Gaseous Effluents	Relocated to the ODCM.
3.11.2.2 Dose - Noble Gases	Relocated to the ODCM.
3.11.2.3 Dose - Iodine-131 and 133, Tritium, and Radioactive Material in Particulate Form	Relocated to the ODCM.
3.11.2.4 Gaseous Radwaste Treatment System	Relocated to the ODCM.
3.11.2.5 Explosive Gas Mixture	Relocated to the Explosive Gas and Storage Tank Radioactivity Monitoring Program per specification 5.7.2.o.

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.11.2.6 Gas Decay Tanks	Relocated to the ODCM.
3.11.3 Solid Radioactive Wastes	Relocated to the Process Control Program (PCP).
3.11.4 Total Dose	Relocated to the ODCM.

WATTS BAR - RETENTION AND RELOCATION SUMMARY TABLE

WATTS BAR Draft, Title (LCO and Surveillance)	WATTS BAR MERITS, Title or Disposition
3.12 <u>RADIOLOGICAL ENVIRONMENTAL MONITORING</u>	
3.12.1 Monitoring Program	Relocated to the ODCM.
3.12.2 Land Use Census	Relocated to the ODCM.
3.12.3 Interlaboratory Comparison Program	Relocated to the ODCM.

ENCLOSURE 3

PROPOSED WBN TS AND BASES

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LIST OF ACRONYMS

<u>Acronym</u>	<u>Title</u>
ABGTS	Auxiliary Building Gas Treatment System
ACRP	Auxiliary Control Room Panel
ASME	American Society of Mechanical Engineers
AFD	Axial Flux Difference
AFW	Auxiliary Feedwater System
ARO	All Rods Out
ARFS	Air Return Fan System
ARV	Atmospheric Relief Valve
BOC	Beginning of Cycle
CAOC	Constant Axial Offset Control
CCS	Component Cooling Water System
CFR	Code of Federal Regulations
COLR	Core Operating Limits Report
CREVS	Control Room Emergency Ventilation System
CSS	Containment Spray System
CST	Condensate Storage Tank
DNB	Departure from Nucleate Boiling
ECCS	Emergency Core Cooling System
EFPD	Effective Full-Power Days
EGTS	Emergency Gas Treatment System
EOC	End of Cycle
ERCW	Essential Raw Cooling Water
ESF	Engineered Safety Feature
ESFAS	Engineered Safety Features Actuation System
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilating, and Air-Conditioning
LCO	Limiting Condition For Operation
MFIV	Main Feedwater Isolation Valve
MFRV	Main Feedwater Regulation Valve
MSIV	Main Steam Line Isolation Valve
MSSV	Main Steam Safety Valve
MTC	Moderator Temperature Coefficient
NMS	Neutron Monitoring System
ODCM	Offsite Dose Calculation Manual
PCP	Process Control Program
PIV	Pressure Isolation Valve
PORV	Power-Operated Relief Valve
PTLR	Pressure and Temperature Limits Report
QPTR	Quadrant Power Tilt Ratio
RAOC	Relaxed Axial Offset Control
RCCA	Rod Cluster Control Assembly
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RTP	Rated Thermal Power
RTS	Reactor Trip System
RWST	Refueling Water Storage Tank
SG	Steam Generator
SI	Safety Injection
SL	Safety Limit
SR	Surveillance Requirement
UHS	Ultimate Heat Sink

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1.0 USE AND APPLICATION

1.1 Definitions

-----NOTE-----

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

<u>Term</u>	<u>Definition</u>
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
ACTUATION LOGIC TEST	An ACTUATION LOGIC TEST shall be the application of various simulated or actual input combinations in conjunction with each possible interlock logic state and the verification of the required logic output. The ACTUATION LOGIC TEST, as a minimum, shall include a continuity check of output devices.
AXIAL FLUX DIFFERENCE (AFD)	AFD shall be the difference in normalized flux signals between the top and bottom halves of a two-section excore neutron detector.
CHANNEL CALIBRATION	A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel so that it responds within the required range and accuracy to known input. The CHANNEL CALIBRATION shall encompass the entire channel, including the required sensor, alarm, interlock, display, and trip functions. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors shall consist of an in place cross calibration of the sensing elements and normal calibration of the remaining adjustable devices in the channel. Whenever a sensing element is replaced, the next required in place cross calibration consists of

(continued)

CHANNEL CALIBRATION
(continued)

comparing the other sensing elements with the recently installed sensing element. The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping calibrations or total channel steps so that the entire channel is calibrated.

CHANNEL CHECK

A CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.

CHANNEL OPERATIONAL
TEST (COT)

An COT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify the OPERABILITY of required alarm, interlock, display, and trip functions. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints so that the setpoints are within the required range and accuracy.

CORE ALTERATION

CORE ALTERATION shall be the movement of any fuel, sources, reactivity control components, or other components affecting reactivity within the reactor vessel with the vessel head removed and fuel in the vessel. Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.

CORE OPERATING LIMITS
REPORT (COLR)

The COLR is the unit-specific document that provides cycle-specific parameter limits for the current reload cycle. These cycle-specific parameter limits shall be determined for each reload cycle in accordance with Specification 5.9.1.6. Plant operation within these cycle-specific parameter limits is addressed in individual Specifications.

DOSE EQUIVALENT I-131

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would

(continued)

DOSE EQUIVALENT I-131
(continued)

produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table E-7 of Regulatory Guide 1.109, Rev. 1, NRC, 1977.

\bar{E} - AVERAGE
DISINTEGRATION ENERGY

\bar{E} shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives > [15] minutes, making up at least 95% of the total non-iodine activity in the coolant.

ENGINEERED SAFETY
FEATURE (ESF) RESPONSE
TIME

The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include diesel generator starting and sequence loading delays, where applicable. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured.

LEAKAGE

LEAKAGE shall be:

a. Identified LEAKAGE

1. LEAKAGE, such as that from pump seals or valve packing (except reactor coolant pump seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank;
2. LEAKAGE into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary LEAKAGE; or

(continued)

LEAKAGE
(continued)

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

b. Unidentified LEAKAGE

All LEAKAGE (except reactor coolant pump seal water injection or leakoff) that is not identified LEAKAGE;

c. Pressure Boundary LEAKAGE

LEAKAGE (except SG tube LEAKAGE) through a non-isolable fault in a RCS component body, pipe wall, or vessel wall.

MASTER RELAY TEST

A MASTER RELAY TEST shall consist of energizing each master relay and verifying the OPERABILITY of each relay. The MASTER RELAY TEST shall include a continuity check of each associated slave relay.

MODE

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

OPERABLE - OPERABILITY

A system, subsystem, train, component, or device shall be OPERABLE when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).

PHYSICS TESTS

PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation. These tests are:

- a. Described in Chapter 14, Initial Test Program of the FSAR;

(continued)

PHYSICS TESTS
(continued)

- b. Authorized under the provisions of 10 CFR 50.59; or
- c. Otherwise approved by the Nuclear Regulatory Commission.

PRESSURE AND
TEMPERATURE LIMITS
REPORT (PTLR)

The PTLR is the unit specific document that provides the reactor vessel pressure and temperature limits, including heatup and cooldown rates, for the current reactor vessel fluence period. These pressure and temperature limits shall be determined for each fluence period in accordance with Specification 5.9.1.7. Plant operation within these operating limits is addressed in LCO 3.4.3, RCS Pressure and Temperature (P/T) Limits and LCO 3.4.12, Low Temperature Overpressure Protection (LTOP) System.

QUADRANT POWER TILT
RATIO (QPTR)

QPTR shall be the ratio of the maximum upper quadrant power to the average upper power or the ratio of the maximum lower quadrant power to the average lower power, whichever is greater.

RATED THERMAL POWER
(RTP)

RTP shall be a total reactor core heat transfer rate to the reactor coolant of 3411 MWt.

REACTOR TRIP
SYSTEM (RTS) RESPONSE
TIME

The RTS RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its RTS trip setpoint at the channel sensor until loss of stationary gripper coil voltage. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured.

SHUTDOWN MARGIN (SDM)

SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:

- a. All rod cluster control assemblies (RCCAs) are fully inserted except for the single RCCA of highest reactivity worth, which is assumed to be fully withdrawn; and

(continued)

SHUTDOWN MARGIN (SDM)
(continued)

- b. In MODES 1 and 2, the fuel and moderator temperatures are changed to the nominal zero power design level.

With any RCCA not capable of being fully inserted, the reactivity worth of the RCCA must be accounted for in the determination of SDM.

SLAVE RELAY TEST

A SLAVE RELAY TEST shall consist of energizing each slave relay and verifying the OPERABILITY of each slave relay. The SLAVE RELAY TEST shall include, as a minimum, a continuity check of associated testable actuation devices.

STAGGERED TEST BASIS

A STAGGERED TEST BASIS shall consist of the testing of one of the systems, subsystems, channels, or other designated components during the interval specified by the Surveillance Frequency so that all systems, subsystems, channels, or other designated components are tested during n Surveillance Frequency intervals, where n is the total number of systems, subsystems, channels, or other designated components in the associated function.

THERMAL POWER

THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

TRIP ACTUATING DEVICE
OPERATIONAL TEST
(TADOT)

TADOT shall consist of operating the trip actuating device and verifying the OPERABILITY of required alarm, interlock, display, and trip functions. The TADOT shall include adjustment, as necessary, of the trip actuating device so that it actuates at the required setpoint within the required accuracy.

Table 1.1-1 (page 1 of 1)
MODES

MODE	TITLE	REACTIVITY CONDITION (K_{eff})	% RATED THERMAL POWER ^(a)	AVERAGE REACTOR COOLANT TEMPERATURE (°F)
1	Power Operation	≥ 0.99	> 5	NA
2	Startup	≥ 0.99	≤ 5	NA
3	Hot Standby	< 0.99	NA	≥ 350
4	Hot Shutdown ^(b)	< 0.99	NA	$350 > T_{avg} > 200$
5	Cold Shutdown ^(b)	< 0.99	NA	≤ 200
6	Refueling ^(c)	NA	NA	NA

(a) Excluding decay heat.

(b) All reactor vessel head closure bolts fully tensioned.

(c) One or more reactor vessel head closure bolts less than fully tensioned.

1.0 USE AND APPLICATION

1.2 Logical Connectors

PURPOSE

The purpose of this section is to explain the meaning of logical connectors.

Logical connectors are used in Technical Specifications (TS) to discriminate between, and yet connect, discrete Conditions, Required Actions, Completion Times, Surveillances, and Frequencies. The only logical connectors that appear in TS are AND and OR. The physical arrangement of these connectors constitutes logical conventions with specific meanings.

BACKGROUND

Several levels of logic may be used to state Required Actions. These levels are identified by the placement (or nesting) of the logical connectors and by the number assigned to each Required Action. The first level of logic is identified by the first digit of the number assigned to a Required Action and the placement of the logical connector in the first level of nesting (i.e., left justified with the number of the Required Action). The successive levels of logic are identified by additional digits of the Required Action number and by successive indentions of the logical connectors.

When logical connectors are used to state a Condition, only the first level of logic is used, and the logical connector is left justified with the Condition statement.

When logical connectors are used to state a Completion Time, Surveillance, or Frequency, only the first level of logic is used, and the logical connector is left justified with the statement of the Completion Time, Surveillance, or Frequency.

(continued)

(continued)

EXAMPLES

The following examples illustrate the use of logical connectors.

EXAMPLE 1.2-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Verify . . . <u>AND</u> A.2 Restore . . .	

In this example the logical connector AND is used to indicate that when in Condition A, both Required Actions A.1 and A.2 must be completed.

EXAMPLES
(continued)

EXAMPLE 1.2-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Trip . . . <u>OR</u> A.2.1 Verify . . . <u>AND</u> A.2.2.1 Reduce . . . <u>OR</u> A.2.2.2 Perform . . . <u>OR</u> A.3 Align . . .	

This example represents a more complicated use of logical connectors. Required Actions A.1, A.2, and A.3 are alternative choices, only one of which must be performed as indicated by the use of the logical connector OR and the left justified placement. Any one of these three Actions may be chosen. If A.2 is chosen, then both A.2.1 and A.2.2 must be performed as indicated by the logical connector AND. Required Action A.2.2 is met by performing A.2.2.1 or A.2.2.2. The indented position of the logical connector OR indicates that A.2.2.1 and A.2.2.2 are alternative choices, only one of which must be performed.

1.0 USE AND APPLICATION

1.3 Completion Times

PURPOSE The purpose of this section is to establish the Completion Time convention and to provide guidance for its use.

BACKGROUND LCOs specify minimum requirements for ensuring safe operation of the unit. The ACTIONS associated with an LCO state Conditions that typically describe the ways in which the requirements of the LCO can fail to be met. Specified with each stated Condition are Required Action(s) and Completion Times(s).

DESCRIPTION The Completion Time is the amount of time allowed for completing a Required Action. It is referenced to the time of discovery of a situation (e.g., inoperable equipment or variable not within limits) that requires entering an ACTIONS Condition unless otherwise specified, providing the unit is in a MODE or specified condition stated in the Applicability of the LCO. Required Actions must be completed prior to the expiration of the specified Completion Time. An ACTIONS Condition remains in effect and the Required Actions apply until the Condition no longer exists or the unit is not within the LCO Applicability.

If situations are discovered that require entry into more than one Condition at a time within a single LCO (multiple Conditions), the Required Actions for each Condition must be performed within the associated Completion Time. When in multiple Conditions, separate Completion Times are tracked for each Condition starting from the time of discovery of the situation that required entry into the Condition.

Once a Condition has been entered, subsequent trains, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition, unless specifically stated. The Required Actions of the Condition continue to apply to each additional failure, with Completion Times based on initial entry into the Condition.

(continued)

DESCRIPTION
(continued)

However, when a subsequent train, subsystem, component, or variable, expressed in the Condition, is discovered to be inoperable or not within limits, the Completion Time(s) may be extended. To apply this Completion Time extension two criteria must first be met. The subsequent inoperability:

- a. Must exist concurrent with the first inoperability; and
- b. Must remain inoperable or not within limits after the first inoperability is resolved.

The total Completion Time allowed for completing a Required Action to address the subsequent inoperability shall be limited to the more restrictive of either:

- a. The stated Completion Time, as measured from the initial entry into the Condition, plus an additional 24 hours; or
- b. The stated Completion Time as measured from discovery of the subsequent inoperability.

The above Completion Time extensions do not apply to those Specifications that have exceptions that allow completely separate re-entry into the Condition (for each train, subsystem, component or variable expressed in the Condition) and separate tracking of Completion Times based on this re-entry. These exceptions are stated in individual Specifications.

The above Completion Time extension does not apply to a Completion Time with a modified "time zero." This modified "time zero" may be expressed as a repetitive time (i.e., "once per 8 hours," where the Completion Time is referenced from a previous completion of the Required Action versus the time of Condition entry) or as a time modified by the phrase "from discovery . . ." Example 1.3-3 illustrates one use of this type of Completion Time. The 10-day Completion Time specified for Condition A and B in Example 1.3-3 may not be extended.

(continued)

(continued)

EXAMPLES

The following examples illustrate the use of Completion Times with different types of Conditions and changing Conditions.

EXAMPLE 1.3-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

Condition B has two Required Actions. Each Required Action has its own separate Completion Time. Each Completion Time is referenced to the time that Condition B is entered.

The Required Actions of Condition B are to be in MODE 3 in 6 hours AND in MODE 5 in 36 hours. A total of 6 hours is allowed for reaching MODE 3 and a total of 36 hours (not 42 hours) is allowed for reaching MODE 5 from the time that Condition B was entered. If MODE 3 is reached in 3 hours, the time allowed for reaching MODE 5 is the next 33 hours because the total time allowed for reaching MODE 5 is 36 hours.

If Condition B is entered while in MODE 3, the time allowed for reaching MODE 5 is the next 36 hours.

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One pump inoperable.	A.1 Restore pump to OPERABLE status.	7 days
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

When a pump is declared inoperable, Condition A is entered. If the pump is not restored to OPERABLE status within 7 days, Condition B is entered and the Completion Time clocks for Required Actions B.1 and B.2 start. If the inoperable pump is restored to OPERABLE status after Condition B is entered, the Required Actions of Condition B may be terminated.

When a second pump is declared inoperable while the first pump is still inoperable, Condition A is not re-entered for the second pump. LCO 3.0.3 is entered, since the ACTIONS do not include a Condition for more than one inoperable pump. The Completion Time clock for Condition A does not stop after LCO 3.0.3 is entered, but continues to be tracked from the time Condition A was initially entered.

While in LCO 3.0.3, if one of the inoperable pumps is restored to OPERABLE status and the Completion Time for Condition A has not expired, LCO 3.0.3 may be exited and operation continued in accordance with Condition A.

While in LCO 3.0.3, if one of the inoperable pumps is restored to OPERABLE status and the Completion Time for Condition A has expired, LCO 3.0.3 may be exited and

(continued)

EXAMPLES

EXAMPLE 1.3-2 (continued)

operation continued in accordance with Condition B. The Completion Time for Condition B is tracked from the time the Condition A Completion Time expired.

On restoring one of the pumps to OPERABLE status the Condition A Completion Time is not reset, but continues from the time the first pump was declared inoperable. This Completion Time may be extended if the pump restored to OPERABLE status was the first inoperable pump. A 24-hour extension to the stated 7 days is allowed, provided this does not result in the second pump being inoperable for > 7 days.

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-3

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Function X train inoperable.	A.1 Restore Function X train to OPERABLE status.	7 days <u>AND</u> 10 days from discovery of failure to meet the LCO
B. One Function Y train inoperable.	B.1 Restore Function Y train to OPERABLE status.	72 hours <u>AND</u> 10 days from discovery of failure to meet the LCO
C. One Function X train inoperable. <u>AND</u> One Function Y train inoperable.	C.1 Restore Function X train to OPERABLE status. <u>OR</u> C.2 Restore Function Y train to OPERABLE status.	72 hours 72 hours

(continued)

EXAMPLES

EXAMPLES 1.3-3 (continued)

When one Function X train and one Function Y train are inoperable, Condition A and Condition B are concurrently applicable. The Completion Times for Condition A and Condition B are tracked separately for each train starting from the time each train was declared inoperable and the Condition was entered. A separate Completion Time is established for Condition C and tracked from the time the second train was declared inoperable (i.e., the time the situation described in Condition C was discovered).

If Required Action C.2 is completed within the specified Completion Time, Conditions B and C are exited. If the Completion Time for Required Action A.1 has not expired, operation may continue in accordance with Condition A. The remaining Completion Time in Condition A is measured from the time the affected train was declared inoperable (i.e., initial entry into Condition A).

The Completion Times of Conditions A and B are modified by a logical connector with a separate 10-day Completion Time measured from the time it was discovered the LCO was not met. In this example, without the separate Completion Time, it would be possible to alternate between Conditions A, B, and C in such a manner that operation could continue indefinitely without ever restoring systems to meet the LCO. The separate Completion Time modified by the phrase "from discovery of failure to meet the LCO" is designed to prevent indefinite continued operation while not meeting the LCO. This Completion Time allows for an exception to the normal "time zero" for beginning the Completion Time "clock". In this instance, the Completion Time "time zero" is specified as commencing at the time the LCO was initially not met, instead of at the time the associated Condition was entered.

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-4

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve(s) to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 4.	12 hours

A single Completion Time is used for any number of valves inoperable at the same time. The Completion Time associated with Condition A is based on the initial entry into Condition A and is not tracked on a per valve basis. Declaring subsequent valves inoperable, while Condition A is still in effect, does not trigger the tracking of separate Completion Times.

Once one of the valves has been restored to OPERABLE status, the Condition A Completion Time is not reset, but continues from the time the first valve was declared inoperable. The Completion Time may be extended if the valve restored to OPERABLE status was the first inoperable valve. The Condition A Completion Time may be extended for up to 4 hours provided this does not result in any subsequent valve being inoperable for > 4 hours.

If the Completion Time of 4 hours (including any extensions) expires while one or more valves are still inoperable, Condition B is entered.

(continued)

EXAMPLE
(continued)

EXAMPLE 1.3-5

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each inoperable valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 4.	12 hours

The Note above the ACTIONS table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to Condition A, the Note may appear in the Condition column.

The Note allows Condition A to be entered separately for each inoperable valve, and Completion Times tracked on a per valve basis. When a valve is declared inoperable, Condition A is entered and its Completion Time starts. If subsequent valves are declared inoperable, Condition A is entered for each valve and separate Completion Times start and are tracked for each valve.

If the Completion Time associated with a valve in Condition A expires, Condition B is entered for that valve. If the Completion Times associated with subsequent valves in

(continued)

EXAMPLES

EXAMPLE 1.3-5 (continued)

Condition A expire, Condition B is entered separately for each valve and separate Completion Times start and are tracked for each valve. If a valve that caused entry into Condition B is restored to OPERABLE status, Condition B is exited for that valve.

Since the Note in this example allows multiple Condition entry and tracking of separate Completion Times, Completion Time extensions do not apply.

EXAMPLE 1.3-6

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One channel inoperable.	A.1 Perform SR 3.x.x.x.	Once per 8 hours
	<u>OR</u> A.2 Reduce THERMAL POWER to $\leq 50\%$ RTP.	8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

Entry into Condition A offers a choice between Required Action A.1 or A.2. Required Action A.1 has a "Once per" Completion Time, which qualifies for the 25% extension, per SR 3.0.2, to each performance after the initial performance. If Required Action A.1 is followed, and the Required Action

(continued)

EXAMPLES

EXAMPLE 1.3-6 (continued)

is not met within the Completion Time (including the 25% extension allowed by SR 3.0.2), Condition B is entered. If Required Action A.2 is followed and the Completion Time of 8 hours is not met, Condition B is entered.

If after entry into Condition B, Required Action A.1 or A.2 is met, Condition B is exited and operation may then continue in Condition A.

EXAMPLE 1.3-7

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One subsystem inoperable.	A.1 Verify affected subsystem isolated.	1 hour <u>AND</u> Once per 8 hours thereafter
	<u>AND</u> A.2 Restore subsystem to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

(continued)

EXAMPLES

EXAMPLE 1.3-7 (continued)

Required Action A.1 has two Completion Times. The 1-hour Completion Time begins at the time the Condition is entered and each "Once per 8 hours thereafter" interval begins upon performance of Required Action A.1.

If after Condition A is entered, Required Action A.1 is not met within either the initial 1 hour, or any subsequent 8-hour interval from the previous performance (including the 25% extension allowed by SR 3.0.2) Condition B is entered. The Completion Time clock for Condition A does not stop after Condition B is entered, but continues from the time Condition A was initially entered. If Required Action A.1 is met after Condition B is entered, Condition B is exited and operation may continue in accordance with Condition A, provided the Completion Time for Required Action A.2 has not expired. Since the second Completion Time of Required Action A.1 has a modified "time zero" (i.e. after the initial 1 hour; not from time of Condition entry), the allowance for a Completion Time extension does not apply.

IMMEDIATE
COMPLETION TIME

When "Immediately" is used as a Completion Time, the Required Action should be pursued without delay and in a controlled manner.

1.0 USE AND APPLICATION

1.4 Frequency

PURPOSE

The purpose of this section is to define the proper use and application of Frequency requirements.

Each Surveillance Requirement (SR) has a specified Frequency in which the Surveillance must be met in order to meet the associated LCO. An understanding of the correct application of the specified Frequency is necessary for compliance with the SR.

The "specified Frequency" is referred to throughout this section and each of the Specifications of Section 3.0, "Surveillance Requirement (SR) Applicability." The "specified Frequency" consists of the requirements of the Frequency column of each Surveillance Requirement, as well as certain Notes in the Surveillance column which modify performance requirements.

Situations where a Surveillance could be required (i.e., its Frequency could expire), but it is not possible or not desired to be performed until sometime after the associated LCO is within its Applicability, represent potential SR 3.0.4 conflicts. To avoid these conflicts, the Surveillance Requirement (i.e., the Surveillance and/or the Frequency) is stated such that it is only "required" when it can be and should be performed. With a Surveillance Requirement satisfied, SR 3.0.4 imposes no restriction.

EXAMPLES

The following examples illustrate the various ways that Frequencies are specified. In these examples, the Applicability of the LCO (LCO not shown) is MODES 1, 2, and 3.

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Perform CHANNEL CHECK.	12 hours

(continued)

EXAMPLES
(continued)

EXAMPLE 1.4-1

Example 1.4-1 contains the type of SR most often encountered in the Technical Specifications (TS). The Frequency specifies an interval (12 hours) during which the associated Surveillance must be performed at least one time. Performance of the Surveillance initiates the subsequent interval. Although the Frequency is stated as 12 hours, an extension of the time interval to 1.25 times the stated Frequency is allowed by SR 3.0.2 for operational flexibility. The measurement of this interval continues at all times, even when the SR is not required to be met per SR 3.0.1 (such as when the equipment is inoperable, a variable is outside specified limits, or the unit is outside the Applicability of the LCO). If the interval specified by SR 3.0.2 is exceeded while the unit is in a MODE or other specified condition in the Applicability of the LCO, and the performance of the Surveillance is not otherwise modified (refer to Example 1.4-3), then SR 3.0.3 becomes applicable.

If the interval as specified by SR 3.0.2 is exceeded while the unit is not in a MODE or other specified condition in the Applicability of the LCO for which performance of the SR is required, the Surveillance must be performed within the Frequency requirements of SR 3.0.2 prior to entry into the MODE or other specified condition. Failure to do so would result in a violation of SR 3.0.4.

EXAMPLE 1.4-2

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify flow is within limits.	Once within 12 hours after ≥ 25% RTP <u>AND</u> 24 hours thereafter

(continued)

Examples
(continued)

EXAMPLE 1.4-2

Example 1.4-2 has two Frequencies. The first is a one-time performance Frequency, and the second is of the type shown in Example 1.4-1. The logical connector "AND" indicates that both Frequency requirements must be met. Each time reactor power is increased from a power level $< 25\%$ RTP to $\geq 25\%$ RTP, the Surveillance must be performed within 12 hours.

The use of "once" indicates a single performance will satisfy the specified Frequency (assuming no other Frequencies are connected by "AND"). This type of Frequency does not qualify for the 25% extension allowed by SR 3.0.2. "Thereafter" indicates future performances must be established per SR 3.0.2, but only after a specified condition is first met (i.e., the "once" performance in this example). If reactor power decreases to $< 25\%$ RTP, the measurement of both intervals stops. New intervals start upon reactor power reaching 25% RTP.

EXAMPLE 1.4-3

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>-----NOTE----- Not required to be performed until 12 hours after $\geq 25\%$ RTP. -----</p>	
<p>Perform channel adjustment.</p>	<p>7 days</p>

The 7-day interval measurement shown in the Frequency column of Example 1.4-3, continues at all times (as described in Example 1.4-1). This Surveillance may be satisfactorily performed within the interval specified by SR 3.0.2, whether or not the unit operation is $< 25\%$ RTP between performances.

(continued)

Examples
(continued)

EXAMPLE 1.4-3

As the Note modifies the require performance of the Surveillance, it is construed to be part of the "specified Frequency." Should the 7-day interval specified by SR 3.0.2 be exceeded while operation is $< 25\%$ RTP, this Note allows 12 hours after $\geq 25\%$ RTP to perform the Surveillance and still consider the performance to be within the "specified Frequency." Therefore, if the Surveillance was not performed within the 7-day (plus 25% per SR 3.0.2) interval, but operation was $< 25\%$ RTP, it would not constitute a failure of the SR or failure to meet the LCO. Also, no violation of SR 3.0.4 occurs when changing MODES, even with the 7-day Frequency not met, provided operation does not exceed 12 hours with power $\geq 25\%$ RTP.

Once the unit reaches 25% RTP, 12 hours would be allowed for completing the Surveillance. If the Surveillance were not performed within this 12-hour interval, there would then be a failure to perform a Surveillance within the specified Frequency; then MODE changes would be restricted in accordance with SR 3.0.4 and the provisions of SR 3.0.3 apply.

OPERABILITY. That is, SR 3.0.1 requires "failure to meet a Surveillance, whether such failure is experienced during performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO." Therefore, when the Surveillance is not required to be met, failure does not constitute failure to meet the LCO.

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

In MODES 1 and 2, the combination of THERMAL POWER, Reactor Coolant System (RCS) highest-loop average temperature, and pressurizer pressure shall not exceed the SLs specified in Figure 2.1.1.-1.

2.1.2 RCS Pressure SL

In MODES 1, 2, 3, 4, and 5, the RCS pressure shall be maintained \leq 2735 psig.

2.2 SL Violations

2.2.1 If SL 2.1.1 is violated, restore compliance and be in MODE 3 within 1 hour.

2.2.2 If SL 2.1.2 is violated:

- a. In MODE 1 or 2, restore compliance and be in MODE 3 within 1 hour.
- b. In MODE 3, 4, or 5, restore compliance within 5 minutes.

2.2.3 Within 1 hour, notify the NRC Operations Center, in accordance with 10 CFR 50.72.

2.2.4 Within 24 hours, notify the Plant Manager and Site Vice President and the Plant Operations Review Committee (PORC).

(continued)

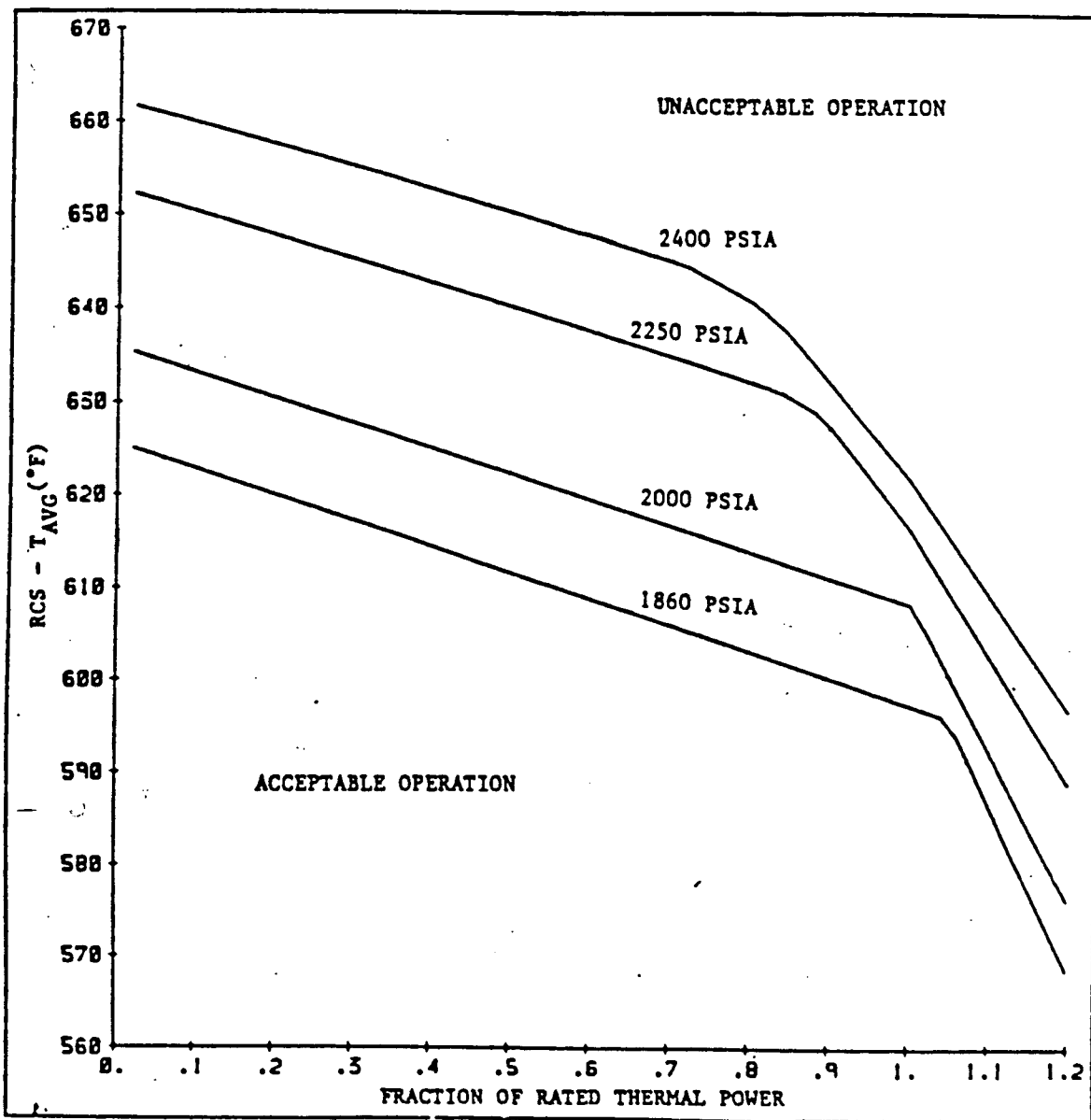


Figure 2.1.1-1
Reactor Core Safety Limits

(continued)

2.2 SL Violations (continued)

2.2.5 Within 30 days a Licensee Event Report (LER) shall be prepared pursuant to 10 CFR 50.73. The LER shall be submitted to the NRC, the PORC, Plant Manager, and the Site Vice President.

2.2.6 Operation of the unit shall not be resumed until authorized by the NRC.

3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

LCO 3.0.1 LCOs shall be met during the MODES or other specified conditions in the Applicability, except as provided in LCO 3.0.2.

LCO 3.0.2 Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 3.0.6.

If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required unless otherwise stated.

LCO 3.0.3 When an LCO is not met and the associated ACTIONS are not met or an associated ACTION is not provided, the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable. Action shall be initiated within 1 hour to place the unit, as applicable, in:

- a. MODE 3 within 7 hours;
- b. MODE 4 within 13 hours; and
- c. MODE 5 within 37 hours.

Exceptions to this Specification are stated in the individual Specifications.

Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the actions required by LCO 3.0.3 is not required.

LCO 3.0.3 is applicable in MODES 1, 2, 3, and 4.

(continued)

LCO APPLICABILITY (continued)

LCO 3.0.4 When an LCO is not met, entry into a MODE or other specified condition in the Applicability shall not be made except when the associated ACTIONS to be entered permit continued operation in the MODE or other specified condition in the Applicability for an unlimited period of time. This Specification shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS.

Exceptions to this Specification are stated in the individual Specifications. These exceptions allow entry into MODES or other specified conditions in the Applicability when the associated ACTIONS to be entered allow unit operation in the MODE or other specified condition in the Applicability only for a limited period of time.

LCO 3.0.5 Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY of other equipment. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate OPERABILITY.

LCO 3.0.6 When a supported system LCO is not met solely due to a support system LCO not being met, the Conditions and Required Actions associated with this supported system are not required to be entered. Only the support system LCO ACTIONS are required to be entered. This is an exception to LCO 3.0.2 for the supported system. In this event, additional evaluations and limitations may be required in accordance with Specification 5.8, "Safety Function Determination Program." If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

(continued)

LCO APPLICABILITY

LCO 3.0.6
(continued)

When a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

SR 3.0.1 SRs shall be met during the MODES or other specified conditions in the Applicability for individual LCOs, unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in SR 3.0.3. Surveillances do not have to be performed on inoperable equipment or variables outside specified limits.

SR 3.0.2 The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met.

For Frequencies specified as "once," the above interval extension does not apply.

If a Completion Time requires periodic performance on a "once per..." basis, the above Frequency extension applies to each performance after the initial performance.

Exceptions to this Specification are stated in the individual Specifications.

SR 3.0.3 If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance.

(continued)

LCO APPLICABILITY

SR 3.0.3
(continued)

If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered. The Completion Times of the Required Actions begin immediately upon expiration of the delay period.

When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered. The Completion Times of the Required Actions begin immediately upon failure to meet the Surveillance.

SR 3.0.4

Entry into a MODE or other specified condition in the Applicability of an LCO shall not be made unless the LCO's Surveillances have been met within their specified Frequency. This provision shall not prevent passage through or to MODES or other specified conditions in compliance with Required Actions.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}F$

LCO 3.1.1 SDM shall be $\geq 1.6\% \Delta k/k$.

APPLICABILITY: MODE 2 with $K_{eff} < 1.0$,
MODES 3 and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SDM not within limit.	A.1 Initiate boration to restore SDM to within limit.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.	24 hours

$$\text{SDM} - T_{\text{avg}} \leq 200^{\circ}\text{F}$$

3.1.2

3.1 REACTIVITY CONTROL SYSTEMS

3.1.2 SHUTDOWN MARGIN (SDM) - $T_{\text{avg}} \leq 200^{\circ}\text{F}$

LCO 3.1.2 The SDM shall be $\geq 1.0\% \Delta k/k$.

APPLICABILITY: MODE 5.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SDM not within limit.	A.1 Initiate boration to restore SDM to within limit.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.2.1 Verify SDM is $\geq 1.0\% \Delta k/k$.	24 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.3 Core Reactivity

LCO 3.1.3 The measured core reactivity shall be within $\pm 1\% \Delta k/k$ of predicted values.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Measured core reactivity not within limit.	A.1 Re-evaluate core design and safety analysis, and determine that the reactor core is acceptable for continued operation.	72 hours
	<u>AND</u> A.2 Establish appropriate operating restrictions and SRs.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.1.3.1 -----NOTE----- The predicted reactivity values may be adjusted (normalized) to correspond to the measured core reactivity prior to exceeding a fuel burnup of 60 effective full power days (EFPD) after each fuel loading. ----- Verify measured core reactivity is within $\pm 1\% \Delta k/k$ of predicted values.</p>	<p>Once prior to entering MODE 1 after each refueling AND -----NOTE----- Only required after 60 EFPD ----- 31 EFPD thereafter</p>

3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Moderator Temperature Coefficient (MTC)

LCO 3.1.4 The MTC shall be maintained within the limits specified in the COLR. The maximum upper limit shall be $\leq 0 \Delta k/k/^\circ F$ at hot zero power.

APPLICABILITY: MODE 1, and MODE 2, with $k_{eff} \geq 1.0$ for the upper MTC limit, MODES 1, 2, and 3 for the lower MTC limit.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MTC not within upper limit.	A.1 Establish administrative withdrawal limits for control banks to maintain MTC within limit.	24 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 2 with $k_{eff} < 1.0$.	6 hours
C. MTC not within lower limit.	C.1 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.4.1 Verify MTC is within upper limit.	Once prior to entering MODE 1 after each refueling
SR 3.1.4.2 Verify MTC is within 300 ppm Surveillance limit (not LCO limit) specified in the COLR.	<p>-----NOTE----- Not required to be performed until 7 effective full power days (EFPDs) after reaching the equivalent of an equilibrium RTP-all rods out (ARO) boron concentration of 300 ppm -----</p> <p>Once each cycle</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.1.4.3 -----NOTES-----</p> <ol style="list-style-type: none"> 1. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.4.3 shall be repeated once per 14 EFPDs during the remainder of the fuel cycle. 2. SR 3.1.4.3 need not be repeated if the MTC measured at the equivalent of equilibrium RTP-ARO boron concentration of ≤ 60 ppm is less negative than the 60 ppm Surveillance limit specified in the COLR. <p>-----</p> <p>Verify MTC is within lower limit.</p>	<p>-----NOTE-----</p> <p>Not required to be performed until 7 EFPDs after reaching the equivalent of an equilibrium RTP-ARO boron concentration of 300 ppm</p> <p>-----</p> <p>Once each cycle</p>

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Rod Group Alignment Limits

LC0 3.1.5 All shutdown and control rods shall be OPERABLE, with all individual indicated rod positions within 12 steps of their group step counter demand position.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more rod(s) untrippable.	A.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.2 Be in MODE 3.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. One rod not within alignment limits.	B.1 Restore rod to within alignment limit.	1 hour
	<u>OR</u>	
	B.2.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.	1 hour
	<u>OR</u>	
	B.2.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	B.2.2 Reduce THERMAL POWER to $\leq 75\%$ RTP.	2 hours
	<u>AND</u>	
	B.2.3 Verify SDM is $\geq 1.6\% \Delta k/k$	Once per 12 hours
	<u>AND</u>	
B.2.4 Perform SR 3.2.1.1.	72 hours	
<u>AND</u>		
B.2.5 Perform SR 3.2.2.1.	72 hours	
<u>AND</u>		
B.2.6 Re-evaluate safety analyses and confirm results remain valid for duration of operation under these conditions.	5 days	

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>C. More than one rod not within alignment limit.</p>	<p>C.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.</p> <p style="text-align: center;"><u>OR</u></p>	<p>1 hour</p>
	<p>C.1.2 Initiate boration to restore required SDM to within limit.</p> <p style="text-align: center;"><u>AND</u></p>	<p>1 hour</p>
	<p>C.2 Be in MODE 3.</p>	<p>6 hours</p>
<p>D. Required Action and associated Completion Time of Condition B not met.</p>	<p>D.1 Be in MODE 3.</p>	<p>6 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.1.5.1 Verify individual rod positions within alignment limit.</p>	<p>12 hours <u>AND</u> Once within 4 hours and every 4 hours thereafter when the rod position deviation monitor is inoperable</p>
<p>SR 3.1.5.2 Verify rod freedom of movement (trippability) by moving each rod not fully inserted in the core ≥ 10 steps in either direction.</p>	<p>92 days</p>
<p>SR 3.1.5.3 Verify rod drop time of each rod, from the fully withdrawn position, is $\leq [2.4]$ seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with:</p> <p>a. $T_{avg} \geq 551^{\circ}F$; and</p> <p>b. All reactor coolant pumps operating.</p>	<p>Prior to reactor criticality after each removal of the reactor head</p>

3.1 REACTIVITY CONTROL SYSTEMS

3.1.6 Shutdown Bank Insertion Limits

LCO 3.1.6 Each shutdown bank shall be within its physical insertion limits specified in the COLR.

APPLICABILITY: MODE 1,
 MODE 2 with any control bank not fully inserted.

-----NOTE-----
This LCO is not applicable while performing SR 3.1.5.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown banks not within limits.	A.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.2 Restore shutdown banks to within limits.	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.6.1 Verify each shutdown bank is within the limits specified in the COLR.	12 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.7 Control Bank Insertion Limits

LCO 3.1.7 Control banks shall be within the insertion, sequence, and overlap limits specified in the COLR.

APPLICABILITY: MODE 1,
MODE 2 with $k_{eff} \geq 1.0$.

-----NOTE-----
This LCO is not applicable while performing SR 3.1.5.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control bank insertion limits not met.	A.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.2 Restore control bank(s) to within limits.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Control banks sequence or overlap limits not met.	B.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.	1 hour
	<u>OR</u>	
	B.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	B.2 Restore control bank(s) sequence and overlap to within limits.	2 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.7.1 Verify estimated critical control bank position is within the limits specified in the COLR.	Within 4 hours prior to achieving criticality

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.1.7.2 Verify each control bank insertion is within the limits specified in the COLR.	12 hours <u>AND</u> Once within 4 hours and every 4 hours thereafter when the rod insertion limit monitor is inoperable
SR 3.1.7.3 Verify sequence and overlap limits specified in the COLR are met for control banks not fully withdrawn from the core.	12 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Rod Position Indication

LCO 3.1.8 The Analog Rod Position Indication (ARPI) System and the Demand Position Indication System shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

-----NOTE-----

Separate Condition entry is allowed for each inoperable rod position indicator per group and each demand position indicator per bank.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ARPI per group inoperable for one or more groups.	A.1 Verify the position of the rods with inoperable position indicators by using movable incore detectors.	Once per 8 hours
	<u>OR</u>	
	A.2 Reduce THERMAL POWER to \leq 50% RTP.	8 hours
B. One or more rods with inoperable position indicators have been moved in excess of 24 steps in one direction since the last determination of the rod's position.	B.1 Verify the position of the rods with inoperable position indicators by using movable incore detectors.	8 hours
	<u>OR</u>	
		(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2 Reduce THERMAL POWER to \leq 50% RTP.	8 hours
C. One demand position indicator per bank inoperable for one or more banks.	C.1.1 Verify by administrative means all ARPIS for the affected banks are OPERABLE.	Once per 8 hours
	<u>AND</u>	
	C.1.2 Verify the most withdrawn rod and the least withdrawn rod of the affected banks are \leq 12 steps apart.	Once per 8 hours
	<u>OR</u>	
	C.2 Reduce THERMAL POWER to \leq 50% RTP.	8 hours
D. Required Action and associated Completion Time of Condition A, Condition B, or Condition C not met.	D.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.8.1 Verify each ARPI agrees within 12 steps of the group demand position for the full indicated range of rod travel.	18 months

3.1 REACTIVITY CONTROL SYSTEMS

3.1.9 PHYSICS TESTS Exceptions - MODE 1

LCO 3.1.9 During the performance of PHYSICS TESTS, the requirements of

LCO 3.1.5, "Rod Group Alignment Limits";
 LCO 3.1.6, "Shutdown Bank Insertion Limits";
 LCO 3.1.7, "Control Bank Insertion Limits";
 LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)"; and
 LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)"

may be suspended, provided:

- a. THERMAL POWER is maintained \leq 85% RTP;
- b. Power Range Neutron Flux - High trip setpoints are \leq 10% RTP above the THERMAL POWER at which the test is performed, with a maximum setting of 90% RTP; and
- c. SDM is \geq 1.6% $\Delta k/k$.

APPLICABILITY: MODE 1 during PHYSICS TESTS.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SDM not within limit.	A.1 Initiate boration to restore SDM to within limit.	15 minutes
	<u>AND</u> A.2 Suspend PHYSICS TESTS exceptions.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. THERMAL POWER not within limit.</p>	<p>B.1 Reduce THERMAL POWER to within limit.</p> <p><u>OR</u></p> <p>B.2 Suspend PHYSICS TESTS exceptions.</p>	<p>1 hour</p> <p>1 hour</p>
<p>C. Power Range Neutron Flux-High trip setpoints > 10% RTP above the PHYSICS TEST power level.</p> <p><u>OR</u></p> <p>Power Range Neutron Flux-High trip setpoints > 90% RTP.</p>	<p>C.1 Restore Power Range Neutron Flux-High trip setpoints to $\leq 10\%$ above the PHYSICS TEST power level, or to $\leq 90\%$ RTP, whichever is lower.</p> <p><u>OR</u></p> <p>C.2 Suspend PHYSICS TESTS exceptions.</p>	<p>1 hour</p> <p>1 hour</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.9.1 Verify THERMAL POWER is \leq 85% RTP.	1 hour
SR 3.1.9.2 Verify Power Range Neutron Flux - High trip setpoints are \leq 10% above the PHYSICS TESTS power level, and \leq 90% RTP.	Within 8 hours prior to initiation of PHYSICS TESTS
SR 3.1.9.3 Perform SR 3.2.1.1 and SR 3.2.2.1.	12 hours
SR 3.1.9.4 Verify SDM is \geq 1.6% $\Delta k/k$.	24 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.10 PHYSICS TESTS Exceptions - MODE 2

LCO 3.1.10 During the performance of PHYSICS TESTS, the requirements of

- LCO 3.1.4, "Moderator Temperature Coefficient (MTC)";
- LCO 3.1.5, "Rod Group Alignment Limits";
- LCO 3.1.6, "Shutdown Bank Insertion Limits";
- LCO 3.1.7, "Control Bank Insertion Limits"; and
- LCO 3.4.2, "RCS Minimum Temperature for Criticality"

may be suspended, provided:

- a. RCS lowest loop average temperature is $\geq 541^{\circ}\text{F}$; and
- b. SDM is $\geq 1.6\% \Delta k/k$.

APPLICABILITY: MODE 2 during PHYSICS TESTS.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SDM not within limit.	A.1 Initiate boration to restore SDM to within limit.	15 minutes
	<u>AND</u> A.2 Suspend PHYSICS TESTS exceptions.	1 hour
B. THERMAL POWER not within limit.	B.1 Open reactor trip breakers.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. RCS lowest loop average temperature not within limit.	C.1 Restore RCS lowest loop average temperature to within limit.	15 minutes
	<u>OR</u> C.2 Be in MODE 3.	30 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.10.1 Perform CHANNEL OPERATIONAL TEST on power-range and intermediate-range channels per SR 3.3.1.7, SR 3.3.1.8, and Table 3.3.1-1.	Within 12 hours prior to initiation of PHYSICS TESTS
SR 3.1.10.2 Verify the RCS lowest loop average temperature is ≥ 541 °F.	30 minutes
SR 3.1.10.3 Verify SDM is $\geq 1.6\%$ $\Delta k/k$.	24 hours

3.2 POWER DISTRIBUTION LIMITS

3.2.1 Heat Flux Hot Channel Factor (F_Q(Z))

LCO 3.2.1 F_Q(Z), as approximated by F_Q^C(Z) and F_Q^W(Z), shall be within the limits specified in the COLR.

APPLICABILITY: MODE 1.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. F _Q ^C (Z) not within limit.	A.1 Reduce THERMAL POWER > 1% RTP for each 1% F _Q ^C (Z) exceeds limit.	15 minutes
	<u>AND</u>	
	A.2 Reduce Power Range Neutron Flux-High trip setpoints ≥ 1% for each 1% F _Q ^C (Z) exceeds limit.	8 hours
	<u>AND</u>	
	A.3 Reduce Overpower ΔT trip setpoints ≥ 1% for each 1% F _Q ^C (Z) exceeds limit.	72 hours
	<u>AND</u>	
	A.4 Perform SR 3.2.1.1.	Prior to increasing THERMAL POWER above the limit of Required Action A.1

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. F _a ^w (Z) not within limits.	B.1 Reduce AFD limits ≥ 1% for each 1% F _a ^w (Z) exceeds limit.	2 hours
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

-----NOTE-----
 During power escalation at the beginning of each cycle, THERMAL POWER may be increased until an equilibrium power level has been achieved, at which a power distribution map is obtained.

SURVEILLANCE	FREQUENCY
SR 3.2.1.1 Verify F _Q ^C (Z) is within limit.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u> 12 hours after achieving equilibrium conditions after exceeding, by ≥ 10% RTP, the THERMAL POWER at which F _Q ^C (Z) was last verified <u>AND</u> 31 EFPD thereafter

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.2.1.2 -----NOTE----- If F_Q^W(Z) is within limits and measurements indicate</p> <p style="text-align: center;">maximum over z $\left[\frac{F_Q^C(Z)}{K(Z)} \right]$</p> <p>has increased since the previous evaluation of F_Q^C(Z):</p> <p>a. Increase F_Q^W(Z) by a factor of [1.02] and reverify F_Q^W(Z) is within limits; or</p> <p>b. Repeat SR 3.2.1.2 once per 7 EFPD until two successive flux maps indicate</p> <p style="text-align: center;">maximum over z $\left[\frac{F_Q^C(Z)}{K(Z)} \right]$</p> <p>has not increased.</p> <p>-----</p> <p>Verify F_Q^W(Z) is within limit.</p>	<p>After each refueling prior to THERMAL POWER exceeding 75% RTP</p> <p><u>AND</u></p> <p>(continued)</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.1.2 (continued)	12 hours after achieving equilibrium conditions after exceeding, by $\geq 10\%$ RTP, the THERMAL POWER at which F _a ^w (Z) was last verified <u>AND</u> 31 EFPD thereafter

3.2 POWER DISTRIBUTION LIMITS

3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)

LCO 3.2.2 $F_{\Delta H}^N$ shall be within the limits specified in the COLR.

APPLICABILITY: MODE 1.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. -----NOTE----- Required Actions A.2 and A.3 must be completed whenever Condition A is entered. ----- $F_{\Delta H}^N$ not within limit.</p>	<p>A.1.1 Restore $F_{\Delta H}^N$ to within limit.</p>	4 hours
	<u>OR</u>	
	<p>A.1.2.1 Reduce THERMAL POWER to < 50% RTP.</p>	4 hours
	<u>AND</u>	
	<p>A.1.2.2 Reduce Power Range Neutron Flux-High trip setpoints to ≤ 55% RTP.</p>	8 hours
	<u>AND</u>	
	<p>A.2 Perform SR 3.2.2.1.</p>	24 hours
	<u>AND</u>	
		(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	<p>A.3</p> <p>-----NOTE----- THERMAL POWER does not have to be reduced to comply with this Required Action. -----</p> <p>Perform SR 3.2.2.1.</p>	<p>Prior to THERMAL POWER exceeding 50% RTP</p> <p><u>AND</u></p> <p>Prior to THERMAL POWER exceeding 75% RTP</p> <p><u>AND</u></p> <p>24 hours after THERMAL POWER reaching ≥ 95% RTP</p>
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.2.1 Verify $F_{\Delta H}^N$ is within limits.	Once after each refueling prior to THERMAL POWER exceeding 75% RTP <u>AND</u> 31 EFPD thereafter

3.2 POWER DISTRIBUTION LIMITS

3.2.3 AXIAL FLUX DIFFERENCE (AFD)

LCO 3.2.3 The AFD in %-flux-difference units shall be maintained within the limits specified in the COLR.

-----NOTE-----
The AFD shall be considered outside limits when two or more OPERABLE excore channels indicate AFD to be outside limits.

APPLICABILITY: MODE 1 with THERMAL POWER \geq 50% RTP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. AFD not within limits.	A.1 Reduce THERMAL POWER to < 50% RTP.	30 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.2.3.1 Verify AFD within limits for each OPERABLE excore channel.	7 days <u>AND</u> Once within 1 hour and every 1 hour thereafter with the AFD monitor alarm inoperable

3.2 POWER DISTRIBUTION LIMITS

3.2.4 QUADRANT POWER TILT RATIO (QPTR)

LCO 3.2.4 The QPTR shall be ≤ 1.02 .

APPLICABILITY: MODE 1 with THERMAL POWER > 50% RTP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. QPTR not within limit.	A.1 Reduce THERMAL POWER at least 3% from RTP for each 1% of QPTR > 1.00.	2 hours <u>AND</u> Once per 12 hours thereafter
	<u>AND</u> A.2 Perform SR 3.2.1.1 and SR 3.2.2.1.	24 hours <u>AND</u>
	<u>AND</u> A.3.1 Reevaluate safety analyses and confirm results remain valid for duration of operation under this condition.	Once per 7 days thereafter Prior to increasing THERMAL POWER above the limit of Required Action A.1
	<u>AND</u>	(continued)

ACTIONS		
CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	<p>A.3.2 -----NOTE----- Perform Required Action A.3.2 only after Required Action A.3.1 is completed. -----</p> <p>Calibrate excore detectors to show zero QPTR.</p> <p><u>AND</u></p> <p>A.3.3 -----NOTE----- Perform Required Action A.3.3 only after Required Action A.3.2 is completed. -----</p> <p>Perform SR 3.2.1.1 and SR 3.2.2.2.</p>	<p>Prior to increasing THERMAL POWER above the limit of Required Action A.1</p> <p>Within 24 hours after reaching RTP</p> <p><u>OR</u></p> <p>Within 48 hours after increasing THERMAL POWER above the limit of Required Action A.1</p>
B. Required Action and associated Completion Time not met.	B.1 Reduce THERMAL POWER to \leq 50% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.2.4.1 -----NOTE----- With one power range channel inoperable and the THERMAL POWER < 75% RTP, the remaining three power range channels can be used for calculating QPTR. ----- Verify QPTR is within limit by calculation.</p>	<p>7 days <u>AND</u> Once within 12 hours and every 12 hours thereafter with the QPTR alarm inoperable.</p>
<p>SR 3.2.4.2 -----NOTE----- Only required to be performed if one power range channel is inoperable with THERMAL POWER \geq 75% RTP. ----- Verify QPTR is within limit using the movable incore detector equivalent.</p>	<p>Once within 12 hours <u>AND</u> 12 hours thereafter</p>

3.3 INSTRUMENTATION

3.3.1 Reactor Trip System (RTS) Instrumentation

LCO 3.3.1 The RTS instrumentation for each Function in Table 3.3.1-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.1-1.

ACTIONS

-----NOTE-----
Separate condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one or more required channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.1-1 for the channel(s).	Immediately
B. One Manual Reactor Trip channel inoperable.	B.1 Restore channel to OPERABLE status.	48 hours
	<u>OR</u> B.2.1 Be in MODE 3.	54 hours
	<u>AND</u> B.2.2 Open Reactor Trip Breakers.	55 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>C. One channel or train inoperable.</p>	<p>-----NOTE----- One train of automatic trip logic may be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. -----</p> <p>C.1 Restore channel or train to OPERABLE status.</p> <p><u>OR</u></p> <p>C.2 Open Reactor Trip Breakers.</p>	<p>48 hours</p> <p>49 hours</p>
<p>D. One Power Range Neutron Flux High channel inoperable.</p>	<p>D.1.1 Place channel in trip.</p> <p><u>AND</u></p> <p>D.1.2 Reduce THERMAL POWER to $\leq 75\%$ (RTP).</p> <p><u>OR</u></p> <p>D.2.1 Place channel in trip.</p> <p><u>AND</u></p> <p>D.2.2 Perform SR 3.2.4.2.</p> <p><u>OR</u></p> <p>D.3 Be in MODE 3.</p>	<p>6 hours</p> <p>12 hours</p> <p>6 hours</p> <p>Once per 12 hours</p> <p>12 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>E. One channel inoperable.</p>	<p>-----NOTE----- Any single channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>E.1 Place channel in trip.</p> <p><u>OR</u></p> <p>E.2 Be in MODE 3.</p>	<p>6 hours</p> <p>12 hours</p>
<p>F. THERMAL POWER between P-6 and P-10, one Intermediate Range Neutron Flux channel inoperable.</p>	<p>F.1 Reduce THERMAL POWER to < P-6.</p> <p><u>OR</u></p> <p>F.2 Increase THERMAL POWER to > P-10.</p>	<p>2 hours</p> <p>2 hours</p>
<p>G. THERMAL POWER between P-6 and P-10, two Intermediate Range Neutron Flux channels inoperable.</p>	<p>G.1 Suspend operations involving positive reactivity additions.</p> <p><u>AND</u></p> <p>G.2 Reduce THERMAL POWER to < P-6.</p>	<p>Immediately</p> <p>2 hours</p>
<p>H. THERMAL POWER below P-6, one or two Intermediate Range Neutron Flux channels inoperable.</p>	<p>H.1 Restore channel(s) to OPERABLE status.</p>	<p>Prior to increasing THERMAL POWER above P-6</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
I. One Source Range Neutron Flux channel inoperable.	I.1 Suspend operations involving positive reactivity additions.	Immediately
J. Two Source Range Neutron flux channels inoperable.	J.1 Open Reactor Trip Breakers.	Immediately
K. One Source Range Neutron Flux channel inoperable.	K.1 Restore channel to OPERABLE status.	48 hours
	<u>OR</u> K.2 Open Reactor Trip Breakers.	49 hours
L. Required Source Range Neutron Flux channel inoperable.	L.1 Suspend all operations involving positive reactivity additions that would reduce the SDM to less than the limits specified in LCO 3.1.1 and LCO 3.1.2.	Immediately
	<u>AND</u> L.2 Close unborated water source isolation valves.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
L. (continued)	<p><u>AND</u></p> <p>L.3 Perform SR 3.1.1.1.</p>	<p>1 hour</p> <p><u>AND</u></p> <p>Once per 12 hours thereafter</p>
M. One channel inoperable.	<p>-----NOTE-----</p> <p>Any single channel may be bypassed for up to 4 hours for surveillance testing.</p> <p>-----</p> <p>M.1 Place channel in trip.</p> <p><u>OR</u></p> <p>M.2 Reduce THERMAL POWER to < P-7.</p>	<p>6 hours</p> <p>12 hours</p>
N. One Reactor Coolant Flow -- Low (single loop) channel inoperable.	<p>-----NOTE-----</p> <p>Any single channel may be bypassed for up to 4 hours for surveillance testing.</p> <p>-----</p> <p>N.1 Place channel in trip.</p> <p><u>OR</u></p> <p>N.2 Reduce THERMAL POWER to < P-8.</p>	<p>6 hours</p> <p>10 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>0. One Turbine Trip channel inoperable.</p>	<p>-----NOTE----- Any single Turbine Trip (Low Fluid Oil Pressure) channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>0.1 Place channel in trip.</p> <p><u>OR</u></p> <p>0.2 Reduce THERMAL POWER to < P-9.</p>	<p>6 hours</p> <p>10 hours</p>
<p>P. One SI input from ESFAS train inoperable.</p>	<p>-----NOTE----- One train may be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. -----</p> <p>P.1 Restore train to OPERABLE status.</p> <p><u>OR</u></p> <p>P.2 Be in MODE 3.</p>	<p>6 hours</p> <p>12 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>Q. One RTB train inoperable.</p>	<p>-----NOTE-----</p> <p>1. One train may be bypassed for up to 2 hours for surveillance testing provided the other train is OPERABLE.</p> <p>2. One reactor trip breaker train may be bypassed for up to 2 hours for maintenance on undervoltage or shunt trip mechanisms, provided the other train is OPERABLE.</p> <p>-----</p> <p>Q.1 Restore train to OPERABLE status.</p> <p><u>OR</u></p> <p>Q.2 Be in MODE 3.</p>	<p>1 hour</p> <p>7 hours</p>
<p>R. One channel inoperable.</p>	<p>R.1 Verify interlock is in required state for existing plant conditions.</p> <p><u>OR</u></p> <p>R.2 Be in MODE 3.</p>	<p>1 hour</p> <p>7 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>S. One channel inoperable.</p>	<p>S.1 Verify interlock is in required state for existing plant conditions.</p> <p><u>OR</u></p> <p>S.2 Be in MODE 2.</p>	<p>1 hour</p> <p>7 hours</p>
<p>T. One trip mechanism inoperable for one Reactor Trip Breaker.</p>	<p>T.1 Restore inoperable trip mechanism to OPERABLE status.</p> <p><u>OR</u></p> <p>T.2.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>T.2.2 Open reactor trip breakers.</p>	<p>48 hours</p> <p>54 hours</p> <p>55 hours</p>

.(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>U. One Steam Generator Water Level Low-Low channel inoperable.</p>	<p>-----NOTE----- Any single channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>U.1.1 Place channel in trip.</p> <p style="text-align: center;"><u>AND</u></p> <p>U.1.2 For the affected protection set, set the Trip Time Delay (T_S) to match the Trip Time Delay (T_M)</p> <p style="text-align: center;"><u>OR</u></p> <p>U.2 Be in MODE 3</p>	<p>6 hours</p> <p>4 hours</p> <p>12 hours</p>
<p>V. One Vessel ΔT channel inoperable.</p>	<p>V.1 Set the Trip Time Delay threshold power level for (T_S) and (T_M) to 0% power.</p> <p style="text-align: center;"><u>OR</u></p> <p>V.2 Be in MODE 3</p>	<p>6 hours</p> <p>12 hours</p>

SURVEILLANCE REQUIREMENTS

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

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.1.2	<p>-----NOTES-----</p> <p>1. Adjust NIS channel if absolute difference is > 2%.</p> <p>2. Not required to be performed until 12 hours after THERMAL POWER is \geq 15% RTP.</p> <p>-----</p> <p>Compare results of calorimetric heat balance calculation to Nuclear Instrumentation System (NIS) channel output.</p>	24 hours
SR 3.3.1.3	<p>-----NOTES-----</p> <p>1. Adjust NIS channel if absolute difference is \geq 3%.</p> <p>2. Not required to be performed until 96 hours after THERMAL POWER is \geq 15% RTP.</p> <p>-----</p> <p>Compare results of the incore detector measurements to NIS AFD.</p>	31 effective full power days (EFPDs)

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.3.1.4 -----NOTE----- This Surveillance must be performed on the reactor trip bypass breaker prior to placing the bypass breaker in service. ----- Perform TADOT.</p>	<p>31 days on a STAGGERED TEST BASIS</p>
<p>SR 3.3.1.5 Perform ACTUATION LOGIC TEST.</p>	<p>31 days on a STAGGERED TEST BASIS</p>
<p>SR 3.3.1.6 -----NOTE----- Not required to be performed until 31 days after THERMAL POWER is \geq 50% RTP. ----- Calibrate excore channels to agree with incore detector measurements.</p>	<p>92 EFPDs</p>
<p>SR 3.3.1.7 Perform COT.</p>	<p>92 days</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.3.1.8</p> <p>-----NOTE----- This surveillance shall include verification that interlocks P-6 and P-10 are in the required state for existing plant conditions. -----</p> <p>Perform COT.</p>	<p>92 days</p>
<p>SR 3.3.1.9</p> <p>-----NOTE----- Verification of setpoint is not required. -----</p> <p>Perform TADOT.</p>	<p>92 days</p>
<p>SR 3.3.1.10</p> <p>-----NOTE----- This surveillance shall include verification that the time constants are adjusted to the prescribed values. -----</p> <p>Perform CHANNEL CALIBRATION.</p>	<p>18 months</p>
<p>SR 3.3.1.11</p> <p>-----NOTE----- Neutron detectors are excluded from the CHANNEL CALIBRATION. -----</p> <p>Perform CHANNEL CALIBRATION.</p>	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.1.12	<p>-----NOTE----- Verification of setpoint is not required. -----</p> <p>Perform TADOT.</p>	18 months
SR 3.3.1.13	<p>-----NOTE----- Verification of setpoint is not required. -----</p> <p>Perform TADOT.</p>	<p>-----NOTE----- Only required when not performed within previous 31 days -----</p> <p>Prior to reactor startup</p>
SR 3.3.1.14	<p>-----NOTE----- Neutron detectors are excluded from response time testing. -----</p> <p>Verify RTS RESPONSE TIME is within limits.</p>	18 months on a STAGGERED TEST BASIS

Table 3.3.1-1 (page 1 of 7)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
1. Manual Reactor Trip	1,2	2	B	SR 3.3.1.12	N/A	N/A
	3(a),4(a),5(a)	2	C	SR 3.3.1.12		
2. Power Range Neutron Flux						
a. High	1,2	4	D	SR 3.3.1.1 SR 3.3.1.2 SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.14	≤ 109% of RATED THERMAL POWER (RTP)	≤ 111.4% of
b. Low	1(b),2	4	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.14	≤ 25% of RTP	≤ 27.4% of RTP
c. $f(\Delta I)$	1,2	4	E	SR 3.3.1.3 SR 3.3.1.6	Refer to Note 1 (Page 3.3-20)	Refer to Note 1 (Page 3.3-20)
3. Power Range Neutron Flux Rate						
a. High Positive Rate	1,2	4	E	SR 3.3.1.7 SR 3.3.1.11	≤ 5% of RTP with time constant ≥ 2 sec	≤ 6.3% of RTP with time constant ≥ 2 sec
b. High Negative Rate	1,2	4	E	SR 3.3.1.7 SR 3.3.1.11 SR 3.3.1.14	≤ 5% of RTP with time constant ≥ 2 sec	≤ 6.3% of RTP with time constant ≥ 2 sec
4. Intermediate Range Neutron Flux	1(b),2(c)	2	F,G	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	≤ 25% of RTP	≤ 31.2% of RTP
	2(d)	2	H	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	≤ 25% of RTP	≤ 31.2% of RTP

(continued)

- (a) With Reactor Trip Breakers closed and Rod Control System capable of rod withdrawal.
- (b) Below the P-10 (Power Range Neutron Flux) interlocks.
- (c) Above the P-6 (Intermediate Range Neutron Flux) interlocks.
- (d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.

Table 3.3.1-1 (page 2 of 7)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
5. Source Range Neutron Flux	2(d)	2	I, J	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11 SR 3.3.1.14	≤ 1E5 cps	≤ 1.4E5 cps
	3(a), 4(a), 5(a)	2	K, J	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11 SR 3.3.1.14	≤ 1E5 cps	≤ 1.4E5 cps
	3(e), 4(e), 5(e)	1	L	SR 3.3.1.1 SR 3.3.1.8 SR 3.3.1.11	≤ 1E5 cps	≤ 1.4E5 cps
6. Overtemperature ΔT	1, 2	4	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	Refer to Note 1 (Page 3.3-19)	Refer to Note 1 (Page 3.3-19)
7. Overpower ΔT	1, 2	4	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	Refer to Note 2 (Page 3.3-19)	Refer to Note 2 (Page 3.3-19)
8. Pressurizer Pressure	1(f)	4	M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	≥ 1970 psig	≥ 1964.2 psig
	1, 2	4	E	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	≤ 2385 psig	≤ 2390.2 psig
	1(f)	3	M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10	≤ 92% of instrument span	≤ 92.7% of instrument span
9. Pressurizer water Level--High						

(continued)

- (d) Below the P-6 (Intermediate Range Neutron Flux) interlocks.
- (a) With Reactor Trip Breakers closed and Rod Control System capable of rod withdrawal.
- (e) With the Reactor Trip Breakers open. In this condition, source range Function does not provide reactor trip, but does provide indication.
- (f) Above the P-7 (Low Power Reactor Trips block) interlock.

Table 3.3.1-1 (page 3 of 7)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
10. Reactor Coolant Flow--Low						
a. Single Loop	1(g)	3/loop	N	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	≥ 90%(i)	≥ 89.6%(i)
b. Two Loops	1(h)	3/loop	M	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	≥ 90%(i)	≥ 89.6%(i)
11. Undervoltage RCPs	1(f)	1/bus	M	SR 3.3.1.9(j) SR 3.3.1.10 SR 3.3.1.14	≥ 4830 volts	≥ 4734 volts
12. Underfrequency RCPs	1(f)	1/bus	M	SR 3.3.1.9(j) SR 3.3.1.10 SR 3.3.1.14	≥ 57.0 Hz	≥ 57.1 Hz
13. SG Water Level--Low-low	1,2	3/SG	U	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	≥ 17% of narrow range span	≥ 15.4% of narrow range span
Coincident with:						
a) Vessel ΔT Equivalent to power ≤ 50% RTP	1,2	4 1/loop	V	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	Vessel ΔT variable input ≤ 50% RTP	Vessel ΔT variable input ≤ 51.8% RTP
With a time delay (Ts) if one steam generator is affected					≤ Ts (Refer to Note 3, page 3.3-21)	≤ [TBD] Ts (Refer to Note 3, page 3.3-20).
or						
A time delay (Tm) if two or more Steam Generators are affected					≤ Tm (Refer to Note 3, page 3.3-21)	≤ [TBD] Tm (Refer to Note 3, page 3.3-20)
OR						

(continued)

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

(i) Percent of thermal design flow.

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

(f) Above the P-7 (Low Power Reactor Trips block) interlock.

(j) Setpoint verification not required.

Table 3.3.1-1 (page 4 of 7)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
b) Vessel ΔT equivalent to power >50% RTP	1,2	4 1/loop	V	SR 3.3.1.1 SR 3.3.1.7 SR 3.3.1.10 SR 3.3.1.14	Vessel ΔT variable input \leq 50% RTP	Vessel ΔT variable input \leq 51.8% RTP
14. Turbine Trip						
a. Low Fluid Oil Pressure	1(k)	3	0	SR 3.3.1.10 SR 3.3.1.13	\geq 45 psig	\geq 43 psig
b. Turbine Stop Valve Closure	1(k)	4	0	SR 3.3.1.10 SR 3.3.1.13	\geq 1% open	\geq 1% open
15. Safety Injection (SI) Input from Engineered Safety Feature Actuation System (ESFAS)	1,2	2 trains	P	SR 3.3.1.12	N/A	N/A
16. Reactor Trip System Interlocks						
a. Intermediate Range Neutron Flux, P-6	2(d)	2	R	SR 3.3.1.11	\geq E-10 amps	\geq 6E-11 amps
b. Low Power Reactor Trips Block, P-7	1	1/train	S	SR 3.3.1.11	N/A	N/A
c. Power Range Neutron Flux, P-8	1	4	S	SR 3.3.1.11	\leq 48% RTP	\leq 50.4% of RTP
d. Power Range Neutron Flux, P-9	1	4	S	SR 3.3.1.11	\leq 50% of RTP	\leq 52.4% of RTP
e. Power Range Neutron Flux, P-10	1,2	4	R	SR 3.3.1.11	\geq 10% of RTP	\geq 7.6% of RTP and \leq 12.4% RTP
f. Turbine Impulse Pressure, P-13	1	2	S	SR 3.3.1.10	\leq 10% turbine power	\leq 12.4% turbine power
17. Reactor Trip Breakers (1)	1,2 3(a),4(a),5(a)	2 trains 2 trains	Q C	SR 3.3.1.4 SR 3.3.1.4	N/A	N/A

(continued)

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

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

(1) Including any reactor trip bypass breakers that are racked-in and closed for bypassing a Reactor Trip Breaker.

(a) With Reactor Trip Breakers closed and Rod Control System capable of rod withdrawal.

Table 3.3.1-1 (page 5 of 7)
Reactor Trip System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
18. Reactor Trip Breaker (RTB) Undervoltage and Shunt Trip ^(m) Mechanisms	1,2	1 each/RTB	T	SR 3.3.1.4	N/A	N/A
	3(a),4(a),5(a)	1 each/RTB	C	SR 3.3.1.4		
19. Automatic Trip Logic	1,2	2 trains	P	SR 3.3.1.5	N/A	N/A
	3(a),4(a),5(a)	2 trains	C	SR 3.3.1.5		

(m) Shunt Trip mechanism does not apply for Reactor Trip Bypass Breakers.

(a) With Reactor Trip Breakers closed and Rod Control System capable of rod withdrawal.

Table 3.3.1-1 (page 6 of 7)
Reactor Trip System Instrumentation

Note 1: Overtemperature ΔT

The Overtemperature ΔT Function Allowable Value shall not exceed the following Trip Setpoint by more than 2.0% of ΔT span.

$$\Delta T \frac{(1+\tau_4 s)}{(1+\tau_5 s)} \leq \Delta T_0 \left\{ K_1 - K_2 \frac{(1+\tau_1 s)}{(1+\tau_2 s)} [T - T'] + K_3 (P - P') - f_1(\Delta I) \right\}$$

Where: ΔT is measured RCS ΔT , °F.
 ΔT_0 is the indicated ΔT at RTP, °F.
 s is the Laplace transform operator, sec⁻¹.
 T is the measured RCS average temperature, °F.
 T' is the indicated T_{avg} at RTP, $\leq 588.2^\circ\text{F}$.
 P is the measured pressurizer pressure, psig.
 P' is the nominal RCS operating pressure, ≤ 2235 psig.
 $K_1 \leq 1.0952$ $K_2 \geq 0.0133/^\circ\text{F}$ $K_3 = 0.000647/\text{psig}$.
 $\tau_1 \geq 33$ sec. $\tau_2 \leq 4$ sec.
 $\tau_4 \geq 12$ sec. $\tau_5 \leq 3$ sec.

$$f_1(\Delta I) = \begin{cases} -1.34(32 + (q_t - q_b)) & \text{when } q_t - q_b < 32\% \text{ RTP} \\ 0\% \text{ of RTP} & \text{when } -32\% \text{ RTP} \leq q_t - q_b \leq 10\% \text{ RTP} \\ 1.22((q_t - q_b) - 10) & \text{when } q_t - q_b > 10\% \text{ RTP} \end{cases}$$

Where q_t and q_b are percent RTP in the upper and lower halves of the core respectively, and $q_t + q_b$ is the total THERMAL POWER in percent RTP.

Note 2: Overpower ΔT

The Overpower ΔT Function Allowable Value shall not exceed the following Trip Setpoint by more than 1.8% of ΔT span.

$$\Delta T \frac{(1+\tau_4 s)}{(1+\tau_5 s)} \leq \Delta T_0 \left\{ K_4 - K_5 \left(\frac{\tau_3 s}{1+\tau_3 s} \right) T - K_6 [T - T'] - f_2(\Delta I) \right\}$$

Where:
 ΔT is measured RCS ΔT , °F.
 ΔT_0 is the indicated ΔT at RTP, °F.
 s is the Laplace transform operator, sec⁻¹.
 T is the measured RCS average temperature, °F.
 T' is the indicated T_{avg} at RTP, $\leq 588.2^\circ\text{F}$.

Table 3.3.1-1 (page 7 of 7)
Reactor Trip System Instrumentation

Note 2: Overpower ΔT (continued)

$K_4 \leq 1.09$ $K_5 \geq 0.02/^{\circ}\text{F}$ for increasing T_{avg} $K_6 \geq 0.00126/^{\circ}\text{F}$ when $T > T''$
 $0/^{\circ}\text{F}$ for decreasing T_{avg} $0/^{\circ}\text{F}$ when $T \leq T''$
 $\tau_3 \leq 5$ sec.
 $\tau_4 \geq 12$ sec.
 $\tau_5 \leq 3$ sec.

$f_2(\Delta I) = 0\%$ of RTP for all ΔI .

NOTE 3 Steam Generator Water Level Low-Low Trip Time Delay:

$$T_s = \{A_1(P)^3 + A_2(P)^2 + A_3(P) + A_4\} \{0.99\}$$

$$T_m = \{B_1(P)^3 + B_2(P)^2 + B_3(P) + B_4\} \{0.99\}$$

Where:

- P = Vessel ΔT Equivalent to power (% RTP), $P \leq 50\%$ RTP.
- T_s = Time Delay for Steam Generator water level--Low-Low Reactor Trip, one Steam Generator affected.
- T_m = Time Delay for Steam Generator water Level--Low-Low Reactor Trip, two or more Steam Generators affected.

$A_1 =$ [TBD]	$B_1 =$ [TBD]
$A_2 =$ [TBD]	$B_2 =$ [TBD]
$A_3 =$ [TBD]	$B_3 =$ [TBD]
$A_4 =$ [TBD]	$B_4 =$ [TBD]

TBD = To Be Determined.

3.3 INSTRUMENTATION

3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation

LCO 3.3.2 The ESFAS instrumentation for each Function in Table 3.3.2-1 shall be OPERABLE.

APPLICABILITY: According to Table 3.3.2-1.

ACTIONS

-----NOTE-----
Separate condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one or more required channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.2-1 for the channel.	Immediately
B. One channel or train inoperable.	B.1 Restore channel or train to OPERABLE status.	48 hours
	<u>OR</u> B.2.1 Be in MODE 3.	54 hours
	<u>AND</u> B.2.2 Be in MODE 5.	84 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>C. One train inoperable.</p>	<p>-----NOTE----- One train may be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. -----</p> <p>C.1 Restore train to OPERABLE status.</p> <p><u>OR</u></p> <p>C.2.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>C.2.2 Be in MODE 5.</p>	<p>6 hours</p> <p>12 hours</p> <p>42 hours</p>
<p>D. One channel inoperable.</p>	<p>-----NOTE----- Any single channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>D.1 Place channel in trip.</p> <p><u>OR</u></p> <p>D.2.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>D.2.2 Be in MODE 4.</p>	<p>6 hours</p> <p>12 hours</p> <p>18 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>E. One Containment Pressure channel inoperable.</p>	<p>-----NOTE----- One additional channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>E.1 Place channel in bypass. <u>OR</u> E.2.1 Be in MODE 3. <u>AND</u> E.2.2 Be in MODE 4.</p>	<p>6 hours</p> <p>12 hours</p> <p>18 hours</p>
<p>F. One channel or train inoperable.</p>	<p>F.1 Restore channel or train to OPERABLE status. <u>OR</u> F.2.1 Be in MODE 3. <u>AND</u> F.2.2 Be in MODE 4.</p>	<p>48 hours</p> <p>54 hours</p> <p>60 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>G. One train inoperable.</p>	<p>-----NOTE----- One train may be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. -----</p> <p>G.1 Restore train to OPERABLE status.</p> <p><u>OR</u></p> <p>G.2.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>G.2.2 Be in MODE 4.</p>	<p>6 hours</p> <p>12 hours</p> <p>18 hours</p>
<p>H. One train inoperable.</p>	<p>-----NOTE----- One train may be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. -----</p> <p>H.1 Restore train to OPERABLE status.</p> <p><u>OR</u></p> <p>H.2 Be in MODE 3.</p>	<p>6 hours</p> <p>12 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>I. One Steam Generator Water Level--High-High channel inoperable.</p>	<p>-----NOTE----- Any single channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>I.1 Place channel in trip. <u>OR</u> I.2 Be in MODE 3.</p>	<p>6 hours 12 hours</p>
<p>J. One MFW Pump Trip channel inoperable.</p>	<p>J.1 Restore channel to OPERABLE status. <u>OR</u> J.2 Be in MODE 3.</p>	<p>48 hours 54 hours</p>
<p>K. One channel inoperable.</p>	<p>-----NOTE----- One additional channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>K.1 Place channel in bypass. <u>OR</u> K.2.1 Be in MODE 3. <u>AND</u> K.2.2 Be in MODE 5.</p>	<p>6 hours 12 hours 42 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>L. One P-11 Interlock channel inoperable.</p>	<p>L.1 Verify interlock is in required state for existing plant condition.</p>	<p>1 hour</p>
	<p><u>OR</u></p>	
	<p>L.2.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>L.2.2 Be in MODE 4.</p>	<p>7 hours</p> <p>13 hours</p>
<p>M. One P-14 Interlock channel inoperable.</p>	<p>M.1 Verify interlock is in required state for existing plant condition.</p>	<p>1 hour</p>
	<p><u>OR</u></p> <p>M.2 Be in MODE 3.</p>	<p>7 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>N. One Steam Generator Water Level--Low-Low channel inoperable.</p>	<p>-----NOTE----- Any single channel may be bypassed for up to 4 hours for surveillance testing. -----</p> <p>N.1.1 Place channel in trip. <u>AND</u> N.1.2 For the affected protection set, set the Trip Time Delay (T_s) to match the Trip Time Delay (T_m)</p> <p><u>OR</u> N.2.1 Be in MODE 3. <u>AND</u> N.2.2 Be in MODE 4.</p>	<p>6- hours</p> <p>4 hours</p> <p>12 hours</p> <p>18 hours</p>
<p>0. One Vessel ΔT channel inoperable.</p>	<p>0.1 Set the Trip Time Delay threshold power level for (T_s) and (T_m) to 0% power. <u>OR</u> 0.2 Be in MODE 3</p>	<p>6 hours</p> <p>12 hours</p>

SURVEILLANCE REQUIREMENTS

-----NOTE-----

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

SURVEILLANCE		FREQUENCY
SR 3.3.2.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.2.2	Perform ACTUATION LOGIC TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.2.3	Perform MASTER RELAY TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.2.4	Perform COT.	92 days
SR 3.3.2.5	-----NOTE----- Slave relays tested by SR 3.3.2.7 are excluded from this Surveillance. ----- Perform SLAVE RELAY TEST.	92 days
SR 3.3.2.6	-----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	92 days
SR 3.3.2.7	Perform SLAVE RELAY TEST on slave relays K603A, K603B, K604A, K604B, K609A, K609B, K625A, and K625B.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.2.8	Perform TADOT.	18 months
SR 3.3.2.9	<p>-----NOTE----- This surveillance shall include verification that the time constants are adjusted to the prescribed values. -----</p> <p>Perform CHANNEL CALIBRATION.</p>	18 months
SR 3.3.2.10	<p>-----NOTE----- Not required to be performed for the turbine driven AFW pump until 24 hours after SG pressure is \geq 1092 psig. -----</p> <p>Verify ESFAS Response Times are within limit.</p>	18 months on a STAGGERED TEST BASIS
SR 3.3.2.11	Perform TADOT.	Once per Reactor Trip Breaker cycle

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

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
1. Safety Injection						
a. Manual Initiation	1,2,3,4	2	B	SR 3.3.2.8	N/A	N/A
b. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.7 SR 3.3.2.10	N/A	N/A
c. Containment Pressure--High	1,2,3	3	D	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≤ 1.54 psid	≤ 1.6 psid
d. Pressurizer Pressure--Low	1,2,3(a)	3	D	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≥ 1870 psig	≥ 1864.8 psig
e. Steam Line Pressure--Low	1,2,3(a)	3/steam line	D	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≥ 675(b)	≥ 666.6(b)
2. Containment Spray						
a. Manual Initiation	1,2,3,4	2/train, 2 trains	B	SR 3.3.2.8	N/A	N/A
b. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.10	N/A	N/A
c. Containment Pressure--High-High	1,2,3	4	E	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≤ 2.81 psid	≤ 2.9 psid
3. Containment Isolation						
a. Phase A Isolation						
(1) Manual Initiation	1,2,3,4	2	B	SR 3.3.2.8	N/A	N/A
(2) Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.10	N/A	N/A
(3) Safety Injection	Refer to Function 1 (Safety Injection) for all initiating functions and requirements.					

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

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

Table 3.3.2-1 (Page 2 of 4)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
b. Phase B Isolation						
(1) Manual Initiation	1,2,3,4	2/train, 2 trains	B	SR 3.3.2.8	N/A	N/A
(2) Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.7 SR 3.3.2.10	N/A	N/A
(3) Containment Pressure--High-High	1,2,3	4	E	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≤ 2.81 psid	≤ 2.9 psid
4. Steam Line Isolation						
a. Manual Initiation	1,2,3	4	F	SR 3.3.2.7	N/A	N/A
b. Automatic Actuation Logic and Actuation Relays	1,2,3	2 trains	G	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.10	N/A	N/A
c. Containment Pressure--High-High	1,2,3 ^(a)	4	E	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≤ 2.81 psid	≤ 2.9 psid
d. Steam Line Pressure Low	1,2,3 ^(a)	3/steam line	D	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≥ 675 psig ^(b)	≥ 666.6 psig ^(b)
e. Steamline Pressure Negative Rate High	3 ^(c)	3/steam line	D	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≥ 100.0 psi ^(d)	≥ 107.8 psi ^(d)
5. Turbine Trip and Feedwater Isolation						
a. Automatic Actuation Logic and Actuation Relays	1,2	2 trains	H	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.10	N/A	N/A

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

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

(c) Function automatically blocked above P-11 (Pressurizer Pressure Interlock) setpoint and may be manually blocked below P-11 when safety injection on Steam Line Pressure Low is not manually blocked.

(d) Time constants used in the rate/lag controller is $t_1 \geq 50$ seconds.

Table 3.3.2-1 (Page 3 of 4)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
b. Steam Generator Water Level--High High P-14	1,2	3/SG	I	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≤ 82.4%	≤ 83.1%
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiating functions and requirements.					
6. Auxiliary Feedwater						
a. Automatic Actuation Logic and Actuation Relays	1,2,3	2 trains	G	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.10	N/A	N/A
b. Steam Generator Water Level--Low-Low	1,2,3	3/SG	N	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.8 SR 3.3.2.10	≥ 17.0% of narrow range instr. span	≥ 15.4% of narrow range instr. span
Coincident with:						
1. Vessel ΔT equivalent to power ≤ 50% RTP	1,2	4 (1/loop)	0	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	Vessel ΔT variables input ≤ 50% RTP	Vessel ΔT variable input ≤ 51.8% RTP
With a time delay (T_s) if one S/G is affected					≤ T_s (Note 3, page 3.3-21)	≤ [] T_s (Note 3, page 3.3-21)
or						
A time delay (T_m) if two or more S/G's are affected					≤ T_m (Note 3, page 3.3-21)	≤ [] T_m (Note 3, page 3.3-21)
or						
2. Vessel ΔT equivalent to power > 50% RTP	1,2	4 (1/loop)	0	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9	Vessel ΔT variable input ≤ 50% RTP	Vessel ΔT variable input ≤ 51.8% RTP
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiating functions and requirements.					
d. Loss of Offsite Power	1,2,3	2/bus	F	SR 3.3.2.6 SR 3.3.2.9 SR 3.3.2.10	4830 V 0.0 volt input to inverse time relay with a 5 second time delay.	4830 \pm 96.6 V 0.0 volt input to inverse time relay with a 5 \pm 1 second time delay.
e. Trip of All Main Feedwater Pumps	1,2	1/pump	J	SR 3.3.2.8 SR 3.3.2.9 SR 3.3.2.10		≥ [] psig

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

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT	ALLOWABLE VALUE
f. Motor-driven AFW Pump Suction Transfer on Suction Pressure--Low	1,2,3	3/pump	F	SR 3.3.2.6 SR 3.3.2.9 SR 3.3.2.10	≥ 2.15 psig	≥ 1.65 psig
g. Turbine-driven AFW Pump Suction Transfer on Suction Pressure--Low	1,2,3	2/train, 2 trains	F	SR 3.3.2.6 SR 3.3.2.9 SR 3.3.2.10	≥ 13.1 psig	≥ 12.1 psig
7. Automatic Switchover To Containment Sump						
a. Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5 SR 3.3.2.10	N/A	N/A
b. RWST Level--Low Low	1,2,3,4	4	K	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≥ 130 inches from tank base	≥ 126 and ≤ [] inches from tank base
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiating functions and requirements.					
and						
Coincident with Containment Sump Level--High	1,2,3,4	4	K	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9 SR 3.3.2.10	≥ 30 in. above EL 703 ft	≤ 32.5 in. above EL 703 ft
8. ESFAS Interlocks						
a. Reactor Trip, P-4	1,2,3	1/train, 2 trains	F	SR 3.3.2.11	N/A	N/A
b. Pressurizer Pressure, P-11	1,2,3	3	L	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9	≤ 1970 psig	≤ 1964.2 psig
c. Steam Generator (SG) Water--Level High High, P-14	1,2	3/SG	M	SR 3.3.2.1 SR 3.3.2.4 SR 3.3.2.9	≤ 82.4%	≤ 83.1%

3.3 INSTRUMENTATION

3.3.3 Post Accident Monitoring (PAM) Instrumentation

LCO 3.3.3 The PAM instrumentation for each Function in Table 3.3.3-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

-----NOTE-----
Source Range Neutron Flux is required OPERABLE below P-6 (Intermediate Range Neutron Flux) interlocks.

ACTIONS

- NOTES-----
1. LCO 3.0.4 is not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one or more required channels inoperable.	A.1 Enter the Condition referenced in Table 3.3.3-1 for the required channel(s).	Immediately
B. One channel inoperable.	B.1 Restore channel to OPERABLE status.	7 days
C. One channel inoperable.	C.1 Restore channel to OPERABLE status.	30 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time of Condition C not met.	D.1 Initiate action in accordance with Specification 5.9.2.c.	Immediately
E. Two or more channels inoperable.	E.1 Restore one channel to OPERABLE status.	7 days
F. Two hydrogen monitor channels inoperable.	F.1 Restore one hydrogen monitor channel to OPERABLE status.	72 hours
G. Two channels inoperable.	G.1 Restore one channel to OPERABLE status.	7 days
H. Required Action and associated Completion Time of Condition G not met.	H.1 Initiate action in accordance with Specification 5.9.2.c.	Immediately
I. Required Action and associated Completion Time of Conditions B, E, or F not met.	I.1 Be in MODE 3. <u>AND</u> I.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

-----NOTE-----
 SR 3.3.3.1 and SR 3.3.3.3 apply to each PAM instrumentation Function in
 Table 3.3.3-1.

SURVEILLANCE		FREQUENCY
SR 3.3.3.1	Perform CHANNEL CHECK for each required instrumentation channel that is normally energized.	31 days
SR 3.3.3.2	Perform COT on hydrogen monitor channels.	184 days
SR 3.3.3.3	-----NOTE----- Neutron detectors are excluded from CHANNEL CALIBRATION. ----- Perform CHANNEL CALIBRATION.	18 months

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

FUNCTION	REQUIRED CHANNELS	CONDITIONS
1. Intermediate Range Neutron Flux ^(d)	2	C, E
2. Source Range Neutron Flux	2	C, E
3. Reactor Coolant System (RCS) Hot Leg Temperature	1 per loop	B
4. RCS Cold Leg Temperature	1 per loop	B
5. RCS Pressure (Wide Range)	3	C, E
6. Reactor Vessel Water Level ^{(c)(d)}	2	C, G
7. Containment Sump Water Level (Wide Range)	2	C, E
8. Containment Lower Comp. Atm. Temperature	2	C, E
9. Containment Pressure (Wide Range) ^(d)	2	C, E
10. Containment Pressure (Narrow Range)	3	C, E
11. Containment Isolation Valve Position ^(d)	1 per valve ^(a)	B
12. Containment Radiation (High Range)	2	C, G
13. Hydrogen Monitors	2	C, F
14. RCS Pressurizer Level	3	C, E
15. Steam Generator Water Level (Wide Range) ^(d)	1 per steam generator	B
16. Steam Generator Water Level (Narrow Range)	3 per steam generator	C, E
17. AFW Valve Status ^(d)	1 per valve	B
18. Core Exit Temperature - Quadrant 1 ^(c)	2 ^(b)	C, E
19. Core Exit Temperature - Quadrant 2 ^(c)	2 ^(b)	C, E
20. Core Exit Temperature - Quadrant 3 ^(c)	2 ^(b)	C, E
21. Core Exit Temperature - Quadrant 4 ^(c)	2 ^(b)	C, E
22. Auxiliary Feedwater Flow	2	C, E
23. Reactor Coolant System Subcooling Margin Monitor ^(c)	2	C, E
24. Refueling Water Storage Tank Level	2	C, E
25. Steam Generator Pressure	2 per steam generator	C, E
26. Auxiliary Building Passive Sump Level ^(d)	2	C, E
27. Steam Line Radiation Monitor	1 per steam generator	B

- (a) Not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.
- (b) A channel consists of two core exit thermocouples (CETs).
- (c) The ICCM provides these functions on a plasma display.
- (d) Regulatory Guide 1.97, non-Type A, Category 1 Variables.

3.3 INSTRUMENTATION

3.3.4 Remote Shutdown System

LCO 3.3.4 The Remote Shutdown System Functions in Table 3.3.4-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

-----NOTES-----

1. LCO 3.0.4 is not applicable.
 2. Separate Condition entry is allowed for each Function.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required Functions inoperable.	A.1 Restore required Function to OPERABLE status.	30 days
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.4.1	Perform CHANNEL CHECK for each required instrumentation channel which is normally energized.	31 days
SR 3.3.4.2	Verify each required control circuit and transfer switch is capable of performing the intended function.	18 months
SR 3.3.4.3	<p>-----NOTE----- Neutron detectors are excluded from the CHANNEL CALIBRATION. -----</p> <p>Perform CHANNEL CALIBRATION for each required instrumentation channel.</p>	18 months
SR 3.3.4.4	Perform TADOT of the reactor trip breaker open/closed indication.	18 months

Table 3.3.4-1 (page 1 of 1)
Remote Shutdown System Instrumentation and Controls

FUNCTION/INSTRUMENT OR CONTROL PARAMETER	REQUIRED NUMBER OF CHANNELS
1. Reactivity Control	
a. Source Range Neutron Flux	1
b. Reactor Trip Breaker Position	1 per trip breaker
2. Reactor Coolant System (RCS) Pressure Control	
a. Pressurizer Pressure OR RCS Wide Range Pressure	1
b. Pressurizer Power-Operated Relief Valve (PORV) Control and Block Valve Control	1, controls must be for PORV & block valves on same line
3. Decay Heat Removal via Steam Generators	
a. RCS Hot Leg Temperature	1 per loop
b. AFW Controls	1
c. SG Pressure	1 per SG
d. SG Level OR AFW Flow	1 per SG
4. RCS Inventory Control	
a. Pressurizer Level	1
b. Charging Pump Controls	1

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator Start Instrumentation

LCO 3.3.5 Three channels per bus of the loss of voltage function and three channels per bus of the degraded voltage function and two channels per bus of the diesel generator starting Function and two channels per bus of the load shedding Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4, and
When associated DG is required to be OPERABLE by LCO 3.8.2, "AC Sources - Shutdown."

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel per bus inoperable.	A.1 -----NOTE----- For loss of voltage or degraded voltage Function, the inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels. ----- Place channel in trip.	6 hours
B. One or more Functions with two or more channels per bus inoperable.	B.1 Restore all but one channel to OPERABLE status.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.5.1 -----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	31 days
SR 3.3.5.2 Verify system actuation Response Time within limit.	18 months on a STAGGERED TEST BASIS

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.3.5.3 Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows:</p> <ul style="list-style-type: none"> a. Loss of voltage Allowable Value 6003±69 volts with a time delay of 0.25 to 0.5 second for trip of the 6.9 kV shutdown board supply breaker. b. Degraded voltage Allowable Value 6762±33 volts with a time delay of 6±0.5 seconds for trip of the 6.9 kV shutdown board supply breaker. c. Diesel Generator start Allowable Value 4830±96.6 volts with an internal time delay of 0.5 seconds nominal at zero volts. d. Load shedding Allowable Value 4830±96.6 volts with an internal time delay of 3 seconds nominal at zero volts. 	<p>18 months</p>

3.3 INSTRUMENTATION

3.3.6 Containment Vent Isolation Instrumentation

LCO 3.3.6 The Containment Vent Isolation instrumentation for each Function in Table 3.3.6-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.
During movement of irradiated fuel assemblies within containment, and
During CORE ALTERATIONS.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One radiation monitoring channel inoperable.	A.1 Restore the affected channel to OPERABLE status.	4 hours
-----NOTE----- Only applicable in MODE 1, 2, 3, or 4. ----- B. One or more Functions with one or more manual or automatic actuation trains inoperable. <u>OR</u> (continued)	B.1 Enter applicable Conditions and Required Actions of LCO 3.6.3 for Containment Purge and Exhaust isolation valves made inoperable by isolation instrumentation.	Immediately

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. (continued)</p> <p>Two radiation monitoring channels inoperable</p> <p><u>OR</u></p> <p>Required Action and associated Completion Time of Condition A not met.</p>		
<p>-----NOTE----- Only applicable during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment. -----</p> <p>C. One or more Functions with one or more manual or automatic actuation trains inoperable.</p> <p><u>OR</u></p> <p>Two radiation monitoring channels inoperable.</p> <p><u>OR</u></p> <p>Required Action and associated Completion Time for Condition A not met.</p>	<p>C.1 Place and maintain containment purge and exhaust valves in closed position.</p> <p><u>OR</u></p> <p>C.2 Enter applicable Conditions and Required Actions of LCO 3.9.4 for Containment Purge and Exhaust isolation valves made inoperable by isolation instrumentation.</p>	<p>Immediately</p> <p>Immediately</p>

SURVEILLANCE REQUIREMENTS

-----NOTE-----

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

SURVEILLANCE		FREQUENCY
SR 3.3.6.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.6.2	Perform ACTUATION LOGIC TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.6.3	Perform MASTER RELAY TEST.	31 days on a STAGGERED TEST BASIS
SR 3.3.6.4	Perform COT.	92 days
SR 3.3.6.5	Perform SLAVE RELAY TEST.	92 days
SR 3.3.6.6	Perform ESF RESPONSE TIME TEST.	18 months on a STAGGERED TEST BASIS
SR 3.3.6.7	Perform TADOT.	18 months
SR 3.3.6.8	Perform CHANNEL CALIBRATION.	18 months

Containment Vent Isolation Instrumentation
3.3.6

Table 3.3.6-1 (page 1 of 1)
Containment Vent Isolation Instrumentation

FUNCTION	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	2	SR 3.3.6.7	N/A
2. Automatic Actuation Logic and Actuation Relays	2 trains	SR 3.3.6.2 SR 3.3.6.3 SR 3.3.6.5 SR 3.3.6.6	N/A
3. Containment Purge Exhaust Radiation Monitors	2	SR 3.3.6.1 SR 3.3.6.4 SR 3.3.6.8	≤ [TBD]
4. Safety Injection (SI)	Refer to LCO 3.3.2 "ESFAS Instrumentation," Function 1, for all initiating Functions and requirements.		

3.3 INSTRUMENTATION

3.3.7 Control Room Emergency Ventilation System (CREVS) Actuation Instrumentation

LCO 3.3.7 The CREVS Actuation instrumentation for each Function in Table 3.3.7-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4.
During movement of irradiated fuel assemblies.
During CORE ALTERATIONS.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel or train inoperable.	A.1 Place one CREVS train in emergency radiation protection mode.	7 days
B. One or more Functions with two channels or two trains inoperable.	B.1.1 Place one CREVS train in emergency radiation protection mode.	Immediately
	<p style="text-align: center;"><u>AND</u></p> B.1.2 Enter applicable Conditions and Required Actions of LCO 3.7.10, CREVS; for one train made inoperable by CREVS actuation instrumentation.	Immediately
	<u>OR</u>	
	(continued)	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2 Place both trains in emergency radiation protection mode.	Immediately
C. Required Action and associated Completion Time for Condition A or B not met in MODE 1, 2, 3, or 4.	C.1 Be in MODE 3.	6 hours
	<u>AND</u> C.2 Be in MODE 5.	36 hours
D. Required Action and associated Completion Time for Condition A or B not met during movement of irradiated fuel assemblies or CORE ALTERATIONS.	D.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> D.2 Suspend movement of irradiated fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

-----NOTE-----

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

SURVEILLANCE	FREQUENCY
SR 3.3.7.1 Perform CHANNEL CHECK.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.3.7.2	Perform COT.	92 days
SR 3.3.7.3	Perform TADOT.	18 months
SR 3.3.7.4	Perform CHANNEL CALIBRATION	18 months

CREVS Actuation Instrumentation
3.3.7

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

FUNCTION	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	2 trains	SR 3.3.7.3	N/A
2. Control Room Air Intake Radiation Monitors	2	SR 3.3.7.1 SR 3.3.7.2 SR 3.3.7.4	≤ [TBD] mR/hr
3. Safety Injection	Refer to LCO 3.3.2, Function 1, for all initiating Functions and requirements.		

3.3 INSTRUMENTATION

3.3.8 Auxiliary Building Gas Treatment System (ABGTS) Actuation Instrumentation

LCO 3.3.8 The ABGTS Actuation instrumentation for each Function in Table 3.3.8-1 shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.
During movement of irradiated fuel assemblies in the fuel handling area.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel or train inoperable.	A.1 Place one ABGTS train in operation.	7 days
B. One or more Functions with two channels or two trains inoperable.	B.1.1 Place one ABGTS train in operation.	Immediately
	<u>AND</u> B.1.2 Enter applicable Conditions and Required Actions of LCO 3.7.12 for one train made inoperable by inoperable actuation instrumentation.	Immediately
	<u>OR</u> B.2 Place both trains in emergency radiation protection mode.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time for Condition A or B not met during movement of irradiated fuel assemblies in the fuel handling area.	C.1 Suspend movement of irradiated fuel assemblies in the fuel handling area.	Immediately
D. Required Action and associated Completion Time for Condition A or B not met in MODE 1, 2, 3, or 4.	D.1 Be in MODE 3.	6 hours
	<u>AND</u> D.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

-----NOTE-----

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

SURVEILLANCE			FREQUENCY
SR	3.3.8.1	Perform CHANNEL CHECK.	12 hours
SR	3.3.8.2	Perform COT.	92 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE			FREQUENCY
SR	3.3.8.3	Perform TADOT.	18 months
SR	3.3.8.4	Perform CHANNEL CALIBRATION.	18 months

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

FUNCTION	REQUIRED CHANNELS	SURVEILLANCE REQUIREMENTS	TRIP SETPOINT
1. Manual Initiation	2	SR 3.3.8.3	N/A
2. Fuel Pool Area Radiation Monitors	2	SR 3.3.8.1 SR 3.3.8.2 SR 3.3.8.4	≤ [TBD] mR/hr
3. Containment Isolation - Phase A	Refer to LCO 3.3.2, Function 3.a., for all initiating Functions and requirements.		

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits

LCO 3.4.1 RCS DNB parameters for pressurizer pressure, RCS average temperature, and RCS total flow rate shall be within the limits specified below:

- a. Pressurizer pressure \geq [2216] psig;
- b. RCS average temperature \leq [592.9]°F; and
- c. RCS total flow rate \geq [390,000] gpm.

APPLICABILITY: MODE 1.

-----NOTE-----
Pressurizer pressure limit does not apply during:

- a. THERMAL POWER ramp > 5% RTP per minute; or
- b. THERMAL POWER step > 10% RTP.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more RCS DNB parameters not within limits.	A.1 Restore RCS DNB parameter(s) to within limit.	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 2.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.1.1 Verify pressurizer pressure is \geq [2216] psig.	12 hours
SR 3.4.1.2 Verify RCS average temperature is \leq [592.9] $^{\circ}$ F.	12 hours
SR 3.4.1.3 Verify RCS total flow rate is \geq [400,140] gpm.	12 hours
SR 3.4.1.4 -----NOTE----- Not required to be performed until 24 hours after \geq 90% RTP. ----- Verify by precision heat balance that RCS total flow rate is \geq [390,000] gpm.	18 months

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.2 RCS Minimum Temperature for Criticality

LCO 3.4.2 Each RCS loop average temperature (T_{avg}) shall be $\geq 551^\circ\text{F}$.

APPLICABILITY: MODE 1
MODE 2 with $K_{eff} \geq 1.0$

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. T_{avg} in one or more RCS loops not within limit.	A.1 Be in MODE 3.	30 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.2.1 Verify RCS T_{avg} in each loop $\geq 551^\circ\text{F}$.	<p>Within 15 minutes prior to achieving criticality</p> <p><u>AND</u></p> <p>-----NOTE----- Only required if $T_{avg} - T_{ref}$ deviation alarm not reset and any RCS loop $T_{avg} < 557^\circ\text{F}$ -----</p> <p>30 minutes</p>

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.3 RCS Pressure and Temperature (P/T) Limits

LCO 3.4.3 RCS pressure, RCS temperature, and RCS heatup and cooldown rates shall be maintained within the limits specified in the PTLR.

APPLICABILITY: At all times.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. -----NOTE----- Required Action A.2 shall be completed whenever this Condition is entered. ----- Requirements of LCO not met in MODES 1, 2, 3 or 4.</p>	<p>A.1 Restore parameter(s) to within limits. <u>AND</u> A.2 Determine RCS is acceptable for continued operation.</p>	<p>30 minutes 72 hours</p>
<p>B. Required Action and associated Completion Time of Condition A not met.</p>	<p>B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5 with RCS pressure < 500 psig.</p>	<p>6 hours 36 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>-----NOTE----- C. Required Action C.2 shall be completed whenever this Condition is entered. -----</p> <p>Requirements of LCO not met anytime in other than MODES 1, 2, 3, or 4.</p>	<p>C.1 Initiate action to restore parameter(s) to within limits. <u>AND</u> C.2 Determine RCS is acceptable for continued operation.</p>	<p>Immediately</p> <p>Prior to entering MODE 4</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.3.1 -----NOTE----- Only required to be performed during RCS heatup and cooldown operations and RCS inservice leak and hydrostatic testing. -----</p> <p>Verify RCS pressure, RCS temperature, and RCS heatup and cooldown rates are within the limits specified in the PTLR,</p>	<p>30 minutes</p>

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.4 RCS Loops - MODES 1 and 2

LCO 3.4.4 Four RCS loops shall be OPERABLE and in operation.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of LCO not met.	A.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.4.1 Verify each RCS loop is in operation.	12 hours

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.5 RCS Loops - MODE 3

LCO 3.4.5 Two RCS loops shall be OPERABLE, and either:

- a. Two RCS loops shall be in operation when the Rod Control System is capable of rod withdrawal; or
- b. One RCS loop shall be in operation when the Rod Control System is not capable of rod withdrawal.

-----NOTE-----
All reactor coolant pumps may be de-energized for ≤ 1 hour per 8-hour period provided:

- a. No operations are permitted that would cause reduction of the RCS boron concentration; and
 - b. Core outlet temperature is maintained at least 10°F below saturation temperature.
-

APPLICABILITY: MODE 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required RCS loop inoperable.	A.1 Restore required RCS loop to OPERABLE status.	72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 4.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One required RCS loop not in operation, and reactor trip breakers closed and Rod Control System capable of rod withdrawal.	C.1 Restore required RCS loop to operation.	1 hour
	<u>OR</u> C.2 Deenergize all CRDMs	1 hour
D. All RCS loops inoperable. <u>OR</u> No RCS loop in operation.	D.1 Deenergize all CRDMs	Immediately
	<u>AND</u> D.2 Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	<u>AND</u> D.3 Initiate action to restore one RCS loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.5.1 Verify required RCS loops are in operation.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.4.5.2 Verify steam generator secondary-side water levels \geq 10% narrow range for required RCS loops.	12 hours
SR 3.4.5.3 Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.6 RCS Loops - MODE 4

LCO 3.4.6 Two loops consisting of any combination of RCS loops and residual heat removal (RHR) loops shall be OPERABLE, and one loop shall be in operation.

-----NOTE-----
No RCP shall be started with any RCS cold leg temperature $\leq 310^{\circ}\text{F}$ unless the secondary-side water temperature of each steam generator (SG) is $\leq 50^{\circ}\text{F}$ above each of the RCS cold leg temperatures.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required RCS loop inoperable. <u>AND</u> Two RHR loops inoperable.	A.1 Initiate action to restore a second loop to OPERABLE status.	Immediately
B. One required RHR loop inoperable. <u>AND</u> Two required RCS loops inoperable.	B.1 Be in MODE 5.	24 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required RCS or RHR loops inoperable. <u>OR</u> No RCS or RHR loop in operation.	C.1 Suspend all operations involving a reduction of RCS boron concentration. <u>AND</u> C.2 Initiate action to restore one loop to OPERABLE status and operation.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.6.1 Verify one RHR or RCS loop is in operation.	12 hours
SR 3.4.6.2 Verify SG secondary-side water levels \geq 10% narrow-range for required RCS loops.	12 hours
SR 3.4.6.3 Verify correct breaker alignment and indicated power available to the required pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.7 RCS Loops - MODE 5, Loops Filled

LCO 3.4.7 One residual heat removal (RHR) loop shall be OPERABLE and in operation, and either:

- a. One additional RHR loop shall be OPERABLE; or
- b. The secondary-side water level of at least two steam generators (SGs) shall be $\geq 10\%$ narrow-range.

-----NOTES-----

- 1. One required RHR loop may be inoperable for up to 2 hours for surveillance testing provided that the other RHR loop is OPERABLE and in operation.
- 2. No reactor coolant pump shall be started with one or more RCS cold leg temperatures $\leq 310^\circ\text{F}$ unless the secondary-side water temperature of each SG is $\leq 50^\circ\text{F}$ above each of the RCS cold leg temperatures.
- 3. All RHR loops may be removed from operation during planned heatup to MODE 4 when at least one RCS loop is in operation.

APPLICABILITY: MODE 5 with RCS loops filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RHR loop inoperable. <u>AND</u> Required SGs secondary-side water levels not within limits.	A.1 Initiate action to restore a second RHR loop to OPERABLE status.	Immediately
	<u>OR</u> A.2 Initiate action to restore required SG secondary-side water levels to within limits.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required RHR loops inoperable. OR No RHR loop in operation.	B.1 Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	AND B.2 Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.7.1 Verify one RHR loop is in operation.	12 hours
SR 3.4.7.2 Verify SG secondary-side water level is $\geq 10\%$ narrow range in required SGs.	12 hours
SR 3.4.7.3 Verify correct breaker alignment and indicated power are available to the required RHR pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.8 RCS Loops - MODE 5, Loops Not Filled

LCO 3.4.8 Two residual heat removal (RHR) loops shall be OPERABLE and one RHR loop shall be in operation.

- NOTES-----
1. All RHR pumps may be de-energized for ≤ 1 hour provided:
 - a. Core outlet temperature is maintained at $> 10^\circ\text{F}$ below saturation temperature;
 - b. No operations are permitted that would cause a reduction of the RCS boron concentration; and
 - c. No draining operations to further reduce the RCS water volume are permitted.
 2. One RHR loop may be inoperable for ≤ 2 hours for surveillance testing provided that the other RHR loop is OPERABLE and in operation.
-

APPLICABILITY: MODE 5 with RCS loops not filled.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One RHR loop inoperable.	A.1 Initiate action to restore RHR loop to OPERABLE status.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required RHR loops inoperable. <u>OR</u> No RHR loop in operation.	B.1 Suspend all operations involving reduction in RCS boron concentration.	Immediately
	<u>AND</u> B.2 Initiate action to restore one RHR loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.8.1 Verify one RHR loop is in operation.	12 hours
SR 3.4.8.2 Verify correct breaker alignment and indicated power are available to the required RHR pump that is not in operation.	7 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.9 Pressurizer

LCO 3.4.9 The pressurizer shall be OPERABLE with:

- a. Pressurizer water level \leq 92% of indicated level, equivalent tr \leq 1656 cubic feet; and
- b. Two groups of pressurizer heaters OPERABLE with the capacity of each group \geq 150 kW.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Pressurizer water level not within limit.	A.1 Be in MODE 3 with reactor trip breakers open.	6 hours
	<u>AND</u>	
	A.2 Be in MODE 4.	12 hours
B. One required group of pressurizer heaters inoperable.	B.1 Restore required group of pressurizer heaters to OPERABLE status.	72 hours
C. Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 3.	6 hours
	<u>AND</u>	
	C.2 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.9.1 Verify pressurizer water level \leq 92% of indicated level.	12 hours
SR 3.4.9.2 Verify capacity of each required group of pressurizer heaters \geq 150 kW.	92 days

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.10 Pressurizer Safety Valves

LCO 3.4.10 Three pressurizer safety valves shall be OPERABLE with lift settings ≥ 2460 psig and ≤ 2510 psig.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 with all RCS cold leg temperatures $> 310^\circ\text{F}$.

-----NOTE-----
The lift settings are not required to be within the LCO limits during MODES 3 and 4 for the purpose of setting the pressurizer safety valves under ambient (hot) conditions. This exception is allowed for 54 hours following entry into MODE 3 provided a preliminary cold setting was made prior to heatup.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One pressurizer safety valve inoperable.	A.1 Restore valve to OPERABLE status.	15 minutes
B. Required Action and associated Completion Time not met. <u>OR</u> Two or more pressurizer safety valves inoperable.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 4 with at least one RCS cold leg temperature $\leq 310^\circ\text{F}$.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.10.1 Verify each pressurizer safety valve is OPERABLE in accordance with the Inservice Testing Program.	In accordance with the Inservice Testing Program

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.11 Pressurizer Power-Operated Relief Valves (PORVs)

LCO 3.4.11 Each PORV and associated block valve shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

-----NOTE-----

1. Separate Condition entry is allowed for each PORV.
 2. LCO 3.0.4 is not applicable.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more PORVs inoperable and capable of being manually cycled.	A.1 Close and maintain power to associated block valve.	1 hour
B. One PORV inoperable and not capable of being manually cycled.	B.1 Close associated block valve.	1 hour
	<u>AND</u>	
	B.2 Remove power from associated block valve.	1 hour
	<u>AND</u>	
	B.3 Restore PORV to OPERABLE status.	72 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One block valve inoperable.	C.1 Place associated PORV in manual control.	1 hour
	<u>AND</u> C.2 Restore block valve to OPERABLE status.	72 hours
D. Required Action and associated Completion Time of Condition A, B, or C not met.	D.1 Be in MODE 3.	6 hours
	<u>AND</u> D.2 Be in MODE 4.	12 hours
E. Two PORVs inoperable and not capable of being manually cycled.	E.1 Close associated block valves.	1 hour
	<u>AND</u> E.2 Remove power from associated block valves.	1 hour
	<u>AND</u> E.3 Be in MODE 3.	6 hours
	<u>AND</u> E.4 Be in MODE 4.	12 hours
F. Two block valves inoperable.	F.1 Place associated PORVs in manual control.	1 hour
	<u>AND</u>	(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
F. (continued)	F.2 Restore one block valve to OPERABLE status.	2 hours
G. Required Action and associated Completion Time of Condition F not met.	G.1 Be in MODE 3.	6 hours
	<u>AND</u> G.2 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.11.1 -----NOTE----- Not required to be met with block valve closed in accordance with the Required Action of Condition B or E. -----</p> <p>Perform a complete cycle of each block valve.</p>	92 days
SR 3.4.11.2 Perform a complete cycle of each PORV.	18 months

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 Cold Overpressure Mitigation System (COMS)

LCO 3.4.12 A COMS shall be OPERABLE with a maximum of one centrifugal charging pump capable of injecting into the RCS and the accumulators isolated and either a or b below:

- a. Two RCS relief valves, as follows:
 - 1. Two power-operated relief valves (PORVs) with lift settings within the limits specified in the PTLR, or
 - 2. One PORV with a lift setting within the limits specified in the PTLR and the RHR suction relief valve with a setpoint ≥ 436.5 psig and ≤ 463.5 psig.
- b. The RCS depressurized and an RCS vent capable of relieving at least 475 gpm water flow.

APPLICABILITY: MODE 4 when any RCS cold leg temperature is $\leq 310^\circ\text{F}$,
 MODE 5,
 MODE 6 when the reactor vessel head is on.

-----NOTE-----
 Accumulator isolation is only required when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in the PTLR.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Two or more charging pumps capable of injecting into the RCS.	-----NOTE----- Two centrifugal charging pumps may be capable of injecting into the RCS during pump swap operations. -----	(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.1 Initiate action to verify a maximum of one centrifugal charging pump is capable of injecting into the RCS.	Immediately
B. An accumulator not isolated when the accumulator pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	B.1 Isolate affected accumulator.	1 hour
C. Required Action and associated Completion Time of Condition B not met.	C.1 Increase RCS cold leg temperature above 310°F. <u>OR</u> C.2 Depressurize affected accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed in the PTLR.	12 hours 12 hours
D. One required RCS relief valve inoperable in MODE 4.	D.1 Restore required RCS relief valve to OPERABLE status.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One required RCS relief valve inoperable in MODES 5 or 6.	E.1 Restore required RCS relief valve to OPERABLE status.	24 hours
F. Two required RCS relief valves inoperable. <u>OR</u> Required Action and associated Completion Time of Condition A, C, D, or E not met. <u>OR</u> COMS inoperable for any reason other than Condition A, B, C, D, or E.	F.1 Depressurize RCS and establish RCS vent.	8 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.12.1 Verify a maximum of one centrifugal charging pump is capable of injecting into the RCS.	12 hours
SR 3.4.12.2 Verify each accumulator is isolated.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.4.12.3 -----NOTE----- Only required to be performed when complying with LCO 3.4.12b. -----</p> <p>Verify RCS vent.</p>	<p>12 hours for unlocked open vent path(s).</p> <p><u>AND</u></p> <p>31 days for locked open vent path(s).</p>
<p>SR 3.4.12.4 Verify PORV block valve is open for each required PORV.</p>	<p>72 hours</p>
<p>SR 3.4.12.5 Verify both RHR suction isolation valves are locked open with operator power removed for the required RHR suction relief valve.</p>	<p>31 days</p>
<p>SR 3.4.12.6 -----NOTE----- Not required to be met until 12 hours after decreasing RCS cold leg temperature to ≤ 310°F. -----</p> <p>Perform ACOT on each required PORV, excluding actuation.</p>	<p>31 days</p>
<p>SR 3.4.12.7 Perform CHANNEL CALIBRATION for each required PORV actuation channel.</p>	<p>18 months</p>

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 RCS Operational LEAKAGE

LCO 3.4.13 RCS operational LEAKAGE shall be limited to:

- a. No pressure boundary LEAKAGE;
- b. 1 gpm unidentified LEAKAGE;
- c. 10 gpm identified LEAKAGE;
- d. 1 gpm total primary-to-secondary LEAKAGE through all steam generators (SGs); and
- e. 500 gallons per day primary-to-secondary LEAKAGE through any one SG.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE.	A.1 Reduce LEAKAGE to within limits.	4 hours
B. Required Action and associated Completion Time of Condition A not met. <u>OR</u> Pressure boundary LEAKAGE exists.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.13.1 -----NOTE----- Not required to be performed in MODES 3 or 4 until 12 hours of steady-state operation. -----</p> <p>Perform RCS water inventory balance.</p>	<p>-----NOTE----- Only required to be performed during steady-state operation -----</p> <p>72 hours</p>
<p>SR 3.4.13.2 Verify steam generator tube integrity is in accordance with the Steam Generator Tube Surveillance Program.</p>	<p>In accordance with the Steam Generator Tube Surveillance Program</p>

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.14 RCS Pressure Isolation Valve (PIV) Leakage

LCO 3.4.14 Leakage from each RCS PIV shall be within limit.

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

ACTIONS

-----NOTES-----

1. Separate Condition entry is allowed for each flow path.
 2. Enter applicable Conditions and Required Actions for systems made inoperable by an inoperable PIV.
 3. Flowpaths may be unisolated intermittently under administrative controls.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. Leakage from one or more RCS PIVs not within limit.</p>	<p>-----NOTE----- The valve used to satisfy Required Action A.1 must have been verified to meet SR 3.4.14.1 and be in the reactor coolant pressure boundary.</p> <p>A.1 Isolate the high-pressure portion of the affected system from the low-pressure portion by use of one closed manual, deactivated automatic, or check valve.</p> <p><u>AND</u></p>	<p>4 hours</p> <p>(continued)</p>

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2 Restore RCS PIV to within limits.	72 hours
B. Required Action and associated Completion Time for Condition A not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.14.1 -----NOTES-----</p> <ol style="list-style-type: none"> 1. Not required to be performed in MODES 3 and 4. 2. Not required to be performed on the RCS PIVs located in the RHR flow path when in the shutdown cooling mode of operation. 3. RCS PIVs actuated during the performance of this Surveillance are not required to be tested more than once if a repetitive testing loop cannot be avoided. <p>-----</p> <p>Verify leakage from each RCS PIV is equivalent to ≤ 0.5 gpm per nominal inch of valve size up to a maximum of 5 gpm at an RCS pressure ≥ 2215 psig and ≤ 2255 psig.</p>	<p>In accordance with the Inservice Testing Program, or 18 months</p> <p><u>AND</u></p> <p>Prior to entering MODE 2 whenever the unit has been in MODE 5 for 7 days or more, if leakage testing has not been performed in the previous 9 months</p> <p><u>AND</u></p> <p>(continued)</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.14.1 (continued)	Within 24 hours following valve actuation due to automatic or manual action or flow through the valve

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.15 RCS Leakage Detection Instrumentation

LCO 3.4.15 The following RCS leakage detection instrumentation shall be OPERABLE:

- a. One containment pocket sump level monitor; and
- b. One lower containment atmosphere radioactivity monitor (gaseous and particulate).

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. Required containment pocket sump level monitor inoperable.</p>	<p>-----NOTE----- LCO 3.0.4 is not applicable. -----</p>	<p>Once per 24 hours</p> <p>30 days</p>
	<p>A.1 Perform SR 3.4.13.1. <u>AND</u> A.2 Restore required containment pocket sump level monitor to OPERABLE status.</p>	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. Required containment atmosphere radioactivity monitor inoperable.</p>	<p>-----NOTE----- LCO 3.0.4 is not applicable. -----</p> <p>B.1.1 Analyze grab samples of the containment atmosphere.</p> <p style="text-align: center;"><u>OR</u></p> <p>B.1.2 Perform SR 3.4.13.1.</p> <p style="text-align: center;"><u>AND</u></p> <p>B.2 Restore required containment atmosphere radioactivity monitor to OPERABLE status.</p>	<p>Once per 24 hours</p> <p>Once per 24 hours</p> <p>30 days</p>
<p>C. Required Action and associated Completion Time not met.</p>	<p>C.1 Be in MODE 3.</p> <p style="text-align: center;"><u>AND</u></p> <p>C.2 Be in MODE 5.</p>	<p>6 hours</p> <p>36 hours</p>
<p>D. All required monitors inoperable.</p>	<p>D.1 Enter LCO 3.0.3.</p>	<p>Immediately</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.15.1 Perform CHANNEL CHECK of the required containment atmosphere radioactivity monitor.	12 hours
SR 3.4.15.2 Perform a COT of the required containment atmosphere radioactivity monitor.	92 days
SR 3.4.15.3 Perform CHANNEL CALIBRATION of the required containment pocket sump level monitor.	18 months
SR 3.4.15.4 Perform CHANNEL CALIBRATION of the required containment atmosphere radioactivity monitor.	18 months

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.16 RCS Specific Activity

LC0 3.4.16 The specific activity of the reactor coolant shall be limited to:

- a. DOSE EQUIVALENT I-131 specific activity $\leq 1.0 \mu\text{Ci/gm}$; and
- b. Gross specific activity $\leq 100/\bar{E} \mu\text{Ci/gm}$.

APPLICABILITY: MODES 1 and 2,
MODE 3 with RCS average temperature (T_{avg}) $\geq 500^\circ\text{F}$.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 $> 1.0 \mu\text{Ci/gm}$.	A.1 Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.16-1.	Once per 4 hours
	<u>AND</u> A.2 Restore DOSE EQUIVALENT I-131 to within limit.	48 hours
B. Gross specific activity of the reactor coolant not within limit.	B.1 Perform SR 3.4.16.2.	4 hours
	<u>AND</u> B.2 Be in MODE 3 with $T_{\text{avg}} < 500^\circ\text{F}$.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>C. Required Action and associated Completion Time of Condition A not met.</p> <p><u>OR</u></p> <p>DOSE EQUIVALENT I-131 in the unacceptable region of Figure 3.4.16-1.</p>	<p>C.1 Be in MODE 3 with $T_{avg} < 500^{\circ}F$.</p>	<p>6 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.4.16.1 Verify reactor coolant gross specific activity $\leq 100/E \mu Ci/gm$.</p>	<p>7 days</p>
<p>SR 3.4.16.2 -----NOTE----- Only required to be performed in MODE 1. ----- Verify reactor coolant DOSE EQUIVALENT I-131 specific activity $\leq 1.0 \mu Ci/gm$.</p>	<p>14 days</p> <p><u>AND</u></p> <p>Between 2 and 6 hours after a THERMAL POWER change of $\geq 15\%$ RTP within a 1-hour period</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.4.16.3 -----NOTE----- Not required to be performed until 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for ≥ 48 hours. -----</p> <p>Determine \bar{E} from a sample taken in MODE 1 after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for ≥ 48 hours.</p>	<p>184 days</p>

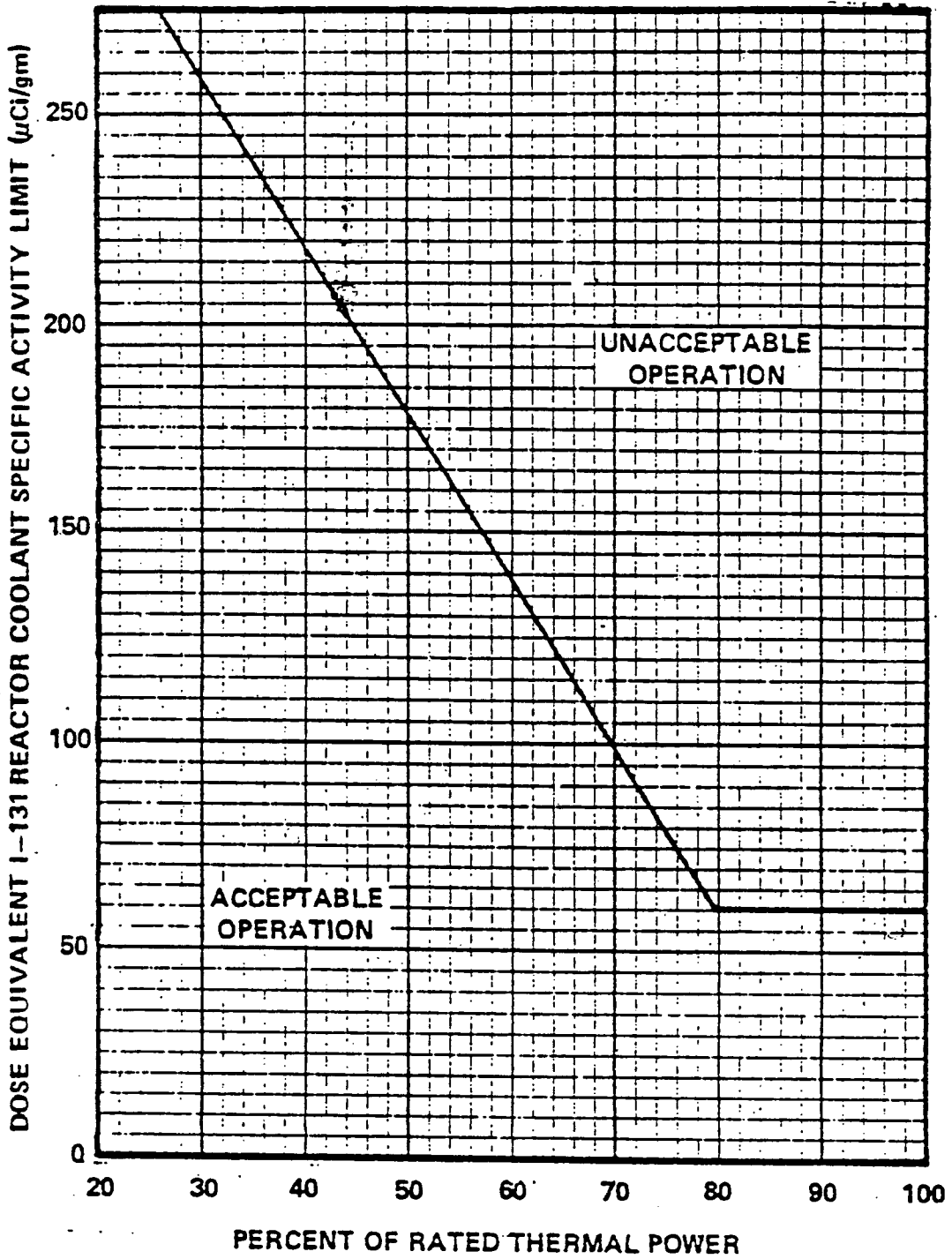


Figure 3.4.16-1

Reactor Coolant DOSE EQUIVALENT I-131 Specific Activity Limit
Versus Percent of RATED THERMAL POWER

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.17 RCS Loops - Test Exceptions

LCO 3.4.17 The requirements of LCO 3.4.4, "RCS Loops - MODES 1 and 2," may be suspended, with THERMAL POWER < P-7.

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

ACTIONS

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.17.1 Verify THERMAL POWER is < P-7.	1 hour
SR 3.4.17.2 Perform an ACOT for each power range neutron flux-low and intermediate range neutron flux channel and P-7.	Within 12 hours prior to initiation of startup and PHYSICS TESTS

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.1 Accumulators

LCO 3.5.1 Four ECCS accumulators shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODE 3 with pressurizer pressure > 1000 psig.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One accumulator inoperable due to boron concentration not within limits.	A.1 Restore boron concentration to within limits.	72 hours
B. One accumulator inoperable for reasons other than Condition A.	B.1 Restore accumulator to OPERABLE status.	1 hour
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Reduce pressurizer pressure to \leq 1000 psig.	6 hours 12 hours
D. Two or more accumulators inoperable.	D.1 Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.5.1.1 Verify each accumulator isolation valve is fully open.	12 hours
SR 3.5.1.2 Verify borated water volume in each accumulator is ≥ 7717 gallons and ≤ 7961 gallons.	12 hours
SR 3.5.1.3 Verify nitrogen cover pressure in each accumulator is ≥ 602 psig and ≤ 661 psig.	12 hours
SR 3.5.1.4 Verify boron concentration in each accumulator is ≥ 1900 ppm and ≤ 2100 ppm.	<p>31 days</p> <p><u>AND</u></p> <p>-----NOTE----- Only required to be performed for affected accumulators -----</p> <p>Once within 6 hours after each solution volume increase of ≥ 77 gallons that is not the result of addition from the refueling water storage tank</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.5.1.5 Verify power is removed from each accumulator isolation valve operator when pressurizer pressure is \geq 2000 psig.	31 days

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.2 ECCS - Operating

LCO 3.5.2 Two ECCS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3.

-----NOTE-----
 In MODE 3, both safety injection (SI) pump flow paths may be isolated by closing the isolation valves for up to 2 hours to perform pressure isolation valve (PIV) testing per SR 3.4.14.1, "Reactor Coolant System (RCS) PIV Leakage" testing.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more trains inoperable. <u>AND</u> At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available.	A.1 Restore train(s) to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY									
SR 3.5.2.1	Verify the following valves are in the listed position with power to the valve operator removed. <table border="0"> <thead> <tr> <th><u>Number</u></th> <th><u>Position</u></th> <th><u>Function</u></th> </tr> </thead> <tbody> <tr> <td>FCV-63-1</td> <td>OPEN</td> <td>RHR SUPPLY</td> </tr> <tr> <td>FCV-63-22</td> <td>OPEN</td> <td>SIS DISCHARGE</td> </tr> </tbody> </table>	<u>Number</u>	<u>Position</u>	<u>Function</u>	FCV-63-1	OPEN	RHR SUPPLY	FCV-63-22	OPEN	SIS DISCHARGE	12 hours
<u>Number</u>	<u>Position</u>	<u>Function</u>									
FCV-63-1	OPEN	RHR SUPPLY									
FCV-63-22	OPEN	SIS DISCHARGE									
SR 3.5.2.2	Verify each ECCS 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 3.5.2.3	Verify ECCS piping is full of water.	31 days									
SR 3.5.2.4	Verify each ECCS pump's developed head at the test flow point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program									
SR 3.5.2.5	Verify each ECCS automatic valve in the flow path actuates to the correct position on an actual or simulated actuation signal.	18 months									
SR 3.5.2.6	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	18 months									

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY															
SR 3.5.2.7	<p>Verify, for each ECCS throttle valve listed below, each position stop is in the correct position.</p> <table border="0"> <tr> <td>CCP Discharge Throttle Valves</td> <td>SI Cold Leg Throttle Valves</td> <td>SI Hot Leg Throttle Valves</td> </tr> <tr> <td>63-582</td> <td>63-550</td> <td>63-542</td> </tr> <tr> <td>63-583</td> <td>63-552</td> <td>63-544</td> </tr> <tr> <td>63-584</td> <td>63-554</td> <td>63-546</td> </tr> <tr> <td>63-585</td> <td>63-556</td> <td>63-548</td> </tr> </table>	CCP Discharge Throttle Valves	SI Cold Leg Throttle Valves	SI Hot Leg Throttle Valves	63-582	63-550	63-542	63-583	63-552	63-544	63-584	63-554	63-546	63-585	63-556	63-548	18 months
CCP Discharge Throttle Valves	SI Cold Leg Throttle Valves	SI Hot Leg Throttle Valves															
63-582	63-550	63-542															
63-583	63-552	63-544															
63-584	63-554	63-546															
63-585	63-556	63-548															
SR 3.5.2.8	<p>Verify, by visual inspection, each ECCS train containment sump suction inlet is not restricted by debris and the suction inlet trash racks and screens show no evidence of structural distress or abnormal corrosion.</p>	18 months															

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.3 ECCS - Shutdown

LCO 3.5.3 One ECCS train shall be OPERABLE.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Required ECCS residual heat removal (RHR) subsystem inoperable.	A.1 Initiate action to restore required ECCS RHR subsystem to OPERABLE status.	Immediately
B. Required ECCS centrifugal charging subsystem inoperable.	B.1 Restore required ECCS centrifugal charging subsystem to OPERABLE status.	1 hour
C. Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 5.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.5.3.1 -----NOTE----- An RHR train may be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned to the ECCS mode of operation. -----</p> <p>Perform the following Surveillances for all equipment required to be OPERABLE:</p> <p>SR 3.5.2.1 SR 3.5.2.7 SR 3.5.2.3 SR 3.5.2.8 SR 3.5.2.4</p>	<p>In accordance with applicable SRs</p>

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.4 Refueling Water Storage Tank (RWST)

LC0 3.5.4 The RWST shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. RWST boron concentration not within limits.</p> <p><u>OR</u></p> <p>RWST borated water temperature not within limits.</p>	<p>A.1 Restore RWST to OPERABLE status.</p>	<p>8 hours</p>
<p>B. RWST inoperable for reasons other than Condition A.</p>	<p>B.1 Restore RWST to OPERABLE status.</p>	<p>1 hour</p>
<p>C. Required Action and associated Completion Time not met.</p>	<p>C.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>C.2 Be in MODE 5.</p>	<p>6 hours</p> <p>36 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.5.4.1 -----NOTE----- Only required to be performed when ambient air temperature is < 60°F or > 105°F. ----- Verify RWST borated water temperature is ≥ 60°F and ≤ 105°F.</p>	<p>24 hours</p>
<p>SR 3.5.4.2 Verify RWST borated water volume is ≥ 370,000 gallons.</p>	<p>7 days</p>
<p>SR 3.5.4.3 Verify RWST boron concentration is ≥ 2000 ppm and ≤ 2100 ppm.</p>	<p>7 days</p>

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.5 Seal Injection Flow

LCO 3.5.5 Reactor coolant pump seal injection flow shall be ≤ 40 gpm with centrifugal charging pump discharge header pressure ≥ 2430 psig and the pressurizer level control valve full open.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Seal injection flow not within limit.	A.1 Adjust manual seal injection throttle valves to give a flow within limit with centrifugal charging pump discharge header pressure ≥ 2430 psig and the pressurizer level control valve full open.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.5.5.1 -----NOTE----- Not required to be performed until 4 hours after the Reactor Coolant System pressure stabilizes at ≥ 2215 psig and ≤ 2255 psig. -----</p> <p>Verify manual seal injection throttle valves are adjusted to give a flow within limit with centrifugal charging pump discharge header pressure ≥ 2430 psig and the pressurizer level control valve full open.</p>	<p>31 days</p>

3.6 CONTAINMENT SYSTEMS

3.6.1 Containment

LCO 3.6.1 Containment shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment inoperable.	A.1 Restore containment to OPERABLE status.	1 hour
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.6.1.1 Perform required visual examinations and leakage rate testing except for containment air lock testing, in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions.</p> <p>The maximum allowable leakage rate, L_a, is 0.25% of containment air weight per day at the calculated peak containment pressure, P_a.</p>	<p>-----NOTE----- SR 3.0.2 is not applicable -----</p> <p>In accordance with 10 CFR 50, Appendix J, as modified by approved exemptions</p>

3.6 CONTAINMENT SYSTEMS

3.6.2 Containment Air Locks

LCO 3.6.2 Two containment air locks shall be OPERABLE.

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

ACTIONS

-----NOTES-----

1. Entry and exit is permissible to perform repairs of the affected air lock components.
2. Separate condition entry is allowed for each air lock.
3. Enter applicable Conditions and Required Actions of LCO 3.6.1, "Containment," when air lock leakage results in exceeding containment overall leakage rate.

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One or more containment air locks with one containment air lock door inoperable.</p>	<p style="text-align: center;">-----NOTES-----</p> <ol style="list-style-type: none"> 1. Required Actions A.1, A.2, and A.3 are not applicable if both doors in the same air lock are inoperable and condition C entered. 2. Entry and exit is permissible for 7 days to perform activities related to Technical Specification Systems if both air locks are inoperable. <p style="text-align: center;">-----</p>	

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. (continued)</p>	<p>A.1 Verify the OPERABLE door is closed in the affected air lock.</p>	<p>1 hour</p>
	<p><u>AND</u></p> <p>A.2 Lock the OPERABLE door closed in the affected air lock.</p>	<p>24 hours</p>
	<p><u>AND</u></p> <p>-----NOTE----- Air lock doors in high radiation areas may be verified locked closed by administrative means. -----</p> <p>A.3 Verify the OPERABLE door locked closed in the affected air lock.</p>	<p>Once per 31 days</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. One or more containment air locks with the containment air lock interlock mechanism inoperable.</p>	<p>-----NOTES-----</p> <p>1. Required Actions B.1, B.2 and B.3 are not applicable if both doors in the same air lock are inoperable and Condition C entered.</p> <p>2. Entry and exit of containment is permissible under the control of a dedicated individual.</p> <p>-----</p> <p>B.1 Verify an OPERABLE door is closed in the affected air lock.</p> <p><u>AND</u></p> <p>B.2 Lock an OPERABLE door closed in the affected air lock.</p> <p><u>AND</u></p> <p>-----NOTE-----</p> <p>Air lock doors in high radiation areas may be verified locked closed by administrative means.</p> <p>-----</p> <p>B.3 Verify an OPERABLE door is locked closed in the affected air lock.</p>	<p>1 hour</p> <p>24 hours</p> <p>Once per 31 days</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>C. One or more containment air locks inoperable for reasons other than Condition A or B.</p>	<p>C.1 Initiate actions to evaluate containment overall leakage rate per LCO 3.6.1 "Containment" using current air lock test results.</p>	<p>Immediately</p>
	<p><u>AND</u></p>	
	<p>C.2 Verify a door is closed in the affected air lock.</p>	<p>1 hour</p>
	<p><u>AND</u></p>	
	<p>C.3 Restore air lock to OPERABLE status.</p>	<p>24 hours</p>
<p>D. Required Action and associated Completion Time not met.</p>	<p>D.1 Be in MODE 3.</p>	<p>6 hours</p>
	<p><u>AND</u> D.2 Be in MODE 5.</p>	<p>36 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.6.2.1 -----NOTES-----</p> <ol style="list-style-type: none"> 1. An inoperable air lock door does not invalidate the previous successful performance of the overall air lock leakage test. 2. Results shall be evaluated against acceptance criteria of SR 3.6.1.1 in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions. <p>-----</p> <p>Perform required air lock leakage rate testing in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions.</p> <p>The acceptance criteria for air lock testing are:</p> <ol style="list-style-type: none"> a. Overall air lock leakage rate is $\leq 0.05 L_a$ when tested at ≥ 15 psig. b. For each door, leakage rate is $\leq 0.01 L_a$ when tested at ≥ 6 psig. 	<p>-----NOTE-----</p> <p>SR 3.0.2 is not applicable</p> <p>-----</p> <p>In accordance with 10 CFR 50, Appendix J, as modified by approved exemptions</p>
<p>SR 3.6.2.2 -----NOTE-----</p> <p>Only required to be performed upon entry into containment.</p> <p>-----</p> <p>Verify only one door in the air lock can be opened at a time.</p>	<p>184 days</p>

3.6 CONTAINMENT SYSTEMS

3.6.3 Containment Isolation Valves

LCO 3.6.3 Each containment isolation valve shall be OPERABLE.

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

ACTIONS

-----NOTES-----

1. Penetration flow path(s) may be opened intermittently under administrative controls.
 2. Separate Condition entry is allowed for each penetration flow path.
 3. Enter applicable Conditions and Required Actions for systems made inoperable by containment isolation valves.
 4. Enter applicable Conditions and Required Actions of LCO 3.6.1, "Containment," when isolation valve leakage results in exceeding containment overall leakage rate.
-

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. -----NOTE----- Only applicable to penetration flow paths with two containment isolation valves. ----- One or more penetration flow paths with one containment isolation valve inoperable except for purge valve or shield building bypass leakage not within limit.</p>	<p>A.1 Isolate the affected penetration flow path by use of at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.</p> <p><u>AND</u></p>	<p>4 hours</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	<p>A.2 -----NOTE----- Valves and blind flanges in high radiation areas may be verified by use of administrative controls. -----</p> <p>Verify the affected penetration flow path is isolated.</p>	<p>Once per 31 days for isolation devices outside containment</p> <p><u>AND</u></p> <p>Prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days for isolation devices inside containment</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. -----NOTE----- Only applicable to penetration flow paths with two containment isolation valves. ----- One or more penetration flow paths with two containment isolation valves inoperable except for purge valve or shield building bypass leakage not within limit.</p>	<p>B.1 Isolate the affected penetration flow path by use of at least one closed and deactivated automatic valve, closed manual valve, or blind flange.</p>	<p>1 hour</p>
<p>C. -----NOTE----- Only applicable to penetration flow paths with only one containment isolation valve and a closed system. ----- One or more penetration flow paths with one containment isolation valve inoperable.</p>	<p>C.1 Isolate the affected penetration flow path by use of at least one closed and deactivated automatic valve, closed manual valve, or blind flange.</p> <p><u>AND</u></p> <p>C.2 -----NOTE----- Valves and blind flanges in high radiation areas may be verified by use of administrative controls. ----- Verify the affected penetration flow path is isolated.</p>	<p>4 hours</p> <p>Once per 31 days</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>D. Shield Building bypass leakage not within limit.</p>	<p>D.1 Restore leakage within limit.</p>	<p>4 hours</p>
<p>E. One or more penetration flow paths with one or more containment purge valves not within purge valve leakage limits.</p>	<p>E.1 Isolate the affected penetration flow path(s) by use of at least one closed and deactivated automatic valve, closed manual valve or blind flange.</p> <p><u>AND</u></p> <p>E.2 -----NOTE----- Valves and blind flanges in high radiation areas may be verified by use of administrative controls. -----</p> <p>Verify the affected penetration flow path is isolated.</p> <p><u>AND</u></p>	<p>24 hours</p> <p>Once per 31 days for isolation devices outside containment</p> <p><u>AND</u></p> <p>Prior to entering MODE 4 from MODE 5 is not performed within the previous 92 days for isolation devices inside containment</p>

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. (continued)	E.3 Perform SR 3.6.3.6 for the resilient seal containment purge valve(s) closed to comply with Required Action E.1.	Once per 92 days
F. Required Action and associated Completion Time not met.	F.1 Be in MODE 3. <u>AND</u> F.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.3.1 Verify the 24 inch containment lower compartment purge supply and exhaust isolation valves are physically restricted to $\leq 50^\circ$ open.	18 months
SR 3.6.3.2 Verify each containment purge valve is closed, except when the containment purge valves are open for pressure control, ALARA or air quality considerations for personnel entry, or for Surveillances which require the valves to be open.	31 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.6.3.3</p> <p>-----NOTE----- Valves and blind flanges in high radiation areas may be verified by use of administrative controls. -----</p> <p>Verify each containment isolation manual valve and blind flange that is located outside containment and required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls.</p>	<p>31 days</p>
<p>SR 3.6.3.4</p> <p>-----NOTE----- Valves and blind flanges in high radiation areas may be verified by use of administrative controls. -----</p> <p>Verify each containment isolation manual valve and blind flange that is located inside containment and required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls.</p>	<p>Prior to entering MODE 4 from MODE 5 if not performed, within the previous 92 days</p>
<p>SR 3.6.3.5</p> <p>Verify the isolation time of each power operated and each automatic containment isolation valve is within limits.</p>	<p>In accordance with the Inservice Testing Program, or 92 days</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.6.3.6</p> <p>-----NOTE----- Results shall be evaluated against acceptance criteria of SR 3.6.1.1 in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions. -----</p> <p>Perform leakage rate testing for containment purge valves with resilient seals.</p>	<p>184 days</p> <p><u>AND</u></p> <p>Within 92 days after opening the valve</p>
<p>SR 3.6.3.7</p> <p>Verify each automatic containment isolation valve actuates to the isolation position on an actual or simulated actuation signal.</p>	<p>18 months</p>
<p>SR 3.6.3.8</p> <p>-----NOTE----- Results shall be evaluated against acceptance criteria of SR 3.6.1.1 in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions. -----</p> <p>Verify the combined leakage rate for all shield building bypass leakage rate for all shield building bypass leakage paths is $\leq 0.25 L_a$ when pressurized to ≥ 15 psig.</p>	<p>18 months</p>

3.6 CONTAINMENT SYSTEMS

3.6.4 Containment Pressure

LCO 3.6.4 Containment pressure shall be ≥ -0.1 and $\leq +0.3$ psid relative to the annulus.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment pressure not within limits.	A.1 Restore containment pressure to within limits.	1 hour
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.4.1 Verify containment pressure is within limits.	12 hours

3.6 CONTAINMENT SYSTEMS

3.6.5 Containment Air Temperature

LC0 3.6.5 Containment average air temperature shall be:

- a. $\geq 85^{\circ}\text{F}$ and $\leq 110^{\circ}\text{F}$ for the containment upper compartment, and
- b. $\geq 100^{\circ}\text{F}$ and $\leq 120^{\circ}\text{F}$ for the containment lower compartment.

-----NOTE-----
The minimum containment average air temperature in MODES 2, 3, and 4 may be reduced to 60°F.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Containment average air temperature not within limits.	A.1 Restore containment average air temperature to within limits.	8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.5.1	Verify containment upper compartment average air temperature is within limits.	24 hours
SR 3.6.5.2	Verify containment lower compartment average air temperature is within limits.	24 hours

3.6 CONTAINMENT SYSTEMS

3.6.6 Containment Spray System

LCO 3.6.6 Two containment spray trains and two RHR spray trains shall be OPERABLE.

-----NOTE-----
The RHR spray train is not required in MODE 4.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One containment spray train inoperable. <u>OR</u> One RHR spray train inoperable.	A.1 Restore inoperable spray train to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	84 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.6.1	Verify each containment spray 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 3.6.6.2	Verify each containment spray pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.6.6.3	Verify each containment spray automatic valve in the flow path actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.6.6.4	Verify each containment spray pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.6.6.5	Verify each spray nozzle is unobstructed.	First refueling outage <u>AND</u> 10 years
SR 3.6.6.6	Perform SR 3.5.2.2 and SR 3.5.2.4 for the RHR spray system.	In accordance with applicable SRs

3.6 CONTAINMENT SYSTEMS

3.6.7 Hydrogen Recombiners

LCO 3.6.7 Two hydrogen recombiners shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One hydrogen recombiner inoperable.	A.1 -----NOTE----- LCO 3.0.4 is not applicable ----- Restore hydrogen recombiner to OPERABLE status.	30 days
B. Two hydrogen recombiners inoperable.	B.1 Verify by administrative means that the hydrogen control function is maintained. <u>AND</u> B.2 Restore one hydrogen recombiner to OPERABLE status.	1 hour <u>AND</u> Every 12 hours thereafter 7 days
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 Hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Perform a system functional test for each hydrogen recombiner.	18 months
SR 3.6.7.2	Visually examine each hydrogen recombiner enclosure and ensure there is no evidence of abnormal conditions.	18 months
SR 3.6.7.3	Perform a resistance to ground test for each heater phase.	18 months

3.6 CONTAINMENT SYSTEMS

3.6.8 Hydrogen Mitigation System (HMS)

LCO 3.6.8 Two HMS trains shall be OPERABLE.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One HMS train inoperable.	A.1 Restore HMS train to OPERABLE status. <u>OR</u> A.2 Perform SR 3.6.8.1 on the OPERABLE train.	7 days Once per 7 days
B. One containment region with no OPERABLE hydrogen ignitor.	B.1 Restore one hydrogen ignitor in the affected containment region to OPERABLE status.	7 days
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.8.1	Energize each HMS train power supply breaker and verify ≥ 33 ignitors are energized in each train.	92 days
SR 3.6.8.2	Verify \geq one hydrogen ignitor OPERABLE in each containment region.	92 days
SR 3.6.8.3	Energize each hydrogen ignitor and verify temperature $\geq 1700^{\circ}\text{F}$.	18 months

3.6 CONTAINMENT SYSTEMS

3.6.9 Emergency Gas Treatment System (EGTS)

LCO 3.6.9 Two EGTS trains shall be OPERABLE and the annulus pressure shall be ≥ 5 inches water gauge vacuum with respect to the penetration room on E1. 737.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One EGTS train inoperable.	A.1 Restore EGTS train to OPERABLE status.	7 days
B. -----Note----- Annulus pressure requirement is not applicable during ventilating operations, required annulus entries, or Auxiliary Building isolations not exceeding 1 hour in duration. ----- Annulus pressure not within limits.	B.1 Restore annulus pressure within limits.	8 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.9.1	Operate each EGTS train for ≥ 10 continuous hours with heaters operating.	31 days
SR 3.6.9.2	Perform required EGTS filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.6.9.3	Verify each EGTS train actuates on an actual or simulated actuation signal and achieves a system flow of $4000 \pm 10\%$ cfm within 20 seconds.	18 months
SR 3.6.9.4	Verify each EGTS train produces an annulus pressure equal to or more negative than -0.5 inch water gauge with respect to the E1. 772 mechanical equipment room with an inleakage of ≤ 250 cfm at a system flow of $4000 \pm 10\%$ cfm.	18 months on a STAGGERED TEST BASIS
SR 3.6.9.5	Verify annulus pressure equal to or more negative than -5 inches water gauge with respect to atmosphere.	24 hours

3.6 CONTAINMENT SYSTEMS

3.6.10 Air Return System (ARS)

LCO 3.6.10 Two ARS trains shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ARS train inoperable	A.1 Restore ARS train to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. <u>AND</u>	6 hours
	B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.10.1 Verify each ARS fan starts on an actual or simulated actuation signal, after a delay of ≥ 8.0 minutes and ≤ 10.0 minutes, and operates for ≥ 15 minutes.	92 days
SR 3.6.10.2 Verify with the ARS fan dampers closed, each ARS fan motor current is ≥ 54 and ≤ 94 amps.	92 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.6.10.3 Verify with the ARS fan not operating, each ARS fan damper opens when \leq 150 inch-lbs is applied to the counterweight.	92 days

3.6 CONTAINMENT SYSTEMS

3.6.11 Ice Bed

LC0 3.6.11 The ice bed shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Ice bed inoperable.	A.1 Restore ice bed to OPERABLE status.	48 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.11.1 Verify maximum ice bed temperature is \leq 27°F.	12 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.11.2	<p>Verify total weight of stored ice is \geq 2,360,875 lb by:</p> <ol style="list-style-type: none">Weighing a representative sample of \geq 144 ice baskets and verifying each basket contains \geq 1214 lb of ice; andCalculating total weight of stored ice, at a 95% confidence level, using all ice basket weights determined in SR 3.6.11.2.a.	9 months
SR 3.6.11.3	<p>Verify azimuthal distribution of ice at a 95% confidence level by subdividing weights, as determined by SR 3.6.11.2.a, into the following groups:</p> <ol style="list-style-type: none">Group 1—bays 1 through 8;Group 2—bays 9 through 16; andGroup 3—bays 17 through 24. <p>The average ice weight of the sample baskets in each group from radial rows 1, 2, 4, 6, 8, and 9 shall be \geq 1214 lbs.</p>	9 months
SR 3.6.11.4	<p>Verify, by visual inspection, accumulation of ice or frost on structural members comprising flow channels through the ice condenser is \leq 0.38 inches thick.</p>	9 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.11.5	Verify by chemical analyses of at least nine representative samples of stored ice: a. Boron concentration is ≥ 1800 ppm; and b. pH is ≥ 9.0 and ≤ 9.5 .	18 months
SR 3.6.11.6	Visually inspect, for detrimental structural wear, cracks, corrosion, or other damage, two ice baskets from each azimuthal group of bays. See SR 3.6.11.3.	40 months

3.6 CONTAINMENT SYSTEMS

3.6.12 Ice Condenser Doors

LC0 3.6.12 The ice condenser inlet doors, intermediate deck doors, and top deck doors shall be OPERABLE and closed.

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

ACTIONS

-----NOTE-----
Separate condition entry is allowed for each ice condenser door.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more ice condenser inlet doors inoperable due to being physically restrained from opening.	A.1 Restore inlet door to OPERABLE status.	1 hour
B. One or more ice condenser doors inoperable for reasons other than Condition A or not closed.	B.1 Verify maximum ice bed temperature $\leq 27^{\circ}\text{F}$.	Once per 4 hours
	<u>AND</u> B.2 Restore ice condenser door to OPERABLE status and closed positions.	14 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition B not met.	C.1 Restore ice condenser door to OPERABLE status and closed positions.	48 hours
D. Required Action and associated Completion Time of Condition A, or C not met.	D.1 Be in MODE 3.	6 hours
	<u>AND</u> D.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.12.1 Verify all inlet doors indicate closed by the Inlet Door Position Monitoring System.	12 hours
SR 3.6.12.2 Verify, by visual inspection, each intermediate deck door is closed and not impaired by ice, frost, or debris.	7 days
SR 3.6.12.3 Verify, by visual inspection, each inlet door is not impaired by ice, frost, or debris.	3 months during first year after receipt of license <u>AND</u> 18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.12.4	Verify torque required to cause each inlet door to begin to open is ≤ 675 in-lbs.	3 months during first year after receipt of license <u>AND</u> 18 months
SR 3.6.12.5	Perform a torque test on a sampling of $\geq 50\%$ of the inlet doors.	3 months during first year after receipt of license <u>AND</u> 18 months
SR 3.6.12.6	Verify for each intermediate deck door: a. No visual evidence of structural deterioration; b. Free movement of the vent assemblies; and c. Free movement of the door.	3 months during first year after receipt of license <u>AND</u> 18 months
SR 3.6.12.7	Verify, by visual inspection, each top deck door: a. Is in place; b. Free movement of the top deck vent assembly; and c. Has no condensation, frost, or ice formed on the doors that would restrict opening.	92 days

3.6 CONTAINMENT SYSTEMS

3.6.13 Divider Barrier Integrity

LCO 3.6.13 Divider barrier integrity shall be maintained.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. -----NOTE----- For this action, separate condition entry is allowed for each personnel access door or equipment hatch. -----</p> <p>One or more personnel access doors or equipment hatches open or inoperable, other than for personnel transit entry.</p>	<p>A.1 Restore personnel access doors and equipment hatches to OPERABLE status and closed positions.</p>	<p>1 hour</p>
<p>B. Divider barrier seal inoperable.</p>	<p>B.1 Restore seal to OPERABLE status.</p>	<p>1 hour</p>
<p>C. Required Action and associated Completion Time not met.</p>	<p>C.1 Be in MODE 3. <u>AND</u> C.2 Be in MODE 5.</p>	<p>6 hours 36 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.13.1	Verify, by visual inspection, all personnel access doors and equipment hatches between upper and lower containment compartments closed.	Prior to entering MODE 4 from MODE 5
SR 3.6.13.2	Verify, by visual inspection, that the seals and sealing surfaces of each personnel access door and equipment hatch have: <ul style="list-style-type: none"> a. No detrimental misalignments; b. No cracks or defects in the sealing surfaces; and c. No apparent deterioration of the seal material. 	Prior to final closure after each opening AND ----NOTE---- Only required for seals made of resilient materials ----- 10 years
SR 3.6.13.3	Verify, by visual inspection, each personnel access door or equipment hatch that has been opened for personnel transit entry is closed.	After each opening
SR 3.6.13.4	Remove two divider barrier seal test coupons and verify both test coupons' tensile strength \geq 60 psi.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.6.13.5 Visually inspect \geq 95% of the divider barrier seal length, and verify: a. Seal and seal mounting bolts are properly installed; and b. Seal material shows no evidence of deterioration due to holes, ruptures, chemical attack, abrasion, radiation damage, or changes in physical appearance.	18 months

3.6 CONTAINMENT SYSTEMS

3.6.14 Containment Recirculation Drains

LCO 3.6.14 The ice condenser floor drains and the refueling canal drains shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ice condenser floor drain inoperable.	A.1 Restore ice condenser floor drain to OPERABLE status.	1 hour
B. One refueling canal drain inoperable.	B.1 Restore refueling canal drain to OPERABLE status.	1 hour
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE REQUIREMENTS		FREQUENCY
SR 3.6.14.1	<p>Verify by visual inspection:</p> <ul style="list-style-type: none"> a. Each refueling canal drain plug is removed; b. Each refueling canal drain is not obstructed by debris; and c. No debris is present in the upper compartment or refueling canal that could obstruct the refueling canal drain. 	<p>92 days</p> <p><u>AND</u></p> <p>Prior to entering MODE 4 from MODE 5 after each partial or complete fill of the canal</p>
SR 3.6.14.2	<p>Verify for each ice condenser floor drain the:</p> <ul style="list-style-type: none"> a. Valve opening is not impaired by ice, frost, or debris; b. Valve seat shows no evidence of damage; c. Valve opening force is ≤ 100 lbs; and d. Drain line from the ice condenser floor to the lower compartment is unrestricted. 	<p>18 months</p>

3.6 CONTAINMENT SYSTEMS

3.6.15 Shield Building

LCO 3.6.15 The shield building shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Shield building inoperable.	A.1 Restore shield building to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.15.1 Verify the door in each access opening is closed except when the access opening is being used for normal transient entry and exit.	31 days
SR 3.6.15.2 Verify shield building structural integrity by performing a visual inspection of the exposed interior and exterior surfaces of the shield building.	During shutdown for SR 3.6.1.1 Type A tests

3.7 PLANT SYSTEMS

3.7.1 Main Steam Safety Valves (MSSVs)

LCO 3.7.1 The MSSVs shall be OPERABLE as specified in Table 3.7.1-1 and Table 3.7.1-2.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each MSSV.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required MSSVs inoperable.	A.1 Reduce power to less than or equal to the applicable % RTP listed in Table 3.7.1-1.	4 hours
B. Required Action and associated Completion Time not met. <u>OR</u> One or more SGs with less than two MSSVs OPERABLE.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.7.1.1 -----NOTE----- Only required to be performed in MODES 1 and 2. ----- Verify each required MSSV lift setpoint per Table 3.7.1-2 in accordance with the Inservice Testing Program.</p>	<p>In accordance with the Inservice Testing Program</p>

Table 3.7.1-1 (page 1 of 1)
OPERABLE Main Steam Safety Valves versus
Applicable Power in Percent of RATED THERMAL POWER

MINIMUM NUMBER OF MSSVs PER STEAM GENERATOR REQUIRED OPERABLE	APPLICABLE POWER (% RTP)
5	≤ 100
4	≤ 80
3	≤ 60
2	≤ 40

Table 3.7.1-2 (page 1 of 1)
Main Steam Safety Valve Lift Settings

VALVE NUMBER				LIFT SETTING (psig ± 1%)
#1	STEAM GENERATOR		#4	
	#2	#3		
1-522	1-517	1-512	1-527	1224
1-523	1-518	1-513	1-528	1215
1-524	1-519	1-514	1-529	1205
1-525	1-520	1-515	1-530	1195
1-526	1-521	1-516	1-531	1185

3.7 PLANT SYSTEMS

3.7.2 Main Steam Isolation Valves (MSIVs)

LCO 3.7.2 Four MSIVs shall be OPERABLE.

APPLICABILITY: MODE 1,
MODES 2, and 3; except when all MSIVs are closed and
deactivated.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One MSIV inoperable in MODE 1.	A.1 Restore MSIV to OPERABLE status.	8 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 2.	6 hours
C. -----NOTE----- Separate Condition entry is allowed for each MSIV. ----- One or more MSIVs inoperable in MODE 2 or 3.	C.1 Close inoperable MSIV. <u>AND</u> C.2 Verify inoperable MSIV is closed.	8 hours Once per 7 days
D. Required Action and associated Completion Time of Condition C not met.	D.1 Be in MODE 3. <u>AND</u> D.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.7.2.1 -----NOTE----- Only required to be performed in MODES 1 and 2. -----</p> <p>Verify closure time of each MSIV is ≤ 5.0 seconds on an actual or simulated actuation signal.</p>	<p>In accordance with the [Inservice Testing Program or 18 months]</p>

3.7 PLANT SYSTEMS

3.7.3 Main Feedwater Isolation and Regulation Valves (MFIVs and MFRVs) and Associated Bypass Valves

LCO 3.7.3 Four MFIVs, four MFRVs, and associated bypass valves shall be OPERABLE.

APPLICABILITY: MODE 1
MODES 2, and 3, except when MFIV, MFRV or associated bypass valve is closed and deactivated.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more MFIVs inoperable.	A.1 Close or isolate MFIV.	72 hours
	<u>AND</u> A.2 Verify MFIV is closed or isolated.	Once per 7 days
B. One or more MFRVs inoperable.	B.1 Close or isolate MFRV.	72 hours
	<u>AND</u> B.2 Verify MFRV is closed or isolated.	Once per 7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. One or more MFIV or MFRV bypass valve(s) inoperable.	C.1 Restore bypass valve to OPERABLE status.	72 hours
D. One MFIV and MFRV in the same flow path inoperable.	D.1 Isolate affected flow path.	8 hours
E. One MFIV bypass valve and MFRV bypass valve in the same flow path inoperable.	E.1 Restore one MFIV bypass valve or MFRV bypass valve to OPERABLE status.	8 hours
F. Required Action and associated Completion Time not met.	F.1 Be in MODE 3.	6 hours
	<u>AND</u> F.2 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.3.1 Verify the closure time of each MFIV, MFRV, and associated bypass valve is ≤ 6.5 seconds on an actual or simulated actuation signal.	In accordance with the Inservice Testing Program or 18 months

3.7 PLANT SYSTEMS

3.7.4 Atmospheric Dump Valves (ADVs)

LCO 3.7.4 Three ADV lines shall be OPERABLE.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required ADV line inoperable.	-----NOTE----- LCO 3.0.4 is not applicable. -----	
	A.1 Restore required ADV line to OPERABLE status.	7 days
B. Two or more required ADV lines inoperable.	B.1 Restore one ADV line to OPERABLE status.	24 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours
	<u>AND</u> C.2 Be in MODE 4 without reliance upon steam generator for heat removal.	18 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.4.1 Verify one complete cycle of each ADV.	18 months
SR 3.7.4.2 Verify one complete cycle of each ADV block valve.	18 months

3.7 PLANT SYSTEMS

3.7.5 Auxiliary Feedwater (AFW) System

LCO 3.7.5 Three AFW trains shall be OPERABLE.

-----NOTE-----
Only one AFW train, which includes a motor-driven pump,
is required to be OPERABLE in MODE 4.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One steam supply to turbine-driven AFW pump inoperable.	A.1 Restore steam supply to OPERABLE status.	7 days <u>AND</u> 10 days from from discovery of failure to meet the LCO
B. One AFW train inoperable in MODE 1, 2, or 3 for reasons other than Condition A.	B.1 Restore AFW train to OPERABLE status.	72 hours <u>AND</u> 10 days from discovery of failure to meet the LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>C. Required Action and associated Completion Time for Condition A or B not met.</p> <p><u>OR</u></p> <p>Two AFW trains inoperable in MODE 1, 2, or 3.</p>	<p>C.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>C.2 Be in MODE 4.</p>	<p>6 hours</p> <p>18 hours</p>
<p>D. Three AFW trains inoperable in MODE 1, 2, or 3.</p>	<p>-----NOTE-----</p> <p>LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one AFW train is restored to OPERABLE status.</p> <p>-----</p> <p>D.1 Initiate action to restore one AFW train to OPERABLE status.</p>	<p>Immediately</p>
<p>E. Required AFW train inoperable in MODE 4.</p>	<p>E.1 Initiate Action restore AFW train to OPERABLE status.</p>	<p>Immediately</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.7.5.1 Verify each AFW manual, power-operated, and automatic valve in each water flow path, and in both steam supply flow paths to the steam turbine-driven pump, that is not locked, sealed, or otherwise secured in position, is in the correct position.</p>	<p>31 days</p>
<p>SR 3.7.5.2 -----NOTE----- Not required to be performed for the turbine-driven AFW pump until 24 hours after ≥ 1092 psig in the steam generator. ----- Verify the developed head of each AFW pump at the flow test point is greater than or equal to the required developed head.</p>	<p>31 days on a STAGGERED TEST BASIS</p>
<p>SR 3.7.5.3 Verify each AFW automatic valve actuates to the correct position on an actual or simulated actuation signal when in MODES 1, 2, and 3.</p>	<p>18 months</p>
<p>SR 3.7.5.4 -----NOTE----- Not required to be performed for the turbine-driven AFW pump until 24 hours after ≥ 1092 psig in the steam generator. ----- Verify each AFW pump starts automatically on an actual or simulated actuation signal when in MODES 1, 2, and 3.</p>	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
SR 3.7.5.5 Verify proper alignment of the required AFW flow paths by verifying flow from the condensate storage tank to each steam generator.	Prior to entering MODE 2, whenever unit has been in MODE 5 or 6 for > 30 days

3.7 PLANT SYSTEMS

3.7.6 Condensate Storage Tank (CST)

LCO 3.7.6 The CST level shall be \geq 210,000 gal.

APPLICABILITY: MODES 1, 2, and 3,
MODE 4 when steam generator is relied upon for heat removal.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. CST level not within limit.	A.1 Verify by administrative means OPERABILITY of ERCW backup water supply.	4 hours <u>AND</u> Once per 12 hours thereafter
	<u>AND</u> A.2 Restore CST level to within limit.	7 days
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 4, without reliance on steam generator for heat removal.	18 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.6.1 Verify the CST level is \geq 210,000 gal.	12 hours

3.7 PLANT SYSTEMS

3.7.7 Component Cooling System (CCS)

LCO 3.7.7 Two CCS trains shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One CCS train inoperable.</p>	<p>-----NOTE----- Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," for residual heat removal loops made inoperable by CCS. -----</p> <p>A.1 Restore CCS train to OPERABLE status.</p>	<p>72 hours</p>
<p>B. Required Action and associated Completion Time of Condition A not met.</p>	<p>B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.</p>	<p>6 hours 36 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1	<p>-----NOTE----- Isolation of flow to individual components does not render the CCS system inoperable. -----</p> <p>Verify each CCS manual, power-operated, and automatic valve in the flow path servicing safety-related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.</p>	31 days
SR 3.7.7.2	Verify each CCS automatic valve in the flow path actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.7.7.3	Verify each CCS pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.7.7.4	Verify that the alternate feeder breaker to the C-S pump is open.	7 days

3.7 PLANT SYSTEMS

3.7.8 Essential Raw Cooling Water (ERCW) System

LCO 3.7.8 Two ERCW trains shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One ERCW train inoperable.</p>	<p>-----NOTES-----</p> <p>1. Enter applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," for emergency diesel generator made inoperable by ERCW.</p> <p>2. Enter applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," for residual heat removal loops made inoperable by ERCW.</p> <p>-----</p> <p>A.1 Restore ERCW train to OPERABLE status.</p>	<p>72 hours</p>
<p>B. Required Action and associated Completion Time of Condition A not met.</p>	<p>B.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>B.3 Be in MODE 5.</p>	<p>6 hours</p> <p>36 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.7.8.1 -----NOTE----- Isolation of flow to individual components does not render the ERCW inoperable. -----</p> <p>Verify each ERCW manual, power-operated, and automatic valve in the flow path servicing safety-related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.</p>	<p>31 days</p>
<p>SR 3.7.8.2 Verify each ERCW automatic valve in the flow path actuates to the correct position on an actual or simulated actuation signal.</p>	<p>18 months</p>
<p>SR 3.7.8.3 Verify each ERCW pump starts automatically on an actual or simulated actuation signal.</p>	<p>18 months</p>

3.7 PLANT SYSTEMS

3.7.9 Ultimate Heat Sink (UHS)

LCO 3.7.9 The UHS shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. UHS inoperable.	A.1 Be in MODE 3.	6 hours
	<u>AND</u> A.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.9.1 Verify average water temperature of UHS is $\leq 85^{\circ}\text{F}$.	24 hours

3.7 PLANT SYSTEMS

3.7.10 Control Room Emergency Ventilation System (CREVS)

LCO 3.7.10 Two CREVS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4, and
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CREVS train inoperable.	A.1 Restore CREVS train to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met in MODE 1, 2, 3, or 4.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours
C. Required Action and associated Completion Time of Condition A not met during movement of irradiated fuel assemblies.	C.1 Place OPERABLE CREVS train in emergency mode.	Immediately
	<u>OR</u> C.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> C.2.2 Suspend movement of irradiated fuel assemblies.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Two CREVS trains inoperable in MODE 1, 2, 3, or 4.	D.1 Enter LCO 3.0.3.	Immediately
E. Two CREVS trains inoperable during movement of irradiated fuel assemblies.	E.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> E.2 Suspend movement of irradiated fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.10.1 Verify the operation of each CREVS train for ≥ 15 minutes.	31 days
SR 3.7.10.2 Perform required CREVS filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with VFTP
SR 3.7.10.3 Verify each CREVS train actuates on an actual or simulated actuation signal.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.7.10.4 Verify one CREVS train can maintain a positive pressure of ≥ 0.125 inches water gauge, relative to the outside atmosphere during the pressurization mode of operation at a makeup flow rate of ≤ 325 cfm and a recirculation flow rate of $3675 \pm 10\%$ cfm.</p>	<p>18 months on a STAGGERED TEST BASIS</p>

3.7 PLANT SYSTEMS

3.7.11 Control Room Emergency Air Temperature Control System (CREATCS)

LCO 3.7.11 Two CREATCS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4 and
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CREATCS train inoperable.	A.1 Restore CREATCS train to OPERABLE status.	30 days
B. Required Action and associated Completion Time of Condition A not met in MODE 1, 2, 3, or 4.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours
C. Required Action and associated Completion Time of Condition A not met during movement of irradiated fuel assemblies.	C.1 Place OPERABLE CREATCS train in operation.	Immediately
	<u>OR</u> C.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> C.2.2 Suspend movement of irradiated fuel assemblies.	Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Two CREATCS inoperable in MODE 1, 2, 3, or 4.	D.1 Enter LCO 3.0.3.	Immediately
E. Two CREATCS trains inoperable during movement of irradiated fuel assemblies.	E.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> E.2 Suspend movement of irradiated fuel assemblies.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.11.1 Verify each CREATCS train has the capability to remove the assumed heat load.	18 months

3.7 PLANT SYSTEMS

3.7.12 Auxiliary Building Gas Treatment System (ABGTS)

LCO 3.7.12 Two ABGTS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4, and
During movement of irradiated fuel assemblies in the fuel
handling area.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ABGTS train inoperable.	A.1 Restore ABGTS train to OPERABLE status.	7 days
B. Required Action and associated Completion Time of Condition A not met in MODE 1, 2, 3, or 4. <u>OR</u> Two ABGTS trains inoperable in MODE 1, 2, 3, or 4.	B.1 Be in MODE 3. <u>AND</u> B.2 Be in MODE 5.	6 hours 36 hours
C. Required Action and associated Completion Time of Condition A not met during movement of irradiated fuel assemblies in the fuel handling area.	C.1 Place OPERABLE ABGTS train in operation. <u>OR</u> C.2 Suspend movement of irradiated fuel assemblies in the fuel handling area.	Immediately Immediately

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Two ABGTS trains inoperable during movement of irradiated fuel assemblies in the fuel handling area.	D.1 Suspend movement of irradiated fuel assemblies in the fuel handling area.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.12.1 Operate each ABGTS train for 10 continuous hours with the heaters operating.	31 days
SR 3.7.12.2 Perform required ABGTS filter testing in accordance with the Ventilation Filter Testing Program (VFTP).	In accordance with the VFTP
SR 3.7.12.3 Verify each ABGTS train actuates on an actual or simulated actuation signal.	18 months
SR 3.7.12.4 Verify one ABGTS train can maintain a pressure between -0.25 and -0.5 inches water gauge with respect to atmospheric pressure during the post-accident mode of operation at a flow rate of 9000 ± 10% cfm while maintaining a vacuum relief flow ≥ 2000 cfm.	18 months on a STAGGERED TEST BASIS

3.7 PLANT SYSTEMS

3.7.13 Fuel Storage Pool Water Level

LCO 3.7.13 The fuel storage pool water level shall be \geq 23 ft over the top of irradiated fuel assemblies seated in the storage racks.

APPLICABILITY: During movement of irradiated fuel assemblies in the fuel storage pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Fuel storage pool water level not within limit.	-----NOTE----- LCO 3.0.3 is not applicable. -----	Immediately
	A.1 Suspend movement of irradiated fuel assemblies in the fuel storage pool.	

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.13.1 Verify the fuel storage pool water level is \geq 23 ft above the top of the irradiated fuel assemblies seated in the storage racks.	7 days

3.7 PLANT SYSTEMS

3.7.14 Secondary Specific Activity

LC0 3.7.14 The specific activity of the secondary coolant shall be $\leq 0.10 \mu\text{Ci/gm DOSE EQUIVALENT I-131}$.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Specific activity not within limit.	A.1 Be in MODE 3.	6 hours
	<u>AND</u> A.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.14.1 Verify the specific activity of the secondary coolant is $\leq 0.10 \mu\text{Ci/gm DOSE EQUIVALENT I-131}$.	31 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.1 AC Sources-Operating

LCO 3.8.1 The following AC electrical sources shall be OPERABLE:

- a. Two qualified circuits between the offsite transmission network and the onsite 1E AC Electrical Power Distribution System, and
- b. Four Diesel Generators (DGs) capable of supplying the onsite Class 1E AC Electrical Power Distribution System.

-----NOTE-----
The C-S DG may be substituted for any of the required DGs.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One offsite circuit inoperable.</p>	<p>A.1 Perform SR 3.8.1.1 for the OPERABLE offsite circuit.</p> <p><u>AND</u></p> <p>A.2 Declare required feature(s) with no offsite power available, inoperable when their redundant required feature(s) are inoperable.</p> <p><u>AND</u></p> <p>(continued)</p>	<p>1 hour</p> <p><u>AND</u></p> <p>Once per 8 hours thereafter</p> <p>24 hours from discovery of no offsite power to one train concurrent with inoperability of redundant required feature(s).</p>

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. (continued)</p>	<p>A.3 Restore offsite circuit to OPERABLE status.</p>	<p>72 hours <u>AND</u> 6 days from discovery of failure to meet the LCO.</p>
<p>B. -----NOTE----- Required Action B.3.1 or B.3.2 shall be completed if this Condition is entered ----- One or more required DG(s) in Train A inoperable. <u>OR</u> One or more required DG(s) in Train B inoperable.</p>	<p>B.1 Perform SR 3.8.1.1 for the offsite circuits. <u>AND</u> B.2 Declare required feature(s) supported by the inoperable DG(s), inoperable when their redundant required feature(s) are inoperable. <u>AND</u> B.3.1 Determine OPERABLE DGs are not inoperable due to common cause failure. <u>OR</u> B.3.2 Perform SR 3.8.1.2 for OPERABLE DGs. <u>AND</u> (continued)</p>	<p>1 hour <u>AND</u> Once per 8 hours thereafter 4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s) 24 hours 24 hours</p>

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.4 Restore required DG(s) to OPERABLE status.	72 hours <u>AND</u> 6 days from discovery of failure to meet LCO.
C. Two offsite circuits inoperable.	C.1 Declare required feature(s) inoperable when their required redundant feature(s) are inoperable. <u>AND</u> C.2 Restore one offsite circuit to OPERABLE status.	12 hours from discovery of Condition C concurrent with inoperability of redundant required features 24 hours
D. One offsite circuit inoperable. <u>AND</u> One or more required DG(s) in Train A inoperable. <u>OR</u> One or more required DG(s) in Train B inoperable.	-----NOTE----- Enter applicable Conditions and Required Actions of LCO 3.8.9, "Distribution System-Operating" for AC distribution subsystem. ----- D.1 Restore offsite circuit to OPERABLE status. <u>OR</u> D.2 Restore required DG(s) to OPERABLE status.	12 hours 12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>E. One or more required DG(s) in Train A inoperable.</p> <p><u>AND</u></p> <p>One or more required DG(s) in Train B inoperable.</p>	<p>E.1 Restore required DGs in Train A to OPERABLE status.</p> <p><u>OR</u></p> <p>E.2 Restore required DGs in Train B to OPERABLE status.</p>	<p>2 hours</p> <p>2 hours</p>
<p>F. Required Action and Associated Completion Time of Condition A, B, C, D or E not met.</p>	<p>F.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>F.2 Be in MODE 5.</p>	<p>6 hours</p> <p>36 hours</p>
<p>G. Two offsite circuits inoperable.</p> <p><u>AND</u></p> <p>One or more required DG(s) in Train A inoperable.</p> <p><u>OR</u></p> <p>One or more required DG(s) in Train B inoperable.</p>	<p>G.1 Enter LCO 3.0.3.</p>	<p>Immediately</p>

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>H. One offsite circuit inoperable.</p> <p><u>AND</u></p> <p>One or more required DG(s) in Train A inoperable.</p> <p><u>AND</u></p> <p>One or more required DG(s) in Train B inoperable.</p>	<p>H.1 Enter LCO 3.0.3.</p>	<p>Immediately</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.1 Verify correct breaker alignment and indicated power availability for each offsite circuit.</p>	<p>7 days</p>
<p>SR 3.8.1.2 -----NOTE----- 1. Performance of SR 3.8.1.7 satisfies this SR. 2. A modified DG start, involving idling and gradual acceleration to synchronous speed may be used for this SR as recommended by the manufacturer. When modified start procedures are not used, the time, voltage, and frequency tolerances specified in SR 3.8.1.7 must be met. ----- Verify each DG starts from standby conditions and achieves steady state voltage \geq [TBD]V and \leq [TBD]V and frequency \geq 58.8Hz and \leq 61.2Hz.</p>	<p>As specified in Table 3.8.1-1</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.3 -----NOTE-----</p> <ol style="list-style-type: none"> 1. DG loadings may include gradual loading as recommended by the manufacturer. 2. Momentary transients outside the load and power factor ranges do not invalidate this test. 3. This Surveillance shall be conducted on only one DG at a time. 4. This SR shall be preceded by and immediately follow without shutdown, a successful performance of SR 3.8.1.2 or SR 3.8.1.7. <p>-----</p> <p>Verify each DG is synchronized and loaded and operates for ≥ 60 minutes at a load ≥ 3960 Kw and ≤ 4400 Kw at a power factor ≤ 0.8.</p>	<p>As specified in Table 3.8.1-1</p>
<p>SR 3.8.1.4 Verify each skid mounted day tank contains $\geq [220]$ gal of fuel oil.</p>	<p>31 days</p>
<p>SR 3.8.1.5 Check for and remove accumulated water from each skid mounted day tank.</p>	<p>31 days</p>
<p>SR 3.8.1.6 Verify fuel oil transfer system operates to automatically transfer fuel oil from the 7-day storage tank(s) to the skid mounted day tank.</p>	<p>92 days</p>
<p>SR 3.8.1.7 Verify each DG starts from standby condition and achieves in < 10 seconds, voltage $\geq 6555V$ and $\leq 7260V$ and frequency $\geq 58.8Hz$ and $\leq 61.2Hz$</p>	<p>184 days</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.8</p> <p>-----NOTES----- 1. This Surveillance shall not be performed in MODE 1 or 2. 2. Credit may be taken for unplanned events that satisfy this SR. -----</p> <p>Verify manual transfer of each 6.9 kV shutdown board power supply from the normal offsite circuit to each alternate offsite circuit.</p>	<p>18 months</p>
<p>SR 3.8.1.9</p> <p>-----NOTES----- 1. This Surveillance shall not be performed in MODE 1 or 2. 2. Credit may be taken for unplanned events that satisfy this SR. -----</p> <p>Verify each DG operating at a power factor of ≤ 0.8 rejects a load $\geq [640]$ Kw, and:</p> <p>a. Following load rejection, the frequency is $\leq 61.2\text{Hz}$; and b. Within [3] seconds following load rejection, the voltage is $\geq 6555\text{V}$ and $\leq 7260\text{V}$; and c. Within [3] seconds following load rejection, the frequency is $\geq 58.8\text{Hz}$ and $\leq 61.2\text{Hz}$.</p>	<p>18 months</p>
<p>SR 3.8.1.10</p> <p>-----NOTES----- 1. This Surveillance shall not be performed in MODE 1 or 2. 2. Credit may be taken for unplanned events that satisfy this SR. -----</p> <p>Verify each DG operating at a power factor of ≤ 0.8 does not trip and voltage is maintained $< 8280\text{ V}$ during and following a load rejection of $\geq 3960\text{ Kw}$ and $\leq 4400\text{Kw}$.</p>	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.11</p> <p>-----NOTES-----</p> <ol style="list-style-type: none"> 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify on an actual or simulated loss of offsite power signal:</p> <ol style="list-style-type: none"> a. De-energization of emergency buses; b. Load shedding from emergency buses; c. DG auto-starts from standby condition and: <ol style="list-style-type: none"> 1. energizes permanently connected loads in ≤ 10 seconds, 2. energizes auto-connected shutdown loads through automatic load sequencer; 3. maintains steady-state voltage \geq [TBD] V and \leq [TBD] V; 4. maintains steady-state frequency ≥ 58.8 Hz and ≤ 61.2 Hz, and 5. supplies permanently connected and auto-connected shutdown loads for ≥ 5 minutes. 	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.12</p> <p>-----NOTES-----</p> <ol style="list-style-type: none"> 1. This Surveillance shall not be performed in MODE 1 or 2. 2. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify on an actual or simulated Engineered Safety Feature (ESF) actuation signal each DG auto-starts from standby condition and:</p> <ol style="list-style-type: none"> a. In ≤ 10 seconds after auto-start and during tests, achieves voltage $\geq 6555V$ and $\leq 7260V$; b. In ≤ 10 seconds after auto-start and during tests, achieves frequency $\geq 58.8Hz$ and $\leq 61.2Hz$, c. Operates for ≥ 5 minutes; d. Permanently connected loads remain energized from the offsite power system; and e. Emergency loads are energized to the offsite power system. 	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.13 -----NOTES-----</p> <ol style="list-style-type: none"> 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify each DG's automatic trips are bypassed on actual or simulated loss of voltage signal on the emergency bus concurrent with an actual or simulated ESF actuation signal except:</p> <ol style="list-style-type: none"> a. Engine overspeed; and b. Generator differential current. 	<p>18 months</p>
<p>SR 3.8.1.14 -----NOTES-----</p> <ol style="list-style-type: none"> 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. 3. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify each DG operating at a power factor ≤ 0.8 operates for ≥ 24 hours:</p> <ol style="list-style-type: none"> a. For ≥ 2 hours loaded ≥ 4620 Kw and ≤ 4840 Kw; and b. For the remaining hours of the test loaded ≥ 3960 Kw and ≤ 4400 Kw. 	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.15</p> <p>-----NOTE----- This Surveillance shall be performed within 5 minutes of shutting down the DG after the DG has operated \geq 2 hours loaded \geq 3960 Kw and \leq 4400 Kw. Momentary transients outside of load range do not invalidate this test. -----</p> <p>Verify each DG starts and achieves in \leq 10 seconds, voltage \geq 6555V and \leq 7260V and frequency \geq 58.8Hz and \leq 61.2Hz</p>	<p>18 months</p>
<p>SR 3.8.1.16</p> <p>-----NOTES----- 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. -----</p> <p>Verify each DG:</p> <p>a. Synchronizes with offsite power source while loaded with emergency loads upon a simulated restoration of offsite power;</p> <p>b. Transfers loads to offsite power source; and</p> <p>c. Returns to ready-to-load operation.</p>	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.17 -----NOTES-----</p> <ol style="list-style-type: none"> 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify the interval between each sequenced load block is within the specified bands of FSAR Table 8.3-3, for each accident condition and non-accident condition load sequencer.</p>	<p>18 months</p>
<p>SR 3.8.1.18 -----NOTES-----</p> <ol style="list-style-type: none"> 1. This Surveillance shall not be performed in MODE 1, 2, 3 or 4. 2. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify on an actual or simulated loss of offsite power signal in conjunction with an actual or simulated ESF actuation signal:</p> <ol style="list-style-type: none"> a. De-energization of emergency buses; b. Load shedding from emergency buses; c. DG auto-starts from standby condition and: <ol style="list-style-type: none"> 1. energizes permanently connected loads in ≤ 10 seconds, 2. energizes auto-connected emergency loads through load sequencer, <p style="text-align: right;">(continued)</p>	<p>18 months</p>

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.18 (continued)	<ol style="list-style-type: none"> 3. achieves steady-state voltage \geq [TBD] V and \leq [TBD] V, 4. achieves 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. 	
SR 3.8.1.19	Verify when started simultaneously from standby condition, each DG achieves, in \leq 10 seconds, voltage \geq 6555V and \leq 7260V and frequency \geq 58.8Hz and \leq 61.2HZ.	10 years
SR 3.8.1.20	Verify correct breaker alignment and indicated power availability for each DG 125V DC distribution panel and associated battery charger.	7 days
SR 3.8.1.21	Verify battery terminal voltage is \geq 124V on float charge for each DG.	7 days
SR 3.8.1.22	<p>Verify no visible corrosion at terminals and connectors for each DG battery.</p> <p><u>OR</u></p> <p>Verify connection resistance is \leq 150 E-6 ohms for inter-cell connections, \leq 150 E-6 ohms for inter-rack connections, \leq 150 E-6 ohms for inter-tier connections, and \leq 150 E-6 ohms for terminal connections for each DG battery.</p>	92 days

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.1.23	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration for each DG battery.	12 months
SR 3.8.1.24	Remove visible terminal corrosion, verify cell-to-cell and terminal connections are clean and coated with anti-corrosion material for each DG battery.	12 months
SR 3.8.1.25	Verify connection resistance is ≤ 150 E-6 ohms for inter-cell connections, ≤ 150 E-6 ohms for inter-rack connections, ≤ 150 E-6 ohms for inter-tier connections, and ≤ 150 E-6 ohms for terminal connections for each DG battery.	12 months
SR 3.8.1.26	<p>-----NOTES-----</p> <ol style="list-style-type: none"> 1. SR 3.8.1.27 may be performed in lieu of SR 3.8.1.26 once per 60 months. 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 3. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify DG 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.</p>	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.1.27 -----NOTES-----</p> <ol style="list-style-type: none"> 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify DG battery capacity is \geq 80% of the manufacturer's rating when subjected to a performance discharge test.</p>	<p>60 months</p> <p><u>AND</u></p> <p>-----NOTE----- Only applicable when battery shows — degradation or has reached 85% of the expected life -----</p> <p>12 months</p> <p><u>OR</u></p> <p>-----NOTE----- Only applicable when battery does not show degradation and has reached 85% of the expected life and is \geq100% capacity -----</p> <p>24 months</p>

Table 3.8.1-1
Diesel Generator Test Schedule

NUMBER OF FAILURES IN LAST 25 VALID TESTS ^(a)	FREQUENCY
≤ 3	31 days
≥ 4	7 days ^(b) (but no less than 24 hours)

- (a) Criteria for determining number of failures and valid tests shall be in accordance with Regulatory Position [C.2.1 of Regulatory Guide 1.9, Revision 3], where the number of tests and failures is determined on a per DG basis.
- (b) This test frequency shall be maintained until seven consecutive failure-free starts from standby conditions and load-run demands have been performed. This is consistent with Regulatory Position [C.2.3.3, of Regulatory Guide 1.9, Revision 3]. If subsequent to the 7 failure-free tests 1 or more additional failures occur such that there are again 4 or more failures in the last 25 tests, the testing interval shall again be reduced as noted above and maintained until seven consecutive failure-free tests have been performed.

Note: If Revision 3 of Regulatory Guide 1.9 is not approved, the above table will be modified to be consistent with the existing version of Regulatory Guide 1.108, GL 84-15, or other approved version.

3.8 ELECTRICAL POWER SYSTEMS

3.8.2 AC Sources-Shutdown

LCO 3.8.2 The following AC electrical power sources shall be OPERABLE:

- a. One qualified circuit between the offsite transmission network and the onsite Class 1E AC electrical power distribution subsystem(s) required by LCO 3.8.10, "Distribution Systems-Shutdown"; and
- b. Two diesel generators (DGs) either Train A or Train B capable of supplying one train of the onsite Class 1E AC electrical power distribution subsystem(s) required by LCO 3.8.10.

-----NOTE-----
The C-S DG may be substituted for any of the required DGs.

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One required offsite circuit inoperable.</p>	<p>-----NOTE----- Enter applicable Conditions and Required Actions of LCO 3.8.10, "Distribution Systems - Shutdown" for AC distribution subsystem. -----</p> <p>A.1 Declare affected required feature(s) with no offsite power available inoperable.</p> <p><u>OR</u></p> <p>(continued)</p>	<p>Immediately</p>

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2.2 Suspend movement of irradiated fuel assemblies.	Immediately
	<u>AND</u>	
	A.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.	Immediately
<u>AND</u>		
A.2.4 Initiate action to suspend operations involving positive reactivity additions which would exceed limits specified in LCO 3.1.2, Shutdown Margin," or LCO 3.9.1, "Boron Concentration."	Immediately	
<u>AND</u>		
A.2.5 Initiate action to restore required offsite power circuit to OPERABLE status.	Immediately	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. One required DG inoperable.</p>	<p>B.1 Suspend CORE ALTERATIONS.</p>	<p>Immediately</p>
	<p><u>AND</u></p>	
	<p>B.2 Suspend movement of irradiated fuel assemblies.</p>	<p>Immediately</p>
	<p><u>AND</u></p>	
	<p>B.3 Initiate action to suspend operations with a potential for draining the reactor vessel.</p>	<p>Immediately</p>
<p><u>AND</u></p>		
<p>B.4 Initiate action to suspend operations involving positive reactivity additions which would exceed limits specified in LCO 3.1.2, "Shutdown Margin" or LCO 3.9.1, "Boron Concentration.</p>	<p>Immediately</p>	
<p><u>AND</u></p>		
<p>B.5 Initiate action to restore required DG to OPERABLE status.</p>	<p>Immediately</p>	

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.2.1	For all AC sources required to be OPERABLE, the following SRs are required to be met: SR 3.8.1.1 SR 3.8.1.2 SR 3.8.1.4 SR 3.8.1.5 SR 3.8.1.6 SR 3.8.1.7 SR 3.8.1.11 SR 3.8.1.17 SR 3.8.1.20 SR 3.8.1.21 SR 3.8.1.22 SR 3.8.1.23 SR 3.8.1.24 SR 3.8.1.25	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

LCO 3.8.3 The stored diesel fuel oil, lube oil, and starting air subsystem shall be within limits for each required diesel generator (DG).

APPLICABILITY: When associated DG is required to be OPERABLE.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each DG.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more DGs with fuel level < 60,000 gal and ≥ 52,488 gal in 7-day storage tank.	A.1 Restore fuel oil level to within limits.	48 hours
B. One or more DGs with lube oil inventory < 300 gal and ≥ 280 gal.	B.1 Restore lube oil inventory.	48 hours
C. One or more DGs with stored fuel oil total particulates ≥ 10 mg/l.	C.1 Restore fuel oil total particulates < 10 mg/l.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>D. One or more DGs with new fuel oil properties not within limits of the Diesel Fuel Oil Testing Program.</p>	<p>D.1 Restore stored fuel oil properties to within limits.</p>	<p>30 days</p>
<p>E. One or more DGs with starting air receiver pressure < [200] psig and ≥ [] psig.</p>	<p>E.1 Restore starting air receiver pressure to ≥ [200] psig.</p>	<p>48 hours</p>
<p>F. Required Action and associated Completion Time not met.</p> <p><u>OR</u></p> <p>One or more DGs with diesel fuel oil, lube oil, or starting air subsystem not within limits for reasons other than Condition A, B, C, D, or E.</p>	<p>F.1 Declare associated DG inoperable.</p>	<p>Immediately</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.3.1	Verify each 7-day fuel oil storage tank contains \geq [60,000] gal of fuel.	31 days
SR 3.8.3.2	Verify lube oil inventory is \geq [300] gal per engine.	31 days
SR 3.8.3.3	Verify fuel oil properties of fuel oil stored in and prior to transfer to the 7-day storage tanks are tested in accordance with, and maintained within the limits of the Diesel Fuel Oil Testing Program.	In accordance with the Diesel Fuel Oil Testing Program.
SR 3.8.3.4	Verify each DG air start receiver pressure is \geq [200] psig.	31 days
SR 3.8.3.5	Check for and remove accumulated water from each 7-day fuel oil storage tank.	31 days
SR 3.8.3.6	Perform a visual inspection for leaks in the exposed fuel oil system piping while the DG is running.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.8.3.7	For each 7 day fuel oil storage tank: a. Drain the fuel oil; b. Remove the sediment; and c. Clean the tank.	10 years

3.8 ELECTRICAL POWER SYSTEMS

3.8.4 DC Sources-Operating

LCO 3.8.4 The Train A and Train B DC Power Subsystems shall be OPERABLE.

-----NOTE-----
Vital Battery V maybe substituted for any of the required Vital Batteries.

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

ACTIONS :

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required DC electrical power subsystem inoperable.	A.1 Restore DC electrical power subsystem to OPERABLE status.	2 hours
B. Required Action and Associated Completion Time not met.	B.1 Be in MODE 3	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.4.1	Verify battery terminal voltage is $\geq 128V$ (132 for Vital Battery V) on float charge.	7 days
SR 3.8.4.2	Verify the alternate feeder breakers to each required battery charger are open.	7 days
SR 3.8.4.3	Verify no visible corrosion at terminals and connectors. <u>OR</u> Verify connection resistance is $\leq 80 E-6$ ohms for inter-cell connections, $\leq 100 E-6$ ohms for inter-rack connections, $\leq 80 E-6$ ohms for inter-tier connections, and $\leq 100 E-6$ ohms for terminal connections.	92 days
SR 3.8.4.4	Verify cells, cell plates, and battery racks show no visual indication of physical damage or abnormal deterioration.	12 months
SR 3.8.4.5	Remove visible terminal corrosion, verify cell-to-cell and terminal connections are clean and coated with anti-corrosion material.	12 months
SR 3.8.4.6	Verify connection resistance is $\leq 80 E-6$ ohms for inter-cell connections, $\leq 100 E-6$ ohms for inter-rack connections, $\leq 80 E-6$ ohms for inter-tier connections, and $\leq 100 E-6$ ohms for terminal connections.	12 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.7</p> <p>-----NOTES-----</p> <ol style="list-style-type: none"> 1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 2. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>Verify each battery charger supplies \geq 150 amps at \geq 125V for \geq 4 hours.</p>	<p>18 months</p>
<p>SR 3.8.4.8</p> <p>-----NOTES-----</p> <ol style="list-style-type: none"> 1. SR 3.8.4.9 may be performed in lieu of SR 3.8.4.8 once per 60 months. 2. This Surveillance shall not be performed in MODE 1, 2, 3, or 4. 3. Credit may be taken for unplanned events that satisfy this SR. <p>-----</p> <p>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.</p>	<p>18 months</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.8.4.9</p> <p>-----NOTES-----</p> <p>1. This Surveillance shall not be performed in MODE 1, 2, 3, or 4.</p> <p>2. Credit may be taken for unplanned events that satisfy this SR.</p> <p>-----</p> <p>Verify battery capacity is $\geq 80\%$ of the manufacturer's rating when subjected to a performance discharge test.</p>	<p>60 months</p> <p><u>AND</u></p> <p>-----NOTE-----</p> <p>Only applicable when battery shows degradation or has reached 85% of the expected life</p> <p>-----</p> <p>12 months</p> <p><u>OR</u></p> <p>-----NOTE-----</p> <p>Only applicable when battery does not show degradation and has reached 85% of the expected life and is $\geq 100\%$ capacity</p> <p>-----</p> <p>24 months</p>

3.8 ELECTRICAL POWER SYSTEMS

3.8.5 DC Sources-Shutdown

LCO 3.8.5 DC Electrical power subsystem shall be OPERABLE to support the DC power distribution subsystem(s) required by LCO 3.8.10 "Distribution Systems-Shutdown."

-----NOTE-----
Vital Battery V may be substituted for any of the required Vital Batteries.

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One or more required DC electrical power subsystems inoperable.</p>	<p>A.1 Declare affected required feature(s) inoperable.</p>	<p>Immediately</p>
	<p><u>OR</u></p>	
	<p>A.2.1 Suspend CORE ALTERATIONS.</p> <p><u>AND</u></p>	<p>Immediately</p>
	<p>A.2.2 Suspend movement of irradiated fuel assemblies.</p> <p><u>AND</u></p>	<p>Immediately</p>
<p>A.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.</p> <p><u>AND</u></p> <p>(continued)</p>	<p>Immediately</p>	

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.4 Initiate action to suspend operations involving positive reactivity additions which would exceed limits specified in LCO 3.1.2, "Shutdown Margin", or LCO 3.9.1 "Boron Concentration." <u>AND</u>	Immediately
	A.2.5 Initiate action to restore required DC electrical power subsystems to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.5.1 For DC sources required to be OPERABLE, the following SRs are applicable: SR 3.8.4.1 SR 3.8.4.4 SR 3.8.4.7 SR 3.8.4.2 SR 3.8.4.5 SR 3.8.4.8 SR 3.8.4.3 SR 3.8.4.6 SR 3.8.4.9	In accordance with applicable SRs

3.8 ELECTRICAL POWER SYSTEMS

3.8.6 Battery Cell Parameters

LCO 3.8.6 Battery cell parameters for 125V Vital Batteries and 125V Diesel Generator (DG) Batteries shall be within the Category A and Category B limits of Table 3.8.6-1.

APPLICABILITY: When associated DC electrical power subsystems and DGs are required to be OPERABLE.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Battery bank.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more batteries with one or more battery cell parameters not within limits.	A.1 Verify pilot cells electrolyte level and float voltage meet Table 3.8.6-1 Category C values.	1 hour
	<u>AND</u>	
	A.2 Verify battery cell parameters meet Table 3.8.6-1 Category C values.	24 hours
	<u>AND</u>	
	A.3 Restore battery cell parameters to Category A and Category B limits of Table 3.8.6-1.	31 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. Required Action and associated Completion Time of Condition A not met.</p> <p><u>OR</u></p> <p>One or more batteries with average electrolyte temperature of the representative cells is not within limits.</p> <p><u>OR</u></p> <p>One or more batteries with battery cell parameters not within Category C values.</p>	<p>B.1 Declare associated battery inoperable.</p>	<p>Immediately</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.8.6.1	Verify battery cell parameters meet Table 3.8.6-1 Category A limits.	7 days
SR 3.8.6.2	Verify battery cell parameters meet Table 3.8.6-1 the Category B limits.	92 days <u>AND</u> Once within 24 hours after battery discharge < 110V (113.5V for Vital Battery V) <u>AND</u> — Once within 24 hours after an inadvertent battery overcharge > 150V (143V for DG Batteries)
SR 3.8.6.3	Verify the average electrolyte temperature of representative cells is $\geq 60^{\circ}\text{F}$ for the vital batteries and $\geq 50^{\circ}\text{F}$ for the DG batteries.	92 days

Table 3.8.6-1 (Page 1 of 1)
Battery Cell Parameter Requirements

PARAMETER	CATEGORY A: LIMITS FOR EACH DESIGNATED PILOT CELL	CATEGORY B: LIMITS FOR EACH CONNECTED CELL	CATEGORY C: ALLOWABLE VALUE FOR EACH CONNECTED CELL
Electrolyte Level	> Minimum level indicated mark, and \leq 1/4 inch above maximum level indication mark(a)	> Minimum level indication mark, and \leq 1/4 inch above maximum level indication mark(a)	Above top of plates and not overflowing
Float Voltages	\geq 2.13 V	\geq 2.13 V	> 2.07 V
Specific Gravity ^{(b)(c)} Cell	\geq 1.200	\geq 1.195	Not more than 0.020 below the average of all connected cells
Specific Gravity ^{(b)(c)} Battery		Average of all connected cells \geq 1.205.	Average of all connected cells \geq 1.195

- (a) It is acceptable for the electrolyte level to temporarily increase above the specified maximum level during equalizing charges provided it is not overflowing.
- (b) Corrected for electrolyte temperature and level. Level correction is not required, however, when battery charging is < 2 amps when on float charge for vital batteries and < 0.5 amps for DG batteries.
- (c) Or battery charging current is < 2 amps when on float charge for vital batteries and < 0.5 amps for DG batteries. This is acceptable only during a maximum of 31 days following a battery recharge.

3.8 ELECTRICAL POWER SYSTEMS

3.8.7 Inverters-Operating

LCO 3.8.7 The required Train A and Train B inverters shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One inverter inoperable.	A.1 Power AC vital bus from its associated 120V AC instrument power distribution panel.	2 hours
	<u>AND</u> A.2 Restore inverter to OPERABLE status.	24 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.7.1 Verify correct inverter voltage, frequency, and alignment to required AC vital buses and from associated vital battery board and 480V shutdown board.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.8 Inverters-Shutdown

LCO 3.8.8 Inverters shall be OPERABLE to support the onsite Class 1E AC Vital Bus electrical distribution subsystem(s) required by LCO 3.8.10, "Distribution System-Shutdown."

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One or more required inverters inoperable.</p>	<p>A.1 Declare affected required feature(s) inoperable.</p>	<p>Immediately</p>
	<p><u>OR</u></p>	
	<p>A.2.1 Suspend CORE ALTERATIONS.</p>	<p>Immediately</p>
	<p><u>AND</u></p>	
	<p>A.2.2 Suspend movement of irradiated fuel assemblies.</p>	<p>Immediately</p>
<p><u>AND</u></p>		
<p>A.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.</p>	<p>Immediately</p>	
<p><u>AND</u></p>		

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.4 Initiate action to suspend operations involving positive reactivity additions which would exceed limits specified in LCO 3.1.2, "Shutdown Margin", or LCO 3.9.1, "Boron concentration." <p style="text-align: center;"><u>AND</u></p> A.2.5 Initiate action to restore required inverters to OPERABLE status.	Immediately Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.8.1 Verify correct inverter voltage, frequency, and alignments to required AC vital bus and from associated vital battery board and 480V shutdown board.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.9 Distribution Systems-Operating

LCO 3.8.9 Train A and Train B AC, AC vital bus, and DC electrical power distribution subsystems shall be OPERABLE.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One AC electrical power distribution subsystem inoperable.	A.1 Restore AC electrical power distribution subsystem to OPERABLE status.	8 hours <u>AND</u> 16 hours from discovery of failure to meet LCO.
B. One AC vital bus inoperable.	B.1 Restore AC vital bus subsystem to OPERABLE status.	2 hours <u>AND</u> 16 hours from discovery of failure to meet LCO.
C. One DC electrical power distribution subsystem inoperable.	C.1 Restore DC electrical power distribution subsystem to OPERABLE status.	2 hours <u>AND</u> 16 hours from discovery of failure to meet LCO.

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Required Action and associated Completion Time not met.	D.1 Be in MODE 3. <u>AND</u>	6 hours
	D.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.9.1 Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

3.8 ELECTRICAL POWER SYSTEMS

3.8.10 Distribution Systems-Shutdown

LCO 3.8.10 The necessary portion of the AC, DC, and AC vital bus electrical power distribution subsystems shall be OPERABLE to support equipment required to be OPERABLE.

APPLICABILITY: MODES 5 and 6,
During movement of irradiated fuel assemblies.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One or more required AC, DC, or AC vital bus electrical power distribution subsystems inoperable.</p>	<p>A.1 Declare associated supported required feature(s) inoperable.</p>	<p>Immediately</p>
	<p><u>OR</u></p> <p>A.2.1 Suspend CORE ALTERATIONS.</p>	<p>Immediately</p>
	<p><u>AND</u></p> <p>A.2.2 Suspend movement of irradiated fuel assemblies.</p>	<p>Immediately</p>
	<p><u>AND</u></p> <p>A.2.3 Initiate action to suspend operations with a potential for draining the reactor vessel.</p> <p><u>AND</u></p>	<p>Immediately</p> <p>(continued)</p>

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.4 Initiate action to suspend operations involving positive reactivity additions.	Immediately
	<p style="text-align: center;"><u>AND</u></p> A.2.5 Initiate actions to restore required AC, DC and AC vital bus electrical power distribution subsystems to OPERABLE status.	Immediately
	<p style="text-align: center;"><u>AND</u></p> A.2.6 Declare associated required RHR subsystem(s) inoperable and not in operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.8.10.1 Verify correct breaker alignments and voltage to required AC, DC, and AC vital bus electrical power distribution subsystems.	7 days

3.9 REFUELING OPERATIONS

3.9.1 Boron Concentration

LCO 3.9.1 Boron concentrations of the Reactor Coolant System, the refueling canal, and the refueling cavity shall be maintained within the limit specified in the COLR.

APPLICABILITY: MODE 6.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Boron concentration not within limit.	A.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2 Suspend positive reactivity additions.	Immediately
	<u>AND</u>	
	A.3 Initiate actions to restore boron concentration to within limits.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.1.1 Verify boron concentration is within limit specified in COLR.	72 hours

3.9 REFUELING OPERATIONS

3.9.2 Unborated Water Source Isolation Valves

LCO 3.9.2 Each valve used to isolate unborated water sources shall be secured in the closed position.

APPLICABILITY: MODE 6.

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each unborated water source isolation valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. -----NOTE----- Required Action A.3 must be completed whenever Condition A is entered. ----- One or more valves not secured in closed position.	A.1 Suspend CORE ALTERATIONS. AND	Immediately
	A.2 Initiate actions to secure valve in closed position. AND	Immediately
	A.3 Perform SR 3.9.1.1, boron concentration verification.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.2.1 Verify each valve that isolates unborated water sources is secured in the closed position.	31 days

3.9 REFUELING OPERATIONS

3.9.3 Nuclear Instrumentation

LCO 3.9.3 Two source range neutron flux monitors shall be OPERABLE.

APPLICABILITY: MODE 6.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One source range neutron flux monitor inoperable.	A.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> A.2 Suspend all operations involving positive reactivity additions that would reduce the boron concentration to less than the limit specified in the COLR.	Immediately
B. Two source range neutron flux monitors inoperable.	B.1 Initiate actions to restore one source range neutron flux monitor to OPERABLE status.	Immediately
	<u>AND</u> B.2 Perform SR 3.9.1.1, boron concentration verification.	4 hours <u>AND</u> Once per 12 hours thereafter

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.3.1 Perform CHANNEL CHECK.	12 hours
SR 3.9.3.2 -----NOTE----- Neutron detectors are excluded from CHANNEL CALIBRATION. ----- Perform CHANNEL CALIBRATION.	18 months

3.9 REFUELING OPERATIONS

3.9.4 Containment Penetrations

- LCO 3.9.4 The containment penetrations shall be in the following status:
- a. The equipment hatch closed and held in place by four bolts;
 - b. One door in each airlock closed; and
 - c. Each penetration providing direct access from the containment atmosphere to the outside atmosphere either;
 - 1. closed by a manual or automatic isolation valve, blind flange, or equivalent, or
 - 2. capable of being closed by an OPERABLE Containment Vent Isolation System.

APPLICABILITY: During CORE ALTERATIONS;
 During movement of irradiated fuel assemblies within containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more containment penetrations not in required status.	A.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> A.2 Suspend movement of irradiated fuel assemblies within containment.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.4.1	Verify each required containment penetration is in the required status.	7 days
SR 3.9.4.2	Verify each required containment vent isolation valve actuates to the isolation position on an actual or simulated actuation signal.	18 months

3.9 REFUELING OPERATIONS

3.9.5 Residual Heat Removal (RHR) and Coolant Circulation - High Water Level

LCO 3.9.5 One RHR loop shall be OPERABLE and in operation.

-----NOTE-----
The required RHR loop may be removed from operation for ≤ 1 hour per 8-hour period provided no operations are permitted that would cause dilution of the Reactor Coolant System boron concentration.

APPLICABILITY: MODE 6 with the water level ≥ 23 ft above the top of reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RHR loop requirements not met.	A.1 Suspend operations involving a reduction in reactor coolant boron concentration.	Immediately
	<u>AND</u>	
	A.2 Suspend loading irradiated fuel assemblies in the core.	Immediately
	<u>AND</u>	
	A.3 Initiate action to satisfy RHR loop requirements.	Immediately
	<u>AND</u>	
		(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.4 Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.5.1 Verify one RHR loop is in operation and circulating reactor coolant at a flow rate of \geq [2500] gpm.	12 hours

3.9 REFUELING OPERATIONS

3.9.6 Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level

LCO 3.9.6 Two RHR loops shall be OPERABLE, and one RHR loop shall be in operation.

-----NOTE-----
Prior to initial criticality, only one RHR loop needs to be OPERABLE and in operation and the required RHR loop may be removed from operation for ≤ 1 hour per 8-hour period provided no operations are permitted that would cause dilution of the Reactor Coolant System boron concentration.

APPLICABILITY: MODE 6 with the water level < 23 ft above the top of reactor vessel flange.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Fewer than the required number of RHR loops OPERABLE.	A.1 Initiate action to restore required RHR loops to OPERABLE status.	Immediately
	<u>OR</u> A.2 Initiate actions to establish ≥ 23 ft of water above the top of reactor vessel flange.	Immediately
		(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. No RHR loop in operation.	B.1 Suspend operations involving a reduction in reactor coolant boron concentration.	Immediately
	<u>AND</u>	
	B.2 Initiate action to restore one RHR loop to operation.	Immediately
	<u>AND</u>	
	B.3 Close all containment penetrations providing direct access from containment atmosphere to outside atmosphere.	4 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.6.1 Verify one RHR loop is in operation and circulating reactor coolant at a flow rate of \geq [2000] gpm.	12 hours

3.9 REFUELING OPERATIONS

3.9.7 Refueling Cavity Water Level

LCO 3.9.7 Refueling cavity water level shall be maintained \geq 23 ft above the top of reactor vessel flange.

-----NOTE-----
This LCO is not required to be met for the initial core loading.

APPLICABILITY: During CORE ALTERATIONS
 During movement of irradiated fuel assemblies within containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Refueling cavity water level not within limit.	A.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u>	
	A.2 Suspend movement of irradiated fuel assemblies within containment.	Immediately
	<u>AND</u>	
	A.3 Initiate actions to restore refueling cavity water level to within limits.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.7.1 Verify refueling cavity water level is \geq 23 ft above the top of reactor vessel flange.	24 hours

3.9 REFUELING OPERATIONS

3.9.8 Reactor Building Purge Air Cleanup Units

LCO 3.9.8 Two Reactor Building Purge Air Cleanup Units shall be OPERABLE.

APPLICABILITY: During CORE ALTERATIONS;
During movement of irradiated fuel assemblies within the containment.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Reactor Building Purge Air Cleanup Unit inoperable.	A.1 Isolate the inoperable air cleanup unit.	Immediately
	<u>AND</u> A.2 Verify the OPERABLE air cleanup unit is in operation.	Immediately
B. Two Reactor Building Purge Air Cleanup Units inoperable.	B.1 Suspend CORE ALTERATIONS.	Immediately
	<u>AND</u> B.2 Suspend movement of irradiated fuel assemblies within containment.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.9.8.1 Perform required filter testing in accordance with the Ventilation Filter Testing Program.	In accordance with the Ventilation Filter Testing Program

4.0 DESIGN FEATURES

4.1 Site

Site and Exclusion Boundaries

- 4.1.1 The site and exclusion boundaries shall be as shown in Figure 4.1-1.

Low Population Zone (LPZ)

- 4.1.2 The LPZ shall be as shown in Figure 4.1-2 (within the 3-mile circle).
-

4.2 Reactor Core

Fuel Assemblies

- 4.2.1 The reactor shall contain 193 fuel assemblies. Each assembly shall consist of a matrix of zirconium alloy fuel rods with an initial composition of natural and/or slightly enriched uranium dioxide (UO_2) as fuel material. Limited substitutions of zirconium alloy or stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff-approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. A limited number of lead test assemblies that have not completed representative testing may be placed in non-limiting core regions.

Control Rod Assemblies

- 4.2.2 The reactor core shall contain [57] control rod assemblies. The control material shall be boron carbide with silver indium cadmium tips for Cycle 1. Subsequent cycles may utilize any combination of control rod assemblies with control material of boron carbide with silver indium cadmium tips or full silver indium cadmium.
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(continued)

(continued)

4.3 Fuel Storage

Criticality

- 4.3.1 The spent fuel storage racks are designed and shall be maintained with:
- Fuel assemblies having a maximum U-235 enrichment of 3.15 weight percent;
 - K_{eff} no greater than 0.95 if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the FSAR;
 - A nominal 10.7-inch center-to-center distance between fuel assemblies placed in the high density fuel storage racks;
- 4.3.2 The new fuel storage racks are designed and shall be maintained with:
- Fuel assemblies having a maximum U-235 enrichment of 4.3 weight percent when 130 of the 130 cells are utilized or fuel assemblies having a maximum U-235 enrichment of 5.05 weight percent when utilizing 120 of the 130 cells, specifically Cells D5 through D9 and G5 through G9 must remain empty when fuel assemblies having an enrichment of between 4.3 and 5.05 weight percent are stored;
 - K_{eff} no greater than 0.95 if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.1 of the FSAR;
 - K_{eff} no greater than 0.98 if moderated by aqueous foam, which includes an allowance for uncertainties as described in Section 9.1 of the FSAR; and
 - A nominal 21-inch center-to-center distance between fuel assemblies placed in the storage racks.

Drainage

- 4.3.3 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 745 ft - 1 1/2 inches.

(continued)

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Capacity

- 4.3.4 The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than [1,312] fuel assemblies.
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-

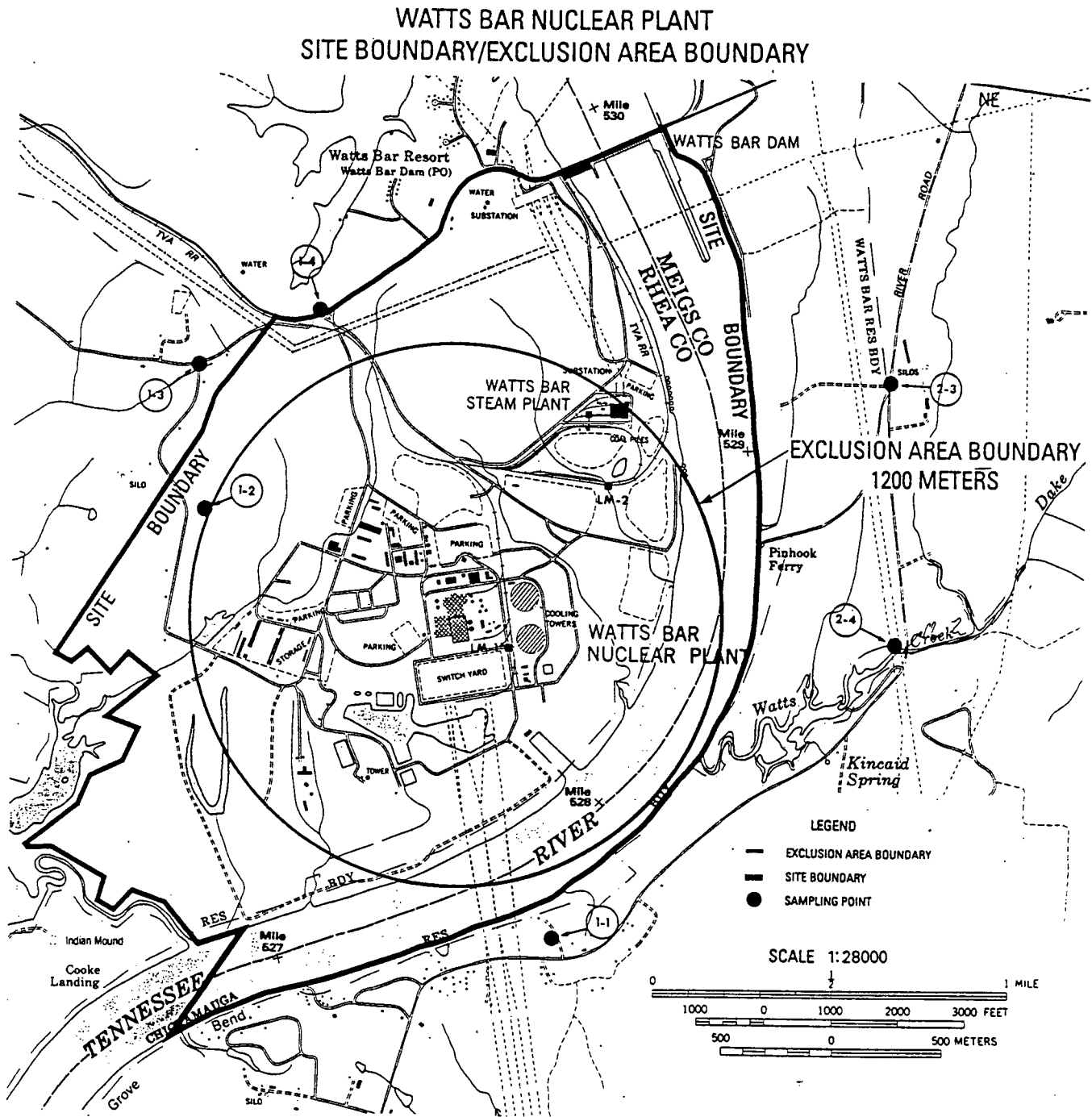


Figure 4.1-1 (page 1 of 1)
Site and Exclusion Area Boundaries

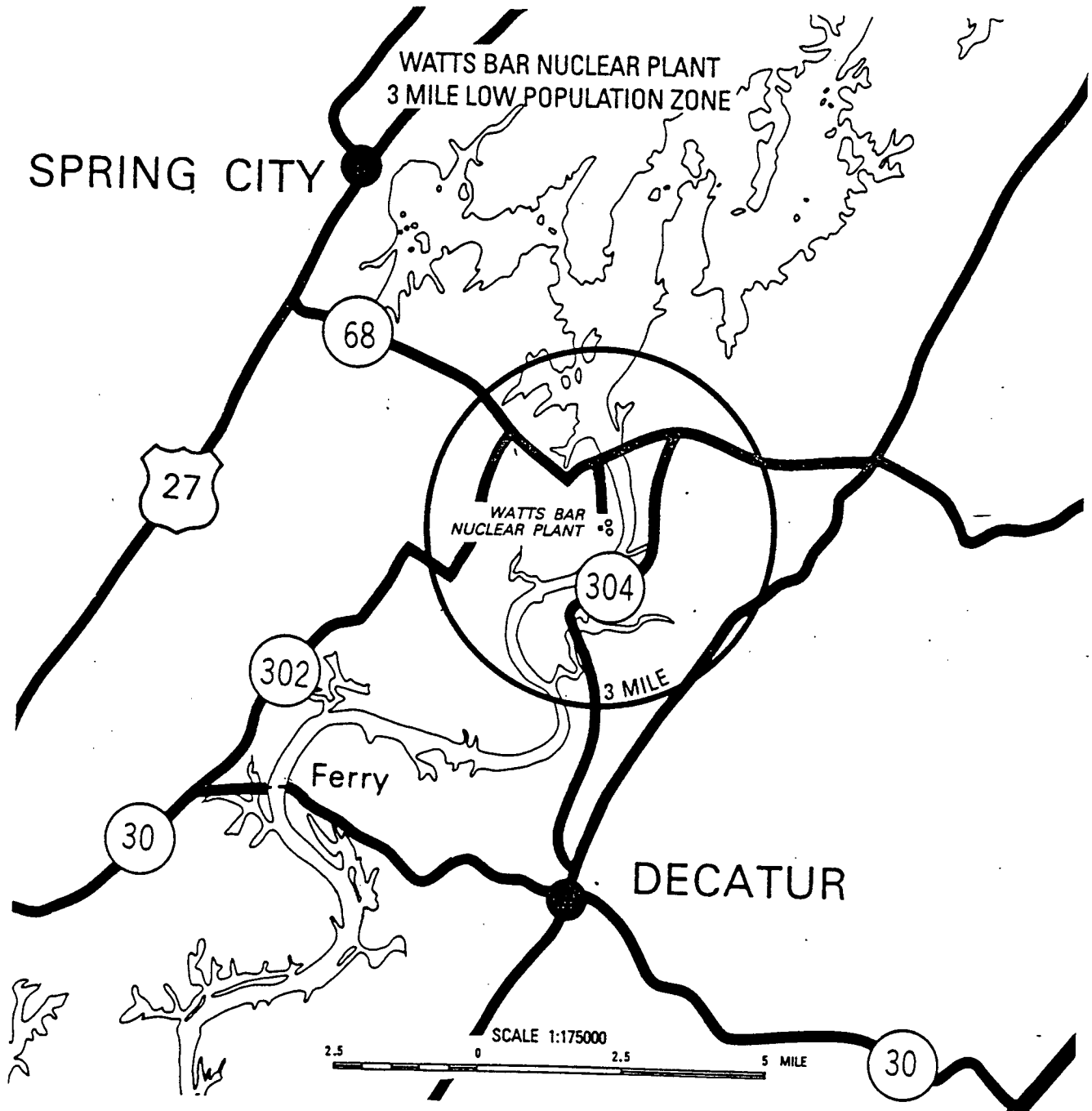


Figure 4.1-2 (page 1 of 1)
Low Population Zone

5.0 ADMINISTRATIVE CONTROLS

5.1 Responsibility

- 5.1.1 The Site Vice President shall be responsible for overall activities of the site, while the Plant Manager shall be responsible for overall unit operation. The Site Vice President and Plant Manager shall delegate in writing the succession to this responsibility during their absence.

The Plant Manager, or his designee, in accordance with approved administrative procedures, shall approve each proposed test or experiment and proposed changes and modifications to unit systems or equipment that affect nuclear safety prior to implementation.

- 5.1.2 The Shift Operations Supervisor (SOS) shall be responsible for the control room command function. A management directive to this effect, signed by the Site Vice President shall be issued annually to all station personnel. During any absence of the SOS from the control room while the unit is in MODE 1, 2, 3, or 4, an individual with a valid Senior Reactor Operator (SRO) license shall be designated to assume the control room command function. During any absence of the SOS from the control room while the unit is in MODE 5 or 6, an individual with a valid SRO license or Reactor Operator license shall be designated to assume the control room command function.
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5.0 ADMINISTRATIVE CONTROLS

5.2 Organization

5.2.1 Onsite and Offsite Organizations

Onsite and offsite organizations shall be established for unit operation and corporate management, respectively. The onsite and offsite organizations shall include the positions for activities affecting safety of the nuclear power plant.

- a. Lines of authority, responsibility, and communication shall be defined and established throughout highest management levels, intermediate levels, and all operating organization positions. These relationships shall be documented and updated, as appropriate, in organization charts, functional descriptions of departmental responsibilities and relationships, and job descriptions for key personnel positions, or in equivalent forms of documentation. These requirements shall be documented in the Nuclear Power Organization Topical Report (TVA-NPOD89-A);
- b. The Plant Manager shall be responsible for overall safe operation of the plant and shall have control over those onsite activities necessary for safe operation and maintenance of the plant;
- c. The Site Vice President shall have corporate responsibility for overall plant nuclear safety and shall take any measures needed to ensure acceptable performance of the staff in operating, maintaining, and providing technical support to the plant to ensure nuclear safety; and
- d. The individuals who train the operating staff, carry out radiological controls, or perform quality assurance functions may report to the appropriate onsite manager; however, these individuals shall have sufficient organizational freedom to ensure their independence from operating pressures.

(continued)

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5.2.2 Unit Staff

The unit staff organization shall be as follows:

- a. Each on-duty shift shall be composed of at least the minimum shift crew composition shown in Table 5.2.2-1.
- b. At least one licensed Reactor Operator (RO) shall be present in the control room when fuel is in the reactor. In addition, while the unit is in MODE 1, 2, 3, or 4, at least one licensed Senior Reactor Operator (SRO) shall be present in the control room.
- c. A Radiological Control Technician shall be on site when fuel is in the reactor. The position may be vacant for not more than 2 hours, in order to provide for unexpected absence, provided immediate action is taken to fill the required position.
- d. Either a licensed SRO or licensed SRO limited to fuel handling who has no concurrent responsibilities during this operation shall be present during fuel handling and shall directly supervise all CORE ALTERATIONS.
- e. Administrative procedures shall be developed and implemented to limit the working hours of unit staff who perform safety-related functions (e.g., licensed SROs, licensed ROs, radiological control technicians, auxiliary operators, and key maintenance personnel).

Adequate shift coverage shall be maintained without routine heavy use of overtime. The objective shall be to have operating personnel work an 8, 10 or 12-hour day, nominal 40-hour week while the unit is operating. However, in the event that unforeseen problems require substantial amounts of overtime to be used, or during extended periods of shutdown for refueling, major maintenance, or major plant modification, on a temporary basis the following guidelines shall be followed:

1. An individual should not be permitted to work more than 16 hours straight, excluding shift turnover time;

(continued)

5.2.2 Unit Staff (continued)

2. An individual should not be permitted to work more than 16 hours in any 24-hour period, nor more than 24 hours in any 48-hour period, nor more than 72 hours in any 7-day period, all excluding shift turnover time;
3. A break of at least 8 hours should be allowed between work periods, including shift turnover time;
4. Except during extended shutdown periods, the use of overtime should be considered on an individual basis and not for the entire staff on a shift.

Any deviation from the above guidelines shall be authorized in advance by the Plant Manager or his designee, in accordance with approved administrative procedures, or by higher levels of management, in accordance with established procedures and with documentation of the basis for granting the deviation.

Controls shall be included in the procedures such that individual overtime shall be reviewed monthly by the Plant Manager or his designee to ensure that excessive hours have not been assigned. Routine deviation from the above guidelines is not authorized.

- f. The individual directly supervising the Shift Operations Supervisors shall hold an SRO license.
 - g. The Shift Technical Advisor (STA) shall provide advisory technical support to the Shift Operations Supervisor (SOS) in the areas of thermal hydraulics, reactor engineering, and plant analysis with regard to the safe operation of the unit.
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Table 5.2.2-1 (page 1 of 1)
Minimum Shift Crew Composition^(a)

POSITION ^(b)	MINIMUM CREW NUMBER	
	UNIT IN MODE 1, 2, 3, OR 4	UNIT IN MODE 5 OR 6
SOS	1	1
SRO	1	None
RO	2	1
AUO	4	1
STA ^(c)	1	None

(a) The shift crew composition may be one less than the minimum requirements of Table 5.2.2-1 for not more than 2 hours to accommodate unexpected absences of on-duty shift crew members provided immediate action is taken to restore the shift crew composition to within the minimum requirements of Table 5.2.2-1. This provision does not permit any shift crew position to be unmanned upon shift change due to an oncoming shift crewman being late or absent.

(b) Table Notation:

SOS - Shift Operations Supervisor with a Senior Reactor Operator license;
SRO - Individual with a Senior Reactor Operator license;
RO - Individual with a Reactor Operator license;
AUO - Auxiliary Unit Operator;
STA - Shift Technical Advisor.

(c) The STA position may be filled by an on-shift SOS or SRO provided the individual meets the Commission Policy Statement on Engineering Expertise on Shift.

5.0 ADMINISTRATIVE CONTROLS

5.3 Unit Staff Qualifications

- 5.3.1 Each member of the unit staff shall meet or exceed the minimum qualifications for comparable positions as specified in the TVA Nuclear Quality Assurance Plan (TVA-NQA-PLN89-A). In addition, the Shift Technical Advisor shall meet the qualifications specified by the Commission Policy Statement on Engineering Expertise on Shift.
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5.0 ADMINISTRATIVE CONTROLS

5.4 Training

5.4.1 A retraining and replacement training program for the unit staff shall be maintained under the direction of the Plant Manager and shall meet or exceed the requirements of 10 CFR 55 and the TVA Nuclear Quality Assurance Plan (TVA-NQA-PLN89-A), and shall include familiarization with relevant industry operating experience.

5.0 ADMINISTRATIVE CONTROLS

5.5 Reviews and Audits

The plant staff organization provides reviews of day-to-day activities to ensure they are conducted in a safe manner. The Plant Operations Review Committee (PORC) is a multi-disciplined committee responsible for providing an oversight review of documents required for the safe operation of the plant. The PORC advises the Plant Manager on all matters related to nuclear safety. Also, Technical Reviewers provide for reviews of procedure changes and proposed changes to structures, systems, and components that affect nuclear safety in their area of expertise. These technical reviews determine the need for a cross-disciplinary review and whether or not an unreviewed safety question is involved.

The Nuclear Assurance organization provides independent technical reviews and audits of activities effecting nuclear plant safety. The Nuclear Safety Review Board (NSRB) is an off site committee which provides senior level oversight of TVA's nuclear program with respect to nuclear safety. The NSRB reviews include the activities of the line organizations, as well as other review, audit and verification organizations. The NSRB advises the Senior Vice President, Nuclear Power (SVP, NP), on the adequacy and implementation of TVA's nuclear safety policies and programs. The NSRB also provides senior level management with an assessment of facility operations and recommendations to improve nuclear safety and plant reliability.

5.5.1 Plant Reviews

The items in Specification 5.5.1.2 receive varying degrees of review, before final approval or use, as specified in approved administrative procedures. The degree of review shall be commensurate with the potential to affect nuclear safety. As a minimum each item shall be reviewed by at least one individual knowledgeable in the subject matter and cross-disciplinary review(s) shall be obtained, as needed, before approval.

The staff shall provide technical and cross-disciplinary reviews. These reviews shall be governed by administrative procedures for items considered under Specification 5.5.1.2. The sponsor of each item shall be responsible for the conduct of all reviews.

(continued)

5.5.1 Plant Reviews (continued)

a. Plant Technical Review Process

Technical Reviewers shall be chosen by the discipline supervisors to perform technical reviews based on the individual's training, experience, and knowledge level. Technical Reviewers assigned the responsibility for reviewing for 10 CFR 50.59 requirements shall receive training in this process. Technical Reviewers shall not review their own work. The minimum qualification requirements shall be as recommended in Section 4 of ANSI N18.1-1971.

1. Organization

Each supervisor is responsible for ensuring that technical reviewers are available for reviews for the equipment, systems, programs, procedures and other areas under their supervision, and that reviews are performed to detect safety questions.

2. Reporting

Technical Reviewers report to their supervisors or PORC on all activities and findings. The signed document processing form(s) shall serve as the reviewer's approval recommendation to the designated Approval Authority.

b. Plant Operations Review Committee (PORC)

The PORC shall be the onsite review committee. The committee shall function as a multi-disciplinary review body for items which affect plant nuclear safety. PORC shall be organized and shall conduct business as described below:

1. Composition

Chairman: Plant Manager
Member: Operations Manager
Member: Maintenance Manager
Member: Technical Support Manager
Member: Quality Assurance Representative
Member: Site Radiological Control Manager
Member: Site Nuclear Engineering Representative

(continued)

5.5.1 Plant Reviews (continued)

Individuals performing the duties and serving in the official capacity of the above titled member positions may be considered, if qualified, the PORC Member for quorum purposes.

The qualifications required to serve as a member or alternate member shall be specified with the minimum qualifications as recommended in Section 4 of ANSI N18.1-1971, except for the Site Radiological Control Manager who must meet the qualifications of Regulatory Guide 1.8, Revision 2.

2. Alternates

All alternate members shall be appointed in writing by the PORC Chairman to serve on a temporary basis; however, no more than two alternates shall participate as voting members in PORC activities at any one time.

3. Meeting Frequency

The PORC shall meet on an as needed basis as convened by the PORC Chairman or his designated alternate.

4. Quorum

The PORC quorum shall consist of the Chairman or his designated alternate and four members of which two may be alternates.

5. Reporting

The PORC reports to the Plant Manager on all activities and findings. The meeting minutes shall serve as the official correspondence from PORC to the Plant Manager. PORC recommendations shall be recorded in the minutes and submitted to the Plant Manager by the PORC Chairman.

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5.5.1.1 Functions

a. The PORC shall:

1. Advise the Plant Manager on all matters related to nuclear safety;
2. Recommend to the Plant Manager, or his designee, approval or disapproval of procedures that delegate review responsibilities of items considered under Specifications 5.5.1.2.a and 5.7.1.3;
3. Recommend to the Plant Manager, or his designee, approval or disapproval of items considered under Specifications 5.5.1.2.a.1 through 5.5.1.2.a.5 prior to their implementation, except as provided in Specification 5.7.1.3;
4. Determine whether each item considered under Specifications 5.5.1.2.a.1 through 5.5.1.2.a.4 constitutes an unreviewed safety question as defined in 10 CFR 50.59; and
5. Notify the Site Vice President and the Nuclear Safety Review Board (NSRB) of any safety-significant disagreement between the PORC and the Plant Manager within 24 hours. However, the Plant Manager shall have responsibility for resolution of such disagreements pursuant to Specification 5.1.1.

b. The Technical Reviewer(s) shall:

1. Advise his supervisor and/or PORC on all matters related to nuclear safety;
2. Determine the need for additional reviews by other disciplines and ensure that identified reviews are conducted for items considered under Specification 5.5.1.2.b prior to their implementation, except as provided in Specification 5.7.1.3;

(continued)

5.5.1.1 Functions (continued)

3. Recommend to the designated Approval Authority, approval or disapproval of items considered under Specification 5.5.1.2.b prior to their implementation, except as provided in Specification 5.7.1.3; and
4. Determine whether each item considered under Specifications 5.5.1.2.b.1 through 5.5.1.2.b.4 constitutes an unreviewed safety question as defined in 10 CFR 50.59.

5.5.1.2 Responsibilities

- a. The PORC shall be responsible for the review of:
 1. Administrative procedures required by Specification 5.7.1.1 and changes thereto;
 2. Program descriptions for programs required by Specification 5.7.2 and changes thereto;
 3. All proposed changes and modifications to unit systems or equipment that affect nuclear safety;
 4. All proposed tests and experiments that affect nuclear safety; and
 5. All proposed changes to these Technical Specifications (TS), their Bases, and the Operating License.
- b. The Technical Reviewers shall be responsible for the technical review of:
 1. Proposed procedures required by Specification 5.7.1.1 and changes thereto;
 2. Proposed programs required by Specification 5.7.2 and changes thereto;
 3. Proposed changes and modifications to unit systems or equipment that affect nuclear safety;
 4. Proposed tests and experiments that affect nuclear safety; and

(continued)

5.5.1.2 Responsibilities (continued)

5. Proposed changes to these Technical Specifications (TS), their Bases, and the Operating License.

5.5.2 Offsite Review and Audit

The Nuclear Safety Review Board (NSRB) shall function to provide for independent review as specified in Specification 5.5.2.2 and oversight of the audits and technical reviews as specified in 5.5.2.3 and 5.5.2.4.

The Chairman, members, and alternate members of the NSRB shall meet the qualification requirements of ANSI 18.7, 1976/ANS 3.2 Section 4.3.1.

Nuclear Assurance (NA) shall function to provide audits and onsite technical reviews as specified in Specifications 5.5.2.3 and 5.5.2.4.

NA audit personnel shall meet the qualification requirements as committed to the NRC in TVA's Nuclear Quality Assurance Plan (TVA-NQA-PLN89-A).

NA onsite technical review personnel shall have a bachelor's degree in engineering or equivalent and two to four years experience in their field, including one to two years nuclear experience.

5.5.2.1 Functions

The NSRB shall, as a minimum, incorporate the following functions that:

- a. Advise the Senior Vice President, Nuclear Power on all matters related to nuclear safety;
- b. Recommend to the Senior Vice President, Nuclear Power, any corrective action to improve nuclear safety and plant operation; and
- c. Notify the Senior Vice President, Nuclear Power of any safety significant disagreement between the NSRB and the organization or function being reviewed within 24 hours.

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5.5.2.2 NSRB Review Responsibilities

The NSRB shall be responsible for the review of:

- a. The 10 CFR 50.59 Safety Evaluation Program;
- b. Proposed changes to procedures, equipment, or systems that involve an unreviewed safety question as defined in 10 CFR 50.59;
- c. Proposed tests or experiments that involve an unreviewed safety question as defined in 10 CFR 50.59;
- d. Proposed changes to TS and the Operating License;
- e. Violations of codes, regulations, orders, license requirements, and internal procedures or instructions having nuclear safety significance;
- f. All Licensee Event Reports required by 10 CFR 50.73;
- g. Plant staff performance;
- h. Indications of unanticipated deficiencies in any aspect of design or operation of structures, systems, or components that could affect nuclear safety;
- i. Significant accidental, unplanned, or uncontrolled radioactive releases, including corrective action to prevent recurrence;
- j. Significant operating abnormalities or deviations from normal and expected performance of equipment that affect nuclear safety; and
- k. Implementation of the corrective action program.

Minutes of each NSRB meeting and reports of these reviews shall be forwarded to the Senior Vice President, Nuclear Power within 30 days following completion of the review.

5.5.2.3 Nuclear Assurance Audit Responsibilities

Nuclear Assurance is responsible for the audit program whose audit responsibilities shall encompass:

(continued)

5.5.2.3 Nuclear Assurance Audit Responsibilities (continued)

- a. The conformance of unit operation to provisions contained within the TS and applicable license conditions;
- b. The training and qualifications of the unit staff;
- c. Safety evaluations for changes to procedures, equipment or systems, and tests or experiments completed under the provisions of 10 CFR 50.59, to verify that such actions do not constitute an unreviewed safety question;
- d. The advisement to management of the audited organization, and appropriate senior management, of the audit results as they relate to nuclear safety;
- e. The implementation of all programs required by Specification 5.7.2;
- f. Actions taken to correct deficiencies occurring in equipment, structures, systems, components, or method of operation that affect nuclear safety; and
- g. Other activities and documents as requested by the Senior Vice President, Nuclear Power.

Reports or records of these audits shall be forwarded to the Senior Vice President, Nuclear Power and audited organization as committed to the NRC in the Nuclear Quality Assurance Plan.

5.5.2.4 Nuclear Assurance Technical Review Responsibilities

Nuclear Assurance is responsible for technical review whose responsibilities shall encompass:

- a. Plant operating characteristics, NRC issuances, industry advisories, Licensee Event Reports, and other sources that may indicate areas for improving plant safety;
- b. Plant operations, modifications, maintenance, and surveillance to verify independently that these activities are performed safely and correctly and that human errors are reduced as much as practical;

(continued)

5.5.2.4 Nuclear Assurance Technical Review Responsibilities (continued)

- c. Internal and external operational experience information that may indicate areas for improving plant safety; and
- d. Making detailed recommendations through the Site Vice President, for revising procedures, equipment modifications or other means of improving nuclear safety and plant reliability.

5.5.3 Records

Written records of reviews and audits shall be maintained. As a minimum these records shall include:

- a. Results of the activities conducted under the provisions of Section 5.5;
 - b. Recommendations to the management of the organization being audited;
 - c. An assessment of the safety significance of the review or audit findings;
 - d. Recommended approval or disapproval of items considered under Specifications 5.5.1.2.a.1 through 5.5.1.2.b.5; and
 - e. Determination whether each item considered under Specifications 5.5.1.2.a.1 through 5.5.1.2.a.4, and 5.5.1.2.b.1 through 5.5.1.2.b.4 constitutes an unreviewed safety question as defined in 10 CFR 50.59.
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5.0 ADMINISTRATIVE CONTROLS

5.6 Technical Specifications (TS) Bases Control

- 5.6.1 Changes to the Bases of the TS shall be made under appropriate administrative controls and reviewed according to Specification 5.5.1.
- 5.6.2 Licensees may make changes to Bases without prior NRC approval provided the changes do not involve either of the following:
- a. A change in the TS incorporated in the license; or
 - b. A change to the updated FSAR or Bases that involves an unreviewed safety question as defined in 10 CFR 50.59.
- 5.6.3 The Bases Control Program shall contain provisions to ensure that the Bases are maintained consistent with the FSAR.
- 5.6.4 Proposed changes that meet the criteria of Specification 5.6.2 shall be reviewed and approved by the NRC prior to implementation. Changes to the Bases implemented without prior NRC approval shall be provided to the NRC on a frequency consistent with 10 CFR 50.71.
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5.0 ADMINISTRATIVE CONTROLS

5.7 Procedures, Programs, and Manuals

5.7.1 Procedures

5.7.1.1 Scope

Written procedures shall be established, implemented, and maintained covering the following activities:

- a. The applicable procedures recommended in Regulatory Guide 1.33, Revision 2, Appendix A, February 1978;
- b. The emergency operating procedures required to implement the requirements of NUREG-0737 and NUREG-0737, Supplement 1, as stated in [Generic Letter 82-33];
- c. Security plan implementation;
- d. Site Radiological Emergency Plan implementation;
- e. Quality assurance for effluent and environmental monitoring;
- f. Fire Protection Program implementation; and
- g. All programs specified in Specification 5.7.2.

5.7.1.2 Review and Approval

Each procedure of Specification 5.7.1.1, and changes thereto, shall be reviewed in accordance with Specification 5.5.1, approved by the Plant Manager or his designee in accordance with approved administrative procedures prior to implementation, except as specified in Specification 5.7.1.3, and reviewed periodically as set forth in administrative procedures.

5.7.1.3 Temporarily Approved Changes

Temporarily Approved changes to procedures of Specification 5.7.1.1 may be made provided:

- a. The intent of the existing procedure is not altered;

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5.7.1.3 Temporarily Approved Changes (continued)

- b. The change is approved by two members of the plant management staff, at least one of whom holds a Senior Reactor Operator license on the unit affected; and
- c. The change is documented and reviewed in accordance with Specification 5.5.1 and approved by the Plant Manager or his designee in accordance with approved administrative procedures within 14 days of implementation.

5.7.2 Programs and Manuals

The following programs shall be established, implemented, and maintained.

5.7.2.1 Radiation Protection Program .

Procedures for personnel radiation protection shall be prepared consistent with the requirements of 10 CFR 20 and shall be approved, maintained, and adhered to for all operations involving personnel radiation exposure.

5.7.2.2 Process Control Program (PCP)

The PCP shall describe the program to ensure that processing and packaging of solid radioactive wastes will be accomplished in accordance with 10 CFR 20, 10 CFR 61, and 10 CFR 71; state regulations; burial ground requirements; and other requirements governing the disposal of solid radioactive waste.

Licensee-initiated changes to the PCP:

- a. Shall be documented and records of reviews performed shall be retained. This documentation shall contain:
 1. Sufficient information to support the change(s) and appropriate analyses or evaluations justifying the change(s); and

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5.7.2.2 Process Control Program (PCP) (continued)

2. A determination that the change(s) maintain the overall conformance of the solidified waste product to the existing requirements of Federal, State, or other applicable regulations.
- b. Shall be effective after review and acceptance by the PORC and the approval of the Plant Manager.

5.7.2.3 Offsite Dose Calculation Manual (ODCM)

- a. The ODCM shall contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm and trip setpoints, and in the conduct of the Radiological Environmental Monitoring Program;
- b. The ODCM shall also contain the Radioactive Effluent Controls and Radiological Environmental Monitoring programs required by Specifications 5.7.2.7 and 5.7.2.8, and descriptions of the information that should be included in the Annual Radiological Environmental Operating, and Radioactive Effluent Release Reports required by Specification 5.9.1.3 and Specification 5.9.1.4.

Licensee-initiated changes to the ODCM:

- a. Shall be documented and records of reviews performed shall be retained. This documentation shall contain:
 1. Sufficient information to support the change(s) together with the appropriate analyses or evaluations justifying the change(s),
 2. A determination that the change(s) maintain the levels of radioactive effluent control required by 10 CFR 20.106, 40 CFR 190, 10 CFR 50.36a, and 10 CFR 50, Appendix I, and not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations.
- b. Shall become effective after review and acceptance by the PORC and the approval of the Plant Manager.

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5.7.2.3 Offsite Dose Calculation Manual (ODCM) (continued)

- c. Shall be submitted to the NRC in the form of a complete, legible copy of the entire ODCM as a part of or concurrent with the Radioactive Effluent Release Report for the period of the report in which any change in the ODCM was made. Each change shall be identified by 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.

5.7.2.4 Primary Coolant Sources Outside Containment

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 Containment Spray, Safety Injection, Residual Heat Removal, Chemical and Volume Control, RCS sampling, and Waste Gas. The program shall include the following:

- a. Preventive maintenance and periodic visual inspection requirements; and
- b. Integrated leak test requirements for each system at refueling cycle intervals or less.

5.7.2.5 In-Plant Radiation Monitoring

This program provides controls to ensure the capability to accurately determine the airborne iodine concentration in vital areas under accident conditions. This program shall include the following:

- a. Training of personnel;
- b. Procedures for monitoring; and
- c. Provisions for maintenance of sampling and analysis equipment.

5.7.2.6 Post-Accident Sampling

This program provides controls that ensure the capability to obtain and analyze reactor coolant, radioactive gases and

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5.7.2.6 Post-Accident Sampling (continued)

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.

5.7.2.7 Radioactive Effluent Controls Program

This program conforms to 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to members of the public from radioactive effluents as low as reasonably achievable. The program shall be contained in the ODCM, shall be implemented by procedures, and shall include remedial actions to be taken whenever the program limits are exceeded. The program shall include the following elements:

- a. Limitations on the functional capability of radioactive liquid and gaseous monitoring instrumentation including surveillance tests and setpoint determination in accordance with the methodology in the ODCM;
- b. Limitations on the concentrations of radioactive material released in liquid effluents to unrestricted areas, conforming to 10 CFR 20, Appendix B, Table II, Column 2;
- c. Monitoring, sampling, and analysis of radioactive liquid and gaseous effluents in accordance with 10 CFR 20.1302 and with the methodology and parameters in the ODCM;
- d. Limitations on the annual and quarterly doses or dose commitment to a member of the public from radioactive materials in liquid effluents released from each unit to unrestricted areas, conforming to 10 CFR 50, Appendix I;
- e. Determination of cumulative and projected dose contributions from radioactive effluents for the current calendar quarter and current calendar year in accordance with the methodology and parameters in the ODCM at least every 31 days;

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5.7.2.7 Radioactive Effluent Controls Program (continued)

- f. Limitations on the functional capability and use of the liquid and gaseous effluent treatment systems to ensure that appropriate portions of these systems are used to reduce releases of radioactivity when the projected doses in a period of 31 days would exceed 2% of the guidelines for the annual dose or dose commitment, conforming to 10 CFR 50, Appendix I;
- g. Limitations on the dose rate resulting from radioactive material released in gaseous effluents to areas beyond the site boundary conforming to the dose associated with 10 CFR 20, Appendix B, Table II, Column 1;
- h. Limitations on the annual and quarterly air doses resulting from noble gases released in gaseous effluents from each unit to areas beyond the site boundary, conforming to 10 CFR 50, Appendix I;
- i. Limitations on the annual and quarterly doses to a member of the public from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each unit to areas beyond the site boundary, conforming to 10 CFR 50, Appendix I; and
- j. Limitations on the annual dose or dose commitment to any member of the public due to releases of radioactivity and to radiation from uranium fuel cycle sources, conforming to 40 CFR 190.

5.7.2.8 Radiological Environmental Monitoring Program

This program is for monitoring the radiation and radionuclides in the environs of the plant. The program shall provide representative measurements of radioactivity in the highest potential exposure pathways and verification of the accuracy of the effluent monitoring program and modeling of environmental exposure pathways. The program shall be contained in the ODCM, shall conform to the guidance of 10 CFR 50, Appendix I, and shall include the following:

(continued)

5.7.2.8 Radiological Environmental Monitoring Program (continued)

- a. Monitoring, sampling, analysis, and reporting of radiation and radionuclides in the environment in accordance with the methodology and parameters in the ODCM;
- b. A Land Use Census to ensure that changes in the use of areas at and beyond the site boundary are identified and that modifications to the monitoring program are made if required by the results of this census; and
- c. Participation in an Interlaboratory Comparison Program to ensure that independent checks on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring.

5.7.2.9 Component Cyclic or Transient Limit

This program provides controls to track the FSAR Section 5.2.1.5 cyclic and transient occurrences to ensure that components are maintained within the design limits.

5.7.2.10 Inservice Inspection Program

This program provides controls for inservice inspection of ASME Code Class 1, 2, and 3 components, including applicable supports. The program shall include the following:

- a. Provisions that inservice inspection of ASME Code Class 1, 2, and 3 components shall be performed in accordance with ASME Boiler and Pressure Vessel Code and Addenda, Section XI, as required by 10 CFR 50.55a(g), except where relief has been requested from the NRC pursuant to 10 CFR 50.55a(g)(6)(i) and 10 CFR 50.55a(a)(3);
- b. The provisions of SR 3.0.2 are applicable to the frequencies for performing inservice inspection activities;
- c. Inspection of each reactor coolant pump flywheel per the recommendations of Regulation Position C.4.b of Regulatory Guide 1.14, Revision 1, August 1975; and
- d. Nothing in the ASME Boiler and Pressure Vessel code shall be construed to supersede the requirements of any TS.

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5.7.2.11 Inservice Testing Program

This program provides controls for inservice testing of ASME Code Class 1, 2, and 3 components including applicable supports. The program shall include the following:

- a. Provisions that inservice testing of ASME Code Class 1, 2, and 3 pumps, valves, and snubbers shall be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as required by 10 CFR 50.55a(g), except where relief has been requested from the Commission pursuant to 10 CFR 50.55a(g)(6)(i) and 10 CFR 50.55a(a)(3), or as provided in GL89-04;
- b. Testing frequencies specified in Section XI of the ASME Boiler and Pressure Vessel Code and applicable Addenda as follows:

<u>ASME Boiler and Pressure Vessel Code and applicable Addenda terminology for inservice testing activities</u>	<u>Required frequencies for performing inservice testing activities</u>
Weekly	At least once per 7 days
Monthly	At least once per 31 days
Quarterly or every 3 months	At least once per 92 days
Semiannually or every 6 months	At least once per 184 days
Every 9 months	At least once per 276 days
Yearly or annually	At least once per 366 days
Biennially or every 2 years	At least once per 731 days
- c. The provisions of SR 3.0.2 are applicable to the above required Frequencies for performing inservice testing activities;
- d. The provisions of SR 3.0.3 are applicable to inservice testing activities; and
- e. Nothing in the ASME Boiler and Pressure Vessel Code shall be construed to supersede the requirements of any TS.

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5.7.2.12 Steam Generator (SG) Tube Surveillance Program

Each SG shall be demonstrated OPERABLE by performance of an inservice inspection program. The program shall include the following:

- a. SG tube sample size selection, sample size expansion, and inspection result classification criteria. Sample selection and testing shall be in accordance with Regulatory Guide 1.83, Revision 1, July 1975.
- b. The establishment of SG tube inspection frequency dependent upon inspection result classification. Inspection frequency shall be in accordance with Regulatory Guide 1.83, Revision 1, July 1975.
- c. SG tube plugging/repair limits. These limits shall be 40% of the nominal tube wall thickness consistent with Regulatory Guide 1.83, Revision 1, July 1975.
- d. Specific definitions and limits for steam generator tube inservice inspection acceptance criteria consistent with Regulatory Guide 1.83, Revision 1, July 1975.
- e. The minimum type testing to determine tube integrity.

The content and frequency of written reports shall be in accordance with Specification 5.9.2.

The provisions of SR 3.0.2 are applicable to Steam Generator Tube Surveillance Program inspection frequencies except those established by Category C-3 inspection results.

5.7.2.13 Secondary Water Chemistry Program

This program provides controls for monitoring secondary water chemistry to inhibit SG tube degradation and low pressure turbine disc stress corrosion cracking. The program shall include:

- a. Identification of a sampling schedule for the critical variables and control points for these variables;
- b. Identification of the procedures used to measure the values of the critical variables;

(continued)

5.7.2.13 Secondary Water Chemistry Program (continued)

- c. Identification of process sampling points which shall include monitoring the discharge of the condensate pumps for evidence of condenser in-leakage;
- d. Procedures for the recording and management of data;
- e. Procedures defining corrective actions for all off-control point chemistry conditions; and
- f. A procedure identifying the authority responsible for the interpretation of the data and the sequence and timing of administrative events, which is required to initiate corrective action.

5.7.2.14 Ventilation Filter Testing Program

A program shall be established to implement the following required testing of ESF filter ventilation systems at the frequencies specified in, and in accordance with, Regulatory Guide 1.52, Revision 2, and ASME N510-1989.

- 1. Demonstrate for each of the ESF systems that an in-place test of the HEPA filters shows a penetration and system bypass within acceptance criterion when tested in accordance with RG 1.52, Revision 2 and ASME N510-1989 at the system flowrate specified below.

(continued)

5.7.2.14 Ventilation Filter Testing Program (continued)

ESF VENTILATION SYSTEM	ACCEPTANCE CRITERIA	FLOW RATE
Reactor Building Purge	Less than 1.00%	14,000 cfm \pm 10%
Emergency Gas Treatment	Less than 0.05%	4,000 cfm \pm 10%
Auxiliary Building Gas Treatment	Less than 0.05%	9,000 cfm \pm 10%
Control Room Emergency	Less than 1.00%	4,000 cfm \pm 10%

2. Demonstrate for each of the ESF systems that an in-place test of the charcoal adsorber shows a penetration and system bypass within acceptance criterion when tested in accordance with Regulatory Guide 1.52, Revision 2 and ASME N510-1989 at the system flowrate specified below.

ESF VENTILATION SYSTEM	ACCEPTANCE CRITERIA	FLOW RATE
Reactor Building Purge	Less than 1.00%	14,000 cfm \pm 10%
Emergency Gas Treatment	Less than 0.05%	4,000 cfm \pm 10%
Auxiliary Building Gas Treatment	Less than 0.05%	9,000 cfm \pm 10%
Control Room Emergency	Less than 1.00%	4,000 cfm \pm 10%

(continued)

5.7.2.14 Ventilation Filter Testing Program (continued)

3. Demonstrate for each of the ESF systems that a laboratory test of a sample of the charcoal adsorber, when obtained as described in Regulatory Guide 1.52, Revision 2, shows the methyl iodide penetration less than the value specified below when tested in accordance with ASTM D3803-1989 at a temperature of $\leq 30^{\circ}\text{C}$ and greater than or equal to the relative humidity specified below.

ESF VENTILATION SYSTEM	METHYL IODIDE PENETRATION	RELATIVE HUMIDITY
Reactor Building Purge	Less than 10%	95%
Emergency Gas Treatment	Less than 0.175%	70%
Auxiliary Building Gas Treatment	Less than 0.175%	70%
Control Room Emergency	Less than 1%	70%

4. Demonstrate for each of the ESF systems that the pressure drop across the entire filtration unit is less than the value specified below when tested in accordance with Regulatory 1.52, Revision 2 and ASME N510-1989 at the system flow rate specified below.

ESF VENTILATION SYSTEM	PRESSURE DROP	FLOW RATE
Reactor Building Purge	Less than [6.0] inches water	14,000 cfm \pm 10%
Emergency Gas Treatment	Less than [8.0] inches water	4,000 cfm \pm 10%
Auxiliary Building Gas Treatment	Less than [8.0] inches water	9,000 cfm \pm 10%
Control Room Emergency	Less than [8.0] inches water	4,000 cfm \pm 10%

(continued)

5.7.2.14 Ventilation Filter Testing Program (continued)

5. Demonstrate that the heaters for each of the ESF systems dissipate the value specified below when tested in accordance with ASME N510-1989.

ESF VENTILATION SYSTEM	AMOUNT OF HEAT
Emergency Gas Treatment	20 ± 2.0 kW
Auxiliary Building Gas Treatment	50 ± 5.0 kW

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the Ventilation Filter Testing Program test frequencies.

5.7.2.15 Explosive Gas and Storage Tank Radioactivity Monitoring Program

This program provides controls for potentially explosive gas mixtures contained in the waste gas holdup system, the quantity of radioactivity contained in gas storage tanks, and the quantity of radioactivity contained in unprotected outdoor liquid storage tanks. The gaseous radioactivity quantities shall be determined following the methodology in Branch Technical Position (BTP) ETSB 11-5, "Postulated Radioactive Release due to Waste Gas System Leak or Failure." The liquid radwaste quantities shall be determined in accordance with Standard Review Plan Section 15.7.3, "Postulated Radioactive Release due to Tank Failures."

The program shall include:

- a. The limits for the concentrations of hydrogen and oxygen in the Waste Gas Holdup System and a surveillance program to ensure the limits are maintained. Such limits shall be appropriate to the system's design criteria (i.e., whether or not the system is designed to withstand a hydrogen explosion),

(continued)

5.7.2.15 Explosive Gas and Storage Tank Radioactivity Monitoring Program
(continued)

- b. A surveillance program to ensure that the quantity of radioactivity contained in each gas storage tank is less than the amount that would result in a whole body exposure of ≥ 0.5 rem to any individual in an unrestricted area, in the event of an uncontrolled release of the tank's contents, and
- c. A surveillance program to ensure that the quantity of radioactivity contained in all outdoor liquid radwaste tanks that are not surrounded by liners, dikes, or walls, capable of holding the tanks' contents and that do not have tank overflows and surrounding area drains connected to the Liquid Radwaste Treatment System is less than the amount that would result in concentrations equaling or exceeding the limits of 10 CFR Part 20, Appendix B, Table II, Column 2 at the nearest potable water supply and the nearest surface water supply in an unrestricted area, in the event of an uncontrolled release of the tank's contents.

The provisions of SR 3.0.2 and SR 3.0.3 are applicable to the Explosive Gas and Storage Tank Radioactivity Monitoring Program surveillance frequencies.

5.7.2.16 Diesel Fuel Oil Testing Program

A diesel fuel oil testing program to implement required testing of fuel oil stored in, or prior to transfer to, the 7-day storage tanks shall be established. The program shall include sampling and testing requirements, and acceptance criteria, all in accordance with applicable ASTM standards. The purpose of the program is to establish the following:

- a. Acceptability of new fuel oil for use prior to addition to the 7-day storage tanks by determining that the fuel oil has:
 - 1. An API gravity or an absolute specific gravity within limits;
 - 2. A flash point and kinematic viscosity within limits for ASTM 2D fuel oil;

(continued)

5.7.2.16 Diesel Fuel Oil Testing Program (continued)

3. A clear and bright appearance with proper color.
- b. Other properties for ASTM 2D fuel oil are within limits within 31 days following sampling and addition to the 7-day storage tanks.
- c. Total particulate concentration of the fuel oil in each of the four interconnected tanks which constitute a 7-day storage tank is within limits when tested every 31 days in accordance with ASTM D-2276, Method A-2 or A-3.

5.7.2.17 Fire Protection Program

This program provides controls to ensure that appropriate fire protection measures are maintained to protect the plant from fire and to ensure the capability to achieve and maintain safe shutdown in the event of a fire is maintained.

5.0 ADMINISTRATIVE CONTROLS

5.8 Safety Function Determination Program (SFDP)

5.8.1 This program ensures loss of safety function is detected and appropriate actions taken. Upon failure to meet two or more LCOs at the same time, an evaluation shall be made to determine if loss of safety function exists. Additionally, other appropriate limitations and remedial or compensatory actions may be identified to be taken as a result of the support system inoperability and corresponding exception to entering supported system Condition and Required Actions. This program implements the requirements of LCO 3.0.6.

5.8.2 The SFDP shall contain the following:

- a. Provisions for cross-train checks to ensure a loss of the capability to perform the safety function assumed in the accident analysis does not go undetected.
- b. Provisions for ensuring the plant is maintained in a safe condition if a loss of function condition exists.
- c. Provisions to ensure that an inoperable supported system's Completion Time is not inappropriately extended as a result of multiple support system inoperabilities.
- d. Other appropriate limitations and remedial or compensatory actions.

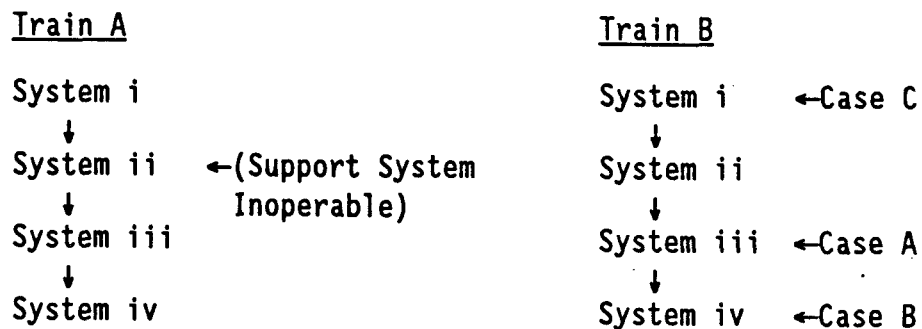
5.8.3 A loss of safety function exists when, assuming no concurrent single failure, a safety function assumed in the accident analysis cannot be performed. For the purpose of this program, a loss of safety function may exist when a support system is inoperable, and:

- a. A required system redundant to system(s) supported by the inoperable support system is also inoperable (Case A); or
- b. A required system redundant to system(s) in turn supported by the inoperable supported system is also inoperable (Case B); or
- c. A required system redundant to support system(s) for the supported systems (a) and (b) above is also inoperable (Case C).

(continued)

5.8.3 (continued)

Generic Example:



5.8.4 The Safety Function Determination Program identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

5.0 ADMINISTRATIVE CONTROLS

5.9 Reporting Requirements

5.9.1 Routine Reports

The following reports shall be submitted in accordance with 10 CFR 50.4.

5.9.1.1 Startup Report

A summary report of plant startup and power escalation testing shall be submitted following:

- a. Receipt of an Operating License;
- b. Amendment to the license involving a planned increase in power level;
- c. Installation of fuel that has a different design or has been manufactured by a different fuel supplier; and
- d. Modifications that may have significantly altered the nuclear, thermal, or hydraulic performance of the unit.

The initial Startup Report shall address each of the power ascension tests identified in FSAR, Chapter 14, and shall include a description of the measured values of the operating conditions or characteristics obtained during the test program and a comparison of these values with design predictions and specifications. Any corrective actions that were required to obtain satisfactory operation shall also be described. Any additional specific details required in license conditions based on other commitments shall be included in this report. Subsequent Startup Reports shall address startup tests that are necessary to demonstrate the acceptability of changes and modifications.

Startup Reports shall be submitted within 90 days following completion of the Power Ascension Test Program; 90 days following resumption or commencement of commercial power operation; or 9 months following initial criticality, whichever is earliest. If the Startup Report does not cover all three events (i.e.; initial criticality, completion of Power Ascension Test Program, and resumption or commencement of commercial operation), supplementary reports shall be submitted at least every 3 months until all three events have been completed.

(continued)

5.9.1 Routine Reports (continued)

5.9.1.2 Annual Reports

-----NOTE-----
A single submittal may be made for a multiple unit station. The submittal should combine sections common to all units at the station.

Annual Reports covering the activities of the unit as described below for the previous calendar year shall be submitted by March 31 of each year. The initial report shall be submitted by March 31 of the year following the year in which initial criticality was achieved. If six months have not passed since initial criticality, the initial report will be submitted one year later.

Reports required on an annual basis include:

a. Occupational Radiation Exposure Report

A tabulation on an annual basis of the number of station, utility, and other personnel (including contractors) receiving exposures greater than 100 mrem/yr and their associated man-rem exposure according to work and job functions (e.g., reactor operations and surveillance, inservice inspection, routine maintenance, special maintenance, waste processing, and refueling). This tabulation supplements the requirements of 10 CFR 20.2206. The dose assignments to various duty functions may be estimated based on pocket dosimeter, thermoluminescent dosimeter (TLD), or film badge measurements. Small exposures totalling less than 20% of the individual total dose need not be accounted for. In the aggregate, at least 80% of the total whole-body dose received from external sources should be assigned to specific major work functions.

5.9.1.3 Annual Radiological Environmental Operating Report

-----NOTE-----
A single submittal may be made for a multiple unit station. The submittal should combine sections common to all units at the station.

(continued)

5.9.1 Routine Reports (continued)

The Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted by May 15 of each year. The report shall include summaries, interpretations, and analyses of trends of the results of the Radiological Environmental Monitoring Program for the reporting period. The material provided shall be consistent with the objectives outlined in the Offsite Dose Calculation Manual (ODCM), and in 10 CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C.

The Annual Radiological Environmental Operating Report shall include the results of analyses of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in the table and figures in the ODCM, as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. The report shall identify the thermoluminescent dosimeter (TLD) results that represent collocated dosimeters in relation to the NRC TLD program and the exposure period associated with each result. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in a supplementary report as soon as possible.

5.9.1.4 Radioactive Effluent Release Report

-----NOTE-----
A single submittal may be made for a multiple unit station. The submittal should combine sections common to all units at the station; however, for units with separate radwaste systems, the submittal shall specify the releases of radioactive material from each unit.

(continued)

5.9.1.4 Radioactive Effluent Release Report (continued)

The Radioactive Effluent Release Report covering the operation of the unit during the previous 6 months of operation shall be submitted in accordance with 10 CFR 50.36a. The initial report will be submitted by January 1 or July 1 of the year following at least six months of operation after initial criticality. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and Process Control Program (PCP) and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

5.9.1.5 Monthly Operating Reports

Routine reports of operating statistics and shutdown experience, including documentation of all challenges to the pressurizer power-operated relief valves (PORVs) or pressurizer safety valves, shall be submitted on a monthly basis no later than the 15th of each month following the calendar month covered by the report.

5.9.1.6 CORE OPERATING LIMITS REPORT (COLR)

- a. Core operating limits shall be established prior to each cycle, or prior to changing any remaining portion of a cycle, and shall be documented in the COLR for the following:

- LCO 3.1.4 Moderator Temperature Coefficient
- LCO 3.1.6 Shutdown Bank Insertion Limit
- LCO 3.1.7 Control Bank Insertion Limits
- LCO 3.2.1 Heat Flux Hot Channel Factor
- LCO 3.2.2 Nuclear Enthalpy Rise Hot Channel Factor
- LCO 3.2.3 Axial Flux Difference
- LCO 3.9.1 Boron Concentration

- b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. WCAP-9272-P-A, WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY", July 1985 (W Proprietary).

(continued)

5.9.1.6 CORE OPERATING LIMITS REPORT (COLR) (continued)

(Methodology for Specifications 3.1.4 - Moderator Temperature Coefficient, 3.1.6 - Shutdown Bank Insertion Limit, 3.1.7 - Control Bank Insertion Limits, 3.2.1 - Heat Flux Hot Channel Factor, 3.2.2 - Nuclear Enthalphy Rise Hot Channel Factor, 3.2.3 - Axial Flux Difference, and 3.9.1 - Boron Concentration.

2. WCAP-10266-P-A Rev. 2, "THE 1981 VERSION OF WESTINGHOUSE EVALUATION MODEL USING BASH CODE", March 1987, (W Proprietary).
(Methodology for Specification 3.2.1 - Heat Flux Hot Channel Factor).
3. WCAP-10216-P-A, "RELAXATION OF CONSTANT AXIAL OFFSET CONTROL F(Q) SURVEILLANCE TECHNICAL SPECIFICATION", June 1983 (W Proprietary).
(Methodology for Specifications 3.2.1 - Heat Flux Hot Channel Factor (W(Z) Surveillance Requirements For F(Q) Methodology) and 3.2.3 - Axial Flux Difference (Relaxed Axial Offset Control).)

- c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal-mechanical limits, core thermal hydraulic limits, Emergency Core Cooling System (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.
- d. The COLR, including any mid-cycle revisions or supplements, shall be provided within 30 days of issuance for each reload cycle to the NRC.

5.9.1.7 RCS PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

RCS pressure and temperature limits, including heatup and cooldown rates, criticality, and hydrostatic and leak test limits, shall be established and documented in the PTLR. The analytical methods used to determine the pressure and temperature limits including the heatup and cooldown rates shall be those previously reviewed and approved by the NRC in WCAP-7924-A, "WESTINGHOUSE BASIS FOR HEATUP AND COOLDOWN LIMIT CURVES", April 1975, or Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials", May 1988. The reactor vessel pressure and temperature limits, including those for heatup and cooldown rates, shall be

(continued)

5.9.1.7 RCS PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR) (continued)

determined so that all applicable limits (e.g., heatup limits, cooldown limits, and inservice leak and hydrostatic testing limits) of the analysis are met. The PTLR, including revisions or supplements thereto, shall be provided within 30 days of issuance.

5.9.2 Special Reports

Special Reports shall be submitted in accordance with 10 CFR 50.4 within the time period specified for each report.

The following Special Reports shall be submitted:

- a. In the event an ECCS is actuated and injects water into the RCS in MODE 1, 2 or 3 a Special Report shall be prepared and submitted within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date. The current value of the usage factor for each affected safety injection nozzle shall be provided in this Special Report whenever its value exceeds 0.70;
- b. If an individual emergency diesel generator (EDG) experiences three or more valid failures in the last 20 demands, these failures and any non-valid failures experienced by that EDG in that time period shall be reported within 30 days. Reports on EDG failures shall include the information recommended in Regulatory Guide 1.9, Revision-3, Regulatory Position C.5, or existing Regulatory Guide 1.108 reporting requirement; and
- c. When a Special Report is required by Condition D or H of LCO 3.3.3, "Post Accident Monitoring Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.
- d. Following each inservice inspection of steam generator tubes, in accordance with the Steam Generator Tube Surveillance Program, the number of tubes plugged and tubes sleeved in each steam generator shall be reported to the NRC within 15 days.

(continued)

5.9.2 Special Reports (continued)

The complete results of the steam generator tube inservice inspection shall be submitted to the NRC within 12 months following the completion of the inspection. The report shall include:

1. Number and extent of tubes inspected.
2. Location and percent of wall-thickness penetration for each indication of an imperfection.
3. Identification of tubes plugged and tubes sleeved.

Results of steam generator tube inspections which fall into Category C-3 shall be reported to the NRC prior to resumption of plant operation. This report shall provide a description of investigations conducted to determine cause of the tube degradation and corrective measures taken to prevent recurrence.

5.0 ADMINISTRATIVE CONTROLS

5.10 Record Retention

- 5.10.1 The following records shall be retained for at least 3 years:
- a. All License Event Reports required by 10 CFR 50.73; and
 - b. Records of radioactive shipments.
- 5.10.2 The following records shall be retained for at least 5 years:
- a. Official records and logs of unit operation covering time intervals at each power level;
 - b. Official records and logs of principal maintenance activities, inspections, repair, and replacement of principal items of equipment related to nuclear safety;
 - c. Records of surveillance activities, inspections, and calibrations required by the Technical Specifications (TS) and the Fire Protection Program;
 - d. Records of sealed source and fission detector leak tests and results; and
 - e. Records of annual physical inventory of all sealed source material of record.
- 5.10.3 The following records shall be retained for the duration of the unit Operating License:
- a. Records and drawing changes reflecting unit design modifications made to systems and equipment described in the FSAR;
 - b. Records of new and irradiated fuel inventory, fuel transfers, and assembly burnup histories;
 - c. Records of radiation exposure for all individuals entering radiation control areas;

(continued)

5.10.3 (continued)

- d. Records of gaseous and liquid radioactive material released to the environs;
- e. Records of transient or operational cycles for those unit components identified in FSAR, Section 5.2.1.5;
- f. Records of reactor tests and experiments;
- g. Records of training and qualification for members of the unit staff;
- h. Records of inservice inspections performed pursuant to the TS;
- i. Records of quality assurance activities required by the Operational Quality Assurance (QA) Plan not listed in Specification 5.10.1 and which are classified as permanent records by applicable regulations, codes, and standards;
- j. Records of reviews performed pursuant to 10 CFR 50.59 for changes made to procedures, equipment, and for reviews of tests and experiments;
- k. Records of the reviews and audits required by Specification 5.5.1 and Specification 5.5.2;
- l. Records of the service lives of all hydraulic and mechanical snubbers required by Technical Requirement (TR) 3.7.3, "Snubbers", including the date at which the service life commences, and associated installation and maintenance records;
- m. Records of steam generator water sampling and water quality;
- n. Records of analyses required by the Radiological Environmental Monitoring Program that would permit evaluation of the accuracy of the analysis at a later date.

These records should include procedures effective at specified times and QA records showing that these procedures were followed;

(continued)

5.10.3 (continued)

- o. Records of reviews performed for changes made to the Offsite Dose Calculation Manual and the Process Control Program; and
 - p. Records of steam generator tube surveillances.
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5.0 ADMINISTRATIVE CONTROLS

5.11 High Radiation Area

5.11.1 Pursuant to 10 CFR 20, paragraph 20.1601(c), in lieu of the requirements of 10 CFR 20.1601, each high radiation area, as defined in 10 CFR 20, in which the intensity of radiation is > 100 mrem/hr but < 1000 mrem/hr, shall be barricaded and conspicuously posted as a high radiation area and entrance thereto shall be controlled by requiring issuance of a Radiation Work Permit (RWP). Individuals qualified in radiation protection procedures (e.g., Radiological Control Technicians) or personnel continuously escorted by such individuals may be exempt from the RWP issuance requirement during the performance of their assigned duties in high radiation areas with exposure rates ≤ 1000 mrem/hr, provided they are otherwise following plant radiation protection procedures for entry into such high radiation areas.

Any individual or group of individuals permitted to enter such areas shall be provided with or accompanied by one or more of the following:

- a. A radiation monitoring device that continuously indicates the radiation dose rate in the area.
- b. A radiation monitoring device that continuously integrates the radiation dose rate in the area and alarms when a preset integrated dose is received. Entry into such areas with this monitoring device may be made after the dose rate levels in the area have been established and personnel are aware of them.
- c. An individual qualified in radiation protection procedures with a radiation dose rate monitoring device, who is responsible for providing positive control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by the Radiological Controls Manager in the RWP.

5.11.2 In addition to the requirements of Specification 5.11.1, areas with radiation levels ≥ 1000 mrem/hr shall be provided with locked doors or be continuously guarded to prevent unauthorized entry and the keys shall be maintained under the administrative control of the Shift Operations Supervisor on duty or radiological controls supervision. Doors shall remain locked except during periods of

(continued)

5.11.2 (continued)

access by personnel under an approved RWP that shall specify the dose rate levels in the immediate work areas and the maximum allowable stay times for individuals in those areas. In lieu of the stay time specification of the RWP, direct or remote (such as closed circuit TV cameras) continuous surveillance may be made by personnel qualified in radiation protection procedures to provide positive exposure control over the activities being performed within the area.

- 5.11.3 For individual high radiation areas with radiation levels of > 1000 mrem/hr, accessible to personnel, that are located within large areas such as reactor containment, where no enclosure exists for purposes of locking, or that cannot be continuously guarded, and where no enclosure can be reasonably constructed around the individual area, that individual area shall be barricaded and conspicuously posted. However, barricades will not be left in the reactor containment during power operation.
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LIST OF ACRONYMS

<u>Acronym</u>	<u>Title</u>
ABGTS	Auxiliary Building Gas Treatment System
ACRP	Auxiliary Control Room Panel
ASME	American Society of Mechanical Engineers
AFD	Axial Flux Difference
AFW	Auxiliary Feedwater System
ARO	All Rods Out
ARFS	Air Return Fan System
ARV	Atmospheric Relief Valve
BOC	Beginning of Cycle
CAOC	Constant Axial Offset Control
CCS	Component Cooling Water System
CFR	Code of Federal Regulations
COLR	Core Operating Limits Report
CREVS	Control Room Emergency Ventilation System
CSS	Containment Spray System
CST	Condensate Storage Tank
DNB	Departure from Nucleate Boiling
ECCS	Emergency Core Cooling System
EFPD	Effective Full-Power Days
EGTS	Emergency Gas Treatment System
EOC	End of Cycle
ERCW	Essential Raw Cooling Water
ESF	Engineered Safety Feature
ESFAS	Engineered Safety Features Actuation System
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilating, and Air-Conditioning
LCO	Limiting Condition For Operation
MFIV	Main Feedwater Isolation Valve
MFRV	Main Feedwater Regulation Valve
MSIV	Main Steam Line Isolation Valve
MSSV	Main Steam Safety Valve
MTC	Moderator Temperature Coefficient
NMS	Neutron Monitoring System
ODCM	Offsite Dose Calculation Manual
PCP	Process Control Program
PIV	Pressure Isolation Valve
PORV	Power-Operated Relief Valve
PTLR	Pressure and Temperature Limits Report
QPTR	Quadrant Power Tilt Ratio
RAOC	Relaxed Axial Offset Control
RCCA	Rod Cluster Control Assembly
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RTP	Rated Thermal Power
RTS	Reactor Trip System
RWST	Refueling Water Storage Tank
SG	Steam Generator
SI	Safety Injection
SL	Safety Limit
SR	Surveillance Requirement
UHS	Ultimate Heat Sink

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B 2.0 SAFETY LIMITS (SLs)

B 2.1.1 Reactor Core SLs

BASES

BACKGROUND

GDC 10 (Ref. 1) requires that specified acceptable fuel design limits are not to be exceeded during steady-state operation, normal operational transients, and anticipated operational occurrences (AOOs). This is accomplished by having a departure from nucleate boiling (DNB) design basis, which corresponds to a 95% probability at a 95% confidence level (the 95/95 DNB criterion) that DNB will not occur and by requiring that fuel-centerline temperature stays below the melting temperature.

The restrictions of this SL prevent overheating of the fuel and cladding, as well as possible cladding perforation, that would result in the release of fission products to the reactor coolant. Overheating of the fuel is prevented by maintaining the steady-state peak linear heat rate (LHR) below the level at which fuel-centerline melting occurs. Overheating of the fuel cladding is prevented by restricting fuel operation to within the nucleate boiling regime, where the heat-transfer coefficient is large and the cladding-surface temperature is slightly above the coolant-saturation temperature.

Fuel-centerline melting occurs when the local LHR, or power peaking, in a region of the fuel is high enough to cause the fuel-centerline temperature to reach the melting point of the fuel. Expansion of the pellet upon centerline melting may cause the pellet to stress the cladding to the point of failure, allowing an uncontrolled release of activity to the reactor coolant.

Operation above the boundary of the nucleate boiling regime could result in excessive cladding temperature because of the onset of DNB and the resultant sharp reduction in heat-transfer coefficient. Inside the steam film, high cladding temperatures are reached, and a cladding-water (zirconium-water) reaction may take place. This chemical reaction results in oxidation of the fuel cladding to a structurally weaker form. This weaker form may lose its integrity, resulting in an uncontrolled release of activity to the reactor coolant.

(continued)

BASES

BACKGROUND
(continued)

The proper functioning of the Reactor Protection System (RPS) and steam generator safety valves prevents violation of the reactor core SLs.

APPLICABLE
SAFETY ANALYSES

The fuel cladding must not sustain damage as a result of normal operation and AOOs. The reactor core SLs are established to preclude violation of the following fuel design criteria:

- a. There must be at least 95% probability at a 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience DNB; and
- b. The hot fuel pellet in the core must not experience centerline fuel melting.

The Reactor Trip System (RTS) setpoints (Ref. 2), in combination with all the LCOs, are designed to prevent any anticipated combination of transient conditions for Reactor Coolant System (RCS) temperature, pressure, and THERMAL POWER level that would result in a departure from nucleate boiling ratio (DNBR) of less than the DNBR limit and preclude the existence of flow instabilities.

Automatic enforcement of these reactor core SLs is provided by the following functions:

- a. High pressurizer pressure trip;
- b. Low pressurizer pressure trip;
- c. Overtemperature ΔT trip;
- d. Overpower ΔT trip;
- e. Power Range Neutron Flux trip; and
- f. Steam generator safety valves.

The limitation that the average enthalpy in the hot leg be less than or equal to the enthalpy of saturated liquid also ensures that the ΔT measured by instrumentation, used in the RPS design as a measure of core power, is proportional to core power.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The SLs represent a design requirement for establishing the RPS trip setpoints identified previously. LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits," or the assumed initial conditions of the safety analyses (as indicated in the FSAR, Ref. 2) provide more restrictive limits to ensure that the SLs are not exceeded.

SAFETY LIMITS

The curves provided in Figure B 2.1.1-1 show the loci of points of THERMAL POWER, RCS pressure, and average temperature for which the minimum DNBR is not less than the safety analyses limit, that fuel centerline temperatures remain below melting, that the average enthalpy in the hot leg is less than or equal to the enthalpy of saturated liquid, or that the exit quality is within the limits defined by the DNBR correlation.

The curves are based on enthalpy hot channel factor limits provided in the COLR. The dashed line of Figure B 2.1.1-1 shows an example of a limit curve at 2235 psig. In addition, it illustrates the various RPS functions that are designed to prevent the unit from reaching the limit.

The SL is higher than the limit calculated when the AFD is within the limits of the $F_1(\Delta I)$ function of the overtemperature ΔT reactor trip. When the AFD is not within the tolerance, the AFD effect on the overtemperature ΔT reactor trips will reduce the setpoints to provide protection consistent with the reactor core SLs (Refs. 3 and 4).

APPLICABILITY

SL 2.1.1 only applies in MODES 1 and 2 because these are the only MODES in which the reactor is critical. Automatic protection functions are required to be OPERABLE during MODES 1 and 2 to ensure operation within the reactor core SLs. The steam generator safety valves or automatic protection actions serve to prevent RCS heatup to the reactor core SL conditions or to initiate a reactor trip function, which forces the unit into MODE 3. Setpoints for

(continued)

BASES

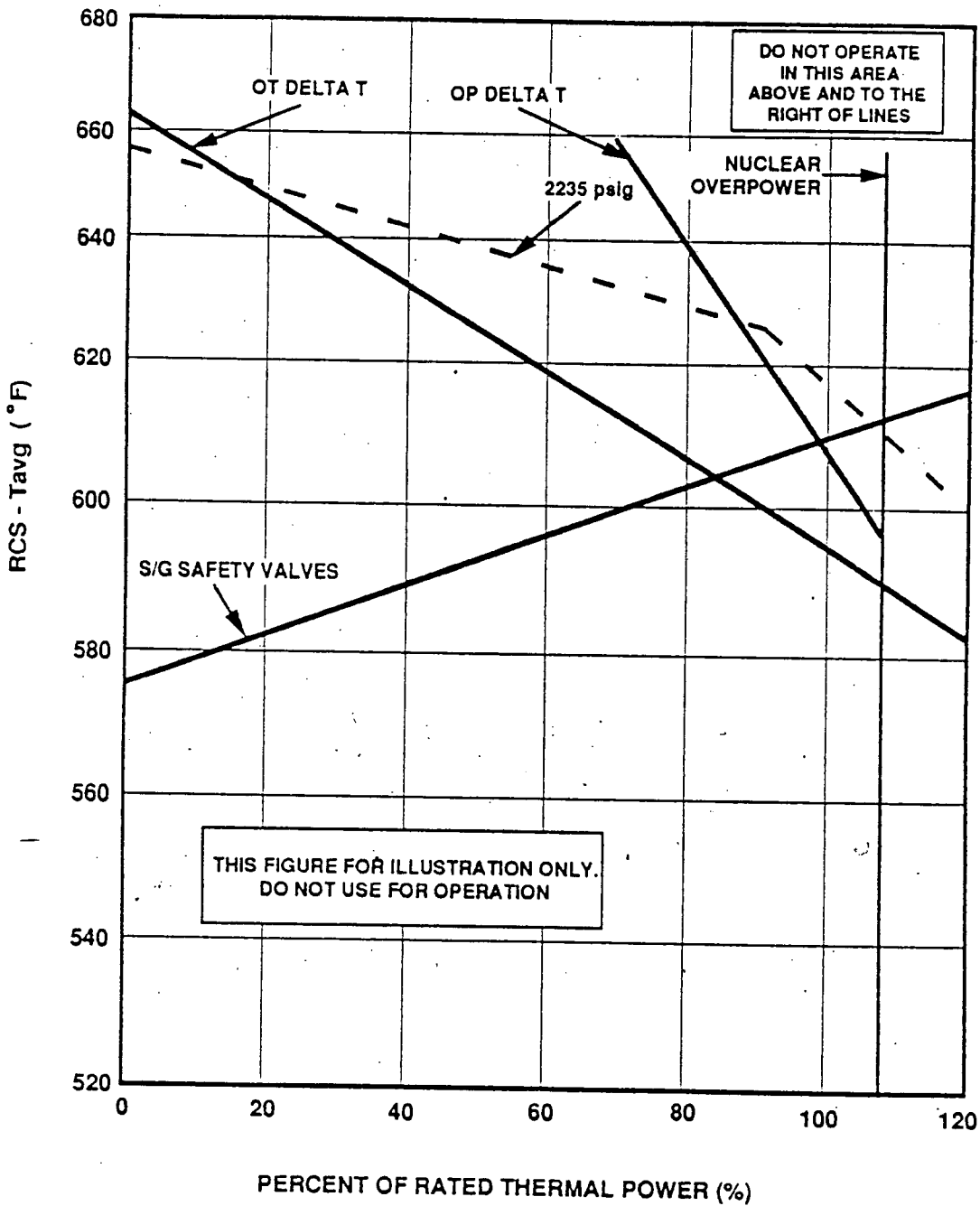


Figure B 2.1.1-1
Reactor Core Safety Limits vs Boundary of Protection

(continued)

BASES (continued)

APPLICABILITY (continued) the reactor trip functions are specified in LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation." In MODES 3, 4, 5, and 6, Applicability is not required since the reactor is not generating significant THERMAL POWER.

SAFETY LIMIT VIOLATIONS The following SL violation responses are applicable to the reactor core SLs.

2.2.1

If SL 2.1.1 is violated, the requirement to go to MODE 3 places the unit in a MODE in which this SL is not applicable.

The allowed Completion Time of 1 hour recognizes the importance of bringing the unit to a MODE of operation where this SL is not applicable, and reduces the probability of fuel damage.

2.2.3

If SL 2.1.1 is violated, the NRC Operations Center must be notified within 1 hour, in accordance with 10 CFR 50.72 (Ref. 5).

2.2.4

If SL 2.1.1 is violated, the Plant Manager and the Site Vice President shall be notified within 24 hours. This 24-hour period provides time for the plant operators and staff to take the appropriate immediate action and assess the condition of the unit before reporting to the senior management.

2.2.5

If SL 2.1.1 is violated, a Licensee Event Report shall be prepared and submitted within 30 days to the NRC, the Plant Manager and the Site Vice President.

BASES (continued)

SAFETY LIMIT
VIOLATIONS

2.2.5 (continued)

This requirement is in accordance with 10 CFR 50.73
(Ref. 6).

2.2.6

If SL 2.1.1 is violated, restart of the unit shall not commence until authorized by the NRC. This requirement ensures the NRC that all necessary reviews, analyses, and actions are completed before the unit begins its restart to normal operation.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 10, "Reactor Design," 1988.
 2. Watts Bar FSAR; Section 7.2, "Reactor Trip System".
 3. WCAP-8746-A, "Design Bases for the Overtemperature ΔT and the Overpower ΔT Trips," March 1977.
 4. WCAP-9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
 5. Title 10, Code of Federal Regulations, Part 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors."
 6. Title 10, Code of Federal Regulations, Part 50.73, "Licensee Event Report System."
-

B 2.0 SAFETY LIMITS (SLs)

B 2.1.2 Reactor Coolant System (RCS) Pressure SL

BASES

BACKGROUND

The SL on RCS pressure protects the integrity of the RCS against overpressurization. In the event of fuel cladding failure, fission products are released into the reactor coolant. The RCS then serves as the primary barrier in preventing the release of fission products into the atmosphere. By establishing an upper limit on RCS pressure, the continued integrity of the RCS is ensured. According to 10 CFR 50, Appendix A, GDC 14, "Reactor Coolant Pressure Boundary," and GDC 15, "Reactor Coolant System Design" (Ref. 1), the reactor pressure coolant boundary (RCPB) design conditions are not to be exceeded during normal operation and anticipated operational occurrences (AOOs). Also, in accordance with GDC 28, "Reactivity Limits" (Ref. 1), reactivity accidents, including rod ejection, do not result in damage to the RCPB greater than limited local yielding.

The design pressure of the RCS is 2500 psia. During normal operation and AOOs, RCS pressure is limited from exceeding the design pressure by more than 10%, in accordance with Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 2). To ensure system integrity, all RCS components are hydrostatically tested at 125% of design pressure, according to the ASME Code requirements prior to initial operation when there is no fuel in the core. Following inception of unit operation, RCS components shall be pressure tested, in accordance with the requirements of ASME Code, Section XI (Ref. 3).

Overpressurization of the RCS could result in a breach of the RCPB. If such a breach occurs in conjunction with a fuel cladding failure, fission products could enter the containment atmosphere, raising concerns relative to limits on radioactive releases specified in 10 CFR 100, "Reactor Site Criteria" (Ref. 4).

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The RCS pressurizer safety valves, the main steam safety valves (MSSVs), and the reactor high-pressure trip have settings established to ensure that the RCS pressure SL will not be exceeded.

The RCS pressurizer safety valves are sized to prevent system pressure from exceeding the design pressure by more than 10%, as specified in Section III of the ASME Code for Nuclear Power Plant Components (Ref. 2). The transient that establishes the required relief capacity, and hence valve size requirements and lift settings, is a complete loss of external load without a direct reactor trip. During the transient, no control actions are assumed, except that the safety valves on the secondary plant are assumed to open when the steam pressure reaches the secondary plant safety valve settings, and nominal feedwater supply is maintained.

The Reactor Trip System (RTS) setpoints (Ref. 5), together with the settings of the MSSVs (Ref. 9), provide pressure protection for normal operation and AOOs. The reactor high-pressure trip setpoint is specifically set to provide protection against overpressurization (Ref. 5). The safety analyses for both the high-pressure trip and the RCS pressurizer safety valves are performed, using conservative assumptions relative to pressure control devices.

More specifically, no credit is taken for operation of the following:

- a. Pressurizer power-operated relief valves (PORVs);
- b. Steam line PORVs;
- c. Steam Dump System;
- d. Reactor Control System;
- e. Pressurizer Level Control System; or
- f. Pressurizer spray valve.

(continued)

BASES (continued)

SAFETY LIMITS The maximum transient pressure allowed in the RCS pressure vessel under the ASME Code, Section III, is 110% of design pressure. The maximum transient pressure allowed in the RCS piping, valves, and fittings under [USAS, Section B31.1 (Ref. 6)] is 120% of design pressure. The most limiting of these two allowances is the 110% of design pressure; therefore, the SL on maximum allowable RCS pressure is 2735 psig.

APPLICABILITY SL 2.1.2 applies in MODES 1, 2, 3, 4, and 5 because this SL could be approached or exceeded in these MODES due to overpressurization events. The SL is not applicable in MODE 6 because the reactor vessel head closure bolts are not fully tightened, making it unlikely that the RCS can be pressurized.

SAFETY LIMIT VIOLATIONS

The following SL violations are applicable to the RCS pressure SL.

- a. If the RCS pressure SL is violated when the reactor is in MODE 1 or 2, the requirement is to restore compliance and be in MODE 3 within 1 hour.

Exceeding the RCS pressure SL may cause immediate RCS failure and create a potential for radioactive releases in excess of 10 CFR 100, "Reactor Site Criteria" (Ref. 4).

The allowable Completion Time of 1 hour recognizes the importance of reducing power level to a MODE of operation where the potential for challenges to safety systems is minimized.

- b. If the RCS pressure SL is exceeded in MODE 3, 4, or 5, RCS pressure must be restored to within the SL value within 5 minutes. Exceeding the RCS pressure SL in MODE 3, 4, or 5 is more severe than exceeding this SL in MODE 1 or 2, since the reactor vessel temperature may be lower and the vessel material, consequently,

(continued)

BASES (continued)

SAFETY LIMIT
VIOLATIONS
(continued)

- b. less ductile. As such, pressure must be reduced to to less than the SL within 5 minutes. The action does not require reducing MODES, since this would require reducing temperature, which would compound the problem by adding thermal gradient stresses to the existing pressure stress.

2.2.3

If the RCS pressure SL is violated, the NRC Operations Center must be notified within 1 hour, in accordance with 10 CFR 50.72 (Ref. 7).

2.2.4

If the RCS pressure SL is violated, the Plant Manager and the Site Vice President shall be notified within 24 hours. The 24-hour period provides time for the plant operators and staff to take the appropriate immediate action and assess the condition of the unit before reporting to senior management.

2.2.5

If the RCS pressure SL is violated, a Licensee Event Report shall be prepared and submitted within 30 days to the NRC, the Plant Manager and the Site Vice-President. This requirement is in accordance with 10 CFR 50.73 (Ref. 8).

2.2.6

If the RCS pressure SL is violated, restart of the unit shall not commence until authorized by the NRC. This requirement ensures the NRC that all necessary reviews, analyses, and actions are completed before the unit begins its restart to normal operation.

(continued)

BASES (continued)

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 14, "Reactor Coolant Pressure Boundary"; General Design Criterion 15, "Reactor Coolant System Design"; and General Design Criterion 28, "Reactivity Limits."
 2. American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section III, "Nuclear Power Plant Components," Article NB-7000, "Protection Against Overpressure."
 3. American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, IWX-5000, "System Pressure Tests".
 4. Title 10, Code of Federal Regulations, Part 100, "Reactor Site Criteria".
 5. Watts Bar FSAR, Section 7.2, "Reactor Trip System".
 6. USAS B31.1, "Standard Code for Pressure Piping," American Society of Mechanical Engineers, 1967.
 7. Title 10, Code of Federal Regulations, Part 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors."
 8. Title 10, Code of Federal Regulations, Part 50.73, "Licensee Event Report System."
 9. Watts Bar FSAR, Section 10.3, "Main Steam Supply System."
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B 3.0 LIMITING CONDITIONS FOR OPERATION (LCOs) AND SURVEILLANCE REQUIREMENTS (SRs)

BASES

LCOs LCO 3.0.1 through LCO 3.0.6 establish the general requirements applicable to all Specifications in Chapter 3.0 and apply at all times, unless otherwise stated.

LCO 3.0.1

LCO 3.0.1 establishes the Applicability statement within each individual Specification as the requirement for when the LCO is required to be met (i.e., when the unit is in the MODES or other specified conditions of the Applicability statement of each Specification).

LCO 3.0.2

LCO 3.0.2 establishes that upon discovery of a failure to meet an LCO, the associated ACTIONS shall be met. The Completion Time of each Required Action for an ACTIONS Condition is applicable from the point in time that an ACTIONS Condition is entered. The Required Actions establish those remedial measures that must be taken within specified Completion Times when the requirements of an LCO are not met. This Specification establishes that:

- a. Completion of the Required Actions within the specified Completion Times constitutes compliance with a Specification; and
- b. Completion of the Required Actions is not required when an LCO is met within the specified Completion Time, unless otherwise specified.

There are two basic types of Required Actions. The first type of Required Action specifies a time limit in which the LCO must be met. This time limit is the Completion Time to restore an inoperable system or component to OPERABLE status or to restore variables to within specified limits. If this type of Required Action is not completed within the specified Completion Time, a shutdown may be required to

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BASES

LCOs
(continued)

LCO 3.0.2

place the unit in a MODE or condition in which the Specification is not applicable. (Whether stated as a Required Action or not, correction of the entered Condition is an action that may always be considered upon entering ACTIONS.) The second type of Required Action specifies the remedial measures that permit continued operation of the unit that is not further restricted by the Completion Time. In this case, compliance with the Required Actions provides an acceptable level of safety for continued operation.

Completing the Required Actions is not required when an LCO is met or is no longer applicable, unless otherwise stated in the individual Specifications.

The nature of some Required Actions of some Conditions necessitates that, once the Condition is entered, the Required Actions must be completed even though the associated Conditions no longer exist. The individual LCO's ACTIONS specify the Required Actions where this is the case. An example of this is in LCO 3.8.1, "AC Sources - Operating."

The Completion Times of the Required Actions are also applicable when a system or component is removed from service intentionally. The reasons for intentionally relying on the ACTIONS include, but are not limited to, performance of Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering ACTIONS for these reasons must be done in a manner that does not compromise safety. Intentional entry into ACTIONS should not be made for operational convenience. Alternatives that would not result in redundant equipment being inoperable should be used instead. Doing so limits the time both subsystems/trains of a safety function are inoperable and limits the time other conditions exist which result in LCO 3.0.3 being entered. Individual Specifications may specify a time limit for performing an SR when equipment is removed from service or bypassed for testing. In this case, the Completion Times of the Required Actions are applicable when this time limit expires, if the equipment remains removed from service or bypassed.

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BASES

LCOs

LCO 3.0.2 (continued)

When a change in MODE or other specified condition is required to comply with Required Actions, the unit may enter a MODE or other specified condition in which another Specification becomes applicable. In this case, the Completion Times of the associated Required Actions would apply from the point in time that the new Specification becomes applicable, and the ACTIONS Condition(s) are entered.

LCO 3.0.3

LCO 3.0.3 establishes the actions that must be implemented when an LCO is not met and:

- a. An associated Required Action and Completion Time is not met and no other Condition applies; or
- b. The condition of the unit is not specifically addressed by the associated ACTIONS. This means that no combination of Conditions stated in the ACTIONS can be made that exactly corresponds to the actual condition of the unit. Sometimes, possible combinations of Conditions are such that entering LCO 3.0.3 is warranted; in such cases, the ACTIONS specifically state a Condition corresponding to such combinations and also that LCO 3.0.3 be entered immediately.

This Specification delineates the time limits for placing the unit in a safe MODE or other specified condition when operation cannot be maintained within the limits for safe operation as defined by the LCO and its ACTIONS. It is not intended to be used as an operational convenience that permits routine voluntary removal of redundant systems or components from service in lieu of other alternatives that would not result in redundant systems or components being inoperable.

Upon entering LCO 3.0.3, 1 hour is allowed to prepare for an orderly shutdown before initiating a change in unit operation. This includes time to permit the operator to

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BASES

LCOs

LCO 3.0.3 (continued)

coordinate the reduction in electrical generation with the load dispatcher to ensure the stability and availability of the electrical grid. The time limits specified to reach lower MODES of operation permit the shutdown to proceed in a controlled and orderly manner that is well within the specified maximum cooldown rate and within the capabilities of the unit, assuming that only the minimum required equipment is OPERABLE. This reduces thermal stresses on components of the Reactor Coolant System and the potential for a plant upset that could challenge safety systems under conditions to which this Specification applies. The use and interpretation of specified times to complete the actions of LCO 3.0.3 is consistent with the discussion of Section 1.3, Completion Times.

A unit shutdown required in accordance with LCO 3.0.3 may be terminated and LCO 3.0.3 exited if any of the following occurs:

- a. The LCO is now met.
- b. A Condition exists for which the Required Actions have now been performed.
- c. ACTIONS exist that do not have expired Completion Times. These Completion Times are applicable from the point in time that the Condition is initially entered and not from the time LCO 3.0.3 is exited.

The time limits of Specification 3.0.3 allow 37 hours for the unit to be in MODE 5 when a shutdown is required during MODE 1 operation. If the unit is in a lower MODE of operation when a shutdown is required, the time limit for reaching the next lower MODE applies. If a lower MODE is reached in less time than allowed, however, the total allowable time to reach MODE 5, or other applicable MODE, is not reduced. For example, if MODE 3 is reached in 2 hours, then the time allowed for reaching MODE 4 is the next 11 hours, because the total time for reaching MODE 4 is not reduced from the allowable limit of 13 hours. Therefore, if remedial measures are completed that would permit a return

(continued)

BASES

LCOs

LCO 3.0.3 (continued)

to MODE 1, a penalty is not incurred by having to reach a lower MODE of operation in less than the total time allowed.

In MODES 1, 2, 3, and 4, LCO 3.0.3 provides actions for Conditions not covered in other Specifications. The requirements of LCO 3.0.3 do not apply in MODES 5 and 6 because the unit is already in the most restrictive Condition required by LCO 3.0.3. The requirements of LCO 3.0.3 do not apply in other specified conditions of the Applicability (unless in MODE 1, 2, 3, or 4) because the ACTIONS of individual Specifications sufficiently define the remedial measures to be taken.

Exceptions to LCO 3.0.3 are provided in instances where requiring a unit shutdown, in accordance with LCO 3.0.3, would not provide appropriate remedial measures for the associated condition of the unit. An example of this is in LCO 3.7.13, "Fuel Storage Pool Water Level." LCO 3.7.13 has an Applicability of "During movement of irradiated fuel assemblies in the fuel storage pool." Therefore, this LCO can be applicable in any or all MODES. If the LCO and the Required Actions of LCO 3.7.13 are not met while in MODE 1, 2, or 3, there is no safety benefit to be gained by placing the unit in a shutdown condition. The Required Action of LCO 3.7.13 of "Suspend movement of irradiated fuel assemblies in the fuel storage pool" is the appropriate Required Action to complete in lieu of the actions of LCO 3.0.3. These exceptions are addressed in the individual Specifications.

LCO 3.0.4

LCO 3.0.4 establishes limitations on changes in MODES or other specified conditions in the Applicability when an LCO is not met. It precludes placing the unit in a different MODE or other specified condition when the following exist:

- a. The requirements of an LCO, in the MODE or other specified condition to be entered, are not met; and

(continued)

BASES

LCOs

LCO 3.0.4 (continued)

- b. Continued noncompliance with these LCO requirements would result in the unit being required to be placed in a MODE or other specified condition in which the LCO does not apply to comply with the Required Actions.

Compliance with Required Actions that permit continued operation of the unit for an unlimited period of time in a MODE or other specified condition provides an acceptable level of safety for continued operation. This is without regard to the status of the unit before or after the MODE change. Therefore, in such cases, entry into a MODE or other specified condition in the Applicability may be made in accordance with the provisions of the Required Actions. The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components to OPERABLE status before unit startup.

The provisions of LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS. In addition, the provisions of LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that result from a normal shutdown.

Exceptions to LCO 3.0.4 are stated in the individual Specifications. Exceptions may apply to all the ACTIONS or to a specific Required Action of a Specification.

Surveillances do not have to be performed on the associated inoperable equipment (or on variables outside the specified limits), as permitted by SR 3.0.1. Therefore, changing MODES or other specified conditions while in an ACTIONS Condition, either in compliance with LCO 3.0.4, or where an exception to LCO 3.0.4 is stated, is not a violation of SR 3.0.1 or SR 3.0.4 for those Surveillances that do not have to be performed due to the associated inoperable equipment. However, SRs must be met to assure OPERABILITY prior to declaring the associated equipment OPERABLE (or variable within limits) and restoring compliance with the affected LCO.

(continued)

BASES

LCOs
(continued)

LCO 3.0.5

LCO 3.0.5 establishes the allowance for restoring equipment to service under administrative controls when it has been removed from service or declared inoperable to comply with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 (e.g. to not comply with the applicable Required Action(s)) to allow the performance of SRs to demonstrate:

- a. The OPERABILITY of the equipment being returned to service; or
- b. The OPERABILITY of other equipment.

The administrative controls ensure the time the equipment is returned to service in conflict with the requirements of the ACTIONS is limited to the time absolutely necessary to perform the allowed SRs. This Specification does not provide time to perform any other preventive or corrective maintenance.

An example of demonstrating the OPERABILITY of the equipment being returned to service is reopening a containment isolation valve that has been closed to comply with Required Actions, and must be reopened to perform the SRs.

An example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to prevent the trip function from occurring during the performance of an SR on another channel in the other trip system. A similar example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to permit the logic to function and indicate the appropriate response during the performance of an SR on another channel in the same trip system.

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BASES

LCOs

LCO 3.0.6 (continued)

LCO 3.0.6 establishes an exception to LCO 3.0.2 for support systems that have an LCO specified in the Technical Specifications (TS). This exception is provided because LCO 3.0.2 would require that the Conditions and Required Actions of the associated inoperable supported system LCO be entered solely due to the inoperability of the support system. This exception is justified because the actions that are required to ensure the unit is maintained in a safe condition are specified in the support system LCO's Required Actions. These Required Actions may include entering the supported system's Conditions and Required Actions or may specify other Required Actions.

When a support system is inoperable and there is an LCO specified for it in the TS, the supported system(s) are required to be declared inoperable if determined to be inoperable as a result of the support system inoperability. However, it is not necessary to enter into the supported systems' Conditions and Required Actions unless directed to do so by the support system's Required Actions. The potential confusion and inconsistency of requirements related to the entry into multiple support and supported systems LCOs' Conditions and Required Actions are eliminated by providing all the actions that are necessary to ensure the unit is maintained in a safe condition in the support system's Required Actions.

However, there are instances where a support system's Required Action may either direct a supported system to be declared inoperable or direct entry into Conditions and Required Actions for the supported system. This may occur immediately or after some specified delay to perform some other Required Action. Regardless of whether it is immediate or after some delay, when a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

Specification 5.8, "Safety Function Determination Program" (SFDP), ensures loss of safety function is detected and

(continued)

BASES

LCOs

LCO 3.0.6 (continued)

appropriate actions are taken. Upon failure to meet two or more LCOs concurrently, an evaluation shall be made to determine if loss of safety function exists. Additionally, other limitations, remedial actions, or compensatory actions may be identified as a result of the support system inoperability and corresponding exception to entering supported system Conditions and Required Actions. The SFDP implements the requirements of LCO 3.0.6.

Cross train checks to identify a loss of safety function for those support systems that support safety systems are required. The cross train check verifies that the supported systems of the redundant OPERABLE support system are OPERABLE, thereby ensuring safety function is retained. If this evaluation determines that a loss of safety function exists, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

SRs

SR 3.0.1 through SR 3.0.4 establish the general requirements applicable to all Specifications in Chapter 3.0 and apply at all times, unless otherwise stated.

SR 3.0.1

SR 3.0.1 establishes the requirement that SRs must be met during the MODES or other specified conditions in the Applicability for which the requirements of the LCO apply, unless otherwise specified in the individual SRs. This Specification is to ensure that Surveillances are performed to verify the OPERABILITY of systems and components, and that variables are within specified limits. Failure to meet a Surveillance within the specified Frequency, in accordance with SR 3.0.2, constitutes a failure to meet an LCO.

Systems and components are assumed to be OPERABLE when the associated SRs have been met. Nothing in this

(continued)

BASES

SRs

SR 3.0.1 (continued)

Specification, however, is to be construed as implying that systems or components are OPERABLE when:

- a. The systems or components are known to be inoperable, although still meeting the SRs; or
- b. The requirements of the Surveillance(s) are known to be not met between required Surveillance performances.

Surveillances do not have to be performed when the unit is in a MODE or other specified condition for which the requirements of the associated LCO are not applicable, unless otherwise specified. The SRs associated with a test exception are only applicable when the test exception is used as an allowable exception to the requirements of a Specification.

Surveillances, including Surveillances invoked by Required Actions, do not have to be performed on inoperable equipment because the ACTIONS define the remedial measures that apply. Surveillances have to be performed and met in accordance with SR 3.0.2, prior to returning equipment to OPERABLE status.

Upon completion of maintenance, appropriate post maintenance testing is required to declare equipment OPERABLE. This includes assuring applicable Surveillances are not failed and their most recent performance is in accordance with SR 3.0.2. Post maintenance testing may not be possible in the current MODE or other specified conditions in the Applicability due to the necessary unit parameters not having been established. In these situations, the equipment may be considered OPERABLE provided testing has been satisfactorily completed to the extent possible and the equipment is not otherwise believed to be incapable of performing its function. This will allow operation to proceed to a MODE or other specified condition where other necessary post maintenance tests can be completed.

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BASES

SRs

SR 3.0.2

SR 3.0.2 establishes the requirements for meeting the specified Frequency for Surveillances and any Required Action with a Completion Time that requires the periodic performance of the Required Action on a "once per . . ." interval.

SR 3.0.2 permits a 25% extension of the interval specified in the Frequency. This extension facilitates Surveillance scheduling and considers plant operating conditions that may not be suitable for conducting the Surveillance (e.g., transient conditions or other ongoing Surveillance or maintenance activities).

The 25% extension does not significantly degrade the reliability that results from performing the Surveillance at its specified Frequency. This is based on the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the SRs. The exceptions to SR 3.0.2 are those Surveillances for which the 25% extension of the interval specified in the Frequency does not apply. These exceptions are stated in the individual Specifications. An example of where SR 3.0.2 does not apply is a Surveillance with a Frequency of "in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions." The requirements of regulations take precedence over the TS. The TS cannot in and of themselves extend a test interval specified in the regulations. Therefore, there is a Note in the Frequency stating, "SR 3.0.2 is not applicable."

As stated in SR 3.0.2, the 25% extension also does not apply to the initial portion of a periodic Completion Time that requires performance on a "once per . . ." basis. The 25% extension applies to each performance after the initial performance. The initial performance of the Required Action, whether it is a particular Surveillance or some other remedial action, is considered a single action with a single Completion Time. One reason for not allowing the 25% extension to this Completion Time is that such an action

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BASES

SRs

SR 3.0.2 (continued)

usually verifies that no loss of function has occurred by checking the status of redundant or diverse components or accomplishes the function of the inoperable equipment in an alternative manner.

The provisions of SR 3.0.2 are not intended to be used repeatedly merely as an operational convenience to extend Surveillance intervals or periodic Completion Time intervals beyond those specified.

SR 3.0.3

SR 3.0.3 establishes the flexibility to defer declaring affected equipment inoperable or an affected variable outside the specified limits when a Surveillance has not been completed within the specified Frequency. A delay period of up to 24 hours or up to a limit of the specified Frequency, whichever is less, applies from the point in time that it is discovered that the Surveillance has not been performed in accordance with SR 3.0.2, and not at the time that the specified Frequency was not met.

This delay period provides an adequate time to complete Surveillances that have been missed. This delay period permits the completion of a Surveillance before complying with Required Actions or other remedial measures that might preclude completion of the Surveillance.

The basis for this delay period includes consideration of unit conditions, adequate planning, availability of personnel, the time required to perform the Surveillance, the safety significance of the delay in completing the required Surveillance, and the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the requirements.

When a Surveillance with a Frequency based not on time intervals, but upon specified unit conditions or operational situations, is discovered not to have been performed when

(continued)

BASES

SRs

SR 3.0.3 (continued)

specified, SR 3.0.3 allows the full delay period of 24 hours to perform the Surveillance.

SR 3.0.3 also provides a time limit for completion of Surveillances that become applicable as a consequence of MODE changes imposed by Required Actions.

Failure to comply with specified Frequencies for SRs is expected to be an infrequent occurrence. Use of the delay period established by SR 3.0.3 is a flexibility which is not intended to be used as an operational convenience to extend Surveillance intervals.

If a Surveillance is not completed within the allowed delay period, then the equipment is considered inoperable or the variable is considered outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon expiration of the delay period. If a Surveillance is failed within the delay period, then the equipment is inoperable, or the variable is outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon the failure of the Surveillance.

Completion of the Surveillance within the delay period allowed by this Specification, or within the Completion Time of the ACTIONS, restores compliance with SR 3.0.1.

SR 3.0.4

SR 3.0.4 establishes the requirement that all applicable SRs must be met before entry into a MODE or other specified condition in the Applicability.

This Specification ensures that system and component OPERABILITY requirements and variable limits are met before entry into MODES or other specified conditions in the Applicability for which these systems and components ensure safe operation of the unit. This Specification applies to

(continued)

BASES

SRs

SR 3.0.4 (continued)

changes in MODES or other specified conditions in the Applicability associated with unit shutdown as well as startup.

The provisions of SR 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS.

The precise requirements for performance of SRs are specified such that exceptions to SR 3.0.4 are not necessary. The specific time frames and conditions necessary for meeting the SRs are specified in the Frequency, in the Surveillance, or both. This allows performance of Surveillances when the prerequisite condition(s) specified in a Surveillance procedure require entry into the MODE or other specified condition in the Applicability of the associated LCO prior to the performance or completion of a Surveillance. A Surveillance that could not be performed until after entering the LCO Applicability, would have its Frequency specified such that it is not "due" until the specific conditions needed are met. Alternately, the Surveillance may be stated in the form of a Note as not required (to be met or performed) until a particular event, condition, or time has been reached. Further discussion of the specific formats of SRs annotation are found in Section 1.4, Frequency.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.1 SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}F$

BASES

BACKGROUND

According to GDC 26 (Ref. 1), the reactivity control systems must be redundant and capable of holding the reactor core subcritical when shut down under cold conditions. Maintenance of the SDM ensures that postulated reactivity events will not damage the fuel.

SDM requirements provide sufficient reactivity margin to ensure that acceptable fuel design limits will not be exceeded for normal shutdown and anticipated operational occurrences (A00s). As such, the SDM defines the degree of subcriticality that would be obtained immediately following the insertion or trip of all shutdown and control rods, assuming that the single rod cluster assembly of highest reactivity worth is fully withdrawn.

The system design requires that two independent reactivity control systems be provided, and that one of these systems be capable of maintaining the core subcritical under cold conditions. These requirements are provided by the use of movable control assemblies and soluble boric acid in the Reactor Coolant System (RCS). The Control Rod System can compensate for the reactivity effects of the fuel and water temperature changes accompanying power level changes over the range from full-load to no-load. In addition, the Control Rod System, together with the soluble boron, provide the SDM during power operation. The Control Rod System is capable of making the core subcritical rapidly enough to prevent exceeding acceptable fuel damage limits, assuming that the rod of highest reactivity worth remains fully withdrawn. The soluble boron system can compensate for fuel depletion during operation and all xenon burnout reactivity changes and maintain the reactor subcritical under cold conditions.

During power operation, SDM control is ensured by operating with the shutdown banks within the limits of LCO 3.1.6, "Shutdown Bank Insertion Limits," and the control banks within the limits of LCO 3.1.7, "Control Bank Insertion

(continued)

BASES

BACKGROUND
(continued)

Limits." When the unit is in the shutdown and refueling modes, the SDM requirements are met by means of adjustments to the RCS boron concentration.

APPLICABLE
SAFETY ANALYSES

The minimum required SDM is assumed as an initial condition in safety analyses. The safety analysis (Ref. 2) establishes an SDM that ensures specified acceptable fuel design limits are not exceeded for normal operation and AOOs, with the assumption of the highest worth rod stuck out on a trip.

The acceptance criteria for the SDM requirements are that specified acceptable fuel design limits are maintained. This is done by ensuring that:

- a. The reactor can be made subcritical from all operating conditions, transients, and Design Basis Events;
- b. The reactivity transients associated with postulated accident conditions are controllable within acceptable limits (departure from nucleate boiling ratio (DNBR), fuel-centerline temperature limits for AOOs, and ≤ 280 cal/gm energy deposition for the rod ejection accident); and
- c. The reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

The most limiting accident for the SDM requirements is based on a main steam line break (MSLB), as described in the accident analysis (Ref. 2). The increased steam flow resulting from a pipe break in the main steam system causes an increased energy removal from the affected steam generator (SG), and consequently the RCS. This results in a reduction of the reactor coolant temperature. The resultant coolant shrinkage causes a reduction in pressure. In the presence of a negative moderator temperature coefficient, this cooldown causes an increase in core reactivity. As RCS temperature decreases, the severity of an MSLB decreases until the MODE 5 value is reached. The most limiting MSLB, with respect to potential fuel damage before a reactor trip
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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

occurs, is a guillotine break of a main steam line inside containment initiated at the end of core life. The positive reactivity addition from the moderator temperature decrease will terminate when the affected SG boils dry, thus terminating RCS heat removal and cooldown. Following the MSLB, a post-trip return to power may occur; however, no fuel damage occurs as a result of the post-trip return to power, and THERMAL POWER does not violate the Safety Limit (SL) requirement of SL 2.1.1.

In addition to the limiting MSLB transient, the SDM requirement must also protect against:

- a. Inadvertent boron dilution;
- b. An uncontrolled rod withdrawal from subcritical or low power condition;
- c. Startup of an inactive reactor coolant pump (RCP); and
- d. Rod ejection.

Each of these events is discussed below.

In the boron dilution analysis, the required SDM defines the reactivity difference between an initial subcritical boron concentration and the corresponding critical boron concentration. These values, in conjunction with the configuration of the RCS and the assumed dilution flow rate, directly affect the results of the analysis. This event is most limiting at the beginning of core life, when critical boron concentrations are highest.

Depending on the system initial conditions and reactivity insertion rate, the uncontrolled rod withdrawal transient is terminated by either a high power level trip, or a high pressurizer pressure trip. In all cases, power level, RCS pressure, linear heat rate, and the DNBR do not exceed allowable limits.

The startup of an inactive RCP will not result in a "cold water" criticality, even if the maximum difference in temperature exists between the SG and the core. The maximum positive reactivity addition that can occur due to an inadvertent RCP start is less than half the minimum required

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

SDM. An idle RCP cannot, therefore, produce a return to power from the hot standby condition.

The withdrawal of control rods from subcritical or low power conditions adds reactivity to the reactor core, causing both the core power level and heat flux to increase with corresponding increases in reactor coolant temperatures and pressure. The withdrawal of rods also produces a time-dependent redistribution of core power.

SDM satisfies Criterion 2 of the NRC Policy Statement. Even though it is not directly observed from the control room, SDM is considered an initial condition process variable because it is periodically monitored to ensure that the unit is operating within the bounds of accident analysis assumptions.

LCO

SDM is a core design condition that can be ensured during operation through control rod positioning (control and shutdown banks) and through the soluble boron concentration.

The MSLB (Ref. 2) and the boron dilution (Ref. 3) accidents are the most limiting analyses that establish the SDM value of the LCO. For MSLB accidents, if the LCO is violated, there is a potential to exceed the DNBR limit and to exceed 10 CFR 100, "Reactor Site Criteria," limits (Ref. 4). For the boron dilution accident, if the LCO is violated, the minimum required time assumed for operator action to terminate dilution may no longer be applicable.

APPLICABILITY

In MODE 2 with $K_{eff} < 1.0$, MODES 3 and 4, the SDM requirements are applicable to provide sufficient negative reactivity to meet the assumptions of the safety analyses discussed above. In MODE 5, SDM is addressed by LCO 3.1.2, "SHUTDOWN MARGIN (SDM) - $T_{avg} \leq 200^{\circ}\text{F}$." In MODE 6, the shutdown reactivity requirements are given in LCO 3.9.1, "Boron Concentration." In MODES 1 and 2, SDM is ensured by complying with LCO 3.1.6 and LCO 3.1.7.

(continued)

BASES

ACTIONS

A.1

If the SDM requirements are not met, boration must be initiated promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. It is assumed that boration will be continued until the SDM requirements are met.

In the determination of the required combination of boration flow rate and boron concentration, there is no unique requirement that must be satisfied. The operator should borate with the best source available for the plant conditions.

SURVEILLANCE
REQUIREMENTS

SR 3.1.1.1

In MODES 1 and 2, SDM is verified by observing that the requirements of LCO 3.1.6 and LCO 3.1.7 are met. In the event that a rod is known to be untrippable, however, SDM verification must account for the worth of the untrippable rod as well as another rod of maximum worth.

After a reactor trip, the combination of control banks and shutdown banks (less the most reactive RCCA, which is assumed to be fully withdrawn) is sufficient to take the reactor from full-power conditions at rated temperature to zero power, and to maintain the required SDM at rated no-load temperature.

Subsequently, in MODES 3 and 4, the SDM is verified by performing a reactivity balance calculation, considering the listed reactivity effects:

- a. RCS boron concentration;
- b. Control bank position;
- c. RCS average temperature;
- d. Fuel burnup based on gross thermal energy generation;

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS
(continued)

- e. Xenon concentration;
- f. Samarium concentration; and
- g. Design isothermal temperature coefficient (ITC).

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as the RCS.

The Frequency of 24 hours is based on the generally slow change in required boron concentration and the low probability of an accident occurring without the required SDM. This allows time for the operator to collect the required data, which includes performing a boron concentration analysis, and complete the calculation.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 26, "Reactivity Control System Redundancy and Capability."
 2. Watts Bar FSAR, Section 15.4.2, "Major Secondary System Pipe Rupture."
 3. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."
 4. Title 10, Code of Federal Regulations, Part 100, "Reactor Site Criteria."
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.2 SHUTDOWN MARGIN (SDM) - T_{avg} ≤ 200°F

BASES

BACKGROUND

According to GDC 26 (Ref. 1), the reactivity control systems must be redundant and capable of holding the reactor core subcritical when shut down under cold conditions. Maintenance of the SDM ensures that postulated reactivity events will not damage the fuel.

SDM requirements provide sufficient reactivity margin to ensure that acceptable fuel design limits will not be exceeded for normal shutdown and anticipated operational occurrences (AOOs). As such, the SDM defines the degree of subcriticality that would be obtained immediately following the insertion or trip of all shutdown and control rods, assuming the single rod cluster assembly of highest reactivity worth is fully withdrawn.

The system design requires that two independent reactivity control systems be provided, and that one of these systems be capable of maintaining the core subcritical under cold conditions. These requirements are provided by the use of movable control assemblies and soluble boric acid in the Reactor Coolant System (RCS). The Control Rod System can compensate for the reactivity effects of the fuel and water temperature changes accompanying power level changes over the range from full-load to no-load. In addition, the Control Rod System, together with the soluble boron, provide SDM during power operation. The Control Rod System is capable of making the core subcritical rapidly enough to prevent exceeding acceptable fuel damage limits assuming that the rod of highest reactivity worth remains fully withdrawn. The soluble boron system can compensate for fuel depletion during operation and all xenon burnout reactivity changes, and maintain the reactor subcritical under cold conditions.

During power operation, SDM control is ensured by operating with the shutdown banks within the limits of LCO 3.1.6, "Shutdown Bank Insertion Limits," and the control banks within the limits of LCO 3.1.7, "Control Bank Insertion Limits." When the unit is in the shutdown and refueling modes, the SDM requirements are met by means of adjustments to the RCS boron concentration.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The minimum required SDM is assumed as an initial condition in the safety analysis. The safety analysis (Ref. 2) establishes an SDM that ensures specified acceptable fuel design limits are not exceeded for normal operation and AOOs with the assumption of the highest worth rod stuck out on a trip. Specifically, for MODE 5, the primary safety analysis that relies on the SDM limits is the boron dilution analysis.

The acceptance criteria for the SDM requirements are that specified acceptable fuel design limits are maintained. This is done by ensuring that:

- a. The reactor can be made subcritical from all operating conditions, transients, and Design Basis Events;
- b. The reactivity transients associated with postulated accident conditions are controllable within acceptable limits (departure from nucleate boiling ratio, fuel-centerline temperature limits for AOOs, and ≤ 280 cal/gm energy deposition for the rod ejection accident); and
- c. The reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

In the boron dilution analysis, the required SDM defines the reactivity difference between an initial subcritical boron concentration and the corresponding critical boron concentration. These values, in conjunction with the configuration of the RCS and the assumed dilution flow rate, directly affect the results of the analysis. This event is most limiting at the beginning of core life when critical boron concentrations are highest.

SDM satisfies Criterion 2 of the NRC Policy Statement. Even though it is not directly observed from the control room, SDM is considered an initial condition process variable because it is periodically monitored to ensure that the unit is operating within the bounds of accident analysis assumptions.

(continued)

BASES (continued)

LCO

SDM is a core design condition that can be ensured during operation through control rod positioning (control and shutdown banks) and through the soluble boron concentration.

The boron dilution accident (Ref. 2) is the most limiting analysis that establishes the SDM value of the LCO. For the boron dilution accident, if the LCO is violated, then the minimum required time assumed for operator action to terminate dilution may no longer be applicable.

APPLICABILITY

In MODE 5, the SDM requirements are applicable to provide sufficient negative reactivity to meet the assumptions of the safety analyses discussed above. In MODES 3 and 4, the SDM requirements are given in LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}\text{F}$." In MODE 6, the shutdown reactivity requirements are given in LCO 3.9.1, "Boron Concentration." In MODES 1 and 2, SDM is ensured by complying with LCO 3.1.6 and LCO 3.1.7.

ACTIONS

A.1

If the SDM requirements are not met, boration must be initiated promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. It is assumed that boration will be continued until the SDM requirements are met.

In the determination of the required combination of boration flow rate and boron concentration, there is no unique requirement that must be satisfied. The operator should borate with the best source available for the plant conditions.

SURVEILLANCE
REQUIREMENTS

SR 3.1.2.1

In MODE 5, the SDM is verified by performing a reactivity balance calculation, considering the following reactivity effects:

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.1.2.1 (continued)

- a. RCS boron concentration;
- b. Control bank position;
- c. RCS average temperature;
- d. Fuel burnup based on gross thermal energy generation;
- e. Xenon concentration;
- f. Samarium concentration; and
- g. Design isothermal temperature coefficient (ITC).

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as the RCS.

The Frequency of 24 hours is based on the generally slow change in required boron concentration and on the low probability of an accident occurring without the required SDM. This allows time enough for the operator to collect the required data, which includes performing a boron concentration analysis, and complete the calculation.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 26, "Reactivity Control System Redundancy and Capability."
 2. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.3 Core Reactivity

BASES

BACKGROUND

According to GDC 26, GDC 28, and GDC 29 (Ref. 1), reactivity shall be controllable, such that, subcriticality is maintained under cold conditions, and acceptable fuel design limits are not exceeded during normal operation and anticipated operational occurrences. Therefore, reactivity balance is used as a measure of the predicted versus measured core reactivity during power operation. The periodic confirmation of core reactivity is necessary to ensure that Design Basis Accident (DBA) and transient safety analyses remain valid. A large reactivity difference could be the result of unanticipated changes in fuel, or control rod worth, or operation at conditions not consistent with those assumed in the predictions of core reactivity, and could potentially result in a loss of SDM or violation of acceptable fuel design limits. Comparing predicted versus measured core reactivity validates the nuclear methods used in the safety analysis and supports the SDM demonstrations (LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}\text{F}$ ") in ensuring the reactor can be brought safely to cold, subcritical conditions.

When the reactor core is critical or in normal power operation, a reactivity balance exists and the net reactivity is zero. A comparison of predicted and measured reactivity is convenient under such a balance, since parameters are being maintained relatively stable under steady-state power conditions. The positive reactivity inherent in the core design is balanced by the negative reactivity of the control components, thermal feedback, neutron leakage, and materials in the core that absorb neutrons, such as burnable absorbers producing zero net reactivity. Excess reactivity can be inferred from the boron letdown curve (or critical boron curve), which provides an indication of the soluble boron concentration in the Reactor Coolant System (RCS) versus cycle burnup. Periodic measurement of the RCS boron concentration for comparison with the predicted value with other variables fixed (such as rod height, temperature, pressure, and power), provides a convenient method of ensuring that core reactivity is within design expectations and that the

(continued)

BASES

BACKGROUND
(continued)

calculational models used to generate the safety analysis are adequate.

In order to achieve the required fuel cycle energy output, the uranium enrichment, in the new fuel loading and in the fuel remaining from the previous cycle, provides excess positive reactivity beyond that required to sustain steady-state operation throughout the cycle. When the reactor is critical at RTP and moderator temperature, the excess positive reactivity is compensated by burnable absorbers (if any), control rods, whatever neutron poisons (mainly xenon and samarium) are present in the fuel, and the RCS boron concentration.

When the core is producing THERMAL POWER, the fuel is being depleted and excess reactivity is decreasing. As the fuel depletes, the RCS boron concentration is reduced to decrease negative reactivity and maintain constant THERMAL POWER. The boron letdown curve is based on steady-state operation at RTP. Therefore, deviations from the predicted boron letdown curve may indicate deficiencies in the design analysis, deficiencies in the calculational models, or abnormal core conditions, and must be evaluated.

APPLICABLE
SAFETY ANALYSES

The acceptance criteria for core reactivity are that the reactivity balance limit ensures plant operation is maintained within the assumptions of the safety analyses.

Accurate prediction of core reactivity is either an explicit or implicit assumption in the accident analysis evaluations. Every accident evaluation (Ref. 2) is, therefore, dependent upon accurate evaluation of core reactivity. In particular, SDM and reactivity transients, such as control rod withdrawal accidents or rod ejection accidents, are very sensitive to accurate prediction of core reactivity. These accident analysis evaluations rely on computer codes that have been qualified against available test data, operating plant data, and analytical benchmarks. Monitoring reactivity balance additionally ensures that the nuclear methods provide an accurate representation of the core reactivity.

Design calculations and safety analyses are performed for each fuel cycle for the purpose of predetermining reactivity

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

behavior and the RCS boron concentration requirements for reactivity control during fuel depletion.

The comparison between measured and predicted initial core reactivity provides a normalization for the calculational models used to predict core reactivity. If the measured and predicted RCS boron concentrations for identical core conditions at beginning-of-cycle (BOC) do not agree, then the assumptions used in the reload cycle design analysis or the calculational models used to predict soluble boron requirements may not be accurate. If reasonable agreement between measured and predicted core reactivity exists at BOC, then the prediction may be normalized to the measured boron concentration. Thereafter, any significant deviations in the measured boron concentration from the predicted boron letdown curve that develop during fuel depletion may be an indication that the calculational model is not adequate for core burnups beyond BOC, or that an unexpected change in core conditions has occurred.

The normalization of predicted RCS boron concentration to the measured value is typically performed after reaching RTP following startup from a refueling outage, with the control rods in their normal positions for power operation. The normalization is performed at BOC conditions, so that core reactivity relative to predicted values can be continually monitored and evaluated as core conditions change during the cycle.

Core reactivity satisfies Criterion 2 of the NRC Policy Statement.

LCO

Long-term core reactivity behavior is a result of the core physics design and cannot be easily controlled once the core design is fixed. During operation, therefore, the LCO can only be ensured through measurement and tracking, and appropriate actions taken as necessary. Large differences between actual and predicted core reactivity may indicate that the assumptions of the DBA and transient analyses are no longer valid, or that the uncertainties in the Nuclear Design Methodology are larger than expected. A limit on the reactivity balance of $\pm 1\% \Delta k/k$ has been established based on engineering judgment. A 1% deviation in reactivity from

(continued)

BASES

LCO
(continued)

that predicted is larger than expected for normal operation and should therefore be evaluated.

When measured core reactivity is within 1% $\Delta k/k$ of the predicted value at steady-state thermal conditions, the core is considered to be operating within acceptable design limits. Since deviations from the limit are normally detected by comparing predicted and measured steady-state RCS critical boron concentrations, the difference between measured and predicted values would be dependent on the boron worth. These values are well within the uncertainty limits for analysis of boron concentration samples, so that spurious violations of the limit due to uncertainty in measuring the RCS boron concentration are unlikely.

APPLICABILITY

The limits on core reactivity must be maintained during MODES 1 and 2 because a reactivity balance must exist when the reactor is critical or producing THERMAL POWER. As the fuel depletes, core conditions are changing, and confirmation of the reactivity balance ensures the core is operating as designed. This Specification does not apply in MODES 3, 4, and 5 because the reactor is shut down, and the reactivity balance is used only as a comparison of predicted versus measured reactivity when the reactor is critical.

In MODE 6, fuel loading results in a continually changing core reactivity. Boron concentration requirements (LCO 3.9.1, "Boron Concentration") ensure that fuel movements are performed within the bounds of the safety analysis. An SDM demonstration is required during the first startup following operations that could have altered core reactivity (e.g., fuel movement, control rod replacement, control rod shuffling).

ACTIONS

A.1 and A.2

Should an anomaly develop between measured and predicted core reactivity, an evaluation of the core design and safety analysis must be performed. Core conditions are evaluated to determine their consistency with input to design

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

calculations. Measured core and process parameters are evaluated to determine that they are within the bounds of the safety analysis, and safety analysis calculational models are reviewed to verify that they are adequate for representation of the core conditions. The required Completion Time of 72 hours is based on the low probability of a DBA occurring during this period, and allows sufficient time to assess the physical condition of the reactor and complete the evaluation of the core design and safety analysis.

Following evaluations of the core design and safety analysis, the cause of the reactivity anomaly may be resolved. If the cause of the reactivity anomaly is a mismatch in core conditions at the time of RCS boron concentration sampling, then a recalculation of the RCS boron concentration requirements may be performed to demonstrate that core reactivity is behaving as expected. If an unexpected physical change in the condition of the core has occurred, it must be evaluated and corrected, if possible. If the cause of the reactivity anomaly is in the calculation technique, then the calculational models must be revised to provide more accurate predictions. If any of these results are demonstrated, and it is concluded that the reactor core is acceptable for continued operation, then the boron letdown curve may be renormalized and power operation may continue. If operational restriction or additional SRs are necessary to ensure the reactor core is acceptable for continued operation, then they must be defined.

The required Completion Time of 72 hours is adequate for preparing whatever operating restrictions or Surveillances that may be required to allow continued reactor operation.

B.1

If the core reactivity cannot be restored to within the 1% $\Delta k/k$ limit, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. If the SDM for MODE 3 is not met, then the boration required by SR 3.1.1.1 would occur. The allowed Completion Time is reasonable, based on operating experience, for reaching

(continued)

BASES

ACTIONS

B.1 (continued)

MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.3.1

Core reactivity is verified by periodic comparisons of measured and predicted RCS boron concentrations. The comparison is made, considering that other core conditions are fixed or stable, including control rod position, moderator temperature, fuel temperature, fuel depletion, xenon concentration, and samarium concentration. The Surveillance is performed prior to entering MODE 1 as an initial check on core conditions and design calculations at BOC. The SR is modified by a Note. The Note indicates that the normalization of predicted core reactivity to the measured value must take place within the first 60 effective full power days (EFPDs) after each fuel loading. This allows sufficient time for core conditions to reach steady state, but prevents operation for a large fraction of the fuel cycle without establishing a benchmark for the design calculations. The required subsequent Frequency of 31 EFPDs, following the initial 60 EFPDs after entering MODE 1, is acceptable, based on the slow rate of core changes due to fuel depletion and the presence of other indicators (QPTR, AFD, etc.) for prompt indication of an anomaly.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 26, "Reactivity Control System Redundancy and Capability"; General Design Criterion 28, "Reactivity Limits"; and General Design Criterion 29, "Protection Against Anticipated Operational Occurrences."
 2. Watts Bar FSAR, Section 15.0, "Accident Analyses."
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.4 Moderator Temperature Coefficient (MTC)

BASES

BACKGROUND

According to GDC 11 (Ref. 1), the reactor core and its interaction with the Reactor Coolant System (RCS) must be designed for inherently stable power operation, even in the possible event of an accident. In particular, the net reactivity feedback in the system must compensate for any unintended reactivity increases.

The MTC relates a change in core reactivity to a change in reactor coolant temperature (a positive MTC means that reactivity increases with increasing moderator temperature; conversely, a negative MTC means that reactivity decreases with increasing moderator temperature). The reactor is designed to operate with a negative MTC over the largest possible range of fuel cycle operation. Therefore, a coolant temperature increase will cause a reactivity decrease, so that the coolant temperature tends to return toward its initial value. Reactivity increases that cause a coolant temperature increase will thus be self-limiting, and stable power operation will result.

MTC values are predicted at selected burnups during the safety evaluation analysis and are confirmed to be acceptable by measurements. Both initial and reload cores are designed so that the beginning-of-cycle (BOC) MTC is less than zero when THERMAL POWER is at RTP. The actual value of the MTC is dependent on core characteristics, such as fuel loading and reactor coolant soluble boron concentration. The core design may require additional fixed distributed poisons to yield an MTC at BOC within the range analyzed in the plant accident analysis. The end-of-cycle (EOC) MTC is also limited by the requirements of the accident analysis. Fuel cycles that are designed to achieve high burnups or that have changes to other characteristics are evaluated to ensure that the MTC does not exceed the EOC limit.

The limitations on MTC are provided to ensure that the value of this coefficient remains within the limiting conditions assumed in the FSAR accident and transient analyses.

(continued)

BASES

BACKGROUND
(continued)

If the LCO limits are not met, the unit response during transients may not be as predicted. The core could violate criteria that prohibit a return to criticality during non-MSLB events, or the departure from nucleate boiling ratio criteria of the approved correlation may be violated, which could lead to a loss of the fuel cladding integrity.

The SRs for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits, since this coefficient changes slowly, due principally to the reduction in RCS boron concentration associated with fuel burnup.

APPLICABLE
SAFETY ANALYSES

The acceptance criteria for the specified MTC are:

- a. The MTC values must remain within the bounds of those used in the accident analysis (Ref. 2); and
- b. The MTC must be such that inherently stable power operations result during normal operation and accidents, such as overheating and overcooling events.

The FSAR, Section 15 (Ref. 2), contains analyses of accidents that result in both overheating and overcooling of the reactor core. MTC is one of the controlling parameters for core reactivity in these accidents. Both the most positive value and most negative value of the MTC are important to safety, and both values must be bounded. Values used in the analyses consider worst-case conditions to ensure that the accident results are bounding (Ref. 3).

The consequences of accidents that cause core overheating must be evaluated when the MTC is positive. Such accidents include the rod withdrawal transient from either zero (Ref. 4) or RTP, loss of main feedwater flow, and loss of forced reactor coolant flow. The consequences of accidents that cause core overcooling must be evaluated when the MTC is negative. Such accidents include sudden feedwater flow increase and sudden decrease in feedwater temperature.

In order to ensure a bounding accident analysis, the MTC is assumed to be its most limiting value for the analysis conditions appropriate to each accident. The bounding value is determined by considering rodded and unrodded conditions,

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

whether the reactor is at full or zero power, and whether it is the BOC or EOC life. The most conservative combination appropriate to the accident is then used for the analysis (Ref. 2).

MTC values are bounded in reload safety evaluations assuming steady-state conditions at BOC and EOC. An EOC measurement is conducted at conditions when the RCS boron concentration reaches approximately 300 ppm. The measured value may be extrapolated to project the EOC value, in order to confirm reload design predictions.

MTC satisfies Criterion 2 of the NRC Policy Statement. Even though it is not directly observed and controlled from the control room, MTC is considered an initial condition process variable because of its dependence on boron concentration.

LCO

LCO 3.1.4 requires the MTC to be within specified limits of the COLR to ensure that the core operates within the assumptions of the accident analysis. During the reload core safety evaluation, the MTC is analyzed to determine that its values remain within the bounds of the original accident analysis during operation.

Assumptions made in safety analyses require that the MTC be less positive than a given upper bound and more positive than a given lower bound. The MTC is most positive at BOC; this upper bound must not be exceeded. This maximum upper limit occurs at BOC, all rods out, hot zero power conditions. At EOC the MTC takes on its most negative value, when the lower bound becomes important. This LCO exists to ensure that both the upper and lower bounds are not exceeded.

During operation, therefore, the conditions of the LCO can only be ensured through measurement. The Surveillance checks at BOC and EOC on MTC provide confirmation that the MTC is behaving as anticipated so that the acceptance criteria are met.

The LCO establishes a maximum positive value that cannot be exceeded. The BOC positive limit and the EOC negative limit are established in the COLR to allow specifying limits for each particular cycle. This permits the unit to take

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BASES

LCO (continued) advantage of improved fuel management and changes in unit operating schedule.

APPLICABILITY Technical Specifications place both LCO and SR values on MTC, based on the safety analysis assumptions described above.

In MODE 1, the limits on MTC must be maintained to ensure that any accident initiated from THERMAL POWER operation will not violate the design assumptions of the accident analysis. In MODE 2 with the reactor critical, the upper limit must also be maintained to ensure that startup and subcritical accidents (such as the uncontrolled CONTROL ROD assembly or group withdrawal) will not violate the assumptions of the accident analysis. The lower MTC limit must be maintained in MODES 2 and 3, in addition to MODE 1, to ensure that cooldown accidents will not violate the assumptions of the accident analysis. In MODES 4, 5, and 6, this LCO is not applicable, since no Design Basis Accidents using the MTC as an analysis assumption are initiated from these MODES.

ACTIONS

A.1

If the BOC MTC limit is violated, administrative withdrawal limits for control banks must be established to maintain the MTC within its limits. The MTC becomes more negative with control bank insertion and decreased boron concentration. A Completion Time of 24 hours provides enough time for evaluating the MTC measurement and computing the required bank withdrawal limits.

As cycle burnup is increased, the RCS boron concentration will be reduced. The reduced boron concentration causes the MTC to become more negative. Using physics calculations, the time in cycle life at which the calculated MTC will meet the LCO requirement can be determined. At this point in core life Condition A no longer exists. The unit is no longer in the Required Action, so the administrative withdrawal limits are no longer in effect.

(continued)

BASES

ACTIONS
(continued)

B.1

If the required administrative withdrawal limits at BOC are not established within 24 hours, the unit must be brought to MODE 2 with $k_{eff} < 1.0$ to prevent operation with an MTC that is more positive than that assumed in safety analyses.

The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

C.1

Exceeding the EOC MTC limit means that the safety analysis assumptions for the EOC accidents that use a bounding negative MTC value may be invalid. If the EOC MTC limit is exceeded, the plant must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 4 within 12 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.4.1

This SR requires measurement of the MTC at BOC prior to entering MODE 1 in order to demonstrate compliance with the most positive MTC LCO. Meeting the limit prior to entering MODE 1 ensures that the limit will also be met at higher power levels.

The BOC MTC value for all rods out (ARO) will be inferred from isothermal temperature coefficient measurements obtained during the physics tests after refueling. The ARO value can be directly compared to the BOC MTC limit of the LCO. If required, measurement results and predicted design values can be used to establish administrative withdrawal limits for control banks.

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BASES

SURVEILLANCE
REQUIREMENTS
(continued)SR 3.1.4.2 and SR 3.1.4.3

In similar fashion, the LCO demands that the MTC be less negative than the specified value for EOC full power conditions. This measurement may be performed at any THERMAL POWER, but its results must be extrapolated to the conditions of RTP and all banks withdrawn in order to make a proper comparison with the LCO value. Because the RTP MTC value will gradually become more negative with further core depletion and boron concentration reduction, a 300 ppm SR value of MTC should necessarily be less negative than the EOC LCO limit. The 300 ppm SR value is sufficiently less negative than the EOC LCO limit value to ensure that the LCO limit will be met when the 300 ppm Surveillance criterion is met.

SR 3.1.4.3 is modified by a Note that includes the following requirements:

- a. If the 300 ppm Surveillance limit is exceeded, it is possible that the EOC limit on MTC could be reached before the planned EOC. Because the MTC changes slowly with core depletion, the Frequency of 14 effective full power days is sufficient to avoid exceeding the EOC limit.
- b. The Surveillance limit for RTP boron concentration of 60 ppm is conservative. If the measured MTC at 60 ppm is more positive than the 60 ppm Surveillance limit, the EOC limit will not be exceeded because of the gradual manner in which MTC changes with core burnup.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 11, "Reactor Inherent Protection."
 2. Watts Bar FSAR, Section 15.0, "Accident Analyses."
 3. WCAP 9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
 4. Watts Bar FSAR, Section 15.2.1, "Uncontrolled Rod Cluster Control Assembly Bank Withdrawal From a Subcritical Condition."
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.5 Rod Group Alignment Limits

BASES

BACKGROUND

The OPERABILITY (e.g., trippability) of the shutdown and control rods are initial assumptions in all safety analyses that assume rod insertion upon reactor trip. Maximum rod misalignment is an initial assumption in the safety analysis that directly affects core power distributions and assumptions of available SDM.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Plants" (Ref. 2).

Mechanical or electrical failures may cause a control rod to become inoperable or to become misaligned from its group. Control rod inoperability or misalignment may cause increased power peaking, due to the asymmetric reactivity distribution and a reduction in the total available rod worth for reactor shutdown. Therefore, control rod alignment and OPERABILITY are related to core operation in design power peaking limits and the core design requirement of a minimum SDM.

Limits on control rod alignment have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

Rod cluster control assemblies (RCCAs), or rods, are moved by their control rod drive mechanisms (CRDMs). Each CRDM moves its RCCA one step (approximately 5/8 inches) at a time, but at varying rates (steps per minute) depending on the signal output from the Rod Control System.

The RCCAs are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups

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BASES

BACKGROUND
(continued)

that are moved in a staggered fashion, but always within one step of each other. There are four control banks and four shutdown banks.

The shutdown banks are maintained either in the fully inserted or fully withdrawn position. The control banks are moved in an overlap pattern, using the following withdrawal sequence: When control bank A reaches a predetermined height in the core, control bank B begins to move out with control bank A. Control bank A stops at the position of maximum withdrawal, and control bank B continues to move out. When control bank B reaches a predetermined height, control bank C begins to move out with control bank B. This sequence continues until control banks A, B, and C are at the fully withdrawn position, and control bank D is approximately halfway withdrawn. The insertion sequence is the opposite of the withdrawal sequence. The control rods are arranged in a radially symmetric pattern, so that control bank motion does not introduce radial asymmetries in the core power distributions.

The axial position of shutdown rods and control rods is indicated by two separate and independent systems, which are the Bank Demand Position Indication System (commonly called group step counters) and the Analog Rod Position Indication (ARPI) System.

The Bank Demand Position Indication System counts the pulses from the rod control system that moves the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Bank Demand Position Indication System is considered highly precise (± 1 step or $\pm 5/8$ inch). If a rod does not move one step for each demand pulse, the step counter will still count the pulse and incorrectly reflect the position of the rod.

The ARPI System provides an accurate indication of actual control rod position, but at a lower precision than the step counters. This system is based on inductive analog signals from a series of coils spaced along a hollow tube with a center-to-center distance of 3.75 inches, which is six steps.

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BASES

BACKGROUND
(continued)

The normal indication accuracy of the ARPI System is ± 6 steps (± 3.75 inches), and the maximum uncertainty is ± 12 steps (± 7.5 inches). With an indicated deviation of 12 steps between the group step counter and ARPI, the maximum deviation between actual rod position and the demand position could be 24 steps, or 15 inches.

APPLICABLE
SAFETY ANALYSES

Control rod misalignment accidents are analyzed in the safety analysis (Ref. 3). The acceptance criteria for addressing control rod inoperability or misalignment are that:

- a. There be no violations of:
 1. specified acceptable fuel design limits, or
 2. Reactor Coolant System (RCS) pressure boundary integrity; and
- b. The core remains subcritical after accident transients other than a Main Steam Line Break (MSLB).

Two types of misalignment are distinguished. During movement of a control rod group, one rod may stop moving, while the other rods in the group continue. This condition may cause excessive power peaking. The second type of misalignment occurs if one rod fails to insert upon a reactor trip and remains stuck fully withdrawn. This condition requires an evaluation to determine that sufficient reactivity worth is held in the control rods to meet the SDM requirement, with the maximum worth rod stuck fully withdrawn.

Two types of analysis are performed in regard to static rod misalignment (Ref. 4). With control banks at their insertion limits, one type of analysis considers the case when any one rod is completely inserted into the core. The second type of analysis considers the case of a completely withdrawn single rod from a bank inserted to its insertion limit. Satisfying limits on departure from nucleate boiling ratio in both of these cases bounds the situation when a rod is misaligned from its group by 12 steps.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

Another type of misalignment occurs if one RCCA fails to insert upon a reactor trip in response to a mainsteam pipe rupture and remains stuck fully withdrawn. This condition is assumed in the evaluation to determine that the required SDM is met with the maximum worth RCCA also fully withdrawn (Ref. 5). The reactor is shutdown by the boric acid injection delivered by the ECCS.

The Required Actions in this LCO ensure that either deviations from the alignment limits will be corrected or that THERMAL POWER will be adjusted so that excessive local linear heat rates (LHRs) will not occur, and that the requirements on SDM and ejected rod worth are preserved.

- = Continued operation of the reactor with a misaligned control rod is allowed if the heat flux hot channel factor ($F_Q(Z)$) and the nuclear enthalpy hot channel factor ($F_{\Delta H}^N$) are verified to be within their limits in the COLR, and the safety analysis is verified to remain valid. When a control rod is misaligned, the assumptions that are used to determine the rod insertion limits, AFD limits, and quadrant power tilt limits are not preserved. Therefore, the limits may not preserve the design peaking factors, and $F_Q(Z)$ and $F_{\Delta H}^N$ must be verified directly by incore mapping. Bases Section 3.2 (Power Distribution Limits) contains more complete discussions of the relation of $F_Q(Z)$ and $F_{\Delta H}^N$ to the operating limits.

Shutdown and control rod OPERABILITY and alignment are directly related to power distributions and SDM, which are initial conditions assumed in safety analyses. Therefore they satisfy Criterion 2 of the NRC Policy Statement.

LCO

The limits on shutdown or control rod alignments ensure that the assumptions in the safety analysis will remain valid. The requirements on OPERABILITY ensure that upon reactor trip, the assumed reactivity will be available and will be inserted. The OPERABILITY requirements also ensure that the RCCAs and banks maintain the correct power distribution and rod alignment.

The requirement to maintain the rod alignment to within plus or minus 12 steps is conservative. The minimum misalignment assumed in safety analysis is 24 steps (15 inches), and in

(continued)

BASES

LCO
(continued) some cases a total misalignment from fully withdrawn to fully inserted is assumed. Failure to meet the requirements of this LCO may produce unacceptable power peaking factors and LHRs, or unacceptable SDMs, all of which may constitute initial conditions inconsistent with the safety analysis.

APPLICABILITY The requirements on RCCA OPERABILITY and alignment are applicable in MODES 1 and 2 because these are the only MODES in which neutron (or fission) power is generated, and the OPERABILITY (i.e., trippability) and alignment of rods have the potential to affect the safety of the plant. In MODES 3, 4, 5, and 6, the alignment limits do not apply because the reactor is shut down and not producing fission power. In the shutdown MODES, the OPERABILITY of the shutdown and control rods has the potential to affect the required SDM, but this effect can be compensated for by an increase in the boron concentration of the RCS. See LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}\text{F}$," for SDM in MODES 3 and 4, LCO 3.1.2, "Shutdown Margin (SDM) - $T_{avg} \leq 200^{\circ}\text{F}$," for SDM in MODE 5, and LCO 3.9.1, "Boron Concentration," for boron concentration requirements during refueling.

ACTIONS A.1.1 and A.1.2

When one or more rods are untrippable, there is a possibility that the required SDM may be adversely affected. Under these conditions, it is important to determine the SDM, and if it is less than the required value, initiate boration until the required SDM is recovered. The Completion Time of 1 hour is adequate for determining SDM and, if necessary, for initiating boration and restoring SDM.

In this situation, SDM verification must include the worth of the untrippable rod, as well as a rod of maximum worth.

(continued)

BASES

ACTIONS
(continued)

A.2

If the untrippable rod(s) cannot be restored to OPERABLE status, the plant must be brought to a MODE or condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours. The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3 from full-power conditions in an orderly manner and without challenging plant systems.

B.1

When a rod becomes misaligned, it can usually be moved and is still trippable. If the rod can be realigned within the Completion Time of 1 hour, local xenon redistribution during this short interval will not be significant, and operation may proceed without further restriction.

An alternative to realigning a single misaligned RCCA to the group average position is to align the remainder of the group to the position of the misaligned RCCA. However, this must be done without violating the bank sequence, overlap, and insertion limits specified in LCO 3.1.6, "Shutdown Bank Insertion Limits," and LCO 3.1.7, "Control Bank Insertion Limits." The Completion Time of 1 hour gives the operator sufficient time to adjust the rod positions in an orderly manner.

B.2.1.1 and B.2.1.2

With a misaligned rod, SDM must be verified to be within limit or boration must be initiated to restore SDM to within limit.

In many cases, realigning the remainder of the group to the misaligned rod may not be desirable. For example, realigning control bank B to a rod that is misaligned 15 steps from the top of the core would require a

(continued)

BASES

ACTIONS

B.2.1.1 and B.2.1.2 (continued)

significant power reduction, since control bank D must be moved fully in and control bank C must be moved in to approximately 100 to 115 steps.

Power operation may continue with one RCCA trippable but misaligned, provided that SDM is verified within 1 hour.

The Completion Time of 1 hour represents the time necessary for determining the actual unit SDM and, if necessary, aligning and starting the necessary systems and components to initiate boration.

B.2.2, B.2.3, B.2.4, B.2.5, and B.2.6

For continued operation with a misaligned rod, RTP must be reduced, SDM must periodically be verified within limits, hot channel factors ($FQ(Z)$ and $F_{\Delta H}^N$) must be verified within limits, and the safety analyses must be re-evaluated to confirm continued operation is permissible.

Reduction of power to 75% RTP ensures that local LHR increases due to a misaligned RCCA will not cause the core design criteria to be exceeded (Ref. 6). The Completion Time of 2 hours gives the operator sufficient time to accomplish an orderly power reduction without challenging the Reactor Protection System.

When a rod is known to be misaligned, there is a potential to impact the SDM. Since the core conditions can change with time, periodic verification of SDM is required. A Frequency of 12 hours is sufficient to ensure this requirement continues to be met.

Verifying that $FQ(Z)$ and $F_{\Delta H}^N$ are within the required limits ensures that current operation at 75% RTP with a rod misaligned is not resulting in power distributions that may invalidate safety analysis assumptions at full power. The Completion Time of 72 hours allows sufficient time to obtain flux maps of the core power distribution using the incore flux mapping system and to calculate $FQ(Z)$ and $F_{\Delta H}^N$.

(continued)

BASES

ACTIONS

B.2.2, B.2.3, B.2.4, B.2.5, and B.2.6 (continued)

Once current conditions have been verified acceptable, time is available to perform evaluations of accident analysis to determine that core limits will not be exceeded during a Design Basis Event for the duration of operation under these conditions. A Completion Time of 5 days is sufficient time to obtain the required input data and to perform the analysis.

C.1.1 and C.1.2

More than one control rod becoming misaligned from its group average position is not expected, and has the potential to reduce SDM. Therefore, SDM must be evaluated. One hour allows the operator adequate time to determine SDM. Restoration of the required SDM, if necessary, requires increasing the RCS boron concentration to provide negative reactivity, as described in the Bases or LCO 3.1.1. The required Completion Time of 1 hour for initiating boration is reasonable, based on the time required for potential xenon redistribution, the low probability of an accident occurring, and the steps required to complete the action. This allows the operator sufficient time to align the required valves and start the boric acid pumps. Boration will continue until the required SDM is restored.

C.2

If more than one rod is found to be misaligned or becomes misaligned because of bank movement, the unit conditions fall outside of the accident analysis assumptions. Since automatic bank sequencing would continue to cause misalignment, the unit must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3 from full-power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES

ACTIONS
(continued)

D.1

When Required Actions cannot be completed within their Completion Time, the unit must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours, which obviates concerns about the development of undesirable xenon or power distributions. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching MODE 3 from full-power conditions in an orderly manner and without challenging the plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.5.1

Verification that individual rod positions are within alignment limits at a Frequency of 12 hours provides a history that allows the operator to detect a rod that is beginning to deviate from its expected position. If the rod position deviation monitor is inoperable, a Frequency of 4 hours accomplishes the same goal. The specified Frequency takes into account other rod position information that is continuously available to the operator in the control room, so that during actual rod motion, deviations can immediately be detected.

SR 3.1.5.2

Verifying each control rod is OPERABLE would require that each rod be tripped. However, in MODES 1 and 2, tripping each control rod would result in radial or axial power tilts, or oscillations. Exercising each individual control rod every 92 days provides increased confidence that all rods continue to be OPERABLE without exceeding the alignment limit, even if they are not regularly tripped. Moving each control rod by 10 steps will not cause radial or axial power tilts, or oscillations, to occur. The 92-day Frequency takes into consideration other information available to the operator in the control room and SR 3.1.5.1, which is performed more frequently and adds to the determination of

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.1.5.2 (continued)

OPERABILITY of the rods. Between required performances of SR 3.1.5.2 (determination of control rod OPERABILITY by movement), if a control rod(s) is discovered to be immovable, but remains trippable and aligned, the control rod(s) is considered to be OPERABLE. At any time, if a control rod(s) is immovable, a determination of the trippability (OPERABILITY) of the control rod(s) must be made, and appropriate action taken.

SR 3.1.5.3

Verification of rod drop times allows the operator to determine that the maximum rod drop time permitted is consistent with the assumed rod drop time used in the safety analysis. Measuring rod drop times prior to reactor criticality, after reactor vessel head removal, ensures that the reactor internals and rod drive mechanism will not interfere with rod motion or rod drop time, and that no degradation in these systems has occurred that would adversely affect control rod motion or drop time. This testing is performed with all RCPs operating and the average moderator temperature $\geq 551^{\circ}\text{F}$ to simulate a reactor trip under actual conditions.

This Surveillance is performed during a plant outage, due to the plant conditions needed to perform the SR and the potential for an unplanned plant transient if the Surveillance were performed with the reactor at power.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 10, "Reactor Design," General Design Criterion 26, "Reactivity Limits."
2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
3. Watts Bar FSAR, Section 15.0, "Accident Analyses."
4. Watts Bar FSAR, Section 15.2.3, "Rod Cluster Control Assembly Misalignment."

(continued)

BASES

REFERENCES
(continued)

5. Watts Bar FSAR, Section 15.4.2, "Major Secondary System Pipe Rupture."
 6. Watts Bar FSAR, Section 15.3.6, "Single RCCA Withdrawal at Full Power."
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.6 Shutdown Bank Insertion Limits

BASES

BACKGROUND

The insertion limits of the shutdown and control rods are initial assumptions in all safety analyses that assume rod insertion upon reactor trip. The insertion limits directly affect core power and fuel burnup distributions and assumptions of available ejected rod worth, SDM and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on control rod insertion have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

The rod cluster control assemblies (RCCAs) are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. There are four control banks and four shutdown banks. See LCO 3.1.5, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.8, "Rod Position Indication," for position indication requirements.

The control banks are used for precise reactivity control of the reactor. The positions of the control banks are normally automatically controlled by the Rod Control System, but they can also be manually controlled. They are capable of adding negative reactivity very quickly (compared to borating). The control banks must be maintained above designed insertion limits and are typically near the fully withdrawn position during normal full power operations. Hence, they are not capable of adding a large amount of positive reactivity. Boration or dilution of the Reactor

(continued)

BASES

BACKGROUND
(continued)

Coolant System (RCS) compensates for the reactivity changes associated with large changes in RCS temperature. The design calculations are performed with the assumption that the shutdown banks are withdrawn first. The shutdown banks are controlled manually by the control room operator. During normal unit operation, the shutdown banks are either fully withdrawn or fully inserted. The shutdown banks must be completely withdrawn from the core, prior to withdrawing any control banks during an approach to criticality. The shutdown banks can be fully withdrawn without the core going critical. This provides available negative reactivity for SDM in the event of boration errors. The shutdown banks are then left in this position until the reactor is shut down. They add negative reactivity to shut down the reactor upon receipt of a reactor trip signal.

APPLICABLE
SAFETY ANALYSES

On a reactor trip, all RCCAs (shutdown banks and control banks), except the most reactive RCCA, are assumed to insert into the core. The shutdown banks shall be at or above their insertion limits and available to insert the maximum amount of negative reactivity on a reactor trip signal. The control banks may be partially inserted in the core, as allowed by LCO 3.1.7, "Control Bank Insertion Limits." The shutdown bank and control bank insertion limits are established to ensure that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM (see LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}F$," and LCO 3.1.2, "SHUTDOWN MARGIN (SDM) - $T_{avg} \leq 200^{\circ}F$ ") following a reactor trip from full power. The combination of control banks and shutdown banks (less the most reactive RCCA, which is assumed to be fully withdrawn) is sufficient to take the reactor from full-power conditions at rated temperature to zero power, and to maintain the required SDM at rated no-load temperature (Ref. 3). The shutdown bank insertion limit also limits the reactivity worth of an ejected shutdown rod.

The acceptance criteria for addressing shutdown and control rod bank insertion limits and inoperability or misalignment is that:

- a. There be no violations of:

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

1. specified acceptable fuel design limits, or
 2. RCS pressure boundary integrity; and
- b. The core remains subcritical after accident transients other than a Main Steam Line Break (MSLB).

As such, the shutdown bank insertion limits affect safety analysis involving core reactivity and SDM (Ref. 3).

The shutdown bank insertion limits preserve an initial condition assumed in the safety analyses and, as such, satisfy Criterion 2 of the NRC Policy Statement.

LCO

The shutdown banks must be within their insertion limits any time the reactor is critical or approaching criticality. This ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip.

The shutdown bank insertion limits are defined in the COLR.

APPLICABILITY

The shutdown banks must be within their insertion limits, with the reactor in MODES 1 and 2. The applicability in MODE 2 begins prior to initial control bank withdrawal, during an approach to criticality, and continues throughout MODE 2, until all control bank rods are again fully inserted by reactor trip or by shutdown. This ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip. The shutdown banks do not have to be within their insertion limits in MODE 3, unless an approach to criticality is being made. Refer to LCO 3.1.1 and LCO 3.1.2 for SDM requirements in MODES 3, 4, and 5. LCO 3.9.1, "Boron Concentration," ensures adequate SDM in MODE 6.

The Applicability requirements have been modified by a Note indicating the LCO requirement is suspended during SR 3.1.5.2. This SR verifies the freedom of the rods to move, and requires the shutdown bank to move below the LCO limits, which would normally violate the LCO.

(continued)

BASES (continued)

ACTIONS

A.1.1, A.1.2 and A.2

When one or more shutdown banks is not within insertion limits, 2 hours is allowed to restore the shutdown banks to within the insertion limits. This is necessary because the available SDM may be significantly reduced, with one or more of the shutdown banks not within their insertion limits. Also, verification of SDM or initiation of boration within 1 hour is required, since the SDM in MODES 1 and 2 is ensured by adhering to the control and shutdown bank insertion limits (see LCO 3.1.1). If shutdown banks are not within their insertion limits, then SDM will be verified by performing a reactivity balance calculation, considering the effects listed in SR 3.1.1.1.

The allowed Completion Time of 2 hours provides an acceptable time for evaluating and repairing minor problems without allowing the plant to remain in an unacceptable condition for an extended period of time.

B.1

If the shutdown banks cannot be restored to within their insertion limits within 2 hours, the unit must be brought to a MODE where the LCO is not applicable. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.6.1

Verification that the shutdown banks are within their insertion limits prior to an approach to criticality ensures that when the reactor is critical, or being taken critical, the shutdown banks will be available to shut down the reactor, and the required SDM will be maintained following a reactor trip. This SR and Frequency ensure that the shutdown banks are withdrawn before the control banks are withdrawn during a unit startup.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.1.6.1

Since the shutdown banks are positioned manually by the control room operator, a verification of shutdown bank position at a Frequency of 12 hours, after the reactor is taken critical, is adequate to ensure that they are within their insertion limits. Also, the 12-hour Frequency takes into account other information available in the control room for the purpose of monitoring the status of shutdown rods.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 10, "Reactor Design," General Design Criterion 26, "Reactivity Limits."
 2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
 3. Watts Bar FSAR, Section 15.0, "Accident Analyses."
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(continued)

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.7 Control Bank Insertion Limits

BASES

BACKGROUND

The insertion limits of the shutdown and control rods are initial assumptions in all safety analyses that assume rod insertion upon reactor trip. The insertion limits directly affect core power distributions, assumptions of available ejected rod worth, SDM, and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on control rod insertion have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

The rod cluster control assemblies (RCCAs) are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. There are four control banks and four shutdown banks. See LCO 3.1.5, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.8, "Rod Position Indication," for position indication requirements.

The control bank insertion limits are specified in the COLR. An example is provided for information only in Figure B 3.1.7-1. The control banks are required to be at or above the insertion limit lines.

Figure B 3.1.7-1 also indicates how the control banks are moved in an overlap pattern. Overlap is the distance

(continued)

BASES

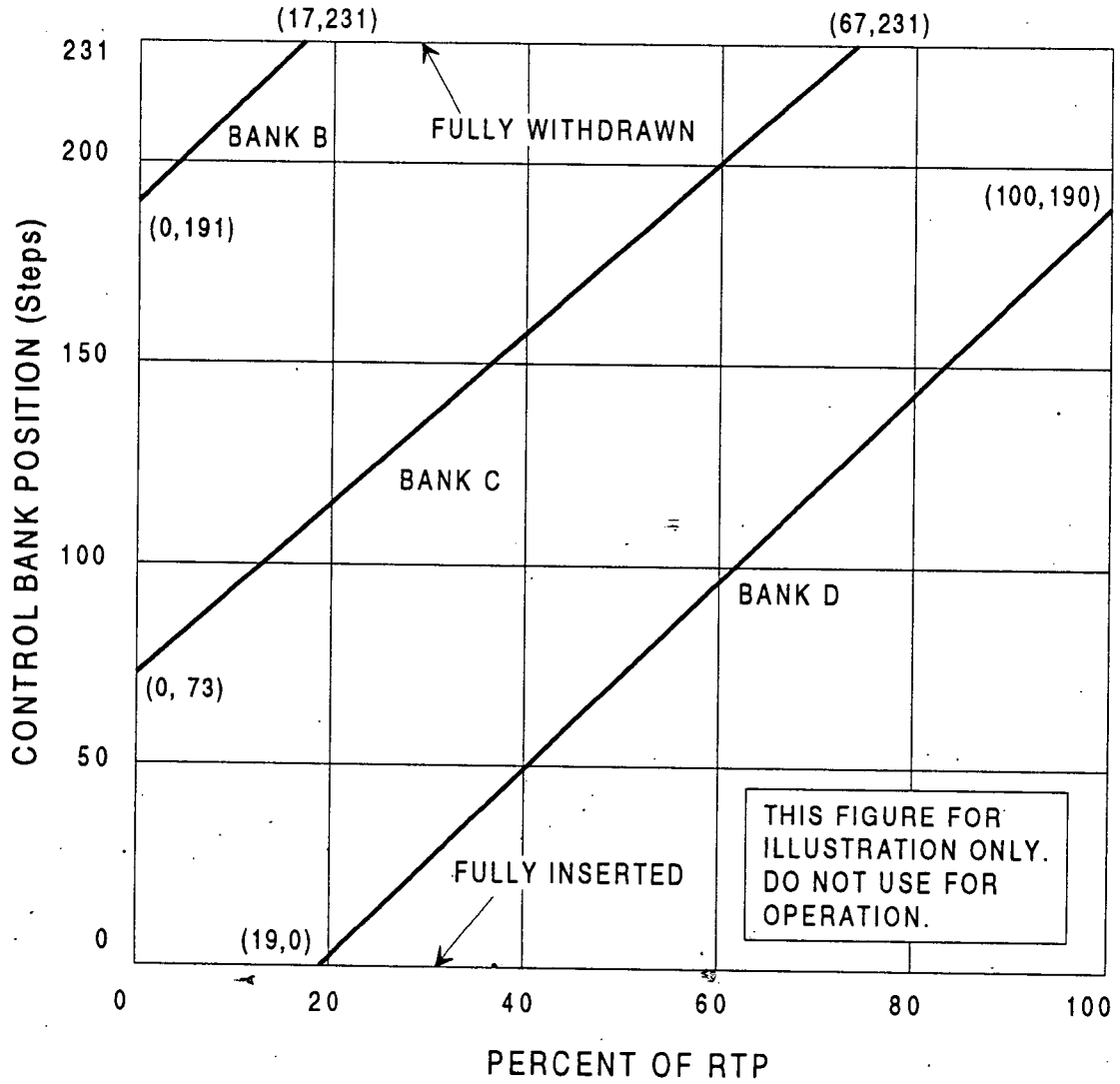


Figure B 3.1.7-1 (page 1 of 1)
Control Bank Insertion vs. Percent RTP

(continued)

BASES

BACKGROUND
(continued)

travelled together by two control banks. The predetermined position of control bank C, at which control bank D will begin to move with bank C on a withdrawal, as an example may be at 128 steps. Therefore, in this example, control bank C overlaps control bank D from 128 steps to the fully withdrawn position for control bank C. The fully withdrawn position and predetermined overlap positions are defined in the COLR.

The control banks are used for precise reactivity control of the reactor. The positions of the control banks are normally controlled automatically by the Rod Control System, but can also be manually controlled. They are capable of adding reactivity very quickly (compared to borating or diluting).

The power density at any point in the core must be limited, so that the fuel design criteria are maintained. Together, LCO 3.1.5, LCO 3.1.6, "Shutdown Bank Insertion Limits," LCO 3.1.7, LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)," and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)," provide limits on control component operation and on monitored process variables, which ensure that the core operates within the fuel design criteria.

The shutdown and control bank insertion and alignment limits, AFD, and QPTR are process variables that together characterize and control the three-dimensional power distribution of the reactor core. Additionally, the control bank insertion limits control the reactivity that could be added in the event of a rod ejection accident, and the shutdown and control bank insertion limits ensure the required SDM is maintained.

Operation within the subject LCO limits will prevent fuel cladding failures that would breach the primary fission-product barrier and release fission products to the reactor coolant in the event of a loss-of-coolant accident (LOCA), loss of flow, ejected rod, or other accident requiring termination by a Reactor Trip System (RTS) trip function.

APPLICABLE
SAFETY ANALYSES

The shutdown and control bank insertion limits, AFD, and QPTR LCOs are required to prevent power distributions that could result in fuel cladding failures in the event of a

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

LOCA, loss of flow, ejected rod, or other accident requiring termination by an RTS trip function.

The acceptance criteria for addressing shutdown and control bank insertion limits and inoperability or misalignment are that:

- a. There be no violations of:
 1. specified acceptable fuel design limits, or
 2. Reactor Coolant System pressure boundary integrity; and
- b. The core remains subcritical after accident transients other than a Main Steam Line Break (MSLB).

As such, the shutdown and control bank insertion limits affect safety analysis involving core reactivity and power distributions (Ref. 3 through 13).

The SDM requirement is ensured by limiting the control and shutdown bank insertion limits so that allowable inserted worth of the RCCAs is such that sufficient reactivity is available in the rods to shut down the reactor to hot zero power with a reactivity margin that assumes the maximum worth RCCA remains fully withdrawn upon trip (Ref. 5, 6, 8 and 11).

Operation at the insertion limits or AFD limits may approach the maximum allowable linear heat generation rate or peaking factor with the allowed QPTR present. Operation at the insertion limit may also indicate the maximum ejected RCCA worth could be equal to the limiting value in fuel cycles that have sufficiently high ejected RCCA worths.

The control and shutdown bank insertion limits ensure that safety analyses assumptions for SDM, ejected rod worth, and power distribution peaking factors are preserved (Ref. 3 through 13).

The insertion limits satisfy Criterion 2 of the NRC Policy Statement, in that they are initial conditions assumed in the safety analysis.

(continued)

BASES (continued)

LCO The limits on control banks sequence, overlap, and physical insertion, as defined in the COLR, must be maintained because they serve the function of preserving power distribution, ensuring that the SDM is maintained, ensuring that ejected rod worth is maintained, and ensuring adequate negative reactivity insertion is available on trip. The overlap between control banks provides more uniform rates of reactivity insertion and withdrawal and is imposed to maintain acceptable power peaking during control bank motion.

APPLICABILITY The control bank sequence, overlap, and physical insertion limits shall be maintained with the reactor in MODES 1 and 2 with $k_{eff} \geq 1.0$. These limits must be maintained, since they preserve the assumed power distribution, ejected rod worth, SDM, and reactivity rate insertion assumptions. Applicability in MODES 3, 4, and 5 is not required, since neither the power distribution nor ejected rod worth assumptions would be exceeded in these MODES.

The applicability requirements have been modified by a Note indicating the LCO requirements are suspended during the performance of SR 3.1.5.2. This SR verifies the freedom of the rods to move, and requires the control bank to move below the LCO limits, which would violate the LCO.

ACTIONS A.1.1, A.1.2, A.2, B.1.1, B.1.2, and B.2

When the control banks are outside the acceptable insertion limits, they must be restored to within those limits. This restoration can occur in two ways:

- a. Reducing power to be consistent with rod position; or
- b. Moving rods to be consistent with power.

Also, verification of SDM or initiation of boration to regain SDM is required within 1 hour, since the SDM in MODES 1 and 2 normally ensured by adhering to the control

(continued)

BASES

ACTIONS

A.1.1, A.1.2, A.2, B.1.1, B.1.2, and B.2 (continued)

and shutdown bank insertion limits (see LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}\text{F}$ ") has been upset. If control banks are not within their insertion limits, then SDM will be verified by performing a reactivity balance calculation, considering the effects listed in SR 3.1.1.1.

Similarly, if the control banks are found to be out of sequence or in the wrong overlap configuration, they must be restored to meet the limits.

Operation beyond the LCO limits is allowed for a short time period in order to take conservative action because the simultaneous occurrence of either a LOCA, loss of flow accident, ejected rod accident, or other accident during this short time period, together with an inadequate power distribution or reactivity capability, has an acceptably low probability.

The allowed Completion Time of 2 hours for restoring the banks to within the insertion limits provides an acceptable time for evaluating and repairing minor problems without allowing the plant to remain in an unacceptable condition for an extended period of time.

C.1

If Required Actions A.1 and A.2, or B.1 and B.2 cannot be completed within the associated Completion Times, the plant must be brought to MODE 3, where the LCO is not applicable. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.7.1

This Surveillance is required to ensure that the reactor does not achieve criticality with the control banks below their insertion limits.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.1.7.1 (continued)

The estimated critical position (ECP) depends upon a number of factors, one of which is xenon concentration. If the ECP was calculated long before criticality, xenon concentration could change to make the ECP substantially in error. Conversely, determining the ECP immediately before criticality could be an unnecessary burden. There are a number of unit parameters requiring operator attention at that point. Performing the ECP calculation within 4 hours prior to criticality avoids a large error from changes in xenon concentration, but allows the operator some flexibility to schedule the ECP calculation with other startup activities.

SR 3.1.7.2

With an OPERABLE bank insertion limit monitor, verification of the control bank insertion limits at a Frequency of 12 hours is sufficient to ensure OPERABILITY of the bank insertion limit monitor and to detect control banks that may be approaching the insertion limits since, normally, very little rod motion occurs in 12 hours. If the insertion limit monitor becomes inoperable, verification of the control bank position at a Frequency of 4 hours is sufficient to detect control banks that may be approaching the insertion limits.

SR 3.1.7.3

When control banks are maintained within their insertion limits as checked by SR 3.1.7.2 above, it is unlikely that their sequence and overlap will not be in accordance with requirements provided in the COLR. A Frequency of 12 hours is consistent with the insertion limit check above in SR 3.1.7.2.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 10, "Reactor Design," General Design Criterion 26, "Reactivity Limits."

(continued)

BASES

REFERENCES
(continued)

2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
 3. Watts Bar FSAR, Section 15.2.1, "Uncontrolled Rod Cluster Control Assembly Bank Withdrawal Form a Subcritical Condition."
 4. Watts Bar FSAR, Section 15.2.2, "Uncontrolled Rod Cluster Control Assembly Bank Withdrawal At Power."
 5. Watts Bar FSAR, Section 15.2.3, "Rod Cluster Control Assembly Misalignment."
 6. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."
 7. Watts Bar FSAR, Section 15.2.5, "Partial Loss of Forced Reactor Coolant Flow."
 8. Watts Bar FSAR, Section 15.2.13, "Accidental Depressurization of the Main Steam System."
 9. Watts Bar FSAR, Section 15.3.4, "Complete Loss of Forced Reactor Coolant Flow."
 10. Watts Bar FSAR, Section 15.3.6, "Single Rod Cluster Control Assembly Withdrawal At Full Power."
 11. Watts Bar FSAR, Section 15.4.2.1, "Major Rupture of Main Steam Line."
 12. Watts Bar FSAR, Section 15.4.4, "Single Reactor Coolant Pump Locked Rotor."
 13. Watts Bar FSAR, Section 15.4.6, "Rupture of a Control Rod Drive Mechanism Housing (Rod Cluster Control Assembly Ejection)."
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.8 Rod Position Indication

BASES

BACKGROUND

According to GDC 13 (Ref. 1), instrumentation to monitor variables and systems over their operating ranges during normal operation, anticipated operational occurrences, and accident conditions must be OPERABLE. LCO 3.1.8 is required to ensure OPERABILITY of the control rod position indicators to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits.

The OPERABILITY, including position indication, of the shutdown and control rods are initial assumptions in all safety analyses that assume rod insertion upon reactor trip. Maximum rod misalignment is an initial assumption in the safety analysis that directly affects core power distributions and assumptions of available SDM. Rod position indication is required to assess OPERABILITY and misalignment.

Mechanical or electrical failures may cause a control rod to become inoperable or to become misaligned from its group. Control rod inoperability or misalignment may cause increased power peaking, due to the asymmetric reactivity distribution and a reduction in the total available rod worth for reactor shutdown. Therefore, control rod alignment and OPERABILITY are related to core operation in design power peaking limits and the core design requirement of a minimum SDM.

Limits on control rod alignment and OPERABILITY have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

Rod cluster control assemblies (RCCAs), or rods, are moved out of the core (up or withdrawn) or into the core (down or inserted) by their control rod drive mechanisms. The RCCAs are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control.

(continued)

BASES

BACKGROUND
(continued)

The axial position of shutdown rods and control rods are determined by two separate and independent systems: the Bank Demand Position Indication System (commonly called group step counters) and the Analog Rod Position Indication (ARPI) System.

The Bank Demand Position Indication System counts the pulses from the Rod Control System that move the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Bank Demand Position Indication System is considered highly precise (± 1 step or $\pm 5/8$ inch). If a rod does not move one step for each demand pulse, the step counter will still count the pulse and incorrectly reflect the position of the rod.

The ARPI System provides an accurate indication of actual control rod position, but at a lower precision than the step counters. This system is based on inductive analog signals from a series of coils spaced along a hollow tube with a center-to-center distance of 3.75 inches, which is 6 steps. The normal indication accuracy of the ARPI System is ± 6 steps (± 3.75 inches), and the maximum uncertainty is ± 12 steps (± 7.5 inches). With an indicated deviation of 12 steps between the group step counter and ARPI, the maximum deviation between actual rod position and the demand position could be 24 steps, or 15 inches.

APPLICABLE
SAFETY ANALYSES

Control and shutdown rod position accuracy is essential during power operation. Power peaking, ejected rod worth, or SDM limits may be violated in the event of a Design Basis Accident (Ref. 2 through 12), with control or shutdown rods operating outside their limits undetected. Therefore, the acceptance criteria for rod position indication is that rod positions must be known with sufficient accuracy in order to verify the core is operating within the group sequence, overlap, design peaking limits, ejected rod worth, and with minimum SDM (LCO 3.1.6, "Shutdown Bank Insertion Limits," and LCO 3.1.7, "Control Bank Insertion Limits"). The rod

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

positions must also be known in order to verify the alignment limits are preserved (LCO 3.1.5, "Rod Group Alignment Limits"). Control rod positions are continuously monitored to provide operators with information that ensures the plant is operating within the bounds of the accident analysis assumptions.

The control rod position indicator channels satisfy Criterion 2 of the NRC Policy Statement. The control rod position indicators monitor control rod position, which is an initial condition of the accident.

LCO

LCO 3.1.8 specifies that the ARPI System and the Bank Demand Position Indication System be OPERABLE for all control rods. For the control rod position indicators to be OPERABLE requires meeting the SR of the LCO and the following:

- a. The ARPI System has passed a CHANNEL FUNCTIONAL CHECK within the prescribed interval;
- b. For the ARPI System there are no failed coils; and
- c. The Bank Demand Indication System has been calibrated either in the fully inserted position or to the ARPI System.

The agreement between the Bank Demand Position Indication System and the ARPI System is within the limit, indicating that the Bank Demand Position Indication System is adequately calibrated for measurement of control rod bank position.

A deviation of less than the allowable limit, given in the COLR, in position indication for a single control rod, ensures high confidence that the position uncertainty of the corresponding control rod group is within the assumed values used in the analysis (that specified control rod group insertion limits).

These requirements ensure that control rod position indication during power operation and PHYSICS TESTS is accurate, and that design assumptions are not challenged. OPERABILITY of the position indicator channels ensures that

(continued)

BASES

LCO
(continued) inoperable, misaligned, or mispositioned control rods can be detected. Therefore, power peaking, ejected rod worth, and SDM can be controlled within acceptable limits.

APPLICABILITY The requirements on the ARPI and step counters are only applicable in MODES 1 and 2 (consistent with LCO 3.1.5, LCO 3.1.6, and LCO 3.1.7), because these are the only MODES in which power is generated, and the OPERABILITY and alignment of rods have the potential to affect the safety of the plant. In the shutdown MODES, the OPERABILITY of the shutdown and control banks has the potential to affect the required SDM, but this effect can be compensated for by an increase in the boron concentration of the Reactor Coolant System.

ACTIONS The Actions table is modified by a NOTE indicating that a separate Condition entry is allowed for each inoperable rod position indicator per group and each demand position indicator per bank. This is acceptable because the Required Actions for each Condition provide appropriate compensatory actions for each inoperable position indicator.

A.1

When one ARPI channel per group fails, the position of the rod can still be determined by use of the incore movable detectors. Based on experience, normal power operation does not require excessive movement of banks. If a bank has been significantly moved, the Required Action of B.1 or B.2 below is required. Therefore, verification of RCCA position within the Completion Time of 8 hours is adequate for allowing continued full-power operation, since the probability of simultaneously having a rod significantly out of position and an event sensitive to that rod position is small.

(continued)

BASES

ACTIONS
(continued)

A.2

Reduction of THERMAL POWER to $\leq 50\%$ RTP puts the core into a condition where rod position is not significantly affecting core peaking factors (Ref. 13).

The allowed Completion Time of 8 hours is reasonable, based on operating experience, for reducing power to $\leq 50\%$ RTP from full-power conditions without challenging plant systems and allowing for rod position determination by Required Action A.1 above.

B.1 and B.2

These Required Actions clarify that when one or more rods with inoperable position indicators have been moved in excess of 24 steps in one direction, since the position was last determined, the Required Actions of A.1 and A.2 are still appropriate but must be initiated promptly under Required Action B.1 to begin verifying that these rods are still properly positioned, relative to their group positions.

If, within 8 hours, the rod positions have not been determined, THERMAL POWER must be reduced to $\leq 50\%$ RTP to avoid undesirable power distributions that could result from continued operation at $> 50\%$ RTP, if one or more rods are misaligned by more than 24 steps. The allowed Completion Time of 8 hours provides an acceptable period of time to verify the rod positions.

C.1.1 and C.1.2

With one demand position indicator per bank inoperable, the rod positions can be determined by the ARPI System. Since normal power operation does not require excessive movement of rods, verification by administrative means that the rod position indicators are OPERABLE and the most withdrawn rod and the least withdrawn rod are ≤ 12 steps apart within the allowed Completion Time of once every 8 hours is adequate.

(continued)

BASES

ACTIONS
(continued)

C.2

Reduction of THERMAL POWER to $\leq 50\%$ RTP puts the core into a condition where rod position is not significantly affecting core peaking factor limits (Ref. 13). The allowed Completion Time of 8 hours provides an acceptable period of time to verify the rod positions per Required Actions C.1.1 and C.1.2 or reduce power to $\leq 50\%$ RTP.

D.1

If the Required Actions cannot be completed within the associated Completion Time, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The allowed Completion Time is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.8.1

Verification that the ARPI agrees with the demand position within 12 steps ensures that the ARPI is operating correctly.

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 unnecessary plant transients if the SR were performed with the reactor at power. Operating experience has shown these components virtually always pass the SR when performed at a Frequency of once every 18 months. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 13, "Instrumentation and Control."
2. Watts Bar FSAR, Section 15.2.1, "Uncontrolled Rod Cluster Control Assembly Bank Withdrawal From a Subcritical Condition."

(continued)

BASES

REFERENCES
(continued)

3. Watts Bar FSAR, Section 15.2.2, "Uncontrolled Rod Cluster Control Assembly Bank Withdrawal At Power."
 4. Watts Bar FSAR, Section 15.2.3, "Rod Cluster Control Assembly Misalignment."
 5. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."
 6. Watts Bar FSAR, Section 15.2.5, "Partial Loss of Forced Reactor Coolant Flow."
 7. Watts Bar FSAR, Section 15.2.13, "Accidental Depressurization of the Main Steam System."
 8. Watts Bar FSAR, Section 15.3.4, "Complete Loss of Forced Reactor Coolant Flow."
 9. Watts Bar FSAR, Section 15.3.6, "Single Rod Cluster Control Assembly Withdrawal At Full Power."
 10. Watts Bar FSAR, Section 15.4.2.1, "Major Rupture of Main Steam Line."
 11. Watts Bar FSAR, Section 15.4.4, "Single Reactor Coolant Pump Locked Rotor."
 12. Watts Bar FSAR, Section 15.4.6, "Rupture of a Control Rod Drive Mechanism Housing (Rod Cluster Control Assembly Ejection)."
 13. Watts Bar FSAR, Section 4.3, "Nuclear Design."
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.9 PHYSICS TESTS Exceptions - MODE 1

BASES

BACKGROUND

The primary purpose of the MODE 1 PHYSICS TESTS exceptions is to permit relaxations of existing LCOs to allow the performance of instrumentation calibration tests and special PHYSICS TESTS. The exceptions to LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)," and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)" are most often appropriate for xenon stability tests. The exceptions to LCO 3.1.5, "Rod Group Alignment Limits"; LCO 3.1.6, "Shutdown Bank Insertion Limit"; and LCO 3.1.7, "Control Bank Insertion Limits," may be required in the event that it is necessary or desirable to do special PHYSICS TESTS involving abnormal rod or bank configurations.

Section XI of 10 CFR 50, Appendix B (Ref. 1), requires that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service. All functions necessary to ensure that the specified design conditions are not exceeded during normal operation and anticipated operational occurrences must be tested. This testing is an integral part of the design, construction, and operation of the plant. Requirements for notification of the NRC, for the purpose of conducting tests and experiments, are specified in 10 CFR 50.59 (Ref. 2).

The key objectives of a test program are to (Ref. 3):

- a. Ensure that the facility has been adequately designed;
- b. Validate the analytical models used in the design and analysis;
- c. Verify the assumptions used to predict unit response;
- d. Ensure that installation of equipment at the facility has been accomplished, in accordance with the design; and
- e. Verify that the operating and emergency procedures are adequate.

To accomplish these objectives, testing is performed prior to initial criticality; during startup, low power, power

(continued)

BASES

BACKGROUND
(continued)

ascension, and at-power operation; and after each refueling. The PHYSICS TESTS requirements for reload fuel cycles ensure that the operating characteristics of the core are consistent with the design predictions, and that the core can be operated as designed (Ref. 4).

PHYSICS TESTS procedures are written and approved, in accordance with established formats. The procedures include all information necessary to permit a detailed execution of the testing required to ensure that the design intent is met. PHYSICS TESTS are performed in accordance with these procedures, and test results are approved prior to continued power escalation and long-term power operation.

The PHYSICS TESTS required for reload fuel cycles (Ref. 4) in MODE 1 are listed below:

- a. Neutron Flux Symmetry;
- b. Power Distribution - Intermediate Power;
- c. Power Distribution - Full Power; and
- d. Critical Boron Concentration - Full Power.

The first test can be performed in either MODE 1 or 2, and the last three tests are performed in MODE 1. These and other supplementary tests may be required to calibrate the nuclear instrumentation or to diagnose operational problems. These tests may cause the operating controls and process variables to deviate from their LCO requirements during their performance. The last two tests are performed at $\geq 90\%$ RTP.

- a. The Neutron Flux Symmetry Test measures the degree of azimuthal symmetry of the core neutron flux at as low a power level as practical, depending on the method used. The Flux Distribution Method uses incore flux detectors to measure the azimuthal flux distribution at selected locations with the core at $\leq 30\%$ RTP.
- b. The Power Distribution - Intermediate Power Test measures the power distribution of the reactor core at intermediate power levels between 40% and 75% RTP. This test uses the incore flux detectors to measure core power distribution.

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BASES

BACKGROUND
(continued)

- c. The Power Distribution - Full Power Test measures the power distribution of the reactor core at $\geq 90\%$ RTP using incore flux detectors.
- d. The Critical Boron Concentration - Full Power Test simply measures the critical boron concentration at $> 90\%$ RTP, with all rods fully withdrawn, the lead control bank being at or near its fully withdrawn position, and with the core at equilibrium xenon conditions.

For initial startups, it may be necessary to perform special PHYSICS TESTS involving abnormal rod or bank configurations that exceed the limits specified in the relevant LCO.

APPLICABLE
SAFETY ANALYSES

The fuel is protected by an LCO, which preserves the initial conditions of the core assumed during the safety analyses. The methods for development of the LCO, which are superseded by this LCO, are described in the Westinghouse Reload Safety Evaluation Methodology Report (Ref. 5). The above-mentioned PHYSICS TESTS, and other tests that may be required to calibrate nuclear instrumentation or to diagnose operational problems, may require the operating controls or process variables to deviate from their LCO limitations.

Reference 6 defines requirements for initial testing of the facility, including PHYSICS TESTS. Table 14.2-2 (Ref. 6) summarizes the zero, low power, and power tests. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). Although these PHYSICS TESTS are generally accomplished within the limits for all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. When one or more of the requirements specified in:

- LCO 3.1.5, "Rod Group Alignment Limits";
- LCO 3.1.6, "Shutdown Bank Insertion Limits";
- LCO 3.1.7, "Control Bank Insertion Limits";

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)"; or
LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)"

are suspended for PHYSICS TESTS, the fuel design criteria are preserved as long as the requirements of LCO 3.2.1, "Heat Flux Hot Channel Factor ($F_0(Z)$)," and LCO 3.2.2, "Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)," are satisfied, power level is maintained $\leq 85\%$ RTP, and SDM is $\geq 1.6\% \Delta k/k$. Therefore, LCO 3.1.9 requires surveillance of the hot channel factors and SDM to verify that their limits are not being exceeded.

PHYSICS TESTS include measurements of core nuclear parameters or the exercise of control components that affect process variables. Among the process variables involved are AFD and QPTR, which represent initial conditions of the unit safety analyses. Also involved are the movable control components (control and shutdown rods), which are required to shut down the reactor. The limits for these variables are specified for each fuel cycle in the COLR.

PHYSICS TESTS meet the criteria for inclusion in the Technical Specifications, since the component and process variable LCOs suspended during PHYSICS TESTS meet Criteria 1, 2, and 3 of the NRC Policy Statement.

Reference 7 allows special test exceptions to be included as part of the LCO that they affect. However, it was decided to retain this special test exception as a separate LCO because it was less cumbersome and provided additional clarity.

LCO

This LCO allows selected control rods and shutdown rods to be positioned outside their specified alignment limits and insertion limits to conduct PHYSICS TESTS in MODE 1, to verify certain core physics parameters. The power level is limited to $\leq 85\%$ RTP and the power range neutron flux trip setpoint is set at 10% RTP above the PHYSICS TESTS power level with a maximum setting of 90% RTP. Violation of LCO 3.1.5, LCO 3.1.6, LCO 3.1.7, LCO 3.2.3, or LCO 3.2.4, during the performance of PHYSICS TESTS does not pose any threat to the integrity of the fuel as long as the

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BASES

LCO
(continued)

requirements of LCO 3.2.1 and LCO 3.2.2, are satisfied, and provided:

- a. THERMAL POWER is maintained $\leq 85\%$ RTP;
- b. Power Range Neutron Flux-High trip setpoints are $\leq 10\%$ RTP above the THERMAL POWER at which the test is performed, with a maximum setting of 90% RTP; and
- c. SDM is $\geq 1.6\% \Delta k/k$.

Operation with THERMAL POWER $\leq 85\%$ RTP during PHYSICS TESTS provides an acceptable thermal margin when one or more of the applicable LCOs is out of specification. The Power Range Neutron Flux-High trip setpoint is reduced so that a similar margin exists between the steady-state condition and the trip point that exists during normal operation at RTP.

APPLICABILITY

This LCO is applicable in MODE 1 when performing PHYSICS TESTS. The applicable PHYSICS TESTS are performed at $\leq 85\%$ RTP. Other PHYSICS TESTS are performed at full power but do not require violation of any existing LCO, and therefore do not require a PHYSICS TESTS exception. The PHYSICS TESTS performed in MODE 2 are covered by LCO 3.1.10, "PHYSICS TESTS Exceptions - MODE 2."

ACTIONS

A.1 and A.2

If the SDM requirement is not met, boration must be initiated promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. The operator should begin boration with the best source available for the plant conditions. Boration will be continued until SDM is within limit.

Suspension of PHYSICS TESTS exceptions requires restoration of each of the applicable LCOs to within specification.

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BASES

ACTIONS
(continued)

B.1 and B.2

When THERMAL POWER is $> 85\%$ RTP, the only acceptable actions are to reduce THERMAL POWER to $\leq 85\%$ RTP or to suspend the PHYSICS TESTS exceptions. With the PHYSICS TESTS exceptions suspended, the PHYSICS TESTS may proceed if all other LCO requirements are met. Fuel integrity may be challenged with control rods or shutdown rods misaligned and THERMAL POWER $> 85\%$ RTP. The allowed Completion Time of 1 hour is reasonable, based on operating experience, for completing the Required Actions in an orderly manner and without challenging plant systems. This Completion Time is also consistent with the Required Actions of the LCOs that are suspended by the PHYSICS TESTS.

C.1 and C.2

When the Power Range Neutron Flux-High trip setpoints are $> 10\%$ RTP above the PHYSICS TESTS power level or $> 90\%$ RTP, the Reactor Trip System (RTS) may not provide the required degree of core protection if the trip setpoint is greater than the specified value.

The only acceptable actions are to restore the trip setpoint to the allowed value or to suspend the performance of the PHYSICS TESTS exceptions. The Completion Time of 1 hour is based on the practical amount of time it may take to restore the Neutron Flux-High trip setpoints to the correct value, consistent with operating plant safety. This Completion Time is consistent with the Required Actions of the LCOs that are suspended by the PHYSICS TESTS.

SURVEILLANCE
REQUIREMENTS

SR 3.1.9.1

Verification that the THERMAL POWER level is $\leq 85\%$ RTP will ensure that the required core protection is provided during the performance of PHYSICS TESTS. Control of the reactor power level is a vital parameter and is closely monitored during the performance of PHYSICS TESTS. A Frequency of 1 hour is sufficient for ensuring that the power level does not exceed the limit.

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BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.1.9.2

Verification of the Power Range Neutron Flux-High trip setpoints within 8 hours prior to initiation of the PHYSICS TESTS will ensure that the RTS is properly set to perform PHYSICS TESTS.

SR 3.1.9.3

The performance of SR 3.2.1.1 and SR 3.2.2.1 measures the core $F_0(Z)$ and the $F_{\Delta H}$, respectively. If the requirements of these LCOs are met, the core has adequate protection from exceeding its design limits, while other LCO requirements are suspended. The Frequency of 12 hours is based on operating experience and the practical amount of time that it may take to run an incore flux map and calculate the hot channel factors.

SR 3.1.9.4

The SDM is verified by performing a reactivity balance calculation, considering the following reactivity effects:

- a. Reactor Coolant System (RCS) boron concentration;
- b. Control bank position;
- c. RCS average temperature;
- d. Fuel burnup based on gross thermal energy generation;
- e. Xenon concentration; and
- f. Design isothermal temperature coefficient (ITC).

Using the ITC accounts for Doppler reactivity in the calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as the RCS.

The Frequency of 24 hours is based on the generally slow change in required boron concentration and on the low probability of an accident without the required SDM.

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BASES (continued)

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," 1988.
 2. Title 10, Code of Federal Regulations, Part 50.59, "Changes, Tests, and Experiments."
 3. Regulatory Guide 1.68, Revision 2, "Initial Test Programs for Water-Cooled Nuclear Power Plants," U.S. Nuclear Regulatory Commission, August 1978.
 4. ANSI/ANS-19.6.1-1985, "Reload Startup PHYSICS TESTS for Pressurized Water Reactors," American National Standards Institute, December 13, 1985.
 5. WCAP-9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology Report," July 1985.
 6. Watts Bar FSAR, Section 14.2, "Test Program."
 7. WCAP-11618, "MERITS Program - Phase II, Task 5, Criteria Application," dated November 1987, including Addendum 1, April 1989.
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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.10 PHYSICS TESTS Exceptions - MODE 2

BASES

BACKGROUND

The primary purpose of the MODE 2 PHYSICS TESTS exceptions is to permit relaxations of existing LCOs to allow certain PHYSICS TESTS to be performed.

Section XI of 10 CFR 50, Appendix B (Ref. 1), requires that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service. All functions necessary to ensure that the specified design conditions are not exceeded during normal operation and anticipated operational occurrences must be tested. This testing is an integral part of the design, construction, and operation of the plant. Requirements for notification of the NRC, for the purpose of conducting tests and experiments, are specified in 10 CFR 50.59 (Ref. 2).

The key objectives of a test program are to (Ref. 3):

- a. Ensure that the facility has been adequately designed;
- b. Validate the analytical models used in the design and analysis;
- c. Verify the assumptions used to predict unit response;
- d. Ensure that installation of equipment in the facility has been accomplished, in accordance with the design; and
- e. Verify that the operating and emergency procedures are adequate.

To accomplish these objectives, testing is performed prior to initial criticality, during startup, during low power operations, during power ascension, at high power, and after each refueling. The PHYSICS TESTS requirements for reload fuel cycles ensure that the operating characteristics of the core are consistent with the design predictions and that the core can be operated as designed (Ref. 4).

PHYSICS TESTS procedures are written and approved, in accordance with established formats. The procedures include

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BASES

BACKGROUND
(continued)

all information necessary to permit a detailed execution of the testing required to ensure that the design intent is met. PHYSICS TESTS are performed in accordance with these procedures and test results are approved prior to continued power escalation and long-term power operation.

The PHYSICS TESTS required for reload fuel cycles (Ref. 4) in MODE 2 are listed below:

- a. Critical Boron Concentration - Control Rods Withdrawn;
- b. Critical Boron Concentration - Control Rods Inserted;
- c. Control Rod Group Worth;
- d. Isothermal Temperature Coefficient (ITC); and
- e. Neutron Flux Symmetry.

The first four tests are performed in MODE 2, and the last test can be performed in either MODE 1 or 2. These and other supplementary tests may be required to calibrate the nuclear instrumentation or to diagnose operational problems. These tests may cause the operating controls and process variables to deviate from their LCO requirements during their performance.

- a. The Critical Boron Concentration Control Rods Withdrawn Test measures the critical boron concentration at hot zero power (HZP). With all rods out, the lead control bank is at or near its fully withdrawn position. HZP is where the core is critical ($k_{eff} = 1.0$), and the Reactor Coolant System (RCS) is at design temperature and pressure for zero power. Performance of this test should not violate any of the referenced LCOs.
- b. The Critical Boron Concentration Control Rods Inserted Test measures the critical boron concentration at HZP, with a bank having a worth of at least 1% $\Delta k/k$ when fully inserted into the core. This test is used to measure the boron reactivity coefficient. With the core at HZP and all banks fully withdrawn, the boron concentration of the reactor coolant is gradually lowered in a continuous manner. The selected bank is

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BASES

BACKGROUND
(continued)

then inserted to make up for the decreasing boron concentration until the selected bank has been moved over its entire range of travel. The reactivity resulting from each incremental bank movement is measured with a reactivity computer. The difference between the measured critical boron concentration with all rods fully withdrawn and with the bank inserted is determined. The boron reactivity coefficient is determined by dividing the measured bank worth by the measured boron concentration difference. Performance of this test could violate LCO 3.1.5, "Rod Group Alignment Limits"; LCO 3.1.6, "Shutdown Bank Insertion Limit"; or LCO 3.1.7, "Control Bank Insertion Limits."

- c. The Control Rod Group Worth Test is used to measure the reactivity worth of selected control banks. This test is performed at HZP and has three alternative methods of performance. The first method, the Boron Exchange Method, varies the reactor coolant boron concentration and moves the selected control bank in response to the changing boron concentration. The reactivity changes are measured with a reactivity computer. This sequence is repeated for the remaining control banks. The second method, the Rod Swap Method, measures the worth of a predetermined reference bank using the Boron Exchange Method above. The reference bank is then nearly fully inserted into the core. The selected bank is then inserted into the core as the reference bank is withdrawn. The HZP critical conditions are then determined with the selected bank fully inserted into the core. The worth of the selected bank is inferred, based on the position of the reference bank with respect to the selected bank. This sequence is repeated as necessary for the remaining control banks. The third method, the Boron Endpoint Method, moves the selected control bank over its entire length of travel and then varies the reactor coolant boron concentration to achieve HZP criticality again. The difference in boron concentration is the worth of the selected control bank. This sequence is repeated for the remaining control banks. Performance of this test could violate LCO 3.1.5, LCO 3.1.6, or LCO 3.1.7.
- d. The ITC Test measures the ITC of the reactor. This test is performed at HZP and has two methods of

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BASES

BACKGROUND
(continued)

performance. The first method, the Slope Method, varies RCS temperature in a slow and continuous manner. The reactivity change is measured with a reactivity computer as a function of the temperature change. The ITC is the slope of the reactivity versus the temperature plot. The test is repeated by reversing the direction of the temperature change, and the final ITC is the average of the two calculated ITCs. The second method, the Endpoint Method, changes the RCS temperature and measures the reactivity at the beginning and end of the temperature change. The ITC is the total reactivity change divided by the total temperature change. The test is repeated by reversing the direction of the temperature change, and the final ITC is the average of the two calculated ITCs. Performance of this test could violate LCO 3.4.2, "RCS Minimum Temperature for Criticality."

- e. The Flux Symmetry Test measures the degree of azimuthal symmetry of the neutron flux at as low a power level as practical, depending on the test method employed. This test can be performed at HZP (Control Rod Worth Symmetry Method) or at $\leq 30\%$ RTP (Flux Distribution Method). The Control Rod Worth Symmetry Method inserts a control bank, which can then be withdrawn to compensate for the insertion of a single control rod from a symmetric set. The symmetric rods of each set are then tested to evaluate the symmetry of the control rod worth and neutron flux (power distribution). A reactivity computer is used to measure the control rod worths. Performance of this test could violate LCO 3.1.5, LCO 3.1.6, or LCO 3.1.7. The Flux Distribution Method uses the incore flux detectors to measure the azimuthal flux distribution at selected locations with the core at $\leq 30\%$ RTP.

APPLICABLE
SAFETY ANALYSES

The fuel is protected by LCOs that preserve the initial conditions of the core assumed during the safety analyses. The methods for development of the LCOs that are excepted by this LCO are described in the Westinghouse Reload Safety Evaluation Methodology Report (Ref. 5). The above-mentioned PHYSICS TESTS, and other tests that may be required to calibrate nuclear instrumentation or to diagnose operational

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

problems, may require the operating control or process variables to deviate from their LCO limitations.

The COLR defines requirements for initial testing of the facility, including PHYSICS TESTS. Table 14.2-2 summarize the zero, low power, and power tests. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). Although these PHYSICS TESTS are generally accomplished within the limits for all LCOs, conditions may occur when one or more LCOs must be suspended to make completion of PHYSICS TESTS possible or practical. This is acceptable as long as the fuel design criteria are not violated. When one or more of the requirements specified in LCO 3.1.4, "Moderator Temperature Coefficient (MTC)," LCO 3.1.5, LCO 3.1.6, LCO 3.1.7, and LCO 3.4.2 are suspended for PHYSICS TESTS, the fuel design criteria are preserved as long as the power level is limited to $\leq 5\%$ RTP, the reactor coolant temperature is kept $\geq 541^\circ\text{F}$, and SDM is $\geq 1.6\% \Delta k/k$.

The PHYSICS TESTS include measurement of core nuclear parameters or the exercise of control components that affect process variables. Among the process variables involved are AFD and QPTR, which represent initial conditions of the unit safety analyses. Also involved are the movable control components (control and shutdown rods), which are required to shut down the reactor. The limits for these variables are specified for each fuel cycle in the COLR. PHYSICS TESTS meet the criteria for inclusion in the Technical Specifications, since the components and process variable LCOs suspended during PHYSICS TESTS meet Criteria 1, 2, and 3 of the NRC Policy Statement.

Reference 6 allows special test exceptions (STEs) to be included as part of the LCO that they affect. It was decided, however, to retain this STE as a separate LCO because it was less cumbersome and provided additional clarity.

LCO

This LCO allows the reactor parameters of MTC and minimum temperature for criticality to be outside their specified limits. In addition, it allows selected control and shutdown rods to be positioned outside of their specified alignment and insertion limits. Operation beyond specified

(continued)

BASES

LCO
(continued)

Limits is permitted for the purpose of performing PHYSICS TESTS and poses no threat to fuel integrity, provided the SRs are met.

The requirements of LCO 3.1.4, LCO 3.1.5, LCO 3.1.6, LCO 3.1.7, and LCO 3.4.2 may be suspended during the performance of PHYSICS TESTS provided:

- a. RCS lowest loop average temperature is $\geq 541^{\circ}\text{F}$; and
 - b. SDM is $\geq 1.6\% \Delta k/k$.
-

APPLICABILITY

This LCO is applicable in MODE 2 when performing low power PHYSICS TESTS. The applicable PHYSICS TESTS are performed in MODE 2 at HZP. Other PHYSICS TESTS are performed in MODE 1 and are addressed in LCO 3.1.9, "PHYSICS TESTS Exceptions - MODE 1."

ACTIONS

A.1 and A.2

If the SDM requirement is not met, boration must be initiated promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. The operator should begin boration with the best source available for the plant conditions. Boration will be continued until SDM is within limit.

Suspension of PHYSICS TESTS exceptions requires restoration of each of the applicable LCOs to within specification.

B.1

When THERMAL POWER is $> 5\%$ RTP, the only acceptable action is to open the reactor trip breakers to prevent operation of the reactor beyond its design limits. Immediately opening the reactor trip breakers will shut down the reactor and prevent operation of the reactor outside of its design limits.

(continued)

BASES

ACTIONS
(continued)

C.1 and C.2

When the RCS lowest T_{avg} is $< 541^{\circ}\text{F}$, the appropriate action is to restore T_{avg} to within its specified limit. The allowed Completion Time of 15 minutes provides time for restoring T_{avg} to within limits without allowing the plant to remain in an unacceptable condition for an extended period of time. Operation with the reactor critical and with temperature below 541°F could violate the assumptions for accidents analyzed in the safety analyses. If the Required Actions cannot be completed within the associated Completion Time, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within an additional 15 minutes. The Completion Time of 15 additional minutes is reasonable, based on operating experience, for reaching MODE 3 from full-power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.10.1

The power-range and intermediate-range neutron detectors must be verified to be OPERABLE in MODE 2 by LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation." A CHANNEL OPERATIONAL TEST is performed on each power-range and intermediate-range channel within 12 hours prior to initiation of the PHYSICS TESTS. This will ensure that the RTS is properly aligned to provide the required degree of core protection during the performance of the PHYSICS TESTS. The 12-hour time limit is sufficient to ensure that the instrumentation is OPERABLE shortly before initiating PHYSICS TESTS.

SR 3.1.10.2

Verification that the RCS lowest loop T_{avg} is $\geq 541^{\circ}\text{F}$ will ensure that the unit is not operating in a Condition that could invalidate the safety analyses. Verification of the RCS temperature at a Frequency of 30 minutes during the performance of the PHYSICS TESTS will ensure that the initial conditions of the safety analyses are not violated.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.1.10.3

The SDM is verified by performing a reactivity balance calculation, considering the following reactivity effects:

- a. RCS boron concentration;
- b. Control bank position;
- c. RCS average temperature;
- d. Fuel burnup based on gross thermal energy generation;
- e. Xenon concentration; and
- f. Isothermal temperature coefficient (ITC).

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as the RCS.

The Frequency of 24 hours is based on the generally slow change in required boron concentration and on the low probability of an accident occurring without the required SDM.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."
2. Title 10, Code of Federal Regulations, Part 50.59, "Changes, Tests and Experiments."
3. Regulatory Guide 1.68, Revision 2, "Initial Test Programs for Water-Cooled Nuclear Power Plants," August, 1978.
4. ANSI/ANS-19.6.1-1985, "Reload Startup Physics Tests for Pressurized Water Reactors," American National Standards Institute, December 13, 1985.

(continued)

BASES

- REFERENCES
(continued)
5. WCAP-9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology Report," July 1985.
 6. WCAP-11618, "MERITS Program— Phase II, Task 5, Criteria Application," dated November 1987, including Addendum 1, April 1989.
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Unit 1
WATTS BAR

B 3.1-70

Amendment 0
Draft 08/92

Using the measured three-dimensional power distributions, it is possible to derive a measured value for $F_Q(Z)$. However, because this value represents a steady-state condition, it does not include the variations in the value of $F_Q(Z)$ that are present during nonequilibrium situations, such as load following.

To account for these possible variations, the steady-state value of $F_Q(Z)$ is adjusted by an elevation-dependent factor that accounts for the calculated worst-case transient conditions.

Core monitoring and control under non-steady-state conditions are accomplished by operating the core within the

(continued)

Unit 1
WATTS BAR

B 3.2-1

Amendment 0
Draft 08/92

BASES

BACKGROUND (continued) Limits of the appropriate LCOs, including the limits on AFD, QPTR, and control rod insertion.

APPLICABLE SAFETY ANALYSES

This LCO precludes core power distributions that violate the following fuel design criteria:

- a. During a large-break loss-of-coolant accident (LOCA), the peak cladding temperature must not exceed 2200°F (Ref. 1);
- b. During a loss-of-forced-reactor-coolant-flow accident, there must be at least 95% probability at the 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience a departure from nucleate boiling (DNB) condition;
- c. During an ejected rod accident, the fission energy input to the fuel must not exceed 280 cal/gm (Ref. 2); and
- d. The control rods must be capable of shutting down the reactor with a minimum required SDM with the highest worth control rod stuck fully withdrawn (Ref. 3).

Limits on F_Q(Z) ensure that the value of the initial total peaking factor assumed in the accident analyses remains valid. Other criteria must also be met (e.g., maximum cladding oxidation, maximum hydrogen generation, coolable geometry, and long-term cooling). However, the peak cladding temperature is typically most limiting.

F_Q(Z) limits assumed in the LOCA analysis are typically limiting relative to (i.e., lower than) the F_Q(Z) limit assumed in safety analyses for other postulated accidents. Therefore, this LCO provides conservative limits for other postulated accidents.

F_Q(Z) satisfies Criterion 2 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

The Heat Flux Hot Channel Factor, F_Q(Z), shall be limited by the following relationships:

$$F_Q(Z) \leq \frac{CFQ}{P} K(Z) \quad \text{for } P > 0.5$$

$$F_Q(Z) \leq \frac{CFQ}{0.5} K(Z) \quad \text{for } P \leq 0.5$$

where: CFQ is the F_Q(Z) limit at RTP provided in the COLR,

K(Z) is the normalized F_Q(Z) as a function of core height provided in the COLR, and

$$P = \frac{\text{THERMAL POWER}}{\text{RTP}}$$

For this facility, the actual values of CFQ and K(Z) are given in the COLR; however, CFQ is normally a number on the order of 2.4, and K(Z) is a function that looks like the one provided in Figure B 3.2.1-1.

For Relaxed Axial Offset Control operation, F_Q(Z) is approximated by F_Q^C(Z) and F_Q^W(Z). Thus, both F_Q^C(Z) and F_Q^W(Z) must meet the preceding limits on F_Q(Z).

An F_Q^C(Z) evaluation requires obtaining an incore flux map in MODE 1. From the incore flux map results we obtain the measured value (F_Q^M(Z)) of F_Q(Z). Then,

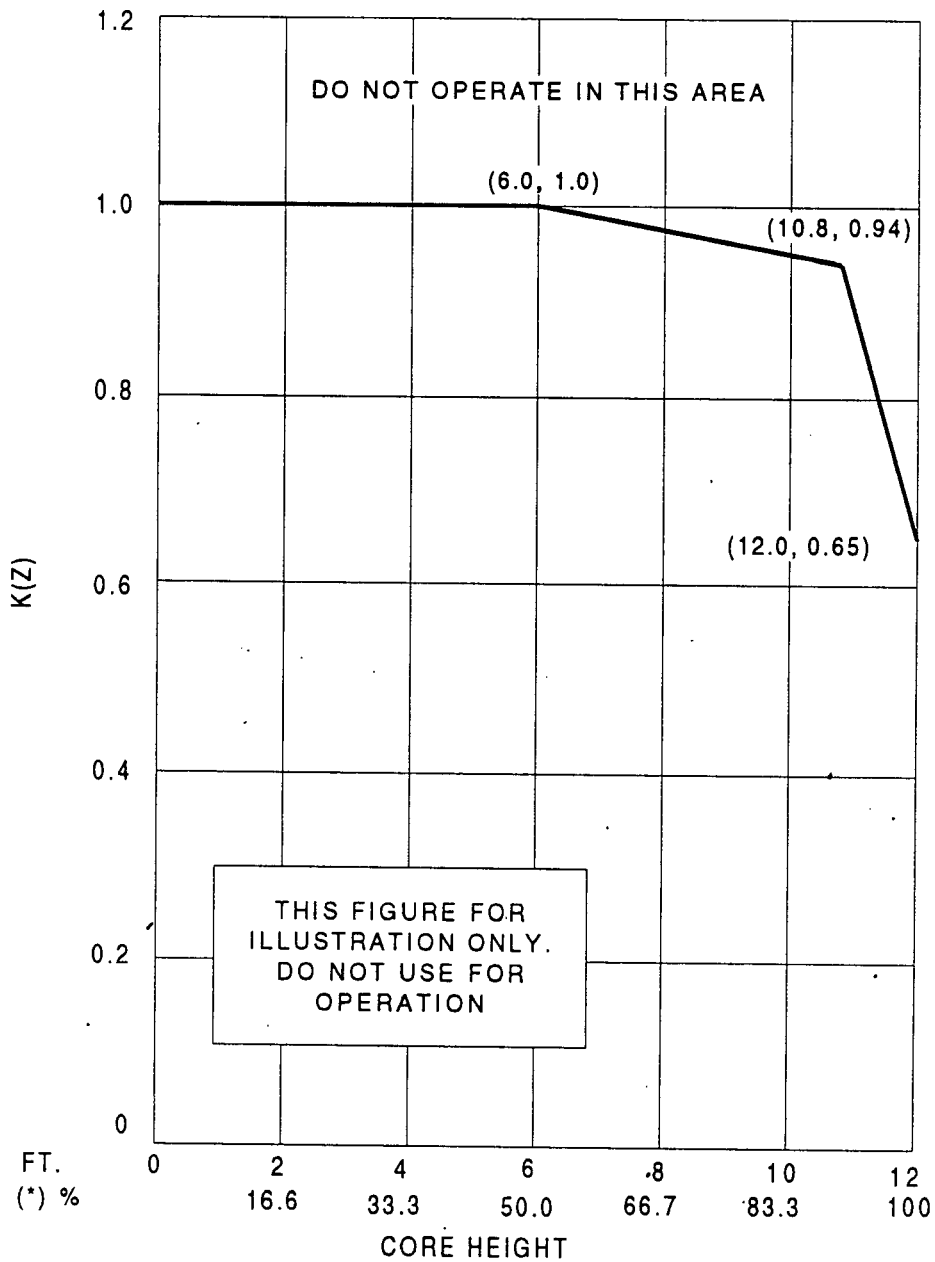
$$F_Q^C(Z) = F_Q^M(Z) [1.0815]$$

where [1.0815] is a factor that accounts for fuel manufacturing tolerances and flux map measurement uncertainty.

F_Q^C(Z) is an excellent approximation for F_Q(Z) when the reactor is at the steady-state power at which the incore flux map was taken.

(continued)

BASES (continued)



*For core height of 12 feet

Figure B 3.2.1-1 (page 1 of 1)
K(Z) - Normalized F_Q(Z) as a Function of Core Height

BASES

LCO
(continued)

The expression for F_Q^W(Z) is:

$$F_Q^W(Z) = F_Q^C(Z) W(Z)$$

where W(Z) is a cycle-dependent function that accounts for power distribution transients encountered during normal operation. W(Z) is included in the COLR.

The F_Q(Z) limits define limiting values for core power peaking that precludes peak cladding temperatures above 2200°F during either a large- or small-break LOCA.

This LCO requires operation within the bounds assumed in the safety analyses. Calculations are performed in the core design process to confirm that the core can be controlled in such a manner during operation that it can stay within the LOCA F_Q(Z) limits. If F_Q(Z) cannot be maintained within the LCO limits, reduction of the core power is required.

Violating the LCO limits for F_Q(Z) produces unacceptable consequences if a design basis event occurs while F_Q(Z) is outside its specified limits.

APPLICABILITY

The F_Q(Z) limits must be maintained in MODE 1 to prevent core power distributions from exceeding the limits assumed in the safety analyses. Applicability in other MODES is not required because there is either insufficient stored energy in the fuel or insufficient energy being transferred to the reactor coolant to require a limit on the distribution of core power.

ACTIONS

A.1

Reducing THERMAL POWER by ≥ 1% RTP for each 1% by which F_Q^C(Z) exceeds its limit maintains an acceptable absolute power density. F_Q^C(Z) is F_Q^M(Z) multiplied by a factor accounting for manufacturing tolerances and measurement uncertainties. F_Q^M(Z) is the measured value of F_Q(Z). The Completion Time of 15 minutes provides an acceptable time to reduce power in an orderly manner and without allowing the plant to remain in an unacceptable condition for an extended period of time.

(continued)

BASES

ACTIONS
(continued)

A.2

A reduction of the Power Range Neutron Flux-High trip setpoints by $\geq 1\%$ for each 1% by which $F_Q^C(Z)$ exceeds its limit is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 8 hours is sufficient considering the small likelihood of a severe transient in this time period and the preceding prompt reduction in THERMAL POWER in accordance with Required Action A.1.

A.3

Reduction in the Overpower ΔT trip setpoints by $\geq 1\%$ for each 1% by which $F_Q^C(Z)$ exceeds its limit is a conservative action for protection against the consequences of severe transients with unanalyzed power distributions. The Completion Time of 72 hours is sufficient considering the small likelihood of a severe transient in this time period and the preceding prompt reduction in THERMAL POWER in accordance with Required Action A.1.

A.4

Verification that $F_Q^C(Z)$ has been restored to within its limit by performing SR 3.2.1.1 prior to increasing THERMAL POWER above the limit imposed by Required Action A.1 ensures that core conditions during operation at higher power levels are consistent with safety analyses assumptions.

B.1

If it is found that the maximum calculated value of $F_Q(Z)$ that can occur during normal maneuvers, $F_Q^W(Z)$, exceeds its specified limits, there exists a potential for $F_Q^C(Z)$ to become excessively high if a normal operational transient occurs. Reducing the AFD by $\geq 1\%$ for each 1% by which $F_Q^W(Z)$ exceeds its limit within the allowed Completion Time of 2 hours restricts the axial flux distribution such that even if a transient occurred, core peaking factors are not exceeded.

(continued)

BASES

ACTIONS
(continued)

C.1

If Required Actions A.1 through A.4 or B.1 are not met within their associated Completion Times, the plant must be placed in a mode or condition in which the LCO requirements are not applicable. This is done by placing the plant in at least MODE 2 within 6 hours.

This allowed Completion Time is reasonable based on operating experience regarding the amount of time it takes to reach MODE 2 from full power operation in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.2.1.1 and SR 3.2.1.2 are modified by a Note. The Note applies during the first power ascension after a refueling. It states that THERMAL POWER may be increased until an equilibrium power level has been achieved at which a power distribution map can be obtained. This allowance is modified, however, by one of the Frequency conditions that requires verification that $F_a^C(Z)$ and $F_a^W(Z)$ are within their specified limits after a power rise of more than 10% RTP over the THERMAL POWER at which they were last verified to be within specified limits. Because $F_a^C(Z)$ and $F_a^W(Z)$ could not have previously been measured in this reload core, there is a second Frequency condition, applicable only for reload cores, that requires determination of these parameters before exceeding 75% RTP. This ensures that some determination of $F_a^C(Z)$ and $F_a^W(Z)$ is made at a lower power level at which adequate margin is available before going to 100% RTP. Also, this frequency condition, together with the frequency condition requiring verification of $F_a^C(Z)$ and $F_a^W(Z)$ following a power increase of more than 10%, ensures that they are verified as soon as RTP (or any other level for extended operation) is achieved. In the absence of these Frequency conditions, it is possible to increase power to RTP and operate for 31 days without verification of $F_a^C(Z)$ and $F_a^W(Z)$. The Frequency condition is not intended to require verification of these parameters after every 10% increase in power level above the last verification. It only requires verification after a power level is achieved for extended operation that is 10% higher than that at which was last measured.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.2.1.1

Verification that $F_Q^C(Z)$ is within its specified limits involves increasing $F_Q^M(Z)$ to allow for manufacturing tolerance and measurement uncertainties in order to obtain $F_Q^C(Z)$. Specifically, $F_Q^M(Z)$ is the measured value of $F_Q(Z)$ obtained from incore flux map results and $F_Q^C(Z) = F_Q^M(Z) [1.0815]$ (Ref. 4). $F_Q^C(Z)$ is then compared to its specified limits.

The limit with which $F_Q^C(Z)$ is compared varies inversely with power and directly with a function called $K(Z)$ provided in the COLR.

Performing this Surveillance in MODE 1 prior to exceeding 75% RTP ensures that the $F_Q^C(Z)$ limit is met when RTP is achieved because Peaking Factors generally decrease as power level is increased.

If THERMAL POWER has been increased by $\geq 10\%$ RTP since the last determination of $F_Q^C(Z)$, another evaluation of this factor is required 12 hours after achieving equilibrium conditions at this higher power level (to ensure that $F_Q^C(Z)$ values are being reduced sufficiently with power increase to stay within the LCO limits).

The Frequency of 31 EFPD is adequate to monitor the change of power distribution with core burnup because such changes are slow and well controlled when the plant is operated in accordance with technical specifications.

SR 3.2.1.2

The nuclear design process includes calculations performed to determine that the core can be operated within the $F_Q(Z)$ limits. Because flux maps are taken in steady-state conditions, the variations in power distribution resulting from normal operational maneuvers are not present in the flux map data. These variations are, however, conservatively calculated by considering a wide range of unit maneuvers in normal operation. The maximum peaking

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.2.1.2 (continued)

factor increase over steady-state values, calculated as a function of core elevation, Z, is called W(Z). Multiplying the measured total peaking factor, F_Q^C(Z), by W(Z) gives the maximum F_Q(Z) calculated to occur in normal operation, F_Q^W(Z).

The limit with which F_Q^W(Z) is compared varies inversely with power and directly with the function K(Z) provided in the COLR.

The W(Z) curve is provided in the COLR for discrete core elevations. Flux map data are typically taken for 30 to 75 core elevations. F_Q^W(Z) evaluations are not applicable for the following axial core regions, measured in percent of core height:

- a. Lower core region, from 0 to 15% inclusive; and
- b. Upper core region, from 85 to 100% inclusive.

The top and bottom 15% of the core are excluded from the evaluation because of the low probability that these regions would be more limiting in the safety analyses and because of the difficulty of making a precise measurement in these regions.

This Surveillance has been modified by a Note that may require that more frequent surveillances be performed. If F_Q^W(Z) is evaluated and found to be within its limit, an evaluation of the expression below is required to account for any increase to F_Q^M(Z) that may occur and cause the F_Q(Z) limit to be exceeded before the next required F_Q(Z) evaluation.

If the two most recent F_Q(Z) evaluations show an increase in the expression

$$\text{maximum over } z \quad \left[\frac{F_Q^C(Z)}{K(Z)} \right],$$

it is required to meet the F_Q(Z) limit with the last F_Q^W(Z) increased by a factor of [1.02], or to evaluate F_Q(Z) more

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.2.1.2 (continued)

frequently, each 7 EFPD. These alternative requirements prevent F_a(Z) from exceeding its limit for any significant period of time without detection.

Performing the Surveillance in MODE 1 prior to exceeding 75% RTP ensures that the F_a(Z) limit is met when RTP is achieved, because peaking factors are generally decreased as power level is increased.

F_a(Z) is verified at power levels $\geq 10\%$ RTP above the THERMAL POWER of its last verification 12 hours after achieving equilibrium conditions to ensure that F_a(Z) is within its limit at higher power levels.

The Surveillance Frequency of 31 EFPD is adequate to monitor the change of power distribution with core burnup. The Surveillance may be done more frequently if required by the results of F_a(Z) evaluations.

The Frequency of 31 EFPD is adequate to monitor the change of power distribution because such a change is sufficiently slow, when the plant is operated in accordance with Technical Specifications, to preclude adverse peaking factors between 31-day surveillances.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
 2. Regulatory Guide 1.77, Rev. 0, "Assumptions Used for Evaluating a Control Rod Ejection Accident for Pressurized water Reactors," May 1974.
 3. Title 10, Code of Federal Regulations, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," GDC 26, "Reactivity Control System Redundancy and Capability."
 4. [WCAP-7308-L-P-A, Evaluation of Nuclear Hot Channel Factor Uncertainties, June 1988.]
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B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.2 Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)

BASES

BACKGROUND

The purpose of this LCO is to establish limits on the power density at any point in the core so that the fuel design criteria are not exceeded and the accident analysis assumptions remain valid. The design limits on local (pellet) and integrated fuel rod peak power density are expressed in terms of hot channel factors. Control of the core power distribution with respect to these factors ensures that local conditions in the fuel rods and coolant channels do not challenge core integrity at any location during either normal operation or a postulated accident analyzed in the safety analyses.

$F_{\Delta H}^N$ is defined as the ratio of the integral of the linear power along the fuel rod with the highest integrated power to the average integrated fuel rod power. Therefore, $F_{\Delta H}^N$ is a measure of the maximum total power produced in a fuel rod.

$F_{\Delta H}^N$ is sensitive to fuel loading patterns, bank insertion, and fuel burnup. $F_{\Delta H}^N$ typically increases with control bank insertion and typically decreases with fuel burnup.

$F_{\Delta H}^N$ is not directly measurable but is inferred from a power distribution map obtained with the movable incore detector system. Specifically, the results of the three-dimensional power distribution map are analyzed by a computer to determine $F_{\Delta H}^N$. This factor is calculated at least every 31 EFPD. However, during power operation, the global power distribution is monitored by LCO 3.2.3, "Axial Flux Difference (AFD)," and LCO 3.2.4, "Quadrant Power Tilt Ratio (QPTR)," which address directly and continuously measured process variables.

The COLR provides peaking factor limits that ensure that the design basis value of the departure from nucleate boiling (DNB) is met for normal operation, operational transients, and any transient condition arising from events of moderate frequency. The DNB design basis precludes DNB and is met by limiting the minimum local DNB heat flux ratio to 1.3 using the [WRB1] CHF correlation. All DNB-limited transient events are assumed to begin with an $F_{\Delta H}^N$ value that satisfies the LCO requirements.

(continued)

BASES

BACKGROUND
(continued)

Operation outside the LCO limits may produce unacceptable consequences if a DNB limiting event occurs. The DNB design basis ensures that there is no overheating of the fuel that results in possible cladding perforation with the release of fission products to the reactor coolant.

APPLICABLE
SAFETY ANALYSES

Limits on $F_{\Delta H}^N$ preclude core power distributions that exceed the following fuel design limits:

- a. There must be at least 95% probability at the 95% confidence level (the 95/95 DNB criterion) that the hottest fuel rod in the core does not experience a DNB condition;
- b. During a large-break loss-of-coolant accident (LOCA), peak cladding temperature (PCT) must not exceed 2200°F;
- c. During an ejected rod accident, the fission energy input to the fuel must not exceed 280 cal/gm [Ref. 1]; and
- d. Fuel design limits required by GDC 26 (Ref. 2) for the condition when control rods must be capable of shutting down the reactor with a minimum required SDM with the highest worth control rod stuck fully withdrawn.

For transients that may be DNB limited, the Reactor Coolant System flow and $F_{\Delta H}^N$ are the core parameters of most importance. The limits on $F_{\Delta H}^N$ ensure that the DNB design basis is met for normal operation, operational transients, and any transients arising from events of moderate frequency. The DNB design basis is met by limiting the minimum DNBR to the 95/95 DNB criterion of 1.3 using the [WRB1] CHF correlation. This value provides a high degree of assurance that the hottest fuel rod in the core does not experience a DNB.

The allowable $F_{\Delta H}^N$ limit increases with decreasing power level. This functionality in $F_{\Delta H}^N$ is included in the analyses that provide the Reactor Core Safety Limits (SLs) of SL 2.1.1. Therefore, any DNB events in which the calculation of the core limits is modeled implicitly use

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

this variable value of $F_{\Delta H}^N$ in the analyses. Likewise, all transients that may be DNB limited are assumed to begin with an initial $F_{\Delta H}^N$ as a function of power level defined by the COLR limit equation.

The LOCA safety analysis indirectly models $F_{\Delta H}^N$ as an input parameter. The Nuclear Heat Flux Hot Channel Factor ($F_Q(Z)$) and the axial peaking factors are inserted directly into the LOCA safety analyses that verify the acceptability of the resulting peak cladding temperature [Ref. 3].

The fuel is protected in part by Technical Specifications, which ensure that the initial conditions assumed in the safety and accident analyses remain valid. The following LCOs ensure this: LCO 3.2.3, "Axial Flux Difference (AFD)," LCO 3.2.4, "Quadrant Power Tilt Ratio (QPTR)," LCO 3.1.7, "Control Bank Insertion Limits," LCO 3.2.2, "Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$)," and LCO 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)."

$F_{\Delta H}^N$ and $F_Q(Z)$ are measured periodically using the movable incore detector system. Measurements are generally taken with the core at, or near, steady-state conditions. Core monitoring and control under transient conditions (Condition 1 events) are accomplished by operating the core within the limits of the LCOs on AFD, QPTR, and Bank Insertion Limits.

$F_{\Delta H}^N$ satisfies Criterion 2 of the NRC Policy Statement.

LCO

$F_{\Delta H}^N$ shall be maintained within the limits of the relationship provided in the COLR.

The $F_{\Delta H}^N$ limit identifies the coolant flow channel with the maximum enthalpy rise. This channel has the least heat removal capability and thus the highest probability for a DNB.

The limiting value of $F_{\Delta H}^N$, described by the equation contained in the COLR, is the design radial peaking factor used in the unit safety analyses.

A power multiplication factor in this equation includes an additional margin for higher radial peaking from reduced

(continued)

BASES

LCO
(continued)

thermal feedback and greater control rod insertion at low power levels. The limiting value of $F_{\Delta H}^N$ is allowed to increase 0.3% for every 1% RTP reduction in THERMAL POWER.

APPLICABILITY

The $F_{\Delta H}^N$ limits must be maintained in MODE 1 to preclude core power distributions from exceeding the fuel design limits for DNBR and PCT. Applicability in other modes is not required because there is either insufficient stored energy in the fuel or insufficient energy being transferred to the coolant to require a limit on the distribution of core power. Specifically, the design bases events that are sensitive to $F_{\Delta H}^N$ in other modes (MODES 2 through 5) have significant margin to DNB, and therefore, there is no need to restrict $F_{\Delta H}^N$ in these modes.

ACTIONS

A.1.1

With $F_{\Delta H}^N$ exceeding its limit, the unit is allowed 4 hours to restore $F_{\Delta H}^N$ to within its limits. This restoration may, for example, involve realigning any misaligned rods or reducing power enough to bring $F_{\Delta H}^N$ within its power-dependent limit. When the $F_{\Delta H}^N$ limit is exceeded, the DNBR limit is not likely violated in steady-state operation, because events that could significantly perturb the $F_{\Delta H}^N$ value (e.g., static control rod misalignment) are considered in the safety analyses. However, the DNBR limit may be violated if a DNB limiting event occurs. Thus, the allowed Completion Time of 4 hours provides an acceptable time to restore $F_{\Delta H}^N$ to within its limits without allowing the plant to remain in an unacceptable condition for an extended period of time.

Condition A is modified by a Note that requires that Required Actions A.2 and A.3 must be completed whenever Condition A is entered. Thus, if power is not reduced because this Required Action is completed within the 4-hour time period, Required Action A.2 nevertheless requires another measurement and calculation of $F_{\Delta H}^N$ within 24 hours in accordance with SR 3.2.2.1.

However, if power is reduced below 50% RTP, Required Action A.3 requires that another determination of $F_{\Delta H}^N$ must be done prior to exceeding 50% RTP, prior to exceeding

(continued)

BASES

ACTIONS

A.1.1 (continued)

75% RTP, and within 24 hours after reaching or exceeding 95% RTP. In addition, Required Action A.2 is performed if power ascension is delayed past 24 hours.

A.1.2.1 and A.1.2.2

If the value of $F_{\Delta H}^N$ is not restored to within its specified limit either by adjusting a misaligned rod or by reducing THERMAL POWER, the alternative option is to reduce THERMAL POWER to < 50% RTP in accordance with Required Action A.1.2.1 and reduce the Power Range Neutron Flux-High to \leq 55% RTP in accordance with Required Action A.1.2.2. Reducing RTP to < 50% RTP increases the DNB margin and does not likely cause the DNBR limit to be violated in steady-state operation. The reduction in trip setpoints ensures that continuing operation remains at an acceptable low power level with adequate DNBR margin. The allowed Completion Time of 4 hours for Required Action A.1.2.1 is consistent with those allowed for in Required Action A.1.1 and provides an acceptable time to reach the required power level from full power operation without allowing the plant to remain in an unacceptable condition for an extended period of time. The Completion Times of 4 hours for Required Actions A.1.1 and A.2.2.1 are not additive.

The allowed Completion Time of 8 hours to reset the trip setpoints per Required Action A.1.2.2 recognizes that, once power is reduced, the safety analysis assumptions are satisfied and there is no urgent need to reduce the trip setpoints. This is a sensitive operation that may inadvertently trip the Reactor Protection System.

A.2

Once the power level has been reduced to < 50% RTP per Required Action A.1.1, an incore flux map (SR 3.2.2.1) must be obtained and the measured value of $F_{\Delta H}^N$ verified not to exceed the allowed limit at the lower power level. The unit is provided 20 additional hours to perform this task over and above the 4 hours allowed by either Action A.1.1 or Action A.1.2.1. The Completion Time of 24 hours is acceptable because of the increase in the DNB margin, which

 (continued)

BASES

ACTIONS

A.2 (continued)

is obtained at lower power levels, and the low probability of having a DNB limiting event within this 24-hour period. Additionally, operating experience has indicated that this Completion Time is sufficient to obtain the incore flux map, perform the required calculations, and evaluate $F_{\Delta H}^N$.

A.3

Verification that $F_{\Delta H}^N$ is within its specified limits after an out-of-limit occurrence ensures that the cause that led to the $F_{\Delta H}^N$ exceeding its limit is corrected, and that subsequent operation proceeds within the LCO limit. This Action demonstrates that the $F_{\Delta H}^N$ limit is within the LCO limits prior to exceeding 50% RTP, again prior to exceeding 75% RTP, and within 24 hours after THERMAL POWER is $\geq 95\%$ RTP.

This Required Action is modified by a Note that states that THERMAL POWER does not have to be reduced prior to performing this Action.

B.1

When Required Actions A.1.1 through A.3 cannot be completed within their required Completion Times, the plant must be placed in a mode in which the LCO requirements are not applicable. This is done by placing the plant in at least MODE 2 within 6 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience regarding the time required to reach MODE 2 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.2.2.1

The value of $F_{\Delta H}^N$ is determined by using the movable incore detector system to obtain a flux distribution map. A data reduction computer program then calculates the maximum value of $F_{\Delta H}^N$ from the measured flux distributions. The measured value of $F_{\Delta H}^N$ must be multiplied by 1.04 to account for

(continued)

BASES

 SURVEILLANCE
 REQUIREMENTS

SR 3.2.2.1 (continued)

measurement uncertainty before making comparisons to the $F_{\Delta H}^N$ limit.

After each refueling, $F_{\Delta H}^N$ must be determined in MODE 1 prior to exceeding 75% RTP. This requirement ensures that $F_{\Delta H}^N$ limits are met at the beginning of each fuel cycle.

The 31-EFPD Frequency is acceptable because the power distribution changes relatively slowly over this amount of fuel burnup. Accordingly, this Frequency is short enough that the $F_{\Delta H}^N$ limit cannot be exceeded for any significant period of operation.

REFERENCES

1. Regulatory Guide 1.77, Rev 0, "Assumptions Used for Evaluating a Control Rod Ejection Accident for Pressurized water Reactors," May 1974.
 2. Title 10, Code of Federal Regulations, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," GDC 26, "Reactivity Control System Redundancy and Capability."
 3. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
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B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.3 AXIAL FLUX DIFFERENCE (AFD)

BASES

BACKGROUND

The purpose of this LCO is to establish limits on the values of the AFD in order to limit the amount of axial power distribution skewing to either the top or bottom of the core. By limiting the amount of power distribution skewing, core peaking factors are consistent with the assumptions used in the safety analyses. Limiting power distribution skewing over time also minimizes the xenon distribution skewing, which is a significant factor in axial power distribution control.

RAOC is a calculational procedure that defines the allowed operational space of the AFD versus THERMAL POWER. The AFD limits are selected by considering a range of axial xenon distributions that may occur as a result of large variations of the AFD. Subsequently, power peaking factors and power distributions are examined to ensure that the loss-of-coolant accident (LOCA), loss-of-flow accident, and anticipated transient limits are met. Violation of the AFD limits invalidate the conclusions of the accident and transient analyses with regard to fuel cladding integrity.

Although the RAOC defines limits that must be met to satisfy safety analyses, typically an operating scheme, Constant Axial Offset Control (CAOC), is used to control axial power distribution in day-to-day operation (Ref. 1). CAOC requires that the AFD be controlled within a narrow tolerance band around a burnup-dependent target to minimize the variation of axial peaking factors and axial xenon distribution during unit maneuvers.

The CAOC operating space is typically smaller and lies within the RAOC operating space. Control within the CAOC operating space constrains the variation of axial xenon distributions and axial power distributions. RAOC calculations assume a wide range of xenon distributions and then confirm that the resulting power distributions satisfy the requirements of the accident analyses.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The AFD is a measure of the axial power distribution skewing to either the top or bottom half of the core. The AFD is sensitive to many core-related parameters such as control bank positions, core power level, axial burnup, axial xenon distribution, and, to a lesser extent, reactor coolant temperature and boron concentration.

The allowed range of the AFD is used in the nuclear design process to confirm that operation within these limits produces core peaking factors and axial power distributions that meet safety analysis requirements.

The RAOC methodology (Ref. 2) establishes a xenon distribution library with tentatively wide AFD limits. One-dimensional axial power distribution calculations are then performed to demonstrate that normal operation power shapes are acceptable for the LOCA and loss-of-flow accident, and for initial conditions of anticipated transients. The tentative limits are adjusted as necessary to meet the safety analysis requirements.

The limits on the AFD ensure that the Heat Flux Hot Channel Factor ($F_Q(Z)$) is not exceeded during either normal operation or in the event of xenon redistribution following power changes. The limits on the AFD also restrict the range of power distributions that are used as initial conditions in the analyses of Condition 2, 3, or 4 events. This ensures that the fuel cladding integrity is maintained for these postulated accidents. The most important Condition 4 event is the LOCA. The most important Condition 3 event is the loss-of-flow accident. The most important Condition 2 events are uncontrolled bank withdrawal and boration or dilution accidents. Condition 2 accidents simulated to begin from within the AFD limits are used to confirm the adequacy of the Overpower ΔT and Overtemperature ΔT trip setpoints.

The limits on the AFD satisfy Criterion 2 of the NRC Policy Statement.

LCO

The shape of the power profile in the axial (i.e., the vertical) direction is largely under the control of the operator through the manual operation of the control banks

(continued)

BASES

LCO
(continued)

or automatic motion of control banks. The automatic motion of the control banks is in response to temperature deviations resulting from manual operation of the Chemical and Volume Control System to change boron concentration or from power level changes.

Signals are available to the operator from the Nuclear Instrumentation System (NIS) excore neutron detectors (Ref. 3). Separate signals are taken from the top and bottom detectors. The AFD is defined as the difference in normalized flux signals between the top and bottom excore detectors in each detector well. For convenience, this flux difference is converted to provide flux difference units expressed as a percentage and labeled as $\% \Delta$ -flux.

The AFD limits are provided in the COLR. Figure B 3.2.3-1 shows typical RAOC AFD limits. The AFD limits for RAOC do not depend on the target flux difference. However, the target flux difference may be used to minimize changes in the axial power distribution.

Violating this LCO on the AFD could produce unacceptable consequences if a Condition 2, 3, or 4 event occurs while the AFD is outside its specified limits.

APPLICABILITY

The AFD requirements are applicable in MODE 1 above 50% RTP when the combination of THERMAL POWER and core peaking factors are of primary importance in safety analysis.

For AFD limits developed using RAOC methodology, the value of the AFD does not affect the limiting accident consequences with THERMAL POWER < 50% RTP and for lower operating power MODES.

ACTIONSA.1

As an alternative to restoring the AFD to within its specified limits, Required Action A.1 requires a THERMAL POWER reduction to < 50% RTP. This places the core in a condition for which the value of the AFD is not important in the applicable safety analyses. A Completion Time of

(continued)

BASES

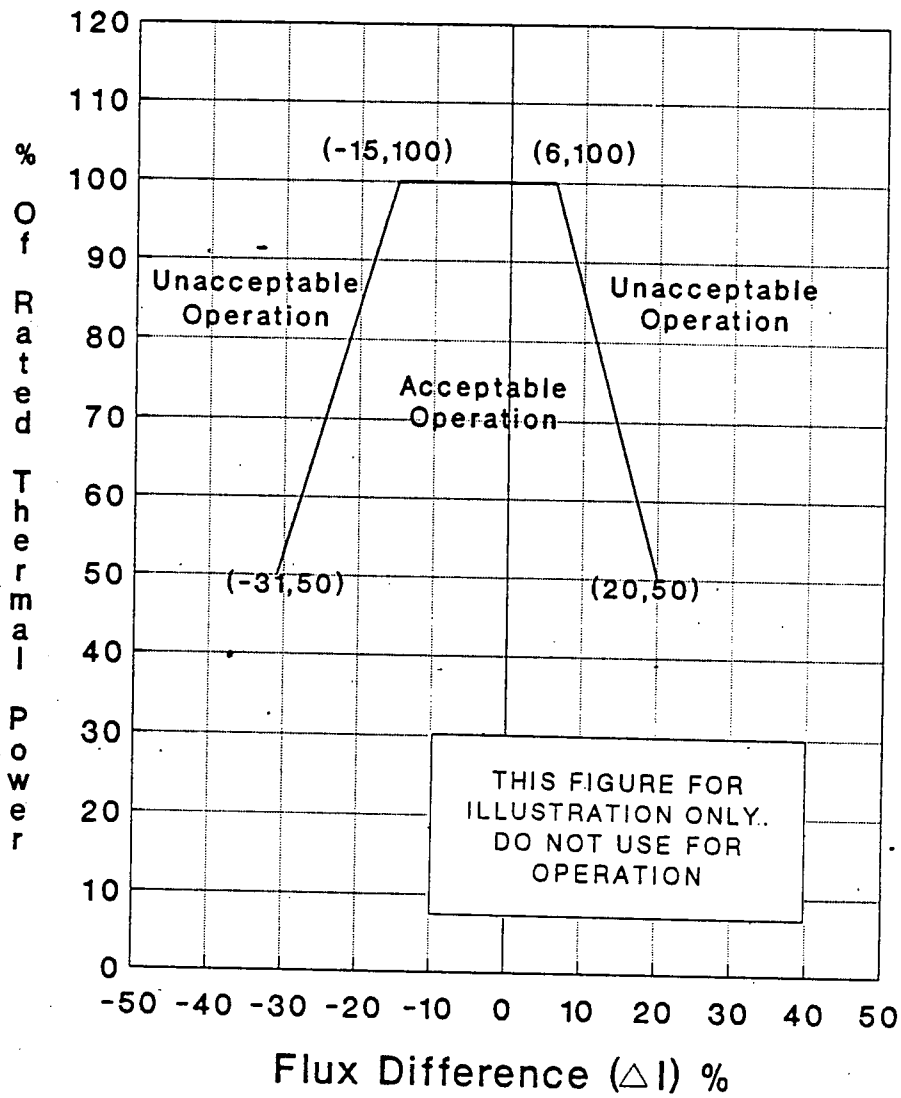


Figure B 3.2.3-1 (Page 1 of 1)
AXIAL FLUX DIFFERENCE Acceptable Operation Limits
as a Function of RATED THERMAL POWER

(continued)

BASES

ACTIONS

A.1 (continued)

30 minutes is reasonable, based on operating experience, to reach 50% RTP without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.2.3.1

The AFD is monitored on an automatic basis using the unit process computer, which has an AFD monitor alarm. The computer determines the 1-minute average of each of the OPERABLE excore detector outputs and provides an alarm message immediately if the AFD for two or more OPERABLE excore channels is outside its specified limits.

This Surveillance verifies that the AFD, as indicated by the NIS excore channel, is within its specified limits and is consistent with the status of the AFD monitor alarm. With the AFD monitor alarm inoperable, the AFD is monitored every hour to detect operation outside its limit. The Frequency of 1 hour is based on operating experience regarding the amount of time required to vary the AFD, and the fact that the AFD is closely monitored. With the AFD monitor alarm OPERABLE, the Surveillance Frequency of 7 days is adequate considering that the AFD is monitored by a computer and any deviation from requirements is alarmed.

REFERENCES

1. WCAP-8403 (nonproprietary), "Power Distribution Control and Load Following Procedures," Westinghouse Electric Corporation, September 1974.
 2. R. W. Miller et al., "Relaxation of Constant Axial Offset Control: F_a Surveillance Technical Specification," WCAP-10217(NP), June 1983.
 3. Watts Bar FSAR, Chapter 7.7, "Control Systems Not Required for Safety."
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B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.4 QUADRANT POWER TILT RATIO (QPTR)

BASES

BACKGROUND

The QPTR limit ensures that the gross radial power distribution remains consistent with the design values used in the safety analyses. Precise radial power distribution measurements are made during startup testing, after refueling, and periodically during power operation.

The power density at any point in the core must be limited so that the fuel design criteria are maintained. Together, LCO 3.2.3, "Axial Flux Difference (AFD)," LCO 3.2.4, and LCO 3.1.7, "Control Rod Insertion Limits," provide limits on process variables that characterize and control the three-dimensional power distribution of the reactor core. Control of these variables ensures that the core operates within the fuel design criteria and that the power distribution remains within the bounds used in the safety analyses.

APPLICABLE
SAFETY ANALYSES

This LCO precludes core power distributions that violate the following fuel design criteria:

- a. During a large-break loss-of-coolant accident, the peak cladding temperature must not exceed 2200°F (Ref. 1);
- b. During a loss-of-forced-reactor-coolant-flow accident, there must be at least 95% probability at the 95% confidence level (the 95/95 departure from nucleate boiling (DNB) criterion) that the hot fuel rod in the core does not experience a DNB condition;
- c. During an ejected rod accident, the fission energy input to the fuel must not exceed 280 cal/gm (Ref. 2); and
- d. The control rods must be capable of shutting down the reactor with a minimum required SDM with the highest worth control rod stuck fully withdrawn (Ref. 3).

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The LCO limits on the AFD, the QPTR, the Heat Flux Hot Channel Factor ($F_Q(Z)$), the Nuclear Enthalpy Rise Hot Channel Factor ($F_{\Delta H}^N$), and control bank insertion are established to preclude core power distributions that exceed the safety analyses limits.

The QPTR limits ensure that $F_{\Delta H}^N$ and $F_Q(Z)$ remain below their limiting values by preventing an undetected change in the gross radial power distribution.

In MODE 1, the $F_{\Delta H}^N$ and $F_Q(Z)$ limits must be maintained to preclude core power distributions from exceeding design limits assumed in the safety analyses.

The QPTR satisfies Criterion 2 of the NRC Policy Statement.

LCO

The QPTR limit of 1.02, at which corrective action is required, provides a margin of protection for both the DNB ratio and linear heat generation rate contributing to excessive power peaks resulting from X-Y plane power tilts. A limiting QPTR of 1.02 can be tolerated before the margin for uncertainty in $F_Q(Z)$ and ($F_{\Delta H}^N$) is possibly challenged.

APPLICABILITY

The QPTR limit must be maintained in MODE 1 with THERMAL POWER > 50% RTP to prevent core power distributions from exceeding the design limits.

Applicability in MODE 1 \leq 50% RTP and in other MODES is not required because there is either insufficient stored energy in the fuel or insufficient energy being transferred to the reactor coolant to require the implementation of a QPTR limit on the distribution of core power. The QPTR limit in these conditions is, therefore, not important. Note that the $F_{\Delta H}^N$ and $F_Q(Z)$ LCOs still apply, but allow progressively higher peaking factors at 50% RTP or lower.

ACTIONS

A.1

With the QPTR exceeding its limit, a power level reduction of 3% RTP for each 1% by which the QPTR exceeds 1.00 is a

(continued)

BASES

ACTIONS

A.1 (continued)

conservative tradeoff of total core power with peak linear power. The Completion Time of 2 hours allows sufficient time to identify the cause and correct the tilt. Note that the power reduction itself may cause a change in the tilted condition. Because the QPTR alarm is already in its alarmed state, any additional changes in the QPTR are detected by requiring a check of the QPTR once per 12 hours thereafter. If the QPTR continues to increase, THERMAL POWER has to be reduced accordingly. A 12-hour Completion Time is sufficient because any additional rate of change in QPTR would be relatively slow, and the cause for the initial QPTR excursion will, in all likelihood, have been identified and controlled.

A.2

The peaking factors $F_{\Delta H}^N$ and $F_Q(Z)$ are of primary importance in ensuring that the power distribution remains consistent with the initial conditions used in the safety analyses. Performing SRs on $F_{\Delta H}^N$ and $F_Q(Z)$ within the Completion Time of 24 hours ensures that these primary indicators of power distribution are within their respective limits. A Completion Time of 24 hours takes into consideration the rate at which peaking factors are likely to change, and the time required to stabilize the plant and perform a flux map. If these peaking factors are not within their limits, the Required Actions of these Surveillances provide an appropriate response for the abnormal condition. If the QPTR remains above its specified limit, the peaking factor surveillances are required each 7 days thereafter to evaluate $F_{\Delta H}^N$ and $F_Q(Z)$ with changes in power distribution. Relatively small changes are expected due to either burnup and xenon redistribution or correction of the cause for exceeding the QPTR limit.

A.3.1

Although $F_{\Delta H}^N$ and $F_Q(Z)$ are of primary importance as initial conditions in the safety analyses, other changes in the power distribution may occur as the QPTR limit is exceeded and may have an impact on the validity of the safety

(continued)

BASES

ACTIONS

A.3.1 (continued)

analysis. A change in the power distribution can affect such reactor parameters as bank worths and peaking factors for rod malfunction accidents. When the QPTR exceeds its limit, it does not necessarily mean a safety concern exists. It does mean that there is an indication of a change in the gross radial power distribution that requires an investigation and evaluation that is accomplished by examining the incore power distribution. Specifically, the core peaking factors and the quadrant tilt must be evaluated because they are the factors that best characterize the core power distribution. This reevaluation is required to ensure that, before increasing THERMAL POWER above the limit of Required Action A.1, the reactor core conditions are consistent with the assumptions in the safety analyses.

A.3.2

If the QPTR has exceeded the 1.02 limit and a reevaluation of the safety analysis is completed and shows that safety requirements are met, the excore detectors are recalibrated to show a zero QPTR prior to increasing THERMAL POWER above the limit of Required Action A.1. This is done to detect any subsequent significant changes in QPTR.

Required Action A.3.2 is modified by a Note that states that the indicated QPT is not zeroed out until after the reevaluation of the safety analysis has determined that core conditions at RTP are within the safety analysis assumptions (i.e., Required Action A.3.1). This Note is intended to prevent any ambiguity about the required sequence of actions.

A.3.3

Once the flux tilt is zeroed out (i.e., Required Action A.3.2 is performed), it is acceptable to return to full power operation. However, as an added check that the core power distribution at RTP is consistent with the safety analysis assumptions, Action A.3.3 requires verification that $F_Q(Z)$ and $F_{\Delta H}^N$ are within their specified limits within 24 hours of reaching RTP. As an added precaution, if the core power does not reach RTP within 24 hours, but is

(continued)

BASES

ACTIONS

A.3.3 (continued)

increased slowly, then the peaking factor surveillances must be performed within 48 hours of the time when the ascent to power was begun. These Completion Times are intended to allow adequate time to increase THERMAL POWER to above the limit of Required Action A.1 while not permitting the core to remain with unconfirmed power distributions for extended periods of time.

Action A.3.3 is modified by a Note that states that the peaking factor surveillances may only be done after the excore detectors have been calibrated to show zero tilt (i.e., Required Action A.3.2). The intent of this Note is to have the peaking factor surveillances performed at operating power levels, which can only be accomplished after the excore detectors are calibrated to show zero tilt and the core returned to power.

B.1

If Required Actions A.1 through A.3.3 are not completed within their associated Completion Times, the unit must be brought to a MODE or condition in which the requirements do not apply. To achieve this status, THERMAL POWER must be reduced to < 50% RTP within 4 hours. The allowed Completion Time of 4 hours is reasonable, based on operating experience regarding the amount of time required to reach the reduced power level without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.2.4.1

SR 3.2.4.1 is modified by a Note that allows QPTR to be calculated with three power range channels, if THERMAL POWER < 75% RTP and one power range channel is inoperable.

This Surveillance verifies that the QPTR as indicated by the Nuclear Instrumentation System (NIS) excore channels is within its limits. The Frequency of 7 days when the QPTR alarm is OPERABLE is acceptable because of the low probability that this alarm can remain inoperable without detection.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.2.4.1 (continued)

When the QPTR alarm is inoperable, the Frequency is increased to 12 hours. This Frequency is adequate to detect any relatively slow changes in QPTR because for those causes of QPT that occur quickly (e.g., a dropped rod), there typically are other indications of abnormality that prompt a verification of core power tilt.

SR 3.2.4.2

This Surveillance is modified by a Note which states that it is required only when one power range channel is inoperable and the THERMAL POWER is $\geq 75\%$ RTP.

With an NIS power range channel inoperable, tilt monitoring for a portion of the reactor core becomes degraded. Large tilts are likely detected with the remaining channels, but the capability for detection of small power tilts in some quadrants is decreased. Performing SR 3.2.4.2 at a Frequency of 12 hours provides an accurate alternative means for ensuring that any tilt remains within its limits.

For purposes of monitoring the QPTR when one power range channel is inoperable, the moveable incore detectors are used to confirm that the normalized symmetric power distribution is consistent with the indicated QPTR and any previous data indicating a tilt. The incore detector monitoring is performed with a full incore flux map or two sets of four-thimble locations with quarter-core symmetry. The two sets of four symmetric thimbles is a set of eight unique detector locations. These locations are C-8, E-5, E-11, H-3, H-13, L-5, L-11, and N-8.

The symmetric thimble flux map can be used to generate symmetric thimble "tilt". This can be compared to a reference symmetric thimble tilt, from the most recent full core flux map, to generate an incore QPTR. The incore QPTR can be used to confirm that QPTR is within limits.

With one NIS channel inoperable, the indicated tilt may be changed from the value indicated with all four channels OPERABLE. To confirm that no change in tilt has actually occurred, which might cause the QPTR limit to be exceeded, the incore result may be compared against previous flux maps either using the symmetric thimbles as described above or a

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.2.4.2 (continued)

complete flux map. Nominally, quadrant tilt from the Surveillance should be within 2% of the tilt shown by the most recent flux map data.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
 2. Regulatory Guide 1.77, Rev 0, "Assumptions Used for Evaluating a Control Rod Ejection Accident for Pressurized Water Reactors," May 1974.
 3. Title 10, Code of Federal Regulations, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," GDC 26, "Reactivity Control System Redundancy and Capability."
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B 3.3 INSTRUMENTATION

B 3.3.1 Reactor Trip System (RTS) Instrumentation

BASES

BACKGROUND

The RTS initiates a unit shutdown, based upon the values of selected unit parameters, to protect against violating the core fuel design limits and Reactor Coolant System (RCS) pressure boundary during anticipated operational occurrences (AOOs) and to assist the Engineered Safety Features (ESF) Systems in mitigating accidents.

The protection and monitoring systems have been designed to assure safe operation of the reactor. This is achieved by specifying limiting safety system settings (LSSS) in terms of parameters directly monitored by the RTS, as well as LCOs on other reactor system parameters and equipment performance.

The LSSS, defined in this specification as the Trip Setpoints, in conjunction with the LCOs, establish the threshold for protective system action to prevent exceeding acceptable limits during Design Basis Accidents (DBAs).

During AOOs, which are those events expected to occur one or more times during the unit life, the acceptable limits are:

1. The Departure from Nucleate Boiling Ratio (DNBR) shall be maintained above the Safety Limit value to prevent departure from nuclear boiling (DNB);
2. Fuel centerline melt shall not occur; and
3. The RCS pressure SL of 2750 psia shall not be exceeded.

Operation within the SLs of Specification 2.0, "Safety Limits," also maintains the above values and assures that offsite dose will be within the 10 CFR 20 and 10 CFR 100 criteria during AOOs.

Accidents are events which are analyzed even though they are not expected to occur during the unit life. The acceptable limit during accidents is that offsite dose shall be maintained within an acceptable fraction of 10 CFR 100

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BASES

BACKGROUND
(continued)

limits. Different accident categories allow a different fraction of these limits, based on the probability of occurrence. Meeting the acceptable dose limit for an accident category is considered having acceptable consequences for that event.

The RTS instrumentation is segmented into four distinct but interconnected modules as illustrated in Figure 7.1-1, FSAR Chapter 7, and as identified below:

1. Field transmitters or process sensors: provide a measurable electronic signal or contact actuation based upon the physical characteristics of the parameter being measured;
2. Signal Process Control and Protection System, including Process Protection System, Neutron Monitoring System (NIS), and field contacts: provides analog to digital conversion (Digital Protection System), signal conditioning, setpoint comparison, process algorithm actuation (Digital Protection System), compatible electrical signal output to protection system devices, and control board/control room/miscellaneous indications;
3. Solid State Protection System (SSPS), including input, logic, and output bays: initiates proper unit shutdown and/or ESF actuation in accordance with the defined logic which is based on the bistable, setpoint comparators, or contact outputs from the signal process control and protection system; and
4. Reactor trip switchgear; including Reactor Trip Breakers (RTBs) and bypass breakers: provides the means to interrupt power to the Control Rod Drive Mechanisms (CRDM) and allow the Rod Cluster Control Assemblies (RCCAs), or "rods," to fall into the core and shut down the reactor. The bypass breakers allow testing of the RTBs at power.

Field Transmitters or Process Sensors

In order to meet the design demands for redundancy and reliability, more than one, and often as many as five, field transmitters or sensors are used to measure plant

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BASES

BACKGROUND
(continued)

parameters. To account for the calibration tolerances and instrument drift, which are assumed to occur between and during calibrations, statistical allowances are provided in the Trip Setpoint and Allowable Values. The OPERABILITY of each transmitter or sensor can be evaluated when its "as found" calibration data are compared against its documented acceptance criteria.

Signal Process Control and Protection System

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides analog to digital conversion (Digital Protection System), signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with setpoints established by safety analyses. These setpoints are defined in References 1, 2, and 3. If the measured value of a plant parameter exceeds the predetermined setpoint, an output from a bistable, setpoint comparator or contact is forwarded to the SSPS for decision evaluation. Channel separation is maintained up to and through the input bays. However, not all unit parameters require four channels of sensor measurement and signal processing. Some unit parameters provide input only to the SSPS while others provide input to the SSPS, main control board, unit computer, and one or more control systems.

Generally, if a parameter is used only for input to the protection circuits, three channels with a two out of three logic are sufficient to provide the required reliability and redundancy. If one channel fails in the nonconservative direction, the Function is still OPERABLE with a two out of two logic. If one channel fails in the conservative direction, a trip will not occur because of the single failure, and the Function is still OPERABLE with a one out of two logic.

Generally, if a parameter is used for input to the SSPS and a control function, four channels with a two out of four logic are sufficient to provide the required reliability and redundancy. The circuit must be able to withstand both an

(continued)

BASES

BACKGROUND
(continued)

input failure to the control system, which may then require the protection Function actuation, and a single failure in the other channels providing the protection Function actuation. Again, a single failure will neither cause nor prevent the protection Function actuation. These requirements are described in IEEE-279-1971 (Ref. 4). The actual number of channels required for each unit parameter is specified in Reference 2.

Two logic trains are required to ensure no single random failure of a logic train will disable the RTS. The logic trains are designed such that testing required while the reactor is at power may be accomplished without causing a trip.

Trip Setpoints and Allowable Values

The Trip Setpoint are the nominal values at which the bistables, setpoint comparators, or contact trip outputs are set. Any bistable or trip output is considered to be properly adjusted when the "as left" value is within the band for CHANNEL CALIBRATION accuracy.

The Trip Setpoints used in the bistables, setpoint comparators, or contact trip outputs are based on the analytical limits stated in Reference 2. 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 RTS channels which must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), the Trip Setpoints and Allowable Values specified in Table 3.3.1-1 are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the trip setpoints, including their explicit uncertainties, is provided in the "Westinghouse Setpoint Methodology for Protection Systems, Watts Bar 1 and 2," (Ref. 6). The actual nominal Trip Setpoint entered into the bistable/comparator is more conservative than that specified by the Allowable Value, to account for changes in random measurement errors detectable by a COT. 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/comparator is considered OPERABLE.

(continued)

BASES

BACKGROUND
(continued)

Setpoints in accordance with the Allowable Value will ensure that SLs are not violated during AOOs; (and that the consequences of DBAs will be acceptable, providing the unit is operated from within the LCOs at the onset of the AOO or DBA and the equipment functions as designed).

Note that in the accompanying LCO, the Trip Setpoints of Table 3.3.1-1 are the LSSS.

Each channel of the process control equipment can be tested on line to verify that the signal or setpoint accuracy is within the specified allowance requirements of Reference 2. Once a designated channel is taken out of service for testing, a simulated signal is injected in place of the field instrument signal. The process equipment for the channel in test is then tested, verified, and calibrated. SRs for the channels are specified in the SRs section.

The Trip Setpoints and Allowable Values listed in Table 3.3.1-1 are based upon the methodology described in Reference 6, which incorporates 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.

Solid State Protection System

The SSPS equipment is used for the decision logic processing of setpoint comparator trip outputs, contact outputs and bistable outputs from the signal processing equipment. To meet the redundancy requirements, two trains of SSPS, each performing the same functions, are provided. In the event that one train is taken out of service for maintenance or test purposes, the second train will provide reactor trip and/or ESF actuation for the unit. In the event that both trains are taken out of service or placed in test, a reactor trip will result. Each train is packaged in its own cabinet for physical and electrical separation to satisfy separation and independence requirements. The system has been designed to trip in the event of a loss of power, directing the unit to a safe shutdown condition.

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The SSPS provides the decision logic for actuating a reactor trip or ESF actuation, provides the electrical output signal that will initiate the required trip or actuation, and provides the status, interlock, and annunciator output signals to the main control room of the plant.

The setpoint comparator trip outputs, contact outputs and bistable outputs from the signal processing equipment are sensed by the SSPS equipment and combined into logic matrices that represent combinations indicative of various plant upset and accident transients. If a required logic matrix combination is completed, the system will initiate a reactor trip and/or send actuation signals via master and slave relays to those components whose aggregate function best serves to alleviate the condition and restore the unit to a safe condition. Examples are given in the section on Applicable Safety Analyses, LCO, and Applicability sections of the Bases.

Reactor Trip Switchgear

The RTBs are in the electrical power supply line from the control rod drive motor generator set power supply to the CRDMs. Opening of the RTBs interrupts power to the CRDMs, which allows the shutdown rods and control rods to fall into the core by gravity. Each RTB is equipped with a bypass breaker to allow testing of the RTB while the unit is at power. During normal operation the output from the SSPS is a voltage signal that energizes the undervoltage coils in the RTBs, and bypass breakers if in use. When the required logic matrix combination is completed, the SSPS output voltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs and bypass breakers are tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each RTB is also equipped with a shunt trip device that is energized to trip the breaker open upon receipt of a reactor trip signal from the SSPS. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself, thus providing a diverse trip mechanism.

The decision logic matrix functions are described in the functional diagrams included in Reference 2. In addition to the reactor trip or ESF, these diagrams also describe the

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various "permissive interlocks" that are associated with unit conditions. Each train has a built in testing device that can automatically test the decision logic matrix functions and the actuation devices while the unit is at power. When any one train is taken out of service for testing, the other train is capable of providing unit monitoring and protection until the testing has been completed. The testing device is semiautomatic to minimize testing time.

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The RTS functions to maintain the SLs during all AOOs and mitigates the consequences of DBAs in all MODES in which the RTBs are closed.

Each of the analyzed accidents and transients can be detected by one or more RTS Functions. The accident analysis described in Reference 3 takes credit for most RTS trip Functions. RTS trip Functions not specifically credited in the accident analysis were qualitatively credited in the safety analysis and the NRC staff-approved licensing basis for the unit. These RTS trip Functions may provide protection for conditions that do not require LCOs, and dynamic transient analysis to demonstrate function performance. They may also serve as backups to RTS trip Functions that were credited in the accident analysis.

The LCO requires all instrumentation performing an RTS Function listed in Table 3.3.1-1 to be OPERABLE. Failure of any instrument renders the affected channel(s) inoperable and reduces the accompanying LCO reliability of the affected Functions.

The LCO generally requires OPERABILITY of four or three channels in each instrumentation Function and two channels in each logic Function. Four operable instrumentation channels in a two out of four configuration are required when one RTS channel is also used as a control system input. This configuration accounts for the possibility of the shared channel failing in such a manner that creates a transient that requires RTS action. In this case, the RTS will still provide protection, even with random failure of one of the other three protection channels. Three OPERABLE instrumentation channels in a two out of three configuration

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are generally required when there is no potential for control system and protection system interaction that could simultaneously create a need for RTS trip and disable one RTS channel. The two out of three and two out of four configurations allow one channel to be tripped during maintenance or testing without causing a reactor trip. Specific exceptions to the above general philosophy exist and are discussed below.

REACTOR TRIP SYSTEM FUNCTIONS

The safety analyses and OPERABILITY requirements applicable to each RTS Function are discussed below.

1. Manual Reactor Trip

The Manual Reactor Trip ensures that the control room operator can initiate a reactor trip at any time by using either of two reactor trip switches in the control room. A Manual Reactor Trip accomplishes the same results as any one of the automatic trip Functions. It is used by the reactor operator to shut down the reactor whenever any parameter is rapidly trending toward its Trip Setpoint.

The LCO requires two Manual Reactor Trip channels, one per train, to be OPERABLE. Two independent channels are required to be OPERABLE so that no single random failure will disable the manual reactor trip Function.

In MODE 1 or 2, manual initiation of a reactor trip must be OPERABLE. These are the MODES in which the shutdown rods and/or control rods are partially or fully withdrawn from the core. In MODE 3, 4, or 5, the manual initiation Function must also be OPERABLE if the shutdown rods or control rods are withdrawn or the Control Rod Drive (CRD) System is capable of withdrawing the shutdown rods or the control rods. In this condition, inadvertent control rod withdrawal is possible. In MODE 3, 4, or 5, manual initiation of a reactor trip does not have to be OPERABLE if the CRD System is not capable of withdrawing the shutdown rods or control rods. If the rods cannot be withdrawn from the core, there is no need to be able to trip the

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reactor because all of the rods are inserted. In MODE 6, neither the shutdown rods nor the control rods are permitted to be withdrawn and the CRD Mechanisms are disconnected from the control rods and shutdown rods. Therefore, the manual initiation Function is not required.

2. Power Range Neutron Flux

The NIS power range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS power range detectors provide input to the Rod Control System and the Steam Generator (SG) Water Level Control System. Therefore, the actuation logic must be able to withstand an input failure to the control system (which may then require the protection Function actuation) and a single failure in the other channels providing the protection Function actuation. Note that this Function also provides a signal to prevent automatic and manual rod withdrawal prior to initiating a reactor trip. Limiting further rod withdrawal may terminate the transient and eliminate the need to trip the reactor.

2.a Power Range Neutron Flux--High

The Power Range Neutron Flux--High trip Function ensures that protection is provided, from all power levels, against a positive reactivity excursion during power operations. These can be caused by rod withdrawal or reductions in RCS temperature. The LCO requires all four of the Power Range Neutron Flux--High channels to be OPERABLE.

In MODE 1 or 2, when a positive reactivity excursion could occur, the Power Range Neutron Flux--High trip must be OPERABLE. This Function will terminate the reactivity excursion and shut down the reactor prior to reaching a power level that could damage the fuel. In MODES 3, 4, 5, or 6, the NIS power range detectors cannot detect neutron levels in this range. In these MODES, the Power Range Neutron Flux--High does not have to be OPERABLE because the reactor is shut down and reactivity excursions in the power range are extremely unlikely. Other RTS Functions and

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administrative controls provide protection against reactivity additions when in MODE 3, 4, 5, or 6.

2.b Power Range Neutron Flux--Low

The LCO requirement for the Power Range Neutron Flux--Low trip Function ensures that protection is provided against a positive reactivity excursion from low power or subcritical conditions.

The LCO requires all four of the Power Range Neutron Flux--Low channels to be OPERABLE.

In MODE 1, below the Power Range Neutron Flux, (P-10 setpoint) and in MODE 2, the Power Range Neutron Flux--Low trip must be OPERABLE.

This Function may be manually blocked by the operator when two out of four power-range channels are greater than approximately 10% of RTP (P-10 setpoint). This Function is automatically unblocked when three out of four power range channels are below the P-10 setpoint. Above the P-10 setpoint, positive reactivity additions are mitigated by the Power Range Neutron Flux--High trip Function.

In MODE 3, 4, 5, or 6, the Power Range Neutron Flux--Low trip Function does not have to be OPERABLE because the reactor is shut down and the NIS power range detectors cannot detect neutron levels in this range. Other RTS trip Functions and administrative controls provide protection against positive reactivity additions or power excursions in MODE 3, 4, 5, or 6.

2.c Power Range Neutron Flux--f(Δ I)

The f(Δ I) function is used in the calculation of the Overtemperature Δ T trip. It is a Function of the indicated difference between the upper and lower NIS power range detectors. This Function measures the axial power distribution. The

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Overtemperature ΔT Trip Setpoint is varied to account for imbalances in the axial power distribution as detected by the NIS upper and lower power range detectors. If axial peaks are greater than the design limit, as indicated by the difference between the upper and lower NIS power range detectors, the Trip Setpoint is reduced in accordance with Note 1 of Table 3.3.1-1.

The LCO requires all four channels of $f(\Delta I)$ to be OPERABLE.

This Function acts only as an input to the Overtemperature ΔT Function; therefore, no LSSS are specifically applied to the $f(\Delta I)$ trip Function.

In MODE 1 or 2, when the Overtemperature ΔT trip is required to be OPERABLE, the $f(\Delta I)$ Function must be OPERABLE because the $f(\Delta I)$ Function provides one of the inputs to the Overtemperature ΔT trip.

3. Power Range Neutron Flux Rate

The Power Range Neutron Flux Rate trips use the same channels as discussed for Function 2 above.

3.a Power Range Neutron Flux--High Positive Rate

The Power Range Neutron Flux--High Positive Rate trip Function ensures that protection is provided against rapid increases in neutron flux which are characteristic of an RCCA drive rod housing rupture and the accompanying ejection of the RCCA. This Function compliments the Power Range Neutron Flux--High and Low Setpoint trip Functions to ensure that the criteria are met for a rod ejection from the power range.

The LCO requires all four of the Power Range Neutron Flux--High Positive Rate channels to be OPERABLE.

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In MODE 1 or 2, when there is a potential to add a large amount of positive reactivity from a rod ejection accident (REA), the Power Range Neutron Flux--High Positive Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux--High Positive Rate trip Function does not have to be OPERABLE because other RTS trip Functions and administrative controls will provide protection against positive reactivity additions. Also, since only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA. In MODE 6, no rods are withdrawn and the SDM is increased during refueling operations. The reactor vessel head is also removed or the closure bolts are detensioned preventing any pressure buildup. In addition, the NIS power range detectors cannot detect neutron levels present in this mode.

3.b Power Range Neutron Flux--High Negative Rate

The Power Range Neutron Flux--High Negative Rate trip function ensures that protection is provided for multiple rod drop accidents. At high power levels, a multiple rod drop accident could cause local flux peaking which would result in an unconservative local DNBR. DNBR is defined as the ratio of the heat flux required to cause a DNB at a particular location in the core to the local heat flux. The DNBR is indicative of the margin to DNB. No credit is taken for the operation of this Function for those rod drop accidents in which the local DNBRs will be greater than the limit.

The LCO requires all four Power Range Neutron Flux--High Negative Rate channels to be OPERABLE. In MODE 1 or 2, when there is a potential for a multiple rod drop accident to occur, the Power Range Neutron Flux--High Negative Rate trip must be OPERABLE. In MODE 3, 4, 5, or 6, the Power Range Neutron Flux--High Negative Rate trip function does not have to be OPERABLE because the core is not critical and DNBR is not a concern. Also, since

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only the shutdown banks may be withdrawn in MODE 3, 4, or 5, the remaining complement of control bank worth ensures a sufficient degree of SDM in the event of an REA. In MODE 6, no rods are withdrawn and the required SDM is increased during refueling operations. In addition, the NIS power range detectors cannot detect neutron levels present in this MODE.

4. Intermediate Range Neutron Flux

The Intermediate Range Neutron Flux trip Function ensures that protection is provided against an uncontrolled RCCA bank withdrawal accident from a subcritical condition during startup. This trip Function provides redundant protection to the Power Range Neutron Flux--Low Setpoint trip Function. The NIS intermediate range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS intermediate range detectors do not provide any input to control systems. Note that this Function also provides a signal to prevent automatic and manual rod withdrawal prior to initiating a reactor trip. Limiting further rod withdrawal may terminate the transient and eliminate the need to trip the reactor.

The LCO requires two channels of Intermediate Range Neutron Flux to be OPERABLE. Two OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function.

Because this trip Function is important only during startup, there is generally no need to disable channels for testing while the Function is required to be OPERABLE. Therefore, a third channel is unnecessary.

In MODE 1 below the P-10 setpoint and in MODE 2 when there is a potential for an uncontrolled rod withdrawal accident during reactor startup, the Intermediate Range Neutron Flux trip must be OPERABLE. Above the P-10 setpoint, the Power Range Neutron Flux--High Setpoint trip provides core protection for a rod withdrawal accident. In MODE 3, 4, or 5, the Intermediate Range Neutron Flux trip does not have to be OPERABLE because

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protection from an uncontrolled rod withdrawal accident is provided by the Source Range Neutron Flux monitor. The core also has the required SDM to mitigate the consequences of a positive reactivity addition accident. In MODE 6, all rods are fully inserted and the core has a required increased SDM. Also, the NIS intermediate range detectors cannot detect neutron levels present in this mode.

5. Source Range Neutron Flux

The LCO requirement for the Source Range Neutron Flux trip Function ensures that protection is provided against an uncontrolled rod bank withdrawal accident from a subcritical condition during startup. This trip Function provides redundant protection to the Power Range Neutron Flux--Low Setpoint and Intermediate Range Neutron Flux trip Functions. In MODES 3, 4, and 5, administrative controls also prevent the uncontrolled withdrawal of rods. The NIS source range detectors are located external to the reactor vessel and measure neutrons leaking from the core. The NIS source range detectors do not provide any inputs to control systems. The source range trip is the only RTS automatic protective Function required in MODES 3, 4, and 5. Therefore, the functional capability at the specified Trip Setpoint is assumed to be available.

The LCO requires two channels of Source Range Neutron Flux to be OPERABLE. Two OPERABLE channels are sufficient to ensure no single random failure will disable this trip Function. The LCO also requires one channel of the Source Range Neutron Flux to be OPERABLE in MODES 3, 4, or 5 with RTBs open.

The Source Range Neutron Flux Function provides protection for control rod withdrawal from subcritical, boron dilution and control rod ejection events. The Function also provides visual neutron flux indication in the control room.

In MODE 2 when below the P-6 setpoint during a reactor startup, the Source Range Neutron Flux trip must be OPERABLE. Above the P-6 setpoint, the Intermediate Range Neutron Flux trip and the Power Range Neutron

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Flux--Low Setpoint trip will provide core protection for reactivity accidents. Above the P-6 setpoint, the NIS Source Range Neutron Flux trip Function is disabled and inoperable.

In MODE 3, 4, or 5 with the reactor shut down, the Source Range Neutron Flux trip Function must also be OPERABLE. If the CRD System is capable of rod withdrawal, the Source Range Neutron Flux trip must be OPERABLE to provide core protection against a rod withdrawal accident. If the CRD System is not capable of rod withdrawal, the source range detectors are not required to trip the reactor. However, their monitoring Function must be OPERABLE to monitor core neutron levels and provide indication of reactivity changes that may occur as a result of events like a boron dilution. The requirements for the NIS source range detectors in MODE 6 are addressed in LCO 3.9.3, "Nuclear Instrumentation."

6. Overtemperature ΔT

The Overtemperature ΔT trip Function is provided to ensure that the design limit DNBR is met. This trip Function also limits the range over which the Overpower ΔT trip function must provide protection. The inputs to the Overtemperature ΔT trip include pressurizer pressure, power, reactor coolant temperature, axial power distribution, and reactor power as indicated by loop ΔT assuming full reactor coolant flow. Protection from violating the DNBR limit is assured for those transients that are slow with respect to delays from the core to the measurement system. The Function monitors both variation in power and flow since a decrease in flow has the same effect on ΔT as a power increase. The Overtemperature ΔT trip Function uses each loop's ΔT as a measure of reactor power and is compared with a setpoint that is automatically varied with the following parameters:

- reactor coolant average temperature - the Trip Setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature;
- pressurizer pressure - the Trip Setpoint is varied to correct for changes in system pressure;

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- axial power distribution - (discussed under Function 2.c, $f(\Delta I)$).

Dynamic compensation is included for system piping delays from the core to the temperature measurement system.

The Overtemperature ΔT trip Function is calculated for each loop as described in Note 1 of Table 3.3.1-1. Trip occurs if Overtemperature ΔT is indicated in two loops.

The pressure and temperature signals are used for other control Functions. The actuation logic must be able to withstand an input failure to the control system, which may then require the protection Function actuation, and a single failure in the other channels providing the protection Function actuation. Note that this function also provides a signal to generate a turbine runback prior to reaching the Trip Setpoint. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overtemperature ΔT condition and may prevent a reactor trip.

The LCO requires all four channels of the Overtemperature ΔT trip Function to be OPERABLE in MODE 1 or 2. Note that the Overtemperature ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overtemperature ΔT trip must be OPERABLE to prevent DNB. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about DNB.

7. Overpower ΔT

The Overpower ΔT trip Function ensures that protection is provided to ensure the integrity of the fuel (i.e., no fuel pellet melting and less than 1% cladding strain) under all possible overpower conditions. This trip Function also limits the required range of the

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Overtemperature ΔT trip Function and provides a backup to the Power Range Neutron Flux--High Setpoint trip. The Overpower ΔT trip Function ensures that the allowable heat generation rate (kW/ft) of the fuel is not exceeded. It uses the ΔT of each loop as a measure of reactor power with a setpoint that is automatically varied with the following parameters:

- reactor coolant average temperature - the trip setpoint is varied to correct for changes in coolant density and specific heat capacity with changes in coolant temperature; and
- rate of change of reactor coolant average temperature - including dynamic compensation for the delays between the core and the temperature measurement system.

The Overpower ΔT trip Function is calculated for each loop as per Note 2 of Table 3.3.1-1. Trip occurs if Overpower ΔT is indicated in two loops. The temperature signals are also for other control Functions. Therefore, the actuation logic must be able to withstand an input failure to the control system which may then require the protection Function actuation and a single failure in the remaining channels providing the protection Function actuation. Note that this Function also provides a signal to generate a turbine runback prior to reaching the TRIP SETPOINT. A turbine runback will reduce turbine power and reactor power. A reduction in power will normally alleviate the Overpower ΔT condition and may prevent a reactor trip.

The LCO requires four channels of the Overpower ΔT trip Function to be OPERABLE. Note that the Overpower ΔT Function receives input from channels shared with other RTS Functions. Failures that affect multiple Functions require entry into the Conditions applicable to all affected Functions.

In MODE 1 or 2, the Overpower ΔT trip Function must be OPERABLE. These are the only times that enough heat is generated in the fuel to be concerned about the heat

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generation rates and overheating of the fuel. In MODE 3, 4, 5, or 6, this trip Function does not have to be OPERABLE because the reactor is not operating and there is insufficient heat production to be concerned about fuel overheating and fuel damage.

8. Pressurizer Pressure

The same sensors provide input to the Pressurizer Pressure--High and --Low Setpoint trips and the Overtemperature ΔT trip. The Pressurizer Pressure channels are also used to provide input to the Pressurizer Pressure Control System. Therefore, the actuation logic must be able to withstand an input failure to the control system (which may then require the protection Function actuation) and a single failure in the other channels providing the protection Function actuation.

8.a Pressurizer Pressure--Low

The Pressurizer Pressure--Low trip Function ensures that protection is provided against violating the DNBR limit due to low pressure.

The LCO requires all four channels of Pressurizer Pressure--Low to be OPERABLE in MODE 1 above P-7.

In MODE 1, when DNB is a major concern, the Pressurizer Pressure--Low trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-7 interlock (NIS power range P-10 or turbine impulse pressure greater than approximately 10% of full power equivalent (P-13)). On decreasing power, this trip Function is automatically blocked below P-7. Below the P-7 setpoint, no conceivable power distributions can occur that would cause DNB concerns.

8.b Pressurizer Pressure--High

The Pressurizer Pressure--High trip Function ensures that protection is provided against

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overpressurizing the RCS. This trip Function operates in conjunction with the pressurizer relief and safety valves to prevent RCS overpressure conditions.

The LCO requires all four channels of Pressurizer Pressure--High to be OPERABLE.

The Pressurizer Pressure - High LSSS is selected to be below the pressurizer safety valve actuation pressure and above the power operated relief valve (PORV) setting. This setting minimizes challenges to safety valves while avoiding unnecessary reactor trip for those pressure increases which can be controlled by the PORVs.

In MODE 1 or 2, the Pressurizer Pressure--High trip must be OPERABLE to help prevent RCS overpressurization and minimize challenges to the relief and safety valves. In MODE 3, 4, 5, or 6, the Pressurizer Pressure--High trip Function does not have to be OPERABLE because transients which could cause an overpressure condition will be slow to occur. Therefore, the operator will have sufficient time to evaluate unit conditions and take corrective actions. Additionally, low temperature overpressure protection systems provide overpressure protection when below MODE 4.

9. Pressurizer Water Level--High

The Pressurizer Water Level--High trip Function provides a backup signal for the Pressurizer Pressure--High trip and also provides protection against water relief through the pressurizer safety valves. These valves are designed to pass steam in order to achieve their design energy removal rate. A reactor trip is actuated prior to the pressurizer becoming water solid. The LCO requires three channels of Pressurizer Water Level--High to be OPERABLE. The pressurizer level channels are used as input to the Pressurizer Level Control System. A fourth channel is not required to address control/protection interactions concerns. The level channels do not actuate the safety valves, and the high

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pressure reactor trip is set below the safety valve setting. Therefore, with the slow rate of charging available, pressure overshoot due to level channel failure cannot cause the safety valve to lift before reactor high pressure trip.

In MODE 1 when there is a potential for overfilling the pressurizer, the Pressurizer Water Level--High trip must be OPERABLE. This trip Function is automatically enabled on increasing power by the P-7 interlock. On decreasing power, this trip Function is automatically blocked below P-7. Below the P-7 setpoint, transients which could raise the pressurizer water level will be slow and the operator will have sufficient time to evaluate unit conditions and take corrective actions.

10.a Reactor Coolant Flow--Low (Single Loop)

The Reactor Coolant Flow--Low (Single Loop) trip Function ensures that protection is provided against violating the DNBR limit due to low flow in one or more RCS loops, while avoiding reactor trips due to normal variations in loop flow. Above the P-8 setpoint, which is approximately 48% of RTP, a loss of flow in any RCS loop will actuate a reactor trip.

Each RCS loop has three flow detectors to monitor flow. The flow signals are not used for any control system input.

The LCO requires three Reactor Coolant Flow--Low channels per loop to be OPERABLE in MODE 1 above P-8.

In MODE 1 above the P-8 setpoint, a loss of flow in one RCS loop could result in DNB conditions in the core. In MODE 1 below the P-8 setpoint, a loss of flow in two or more loops is required to actuate a reactor trip (Function 10.b) because of the lower power level and the greater margin to the design limit DNBR.

10.b Reactor Coolant Flow--Low (Two Loops)

The Reactor Coolant Flow--Low (Two Loops) trip Function ensures that protection is provided against violating the DNBR limit due to low flow in two or more RCS loops

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while avoiding reactor trips due to normal variations in loop flow. Above the P-7 setpoint and below the P-8 setpoint, a loss of flow in two or more loops will initiate a reactor trip. Each loop has three flow detectors to monitor flow. The flow signals are not used for any control system input.

The LCO requires three Reactor Coolant Flow--Low channels per loop to be OPERABLE.

In MODE 1 above the P-7 setpoint and below the P-8 setpoint, the Reactor Coolant Flow--Low (Two Loops) trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on low flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the reactor trip on low flow in two or more RCS loops is automatically enabled. Above the P-8 setpoint, a loss of flow in any one loop will actuate a reactor trip because of the higher power level and the reduced margin to the design limit DNBR.

11. Undervoltage Reactor Coolant Pumps

The Undervoltage RCPs reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of flow in two or more RCS loops. The voltage to each RCP is monitored. Above the P-7 setpoint, a loss of voltage detected on two or more RCP buses will initiate a reactor trip. This trip Function will generate a reactor trip before the Reactor Coolant Flow--Low (Two Loops) Trip Setpoint is reached. The loss of voltage in two loops must be sustained for a length of time equal to or greater than that set in the time delays. Time delays are incorporated into the Undervoltage RCPs channels to prevent reactor trips due to momentary electrical power transients.

The LCO requires one Undervoltage RCP channel per bus to be OPERABLE.

In MODE 1, above the P-7 setpoint, the Undervoltage RCP trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on loss of flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level.

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Above the P-7 setpoint, the reactor trip on loss of flow in two or more RCS loops is automatically enabled.

12. Underfrequency Reactor Coolant Pumps

The Underfrequency RCPs reactor trip Function ensures that protection is provided against violating the DNBR limit due to a loss of two or more RCS loops from a major network frequency disturbance. An underfrequency condition will slow down the pumps, thereby reducing their coastdown time following a pump trip. The proper coastdown time is required so that reactor heat can be removed immediately after reactor trip. The frequency of each RCP bus is monitored. Above the P-7 setpoint, a loss of frequency detected on two or more RCP buses will initiate a reactor trip. This trip Function will generate a reactor trip before the Reactor Coolant Flow--Low (Two Loops) Trip Setpoint is reached. Time delays are incorporated into the Underfrequency RCPs channels to prevent reactor trips due to momentary electrical power transients.

The LCO requires one Underfrequency RCP channel per bus to be OPERABLE.

In MODE 1 above the P-7 setpoint, the Underfrequency RCPs trip must be OPERABLE. Below the P-7 setpoint, all reactor trips on loss of flow are automatically blocked since no conceivable power distributions could occur that would cause a DNB concern at this low power level. Above the P-7 setpoint, the reactor trip on loss of flow in two RCS loops is automatically enabled.

13. Steam Generator Water Level--Low Low

The SG Water Level--Low Low trip Function ensures that protection is provided against a loss of heat sink and

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actuates the AFW System prior to uncovering the SG tubes. The SGs are the heat sink for the reactor. In order to act as a heat sink, the SGs must contain a minimum amount of water. A narrow range low-low level in any SG is indicative of a loss of heat sink for the reactor. The level transmitters provide input to the SG Level Control System. Control/protection interaction is addressed by the use of a Median Signal Selector which prevents a single failure of a channel providing input to the control system from initiating a condition requiring protection function action. The Median Signal Selector performs this by not selecting the channels indicating the highest or lowest steam generator levels as input to the control system.

Because one failed protection instrument channel would not result in an adverse control system action, a second random protection system failure (as otherwise required by IEEE 279-1971) need not be considered.

The Steam Generator Water Level Trip Time Delay (TTD) creates additional operational margin when the plant needs it most, during escalation to power, by allowing the operator time to recover level when the primary side load is sufficiently small to allow such action. The TTD is based on continuous monitoring of primary side power through the use of vessel ΔT . Two time delays are calculated, based on the number of steam generators indicating less than the Low-Low Trip Setpoint. The magnitude of the delays decreases with increasing primary side power level, up to 50% RTP. Above 50% RTP there are no time delays for the Low-Low Level channel trips.

In the event of failure of a Steam Generator Water Level Channel, the channel is placed in the trip condition as input to the Solid State Protection System (SSPS) and does not affect the TTD setpoint calculations for the remaining OPERABLE channels. It is then necessary for the operator to force the use of the shorter TTD time delay by adjustment of the single steam generator time delay calculation (T_S) to match the multiple steam generator time delay calculation (T_M) for the affected protection set, through the Man-Machine Interface.

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Failure of the vessel ΔT channel input (failure of more than one T_H RTD or failure of a T_C RTDs) does not affect the TTD calculation for a protection set. This results in the requirement that the operator adjust the threshold power level for zero seconds time delay from 50% RTP to 0% RTP, through the Man Machine Interface.

This Function also performs the ESFAS Function of starting the AFW pumps on low low SG level.

The LCO requires three channels of SG Water Level--Low Low per SG to be OPERABLE in MODE 1 or 2.

In MODE 1 or 2, when the reactor requires a heat sink, the SG Water Level--Low Low trip must be OPERABLE. The normal source of water for the SGs is the Main Feedwater (MFW) System (not-safety related). The AFW System is the safety-related backup source of water to ensure that the SGs remain the heat sink for the reactor. During normal startups and shutdowns, the MFW provides feedwater to maintain SG level. In MODE 3, 4, 5, or 6, the SG Water Level--Low Low Function does not have to be OPERABLE because the reactor is not operating or even critical. Decay heat removal is accomplished by the AFW or MFW System in MODE 3 and by the Residual Heat Removal (RHR) System in MODE 4, 5, or 6.

14. Turbine Trip

14.a Turbine Trip--Low Fluid Oil Pressure

The reactor trip on Turbine Trip--Low Fluid Oil Pressure is anticipatory for the loss of heat removal capabilities of the secondary system following a turbine trip. This trip Function acts to minimize the pressure/temperature transient on the reactor. Any turbine trip from a power level below the P-9 setpoint, approximately 50% power, will not actuate a reactor trip. Three pressure switches monitor the control oil pressure in the Turbine Electrohydraulic Control System. A low pressure sensed by two out of three of the pressure switches will actuate a reactor trip. These pressure switches do not provide any input to the control system. The unit is designed to withstand a complete loss of load and not sustain core damage or challenge the RCS pressure limitations. Core

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protection is provided by the Pressurizer Pressure-High trip Function and RCS integrity is ensured by the pressurizer safety valves.

The LCO requires three channels of Turbine Trip-Low Fluid Oil Pressure to be OPERABLE in MODE 1 above P-9. Below the P-9 setpoint, a turbine trip does not actuate a reactor trip. In MODE 2, 3, 4, 5, or 6, there is no potential for a turbine trip; and the Turbine Trip--Low Fluid Oil Pressure trip Function does not need to be OPERABLE.

14.b Turbine Trip--Turbine Stop Valve Closure

The reactor trip on Turbine Trip--Turbine Stop Valve Closure is anticipatory for the loss of heat removal capabilities of the secondary system following a turbine trip above P-9. Any turbine trip from a power level below the P-9 setpoint, approximately 50% power, will not actuate a reactor trip. The trip Function anticipates the loss of secondary heat removal capability that occurs when the stop valves close. Tripping the reactor in anticipation of loss of secondary heat removal acts to minimize the pressure and temperature transient on the reactor. This trip Function will not and is not required to operate in the presence of a single channel failure. The unit is designed to withstand a complete loss of load and not sustain core damage or challenge the RCS pressure limitations. Core protection is provided by the Pressurizer Pressure--High trip Function, and RCS integrity is ensured by the pressurizer safety valves. This trip Function is diverse to the Turbine Trip--Low Fluid Oil Pressure trip Function. Each turbine stop valve is equipped with one limit switch that inputs to the RTS. If all four limit switches indicate that the stop valves are all closed, a reactor trip is initiated.

The Trip Setpoint for this Function is set to assure channel trip occurs when the associated stop valve is completely closed.

The LCO requires four Turbine Trip--Turbine Stop Valve Closure channels, one per valve, to be OPERABLE in MODE 1 above P-9. All four channels must trip to cause reactor trip.

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Below the P-9 setpoint, a load rejection can be accommodated by the Rod Control System and the Steam Dump System without actuating a Reactor Trip. In MODE 2, 3, 4, 5, or 6, there is no potential for a load rejection; and the Turbine Trip--Turbine Stop Valve Closure trip Function does not need to be OPERABLE.

15. Safety Injection Input from Engineered Safety Feature Actuation System

The SI Input from ESFAS ensures that if a reactor trip has not already been generated by the RTS, the ESFAS automatic actuation logic will initiate a reactor trip upon any signal which initiates SI. This is a condition of acceptability for the LOCA. However, other transients and accidents take credit for varying levels of ESF performance and rely upon rod insertion, except for the most reactive rod which is assumed to be fully withdrawn, to ensure reactor shutdown. Therefore, a reactor trip is initiated every time an SI signal is present.

Trip Setpoint and Allowable Values are not applicable to this Function. The SI input is provided by solid state logic in the ESFAS. Therefore, there is no measurement signal with which to associate an LSSS.

The LCO requires two trains of SI Input from ESFAS to be OPERABLE in MODE 1 or 2.

This trip Function must be OPERABLE in MODE 1 or 2, when the reactor is critical. In MODE 3, 4, 5, or 6, the reactor is not critical; and this trip Function does not need to be OPERABLE.

16. Reactor Trip System Interlocks

Reactor protection interlocks are provided to ensure reactor trips are in the correct configuration for the current unit status. They back up operator actions to ensure protection system Functions are not bypassed during plant conditions under which the safety analysis assumes the Functions are not bypassed. Therefore the interlock Functions do not need to be OPERABLE when the

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unit is not in the applicable MODES which require the associated reactor trip Functions. The interlock Functions are:

16.a Intermediate Range Neutron Flux, P-6

The Intermediate Range Neutron Flux, P-6 interlock is actuated when any NIS intermediate range channel goes approximately one decade above the minimum channel reading. If both channels drop below the setpoint, the permissive will automatically be defeated. The LCO requirement for the P-6 interlock ensures that the following Functions are performed:

- on increasing power, the P-6 interlock allows the manual block of the NIS Source Range, Neutron Flux Reactor Trip. This prevents a premature block of the source range trip and allows the operator to ensure that the intermediate range is OPERABLE prior to leaving the source range;
- on decreasing power, the P-6 interlock automatically enables the NIS Source Range Neutron Flux reactor trip;

The LCO requires two channels of Intermediate Range Neutron Flux, P-6 interlock to be OPERABLE in MODE 2 when below the P-6 interlock setpoint.

P-6 interlock setpoint, the NIS Source Range Neutron Flux reactor trip will be blocked; and this Function will no longer be necessary. In MODE 3, 4, 5, or 6, the P-6 interlock does not have to be OPERABLE because the NIS Source Range is providing core protection.

16.b Low Power Reactor Trips Block, P-7

The Low Power Reactor Trips Block, P-7 interlock is actuated by input from either the Power Range Neutron Flux, P-10 or the Turbine Impulse Pressure,

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P-13 interlock. The LCO requirement for the P-7 interlock ensures that the following Functions are performed:

1. on increasing power, the P-7 interlock automatically enables reactor trips on the following Functions:
 - Pressurizer Pressure--Low;
 - Pressurizer Water Level--High;
 - Reactor Coolant Flow--Low (Two Loops);
 - Undervoltage RCPs; and
 - Underfrequency RCPs.

These reactor trips are only required when operating above the P-7 setpoint (approximately 10% RTP). These reactor trips provide protection against violating the DNBR limit. Below the P-7 setpoint, the RCS is capable of providing sufficient natural circulation without any RCP running.

2. on decreasing power, the P-7 interlock automatically blocks reactor trips on the following Functions:
 - Pressurizer Pressure--Low;
 - Pressurizer Water Level--High;
 - Reactor Coolant Flow--Low (Two Loops);
 - Undervoltage RCPs; and
 - Underfrequency RCPs.

Trip Setpoint and Allowable Value are not applicable to the P-7 interlock because it is a logic Function and thus has no parameter with which to associate an LSSS.

The P-7 interlock is a logic Function with train and not channel identity. Therefore, the LCO requires one channel per train of Low Power Reactor Trips Block, P-7 interlock to be OPERABLE in MODE 1. (continued)

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The low power trips are blocked below the P-7 setpoint and unblocked above the P-7 setpoint. In MODE 2, 3, 4, 5, or 6, this Function does not have to be OPERABLE because the interlock performs its Function when power level drops below 10% power, which is in MODE 1.

16.c Power Range Neutron Flux, P-8

The Power Range Neutron Flux, P-8 interlock is actuated at approximately 48% power as determined by two out of four NIS power range detectors. Above approximately 48% power the P-8 interlock automatically enables the Reactor Coolant Flow--Low (Single Loop) reactor trip on low flow in one or more RCS loops on increasing power. The LCO requirement for this trip Function ensures that protection is provided against a loss of flow in any RCS loop that could result in DNB conditions in the core when greater than approximately 48% power. Below approximately 48% power, the reactor trip on low flow in any loop is automatically blocked.

The LCO requires four channels of Power Range Neutron Flux, P-8 interlock to be OPERABLE in MODE 1.

In MODE 1, when a loss of flow in one RCS loop could result in DNB conditions, the Power Range Neutron Flux, P-8 interlock must be OPERABLE. In MODE 2, 3, 4, 5, or 6, this Function does not have to be OPERABLE because the core is not producing sufficient power to be concerned about DNB conditions.

16.d Power Range Neutron Flux, P-9

The Power Range Neutron Flux, P-9 interlock is actuated at approximately 50% power as determined by two out of four NIS power-range detectors. The LCO requirement for this Function ensures that the reactor trips, Turbine Trip--Low Fluid Oil Pressure and Turbine Trip--Turbine Stop Valve Closure, are enabled above the P-9 setpoint. Above the P-9 setpoint, a turbine trip will cause a load rejection beyond the combined capacity of the Steam Dump System and Rod Control System. A reactor trip is automatically initiated on a turbine trip when it is above the P-9 setpoint to minimize the transient on the reactor.

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The LCO requires four channels of Power Range Neutron Flux, P-9 interlock to be OPERABLE in MODE 1.

In MODE 1 a turbine trip could cause a load rejection beyond the capacity of the Steam Dump System, the Power Range Neutron Flux interlock must be OPERABLE. In MODE 2, 3, 4, 5, or 6, this Function does not have to be OPERABLE because the reactor is not at a power level sufficient to have a load rejection beyond the capacity of the Steam Dump System.

16.e Power Range Neutron Flux, P-10

The Power Range Neutron Flux, P-10 interlock is actuated at approximately 10% power as determined by two out of four NIS power-range detectors. If power level falls below 10% power on 3 of 4 channels, the nuclear instrument trips will be automatically unblocked. The LCO requirement for the P-10 interlock ensures that the following Functions are performed:

- on increasing power, the P-10 interlock allows the operator to manually block the Intermediate Range Neutron Flux reactor trip. Note that blocking the reactor trip also blocks the signal to prevent automatic and manual rod withdrawal;
- on increasing power, the P-10 interlock allows the operator to manually block the Power Range Neutron Flux--Low reactor trip;
- on increasing power, the P-10 interlock automatically provides a backup signal to block the Source Range Neutron Flux reactor trip and also to de-energize the NIS source range detectors,
- the P-10 interlock provides one of the two inputs to the P-7 interlock, and
- on decreasing power, the P-10 interlock automatically enables the Power Range Neutron Flux--Low reactor trip and the Intermediate Range Neutron Flux reactor trip (and rod stop).

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The LCO requires four channels of Power Range Neutron Flux, P-10 interlock to be OPERABLE in MODE 1 or 2.

OPERABILITY in MODE 1 ensures the Function is available to perform its decreasing power functions in the event of a reactor shutdown. This Function must also be OPERABLE in MODE 2 to ensure that core protection is provided during a startup or shutdown by the Power Range Neutron Flux--Low Setpoint and Intermediate Range Neutron Flux reactor trips. In MODE 3, 4, 5, or 6, this Function does not have to be OPERABLE because the reactor is not at power and the Source Range Neutron Flux reactor trip provides core protection.

16.f Turbine Impulse Pressure, P-13

The Turbine Impulse Pressure, P-13 interlock is actuated when the pressure in the first stage of the high pressure turbine is greater than approximately 10% of the rated full power pressure. This is determined by one out of two pressure detectors. The LCO requirement for this Function ensures that one of the inputs to the P-7 interlock is available.

The LCO requires two channels of Turbine Impulse Pressure, P-13 interlock to be OPERABLE in MODE 1.

The Turbine Impulse Chamber Pressure, P-13 interlock must be OPERABLE when the turbine generator is operating. The interlock Function is not required to be OPERABLE in MODE 2, 3, 4, 5, or 6 because the turbine generator is not operating.

17. Reactor Trip Breakers

This trip Function applies to the RTBs exclusive of individual trip mechanisms. The LCO requires two OPERABLE trains of trip breakers. A trip breaker train consists of all trip breakers associated with a single RTS logic train that are racked in, closed, and capable of supplying power to the CRD System. Thus the train may consist of the main breaker, bypass breaker, or main breaker and bypass breaker, depending upon the system configuration. Two OPERABLE trains ensure no single random failure can disable the RTS trip capability.

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These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RTS trip Functions must be OPERABLE when the RTBs and associated bypass breakers are in use, are closed, and the CRD System is capable of rod withdrawal.

18. Reactor Trip Breaker Undervoltage and Shunt Trip Mechanisms

The LCO requires both the undervoltage and shunt trip mechanisms to be OPERABLE for each RTB that is in service. The trip mechanisms are not required to be OPERABLE for trip breakers that are open, racked out, incapable of supplying power to the CRD System, or declared inoperable under Function 17 above.

OPERABILITY of both trip mechanisms on each breaker ensures that no single trip mechanism failure will prevent opening any breaker on a valid signal.

These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RTS trip Functions must be OPERABLE when the RTBs and associated bypass breakers are closed, and the CRD System is capable of rod withdrawal.

19. Automatic Trip Logic

The LCO requirement for the RTBs (Functions 17 and 18 and Automatic Trip Logic (Function 19) ensures that means are provided to interrupt the power to allow the rods to fall into the reactor core. Each RTB is equipped with an undervoltage coil and a shunt trip coil to trip the breaker open when needed. Each RTB is equipped with a bypass breaker to allow testing of the trip breaker while the unit is at power. The reactor trip signals generated by the RTS Automatic Trip Logic cause the RTBs and associated bypass breakers to open and shut down the reactor.

The LCO requires two trains of RTS Automatic Trip Logic to be OPERABLE. Having two OPERABLE trains ensures that random failure of a single logic channel will not prevent a reactor trip.

These trip Functions must be OPERABLE in MODE 1 or 2 when the reactor is critical. In MODE 3, 4, or 5, these RTS trip Functions must be OPERABLE when the RTBs and associated bypass breakers are closed, and the CRD System is capable of rod withdrawal.

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The RTS instrumentation satisfies criterion 3 of the NRC Policy Statement

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A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.1-1. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

In the event a channel's Trip Setpoint is found nonconservative with respect to the Allowable Value, or the transmitter, instrument loop, signal processing electronics, setpoint comparator trip output, contact output, or bistable is found inoperable, then all affected Functions provided by that channel must be declared inoperable and the LCO Condition entered for the particular protection Function affected.

When the number of inoperable channels in a trip Function exceed those specified in one or other related Conditions associated with a trip Function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 must be immediately entered if applicable in the current MODE of operation.

A.1

Condition A is applicable to all RTS protection Functions. Condition A addresses the situation where one or more required channels for one or more functions are inoperable at the same time. The Required Action is to refer to Table 3.3.1-1 and to take the Required Actions for the protection Functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

B.1, B.2.1, and B.2.2

Condition B applies to the Manual Reactor Trip in MODE 1 or 2. This action addresses the train orientation of the SSPS for this Function. With one channel inoperable, the inoperable channel must be restored to OPERABLE status

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within 48 hours. In this Condition, the remaining OPERABLE channel is adequate to perform the safety function.

The Completion Time of 48 hours is reasonable considering that there are two automatic actuation trains and another manual initiation channel OPERABLE and the low probability of an event occurring during this interval.

If the Manual Reactor Trip Function cannot be restored to OPERABLE status in the allowed 48 hour Completion Time, the unit must be placed in a MODE in which the requirement does not apply. This is done by placing the unit within at least MODE 3 within 6 additional hours (54 hours total time) followed by opening the RTBs within 1 additional hour (55 hours total time). The 6 additional hours to reach MODE 3 and the 1 hour to open the RTBs are reasonable, based on operating experience, to reach MODE 3 and open the RTBs from full power operation in an orderly manner and without challenging systems. With the RTBs open and the unit in MODE 3, this trip Function is no longer required to be OPERABLE.

C.1 and C.2

Condition C applies to the following reactor trip functions in MODE 3, 4, or 5 with the RTBs closed and the CRD System capable of rod withdrawal:

- Manual Reactor Trip;
- RTBs;
- RTB Undervoltage and Shunt Trip Mechanisms; and
- Automatic Trip Logic.

This action addresses the channel or train orientation of the SSPS for these Functions. With one channel or train inoperable, the inoperable channel or train must be restored to OPERABLE status within 48 hours. If the affected Function(s) cannot be restored to OPERABLE status within the allowed 48-hour Completion Time, the unit must be placed in a MODE in which the requirement does not apply. This is done by opening the RTBs within the next hour. The additional hour provides sufficient time to accomplish the action in an orderly manner. With the RTBs open, these Functions are no longer required.

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The Completion Time is reasonable considering that in this condition, the remaining OPERABLE train is adequate to perform the safety Function and given the low probability of an event occurring during this interval.

D.1.1, D.1.2, D.2.1, D.2.2, and D.3

Condition D applies to the Power Range Neutron Flux--High Function:

The NIS power range detectors provide input to the CRD System and the SG Water Level Control System and, therefore, have a two out of four trip logic. A known inoperable channel must be placed in the tripped condition. This results in a partial trip condition requiring only one out of three logic for actuation. The 6 hours allowed to place the inoperable channel in the tripped condition is justified in Reference 7.

In addition to placing the inoperable channel in the tripped condition, THERMAL POWER must be reduced to $\leq 75\%$ of RTP within 12 hours. Reducing the power level prevents operation of the core with radial power distributions beyond the design limits. With one of the NIS power range detectors inoperable, 1/4 of the radial power distribution monitoring capability is lost.

As an alternative to the above actions, the inoperable channel can be placed in the tripped condition within 6 hours and the QPTR monitored once every 12 hours as per SR 3.2.4.2, QPTR verification. Calculating QPTR every 12 hours compensates for the lost monitoring capability due to the inoperable NIS power range channel and allows continued unit operation at power levels $> 75\%$ of RTP. The 6 hour Completion Time and the 12 hour Frequency are consistent with LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)."

If the Required Actions described above cannot be met within the specified Completion Times, the unit must be placed in a MODE where this Function is no longer required OPERABLE. An additional 6 hours beyond the Completion Time for Required Action D.1.1 and Required Action D.2.1 are allowed to place the unit in MODE 3. Six hours is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. If Required Action D.2.2 cannot be completed within the allowed Completion Times, LCO 3.0.3 must be entered.

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The Required Actions have been modified by a Note, which allows any single channel, including the inoperable channel, to be bypassed for up to 4 hours while performing surveillance testing. The Note also allows placing the inoperable channel in the bypass condition to allow setpoint adjustments of other channels when required to reduce the setpoint in accordance with other technical specification. The 4 hour time limit is justified in Reference 7.

E.1 and E.2

Condition E applies to the following reactor trip Functions:

- Power Range Neutron Flux--Low;
- Power Range Neutron Flux--f(ΔI);
- Overtemperature ΔT ;
- Overpower ΔT ;
- Power Range Neutron Flux--High Positive Rate;
- Power Range Neutron Flux--High Negative Rate;
- Pressurizer Pressure--High;

A known inoperable channel must be placed in the tripped condition within 6 hours. Placing the channel in the tripped condition results in a partial trip condition requiring only one out of two logic for actuation of the two out of three trips and one out of three logic for actuation of the two out of four trips. The 6 hours allowed to place the inoperable channel in the tripped condition is justified in Reference 7.

If the operable channel cannot be restored or placed in the trip condition within the specified Completion Time, the unit must be placed in a MODE where these Functions are not required OPERABLE. An additional 6 hours is allowed to place the unit in MODE 3. Six hours is a reasonable time, based on operating experience, to place the unit in MODE 3 from full power in an orderly manner and without challenging unit systems.

The Required Actions have been modified by a Note which allows any single channel, including the inoperable channel,

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E.1 and E.2 (continued)

to be bypassed for up to 4 hours while performing surveillance testing. The 4-hour time limit is justified in Reference 7.

F.1 and F.2

Condition F applies to the Intermediate Range Neutron Flux trip when THERMAL POWER is above the P-6 setpoint and below the P-10 setpoint and one channel is inoperable. Above the P-6 setpoint and below the P-10 setpoint, the NIS intermediate range detector performs the monitoring Functions. If THERMAL POWER is greater than the P-6 setpoint but less than the P-10 setpoint, 2 hours is allowed to reduce THERMAL POWER below the P-6 setpoint or increase THERMAL POWER above the P-10 setpoint. The NIS Intermediate Range Neutron Flux channels must be OPERABLE when the power level is above the capability of the source range, P-6, and below the capability of the power range, P-10. If THERMAL POWER is greater than the P-10 setpoint, the NIS power range detectors perform the monitoring and protective functions and the intermediate range is not required. The Completion Times 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 redundant OPERABLE channel and the low probability of its failure during this period. This action does not require the inoperable channel to be tripped because the Function uses one out of two logic. Tripping one channel would trip the reactor. Thus, the Required Actions specified in this Condition are only applicable when channel failure does not result in reactor trip.

G.1 and G.2

Condition G applies to two inoperable Intermediate Range Neutron Flux trip channels in MODE 2 when THERMAL Power is above the P-6 setpoint and below the P-10 setpoint. Required Actions specified in this Condition are only applicable when channel failures do not result in reactor trip. Above the P-6 setpoint and below the P-10 setpoint, the NIS intermediate range detector performs the monitoring Functions. With no intermediate range channels OPERABLE, the Required Actions are to suspend operations involving positive reactivity additions immediately. This will preclude any power level increase since there are no

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OPERABLE Intermediate Range Neutron Flux channels. The operator must also reduce THERMAL POWER below the P-6 setpoint within two hours. Below P-6, the Source Range Neutron Flux channels will be able to monitor the core power level. The Completion Time of 2 hours 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 NIS Intermediate Range Neutron Flux trip.

H.1

Condition H applies to the Intermediate Range Neutron Flux trip when THERMAL POWER is below the P-6 setpoint and one or two channels are inoperable. Below the P-6 setpoint, the NIS source range performs the monitoring and protective Functions. The inoperable NIS intermediate range channel(s) must be returned to OPERABLE status prior to increasing power above the P-6 setpoint. The NIS intermediate range channels must be OPERABLE when the power level is above the capability of the source range, P-6, and below the capability of the power range, P-10.

I.1

Condition I applies to one inoperable Source Range Neutron Flux trip channel when in MODE 2, below the P-6 setpoint, and performing a reactor startup. With the unit in this Condition, < P-6, the NIS source range performs the monitoring and protective functions. With one of the two channels inoperable, operations involving positive reactivity additions shall be suspended immediately.

This will preclude any power escalation. With only one source range channel OPERABLE, core protection is severely reduced and any actions that add positive reactivity to the core must be suspended immediately.

J.1

Condition J applies to two inoperable Source Range Neutron Flux trip channels when in MODE 2, below the P-6 setpoint, and performing a reactor startup; or in MODE 3, 4, or 5 with the RTBs closed and the CRD System capable of rod withdrawal. With the unit in this Condition, < P-6, the NIS source range performs the monitoring and protective

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J.1 (continued)

functions. With both source range channels inoperable, the RTBs must be opened immediately. With the RTBs open the core is in a more stable condition and the unit enters Condition L.

K.1 and K.2

Condition K applies to one inoperable source range channel in MODE 3, 4, or 5 with the RTBs closed and the CRD System capable of rod withdrawal. With the unit in this condition, < P-6, the NIS source range performs the monitoring and protective functions. With one of the source range channels inoperable, 48 hours is allowed to return it to an OPERABLE status. If the channel cannot be returned to an OPERABLE status, 1 additional hour is allowed to open the RTBs. Once the RTBs are open, the core is in a more stable condition and the unit enters Condition L. The allowance of 48 hours to restore the channel to OPERABLE status and the additional hour to open the RTBs are justified in Reference 7.

L.1, L.2, and L.3

Condition L applies when the required Source Range Neutron Flux channel is not met in MODE 3, 4, or 5 with the RTBs open. With the unit in this condition, the NIS source range performs the monitoring and protective Functions. With the required source range channel inoperable, operations involving positive reactivity additions that would reduce the SDM to less than the limits specified in LCO 3.1.1 and LCO 3.1.2 shall be suspended immediately. Required Action L.1 precludes operations involving systems that contain large volumes of water (i.e., CVCS, SIS, and RWST) at reduced boron concentrations with respect to the RCS that could dilute the boron concentrations of the RCS to less than that required to maintain the SDM requirements of LCO 3.1.1 and LCO 3.1.2. This Required Action does not preclude positive reactivity additions that cannot reduce the SDM to less than the limits specified in LCO 3.1.1 and LCO 3.1.2. The addition of water with a boron concentration greater than that required to maintain the reactor shutdown within the requirements of LCO 3.1.1 and LCO 3.1.2, but less than the RCS, is permitted. Positive reactivity additions such as small volume chemical additions and normal plant cooldowns are also permitted as long as the SDM limits specified in LCO 3.1.1 and 3.1.2 are met. This will preclude any power escalation. In addition to suspension of

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(continued)

positive reactivity additions, all valves that could add unborated water to the RCS must be closed within 1 hour as specified in LCO 3.9.2. The isolation of unborated water sources will preclude a boron dilution accident.

Also, the SDM must be verified within 1 hour and once per 12 hours thereafter as per SR 3.1.1.1, SDM verification. With no source range channels OPERABLE, core protection is severely reduced. Verifying the SDM within 1 hour allows sufficient time to perform the calculations and determine that the SDM requirements are met. The SDM must also be verified once per 12 hours thereafter to ensure that the core reactivity has not changed. Required Action L.1 precludes any positive reactivity additions; therefore, core reactivity should not be increasing, and a 12-hour Frequency is adequate. The Completion Times of within 1 hour and once per 12 hours are based on operating experience in performing the Required Actions and the knowledge that unit conditions will change slowly.

M.1 and M.2

Condition M applies to the following reactor trip functions:

- Pressurizer Pressure--Low;
- Pressurizer Water Level--High;
- Reactor Coolant Flow--Low (Two Loops);
- Undervoltage RCPs; and
- Underfrequency RCPs.

With one channel inoperable, the inoperable channel must be placed in the tripped condition within 6 hours. Placing the channel in the tripped condition results in a partial trip condition requiring only one additional channel to initiate a reactor trip above the P-7 setpoint and below the P-8 setpoint. These Functions do not have to be OPERABLE below the P-7 setpoint. The 6 hours allowed to place the channel in the tripped condition is justified in Reference 7. An additional 6 hours is allowed to reduce THERMAL POWER to < P-7 if the inoperable channel cannot be restored to OPERABLE status or placed in trip within the specified Completion Time.

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Allowance of this time interval takes into consideration the redundant capability provided by the remaining redundant OPERABLE channel and the low probability of occurrence of an event during this period that may require the protection afforded by the Functions associated with Condition M.

The Required Actions have been modified by a Note, which allows any single channel, including the inoperable channel, to be bypassed for up to 4 hours while performing surveillance testing. The 4 hour time limit is justified in Reference 7.

N.1 and N.2

Condition N is applicable to the Reactor Coolant Flow--Low (Single Loop) reactor trip function. With one channel inoperable, the inoperable channel must be restored to OPERABLE status, or the channel placed in trip, within 6 hours. If the channel cannot be restored to OPERABLE status or the channel placed in trip within the 6 hours, then THERMAL POWER must be reduced below the P-8 setpoint within the next 4 hours. This places the unit in a MODE where the LCO is no longer applicable. This trip Function does not have to be OPERABLE below the P-8 setpoint because other RTS trip Functions provide core protection below the P-8 setpoint. The 6 hours allowed to restore the channel to OPERABLE status or place in trip and the 4 additional hours allowed to reduce THERMAL POWER to below the P-8 setpoint are justified in Reference 7.

The Required Actions have been modified by a Note which allows any single channel, including the inoperable channel, to be bypassed for up to 4 hours while performing surveillance testing of the other channels. The 4 hour time limit is justified in Reference 7.

O.1 and O.2

Condition O applies to Turbine Trip on Low Fluid Oil Pressure or on Turbine Stop Valve Closure. With one channel inoperable, the inoperable channel must be placed in the trip condition within 6 hours. If placed in the tripped condition, this results in a partial trip condition requiring only one additional channel to initiate a reactor trip. If the channel cannot be restored to OPERABLE status or placed in the trip condition, then power must be reduced below the P-9 setpoint within the next 4 hours. The 6 hours

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(continued)

allowed to place the inoperable channel in the tripped condition and the 4 hours allowed for reducing power are justified in Reference 7.

The Required Actions have been modified by a Note which allows any single channel including the inoperable channel, to be bypassed for up to 4 hours while performing surveillance testing. The 4-hour time limit is justified in Reference 7.

P.1 and P.2

Condition P applies to the SI Input from ESFAS reactor trip and the RTS Automatic Trip Logic in MODES 1 and 2. These actions address the train orientation of the RTS for these Functions. With one train inoperable, 6 hours are allowed to restore the train to OPERABLE status (Required Action P.1) or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours (Required Action P.1) is reasonable considering that in this Condition, the remaining OPERABLE train is adequate to perform the safety function and given the low probability of an event during this interval. The Completion Time of 6 hours (Required Action P.2) is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems.

The Required Actions have been modified by a Note that allows bypassing one train up to 4 hours for surveillance testing, provided the other train is OPERABLE.

Q.1 and Q.2

Condition Q applies to the RTBs in MODES 1 and 2. These actions address the train orientation of the RTS for the RTBs. With one train inoperable, 1 hour is allowed to restore the train to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. The 1-hour and 6-hour Completion Times are equal to the time allowed by LCO 3.0.3 for shutdown actions in the event of a complete loss of RTS Function. Placing the unit in MODE 3 removes the requirement for this particular Function.

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The Required Actions have been modified by two Notes. Note 1 allows one train to be bypassed for up to 2 hours for Surveillance testing, providing the other train is OPERABLE. Note 2 allows one RTB train to be bypassed for up to 2 hours for maintenance on undervoltage or shunt trip mechanisms if the other RTD train is OPERABLE. The 2 hour time limit is justified in Reference 7.

R.1 and R.2

Condition R applies to the P-6 and P-10 interlocks. With one channel inoperable for one out of two or two out of four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 3 within the next 6 hours. Verifying the interlock status manually accomplishes the interlock's Function. The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator actions. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging plant systems. The 1 hour and 6 hour Completion Times are equal to the time allowed by LCO 3:0.3 for shutdown actions in the event of a complete loss of RTS function.

S.1 and S.2

Condition S applies to the P-7, P-8, P-9, and P-13 interlocks. With one channel inoperable for one out of two or two out of four coincidence logic, the associated interlock must be verified to be in its required state for the existing unit condition within 1 hour or the unit must be placed in MODE 2 within the next 6 hours. These actions are conservative for the case where power level is being raised. Verifying the interlock status manually accomplishes the interlock's Function. The Completion Time of 1 hour is based on operating experience and the minimum amount of time allowed for manual operator actions. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 2 from full power in an orderly manner and without challenging unit systems.

T.1, T.2.1, and T.2.2

Condition T applies to the RTB Undervoltage and Shunt Trip Mechanisms, or diverse trip features, in MODES 1 and 2. With one of the diverse trip features inoperable, it must be

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(continued)

restored to an OPERABLE status within 48 hours or the unit must be placed in a MODE where the requirement does not apply. This is accomplished by placing the unit in MODE 3 within the next 6 hours (54 hours total time) followed by opening the RTBs in 1 additional hour. The Completion Time of 6 hours is a reasonable time, based on operating experience, to reach MODE 3 from full power in an orderly manner and without challenging unit systems. With the RTBs open and the unit in MODE 3, this trip function is no longer required to be OPERABLE. The affected RTB shall not be bypassed while one of the diverse features is inoperable except for the time required to perform maintenance to one of the diverse features. The allowable time for performing maintenance of the diverse features is 2 hours for the reasons stated under Condition Q.

The Completion Time of 48 hours for Required Action T.1 is reasonable considering that in this Condition there is one remaining diverse feature for the affected RTB, and one OPERABLE RTB capable of performing the safety Function and given the low probability of an event occurring during this interval.

U.1.1, U.1.2, and U.2

Condition U applies to the Steam Generator Water Level--Low-Low reactor trip Function.

A known inoperable channel must be restored to OPERABLE status or placed in the tripped condition within 6 hours. Placing the channel in the tripped condition requiring only one out of two logic for actuation of the two out of three trips. The 6 hours allowed to place the inoperable channel in the tripped condition is justified in Reference 7.

If a channel fails, it is placed in the tripped condition and does not affect the TTD setpoint calculations for the remaining OPERABLE channels. It is then necessary for the operator to force the use of the shorter TTD time delay by adjustment of the single steam generator time delay calculation (T_S) to match the multiple steam generator time delay calculation (T_M) for the affected protection set, through the Man Machine Interface.

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(continued)

If the inoperable channel cannot be restored or placed in the trip condition within the specified Completion Time, the unit must be placed in a MODE where these Functions are not required OPERABLE. An additional 6 hours is allowed to place the unit in MODE 3. Six hours is a reasonable time, based on operating experience, to place the unit in MODE 3 from MODE 1 from full power in an orderly manner and without challenging plant systems.

V.1 and V.2

Condition V applies to the Vessel ΔT Equivalent to Power reactor trip Function.

Failure of the vessel ΔT channel input (failure of more than one T_H RTD or failure of both T_C RTDs) does not affect the TTD calculation for a protection set. This results in the requirement that the operator adjust the threshold power level for zero seconds time delay from 50% RTP to 0% RTP, through the Man Machine Interface.

If the inoperable channel cannot be restored or placed in the trip condition within the specified Completion Time, the unit must be placed in a MODE where these Functions are not required to be OPERABLE. An additional 6 hours is allowed to place the unit in MODE 3. Six hours is a reasonable time, based on operating experience, to place the unit in MODE 3 from MODE 1 from full power in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

The SRs for each RTS function are identified in the SRs column of Table 3.3.1-1 for that function.

A Note has been added to the SRs Table stating that Table 3.3.1-1 determines which SRs apply to which RTS functions.

Note that each channel of process protection supplies both trains of the RTS. When testing Channel I, Train A and Train B must be examined. Similarly, Train A and Train B must be examined when testing Channel II, Channel III, and Channel IV. The CHANNEL CALIBRATION and COTs are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies.

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SURVEILLANCE
REQUIREMENTS
(continued)

The protection Functions associated with the EAGLE-21™ Process Protection System have an installed bypass capability, and may be tested in either the trip or bypass mode, as approved in Reference 7.

SR 3.3.1.1

Performance of the CHANNEL CHECK once every 12 hours ensures that gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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 two instrument channels could be an indication of excessive instrument drift in one of the channels or even something more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

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

The Frequency is based on operating experience that demonstrates that channel failure is rare. Thus, performance of the CHANNEL CHECK ensures that undetected overt channel failure is limited to 12 hours. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.1.2

SR 3.3.1.2 compares the calorimetric heat balance calculation to the NIS channel output every 24 hours. If the calorimetric exceeds the NIS channel output by > 2% RTP, the NIS is not declared inoperable, but must be adjusted. If the NIS channel output cannot be properly adjusted, the channel is declared inoperable.

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BASES

SURVEILLANCE
REQUIREMENTS
(continued)

Two Notes modify SR 3.3.1.2. The first Note indicates that the NIS channel output shall be adjusted consistent with the calorimetric results if the absolute difference between the NIS channel output and the calorimetric is $> 2\%$. The second Note clarifies that this surveillance is required only if reactor power is $\geq 15\%$ RTP and that 12 hours is allowed for performing the first Surveillance after reaching 15% RTP. At lower power levels, calorimetric data is acceptable.

The Frequency of every 24 hours is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Together these factors demonstrate that the change in the absolute difference between NIS and heat balance calculated powers rarely exceeds 2% in any 24-hour period.

In addition, control room operators periodically monitor redundant indications and alarms to detect deviations in channel outputs.

SR 3.3.1.3

SR 3.3.1.3 compares the incore system to the NIS channel output every 31 effective full power days (EFPDs). If the absolute difference is $\geq 3\%$, the NIS channel is still OPERABLE but must be readjusted. If the NIS channel cannot be properly readjusted, the channel is declared inoperable.

Two Notes modify SR 3.3.1.3. The first Note indicates that the excore NIS channel shall be adjusted if the absolute difference between the incore and excore AFD is $\geq 3\%$. The second Note clarifies that the Surveillance is required only if reactor power is $\geq 15\%$ RTP and that 96 hours is allowed for performing the first Surveillance after reaching 15% RTP. This surveillance is typically performed at 50% RTP to ensure the results of the evaluation are more accurate and the adjustments more reliable. Ninety-six (96) hours are allowed to ensure Xenon stability and allow for instrumentation alignments.

The Frequency of every 31 EFPDs is adequate. It is based on unit operating experience, considering instrument reliability and operating history data for instrument drift. Also the slow changes in neutron flux during the fuel cycle can be detected during this interval.

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SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.1.4

SR 3.3.1.4 is the performance of a TADOT every 31 days on a STAGGERED TEST BASIS. This test shall verify OPERABILITY by actuation of the end devices.

The RTB test shall include independent verification of the undervoltage and manual trip mechanisms. The bypass breaker test shall include a local shunt trip. A Note has been added to indicate that this test must be performed on the bypass breaker prior to placing it in service.

The Frequency of every 31 days on a STAGGERED TEST BASIS is justified in Reference 7.

SR 3.3.1.5

SR 3.3.1.5 is the performance of an ACTUATION LOGIC TEST. The SSPS is tested every 31 days on a STAGGERED TEST BASIS, using the semiautomatic tester. The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. Through the semiautomatic tester, all possible logic combinations, with and without applicable permissives, are tested for each protection function. The time allowed for the testing, 4 hours, and the Frequency of every 31 days on a STAGGERED TEST BASIS are justified in Reference 7.

SR 3.3.1.6

SR 3.3.1.6 is a calibration of the excore channels to the incore channels. If the measurements do not agree, the excore channels are not declared inoperable, but must be calibrated to agree with the incore detectors. If the excore channels cannot be properly adjusted, the channels are declared inoperable.

Two Notes modify SR 3.3.1.6. The first Note indicates that the NIS channel outputs shall be calibrated to agree with the incore channel measurements. The second Note clarifies that this Surveillance is required only if reactor power is > 50% RTP and that up to 31 days is allowed for performing the first surveillance after reaching 50% RTP. Thirty-one days are allowed to ensure xenon stability and allow for instrumentation alignments.

The Surveillance of 92 EFPDs is justified in Reference 7.

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SURVEILLANCE
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SR 3.3.1.7

SR 3.3.1.7 is the performance of a COT every 92 days.

A COT is performed on each required channel to ensure the entire channel will perform the intended function. Setpoints must be within the Allowable Values specified in the Table 3.3.1'-1.

The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology. The setpoint shall be left set consistent with the assumptions of the current Watts Bar unit specific setpoint methodology.

The "as found" and "as left" values must also be recorded and reviewed for consistency with the assumptions of Reference 7.

This Frequency of 92 days is justified in Reference 7.

SR 3.3.1.8

SR 3.3.1.8 is the performance of a COT as described in SR 3.3.1.7, except it is modified by a Note that this test shall include verification that the P-6 and P-10 interlocks are in their required state for the existing unit condition. This test ensures that the NIS source range and intermediate range channels are OPERABLE prior to taking the reactor critical.

SR 3.3.1.9

SR 3.3.1.9 is the performance of a TADOT every 92 days. This test is a check of RTS Functions 11, Undervoltage RCPs and 12, Underfrequency RCPs. These Functions are tested up to, and including, the master transfer relay coils.

This test does not require verification of relay setpoints. Setpoint verification requires removal of the relays from service for extended periods of time, thereby jeopardizing electrical equipment protection for that period of time.

These devices are reliable components and their setpoints are verified during a CHANNEL CALIBRATION performed every 18 months. The 92 day Frequency is justified in Reference 7.

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SURVEILLANCE
REQUIREMENTS

SR 3.3.1.9 (continued)

The SR is modified by a Note that excludes verification of setpoints from the TADOT. Since this SR applies to RCP undervoltage and underfrequency relays setpoint verification is accomplished during the CHANNEL CALIBRATION.

SR 3.3.1.10

A CHANNEL CALIBRATION is performed every 18 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy.

CHANNEL CALIBRATION measurement and setpoint error determination and readjustment must be performed consistent with the assumptions of the Watts Bar setpoint methodology. The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology.

The Surveillance Frequency of 18 months is based on the assumption of an 18-month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.

SR 3.3.1.10 is modified by a Note stating that this test shall include verification that the time constants are adjusted to the prescribed values where applicable.

SR 3.3.1.11

SR 3.3.1.11 is the performance of a CHANNEL CALIBRATION, as described in SR 3.3.1.10, every 18 months. This SR is modified by a Note stating that the neutron detectors may be excluded from the CHANNEL CALIBRATION. The CHANNEL CALIBRATION for the power range detectors consists of a normalization of the channels based on a power calorimetric and flux map performed above 15% RTP. The CHANNEL CALIBRATION for the source range and intermediate range detectors consists of verifying equipment outputs to known electrical inputs. This Surveillance is not required for the NIS power range detectors for entry into MODE 2 or 1, and is not required for the NIS intermediate range detectors for entry into MODE 2, because the unit must be in at least MODE 2 to perform the test for the intermediate range detectors and MODE 1 for the power range detectors. The

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.1.11 (continued)

18-month Frequency was developed considering it was prudent that these Surveillances only be performed during a unit outage. This was due to the unit conditions needed to perform the Surveillance and the potential for unplanned unit transients if the Surveillance is performed with the reactor at power. Operating experience has shown these components usually pass the Surveillance when performed on the 18-month Frequency.

SR 3.3.1.12

SR 3.3.1.12 is the performance of a COT every 18 months.

The Frequency is based upon the known reliability of the interlocks and, the multichannel redundancy available, and has been shown to be acceptable through operating experience.

SR 3.3.1.13

SR 3.3.1.13 is the performance of a TADOT of the Manual Reactor Trip, RCP breaker position, and the SI input from ESFAS. This TADOT is as described in SR 3.3.1.4, except that the test is performed every 18 months.

The SR is modified by a Note that excludes verification of setpoints from the TADOT. The Functions affected have no setpoints associated with them.

The Frequency is based upon the known reliability of the Functions and, the multichannel redundancy available, and has been shown to be acceptable through operating experience.

SR 3.3.1.14

SR 3.3.1.14 is the performance of a TADOT of Turbine Trip Functions. This TADOT is as described in SR 3.3.1.4, except that this test is performed prior to reactor startup. A Note states that this Surveillance is not required if it has been performed within the previous 31 days. Verification of the trip setpoint does not have to be performed for this Surveillance. Performance of this test will ensure that the turbine trip function is OPERABLE prior to taking the reactor critical. This test cannot be performed with the reactor at power and must therefore be performed prior to reactor startup.

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SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.1.15

SR 3.3.1.15 verifies that the individual channel/train actuation response times are less than or equal to the maximum values assumed in the accident analysis.

Response Time testing acceptance criteria are included in Reference 8. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the parameter exceeds the trip setpoint value at the sensor to the point at which the equipment reaches the required functional state (i.e., control and shutdown rods fully inserted in the reactor core).

For channels that include dynamic transfer functions, e.g., lag, lead/lag, rate/lag, etc., the response time test may be performed with the transfer function set to one, with the resulting measured response time compared to the appropriate FSAR response time. Alternately, the response time test can be performed with the time constants set to their nominal value provided the required response time is analytically calculated assuming the time constants are set at their nominal values. The response time may be measured by a series of overlapping tests such that the entire response time is measured.

As appropriate, each channel's response must be verified every 18 months on a STAGGERED TEST BASIS. Response times cannot be determined during unit operation because equipment operation is required to measure response times. Experience has shown that these components usually pass this surveillance when performed on the 18-month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

The SR 3.3.1.15 is modified by a Note stating that neutron detectors may be excluded from RTS response time testing. This Note is necessary because of the difficulty in generating an appropriate detector input signal. Excluding the detectors is acceptable because the principles of detector operation ensure a virtually instantaneous response.

REFERENCES

1. Watts Bar FSAR, Section 6.0, "Engineered Safety Features."

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BASES

REFERENCES

2. Watts Bar FSAR, Section 7.0, "Instrumentation and Controls."
 3. Watts Bar FSAR, Section 15.0, "Accident Analysis."
 4. Institute of Electrical and Electronic Engineers, IEEE-279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," April 5, 1972.
 5. 10 CFR Part 50.49, "Environmental Qualifications of Electric Equipment Important to Safety for Nuclear Power Plants."
 6. WCAP-12096, Rev. 4, "Westinghouse Setpoint Methodology for Protection System, Watts Bar 1 and 2," November 1990.
 7. WCAP-10271-P-A, Supplement 1, Rev. 1 and Supplement 2, Rev. 1, "Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System," May 1986 and June 1990.
 8. Watts Bar Technical Requirements Manual, Section 3.3.1, Reactor Trip System Response Times.
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B 3.3 INSTRUMENTATION

B 3.3.2 Engineered Safety Feature Actuation System (ESFAS) Instrumentation

BASES

BACKGROUND

The ESFAS initiates necessary safety systems, based upon the values of selected unit parameters, to protect against violating core design limits and the Reactor Coolant System (RCS) pressure boundary, and to mitigate accidents.

The ESFAS instrumentation is segmented into three distinct but interconnected modules as identified below:

- Field transmitters or process sensors: provide a measurable electronic signal or contact actuation based upon the physical characteristics of the parameter being measured;
- Signal processing equipment including process protection system, Nuclear Instrumentation System, and field contacts: provide analog to digital conversion (Digital Protection System), signal conditioning, setpoint comparison, process algorithm actuation (Digital Protection System), compatible electrical signal output to protection system devices, and control board/control room/miscellaneous indications;
- Solid State Protection System (SSPS) including input, logic, and output bays: initiates the proper unit shutdown or engineered safety feature (ESF) actuation in accordance with the defined logic and based upon the bistable, setpoint comparators, or contact outputs from the signal process control and protection system.

Field Transmitters and Sensors

In order to meet the design demands for redundancy and reliability, more than one, and often as many as five, field sensors or transmitters are used to measure unit parameters. In many cases field transmitters and sensors that input to the ESFAS are shared with the Reactor Protection System (RPS). In some cases, the same channels also provide control system inputs. To account for calibration tolerances and instrument drift, which are assumed to occur between calibrations, statistical allowances are provided in the Trip Setpoint and Allowable Values. The OPERABILITY of each transmitter or sensor can be evaluated when its "as found" calibration data are compared against its documented acceptance criteria.

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BACKGROUND
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Signal Processing Equipment

Generally, three or four channels of process control equipment are used for the signal processing of unit parameters measured by the field instruments. The process control equipment provides analog to digital conversion (Digital Protection System), signal conditioning, comparable output signals for instruments located on the main control board, and comparison of measured input signals with setpoints established by safety analyses. These setpoints are defined in References 1, 2, and 3. If the measured value of a unit parameter exceeds the predetermined setpoint, an output from a bistable, setpoint comparator or contact is forwarded to the SSPS for decision evaluation. Channel separation is maintained up to and through the input bays. However, not all unit parameters require four channels of sensor measurement and signal processing. Some unit parameters provide input only to the SSPS, while others provide input to the SSPS, main control board, unit computer, and one or more control systems.

Generally, if a parameter is used only for input to the protection circuits, three channels with a two out of three logic are sufficient to provide the required reliability redundancy. If one channel fails in a direction that would not result in a partial Function trip, the Function is still OPERABLE with a two out of two logic. If one channel fails such that a partial Function trip occurs, a trip will not occur and the function is still OPERABLE with a one out of two logic.

Generally, if a parameter is used for input to the SSPS and a control function, four channels with a two out of four logic are sufficient to provide the required reliability and redundancy. The circuit must be able to withstand both an input failure to the control system, which may then require the protection function actuation, and a single failure in the other channels providing the protection function actuation. Again, a single failure will neither cause nor prevent the protection function actuation.

These requirements are described in IEEE-279-1971 (Ref. 4). The actual number of channels required for each unit parameter is specified in Reference 2.

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BASES

BACKGROUND
(continued)Trip Setpoints and Allowable Values

The Trip Setpoints are the nominal values at which the bistables, setpoint comparators, or contact outputs are set. Any bistable output 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, setpoint comparators, or contact outputs are based on the analytical limits stated in Reference 2. 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 ESFAS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 5), Trip Setpoints and Allowable Values specified in Table 3.3.2-1 in the accompanying LCO are conservatively adjusted with respect to the analytical limits. A detailed description of the methodology used to calculate the trip setpoints, including their explicit uncertainties, is provided in the Watts Bar "Westinghouse Setpoint Methodology for Protection Systems, Watts Bar 1 and 2" (Ref. 6). The actual nominal Trip Setpoint entered into the bistable is normally still more conservative than that specified by the Allowable Value to account for changes in random measurement errors detectable by a COT. 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 consequences of Design Basis Accidents (DBAs) will be acceptable, providing the unit is operated from within the LCOs at the onset of the DBA and the equipment functions as designed.

Each channel can be tested on line to verify that the signal processing equipment and setpoint accuracy is within the specified allowance requirements of Reference 2. Once a designated channel is taken out of service for testing, a simulated signal is injected in place of the field instrument signal. The process equipment for the channel in test is then tested, verified, and calibrated. SRs for the channels are specified in the SRs section.

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The Trip Setpoints and Allowable Values listed in Table 3.3.2-1 are based upon the methodology described in Reference 6, which incorporates 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.

Solid State Protection System

The SSPS equipment is used for the decision logic processing of signal outputs from the signal processing equipment. To meet the redundancy requirements, two trains of SSPS, each performing the same functions, are provided. In the event that one train is taken out of service for maintenance or test purposes, the second train will provide ESF actuation for the unit. In the event that both trains are taken out of service or placed in test, a reactor trip will result. Each train is packaged in its own cabinet for physical and electrical separation to satisfy separation and independence requirements. The system has been designed to trip in the event of a loss of power, directing the unit to a safe shutdown condition.

The SSPS performs the decision logic for actuating ESF equipment actuation; generates the electrical output signals that initiate the required actuation; and provides the status, permissive, and annunciator output signals to the main control room of the unit.

The outputs from the signal processing equipment are sensed by the SSPS equipment and combined into logic matrices that represent combinations indicative of various transients. If a required logic matrix combination is completed, the system will send actuation signals via master and slave relays to those components whose aggregate function best serves to alleviate the condition and restore the unit to a safe condition. Examples are given in the section on Applicable Safety Analyses, LCOs, and APPLICABILITY.

Each train has a built-in testing device which can automatically test the decision logic matrix functions and the actuation devices while the unit is at power. When any one train is taken out of service for testing, the other train is capable of providing unit monitoring and protection until the testing has been completed. The testing device is semiautomatic to minimize testing time.

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The actuation of ESF components is accomplished through master and slave relays. The SSPS energizes the master relays appropriate for the condition of the unit. Each master relay then energizes one or more slave relays, which then cause actuation of the end devices. The master and slave relays are routinely tested to ensure operation. The test of the master relays energizes the relay, which then operates the contacts and applies a low voltage to the associated slave relays. The low voltage is not sufficient to actuate the slave relays but only demonstrates signal path continuity. The SLAVE RELAY TEST actuates the devices if their operation will not interfere with continued unit operation. For the latter case, actual component operation is prevented by the SLAVE RELAY TEST circuit, and slave relay contact operation is verified by a continuity check of the circuit containing the slave relay.

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Each of the analyzed accidents can be detected by one or more ESFAS Functions. One of the ESFAS Functions is the primary actuation signal for that accident. An ESFAS Function may be the primary actuation signal for more than one type of accident. An ESFAS Function may also be a secondary, or backup, actuation signal for one or more other accidents. For example, Pressurizer Pressure--Low is a primary actuation signal for small loss-of-coolant accidents (LOCAs) and a backup actuation signal for steam line breaks (SLBs) outside containment. Functions such as manual initiation, not specifically credited in the accident safety analysis, are qualitatively credited in the safety analysis and the NRC staff approved licensing basis for the unit. These functions may provide protection for conditions which do not require dynamic transient analysis to demonstrate Function performance. These Functions may also serve as backups to Functions that were credited in the accident analysis (Ref. 3).

The LCO requires all instrumentation performing an ESFAS Function to be OPERABLE. Failure of any instrument renders the affected channel(s) inoperable and reduces the reliability of the affected Functions.

The LCO generally requires OPERABILITY of four or three channels in each instrumentation Function and two channels in each logic and manual initiation Function. The two out of three and the two out of four configurations allow one

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channel to be tripped during maintenance or testing without causing an ESFAS initiation. Two logic or manual initiation channels are required to ensure no single random failure disables the ESFAS.

The required channels of ESFAS instrumentation provide unit protection in the event of any of the analyzed accidents. ESFAS protective functions are as follows:

1. Safety Injection

Safety Injection (SI) provides two primary functions:

- Primary-side water addition to ensure maintenance or recovery of reactor vessel water level (coverage of the active fuel for heat removal and clad integrity, peak clad temperature < 2200°F); and
- Boration to ensure recovery and maintenance of SHUTDOWN MARGIN* ($k_{eff} < 1.0$).

These functions are necessary to mitigate the effects of high energy line breaks (HELBs) both inside and outside of containment. The SI signal is also used to initiate other functions such as:

- Phase A Isolation;
- Containment Vent Isolation;
- Reactor Trip;
- Turbine Trip;
- Feedwater Isolation;
- Start of motor-driven auxiliary feedwater (AFW) pumps;
- Control room ventilation isolation; and
- Enable automatic switchover of Emergency Core Cooling System (ECCS) suction to containment sump.

These other functions ensure:

- Isolation of nonessential systems through containment penetrations;
- Trip of the turbine and reactor to limit power generation;
- Isolation of MFW to limit secondary side mass losses;
- Start of AFW to ensure secondary side cooling capability;

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- Isolation of the control room to ensure habitability; and
- Enabling ECCS suction from the refueling water storage tank (RWST) switchover on low low RWST level to ensure continued cooling via use of the containment sump.

1.a. Manual Initiation

The LCO requires one channel per train to be OPERABLE. The operator can initiate SI at any time by using either of two switches in the control room. This action will cause actuation of all components in the same manner as any of the automatic actuation signals.

The LCO for Manual Initiation Function ensures the proper amount of redundancy is maintained in the manual ESFAS actuation circuitry to ensure the operator has manual ESFAS initiation capability.

- Each channel consists of one hand switch and the interconnecting wiring to the actuation logic cabinet. Each hand switch actuates both trains. This configuration does not allow testing at power.

1.b. Automatic Actuation Logic and Actuation Relays

This LCO requires two trains to be OPERABLE. Actuation logic consists of all circuitry housed within the actuation subsystems, including the initiating relay contacts responsible for actuating the ESF equipment.

Manual and automatic initiation of SI must be OPERABLE in MODES 1, 2, and 3. In these MODES there is sufficient energy in the primary and secondary systems to warrant automatic initiation of ESF systems. Manual Initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a DBA, but because of the large number of components actuated on a SI, actuation is simplified by the use of the manual actuation hand switches. Automatic actuation logic and actuation relays must be OPERABLE in MODE 4 to support system level manual initiation.

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These Functions are not required to be OPERABLE in MODES 5 and 6 because there is adequate time for the operator to evaluate unit conditions and respond by manually starting individual systems, pumps, and other equipment to mitigate the consequences of an abnormal condition or accident. Unit pressure and temperature are very low and many ESF components are administratively locked out or otherwise prevented from actuating to prevent inadvertent overpressurization of unit systems.

1.c. Containment Pressure--High

This signal provides protection against the following accidents:

- SLB inside containment;
- LOCA; and
- Feed line break inside containment.

Containment Pressure--High provides no input to any control functions. Thus, three OPERABLE channels are sufficient to satisfy protective requirements with a two out of three logic. The transmitters (d/p cells) and electronics are located outside of containment, inside the containment annulus, with the sensing line (high pressure side of the transmitter) located inside containment.

The transmitters and electronics are located inside the containment annulus, but outside containment, and experience more adverse environmental conditions than if they were located outside containment altogether. However, the environmental effects are less severe than if the transmitters were located inside containment. The trip setpoint reflects the inclusion of both steady state instrument uncertainties and slightly more adverse environmental instrument uncertainties.

Containment Pressure--High must be OPERABLE in MODES 1, 2 and 3 when there is sufficient energy in the primary and secondary systems to pressurize the containment following a pipe break. In MODES 4, 5, and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment.

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1.d. Pressurizer Pressure--Low

This signal provides protection against the following accidents:

- Inadvertent opening of a steam generator (SG) relief or safety valve;
- SLB;
- A spectrum of rod cluster control assembly ejection accidents (rod ejection);
- Inadvertent opening of a pressurizer relief or safety valve;
- LOCAs; and
- Steam Generator Tube Rupture (SGTR).

Three protection channels are necessary to satisfy the protective function requirements.

The transmitters are located inside containment, with the taps in the vapor space region of the pressurizer, and thus possibly experiencing adverse environmental conditions (LOCA, SLB inside containment, rod ejection). Therefore, the Trip Setpoint reflects the inclusion of both steady state and adverse environmental instrument uncertainties.

This Function must be OPERABLE in MODES 1, 2 and 3 (above P-11) to mitigate the consequences of an HELB inside containment. This signal may be manually blocked by the operator below the P-11 setpoint. Automatic SI actuation below this pressure setpoint is then performed by the Containment Pressure--High signal.

This Function is not required to be OPERABLE in MODE 3 below the P-11 setpoint. Other ESF functions are used to detect accident conditions and actuate the ESF systems in this MODE. In MODES 4, 5 and 6, this Function is not needed for accident detection and mitigation.

1.e. Steam Line Pressure--Low

Steam Line Pressure--Low provides protection against the following accidents:

- SLB

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- Feed line break; and
- Inadvertent opening of an SG relief or an SG safety valve.

Steam Line Pressure--Low provides no input to any control functions. Thus, three OPERABLE channels on each steam line are sufficient to satisfy the protective requirements with a two out of three logic on each steam line.

With the transmitters located in areas away from the steam lines it is not possible for them to experience adverse environmental conditions during a secondary side break. Therefore, the Trip Setpoint reflects only steady state instrument uncertainties. This Function has lead/lag compensation with a lead/lag ratio of 50/5.

Steam Line Pressure--Low must be OPERABLE in MODES 1, 2, and 3 (above P-11) when a secondary side break or stuck open valve could result in the rapid depressurization of the steam lines. This signal may be manually blocked by the operator below the P-11 setpoint. Below P-11, feed line break is not a concern. Inside containment SLB will be terminated by automatic SI actuation via Containment Pressure--High, and outside containment SLB will be terminated by the Steam Line Pressure--Negative Rate--High signal for steam line isolation. This Function is not required to be OPERABLE IN MODES 4, 5, or 6, because there is insufficient energy in the secondary side of the plant to cause an accident.

2. Containment Spray

Containment Spray provides one primary Function:

It lowers containment pressure and temperature after an HELB in containment, and subsequently reduces the amount of fission-products released from the containment to the environment.

This function is necessary to:

- Ensure the pressure boundary integrity of the containment structure; and

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- Limit the release of radioactive iodine to the environment in the event of a failure of the containment structure;

The containment spray actuation signal starts the containment spray pumps and aligns the discharge of the pumps to the containment spray nozzle headers in the upper levels of containment. Water is initially drawn from the RWST by the containment spray pumps. When the RWST reaches the low low level setpoint, the spray pump suctions are shifted to the containment sump if continued containment spray is required. Containment spray is actuated manually, or by Containment Pressure--High High.

2.a. Manual Initiation

The operator can initiate containment spray at any time from the control room by simultaneously turning two containment spray actuation switches in the same train. Because an inadvertent actuation of containment spray could have such serious consequences, two switches must be turned simultaneously to initiate containment spray. There are two sets of two switches each in the control room. Simultaneously turning the two switches in either set will actuate containmentspray in both trains in the same manner as the automatic actuation signal. Two Manual Initiation switches in each train are required to be OPERABLE to ensure no single failure disables the manual initiator function. Note that manual initiation of containment spray also actuates Phase B containment isolation.

2.b. Automatic Actuation Logic and Actuation Relays

Automatic actuation logic and actuation relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

Manual and automatic initiation of containment spray must be OPERABLE in MODES 1, 2, and 3 when there is a potential for an accident to occur, and sufficient energy in the primary or secondary systems to pose a threat to containment integrity due to overpressure conditions. Manual initiation is also required in MODE 4, even though automatic actuation is not required.

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In this MODE, adequate time is available to manually actuate required components in the event of a DBA. But because of the large number of components actuated on a containment spray, however, actuation is simplified by the use of the manual actuation hand switches. Automatic actuation logic and actuation relays must be OPERABLE in MODE 4 to support system level manual initiation. In MODES 5 and 6, there is insufficient energy in the primary and secondary systems to result in containment overpressure. In MODES 5 and 6, there is also adequate time for the operators to evaluate unit conditions and respond to mitigate the consequences of abnormal conditions by manually starting individual components.

2.c. Containment Pressure --High High

This signal provides protection against a LOCA or an SLB inside containment.

The transmitters (d/p cells) are located outside of containment, inside the containment annulus, with the sensing line (high pressure side of the transmitter) located inside containment. The transmitters and electronics are located inside the containment annulus, but outside containment, and experience more adverse environmental conditions than if they were located outside containment altogether. However, the environmental effects are less severe than if the transmitters were located inside containment. The trip setpoint reflects the inclusion of both steady state instrument uncertainties and slightly more adverse environmental instrument uncertainties.

This is one of the only Functions that requires the output to energize to perform its required action. It is not desirable to have a loss of power actuate containment spray, since the consequences of an inadvertent actuation of containment spray could be serious. Note that this Function also has the inoperable channel placed in bypass rather than trip to decrease the probability of an inadvertent actuation.

This Function uses four channels in a two out of four logic configuration. This arrangement

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exceeds the minimum redundancy requirements. Additional redundancy is warranted because this Function is "energize to trip". Containment Pressure--High High must be OPERABLE in MODES 1, 2, and 3 when there is sufficient energy in the primary and secondary sides to pressurize the containment following a pipe break. In MODES 4, 5, and 6, there is insufficient energy in the primary and secondary sides to pressurize the containment and reach the Containment Pressure--High High setpoints.

3. Containment Isolation

Containment Isolation provides isolation of the containment atmosphere, and all process systems which penetrate containment, from the environment. This Function is necessary to prevent or limit the release of radioactivity to the environment in the event of a large break LOCA.

There are two separate Containment Isolation signals, Phase A and Phase B. Phase A isolation isolates all automatically isolable process lines, except the component cooling system (CCS) and essential raw cooling water (ERCW), at a relatively low containment pressure indicative of primary or secondary system leaks. For these types of events, forced circulation cooling using the reactor coolant pumps (RCPs) and SGs is the preferred (but not required) method of decay heat removal. Since the CCS is required to support RCP operation, not isolating the CCS on the low pressure Phase A signal enhances unit safety by allowing operators to use forced RCS circulation to cool the unit. Isolating the CCS on the low pressure signal may force the use of feed and bleed cooling, which could prove more difficult to control.

Phase A containment isolation is actuated automatically by SI, or manually via the automatic actuation logic. All process lines penetrating containment, with the exception of the CCS and ERCW, are isolated. CCS is not isolated at this time to permit continued operation of the RCPs with cooling water flow to the thermal barrier heat exchangers and ERCW to air or oil coolers. All process lines not equipped with remote operated isolation valves are manually closed, or otherwise isolated, prior to reaching MODE 4.

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Manual Phase A Containment Isolation is accomplished by either of two switches in the control room. Either switch actuates both trains. Note that manual actuation Phase A containment isolation also actuates Containment Vent Isolation.

The Phase B signal isolates the CCS, this occurs at a relatively high containment pressure that is indicative and of a large break LOCA or an SLB. For these events, forced circulation using the RCPs is no longer desirable. Isolating the CCS at the higher pressure does not pose a challenge to the containment boundary, because the CCS is a closed loop inside containment. Although some system components do not meet all of the American Society of Mechanical Engineers (ASME) Code requirements applied to the containment itself, the system is continuously pressurized to a pressure greater than the Phase B setpoint. Thus, routine operation demonstrates the integrity of the system pressure boundary for pressures exceeding the Phase B setpoint. Furthermore, because system pressure exceeds the Phase B setpoint, any system leakage prior to initiation of Phase B isolation would be into containment. Therefore, the combination of CCS design and Phase B isolation ensures the CCS is not a potential path for radioactive release from containment. Phase B containment isolation is actuated by Containment Pressure--High High, automatic actuation logic, or manually, as previously discussed.

For containment pressure to reach a value high enough to actuate Containment Pressure--High-High, a large break LOCA or SLB must have occurred and containment spray must have been actuated. RCP operation will no longer be required and CCS to the RCPs is, therefore, no longer necessary. The RCPs could be operated with seal injection flow alone and without CCS flow to the thermal barrier heat exchanger.

Manual Phase B Containment Isolation is accomplished by the same switches that actuate Containment Spray. When the two switches in either set are turned simultaneously, Phase B Containment Isolation and Containment Spray will be actuated in both trains.

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3.a. Phase A Isolation

3.a.(1). Manual Initiation

Manual Phase A Containment Isolation is actuated by either of two switches in the control room. Either switch actuates both trains. Note that manual initiation of Phase A Containment Isolation also actuates Containment Vent Isolation.

3.a.(2). Automatic Actuation Logic and Actuation Relays

Automatic Actuation Logic and Actuation Relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

Manual and automatic initiation of Phase A Containment Isolation must be OPERABLE in MODES 1, 2, and 3, when there is a potential for an accident to occur. Manual initiation is also required in MODE 4 even though automatic actuation is not required. In this MODE, adequate time is available to manually actuate required components in the event of a DBA, but because of the large number of components actuated on a Phase A containment isolation, actuation is simplified by the use of the manual actuation hand switches. Automatic actuation logic and actuation relays must be OPERABLE in MODE 4 to support system level manual initiation. In MODES 5 and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment to require Phase A containment isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

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3.a.(3). Safety Injection

Containment Phase A Isolation is also initiated by all Functions that initiate SI. The Containment Phase A Isolation requirements for these Functions are the same as the requirements for their SI Function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, SI Function 1, is referenced for all initiating Functions and requirements.

3.b. Phase B Isolation

Phase B isolation is accomplished by manual initiation, Automatic Actuation Logic and Actuation Relays, and by Containment Pressure channels. The Containment Pressure initiation of Phase B isolation is energized to initiation in order to minimize the potential of spurious initiations that may damage the RCPs.

3.b.(1). Manual initiation

3.b.(2). Automatic Actuation Logic and Actuation Relays

Automatic Actuation Logic and Actuation Relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

Manual and automatic initiation of Phase B containment isolation must be OPERABLE in MODES 1, 2, and 3 when there is a potential for an accident to occur. Manual initiation is also required in MODE 4 even though automatic actuation is not required. In that MODE adequate time is available to manually actuate required components in the event of a DBA. However, because of the large number of components actuated on a Phase B containment isolation, actuation is simplified by the use of the manual actuation hand switches. Automatic actuation logic and actuation relays

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WATTS BAR 1

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must be OPERABLE in MODE 4 to support manual initiation. In MODES 5 and 6, there is insufficient energy in the primary or secondary systems to pressurize the containment to require Phase B containment isolation. There also is adequate time for the operator to evaluate unit conditions and manually actuate individual isolation valves in response to abnormal or accident conditions.

3.b.(3). Containment Pressure--High High

The bases for containment pressure MODE applicability is as discussed for Function 2.c above.

4. Steam Line Isolation

Isolation of the main steam lines provides protection in the event of an SLB inside or outside containment. Rapid isolation of the steam lines will limit the steam break accident to the blowdown from one SG at most. For an SLB upstream of the main steam isolation valves (MSIVs), inside or outside of containment, closure of the MSIVs limits the accident to the blowdown from only the affected SG. For an SLB downstream of the MSIVs, closure of the MSIVs terminates the accident as soon as the steam lines depressurize. Steam Line Isolation also mitigates the effects of a feed line break and ensures a source of steam for the turbine-driven AFW pump during a feed line break.

4.a. Manual Initiation

Manual initiation of Steam Line Isolation can be accomplished from the control room. There are four switches in the control room (one for each valve) which can immediately close each individual MSIVs. The LCO requires one switch for each valve to be OPERABLE.

4.b. Automatic Actuation Logic and Actuation Relays

Automatic actuation logic and actuation relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

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due to water in the steam lines and to stop the excessive flow of feedwater into the SGs. These Functions are necessary to mitigate the effects of a high water level in the SGs, which could result in carryover of water into the steam lines and excessive cooldown of the primary system. The SG high water level is due to excessive feedwater flows.

This Function is actuated by SG Water Level--High High, or by an SI signal. The Reactor Trip System also initiates a turbine trip signal whenever a reactor trip (P-4) is generated. In the event of SI, the unit is taken off line and the turbine generator must be tripped. The MFW System is also taken out of operation and the AFW System is automatically started. The SI signal was discussed previously.

5.a. Automatic Actuation Logic and Actuation Relays

Automatic Actuation Logic and Actuation Relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

5.b. Steam Generator Water Level--High High (P-14)

This signal provides protection against excessive feedwater flow. The ESFAS SG water level instruments provide input to the SG Water Level Control System. Therefore, the actuation logic must be able to withstand both an input failure to the control system (which may then require the protection function actuation) and a single failure in the other channels providing the protection function actuation. Since Watts Bar has only 3 level channels per SG, control/protection interaction is addressed by the use of a Median Signal Selector which prevents a single failure of a channel providing input to the control system requiring protection function action. That is, a single failure of a channel providing input to the control system does not result in the control system initiating a condition requiring protection function action. The Median Signal Selector performs this by not selecting the channels indicating the highest or lowest steam generator levels as input to the control system.

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Since no adverse control system action may now result from a single, failed protection instrument channel, a second random protection system failure (as would otherwise be required by IEEE 279-1971) need not be considered.

The transmitters (d/p cells) are located inside containment. However, the events which this Function protects against cannot cause a severe environment in containment. Therefore, the Trip Setpoint reflects only steady state instrument uncertainties.

5.c. Safety Injection

Turbine Trip and Feedwater Isolation are also initiated by all Functions that initiate SI. The Feedwater Isolation Function requirements for these functions are the same as the requirements for their SI Function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead SI Function 1 is referenced for all initiating functions and requirements.

Turbine Trip and Feedwater Isolation Functions must be OPERABLE in MODES 1 and 2 when the MFW is in operation and the turbine generator may be in operation. In MODES 3, 4, 5, and 6, the MFW and the turbine generator are not in service and this Function is not required to be OPERABLE.

6. Auxiliary Feedwater

The AFW System is designed to provide a secondary side heat sink for the reactor in the event that the MFW is not available. The system has two motor driven pumps and a turbine driven pump, making it available during normal unit operation, during a loss of AC power, a loss of MFW, and during a Feedwater System pipe break. The normal source of water for the AFW System is the condensate storage tank (CST) (nonsafety-related). A low suction pressure to the APW pump will automatically realign the pump suctions to the Essential Raw Cooling Water (ERCW) System (safety-related). The AFW System is aligned so that upon a pump start, flow is initiated to the respective SGs immediately.

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In the event of a failure of a Steam Generator Water Level channel, the channel is placed in the trip condition as input to the Solid State Protection System and does not affect the TTD setpoint calculations for the remaining OPERABLE channels. It is then necessary for the operator to force the use of the shorter TTD time delay by adjustment of the single steam generator time delay calculation (T_S) to match the multiple steam generator time delay calculation (T_H) for the affected protection set, through the Man Machine Interface. Failure of the vessel ΔT channel input (failure of more than one T_H RTD or failure of a T_C RTD) does not affect the TTD calculation for a protection set. This results in the requirement that the operator adjust the threshold power level for zero seconds time delay from 50% RTP to 0% RTP, through the Man Machine Interface.

6.c. Safety Injection

An SI signal starts the motor driven and turbine driven AFW pumps. The AFW initiation functions are the same as the requirements for their SI function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, SI Function 1 is referenced for all initiating functions and requirements.

6.d. Loss of Offsite Power

A loss of offsite power to the RCP buses will be accompanied by a loss of reactor coolant pumping power and the subsequent need for some method of decay heat removal. The loss of offsite power is detected by a voltage drop on each 6.9 kV shutdown board. Loss of power to a 6.9 kV shutdown board will start the turbine-driven AFW pump to ensure that at least one SG contains enough water to serve as the heat sink for reactor decay heat and sensible heat removal following the reactor trip.

Functions 6.a, 6.b, 6.c, and 6.d must be OPERABLE in MODES 1, 2, and 3 to ensure that the SGs remain the heat sink for the reactor. SG Water Level--Low Low in any operating SG will cause the motor driven AFW pumps to start. The system is aligned so that upon a start of the pump, water immediately begins to flow to the SGs.

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(continued)

SG Water Level--Low Low in any two operating SGs will cause the turbine driven pump to start. This Function does not have to be OPERABLE in MODES 5 and 6 because there is not enough heat being generated in the reactor to require the SGs as a heat sink. In MODE 4, AFW actuation does not need to be OPERABLE because either AFW or RHR will already be in operation to remove decay heat.

6.e. Trip Of All Main Feedwater Pumps

A Trip of both turbine-driven MFW pumps is an indication of a loss of main feedwater and the subsequent need for some method of decay heat and sensible heat removal to bring the reactor back to no load temperature and pressure. A turbine-driven MFW pump is equipped with one pressure switch on the control oil line for the speed control system. A low pressure signal from this pressure switch indicates a trip of that pump. A trip of both turbine driven MFW pumps starts the motor driven and turbine driven AFW pumps to ensure that at least one SG is available with water to act as the heat sink for the reactor.

This Function must be OPERABLE in MODES 1 and 2. This ensures that at least one SG is provided with water to serve as the heat sink to remove reactor decay heat and sensible heat in the event of an accident. In MODES 3, 4, 5, the RCPs and MFW may be normally shutdown and thus neither pump trip is indicative of a condition requiring automatic AFW initiation.

6.f. and 6.g. Auxiliary Feedwater Pump Suction
Transfer on Suction Pressure--Low

A low pressure to the AFW pump suction protects the AFW pumps against a loss of the normal supply of water for the pumps, the CST. Three pressure switches are located on each motor-driven AFW pump suction line from the CST and two sets of three pressure switches on the turbine-driven AFW pump suction line from the CST. A low pressure sensed by two switches of a set will cause the emergency supply of water for the respective pump to be

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aligned. The ERCW (safety grade) is then lined up to supply the AFW pumps to ensure an adequate supply of water for the AFW System to maintain at least one of the SGs as the heat sink for reactor decay heat and sensible heat removal. Since the detectors are located in areas not affected by HELBs or high radiation, they will not experience any adverse environmental conditions and the Trip Setpoint reflects only steady state instrument uncertainties.

These Functions must be OPERABLE in MODES 1, 2, and 3 to ensure a safety-grade supply of water for the AFW system to maintain the SGs as the heat sink for the reactor. These Functions do not have to be OPERABLE in MODES 5 and 6, because there is not enough heat being generated in the reactor to require the SGs as a heat sink. In MODE 4, AFW automatic suction transfer does not need to be OPERABLE because either AFW or RHR will already be in operation, or sufficient time is available to place RHR in operation, to remove decay heat.

7. Automatic Switchover to Containment Sump

At the end of the injection phase of a LOCA, the RWST will be nearly empty. Continued cooling must be provided by the ECCS to remove decay heat. The source of water for the ECCS pumps is automatically switched to the containment recirculation sump. The low head RHR pumps draw the water from the containment recirculation sump, the RHR pumps pump the water through the RHR heat exchanger, inject the water back into the RCS, and supply the cooled water to the other ECCS pumps. Switchover from the RWST to the containment sump must occur before the RWST empties to prevent damage to the RHR pumps and a loss of core cooling capability. For similar reasons, switchover must not occur before there is sufficient water in the containment sump to support ESF pump suction. Furthermore, early switchover must not occur to ensure that sufficient borated water is injected from the RWST. This ensures the reactor remains shutdown in the recirculation mode.

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7.a. Automatic Actuation Logic and Actuation Relays

Automatic actuation logic and actuation relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

7.b. RWST Level--Low Low Coincident With Safety Injection and Coincident With Containment Sump Level--High

During the injection phase of a LOCA, the RWST is the source of water for all ECCS pumps. As the RWST empties, the water from the RWST and the water from the RCS and accumulators will accumulate inside containment via the break. A low low level in the RWST coincident with an SI signal provides protection against a loss of water for the ECCS pumps and indicates the end of the injection phase of the LOCA. The RWST is equipped with four level transmitters. These transmitters provide no control functions. Two out of four logic is adequate to initiate the protective function actuation. Although only three channels would be sufficient, a fourth channel has been added for increased reliability.

The RWST--Low Low setpoint Allowable Value has both upper and lower limits. The lower limit is selected to ensure switchover occurs before the RWST empties to prevent ECCS pump damage. The upper limit is selected to ensure enough borated water is injected to ensure the reactor remains shutdown. The upper limit also ensures adequate water inventory in the containment sump to provide ECCS pump suction.

The transmitters are located in an area not affected by HELBs or post-accident high radiation. Thus, they will not experience any adverse environmental conditions and the Trip Setpoint reflects only steady state instrument uncertainties.

Automatic switchover occurs only if the RWST low low level signal is coincident with SI. This prevents accidental switchover during normal operation. Accidental switchover could damage

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(continued)

ECCS pumps if they are attempting to take suction from an empty sump. The automatic switchover Function requirements for the SI Functions are the same as the requirements for their SI Function. Therefore, the requirements are not repeated in Table 3.3.2-1. Instead, Function 1, SI, is referenced for all initiating Functions and requirements.

The containment sump is equipped with four level transmitters. These transmitters provide no control functions. Two-out-of-four logic is adequate to initiate the protective function actuation. Although three channels would be sufficient, a fourth channel has been added for increased reliability.

The containment sump level Trip Setpoint/Allowable Value is selected to ensure enough borated water is injected to ensure the reactor remains shutdown. The high limit also ensures adequate water inventory in the containment sump to provide ECCS pump suction. The transmitters are located inside containment, and thus possibly experience adverse environmental conditions. Therefore, the trip setpoint reflects the inclusion of both steady state and environmental instrument uncertainties.

These Functions must be OPERABLE in MODES 1, 2, 3, and 4 when there is a potential for a LOCA to occur, to ensure a continued supply of water for the ECCS pumps. These Functions are not required to be OPERABLE in MODES 5 and 6, because there is adequate time for the operator to evaluate unit conditions and respond by manually starting systems, pumps, and other equipment to mitigate the consequences of an abnormal condition or accident. System pressure and temperature are very low and many ESF components are administratively locked out or otherwise prevented from actuating to prevent inadvertent overpressurization of unit systems.

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8. Engineered Safety Feature Actuation System Interlocks

To allow some flexibility in unit operations, several interlocks are included as part of the ESFAS. These interlocks permit the operator to block some signals, automatically enable other signals, prevent some actions from occurring, and cause other actions to occur. The interlock Functions back up manual actions to ensure bypassable functions are in operation under the conditions assumed in the safety analyses. The LCO section discusses the basis for allowing bypass of individual functions.

8.a. Reactor Trip, P-4

The P-4 interlock is enabled when a RTB and its associated bypass breaker are open. Once the P-4 interlock is enabled, automatic SI initiation may be blocked after a 90 second time delay. This Function allows operators to take manual control of SI systems after the initial phase of injection is complete. Once SI is blocked, automatic actuation of SI cannot occur until the RTBs have been manually closed. The functions of the P-4 interlock are:

- Trip the main turbine;
- Isolate MFW with coincident low Tav_g;
- Prevent reactivation of SI after a manual reset of SI;
- Transfer the steam dump from the load rejection controller to the unit trip controller; and
- Prevent opening of the MFWs if they were closed on SI or SG Water Level--High High.

Each of the above functions is interlocked with P-4 to avert or reduce the continued cooldown of the RCS following a reactor trip. An excessive cooldown of the RCS following a reactor trip could cause an insertion of positive reactivity with a subsequent increase in generated power. To avoid such a situation, the noted functions have been interlocked with P-4 as part of the design of the unit control and protection system.

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None of the noted functions serves a mitigation function in the unit licensing basis safety analyses. Only the turbine trip function is an explicit assumption since it is an immediate consequence of the reactor trip function. Neither the turbine trip nor any of the other four functions associated with the reactor trip signal is required to show that the plant licensing basis safety analysis acceptance criteria are not exceeded.

The RTB position switches that provide input to the P-4 interlock only function to energize or de-energize or open or close contacts. Therefore, this Function has no adjustable Trip Setpoint with which to associate an Allowable Value.

This Function must be OPERABLE in MODES 1, 2, and 3 when the reactor may be critical or approaching criticality. This Function does not have to be OPERABLE in MODES 4, 5, or 6, because the main turbine, the MFW System, and the Steam Dump System are not in operation.

8.b. Pressurizer Pressure, P-11

The P-11 interlock permits a normal unit cooldown and depressurization without actuation of SI or main steam line isolation. With two out of three pressurizer pressure channels (discussed previously) less than the P-11 setpoint, the operator can manually block the Pressurizer Pressure--Low and Steam Line Pressure--Low SI signals, and Steamline Pressure Negative Rate--High is automatically enabled. With two out of three pressurizer pressure channels \geq P-11 setpoint, the Pressurizer Pressure--Low and Steamline Pressure--Low SI signals are automatically enabled, and Steamline Pressure Negative Rate--High is automatically blocked. The Trip Setpoint reflects only steady state instrument uncertainties.

This Function must be OPERABLE in MODES 1, 2, and 3 to allow an orderly cooldown and depressurization of the unit without the actuation of SI. This Function does not have to be OPERABLE

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in MODE 4, 5, or 6, because system pressure must already be below the P-11 setpoint for the requirements of the heatup and cooldown curves to be met.

8.c. Steam Generator Water Level--High High,
P-14

The P-14 interlock is actuated when the level in any SG exceeds the high high setpoint and performs the following functions as part of Function 5:

- Trips the main turbine;
- Trips the MFW pumps;
- Initiates feedwater isolation; and
- Shuts the MFW regulating valves and the bypass feedwater regulating valves.

The MFW pumps are tripped, feedwater isolation is actuated, and the main and bypass feedwater regulating valves are closed to prevent any further addition of water to the SGs. The main turbine is tripped to prevent carryover of excessive moisture to the turbine, which would damage the turbine. The reactor is tripped by the turbine trip to prevent excessive cooldown. This function has previously been discussed as Function 5.b.

This Function must be OPERABLE in MODES 1 and 2 when the turbine generator and the MFW may be in operation. This function does not have to be OPERABLE in MODE 3, 4, 5, or 6, because the turbine generator is not in service.

The ESFAS satisfies Criterion 3 of the NRC Policy Statement.

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In the event a channel s Trip Setpoint is found nonconservative with respect to the Allowable Value, or the transmitter, a rack module, or an SSPS module is found inoperable, then the Function which that channel provides must be declared inoperable and the LCO Condition entered for

(continued)

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(continued)

the particular protection Function affected. When the Required Channels in Table 3.3.2-1 are specified (e.g., on a per steam line, per loop, per SG, etc., basis), then the Condition may be entered separately for each steam line, loop, SG, etc., as appropriate.

A Note has been added in the ACTIONS to clarify the applicability of the Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.2-1. The Completion Times of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

When the number of inoperable channels in a trip function exceed those specified in one or other related Conditions associated with a trip function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 should be immediately entered if applicable in the current MODE of operation.

A.1

Condition A is applicable to all ESFAS protection Functions.

Condition A addresses the situation where one or more channels for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.2-1 and to take the Required Actions for the protection Functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

B.1, B.2.1, and B.2.2

Condition B is applicable to manual initiation of:

- SI;
- Containment Spray;
- Phase A Isolation; and
- Phase B Isolation.

This action addresses the train orientation of the SSPS for the functions listed above. If a channel or train is inoperable, 48 hours is allowed to return it to an OPERABLE status. Note that for containment spray and Phase B isolation, failure of one or both channels in one train renders the train inoperable. Condition B, therefore, encompasses both situations. The completion time is

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reasonable considering that there are two automatic actuation trains and another manual initiation train OPERABLE for each Function and the low probability of an event occurring during this interval. If the train cannot be restored to OPERABLE status, the unit must be placed in a MODE in which the LCO does not apply. This is done by placing the unit in at least MODE 3 within an additional 6 hours (54 hours total time) and in MODE 5 within an additional 30 hours (84 hours total time). The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. The allowance of 48 hours is justified in Reference 7.

C.1, C.2.1, and C.2.2

Condition C is applicable to the automatic actuation logic and actuation relays for the following functions:

- SI;
- Containment Spray;
- Phase A Isolation;
- Phase B Isolation; and
- Automatic Switchover to Containment Sump.

This action addresses the train orientation of the SSPS and the master and slave relays. If one train is inoperable, 6 hours are allowed to restore the train to OPERABLE status. The specified Completion Time is reasonable considering that there is another train OPERABLE and the low probability of an event occurring during this interval. If the train cannot be restored to OPERABLE status, the unit must be placed in a MODE in which the LCO does not apply. This is done by placing the unit in at least MODE 3 within an additional 6 hours (12 hours total time) and in MODE 5 within an additional 30 hours (42 hours total time). The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

The Required Actions are modified by a Note which allows one train to be bypassed for up to 4 hours for surveillance testing, provided the other train is OPERABLE. This allowance is based upon the reliability analysis assumption of Reference 7 that 4 hours is the average time required to perform channel surveillance.

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(continued)

D.1, D.2.1, and D.2.2

Condition D is applicable to:

- Containment Pressure--High;
- Pressurizer Pressure--Low;
- Steam Line Pressure--Low;
- Steam Line Pressure Negative Rate--High

If one channel is inoperable, 6 hours are allowed to restore channel to OPERABLE status or to place it in the tripped condition. Generally this Condition applies to functions that operate on two out of three logic. Therefore, failure of one channel places the function in a two out of two configuration. One channel must be tripped to place the function in a one out of three configuration that satisfies redundancy requirements.

The pressurizer pressure channels provide inputs to control and protection functions. It is therefore necessary to be able to sustain two simultaneous channel failures: one for the initiating failure, which necessitates protection system actuation, and one for the protection system in order to satisfy the redundancy and control protection independence requirements. For this Function, four protection channels are provided. When one channel fails it must be placed in trip in order to create an effective one out of three logic necessary to satisfy this requirement.

Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 6 hours requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. In MODE 4, these Functions are no longer required OPERABLE.

The Required Actions are modified by a Note which allows any single channel, including the inoperable channel, to be bypassed for up to 4 hours for surveillance testing. The 6 hours allowed to restore channel to OPERABLE status or to place the inoperable channel in the tripped condition and the 4 hours allowed for testing is justified in Reference 7.

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(continued)

E.1, E.2.1, and E.2.2

Condition E is applicable to:

- Containment Spray Containment Pressure--High High;
- Steam Line Isolation Containment Pressure--High High setpoint; and
- Containment Phase B Isolation Containment Pressure--High High.

None of these signals has input to a control function. Thus two out of three logic is acceptable protective requirements. However, a two out of three design would require tripping a failed channel. This is undesirable, because a single failure would then cause spurious containment spray initiation. Spurious spray actuation is undesirable because of the cleanup problems presented. Therefore, these channels are designed with two out of four logic so that a failed channel may be bypassed rather than tripped. Note that one channel may be bypassed and still satisfy the single failure criterion. Furthermore, with one channel bypassed, a single instrumentation channel failure will not spuriously initiate containment spray.

In order to avoid the inadvertent actuation of containment spray and Phase B containment isolation, the inoperable channel should not be placed in the tripped condition. Instead it is bypassed. Restoring the channel to OPERABLE status or placing the inoperable channel in the bypass condition within 6 hours is sufficient to assure that the Function remains OPERABLE and minimizes the time that the Function may be in a partial trip condition (assuming the inoperable channel has failed high), and is further justified based on the low probability of an event occurring during this interval. Failure to restore the inoperable channel to OPERABLE status or place it in the bypassed condition within 6 hours requires the unit be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging plant systems. In MODE 4, these Functions are no longer required OPERABLE.

The Required Actions are modified by a Note which allows one additional channel to be bypassed for up to 4 hours for

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(continued)

surveillance testing. Placing a second channel in the bypass condition for up to 4 hours for testing purposes is acceptable based on the results of Reference 7.

F.1, F.2.1, and F.2.2

Condition F is applicable to:

- Manual Initiation of Steam Line Isolation;
- Loss of Offsite Power;
- Auxiliary Feedwater Pump Suction Transfer on Suction Pressure--Low; and
- P-4 Interlock.

For the Manual Initiation and the P-4 Interlock Functions, this action addresses the train orientation of the SSPS. For the Loss of Offsite Power Function this action recognizes the lack of manual trip provision for a failed channel. For the AFW System pump suction transfer channels, this action recognizes that placing a failed channel in trip during operation is not necessarily a conservative action. Spurious trip of this function could align the AFW System to a source that is not immediately capable of supporting pump suction. If a train or channel is inoperable, 48 hours is allowed to return it to OPERABLE status. The specified Completion Time is reasonable considering the nature of these Functions, the available redundancy, and the low probability of an event occurring during this interval. If the Function cannot be returned to OPERABLE status, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The allowed 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 plant systems. In MODE 4, the unit does not have any analyzed transients or conditions which require the explicit use of the protection functions notes above.

G.1, G.2.1, and G.2.2

Condition G is applicable to the automatic actuation logic and actuation relays for the Steam Line Isolation and AFW actuation Functions.

This action addresses the train orientation of the SSPS and the master and slave relays for these functions. If one train is inoperable, 6 hours are allowed to restore the train

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(continued)

to OPERABLE status. The Completion Time for restoring a train to OPERABLE status is reasonable considering that there is another train OPERABLE and the low probability of an event occurring during this interval. If the train cannot be returned to an OPERABLE status, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The allowed 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. Placing the unit in MODE 4 removes all requirements for OPERABILITY of the protection channels and actuation functions. In this MODE, the unit does not have analyzed transients or conditions which require the explicit use of the protection functions noted above.

The Required Actions are modified by a Note which allows one train to be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. This allowance is based upon the reliability analysis (Ref. 7) assumption that 4 hours is the average time required to perform channel surveillance.

H.1 and H.2

Condition H is applicable to the automatic actuation logic and actuation relays for the Turbine Trip and Feedwater Isolation Function.

This action addresses the train orientation of the SSPS and the master and slave relays for this Function. If one train is inoperable, 6 hours are allowed to restore the train to OPERABLE status or the unit must be placed in MODE 3 within the next 6 hours. The Completion Time for restoring a train to OPERABLE status is reasonable considering that there is another train OPERABLE and the low probability of an event occurring during this interval. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from MODE 1 in an orderly manner and without challenging unit systems. These functions are no longer required in MODE 3. Placing the unit in MODE 3 removes all requirements for OPERABILITY of the protection channels and actuation functions. In this MODE, the unit does not have analyzed transients or conditions which require the explicit use of the protection functions noted above. The Required

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ACTIONS
(continued)

Actions are modified by a Note which allows one train to be bypassed for up to 4 hours for surveillance testing provided the other train is OPERABLE. This allowance is based upon the reliability analysis (Ref. 7) assumption that 4 hours is the average time required to perform channel surveillance.

I.1 and I.2

Condition I is applicable to SG Water Level--High High (P-14).

If one channel is inoperable, 6 hours are allowed to restore one channel to OPERABLE status or to place it in the tripped condition. If placed in the tripped condition, the Function is then in a partial trip condition where one out of two will result in actuation. The 6 hour Completion Time is justified in Reference 7. Failure to restore the inoperable channel to OPERABLE status or place it in the tripped condition within 6 hours requires the unit be placed in MODE 3 within the following 6 hours. The allowed Completion Time is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. In MODE 3, these Functions are no longer required OPERABLE.

The Required Actions are modified by a Note that allows any single channel, including the inoperable channel, to be bypassed for up to 4 hours for surveillance testing. The 6 hours allowed to place the inoperable channel in the tripped condition and the 4 hours allowed for a second channel to be in the bypassed condition for testing are justified in Reference 7.

J.1 and J.2

Condition J is applicable to the AFW pump start on trip of all turbine driven MFW pumps. This action addresses the train orientation of the SSPS for the auto-start function of the AFW System on loss of all turbine-driven MFW pumps. The OPERABILITY of the AFW System must be assured by allowing automatic start of the AFW System pumps. If a channel is inoperable, 48 hours are allowed to return it to an OPERABLE status. If the function cannot be returned to an OPERABLE status, 6 hours are allowed to place the unit in MODE 3. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging unit systems. In MODE 3, the unit does not have any analyzed

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ACTIONS
(continued)

transients or conditions which require the explicit use of the protection Function noted above. The allowance of 48 hours to return the train to an OPERABLE status is justified in Reference 7.

K.1, K.2.1, and K.2.2

Condition K is applicable to RWST Level--Low Low Coincident with Safety Injection and Coincident with Containment Sump Level--High.

RWST Level--Low Low Coincident With SI and Coincident With Containment Sump Level--High provides actuation of switchover to the containment sump. Note that this Function requires the bistables to energize to perform their required action. The failure of up to two channels will not prevent the operation of this Function. However, placing a failed channel in the tripped condition could result in the premature switchover to the sump, prior to the injection of the minimum volume from the RWST. Placing the inoperable channel in bypass results in a two out of three logic configuration, which satisfies the requirement to allow another failure without disabling actuation of the switchover when required. Restoring the channel to OPERABLE status or placing the inoperable channel in the bypass condition within 6 hours is sufficient to assure that the function remains OPERABLE and minimizes the time that the function may be in a partial trip condition (assuming the inoperable channel has failed high). The 6 hour Completion Time is justified in Reference 7. If the channel cannot be returned to OPERABLE status or placed in the bypass condition within 6 hours, the unit must be placed in MODE 3 within the following 6 hours and MODE 5 within the next 30 hours. The Completion Times of 6 and 30 hours are reasonable, based on operating experience, to reach the required MODE from full power conditions in an orderly manner and without challenging unit systems. In MODE 5, the unit does not have any analyzed transients or conditions which require the explicit use of the protection Functions noted above.

The Required Actions are modified by a Note that allows placing a second channel in the bypass condition for up to 4 hours for surveillance testing. The total of 12 hours to reach MODE 3 and 4 hours for a second channel to be bypassed is acceptable based on the results of Reference 7.

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BASES

ACTIONS
(continued)

L.1, L.2.1, and L.2.2

Condition L is applicable to the P-11 interlock.

With one channel inoperable, the operator must verify that the interlock is in the required state for the existing unit conditions. This action manually accomplishes the function of the interlock. Determination must be made within 1 hour. The 1 hour Completion Time is equal to the time allowed by LCO 3.0.3. to initiate shutdown actions in the event of a complete loss of ESFAS function. If the interlock is not in the required state (or placed in the required state) for the existing conditions, the unit must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The time allowed 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. Placing the unit in MODE 4 removes all requirements for OPERABILITY of these interlocks.

M.1 and M.2

Condition M is applicable to the P-14 interlock.

The actions for Condition M are identical to those for Condition L except that the P-14 interlock is not required to be OPERABLE in MODE 3. Therefore, shutdown to MODE 3 within 7 hours is required if interlock status cannot be verified within 1 hour. The Completion Times are reasonable, based on operating experience, to reach the required MODE from full power in an orderly manner and without challenging unit systems.

N.1.1, N.1.2 and N.2

Condition N is applicable to the SG Water Level Low-Low Function.

A known channel inoperable, must be restored to OPERABLE status, or placed in the tripped condition within 6 hours. Placing the channel in the tripped condition results in a partial trip condition requiring only one out of two logic for actuation of the two out of three trip. The 6 hours allowed to place the inoperable channel in the tripped condition is justified in Reference 7.

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BASES

ACTIONS
(continued)

If a channel fails, it is placed in the tripped condition and does not affect the TTD setpoint calculations for the remaining OPERABLE channels. It is then necessary for the operator to force the use of the shorter TTD Time Delay by adjustment of the single SG time delay calculation (T_S) to match the multiple SG time delay calculation (T_M) for the affected protection set, through the Man-Machine Interface.

If the inoperable channel cannot be restored or placed in the tripped condition within the specified Completion Time, the unit must be placed in MODE 3 within the following 6 hours and MODE 4 within the next 6 hours. The allowed Completion Times are reasonable, based on operating experience, to place the unit in MODE 3 from MODE 1 full power conditions in an orderly manner and without challenging unit systems.

The Required Actions have been modified by a Note which allows placing any single channel, including the inoperable channel, in the bypassed condition for up to 4 hours while performing routine Surveillance testing. The 4-hour time limit is justified in Reference 7.

0.1 and 0.2

Condition 0 applies to the Vessel ΔT Equivalent to Power Function.

Failure of the vessel ΔT channel input (failure of more than one T_H RTD or failure of both T_C RTDs) will affect the TTD calculation for a protection set. This results in the requirement that the operator adjust the threshold power level for zero seconds time delay from 50% RTP to 0% RTP, through the Man-Machine Interface.

If the inoperable channel cannot be restored or placed in the tripped condition within the specified Completion Time, the unit must be placed in a MODE where this Function is not required to be OPERABLE. An additional 6 hours is allowed to place the unit in MODE 3. Six hours is a reasonable time based on operating experience, to place the unit in MODE 3 from MODE 1 full power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE
REQUIREMENTS

The SRs for each ESFAS function are identified by the SRs column of Table 3.3.2-1.

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BASES

SURVEILLANCE
REQUIREMENTS
(continued)

A Note has been added in the SRs Table to clarify that Table 3.3.2-1 determines which SRs apply to which ESFAS functions.

Note that each channel of process protection supplies both trains of the ESFAS. When testing channel I, train A and train B must be examined. Similarly, train A and train B must be examined when testing channel II, channel III, and channel IV. The CHANNEL CALIBRATION and CHANNEL OPERATIONAL TESTS are performed in a manner that is consistent with the assumptions used in analytically calculating the required channel accuracies.

The protection Functions associated with the EAGLE-21 Process Protection System have an installed bypass capability, and may be tested in either the trip or bypass mode, as approved in Reference 7.

SR 3.3.2.1

Performance of the CHANNEL CHECK once ever 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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 two instrument channels could be an indication of excessive instrument drift in one of the channels or even something 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 unit staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

The Frequency is based upon operating experience that demonstrates channel failure is rare. Thus, performance of the CHANNEL CHECK ensures that undetected overt channel failure is limited to 12 hours. The CHANNEL CHECK supplements less formal, but more frequent, checks of channel OPERABILITY during normal operational use of the displays associated with the LCO required channels.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.2.2

SR 3.3.2.2 is the performance of an ACTUATION LOGIC TEST. The SSPS is tested every 31 days on a STAGGERED TEST BASIS, using the semiautomatic tester. The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. Through the semiautomatic tester, all possible logic combinations, with and without applicable permissive, are tested for each protection function. In addition, the master relay coil is pulse tested for continuity. This verifies that the logic modules are OPERABLE and there is an intact voltage signal path to the master relay coils. The time allowed for the testing (4 hours) and the Frequency are justified in Reference 7.

SR 3.3.2.3

SR 3.3.2.3 is the performance of a MASTER RELAY TEST. The MASTER RELAY TEST is the energizing of the master relay, verifying contact operation and a low voltage continuity check of the slave relay coil. Upon master relay contact operation, a low voltage is injected to the slave relay coil. This voltage is insufficient to pick up the slave relay, but large enough to demonstrate signal path continuity. This test is performed every 31 days on a STAGGERED TEST BASIS. The time allowed for the testing (4 hours) and the surveillance interval are justified in Reference 7.

SR 3.3.2.4

SR 3.3.2.4 is the performance of a COT. A COT is performed on each required channel to ensure the entire channel will perform the intended Function. Setpoints must be found within the Allowable Values specified in Table 3.3.2-1. The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology. The setpoint shall be left set consistent with the assumptions of the current unit specific setpoint methodology.

The "as found" and "as left" values must also be recorded and reviewed for consistency with the assumptions of the surveillance interval extension analysis (Reference 7) when applicable.

This test is performed every 92 days and is justified in Reference 7.

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BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.2.5

SR 3.3.2.5 is the performance of a SLAVE RELAY TEST. The SLAVE RELAY TEST is the energizing of the slave relays. Contact operation is verified in one of two ways. Actuation equipment which may be operated in the design mitigation MODE is either allowed to function or is placed in a condition where the relay contact operation can be verified without operation of the equipment. Actuation equipment which may not be operated in the design mitigation MODE is prevented from operation by the slave relay test circuit. For this latter case, contact operation is verified by a continuity check of the circuit containing the slave relay. This test is performed every 92 days. The time allowed for the testing (4 hours) and the Frequency are justified in Reference 7.

This SR is modified by a Note, which states that performance of this test is not required for those relays tested by SR 3.3.2.7.

SR 3.3.2.6

SR 3.3.2.6 is the performance of a TADOT every 92 days. This test is a check of Function 6.d; the Loss of Offsite Power, and Functions 6.f and 6.g, AFW Pump Suction Transfer on Suction Pressure--Low, for Motor-driven and Turbine-driven pumps respectively. These Functions are tested up to and including, the master transfer relay coils.

The SR is modified by a Note that excludes verification of setpoints for relays. Relay setpoints are verified during CHANNEL CALIBRATION. These devices are reliable components and their setpoints are verified during a CHANNEL CALIBRATION performed every 18 months. The Frequency is justified in Reference 7.

SR 3.3.2.7

SR 3.3.2.7 is the performance of a SLAVE RELAY TEST for slave relays K603A, K603B, K604A, K604B, K609A, K609B, K625A, and K625B. The SLAVE RELAY TEST is the energizing of the slave relays. Contact operation is verified in one of two ways. Actuation equipment which may be operated in the design mitigation MODE is either allowed to function or is placed in a condition where the relay contact operation can be verified without operation of the equipment. Actuation equipment which may not be operated in the design mitigation MODE is prevented from operation by the slave relay test circuit.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

For this latter case, contact operation is verified by a continuity check of the circuit containing the slave relay. This test is performed every 18 months. The time allowed for the testing (4 hours) is justified in Reference 7. The Frequency is justified by TVA correspondence to the NRC, dated November 9, 1984.

SR 3.3.2.8

SR 3.3.2.7 is the performance of a TADOT. This test is a check of the Manual Actuation Functions and AFW pump start on trip of all MFW pumps and is performed every 18 months. Each Manual Actuation function is tested up to, and including, the master relay coils. In some instances, the test includes actuation of the end device (i.e., pump starts, valve cycles, etc.).

The Frequency is justified in Reference 7.

SR 3.3.2.9

SR 3.3.2.9 is the performance of a CHANNEL CALIBRATION.

A CHANNEL CALIBRATION is performed every 18 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy.

CHANNEL CALIBRATION measurement and setpoint error determination and readjustment must be performed consistent with the assumptions of the Watts Bar setpoint methodology. The difference between the current "as found" values and the previous test "as left" values must be consistent with the drift allowance used in the setpoint methodology.

The Surveillance Frequency of 18 months is based on the assumption of an 18-month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.

This SR is modified by a Note, which states that this test should include verification that the time constants are adjusted to the prescribed values where applicable.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.2.10

This SR ensures the individual channel ESF Response Times are less than or equal to the maximum values assumed in the accident analysis. Response Time testing acceptance criteria are included in Reference 8. Response time tests are conducted on an 18-month STAGGERED TEST BASIS. 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.

Response time tests are conducted on an 18 month STAGGERED TEST BASIS. Testing of the final actuation devices, which make up the bulk of the response time, is included in the testing of each channel. The final actuation device in one train is tested with each channel. Therefore, staggered testing results in response time verification of these devices every 18 months. The 18 month Frequency is consistent with the typical refueling cycle and upon unit operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

This SR is modified with a Note that clarifies that the turbine driven AFW is tested within 24 hours after reaching 1092 psig in the SG.

SR 3.3.2.11

SR 3.3.2.11 is the performance of a TADOT as described in SR 3.3.2.8, except that it is performed for the P-4 Reactor Trip Interlock, and the Frequency is once per RTB cycle. This Frequency is based upon operating experience that undetected failure of the P-4 interlock sometimes occurs when the RTB is cycled.

REFERENCES

1. Watts Bar Updated FSAR, Section 6.0, "Engineered Safety Features."
2. Watts Bar Updated FSAR, Section 7.0, "Instrumentation and Controls."

(continued)

BASES

REFERENCES
(continued)

3. Watts Bar Updated FSAR, Section 15.0, "Accident Analyses."
 4. Institute of Electrical and Electronic Engineers, IEEE-279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," April 5, 1972.
 5. Code of Federal Regulations, Title 10, Part 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants."
 6. WCAP-12096, Rev. 4, "Westinghouse Setpoint Methodology for Protection System, Watts Bar 1 and 2," November 1990.
 7. WCAP-10271-P-A, Supplement 1, Rev. 1 and Supplement 2, Rev. 1, "Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System," May 1986 and June 1990.
 8. Watts Bar Technical Requirements Manual, Section 3.3.2, Engineered Safety Feature Response Times.
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B 3.3 INSTRUMENTATION

B 3.3.3 Post Accident Monitoring (PAM) Instrumentation

BASES

BACKGROUND

The primary purpose of the PAM Instrumentation is to display unit variables that provide information required by the control room operators during accident situations. This information provides the necessary support for the operator to take the manual actions for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for Design Basis Accidents (DBAs).

The OPERABILITY of the accident monitoring instrumentation ensures that there is sufficient information available on selected unit parameters to monitor and to assess unit status and behavior following an accident.

The availability of accident monitoring instrumentation is important so that responses to corrective actions can be observed and the need for, and magnitude of, further actions can be determined. These essential instruments are identified by unit specific documents (Ref. 2) addressing the recommendations of Regulatory Guide 1.97 (Ref. 1) as required by Supplement 1 to NUREG-0737, "TMI Action Items" (Ref. 3).

The instrument channels required to be OPERABLE by this LCO include two classes of parameters identified during unit specific implementation of Regulatory Guide 1.97 as Type A and Category I variables.

Type A variables are included in this LCO because they provide the primary information required for the control room operator to take specific manually controlled actions for which no automatic control is provided, and which are required for safety systems to accomplish their safety functions for DBAs. These Type A variables listed in Table 3.3.3-1 are Category I variables.

Category I variables, types B and D, are key variables deemed risk significant because they are needed to:

(continued)

BASES

BACKGROUND
(continued)

- Determine whether other systems important to safety are performing their intended functions;
- Provide information to indicate the operation of individual safety systems and other plant systems. These variables are to help the operator make appropriate decisions in using the individual systems in mitigating the consequences of an accident.

These non-Type A key variables are identified by unit specific Regulatory Guide 1.97 analyses. These analyses also identify the unit specific Type A variables and provide justification for deviating from the NRC proposed list of Category I variables.

The specific instrument Functions listed in Table 3.3.3-1 are discussed in the LCO section.

APPLICABLE
SAFETY ANALYSES

The PAM instrumentation ensures the operability of Regulatory Guide 1.97 (Ref. 1) Type A and Category I key variables so that the control room operating staff can:

- Perform the diagnosis specified in the emergency operating procedures (these variables are restricted to preplanned actions for the primary success path of DBAs e.g., LOCAs); and
- Take the specified, pre-planned, manually controlled actions, for which no automatic control is provided, that are required for safety systems to accomplish their safety function;
- Determine whether systems important to safety are performing their intended functions;

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

- Initiate action necessary to protect the public and to estimate the magnitude of any impending threat.

PAM instrumentation that meets the definition of Type A in Regulatory Guide 1.97 satisfies the requirements of Criterion 3 of the NRC Policy Statement. Category I PAM instrumentation must be retained in TS because they are intended to assist operators in minimizing the consequences of accidents (Ref. 2). Therefore, Category I variables are important in reducing public risk.

LCO

The PAM Instrumentation LCO provides OPERABILITY requirements for Regulatory Guide 1.97 Type A monitors, which provide information required by the control room operators to perform certain manual actions specified in the unit Emergency Operating Procedures. These manual actions ensure that a system can accomplish its safety function, and are credited in safety analyses. Additionally, this LCO addresses Regulatory Guide 1.97 instruments that have been designated Category I, non type A.

The OPERABILITY of the PAM instrumentation ensures there is sufficient information available on selected unit parameters to monitor and assess unit status following an accident. This capability is consistent with the recommendations of Reference 1.

LCO 3.3.3 requires two OPERABLE channels for most Functions. Two OPERABLE channels ensure no single failure prevents operators from getting the information necessary for them to determine the safety status of the unit, and to bring the unit to and maintain it in a safe condition following an accident.

Furthermore, OPERABILITY of two channels allows a CHANNEL CHECK during the post accident phase to confirm the validity of displayed information. More than two channels are required for some Functions because failure of one accident monitoring channel results in information ambiguity (that is, the redundant displays disagree) that could lead operators to defeat or fail to accomplish a required safety Function.

(continued)

BASES

LCO
(continued)

One exception to the two channel requirement is Containment Isolation Valve (CIV) Position. In this case, the important information is the status of the containment penetrations. The LCO requires one position indicator for each active containment isolation valve. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve and prior knowledge of passive valve or via system boundary status. If a normally active CIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE.

Another exception to the two channel requirement is RCS hot and cold leg temperature. One channel is sufficient because the loop temperatures are normally similar in value and there is other adequate instrumentation to verify abnormal readings in one channel.

A third exception is the steam generator water level wide range. One channel is sufficient because the wide range levels are back up measurements for the narrow range indication (three channels) and auxiliary feedwater flow (two channels).

A fourth exception is AFW valve position. This is acceptable for reason similar to containment isolation valve status.

A fifth exception is steam line radiation monitors. One channel is sufficient because there are other monitors available to verify abnormal readings in one channel.

Table 3.3.3-1 provides a list of Type A and Category I variables.

Type A and Category I variables are required to meet Regulatory Guide 1.97 Category I (Ref. 1) design and qualification requirements for seismic and environmental qualification, single failure criterion, utilization of emergency standby power, immediately accessible display, continuous readout, and recording of display.

Listed below are discussions of the specified instrument Functions listed in Table 3.3.3-1.

(continued)

BASES

LCO
(continued)

1, 2. Intermediate Range and Source Range Neutron Flux

Intermediate Range and Source Range Neutron Flux indication is provided to verify reactor shutdown. The two ranges are necessary to cover the full range of flux that may occur post accident.

Neutron flux is used for accident diagnosis, verification of subcriticality, and diagnosis of positive reactivity insertion.

3, 4. Reactor Coolant System (RCS) Hot and Cold Leg Temperature

RCS Hot and Cold Leg Temperatures are variables provided for verification of core cooling and long term surveillance.

RCS hot and cold leg temperatures are used to determine RCS subcooling margin. RCS subcooling margin (and/or reactor vessel water level) is used to make decisions to terminate Safety Injection (SI), if still in progress, or reinitiate SI if it has been stopped. RCS subcooling margin is also used for unit stabilization and cooldown control.

In addition, RCS cold leg temperature is used in conjunction with RCS hot leg temperature to verify the unit conditions necessary to establish natural circulation in the RCS.

The channels provide indication over a range of 50°F to 700°F.

5. Reactor Coolant System Pressure (Wide Range)

RCS wide range pressure is a variable provided for verification of core cooling and RCS long term integrity surveillance.

Wide-range RCS loop pressure is measured by pressure transmitters with a span of 0-3000 psig. Redundant monitoring capability is provided by two trains of instrumentation. Control room indications are provided by panel meters and through the inadequate core cooling monitoring (ICCM) plasma display.

(continued)

BASES

LCO

5. Reactor Coolant System Pressure (Wide Range)
(continued)

RCS pressure is used to verify delivery of SI flow to RCS from at least one train when the RCS pressure is below the pump shutoff head. RCS pressure is also used to verify closure of manually closed spray line valves and pressurizer power operated relief valves (PORVs).

In addition to these verifications, RCS pressure is used for determining RCS subcooling margin. RCS subcooling margin will allow termination of SI, if still in progress, or to reinitiation of SI if it has been stopped. RCS subcooling margin is also used for unit stabilization and cooldown control. RCS pressure can also be used:

- to determine whether to terminate actuated SI or to reinitiate stopped SI;
- as reactor coolant pump (RCP) trip criteria;
- to make a determination on the nature of the accident in progress and where to go next in the procedure.

RCS pressure is also related to three decisions about depressurization. They are:

- to determine whether to proceed with primary system depressurization;
- to verify termination of depressurization; and
- to determine when to close accumulator isolation valves during a controlled cooldown/depressurization.

A final use of RCS pressure is to determine whether to operate the pressurizer heaters.

(continued)

BASES

LCO

5. Reactor Coolant System Pressure (Wide Range)
(continued)

RCS pressure is a Type A variable because the operator uses this indication to monitor the cooldown of the RCS following a steam generator tube rupture (SGTR) or small break LOCA. Operator actions to maintain a controlled cooldown, such as adjusting steam generator (SG) pressure or level, would use this indication. Furthermore, RCS pressure is one factor that may be used in decisions to terminate RCP operation.

6. Reactor Vessel Water Level

Reactor Vessel Water Level is provided for verification and long term surveillance of core cooling. It is also used for accident diagnosis and to determine reactor coolant inventory adequacy.

The Reactor Vessel Level Indicating System (RVLIS) provides a direct measurement of the liquid level above the bottom of the reactor vessel up to the top of the reactor vessel. Indication is in percent of this distance (i.e., the reactor vessel bottom is 0% and the vessel top is 100%). It also has a dynamic range vessel liquid content (% LIQ) normalized from 0% to 100%. Normalization corrects the transmitted level information for the RCP operational configuration so that the accurate dynamic % LIQ is indicated regardless of the pattern of pumps running and the resulting fluid density or void content. Control room indications are provided through the ICCM plasma display. The ICCM plasma display is the primary indication used by the operator during an accident.

7. Containment Sump Water Level (Wide Range)

Containment Sump Water Level is provided for verification and long term Surveillance of RCS integrity.

Containment Sump Water Level is used to:

(continued)

BASES

LCO

7. Containment Sump Water Level (Wide Range)
(continued)

- Verify water source for recirculation mode of ECCS operation after a LOCA.
- Determine whether high energy line rupture has occurred inside or outside containment.

8. Containment Lower Compartment Atmospheric Temperature

The lower compartment temperature monitors will verify the temperatures in the lower compartment after an accident with display in the main control room. The monitoring system consists of two channels with range 0°F to 350°F.

9. Containment Pressure (Wide Range)

Containment Pressure (Wide Range) is provided for verification of RCS and containment OPERABILITY.

Containment Pressure instrumentation consists of two recorded channels on separate power supplies with a range of -5 to +60 psig.

Containment pressure is used to monitor containment pressure during an accident.

10. Containment Pressure (Narrow Range)

Containment Pressure (Narrow Range) is provided to determine margin to containment design pressure. The narrow range monitors are also used to monitor containment conditions following a break inside containment and verify if the accident is properly controlled. The narrow range instrumentation has a range of -2 to +15 psid.

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BASES

LCO
(continued)

11. Containment Isolation Valve Position

CIV Position is provided for verification of Containment OPERABILITY, and isolation.

When used to verify isolation, the important information is the status of the containment penetrations. The LCO requires one position indicator for each active CIV. This is sufficient to redundantly verify the isolation status of each isolable penetration either via indicated status of the active valve and prior knowledge of passive valve, or system boundary status. If a normally active CIV is known to be closed and deactivated, position indication is not needed to determine status. Therefore, the position indication for valves in this state is not required to be OPERABLE. This Function is on a per valve basis and Condition A is entered separately for each inoperable valve indication. A Note to the Required Channels states that the Function is not required for isolation valves whose associated penetration is isolated by at least one closed and deactivated automatic valve, closed manual valve, blind flange, or check valve with flow through the valve secured.

12. Containment Radiation (High Range)

Containment Radiation is provided to monitor for the potential of significant radiation releases and to provide release assessment for use by operators in determining the need to invoke site emergency plans.

Containment radiation level is used to determine a loss of reactor coolant or secondary coolant has occurred.

13. Hydrogen Monitors

Hydrogen Monitors are provided to detect high hydrogen concentration conditions which represent a potential for containment breach from a hydrogen explosion. This variable is also important in

(continued)

BASES

LCO

13. Hydrogen Monitors (continued)

verifying the adequacy of mitigating actions. Hydrogen concentration is also used to determine whether or not to start the hydrogen recombiners. Containment hydrogen instrumentation consists of two channels on separate power supplies with a range of 0-10% (by volume) hydrogen concentration.

14. Pressurizer Level

Pressurizer Level is one factor used to determine whether to terminate SI, if still in progress, or to reinitiate SI if it has been stopped. Knowledge of pressurizer water level is also used to verify the unit conditions necessary to establish natural circulation in the RCS and to verify that the unit is maintained in a safe shutdown condition. Pressurizer Level instrumentation consists of the three differential pressure transmitters and associated instrumentation used to measure pressurizer level. The channels provide indication over the entire distance between taps.

15,16. Steam Generator (SG) Water Level

SG Water Level is provided to monitor operation of decay heat removal via the SGs. The Category I indication of SG level is the wide range level instrumentation.

Steam generator level (Narrow Range) may be used to help identify the faulted steam generator following a tube rupture and verify that the intact steam generators are an adequate heat sink for the reactor. Narrow range steam generator level is also needed to make a determination on the nature of the accident in progress, e.g., verify a steam generator tube rupture. Narrow range steam generator water level is used when verifying plant conditions for termination of SI during secondary plant high energy line breaks outside containment.

(continued)

BASES

LCO
(continued)

17. AFW Valve Status

The status of each AFW valve is monitored with indication in the control room. There is one channel per valve which indicates fully open or fully closed position for each valve.

AFW valve status is monitored to give verification to the operator that automatic transfer to Essential Raw Cooling Water (ERCW) has taken place.

18, 19, 20, 21. Core Exit Temperature

Core Exit Temperature is provided for verification and long term surveillance of core cooling.

The ICCM is used to monitor the core exit thermocouples. There are two isolated systems, with each system monitoring at least four thermocouples per quadrant. The plasma display gives the average quadrant value, the high value, and the low value.

Control room indications are provided through the ICCM plasma display, which is the primary indication used by the operator during an accident. Therefore, the accident monitoring specification deals specifically with this portion of the instrument channel. Core Exit Temperature is used to determine whether to terminate SI, if still in progress, or to reinitiate SI if it has been stopped. Core Exit Temperature is also used for unit stabilization and cooldown control.

Two OPERABLE channels of Core Exit Temperature are required for each channel in each quadrant to provide indication of radial distribution of the coolant temperature exiting the core. Power distribution symmetry was considered in determining the specific number and locations provided for diagnosis of local core problems. Therefore, two randomly selected thermocouples are not sufficient to meet the two thermocouples per channel requirement in any quadrant. The two thermocouples

(continued)

BASES

LCO 18, 19, 20, 21.

Core Exit Temperature (continued)

in each channel must meet the additional requirement that one is located near the center of the core and the other near the core perimeter, such that the pair of Core Exit Temperatures indicate the radial temperature gradient across their core quadrant. Two sets or two thermocouples ensures a single failure will not disable the ability to determine the radial temperature gradient.

22. Auxiliary Feedwater Flow

AFW Flow is provided to monitor operation of decay heat removal via the SGs.

Redundant monitoring capability is provided by two independent trains of instrumentation for each SG. Each differential pressure transmitter provides an input to a control room indicator. Since the primary indication used by the operator during an accident is the control room indicator, the PAM specification deals specifically with this portion of the instrument channel.

AFW flow is used three ways:

- to verify AFW flow to the SGs;
- in conjunction with SG water level (narrow range), to determine whether to terminate SI if still in progress;
- to regulate AFW flow so that the SG tubes remain covered.

23. Reactor Coolant System Subcooling Margin Monitor

The RCS subcooling margin monitor is used to determine the temperature margin to saturation of the primary coolant. Control room indications are provided through the ICCM plasma display. The ICCM plasma display is the primary indication used by the operator during an accident.

(continued)

BASES

LCO
(continued)

24. Refueling Water Storage Tank Level

RWST water level is used to verify the water source availability to the ECCS and Containment Spray Systems. It may also provide an indication of time for initiating cold leg recirculation from the sump following a LOCA.

25. Steam Generator Pressure

Steam pressure is used to determine if a high energy secondary line rupture has occurred and the availability of the steam generators as a heat sink. It is also used to verify that a faulted steam generator is isolated. Steam pressure may be used to ensure proper cooldown rates or to provide a diverse indication for natural circulation cooldown.

26. Auxiliary Building Passive Sump Level

Auxiliary Building Passive Sump Level monitors the sump level in the auxiliary building during LOCA. The purpose is to verify that radioactive water does not leak to the auxiliary building. The Auxiliary Building Passive Sump Level monitor consists of two channels on separate power supply. One channel is recorded. The calibrated range of the two monitors are 0" to 60".

27. Steam Line Radiation Monitor

The steam line radiation monitors are used to detect primary to secondary leakage and monitor radioactivity release.

Two channels are required to be OPERABLE for most functions. Two OPERABLE channels ensure no single failure prevents the operators from having the information necessary to determine the safety status of the plant and to bring the plant to, and maintain it in, a safe condition following an accident.

(continued)

BASES (continued)

APPLICABILITY

The PAM instrumentation LCO is applicable in MODES 1, 2, and 3. These variables are related to the diagnosis and preplanned actions required to mitigate DBAs. The applicable DBAs are assumed to occur in MODES 1, 2, and 3. In MODES 4, 5, and 6, unit conditions are such that the likelihood of an event that would require PAM instrumentation is low; therefore, the PAM instrumentation is not required to be OPERABLE in these MODES.

"A Note modifies the APPLICABILITY to recognize that the Source Range Neutron Flux Channel is not required OPERABLE above the P-6 (Intermediate Range Neutron Flux) interlock."

ACTIONS

Note 1 has been added in the ACTIONS to exclude the MODE change restriction of LCO 3.0.4. This exception allows entry into the applicable MODE while relying on the ACTIONS even though the ACTIONS may eventually require unit shutdown. This exception is acceptable due to the passive function of the instruments, the operator's ability to respond to an accident using alternate instruments and methods, and the low probability of an event requiring these instruments.

Note 2 has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.3-1. The Completion Time(s) of the inoperable channel(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A is applicable to all PAM Instrumentation Functions. Condition A addresses the situation where one or more required channels for one or more functions are inoperable at the same time. The Required Action is to refer to Table 3.3.3-1 and to take the Required Actions for the Functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

(continued)

BASES

ACTIONS
(continued)

B.1

Condition B applies when one channel is inoperable for those PAM instrumentation Functions that only require one channel. Required Action B.1 requires restoring one channel in the Function(s) to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring the operation of PAM instrumentation during this interval.

C.1

Condition C applies when one channel is inoperable for those PAM instrumentation Functions that require two or more channels. Required Action C.1 requires restoring the inoperable channel to OPERABLE status within 30 days. The 30 day Completion Time is based on operating experience and takes into account the remaining OPERABLE channel, the passive nature of the instrument (no critical automatic action is assumed to occur from these instruments), and the relatively low probability of an event requiring the operation of PAM instrumentation during this interval.

D.1

Condition D applies when the Required Action and associated Completion Time for Condition C are not met. This Required Action specifies immediate initiation of actions in Specification 5.9.2.c, "Special Reports," that require a written report, approved by the onsite review committee, to be submitted to the NRC. This report discusses the results of the root cause evaluation of the inoperability and identifies proposed restorative actions. This action is appropriate in lieu of a shutdown requirement since alternative actions are identified before loss of functional capability. Also, given the small likelihood of unit conditions that would require information provided by this instrumentation.

(continued)

BASES

ACTIONS
(continued)

E.1

Condition E applies when two or more channels are inoperable in the same Function. Required Action E.1 requires restoring one channel in the Function(s) to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation and the availability of alternate means to obtain the required information. Continuous operation with two required channels inoperable in a Function is not acceptable because the alternate indications may not fully meet all performance qualification requirements applied to the PAM instrumentation. Therefore, requiring restoration of one inoperable channel of the Function limits the risk that the PAM Function will be in a degraded condition should an accident occur.

F.1

Condition F applies when two hydrogen monitor channels are inoperable. Required Action F.1 requires restoring one hydrogen monitor channel to OPERABLE status within 72 hours. The 72 hour Completion Time is reasonable based on the backup capability of the Post Accident Sampling System to monitor the hydrogen concentration for evaluation of core damage and to provide information for operator decisions. Also, it is unlikely that a LOCA (that would cause core damage) would occur during this time.

G.1

Condition G applies when two channels are inoperable for Containment Radiation High Range or Reactor Vessel Water Level. Required Action G.1 requires restoring one channel in the Function(s) to OPERABLE status within 7 days. The Completion Time of 7 days is based on the relatively low probability of an event requiring PAM instrument operation.

H.1

Alternate means of monitoring Reactor Vessel Water Level and Containment Area Radiation may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status

(continued)

BASES

ACTIONS

H.1 (continued)

within the allotted time. If these alternate means are used, the Required Action is not to shut down the unit but to follow the directions of Specification 5.9.2.c, in the Administrative Controls section of the TS. The report provided to the NRC should discuss the alternate means used, describe the degree to which the alternate means are equivalent to the installed PAM channels, justify the areas in which they are not equivalent, and provide a schedule for restoring the normal PAM channels.

I.1 and I.2

If the Required Action and associated Completion Time of Conditions B, E, or F are not met, the unit must be brought to a MODE where the requirements of this LCO do not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and MODE 4 within 12 hours.

The allowed Completion Times are 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

A Note has been added to the SR Table to clarify that SR 3.3.3.1 and SR 3.3.3.3 apply to each PAM instrumentation Function in Table 3.3.3-1:

SR 3.3.3.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross instrumentation failure has not occurred. A CHANNEL CHECK is a comparison of the parameter indicated on one channel to a similar parameter on other channels where feasible. It is based on the assumption that instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two instrument channels could be an indication of excessive instrument drift in one of the channels or even something more serious. A CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying the instrumentation continues to operate properly between each

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.3.1 (continued)

CHANNEL CALIBRATION. The high radiation instrumentation should be compared to similar unit instruments located throughout the unit.

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

As specified in the SR, a CHANNEL CHECK is only required for those channels which are normally energized.

The Frequency of 31 days is based on operating experience that demonstrates that 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 LCO Required Channels.

SR 3.3.3.2

A COT is performed on each hydrogen monitor every 184 days to ensure the entire channel will perform the intended function. The 184 day Frequency is based on the known reliability of the hydrogen monitors, and has been shown to be acceptable through operating experience.

SR 3.3.3.3

A CHANNEL CALIBRATION is performed every 18 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop, including the sensor. The test verifies that the channel responds to measured parameter with the necessary range and accuracy. This SR is modified by a Note which excludes neutron detectors. The calibration method for neutron detectors is specified in the Bases of LCO 3.3.1, "Reactor Trip System Instrumentation." The Frequency is based on operating experience and consistency with the typical industry refueling cycle.

(continued)

BASES (continued)

- REFERENCES
1. Regulatory Guide 1.97, Revision 2, December 1980.
 2. NUREG-0847, Safety Evaluation Report, Supplement Number 9, June 16, 1992, Section 7.5.2, "Post Accident Monitoring System."
 3. NUREG-0737, Supplement 1.
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B 3.3 INSTRUMENTATION

B 3.3.4 Remote Shutdown System

BASES

BACKGROUND

The Remote Shutdown System provides the control room operator with sufficient instrumentation and controls to place and maintain the unit in a safe shutdown condition from a location other than the control room. This capability is necessary to protect against the possibility that the control room becomes inaccessible. A safe shutdown condition is defined as MODE 3. With the unit in MODE 3, the Auxiliary Feedwater (AFW) System and the steam generator (SG) safety valves or the SG atmospheric dump valves (ADV) can be used to remove core decay heat and meet all safety requirements. The long term supply of water for the AFW System and the ability to borate the Reactor Coolant System (RCS) from outside the control room allows extended operation in MODE 3.

In the event that the control room becomes inaccessible, the operators can establish control and place and maintain the unit in MODE 3. Not all controls and necessary transfer switches are located in the Auxiliary Control Room. Some controls and transfer switches will have to be operated locally at the switchgear, motor control panels, or other local stations. The unit automatically reaches MODE 3 following a unit shutdown and can be maintained safely in MODE 3 for an extended period of time.

The OPERABILITY of the remote shutdown control and instrumentation functions ensures there is sufficient information available on selected unit parameters to place and maintain the unit in MODE 3 should the control room become inaccessible.

APPLICABLE SAFETY ANALYSES

The Remote Shutdown System is required to provide equipment at appropriate locations outside the control room with a capability to promptly shut down and maintain the plant in a safe condition in MODE 3.

The criteria governing the design and specific system requirements of the Remote Shutdown System are located in 10 CFR 50, Appendix A, GDC 19 (Ref. 1).

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The Remote Shutdown System is considered an important contributor to the reduction of plant risk to accidents and as such it has been retained in the Technical Specifications as indicated in the NRC Policy Statement.

LCO

The Remote Shutdown System LCO provides OPERABILITY requirements of the instrumentation and controls necessary to place and maintain the unit in MODE 3 from a location other than the control room. The instrumentation and controls required are listed in Table 3.3.4-1.

For channels that fulfill GDC 19 requirements, the number of OPERABLE channels required depends upon the unit licensing basis as described in the NRC Watts Bar Safety Evaluation Report (SER). Generally, two channels are required OPERABLE. However, only one channel per a given function is required if the plant has justified such a design, and NRC's SER accepted the justification. The controls, instrumentation, and transfer switches are required for:

- Core reactivity control (initial and long term);
- RCS pressure control;
- Decay heat removal via the AFW System and the SG safety valves or SG ADVs;
- RCS inventory control via charging flow; and
- Safety support systems for the above Functions, including service water, component cooling water, and onsite power, including the diesel generators.

The Function of a Remote Shutdown System is OPERABLE if all instruments and controls needed to support the Remote Shutdown System Function are OPERABLE. In some cases, Table 3.3.4-1 may indicate that the required information or control capability is available from several alternate sources. In these cases, the Remote Shutdown System Function is OPERABLE as long as one channel of any of the alternate information or control sources is OPERABLE.

(continued)

BASES

LCO
(continued)

The remote shutdown instruments and control circuits covered by this LCO do not need to be energized to be considered OPERABLE. This LCO is intended to ensure the instruments and control circuits will be OPERABLE if unit conditions require that the Remote Shutdown System be placed in operation.

APPLICABILITY

The Remote Shutdown System LCO is applicable in MODES 1, 2, and 3. This is required so that the unit can be placed and maintained in MODE 3 for an extended period of time from a location other than the control room.

This LCO is not applicable in MODE 4, 5, or 6. In these MODES, the unit is already subcritical and in a condition of reduced RCS energy. Under these conditions, considerable time is available to restore necessary instrument control Functions if control room instruments or controls become unavailable.

ACTIONS

Note 1 is included which excludes the MODE change restriction of LCO 3.0.4. This exception allows entry into an applicable MODE while relying on the ACTIONS even though the ACTIONS may eventually require a unit shutdown. This exception is acceptable due to the low probability of an event requiring Remote Shutdown System equipment and because it can generally be repaired during operation without significant risk of spurious trip.

Note 2 has also been added to the ACTIONS to clarify the application of Completion Time rules. Separate Condition entry is allowed for each Function listed on Table 3.3.4-1. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A addresses the situation where one or more required Functions of the Remote Shutdown System are inoperable. This includes any Function listed in Table 3.3.4-1, as well as the control and transfer switches.

(continued)

BASES

ACTIONS

A.1 (continued)

The Required Action is to restore the required Function to OPERABLE status within 30 days. The Completion Time is based on operating experience and the low probability of an event that would require evacuation of the control room.

B.1 and B.2

The unit must be placed in a MODE in which the LCO does not apply, if the Required Action and associated Completion Time of Condition A is not met. This is done by placing the unit in at least MODE 3 within 6 hours and in MODE 4 within 12 hours. The allowed Completion Times are 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 3.3.4.1

Performance of the CHANNEL CHECK once every 31 days ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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 one of the channels or of even something more serious. CHANNEL CHECK will detect gross channel failure; thus, it is key to verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined by the unit staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the sensor or the signal-processing equipment has drifted outside its limit. If the channels are within the match criteria, it is an indication that the channels are OPERABLE. If the channels are normally off scale during

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.4.1 (continued)

times when Surveillance is required, the CHANNEL CHECK will verify only that they are off scale in the same direction. Off scale low current loop channels are verified to be reading at the bottom of the range and not failed downscale.

As specified in the Surveillance, a CHANNEL CHECK is only required for those channels which are normally energized.

The Frequency of 31 days is based upon operating experience which demonstrates that channel failure is rare.

SR 3.3.4.2

SR 3.3.4.2 verifies each required Remote Shutdown System control circuit and transfer switch performs the intended function. This verification is performed from the Auxiliary Control Room and locally, as appropriate. This will ensure that if the control room becomes inaccessible, the unit can be placed and maintained in MODE 3 from the local control stations. The 18-month Frequency was developed considering it is prudent that these types of surveillances be performed during a unit outage. However, this Surveillance is not required to be performed only during a unit outage. This is due to the unit conditions needed to perform the Surveillance and the potential for unplanned transients if the Surveillance is performed with the reactor at power. Operating experience demonstrates that remote shutdown control channels usually pass the surveillance test when performed on the 18-month Frequency.

SR 3.3.4.3

CHANNEL CALIBRATION is a complete check of the instrument loop and sensor. The test verifies that the channel responds to measured parameters with the necessary range and accuracy.

The Frequency of 18 months is based upon operating experience and consistency with the typical industry refueling cycle.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.4.4

SR 3.3.4.4 is the performance of a TADOT every 18 months. This test should verify the OPERABILITY of the reactor trip breakers (RTBs) open and closed indication on the remote shutdown panel, by actuating the RTBs. The Frequency of 18 months was chosen because the RTBs cannot be exercised while the facility is at power. Operating experience has shown that these components usually pass the surveillance test when performed at an 18-month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants."
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B 3.3 INSTRUMENTATION

B 3.3.5 Loss of Power (LOP) Diesel Generator Start Instrumentation

BASES

BACKGROUND

The DGs provide a source of emergency power when offsite power is either unavailable or is insufficiently stable to allow safe unit operation. Undervoltage protection will generate a LOP start in the event a loss of voltage or degraded voltage condition occurs in the switchyard. There are four LOP start signals, one for each 6.9 kV shutdown bus.

Three degraded voltage relays (one per phase) are provided on each 6900v Class 1E bus for the purpose of detecting a sustained undervoltage condition. The relays are combined in a two out of three logic to generate a supply breaker trip signal if the voltage is below 98% for 6 seconds. Additionally, three undervoltage relays (one per phase) are provided on each 6900v Class 1E bus for the purpose of detecting a loss of voltage condition. The relays are combined in a two out of three logic to generate a supply breaker trip signal if the voltage is below 87% for 0.25 to 0.5 seconds.

Once the supply breakers have been opened, an induction disk type relay, which has a voltage setpoint of 70% of 6.9kV (nominal, decreasing) and an internal time delay of 0.5 seconds at zero volts, will start the diesel generator. Another induction disk type relay, which has a voltage setpoint of 70% of 6.9kV (nominal, decreasing) and an internal time delay of 3 seconds, at zero volts, will initiate load shedding of the 6.9kV shutdown board and close the 480V shutdown board current limiting reactor bypass breaker. The LOP start actuation is described in FSAR Section 8.0, "Electric Power" (Ref. 1).

Trip Setpoints and Allowable Values

The trip setpoints used in the relays are based on the analytical limits presented in FSAR, Section 15, "Accident Analysis" (Ref. 2). The selection of these trip setpoints is such that adequate protection is provided when all sensor and processing time delays are taken into account.

(continued)

BASES

BACKGROUND

Trip Setpoints and Allowable Values (continued)

The actual nominal Trip Setpoint entered into the relays is normally still more conservative than that required by the Allowable Value. If the measured setpoint does not exceed the Allowable Value, the relay is considered OPERABLE.

Setpoints adjusted in accordance with the Allowable Value ensure that the consequences of accidents will be acceptable, providing the plant is operated from within the LCOs at the onset of the accident and the equipment functions as designed.

Allowable Values are specified for each Function in the LCO. Nominal Trip Setpoints are also specified in the unit specific setpoint calculations. The nominal setpoints are selected to ensure that the setpoint measured by the surveillance procedure does not exceed the Allowable Value if the relay is performing as required. If the measured setpoint does not exceed the Allowable Value, the relay is considered OPERABLE. Operation with a Trip Setpoint less conservative than the nominal Trip Setpoint, but within the Allowable Value, is acceptable provided that operation and testing is consistent with the assumptions of the unit specific setpoint calculation. Each Allowable Value specified is more conservative than the analytical limit assumed in the transient and accident analysis in order to account for instrument uncertainties appropriate to the trip function. These uncertainties are defined in the "Westinghouse Setpoint Methodology for Protection System Watts Bar 1 and 2" (Ref. 3).

APPLICABLE
SAFETY ANALYSIS

The LOP DG Start Instrumentation is required for the Engineered Safety Features (ESF) Systems to function in any accident with a loss of offsite power. Its design basis is that of the ESF Actuation System (ESFAS).

Accident analyses credit the loading of the DG based on the loss of offsite power during a loss of coolant accident (LOCA). The actual DG start has historically been associated with the ESFAS actuation. The DG loading has been included in the delay time associated with each safety

(continued)

BASES

APPLICABLE
SAFETY ANALYSIS
(continued)

system component requiring DG supplied power following a loss of offsite power. The analysis assumes a nonmechanistic DG loading, which does not explicitly account for each individual component of loss-of-power detection and subsequent actions.

A time delay includes contributions from the DG start, DG loading, and Safety Injection (SI) System component actuation. The response of the DG to a LOP must be demonstrated to fall within this analysis response time when including the contributions of all portions of the delay.

The required channels of LOP DG Start Instrumentation, in conjunction with the ESF Systems powered from the DGs, provide plant protection in the event of any of the analyzed accidents discussed in Reference 2, in which a loss of offsite power is assumed.

The delay times assumed in the safety analysis for the ESF equipment include the 10-second DG start delay, and the appropriate sequencing delay. The response times for ESFAS actuated equipment in LCO 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," include the appropriate DG loading and sequencing delay.

The LOP DG Start Instrumentation channels satisfy Criterion 3 of the NRC Interim Policy Statement.

LCO

The LCO for the LOP DG Start Instrumentation requires that three channels per bus of the loss of voltage and the degraded voltage Functions and two channels per bus of the diesel generator starting and the load shedding Functions shall be OPERABLE in MODES 1, 2, 3, and 4 when the LOP DG Start Instrumentation supports safety systems associated with the ESFAS. In MODES 5 and 6, the channels must be OPERABLE whenever the associated DG is required to be OPERABLE to ensure that the automatic start of the DG is available when needed.

Loss of LOP DG Start Instrumentation Function could result in the delay of safety systems initiation when required. This could lead to unacceptable consequences during

(continued)

BASES

LCO
(continued)

accidents. During the loss of offsite power the DG powers the motor-driven auxiliary feedwater pumps. Failure of these pumps to start would leave only one turbine driven pump, as well as an increased potential for a loss of decay heat removal through the secondary system.

APPLICABILITY

The LOP DG Start actuation function is required in MODES 1, 2, 3, and 4 because ESF functions are designed to provide protection in these MODES. Actuation in MODES 5 or 6 is required whenever the required DG must be OPERABLE, so that it can perform its function on an LOP or degraded power to the vital bus.

ACTIONS

In the event a channel's trip setpoint is found non-conservative with respect to the Allowable Value, or the channel is found inoperable, then the Function that channel provides must be declared inoperable and the LCO Condition entered for the particular protection Function affected.

Because the required channels are specified on a per bus basis, the Condition may be entered separately for each bus as appropriate.

A Note has been added in the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed in the LCO. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A applies to the LOP DG Start Function with one channel per bus inoperable.

If one channel is inoperable Required Action A.1 requires that channel be placed in trip in 6 hours. With a channel in trip, the LOP DG Start Instrumentation channels are configured to provide a one out of two logic to initiate a trip of the incoming offsite power or one out of one logic for initiation of subsequent DG start and bus load shedding.

(continued)

BASES

ACTIONS

A.1 (continued)

A Note is added to allow bypassing an inoperable channel for up to 4 hours for surveillance testing of other channels. This allowance is made where bypassing the channel does not cause an actuation and where at least two other channels are monitoring that parameter.

The specified Completion Time and time allowed for bypassing one channel are reasonable considering the function remains fully OPERABLE on every bus and the low probability of an event occurring during these intervals.

B.1

Condition B applies when more than one channel on a single bus is inoperable.

Required Action B.1 requires restoring all but one channel to OPERABLE status. The 1-hour Completion Time should allow ample time to repair most failures and takes into account the low probability of an event requiring a LOP start occurring during this interval.

C.1

Condition C applies to each of the LOP DG start functions when the Required Actions and associated Completion Time of Conditions A or B are not met.

In these circumstances the Conditions specified in LCO 3.8.1, "AC Sources-Operating," or 3.8.2, "AC Sources-Shutdown," for the DG made inoperable by failure of the LOP DG start instrumentation are required to be entered immediately. The actions of those LCOs provide for adequate compensatory actions to assure unit safety.

SURVEILLANCE
REQUIREMENTS

SR 3.3.5.1

SR 3.3.5.1 is the performance of a TADOT. This test is performed every 31 days. The test checks trip devices that provide actuation signals directly, bypassing the

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.5.1 (continued)

analog process control equipment. The Frequency is based upon the known reliability of the relays and controls, the multi-channel redundancy available, and has been shown to be acceptable through operating experience.

The SR is modified by a Note that excludes verification of setpoints for relays. Relay setpoints are verified during a CHANNEL CALIBRATION.

SR 3.3.5.2

This SR ensures that the individual channel LOP DG Start Instrumentation actuation response times are less than or equal to the maximum values assumed in the accident analysis. Response time testing acceptance criteria are included in Technical Requirements Manual, Section 3.3.2, Engineered Safety Feature Response Times (Ref. 4).

ESF RESPONSE TIME tests are conducted on an 18 month STAGGERED TEST BASIS. The 18 month Frequency is consistent with the typical refueling cycle and is based upon unit operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

SR 3.3.5.3

SR 3.3.5.3 is the performance of a CHANNEL CALIBRATION. A CHANNEL CALIBRATION is a complete check of the instrument loop and the sensor.

The setpoints, as well as the response to a loss of voltage and a degraded voltage test, shall include a single point verification that the trip occurs within the required time delay, as shown in Reference 1.

A CHANNEL CALIBRATION is performed every 18 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop including the sensor. The test verifies that the channel responds to measured parameter within the necessary range and accuracy.

The Frequency of 18 months is based upon operating

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.5.3 (continued)

experience and consistency with the typical industry refueling cycle and is justified by the assumption of an 18 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

REFERENCES

1. Watts Bar FSAR, Section 8.3, "Electric Power."
 2. Watts Bar FSAR, Section 15, "Accident Analysis."
 3. "Westinghouse Setpoint Methodology for Protection System Watts Bar 1 and 2."
 4. Technical Requirements Manual, Section 3.3.2, Engineered Safety Feature Response Times.
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B 3.3 INSTRUMENTATION

B 3.3.6 Containment Vent Isolation Instrumentation

BASES

BACKGROUND

Containment Vent Isolation closes the containment isolation valves in the Containment Purge System. This action isolates the containment atmosphere from the outside environment to minimize releases of radioactivity in the event of an accident. The Containment Purge System may be in use during reactor operation and with the reactor shutdown.

Containment Vent Isolation is initiated on an automatic Safety Injection (SI) Function or by manual actuation of Phase A or Phase B Isolation. The Bases for LCO 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," discuss these other modes of initiation.

Redundant and independent gaseous radioactivity monitors measure the radioactivity levels of the containment purge exhaust, each of which will initiate its associated train of automatic Containment Vent Isolation upon detection of high gaseous radioactivity.

The Containment Purge System may be in use during reactor operation and with the reactor shutdown. The purge system has inner and outer containment isolation valves in its supply and exhaust ducts. This system is described in the Bases for LCO 3.6.3, "Containment Isolation Valves." The Containment Purge Exhaust Radiation monitoring instrumentation isolates the containment atmosphere from the outside environment to minimize releases of radioactivity in the event of an accident.

APPLICABLE
SAFETY ANALYSIS

The safety analyses assume that the containment remains intact with penetrations unnecessary for core cooling isolated early in the event, approximately 60 seconds. The containment isolation valves for the Containment Purge System close within four seconds following actuation of an isolation signal. The containment vent isolation radiation monitors act as backup to the SI signal to ensure closing the purge air system supply and exhaust valves. They are also the primary means for automatically isolating

(continued)

BASES

APPLICABLE
SAFETY ANALYSIS
(continued)

containment in the event of a fuel handling accident during shutdown. Containment isolation in turn ensures meeting the containment leakage rate assumptions of the safety analyses, and ensures that the calculated accidental offsite radiological doses are below 10 CFR 100 (Ref. 1) limits.

The Containment Vent Isolation Instrumentation satisfies criterion 3 of the NRC Policy Statement.

LCO

The LCO requirements ensure that the instrumentation necessary to initiate Containment Vent Isolation, listed in Table 3.3.6-1, is OPERABLE.

1. Manual Initiation

The LCO requires two channels OPERABLE. The operator can initiate Containment Vent Isolation at any time by using either of two switches in the control room. Either switch actuates both trains. This action will cause actuation of all components in the same manner as any of the automatic actuation signals. These manual switches also initiate a Phase A isolation signal.

The LCO on Manual Initiation ensures the proper amount of redundancy is maintained in the manual actuation circuitry to ensure the operator has manual initiation capability.

Each channel consists of one selector switch and the interconnecting wiring to the actuation logic cabinet.

2. Automatic Actuation Logic and Actuation Relays

The LCO requires two trains of Automatic Actuation Logic and Actuation Relays OPERABLE to assure that no single random failure can prevent automatic actuation.

Automatic actuation logic and actuation relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b., SI. The Applicable MODES and conditions specified for the containment vent isolation portion of the SI Function is different and less restrictive than those for the SI role. If one or more of the SI Functions becomes inoperable in such a

(continued)

BASES

LCO
(continued)

manner that only the Containment Vent Isolation Function is affected, the Conditions applicable to the SI Functions need not be entered. The less restrictive Actions specified for inoperability of the Containment Vent Isolation Functions specify sufficient compensatory measures for this case.

3. Containment Radiation

The LCO specifies 2 required channels of radiation monitors to ensure that the radiation monitoring instrumentation necessary to initiate Containment Vent Isolation remains OPERABLE.

For sampling systems, channel OPERABILITY involves more than OPERABILITY of the channel electronics. OPERABILITY may also require correct valve lineups, sample pump operation, and filter motor operation as well as detector OPERABILITY if these supporting features are necessary for trip to occur under the conditions assumed in the safety analyses.

4. Safety Injection (SI)

Refer to LCO 3.3.2, Function 1 for all initiating Functions and requirements.

APPLICABILITY

Containment Vent Manual Isolation, Automatic Logic, and Radiation Monitoring Instrumentation input functions are required OPERABLE in MODES 1, 2, 3, 4 and during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment. Under these conditions the potential exists for an accident that could release fission product radioactivity into containment. Therefore, the containment purge and exhaust isolation instrumentation must be OPERABLE in these MODES.

While in MODES 5 and 6 without fuel handling in progress, the Containment Vent Isolation System need not be OPERABLE since the potential for radioactive releases is minimized and operator action is sufficient to ensure post accident offsite doses are maintained within the limits of Reference 1.

(continued)

BASES (continued)

ACTIONS

The most common cause of channel inoperability is outright failure or drift sufficient to exceed the tolerance allowed by the unit-specific procedures. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. If the Trip Setpoint is less conservative than the tolerance specified by the calibration procedure, the channel must be declared inoperable immediately and the appropriate Condition entered.

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.6-1 in the accompanying LCO. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

Condition A is applicable to the failure of one containment purge isolation radiation monitor channel. Since the two containment radiation monitors are both gaseous detectors, failure of a single channel may result in loss of the redundancy. Consequently, the failed channel must be restored to OPERABLE status.

The 4 hours allowed to restore the affected channel is justified by the low likelihood of events occurring during this interval, and recognition that the remaining channel will respond to most events.

B.1

Condition B is applicable to the Containment Vent Isolation Function and addresses the train orientation of the Solid State Protection System (SSPS) and the master and slave relays for this Function. It also addresses the failure of multiple radiation monitoring channels, or the inability to restore a single failed channel to OPERABLE in the time

(continued)

BASES

ACTIONS

B.1 (continued)

allowed for Required Action A.1. Condition B is applicable in MODES 1, 2, 3, and 4.

If a train is inoperable, multiple channels are inoperable, or the Required Action and associated Completion Time of Condition A is not met, operation may continue as long as the Required Actions for the applicable Conditions of LCO 3.6.3 are met for each valve made inoperable by failure of isolation instrumentation.

A Note is added stating that Conditions are only applicable in MODES 1, 2, 3, and 4.

C.1

Condition C is applicable to the Containment Vent Isolation Function and addresses the train orientation of the SSPS and the master and slave relays for this Function. It also addresses the failure of multiple radiation monitoring channels, or the inability to restore a single failed channel to OPERABLE status in the time allowed for REQUIRED ACTION A.1.

If a train is inoperable, two Radiation Monitor channels are inoperable, or the Required Action and associated Completion Time of Condition A is not met, operation may continue as long as the Required Action to place and maintain Containment Purge and Exhaust Valves in their closed position is met or the applicable Conditions of LCO 3.9.4, "Containment Penetrations," are met for each valve made inoperable by failure of isolation instrumentation. The Completion Time for these Required Actions is Immediately.

A Note states that Condition C is applicable during CORE ALTERATIONS and during movement of irradiated fuel assemblies within containment.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

A Note has been added to the SR Table to clarify that Table 3.3.6-1 determines which Surveillances apply to which Containment Vent Isolation Functions.

SR 3.3.6.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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 two instrument channels could be an indication of excessive instrument drift in one of the channels or even something 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 unit staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

The Frequency is based upon operating experience that demonstrates channel failure is rare. Thus, performance of the CHANNEL CHECK ensures that undetected overt channel failure is limited to 12 hours. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.6.2

SR 3.3.6.2 is the performance of an ACTUATION LOGIC TEST. The train being tested is placed in the bypass condition, thus preventing inadvertent actuation. Through the semiautomatic tester, all possible logic combinations, with and without applicable permissive are tested for each protection Function. In addition, the master relay coil is pulse tested for continuity. This verifies that the logic modules are OPERABLE and there is an intact voltage signal path to the master relay coils. This test is performed

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.6.2 (continued)

every 31 days on a STAGGERED TEST BASIS. The Surveillance interval is justified in Reference 2.

SR 3.3.6.3

SR 3.3.6.3 is the performance of a MASTER RELAY TEST. The MASTER RELAY TEST is the energizing of the master relay, verifying contact operation and a low voltage continuity check of the slave relay coil. Upon master relay contact operation, a low voltage is injected to the slave relay coil. This voltage is insufficient to pick up the slave relay, but large enough to demonstrate signal path continuity. This test is performed every 31 days on a STAGGERED TEST BASIS. The Surveillance interval is justified in Reference 2.

SR 3.3.6.4

A COT is performed every 92 days on each required channel to ensure the entire channel will perform the intended function. The Frequency is based on the staff recommendation for increasing the availability of radiation monitors, according to "NUREG-1366," (Ref. 3). This test verifies the capability of the instrumentation to provide the containment vent isolation. The setpoint shall be left consistent with the unit specific procedure tolerance. The surveillance frequency is based upon the known reliability of the monitoring equipment and has been shown to be acceptable through operating experience.

SR 3.3.6.5

SR 3.3.6.5 is the performance of a SLAVE RELAY TEST. The SLAVE RELAY TEST is the energizing of the slave relays. Contact operation is verified in one of two ways. Actuation equipment that may be operated in the design mitigation mode is either allowed to function or is placed in a condition where the relay contact operation can be verified without operation of the equipment. Actuation equipment that may not be operated in the design mitigation mode is prevented from operation by the SLAVE RELAY TEST circuit. For this latter case, contact operation is verified by a continuity check of the circuit containing the slave relay. This test

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.6.5 (continued)

is performed every 92 days. The Frequency is justified in Reference 2.

SR 3.3.6.6

This SR ensures the individual channel purge and exhaust isolation times are less than or equal to the maximum values assumed in the accident analysis. Response time testing acceptance criteria are included in the Technical Requirements Manual, Section 3.3.2, ESF Response Times, Reference 4. Individual component response times are not modeled in the safety analyses. The safety analyses model the overall or total elapsed time, from the point at which the parameter exceeds the Trip Setpoint value at the sensor, to the point at which the Containment Vent Isolation valves close.

ESF RESPONSE TIME tests are conducted on an 18-month STAGGERED TEST BASIS. Testing of the isolation valves, which make up the bulk of the response time is included. The 18-month Frequency is consistent with the typical refueling cycle and is based upon unit operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequent occurrences.

SR 3.3.6.7

SR 3.3.6.7 is the performance of a TADOT. This test is a check of the Manual Actuation Functions and is performed every 18 months. Each Manual Actuation Function is tested up to, and including, the master relay coils. In some instances, the test includes actuation of the end device (i.e., pump starts, valve cycles, etc.).

The test also includes trip devices that provide actuation signals directly to the SSPS, bypassing the analog process control equipment. For these tests, the relay Trip Setpoints are verified and adjusted as necessary. The Frequency is justified in Reference 2.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.6.8

A CHANNEL CALIBRATION is performed every 18 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy.

The Frequency is based upon operating experience and is consistent with the typical industry refueling cycle.

REFERENCES

1. 10 CFR 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance," 1973.
 2. WCAP-10271-P-A, Supplement 2, Rev. 1, "Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System," March 1987.
 3. NUREG-1366.
 4. Watts Bar Technical Requirements Manual, Section 3.3.2, Engineered Safety Feature Response Times.
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B 3.3 INSTRUMENTATION

B 3.3.7 Control Room Emergency Ventilation System (CREVS) Actuation
Instrumentation

BASES

BACKGROUND

The CREVS provides an enclosed control room environment from which the unit can be operated following an uncontrolled release of radioactivity. During normal operation, the Control building ventilation system provides control room ventilation. Upon receipt of an actuation signal the system initiates filtered ventilation and pressurization of the control room. This system is described in the Bases for LCO 3.7.10, "Control Room Emergency Filtration System.

The Actuation Instrumentation consists of redundant radiation monitors downstream from the normal pressurizing fans. A high radiation signal from either detector will initiate its associated train of CREVS. The control room operator can also initiate CREVS trains by manual switches in the control room. CREVS is also actuated by a Safety Injection (SI) signal. The SI Function is discussed in LCO 3.2.2, "Engineered Safety Feature Actuation System" (ESFAS) Instrumentation.

APPLICABLE
SAFETY ANALYSIS

The control room must be kept habitable for the operators stationed there during accident recovery and post-accident operations.

The CREVS acts to terminate the supply of unfiltered outside air to the control room and initiates filtration and emergency pressurization of the control room. These actions are necessary to ensure the control room is kept habitable for the operators stationed there during accident recovery and post-accident operations by minimizing the radiation exposure of control room personnel (Ref. 1).

In MODES 1, 2, 3, and 4, the radiation monitor actuation of CREVS is a backup for the SI signal actuation. This ensures initiation of CREVS during a loss of coolant accident or steam generator tube rupture.

(continued)

BASES

APPLICABLE
SAFETY ANALYSIS
(continued)

The radiation monitor actuation of CREVS in Modes 5 and 6, and during movement of irradiated fuel assemblies, is the primary means to ensure control room habitability in the event of a fuel handling or waste gas decay tank rupture accident.

The CREVS actuation instrumentation satisfies criterion 3 of the NRC Policy Statement.

LCO

The LCO requirements ensure that the instrumentation necessary to initiate CREVS is OPERABLE.

1. Manual Initiation

The LCO requires two channels OPERABLE. The operator can initiate CREVS at any time by using either of two switches in the control room. This action will cause actuation of all components in the same manner as any of the automatic actuation signals.

The LCO on Manual Initiation ensures the proper amount of redundancy is maintained in the manual actuation circuitry to ensure the operator has manual initiation capability.

2. Control Room Radiation

The LCO specifies two required Control Room Air Intake Radiation Monitors to ensure that the radiation monitoring instrumentation necessary to initiate CREVS remains OPERABLE. One Radiation Monitor is dedicated to each train of CREVS.

(continued)

BASES

LCO
(continued)

For sampling systems, channel OPERABILITY involves more than OPERABILITY of channel electronics. OPERABILITY may also require correct valve lineups and sample pump operation as well as detector OPERABILITY if these supporting features are necessary for trip to occur under the conditions assumed in the safety analyses.

3. Safety Injection

Refer to LCO 3.3.2, Function 1, for all initiating Functions and requirements.

APPLICABILITY

These CREVS functions must be OPERABLE in MODES 1, 2, 3, and 4, and during CORE ALTERATIONS and during movement of irradiated fuel assemblies to ensure a habitable environment for the control room operators.

ACTIONS

The most common cause of channel inoperability is outright failure or drift sufficient to exceed the tolerance allowed by the unit-specific calibration procedures. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. If the Trip Setpoint is less conservative than the tolerance specified by the procedure, the channel must be declared inoperable immediately and the appropriate Condition entered.

A Note has been added in the ACTIONS indicating that Separate Condition entry is allowed for each Function. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.7-1 in the accompanying LCO. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

(continued)

BASES

ACTIONS
(continued)

A.1

This action addresses the actuation logic train function of the CREVS, the radiation monitor channel Functions, and manual channel Functions.

If one train is inoperable, or one Radiation monitoring channel is inoperable in one or more Functions, 7 days are permitted to restore it to OPERABLE status. The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this Completion Time is the same as provided in LCO 3.7.10. If the channel/train cannot be restored to OPERABLE status, one CREVS train must be placed in the emergency radiation protection mode of operation. This accomplishes the actuation instrumentation Function and places the unit in a conservative mode of operation.

B.1.1, B.1.2, B.2

Condition B applies to the failure of two CREVS actuation trains, two radiation monitor channels or two manual channels. The Required Action is to place one CREVS train in the emergency radiation protection mode of operation immediately. This accomplishes the actuation instrumentation Function which may have been lost and places the unit in a conservative mode of operation.

The applicable Conditions and Required Actions of LCO 3.7.10 must also be entered for the CREVS train made inoperable by the inoperable actuation instrumentation. This ensures appropriate limits are placed upon train inoperability as discussed in the Bases for LCO 3.7.10.

Alternatively, both trains may be placed in the radiation protection mode. This ensures the CREVS function is performed even in the presence of single failure.

C.1 and C.2

Condition C applies when the Required Actions and associated Completion Times for Condition A or B have not been met and the unit is in MODE 1, 2, 3, or 4. The unit must be placed in a MODE in which the LCO requirements are not applicable. This is done by placing the unit in MODE 3 within 6 hours and MODE 5 within 36 hours. The allowed Completion Times

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

D.1 and D.2

Condition D applies when the Required Action and associated Completion Time for Condition A or B have not been met during CORE ALTERATIONS or when irradiated fuel assemblies are being moved. Movement of irradiated fuel assemblies and CORE ALTERATIONS must be suspended immediately to reduce the risk of accidents that would require CREVS actuation.

SURVEILLANCE
REQUIREMENTS

A Note has been added to the SR Table to clarify that Table 3.3.7-1 determines which Surveillances apply to which CREVS Functions.

SR 3.3.7.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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 two instrument channels could be an indication of excessive instrument drift in one of the channels or even something 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 unit staff based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

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

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.3.7.1 (continued)

The Frequency is based upon operating experience that demonstrates channel failure is rare. Thus, performance of the CHANNEL CHECK ensures that undetected overt channel failure is limited to 12 hours

SR 3.3.7.2

A COT is performed once per 92 days on each required channel to ensure the entire channel will perform the intended function. This test verifies the capability of the instrumentation to provide the CREVS actuation. The setpoints shall be left consistent with the unit specific procedure tolerance. The Frequency is based upon the known reliability of the monitoring equipment and has been shown to be acceptable through operating experience.

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

SR 3.3.7.3

SR 3.3.7.3 is the performance of a TADOT. This test is a check of the Manual Actuation Functions and is performed every 18 months. Each Manual Actuation Function is tested up to, and including, the actuation relay coils. In some instances, the test includes actuation of the end device (i.e., pump starts, valve cycles, etc.).

SR 3.3.7.4

A CHANNEL CALIBRATION is performed every 18 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy.

The Frequency is based upon operating experience and is consistent with the typical industry refueling cycle.

(continued)

BASES (continued)

REFERENCES

1. Watts Bar FSAR, Section 9.4, Control Room Area Ventilation System.
 2. WCAP-10271-P-A, Supplement 2, Rev. 1, "Evaluation of Surveillance Frequencies and Out of Service Times for the Reactor Protection Instrumentation System," March 1987.
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B 3.3 INSTRUMENTATION

B 3.3.8 Auxiliary Building Gas Treatment System (ABGTS) Actuation Instrumentation

BASES

BACKGROUND

The Auxiliary Building Gas Treatment System (ABGTS) ensures that radioactive materials in the fuel handling area atmosphere following a fuel handling accident or a loss of coolant accident (LOCA) are filtered and adsorbed prior to exhausting to the environment. The system is described in the Bases for LCO 3.7.12, "Auxiliary Building Gas Treatment System (ABGTS)." The system initiates filtered exhaust of air from the fuel handling area, ECCS pump rooms, and penetration rooms automatically following receipt of a fuel pool area high radiation signal or a Containment Phase A isolation signal. Initiation may also be performed manually as needed from the main control room.

High area radiation monitored by either of two monitors provides ABGTS initiation. Each ABGTS train is initiated by high radiation detected by a channel dedicated to that train. There are a total of two channels, one for each train. High radiation detected by any monitor or a Phase A isolation signal from the Engineered Safety Feature Actuation System (ESFAS) initiates Auxiliary building isolation and starts the ABGTS. These actions function to prevent exfiltration of contaminated air by initiating filtered ventilation, which imposes a negative pressure on the Auxiliary Building Secondary Containment Enclosure (ABSCE).

APPLICABLE SAFETY ANALYSIS

The ABGTS ensures that radioactive materials in the ABSCE atmosphere following a fuel handling accident or a LOCA are filtered and adsorbed prior to being exhausted to the environment. This action reduces the radioactive content in the Auxiliary building exhaust following a LOCA or fuel handling accident so that offsite doses remain within the limits specified in 10 CFR 100 (Ref. 1).

The ABGTS actuation instrumentation satisfy Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

The LCO requirements ensure that instrumentation necessary to initiate ABGTS is OPERABLE.

Two channels of the ABGTS manual initiation, two trains of automatic actuation logic, and two channels of area radiation monitors are required OPERABLE to ensure automatic isolation and initiation of filtered ventilation. ABGTS actuation instrumentation is OPERABLE when all channel and train components necessary to provide an ABGTS actuation signal are functional and in service.

Only a Trip Setpoint is specified for the Fuel Pool Area Radiation Monitors Function in the LCO. The Trip Setpoint specified is assumed to be above local background radiation, and is more conservative than the analytical limit assumed in the safety analysis in order to account for instrument uncertainties appropriate to the trip Function. [These uncertainties are defined in the unit specific setpoint analysis (Ref. 2)].

APPLICABILITY

The manual and Phase A automatic ABGTS Actuation Instrumentation trains must be OPERABLE in MODES 1, 2, 3, and 4 to ensure the ABGTS operates to remove fission products associated with leakage after a LOCA.

High radiation initiation of the ABGTS must also be OPERABLE in any MODE during movement of irradiated fuel assemblies in the fuel building to ensure automatic initiation of the ABGTS when the potential for a fuel handling accident exists.

While in MODES 5 and 6 without fuel handling in progress, the ABGTS instrumentation need not be OPERABLE since the potential for radioactive releases is minimized and manual operator action is sufficient to prevent offsite dose limits from being exceeded.

(continued)

BASES (continued)

ACTIONS

The most common cause of channel inoperability is outright failure or drift sufficient to exceed the tolerance allowed by the unit specific procedures. Typically, the drift is found to be small and results in a delay of actuation rather than a total loss of function. If the Trip Setpoint is less conservative than the tolerance specified by the calibration procedure, the channel must be declared inoperable immediately and the appropriate Condition entered.

A Note has been added to the ACTIONS to clarify the application of Completion Time rules. The Conditions of this Specification may be entered independently for each Function listed on Table 3.3.8-1 in the accompanying LCO. The Completion Time(s) of the inoperable channel(s)/train(s) of a Function will be tracked separately for each Function starting from the time the Condition was entered for that Function.

A.1

This action addresses the actuation logic train Function from the Phase A isolation, the radiation monitor channel Functions, and the manual channel Function. Condition A applies to the failure of a single actuation logic train, radiation monitor channel, or manual channel. If one channel or train is inoperable, 7 days are permitted to restore it to OPERABLE status. If the train cannot be restored to OPERABLE status, one ABGTS train must be placed in operation. This accomplishes the actuation instrumentation Function and places the unit in a conservative mode of operation. The 7 day Completion Time is the same as is allowed if one train of the mechanical portion of the system is inoperable. The basis for this time is the same as provided in LCO 3.7.12.

B.1.1, B.1.2, B.2

Condition B applies to the failure of two ABGTS actuation logic signals from the Phase A isolation, two radiation monitors, or two manual channels. The Required Action is to place one ABGTS train in operation immediately. This accomplishes the actuation instrumentation function which

(continued)

BASES

ACTIONS

B.1.1, B.1.2, B.2 (continued)

may have been lost and places the unit in a conservative mode of operation. The applicable Conditions and Required Actions of LCO 3.7.12 must also be entered for the ABGTS train made inoperable by the inoperable actuation instrumentation. This ensures appropriate limits are placed upon train inoperability as discussed in the bases for LCO 3.7.12.

Alternatively, both trains may be placed in the emergency radiation protection mode. This ensures the ABGTS function is performed even in the presence of single failure.

C.1

Condition C applies when the Required Action and associated Completion Time for Condition A or B have not been met and irradiated fuel assemblies are being moved in the fuel handling area. Movement of irradiated fuel assemblies in the fuel handling area must be suspended immediately to eliminate the potential for events that could require ABGTS actuation. Performance of these actions shall not preclude moving a component to a safe position.

D.1 and D.2

Condition D applies when the Required Action and associated Completion Time for Condition A or B have not been met and the unit is in MODE 1, 2, 3, or 4. The unit must be placed in a MODE in which the LCO requirements are not applicable. This is done by placing the unit in MODE 3 within 6 hours and MODE 5 within 36 hours. The allowed Completion Times are 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

A Note has been added to the SRs Table to clarify that Table 3.3.8-1 determines which Surveillance apply to which ABGTS actuation Functions.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.8.1

Performance of the CHANNEL CHECK once every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is 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 two instrument channels could be an indication of excessive instrument drift in one of the channels or even something 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 unit staff, based on a combination of the channel instrument uncertainties, including indication and readability. If a channel is outside the match criteria, it may be an indication that the sensor or the signal processing equipment has drifted outside its limit.

The Frequency is based upon operating experience that demonstrates channel failure is rare. Thus, performance of the CHANNEL CHECK ensures that undetected overt channel failure is limited to 12 hours. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.

SR 3.3.8.2

A COT is performed once per 92 days on each required channel to ensure the entire channel will perform the intended function. This test verifies the capability of the instrumentation to provide the ABGTS actuation. The setpoints shall be left consistent with the unit specific procedure tolerance. The Frequency of 92 days is based upon the known reliability of the monitoring equipment and has been shown to be acceptable through operating experience.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.3.8.3

SR 3.3.8.3 is the performance of a TADOT. This test is a check of the Manual Actuation Functions and is performed every 18 months. Each Manual Actuation Function is tested up to, and including, the actuation relay coils. In some instances, the test includes actuation of the end device (i.e., pump starts, valve cycles). The Frequency is based upon operating experience and is consistent with the typical industry refueling cycle.

SR 3.3.8.4

A CHANNEL CALIBRATION is performed every 18 months, or approximately at every refueling. CHANNEL CALIBRATION is a complete check of the instrument loop including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. The Frequency is based upon operating experience and is consistent with the typical industry refueling cycle.

REFERENCES

1. 10 CFR 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance," 1973.
 2. [Watts Bar Unit Specific Setpoint Analysis.]
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.1 RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits

BASES

BACKGROUND

These Bases address requirements for maintaining RCS pressure, temperature, and flow rate within limits assumed in the safety analyses. The safety analyses (Ref. 1) of normal operating conditions and anticipated operational occurrences assume initial conditions within the normal steady-state envelope. The limits placed on RCS pressure, temperature, and flow rate ensure that the minimum departure from nucleate boiling ratio (DNBR) will be met for each of the transients analyzed.

The RCS pressure limit is consistent with operation within the nominal operational envelope. Pressurizer pressure indications are averaged to come up with a value for comparison to the limit. A lower pressure will cause the reactor core to approach DNB limits.

The RCS coolant average temperature limit is consistent with full power operation within the nominal operational envelope. Indications of temperature are averaged to determine a value for comparison to the limit. A higher average temperature will cause the core to approach DNB limits.

The RCS flow rate normally remains constant during an operational fuel cycle with all pumps running. The minimum RCS flow limit corresponds to that assumed for DNB analyses. Flow rate indications are averaged to come up with a value for comparison to the limit. A lower RCS flow will cause the core to approach DNB limits.

Operation for significant periods of time outside these DNB limits increases the likelihood of a fuel cladding failure in a DNB-limited event.

APPLICABLE
SAFETY ANALYSES

The requirements of this LCO represent the initial conditions for DNB-limited transients analyzed in the plant safety analyses (Ref. 1). The safety analyses have shown that transients initiated from the limits of this LCO will

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

result in meeting the DNBR criterion of ≥ 1.3 . This is the acceptance limit for the RCS DNB parameters. Changes to the unit that could impact these parameters must be assessed for their impact on the DNBR criteria. The transients analyzed for include loss of coolant flow events and dropped or stuck rod events. A key assumption for the analysis of these events is that the core power distribution is within the limits of LCO 3.1.7, "Control Bank Insertion Limits"; LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)"; and LCO 3.2.4, "QUADRANT POWER TILT RATIO (QPTR)."

The pressurizer pressure limit of [2216] psig and the RCS average temperature limit of [592.9] $^{\circ}$ F correspond to analytical limits of [2189] psig and [594.7] $^{\circ}$ F used in the safety analyses, with allowance for measurement uncertainty and instrument error.

The RCS DNB parameters satisfy Criterion 2 of the NRC Policy Statement.

LCO

This LCO specifies limits on the monitored process variables: pressurizer pressure, RCS average temperature, and RCS total flow rate to ensure the core operates within the limits assumed in the safety analyses. Operating within these limits will result in meeting the DNBR criterion in the event of a DNB limited transient.

RCS total flow rate contains a measurement error of [2.5]% based on performing a precision heat balance and using the result to calibrate the RCS flow rate indicators. Potential fouling of the feedwater venturi, which might not be detected, could bias the result from the precision heat balance in a nonconservative manner. Therefore, a penalty of [0.1]% for undetected fouling of the feedwater venturi raises the nominal flow measurement allowance to [2.6]% for no fouling.

Any fouling that might bias the flow rate measurement greater than [0.1]% can be detected by monitoring and trending various plant performance parameters. If detected, either the effect of the fouling shall be quantified and compensated for in the RCS flow rate measurement or the venturi shall be cleaned to eliminate the fouling.

(continued)

BASES

LCO
(Continued)

The LCO numerical values for pressure, temperature, and flow rate are given for the measurement location and have not been adjusted for instrument error.

APPLICABILITY

In MODE 1, the limits on pressurizer pressure, RCS coolant average temperature, and RCS flow rate must be maintained during steady-state operation in order to ensure DNBR criteria will be met in the event of an unplanned loss of forced coolant flow or other DNB-limited transient. In all other MODES, the power level is low enough that DNB is not a concern.

A Note has been added to indicate the limit on pressurizer pressure is not applicable during short-term operational transients such as a THERMAL POWER ramp increase > 5% RTP per minute or a THERMAL POWER step increase > 10% RTP. These conditions represent short-term perturbations where actions to control pressure variations might be counterproductive. Also, since they represent transients initiated from power levels less than 100% RTP, an increased DNBR margin exists to offset the temporary pressure variations.

Another set of limits on DNB-related parameters is provided in SL 2.1.1, "Reactor Core Safety Limits." Those limits are less restrictive than the limits of this LCO, but violation of a Safety Limit (SL) merits a stricter, more severe Required Action. Should a violation of this LCO occur, the operator must check whether or not an SL may have been exceeded.

ACTIONS

A.1

RCS pressure and RCS average temperature are controllable and measurable parameters. With one or both of these parameters not within LCO limits, action must be taken to restore parameter(s).

RCS total flow rate is not a controllable parameter and is not expected to vary during steady-state operation. If the indicated RCS total flow rate is below the LCO limit, power

(continued)

BASES

ACTIONS

A.1 (continued)

must be reduced, as required by Required Action B.1, to restore DNB margin and eliminate the potential for violation of the accident analysis bounds.

The 2-hour Completion Time for restoration of the parameters provides sufficient time to adjust plant parameters, to determine the cause for the off-normal condition, and to restore the readings within limits and is based on plant operating experience.

B.1

If Required Action A.1 is not met within the associated Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 2 within 6 hours. In

MODE 2, the reduced power condition eliminates the potential for violation of the accident analysis bounds. The Completion Time of 6 hours is reasonable, to reach the required plant conditions in an orderly manner in conjunction with even control of steam generator heat removal.

SURVEILLANCE
REQUIREMENTS

SR 3.4.1.1

Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits, the 12-hour Surveillance Frequency for pressurizer pressure is sufficient to ensure the pressure can be restored to a normal operation, steady-state condition following load changes and other expected transient operations. The 12-hour interval has been shown by operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.

SR 3.4.1.2

Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits,

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.1.2 (continued)

the 12-hour Surveillance Frequency for RCS average temperature is sufficient to ensure the temperature can be restored to a normal operation, steady-state condition following load changes and other expected transient operations. The 12-hour interval has been shown by operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.

SR 3.4.1.3

The 12-hour Surveillance Frequency for RCS total flow rate is performed using the installed flow instrumentation. The 12-hour interval has been shown by operating practice to be sufficient to regularly assess potential degradation and to verify operation within safety analysis assumptions.

SR 3.4.1.4

Measurement of RCS total flow rate by performance of a precision calorimetric heat balance once every 18 months allows the installed RCS flow instrumentation to be calibrated and verifies the actual RCS flow rate is greater than or equal to the minimum required RCS flow rate.

The Frequency of 18 months reflects the importance of verifying flow after a refueling outage when the core has been altered, which may have caused an alteration of flow resistance.

This SR is modified by a Note that allows entry into MODE 1, without having performed the SR, and placement of the unit in the best condition for performing the SR. The Note states that the SR is not required to be performed until 24 hours after $\geq 90\%$ RTP. This exception is appropriate since the heat balance requires the plant to be at a minimum of 90% RTP to obtain the stated RCS flow accuracies. The Surveillance shall be performed within 24 hours after reaching 90% RTP.

(continued)

BASES (continued)

REFERENCES

1. Watts Bar FSAR, Chapter 15, "Accident Analyses",
Section 15.2 and 15.3.4.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.2 RCS Minimum Temperature for Criticality

BASES

BACKGROUND

This LCO is based upon meeting several major considerations before the reactor can be made critical and while the reactor is critical.

The first consideration is moderator temperature coefficient (MTC), LCO 3.1.4 ("Moderator Temperature Coefficient (MTC)"). In the transient and accident analyses, the MTC is assumed to be in a range from slightly positive to negative and the operating temperature is assumed to be within the nominal operating envelope while the reactor is critical. The LCO on minimum temperature for criticality helps ensure the plant is operated consistent with these assumptions.

The second consideration is the protective instrumentation. Because certain protective instrumentation (e.g., excore neutron detectors) can be affected by moderator temperature, a temperature value within the nominal operating envelope is chosen to ensure proper indication and response while the reactor is critical.

The third consideration is the pressurizer operating characteristics. The transients and accident analyses assume that the pressurizer is within its normal startup and operating range (i.e., saturated conditions and steam bubble present). It is also assumed that the RCS temperature is within its normal expected range for startup and power operation. Since the density of the water, and hence the response of the pressurizer to transients, depends upon the initial temperature of the moderator, a minimum value for moderator temperature within the nominal operating envelope is chosen.

The fourth consideration is that the reactor vessel is above its minimum nil-ductility reference temperature when the reactor is critical.

APPLICABLE
SAFETY ANALYSES

Although the RCS minimum temperature for criticality is not itself an initial condition assumed in Design Basis Accidents (DBAs), the closely aligned temperature for

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

hot zero power (HZP) is a process variable that is an initial condition of DBAs, such as the rod cluster control assembly (RCCA) withdrawal, RCCA ejection, and main steam line break accidents performed at zero power that either assumes the failure of, or presents a challenge to, the integrity of a fission-product barrier.

All low power safety analyses assume initial RCS loop temperatures \geq the HZP temperature of 557°F (Ref. 1). The minimum temperature for criticality limitation provides a small band, 6°F, for critical operation below HZP. This band allows critical operation below HZP during plant startup and does not adversely affect any safety analyses since the MTC is not significantly affected by the small temperature difference between HZP and the minimum temperature for criticality.

The RCS minimum temperature for criticality satisfies Criterion 2 of the NRC Policy Statement.

LCO

Compliance with the LCO ensures that the reactor will not be made or maintained critical ($K_{\text{eff}} \geq 1.0$) at a temperature less than a small band below the HZP temperature, which is assumed in the safety analysis. Failure to meet the requirements of this LCO may produce initial conditions inconsistent with the initial conditions assumed in the safety analysis.

APPLICABILITY

In MODES 1 and 2, with $K_{\text{eff}} \geq 1.0$, LCO 3.4.2 is applicable since the reactor can only be critical ($K_{\text{eff}} \geq 1.0$) in these MODES.

The special test exception of LCO 3.1.10, "MODE 2 PHYSICS TESTS Exceptions," permits PHYSICS TESTS to be performed at $\leq 5\%$ RTP with RCS loop average temperatures slightly lower than normally allowed so that fundamental nuclear characteristics of the core can be verified. In order for nuclear characteristics to be accurately measured, it may be

(continued)

BASES

APPLICABILITY (continued) necessary to operate outside the normal restrictions of this LCO. For example, to measure the MTC at beginning of cycle, it is necessary to allow RCS loop average temperatures to fall below $T_{no\ load}$, which may cause RCS loop average temperature to fall below the temperature limit of this LCO.

ACTIONS

A.1

If the parameters that are outside the limits cannot be restored, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 within 30 minutes. Rapid reactor shutdown can be readily and practically achieved within a 30-minute period. The allowed time is reasonable, based on operating experience, to reach MODE 3 in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.4.2.1

RCS loop average temperature is required to be verified at or above 551°F within 15 minutes prior to achieving criticality and every 30 minutes when the $T_{avg} - T_{ref}$ deviation alarm is not reset and any RCS loop $T_{avg} < 557^\circ\text{F}$. The 15-minute time period is long enough to allow the operator to adjust temperatures or delay criticality so the LCO will not be violated, thereby providing assurance that the safety analyses are not violated.

The Note modifies the SR. When any RCS loop average temperature is less than 557°F and the $T_{avg} - T_{ref}$ deviation alarm is alarming, RCS loop average temperatures could fall below the LCO requirement without additional warning. The SR to verify RCS loop average temperatures every 30 minutes is frequent enough to prevent the inadvertent violation of the LCO.

REFERENCES

1. Watts Bar FSAR, Chapter 15, "Accident Analyses."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.3 RCS Pressure and Temperature (P/T) Limits

BASES

BACKGROUND

All components of the RCS are designed to withstand effects of cyclic loads due to system pressure and temperature changes. These loads are introduced by startup (heatup) and shutdown (cooldown) operations, power transients, and reactor trips. This LCO limits the pressure and temperature changes during RCS heatup and cooldown, within the design assumptions and the stress limits for cyclic operation.

The PTLR contains P/T limit curves for heatup, cooldown, inservice leak and hydrostatic (ISLH) testing, and data for the maximum rate of change of reactor coolant temperature (Ref. 1).

Each P/T limit curve defines an acceptable region for normal operation. The usual use of the curves is operational guidance during heatup or cooldown maneuvering, when pressure and temperature indications are monitored and compared to the applicable curve to determine that operation is within the allowable region.

The LCO establishes operating limits that provide a margin to brittle failure of the reactor vessel and piping of the reactor coolant pressure boundary (RCPB). The vessel is the component most subject to brittle failure, and the LCO limits apply mainly to the vessel. The limits do not apply to the pressurizer, which has different design characteristics and operating functions.

10 CFR 50, Appendix G (Ref. 2) requires the establishment of P/T limits for specific material fracture toughness requirements of the RCPB materials. Reference 2 requires an adequate margin to brittle failure during normal operation, anticipated operational occurrences, and system hydrostatic tests. It mandates the use of the American Society of Mechanical Engineers (ASME) Code, Section III, Appendix G (Ref. 3).

The neutron embrittlement effect on the material toughness is reflected by increasing the nil-ductility reference temperature (RT_{NDT}) as exposure to neutron fluence increases.

(continued)

BASES

BACKGROUND
(continued)

The actual shift in the RT_{NDT} of the vessel material will be established periodically by removing and evaluating the irradiated reactor vessel material specimens, in accordance with ASTM E 185 (Ref. 4) and Appendix H of 10 CFR 50 (Ref. 5). The operating P/T limit curves will be adjusted, as necessary, based on the evaluation findings and the recommendations of Regulatory Guide 1.99 (Ref. 6).

The P/T limit curves are composite curves established by superimposing limits derived from stress analyses of those portions of the reactor vessel and head that are the most restrictive. At any specific pressure, temperature, and temperature rate of change, one location within the reactor vessel will dictate the most restrictive limit. Across the span of the P/T limit curves, different locations are more restrictive, and, thus, the curves are composites of the most restrictive regions.

The heatup curve represents a different set of restrictions than the cooldown curve because the directions of the thermal gradients through the vessel wall are reversed. The thermal gradient reversal alters the location of the tensile stress between the outer and inner walls.

The criticality limit curve includes the Reference 2 requirement that it be no less than 40°F above the heatup curve or the cooldown curve, and not less than the minimum permissible temperature for ISLH testing. However, the criticality curve is not operationally limiting; a more restrictive limit exists in LCO 3.4.2, "RCS Minimum Temperature for Criticality."

The consequence of violating the LCO limits is that the RCS has been operated under conditions that can result in brittle failure of the RCPB, possibly leading to a non-isolable leak or loss-of-coolant accident. In the event these limits are exceeded, an evaluation must be performed to determine the effect on the structural integrity of the RCPB components. The ASME Code, Section XI, Appendix E (Ref. 7), provides a recommended methodology for evaluating an operating event that causes an excursion outside the limits.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The P/T limits are not derived from Design Basis Accident (DBA) analyses. They are prescribed during normal operation to avoid encountering pressure, temperature, and temperature rate-of-change conditions that might cause undetected flaws to propagate and cause non-ductile failure of the RCPB, an unanalyzed condition. Reference 1 establishes the methodology for determining the P/T limits. Although the P/T limits are not derived from any DBA, the P/T limits are acceptance limits since they preclude operation in an unanalyzed condition.

RCS P/T limits satisfy Criterion 2 of the NRC Policy Statement.

LCO

The two elements of this LCO are:

- a. The limit curves for heatup, cooldown, and ISLH testing; and
- b. Limits on the rate of change of temperature.

The LCO limits apply to all components of the RCS, except the pressurizer. These limits define allowable operating regions and permit a large number of operating cycles while providing a wide margin to non-ductile failure.

The limits for the rate of change of temperature control the thermal gradient through the vessel wall and are used as inputs for calculating the heatup, cooldown, and ISLH testing P/T limit curves. Thus, the LCO for the rate of change of temperature restricts stresses caused by thermal gradients and also ensures the validity of the P/T limit curves.

Violating the LCO limits places the reactor vessel outside of the bounds of the stress analyses and can increase stresses in other RCPB components. The consequences depend on several factors, as follow:

- a. The severity of the departure from the allowable operating P/T regime or the severity of the rate of change of temperature;

(continued)

BASES

LCO
(continued)

- b. The length of time the limits were violated (longer violations allow the temperature gradient in the thick vessel walls to become more pronounced); and
 - c. The existences, sizes, and orientations of flaws in the vessel material.
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APPLICABILITY

The RCS P/T Limits LCO provides a definition of acceptable operation for prevention of non-ductile failure in accordance with 10 CFR 50, Appendix G (Ref. 2). Although the P/T limits were developed to provide guidance for operation during heatup or cooldown (MODES 3, 4, and 5) or ISLH testing, their applicability is at all times in keeping with the concern for non-ductile failure. The limits do not apply to the pressurizer.

During MODES 1 and 2, other Technical Specifications provide limits for operation that can be more restrictive than or can supplement these P/T limits. LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits"; LCO 3.4.2, "RCS Minimum Temperature for Criticality"; and Safety Limit 2.1, "Safety Limits," also provide operational restrictions for pressure and temperature and maximum pressure. Furthermore, MODES 1 and 2 are above the temperature range of concern for non-ductile failure, and stress analyses have been performed for normal maneuvering profiles, such as power ascension or descent.

ACTIONS

The actions of this LCO consider the premise that a violation of the limits occurred during normal plant maneuvering. Severe violations caused by abnormal transients, at times accompanied by equipment failures, may also require additional actions from emergency operating procedures.

A.1 and A.2

Operation outside the P/T limits during MODES 1, 2, 3, or 4 must be corrected so that the RCPB is returned to a condition that has been verified by stress analyses.

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BASES

ACTIONS

A.1 and A.2 (continued)

The 30-minute Completion Time reflects the urgency of restoring the parameters to within the analyzed range. Most violations will not be severe, and the activity can be accomplished in this time in a controlled manner.

Besides restoring operation within limits, an evaluation is required to determine if RCS operation can continue. The evaluation must verify the RCPB integrity remains acceptable and must be completed before continuing operation. Several methods may be used, including comparison with preanalyzed transients in the stress analyses, new analyses, or inspection of the components.

ASME Code, Section XI, Appendix E (Ref. 7), may be used to support the evaluation. However, its use is restricted to evaluation of the vessel beltline.

The 72-hour Completion Time is reasonable to accomplish the evaluation. The evaluation for a mild violation is possible within this time, but more severe violations may require special, event-specific stress analyses or inspections. A favorable evaluation must be completed before continuing to operate.

Condition A is modified by a Note requiring Required Action A.2 to be completed whenever the Condition is entered. The Note emphasizes the need to perform the evaluation of the effects of the excursion outside the allowable limits. Restoration alone per Required Action A.1 is insufficient because higher-than-analyzed stresses may have occurred and may have affected the RCPB integrity.

B.1 and B.2

If a Required Action and associated Completion Time of Condition A are not met, the plant must be placed in a lower MODE because either the RCS remained in an unacceptable P/T region for an extended period of increased stress or a sufficiently severe event caused entry into an unacceptable region. Either possibility indicates a need for more careful examination of the event, best accomplished with the RCS at reduced pressure and temperature. In reduced

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

pressure and temperature conditions, the possibility of propagation with undetected flaws is decreased.

If the required restoration activity cannot be accomplished within 30 minutes, Required Action B.1 and Required Action B.2 must be implemented to reduce pressure and temperature.

If the required evaluation for continued operation cannot be accomplished within 72 hours or the results are indeterminate or unfavorable, action must proceed to reduce pressure and temperature as specified in Required Action B.1 and Required Action B.2. A favorable evaluation must be completed and documented before returning to operating pressure and temperature conditions.

Pressure and temperature are reduced by bringing the plant to MODE 3 within 6 hours and to MODE 5 with RCS pressure < 500 psig within 36 hours.

The allowed 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.

C.1 and C.2

Actions must be initiated immediately to correct operation outside of the P/T limits at times other than when in MODES 1, 2, 3, or 4, so that the RCPB is returned to a condition that has been verified by stress analysis.

The immediate Completion Time reflects the urgency of initiating action to restore the parameters to within the analyzed range. Most violations will not be severe, and the activity can be accomplished in a controlled manner.

Besides restoring operation within limits, an evaluation is required to determine if RCS operation can continue. The evaluation must verify the RCPB integrity remains acceptable and must be completed prior to entry into MODE 4. Several methods may be used, including comparison with preanalyzed transients in the stress analyses, or inspection of the components.

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

ASME Code, Section XI, Appendix E (Ref. 7), may be used to support the evaluation. However, its use is restricted to evaluation of the vessel beltline.

Condition C is modified by a Note requiring Required Action C.2 to be completed whenever the Condition is entered. The Note emphasizes the need to perform the evaluation of the effects of the excursion outside the allowable limits. Restoration alone per Required Action C.1 is insufficient because higher than analyzed stresses may have occurred and may have affected the RCPB integrity.

SURVEILLANCE
REQUIREMENTS

SR 3.4.3.1

Verification that operation is within the PTLR limits is required every 30 minutes when RCS pressure and temperature conditions are undergoing planned changes. This Frequency is considered reasonable in view of the control room indication available to monitor RCS status. Also, since temperature rate-of-change limits are specified in hourly increments, 30 minutes permit assessment and correction for minor deviations within a reasonable time.

Surveillance for heatup, cooldown, or ISLH testing may be discontinued when the definition given in the relevant plant procedure for ending the activity is satisfied.

This SR is modified by a Note that only requires this SR to be performed only during system heatup, cooldown, and ISLH testing. No SR is given for criticality operations because LCO 3.4.2 contains a more restrictive requirement.

REFERENCES

1. TVA Calculation WBN-MTB-027 RO, "Pressure-Temperature Limits Based on Reg Guide 1.99 R2 for submittal to NRC".
2. Title 10, Code of Federal Regulations, Part 50, Appendix G, "Fracture Toughness Requirements."

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BASES

REFERENCES (continued)

3. ASME Boiler and Pressure Vessel Code, Section III, Appendix G, "Protection Against Non-Ductile Failure."
 4. ASTM E 185-82, "Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels," July 1982.
 5. Title 10, Code of Federal Regulations, Part 50, Appendix H, "Reactor Vessel Material Surveillance Program Requirements."
 6. Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988.
 7. ASME Boiler and Pressure Vessel Code, Section XI, Appendix E, "Evaluation of Unanticipated Operating Events."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.4 RCS Loops - MODES 1 and 2

BASES

BACKGROUND

The primary function of the RCS is removal of the heat generated in the fuel due to the fission process, and transfer of this heat, via the steam generators (SGs) to the secondary plant.

The secondary functions of the RCS include:

- a. Moderating the neutron energy level to the thermal state, to increase the probability of fission;
- b. Improving the neutron economy by acting as a reflector;
- c. Carrying the soluble neutron poison, boric acid;
- d. Providing a second barrier against fission-product release to the environment; and
- e. Removing the heat generated in the fuel due to fission-product decay following a unit shutdown.

The reactor coolant is circulated through four loops connected in parallel to the reactor vessel, each containing an SG, a reactor coolant pump (RCP), and appropriate flow and temperature instrumentation for both control and protection. The reactor vessel contains the clad fuel. The SGs provide the heat sink to the isolated secondary coolant. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and prevent fuel damage. This forced circulation of the reactor coolant ensures mixing of the coolant for proper boration and chemistry control.

APPLICABLE SAFETY ANALYSES

Safety analyses contain various assumptions for the design bases accident initial conditions including RCS pressure, RCS temperature, reactor power level, core parameters, and safety system setpoints. The important aspect for this LCO is the reactor coolant forced flow rate, which is represented by the number of RCS loops in service.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

Both transient and steady-state analyses have been performed to establish the effect of flow on the departure from nucleate boiling (DNB). The transient and accident analyses for the plant have been performed assuming four RCS loops are in operation. The majority of the plant safety analyses are based on initial conditions at high core power or zero power. The accident analyses that are most important to RCP operation are the four-pump coastdown, single pump locked rotor, single pump (broken shaft or coastdown), and rod withdrawal events (Ref. 1).

Steady-state DNB analysis has been performed for the four RCS loop operation. For four RCS loop operation, the steady-state DNB analysis, which generates the pressure and temperature Safety Limit (i.e., the departure from nucleate boiling ratio (DNBR) limit) assumes a maximum power level of 118% RTP. This is the design overpower condition for four RCS loop operation. The value for the accident analysis setpoint of the nuclear overpower (high flux) trip is 118% and is based on an analysis assumption that bounds possible instrumentation errors. The DNBR limit defines a locus of pressure and temperature points that result in a minimum DNBR greater than or equal to the critical heat flux correlation limit.

The plant is designed to operate with all RCS loops in operation to maintain DNBR above the safety limit, during all normal operations and anticipated transients. By ensuring heat transfer in the nucleate boiling region, adequate heat transfer is provided between the fuel cladding and the reactor coolant.

RCS Loops - MODES 1 and 2 satisfy Criterion 2 of the NRC Policy Statement.

LCO

The purpose of this LCO is to require an adequate forced flow rate for core heat removal. Flow is represented by the number of RCPs in operation for removal of heat by the SGs. To meet safety analysis acceptance criteria for DNB, four pumps are required at rated power.

An OPERABLE RCS loop consists of an OPERABLE RCP in operation providing forced flow for heat transport and an

(continued)

BASES

LCO
(continued) OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program.

APPLICABILITY In MODES 1 and 2, the reactor is critical and thus has the potential to produce maximum THERMAL POWER. Thus, to ensure that the assumptions of the accident analyses remain valid, all RCS loops are required to be OPERABLE and in operation in these MODES to prevent DNB and core damage.

The decay heat production rate is much lower than the full power heat rate. As such, the forced circulation flow and heat sink requirements are reduced for lower, noncritical MODES as indicated by the LCOs for MODES 3, 4, and 5.

Operation in other MODES is covered by:

- LCO 3.4.5, "RCS Loops - MODE 3";
 - LCO 3.4.6, "RCS Loops - MODE 4";
 - LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";
 - LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
 - LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level"; and
 - LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level."
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ACTIONS

A.1

If the requirements of the LCO are not met, the Required Action is to reduce power and bring the plant to MODE 3. This lowers power level and thus reduces the core heat removal needs and minimizes the possibility of violating DNB limits.

The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging safety systems.

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BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.4.4.1

This SR requires verification every 12 hours that each RCS loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal while maintaining the margin to DNB. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS loop performance.

REFERENCES

1. Watts Bar FSAR, Chapter 15, "Accident Analyses."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.5 RCS Loops - MODE 3

BASES

BACKGROUND

In MODE 3, the primary function of the reactor coolant is removal of decay heat and transfer of this heat, via the steam generator (SG), to the secondary plant fluid. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops, connected in parallel to the reactor vessel, each containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The reactor vessel contains the clad fuel. The SGs provide the heat sink. The RCPs circulate the water through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and prevent fuel damage.

In MODE 3, RCPs are used to provide forced circulation for heat removal during heatup and cooldown. The MODE 3 decay heat removal requirements are low enough that a single RCS loop with one RCP running is sufficient to remove core decay heat. However, two RCS loops are required to be OPERABLE to ensure redundant capability for decay heat removal.

APPLICABLE SAFETY ANALYSES

Whenever the reactor trip breakers are in the closed position and the control rod drive mechanism are latched, an inadvertent rod withdrawal from subcritical, resulting in a power excursion, is possible. Such a transient could be caused by a malfunction of the Rod Control System. In addition, the possibility of a power excursion due to the ejection of an inserted control rod is possible with the breakers closed or open. Such a transient could be caused by the mechanical failure of a control rod drive mechanism housing.

Therefore, in MODE 3 with reactor trip breakers in the closed position and Rod Control System capable of rod withdrawal, accidental control rod withdrawal from subcritical is postulated and requires at least two RCS

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

loops to be OPERABLE and in operation to ensure that the accident analyses limits are met. For those conditions when the rod control system is not capable of rod withdrawal, two RCS loops are required to be OPERABLE but only one RCS loop is required to be in operation to be consistent with MODE 3 accident analyses.

Failure to provide decay heat removal may result in challenges to a fission-product barrier. The RCS loops are part of the primary success path that functions or actuates to prevent or mitigate a Design Basis Accident or transient that either assumes the failure of, or presents a challenge to, the integrity of a fission-product barrier. RCS Loops - MODE 3 satisfy Criterion 3 of the NRC Policy Statement.

LCO

The purpose of this LCO is to require that at least two RCS loops be OPERABLE. In MODE 3 with the reactor trip breakers in the closed position and the Rod Control System capable of rod withdrawal, two RCS loops must be in operation. Two RCS loops are required to be in operation in MODE 3, with reactor trip breakers closed and the Rod Control System capable of rod withdrawal, due to the postulation of a power excursion because of an inadvertent control rod withdrawal. The required number of RCS loops in operation ensures that the Safety Limit criteria will be met for all of the postulated accidents.

With the reactor trip breakers in the open position or the CRDMs deenergized, the Rod Control System is not capable of rod withdrawal; therefore, only one RCS loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. An additional RCS loop is required to be OPERABLE to ensure that safety analyses limits are met.

The Note permits all RCPs to be de-energized for ≤ 1 hour per 8-hour period. The purpose of the Note is to perform tests that are designed to validate various accident analyses values. One of these tests is validation of the pump coastdown curve used as input to a number of accident analyses including a loss-of-flow accident. This test is generally performed in MODE 3 during the initial startup

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BASES

LCO
(continued)

testing program, and as such should only be performed once. If, however, changes are made to the RCS that would cause a change to the flow characteristics of the RCS, the input values of the coastdown curve must be revalidated by conducting the test again. The 1-hour time period specified is adequate to perform the desired tests, and operating experience has shown that boron stratification is not a problem during this short period with no forced flow.

Utilization of the Note is permitted provided the following conditions are met, along with any other conditions imposed by initial startup test procedures:

- a. No operations are permitted that would dilute the RCS boron concentration, thereby maintaining the margin to criticality. Boron reduction is prohibited because a uniform concentration distribution throughout the RCS cannot be ensured when in natural circulation; and
- b. Core outlet temperature is maintained at least 10°F below saturation temperature, so that no vapor bubble may form and possibly cause a natural circulation flow obstruction.

An OPERABLE RCS loop consists of one OPERABLE RCP and one OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program, and which has the minimum water level specified in SR 3.4.5.2. An RCP is OPERABLE if it is capable of being powered and is able to provide forced flow if required.

APPLICABILITY

In MODE 3, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. The most stringent condition of the LCO, that is, two RCS loops OPERABLE and two RCS loops in operation, applies to MODE 3 with reactor trip breakers in the closed position. The least stringent condition, that is, two RCS loops OPERABLE and one RCS loop in operation, applies to MODE 3 with the reactor trip breakers open.

(continued)

BASES

APPLICABILITY
(continued)

Operation in other MODES is covered by:

- LCO 3.4.4, "RCS Loops - MODES 1 and 2";
 - LCO 3.4.6, "RCS Loops - MODE 4";
 - LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";
 - LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
 - LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level"; and
 - LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level."
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ACTIONS

A.1

If one required RCS loop is inoperable, redundancy for heat removal is lost. The Required Action is restoration of the required RCS loop to OPERABLE status within the Completion Time of 72 hours. This time allowance is a justified period to be without the redundant, non-operating loop because a single loop in operation has a heat transfer capability greater than that needed to remove the decay heat produced in the reactor core and because of the low probability of a failure in the remaining loop occurring during this period.

B.1

If restoration is not possible within 72 hours, the unit must be brought to MODE 4. In MODE 4, the unit may be placed on the Residual Heat Removal System. The additional Completion Time of 12 hours is compatible with required operations to achieve cooldown and depressurization from the existing plant conditions in an orderly manner and without challenging plant systems.

C.1 and C.2

If the required RCS loop is not in operation, and the reactor trip breakers are closed and the Rod Control System capable of rod withdrawal, the Required Action is either to restore the required RCS loop to operation or to deenergize all CRDMs by opening the reactor trip breakers or deenergizing the motor generator sets. When the reactor

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

trip breakers are in the closed position and the Rod Control System capable of rod withdrawal, it is postulated that a power excursion could occur in the event of an inadvertent control rod withdrawal. This mandates having the heat transfer capacity of two RCS loops in operation. If only one loop is in operation, the reactor trip breakers must be opened. The Completion Times of 1 hour to restore the required RCS loop to operation or deenergize all CRDMs is adequate to perform these operations in an orderly manner without exposing the unit to risk for an undue time period.

D.1, D.2, and D.3

If all loops are inoperable or no RCS loop is in operation, except as during conditions permitted by the Note in the LCO section, all CRDMs must be deenergized by opening the reactor trip breakers or deenergizing the MG sets, all operations involving a reduction of RCS boron concentration must be suspended, and action to restore one of the RCS loops to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and opening the reactor trip breakers or deenergizing the MG sets removes the possibility of an inadvertent rod withdrawal. The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE
REQUIREMENTS

SR 3.4.5.1

This SR requires verification every 12 hours that the required number of loops are in operation. Verification includes flow rate, temperature, and pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS loop performance.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.4.5.2

SR 3.4.5.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary-side narrow-range water level is $\geq 10\%$ for required RCS loops. If the SG secondary-side narrow-range water level is $< 10\%$, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink for removal of the decay heat. The 12-hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to a loss of SG level.

SR 3.4.5.3

Verification that the required number of RCS pumps are OPERABLE ensures that safety analyses limits are met. The requirement also ensures that additional RCS pumps can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power availability to the required RCPs.

REFERENCES

None.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.6 RCS Loops - MODE 4

BASES

BACKGROUND

In MODE 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary-side coolant or the component cooling water via the residual heat removal (RHR) heat exchangers. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops connected in parallel to the reactor vessel, each loop containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and to prevent boric acid stratification.

In MODE 4, either RCPs or RHR loops can be used to provide forced circulation. The intent of this LCO is to provide forced flow from at least one RCP or one RHR loop for decay heat removal and transport. The flow provided by one RCP loop or RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that two paths be available to provide redundancy for decay heat removal.

APPLICABLE SAFETY ANALYSES

In MODE 4, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The RCS and RHR loops provide this circulation.

RCS Loops - MODE 4 have been identified in the NRC Policy Statement as important contributors to risk reduction.

LCO

The purpose of this LCO is to require that at least two loops be OPERABLE in MODE 4 and that one of these loops be in operation. The LCO allows the two loops that are required to be OPERABLE to consist of any combination of RCS

(continued)

BASES

LCO
(continued)

loops and RHR loops. Any one loop in operation provides enough flow to remove the decay heat from the core with forced circulation. An additional loop is required to be OPERABLE to provide redundancy for heat removal.

The Note requires that the secondary-side water temperature of each SG be $\leq 50^{\circ}\text{F}$ above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature $\leq 310^{\circ}\text{F}$. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

An OPERABLE RCS loop is comprised of an OPERABLE RCP and an OPERABLE SG in accordance with the Steam Generator Tube Surveillance Program, which has the minimum water level specified in SR 3.4.6.2.

Similarly for the RHR System, an OPERABLE RHR loop is comprised of an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RCPs and RHR pumps are OPERABLE if they are capable of being powered and are able to provide forced flow if required.

APPLICABILITY

In MODE 4, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of either RCS or RHR provides sufficient circulation for these purposes. However, two loops consisting of any combination of RCS and RHR loops are required to be OPERABLE to meet single failure considerations.

Operation in other MODES is covered by: .

- LCO 3.4.4, "RCS Loops - MODES 1 and 2";
- LCO 3.4.5, "RCS Loops - MODE 3";
- LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";
- LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
- LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level"; and
- LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level."

(continued)

BASES (continued)

ACTIONS

A.1

If one required RCS loop is inoperable and two RHR loops are inoperable, redundancy for heat removal is lost. Action must be initiated to restore a second RCS or RHR loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1

If one required RHR loop is OPERABLE and in operation and there are no RCS loops OPERABLE, an inoperable RCS or RHR loop must be restored to OPERABLE status to provide a redundant means for decay heat removal.

If the parameters that are outside the limits cannot be restored, the unit must be brought to MODE 5 within 24 hours. Bringing the unit to MODE 5 is a conservative action with regard to decay heat removal. With only one RHR loop OPERABLE, redundancy for decay heat removal is lost and, in the event of a loss of the remaining RHR loop, it would be safer to initiate that loss from MODE 5 ($\leq 200^{\circ}\text{F}$) rather than MODE 4 (200 to 350°F). The Completion Time of 24 hours is a reasonable time, based on operating experience, to reach MODE 5 from MODE 4 in an orderly manner and without challenging plant systems.

C.1 and C.2

If no loop is OPERABLE or in operation, except during conditions permitted by Note 1 in the LCO section, all operations involving a reduction of RCS boron concentration must be suspended and action to restore one RCS or RHR loop to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that one RCS or RHR loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

SR 3.4.6.2

SR 3.4.6.2 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary-side narrow-range water level is $\geq 10\%$. If the SG secondary-side narrow-range water level is $< 10\%$, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The 12-hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.6.3

Verification that the required pump is OPERABLE ensures that an additional RCS or RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

None.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.7 RCS Loops - MODE 5, Loops Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops filled, the primary function of the reactor coolant is to remove decay heat and transfer this heat to the steam generators (SGs) or residual heat removal (RHR) heat exchangers. While the principal means for decay heat removal is via the RHR System, the SGs are specified as a backup means for redundancy. Even though the SGs cannot produce steam in this MODE, they are capable of being a heat sink due to their large contained volume of secondary water. As long as the SG secondary-side water is at a lower temperature than the reactor coolant, heat transfer will occur. The rate of heat transfer is directly proportional to the temperature difference. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

In MODE 5 with RCS loops filled, the reactor coolant is circulated by means of two RHR loops connected to the reactor vessel, each loop containing an RHR heat exchanger, an RHR pump, and appropriate flow and temperature instrumentation for control, protection, and indication. One RHR pump circulates the water through the RCS at a sufficient rate to prevent boric acid stratification.

The number of loops in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one RHR loop for decay heat removal and transport. The flow provided by one RHR loop is adequate for decay heat removal. The other intent of this LCO is to require that a second path be available to provide redundancy for heat removal.

The LCO provides for redundant paths of decay heat removal capability. The first path can be an RHR loop, that must be OPERABLE and in operation. The second path can be another OPERABLE RHR loop or maintaining two SGs with secondary-side water levels above 10% narrow range to provide an alternate method for decay heat removal.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The RHR loops provide this circulation.

RCS Loops - MODE 5 (Loops Filled) have been identified in the NRC Policy Statement as important contributors to risk reduction.

LCO

The purpose of this LCO is to require that at least one of the RHR loops be OPERABLE and in operation with an additional RHR loop OPERABLE or two SGs with secondary-side water level $\geq 10\%$ narrow range. One RHR loop provides sufficient forced circulation to perform the safety functions of the reactor coolant under these conditions. An additional RHR loop is required to be OPERABLE to meet single failure considerations. However, if the standby RHR loop is not OPERABLE, an acceptable alternate method is two SGs with their secondary-side water levels $\geq 10\%$ narrow range. Should the operating RHR loop fail, the SGs could be used to remove the decay heat.

Note 1 allows one RHR loop to be inoperable for a period of up to 2 hours, provided that the other RHR loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when such testing is safe and possible.

Note 2 requires that the secondary-side water temperature of each SG be $\leq 50^\circ\text{F}$ above each of the RCS cold leg temperatures before the start of a reactor coolant pump (RCP) with an RCS cold leg temperature $\leq 310^\circ\text{F}$. This restriction is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 3 provides for an orderly transition from MODE 5 to MODE 4 during a planned heatup by permitting removal of RHR loops from operation when at least one RCS loop is in operation. This Note provides for the transition to MODE 4 where an RCS loop is permitted to be in operation and replaces the heat removal function provided by the RHR loops.

(continued)

BASES (continued)

LCO
(continued) RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required. An OPERABLE SG can perform as a heat sink when it has an adequate water level and is OPERABLE in accordance with the Steam Generator Tube Surveillance Program.

APPLICABILITY In MODE 5 with RCS loops filled, this LCO requires forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of RHR provides sufficient circulation for these purposes. However, one additional RHR loop is required to be OPERABLE, or the secondary-side water level of at least two SGs is required to be $\geq 10\%$ narrow range.

Operation in other MODES is covered by:

- LCO 3.4.4, "RCS Loops - MODES 1 and 2";
 - LCO 3.4.5, "RCS Loops - MODE 3";
 - LCO 3.4.6, "RCS Loops - MODE 4";
 - LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled";
 - LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level"; and
 - LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level."
-

ACTIONS

A.1 and A.2

If one required RHR loop is inoperable and the required SGs have secondary-side water levels $< 10\%$ narrow range, redundancy for heat removal is lost. Action must be initiated immediately to restore a second RHR loop to OPERABLE status or to restore the required SG secondary-side water levels. Either Required Action A.1 or Required Action A.2 will restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1 and B.2

If no RHR loop is in operation, except during conditions permitted by Note 1, or if no loop is OPERABLE, all

(continued)

BASES (continued)

ACTIONS B.1 and B.2 (continued)

operations involving a reduction of RCS boron concentration must be suspended and action to restore one RHR loop to OPERABLE status and operation must be initiated. Avoidance of a boron dilution requires forced circulation for proper mixing and to preserve the margin to criticality in this type of operation. The immediate Completion Times reflect the importance of maintaining operation for heat removal.

SURVEILLANCE
REQUIREMENTS SR 3.4.7.1

This SR requires verification every 12 hours that the required loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RHR loop performance.

SR 3.4.7.2

Verifying that at least two SGs are OPERABLE by ensuring their secondary-side narrow-range water levels are $\geq 10\%$ narrow range ensures an alternate decay heat removal method in the event that the second RHR loop is not OPERABLE. If both RHR loops are OPERABLE, this Surveillance is not needed. The 12-hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.7.3

Verification that a second RHR pump is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the RHR pump. If secondary-side water level is $\geq 10\%$ narrow range in at least two SGs, this Surveillance is not needed. The Frequency of 7 days is considered reasonable in view of other

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.4.7.3 (continued)

administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

None.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.8 RCS Loops - MODE 5, Loops Not Filled

BASES

BACKGROUND

In MODE 5 with the RCS loops not filled, the primary function of the reactor coolant is the removal of decay heat generated in the fuel, and the transfer of this heat to the component cooling water via the residual heat removal (RHR) heat exchangers. The steam generators (SGs) are not available as a heat sink when the loops are not filled. The secondary function of the reactor coolant is to act as a carrier for the soluble neutron poison, boric acid.

In MODE 5 with loops not filled, only RHR pumps can be used for coolant circulation. The number of pumps in operation can vary to suit the operational needs. The intent of this LCO is to provide forced flow from at least one RHR pump for decay heat removal and transport and to require that two paths be available to provide redundancy for heat removal.

APPLICABLE
SAFETY ANALYSES

In MODE 5, RCS circulation is considered in the determination of the time available for mitigation of the accidental boron dilution event. The RHR loops provide this circulation. The flow provided by one RHR loop is adequate for heat removal and for boron mixing.

RCS loops in MODE 5 (loops not filled) have been identified in the NRC Policy Statement as important contributors to risk reduction.

LCO

The purpose of this LCO is to require that at least two RHR loops be OPERABLE and one of these loops be in operation. An OPERABLE loop is one that has the capability of transferring heat from the reactor coolant at a controlled rate. Heat cannot be removed via the RHR System unless forced flow is used. A minimum of one running RHR pump meets the LCO requirement for one loop in operation. An additional RHR loop is required to be OPERABLE to meet single failure considerations.

(continued)

BASES

LCO
(continued)

Note 1 permits all RHR pumps to be de-energized for ≤ 15 minutes when switching from one loop to another. The circumstances for stopping both RHR pumps are to be limited to situations when the outage time is short and core outlet temperature is maintained at least 10°F below saturation temperature. The Note prohibits boron dilution or draining operations when RHR forced flow is stopped.

Note 2 allows one RHR loop to be inoperable for a period of ≤ 2 hours, provided that the other loop is OPERABLE and in operation. This permits periodic surveillance tests to be performed on the inoperable loop during the only time when these tests are safe and possible.

An OPERABLE RHR loop is comprised of an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RHR pumps are OPERABLE if they are capable of being powered and are able to provide flow if required.

APPLICABILITY

In MODE 5 with loops not filled, this LCO requires core heat removal and coolant circulation by the RHR System.

Operation in other MODES is covered by:

- LCO 3.4.4, "RCS Loops - MODES 1 and 2";
 - LCO 3.4.5, "RCS Loops - MODE 3";
 - LCO 3.4.6, "RCS Loops - MODE 4";
 - LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled";
 - LCO 3.9.5, "Residual Heat Removal (RHR) and Coolant Circulation - High Water Level"; and
 - LCO 3.9.6, "Residual Heat Removal (RHR) and Coolant Circulation - Low Water Level."
-

ACTIONS

A.1

If only one RHR loop is OPERABLE and in operation, redundancy for RHR is lost. Action must be initiated to restore a second loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

(continued)

BASES

ACTIONS
(continued)

B.1 and B.2

If no required RHR loops are OPERABLE or in operation, except during conditions permitted by Note 1, all operations involving a reduction of RCS boron concentration must be suspended and requires initiation of action to immediately start restoration of an RHR loop to OPERABLE status and operation. Boron dilution requires forced circulation for uniform dilution, and the margin to criticality must not be reduced in this type of operation. The immediate Completion Time reflects the importance of maintaining operation for heat removal. The action to restore must continue until one loop is restored to OPERABLE status and operation.

SURVEILLANCE
REQUIREMENTS

SR 3.4.8.1

This SR requires verification every 12 hours that one loop is in operation. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RHR loop performance.

SR 3.4.8.2

Verification that the required number of pumps are OPERABLE ensures that additional pumps can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pumps. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

None.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.9 Pressurizer

BASES

BACKGROUND

The pressurizer provides a point in the RCS where liquid and vapor are maintained in equilibrium under saturated conditions for pressure control purposes to prevent bulk boiling in the remainder of the RCS. Key functions include maintaining required primary system pressure during steady-state operation, and limiting the pressure changes caused by reactor coolant thermal expansion and contraction during normal load transients.

The pressure control components addressed by this LCO include the pressurizer water level, the required heaters, and their controls and emergency power supplies. Pressurizer safety valves and pressurizer power-operated relief valves are addressed by LCO 3.4.10, "Pressurizer Safety Valves," and LCO 3.4.11, "Pressurizer Power-Operated Relief Valves (PORVs)," respectively.

The intent of the LCO is to ensure that a steam bubble exists in the pressurizer prior to power operation to minimize the consequences of potential overpressure transients. The presence of a steam bubble is consistent with analytical assumptions. Relatively small amounts of non-condensable gases can inhibit the condensation heat transfer between the pressurizer spray and the steam, and diminish the spray effectiveness for pressure control.

Electrical immersion heaters, located in the lower section of the pressurizer vessel, keep the water in the pressurizer at saturation temperature and maintain a constant operating pressure. A minimum required available capacity of pressurizer heaters ensures that the RCS pressure can be maintained. The capability to maintain and control system pressure is important for maintaining subcooled conditions in the RCS and ensuring the capability to remove core decay heat by either forced or natural circulation of reactor coolant. Unless adequate heater capacity is available, the hot, high-pressure condition cannot be maintained indefinitely and still provide the required subcooling margin in the primary system. Inability to control the system pressure and maintain subcooling under conditions of natural circulation flow in the primary system could lead to

(continued)

BASES

BACKGROUND (continued) a loss of single-phase natural circulation and decreased capability to remove core decay heat.

APPLICABLE SAFETY ANALYSES In MODES 1, 2, and 3, the LCO requirement for a steam bubble is reflected implicitly in the accident analyses. Safety analyses performed for lower MODES are not limiting. All analyses performed from a critical reactor condition assume the existence of a steam bubble and saturated conditions in the pressurizer. In making this assumption, the analyses neglect the small fraction of non-condensable gases normally present.

Safety analyses presented in the FSAR (Ref. 1) do not take credit for pressurizer heater operation; however, an implicit initial condition assumption of the safety analyses is that the RCS is operating at normal pressure.

The maximum pressurizer water level limit satisfies Criterion 2 of the NRC Policy Statement. Although the heaters are not specifically used in accident analysis, the need to maintain subcooling in the long term during loss of offsite power, as indicated in NUREG-0737 (Ref. 2), is the reason for providing an LCO.

LCO - The LCO requirement for the pressurizer to be OPERABLE with a water volume ≤ 1656 cubic feet, which is equivalent to 92% of indicated level, ensures that a steam bubble exists. Limiting the LCO maximum operating water level preserves the steam space for pressure control. The LCO has been established to ensure the capability to establish and maintain pressure control for steady-state operation and to minimize the consequences of potential overpressure transients. Requiring the presence of a steam bubble is also consistent with analytical assumptions.

The LCO requires two groups of OPERABLE pressurizer heaters, each with a capacity ≥ 150 kW. The minimum heater capacity required is sufficient to maintain the RCS near normal operating pressure when accounting for heat losses through the pressurizer insulation. By maintaining the pressure near the operating conditions, a wide margin to subcooling

(continued)

BASES

LCO
(continued) can be obtained in the loops. The exact design value of 150 kW is derived from the use of twelve heaters rated at 12.5 kW each. The amount needed to maintain pressure is dependent on the heat losses.

APPLICABILITY The need for pressure control is most pertinent when core heat can cause the greatest effect on RCS temperature, resulting in the greatest effect on pressurizer level and RCS pressure control. Thus, applicability has been designated for MODES 1 and 2. The applicability is also provided for MODE 3. The purpose is to prevent solid water RCS operation during heatup and cooldown to avoid rapid pressure rises caused by normal operational perturbation, such as reactor coolant pump startup.

In MODES 1, 2, and 3, there is need to maintain the availability of pressurizer heaters, capable of being powered from an emergency power supply. In the event of a loss of offsite power, the initial conditions of these MODES give the greatest demand for maintaining the RCS in a hot pressurized condition with loop subcooling for an extended period. For MODE 4, 5, or 6, it is not necessary to control pressure (by heaters) to ensure loop subcooling for heat transfer when the Residual Heat Removal (RHR) System is in service, and therefore, the LCO is not applicable.

ACTIONS A.1 and A.2

Pressurizer water level control malfunctions or other plant evolutions may result in a pressurizer water level above the nominal upper limit, even with the plant at steady-state conditions. Normally the plant will trip in this event since the upper limit of this LCO is the same as the Pressurizer Water Level-High Trip.

If the pressurizer water level is not within the limit, action must be taken to restore the plant to operation within the bounds of the safety analyses. To achieve this status, the unit must be brought to MODE 3, with the reactor trip breakers open, within 6 hours and to MODE 4 within 12 hours. This takes the unit out of the applicable MODES

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

and restores the unit to operation within the bounds of the safety analyses.

The allowed 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.

B.1

If one required group of pressurizer heaters is inoperable, restoration is required within 72 hours. The Completion Time of 72 hours is reasonable considering the anticipation that a demand caused by loss of offsite power would be unlikely in this period. Pressure control may be maintained during this time using normal station-powered heaters.

C.1 and C.2

If one group of pressurizer heaters are inoperable and cannot be restored in the allowed Completion Time of Required Action B.1, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed 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 3.4.9.1

This SR requires that during steady-state operation, pressurizer level is maintained below the nominal upper limit to provide a minimum space for a steam bubble. The Surveillance is performed by observing the indicated level. The Frequency of 12 hours corresponds to verifying the parameter each shift. The 12-hour interval has been shown by operating practice to be sufficient to regularly assess level for any deviation and verify that operation is within

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.9.1 (continued)

safety analyses assumptions. Alarms are also available for early detection of abnormal level indications.

SR 3.4.9.2

The SR is satisfied when the power supplies are demonstrated to be capable of producing the minimum power and the associated pressurizer heaters are verified to be at their design rating. This may be done by testing the power supply output and by performing an electrical check on heater element continuity and resistance. The Frequency of 92 days is considered adequate to detect heater degradation and has been shown by operating experience to be acceptable.

REFERENCES

1. WATTS BAR FSAR, Chapter 15, "Accident Analyses."
 2. NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980.
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.10 Pressurizer Safety Valves

BASES

BACKGROUND

The pressurizer safety valves provide, in conjunction with the Reactor Protection System, overpressure protection for the RCS. The pressurizer safety valves are totally enclosed pop-type, spring-loaded, self-actuated valves with backpressure compensation. The safety valves are designed to prevent the system pressure from exceeding the system Safety Limit (SL), 2735 psig, which is 110% of the design pressure.

Because the safety valves are totally enclosed and self-actuating, they are considered independent components. The relief capacity for each valve, 420,000 lb/hr, is based on postulated overpressure transient conditions resulting from a complete loss of steam flow to the turbine. This event results in the maximum surge rate into the pressurizer, which specifies the minimum relief capacity for the safety valves. The discharge flow from the pressurizer safety valves is directed to the pressurizer relief tank. This discharge flow is indicated by an increase in temperature downstream of the pressurizer safety valves or increase in the pressurizer relief tank temperature or level.

Overpressure protection is required in MODES 1, 2, 3, 4, and 5; however, in MODE 4, with one or more RCS cold leg temperatures $\leq 310^{\circ}\text{F}$, and MODE 5 and MODE 6 with the reactor vessel head on, overpressure protection is provided by operating procedures and by meeting the requirements of LCO 3.4.12, "Cold Overpressure Mitigation System (COMS)."

The upper and lower pressure limits are based on the $\pm 1\%$ -tolerance requirement (Ref. 1) for lifting pressures above 1000 psig. The lift setting is for the ambient conditions associated with MODES 1, 2, and 3. This requires either that the valves be set hot or that a correlation between hot and cold settings be established.

The pressurizer safety valves are part of the primary success path and mitigate the effects of postulated accidents. OPERABILITY of the safety valves ensures that

(continued)

BASES

BACKGROUND
(continued)

the RCS pressure will be limited to 110% of design pressure. The consequences of exceeding the American Society of Mechanical Engineers (ASME) pressure limit (Ref. 1) could include damage to RCS components, increased leakage, or a requirement to perform additional stress analyses prior to resumption of reactor operation.

APPLICABLE
SAFETY ANALYSES

All accident and safety analyses in the FSAR (Ref. 2) that require safety valve actuation assume operation of three pressurizer safety valves to limit increases in RCS pressure. The overpressure protection analysis (Ref. 3) is also based on operation of three safety valves. Accidents that could result in overpressurization if not properly terminated include:

- a. Uncontrolled rod withdrawal from full power;
- b. Loss of reactor coolant flow;
- c. Loss of external electrical load;
- d. Loss of normal feedwater;
- e. Loss of all AC power to station auxiliaries; and
- f. Locked Rotor.

Detailed analyses of the above transients are contained in Reference 2. Safety valve actuation is required in events c, d, and e (above) to limit the pressure increase. Compliance with this LCO is consistent with the design bases and accident analyses assumptions.

Pressurizer safety valves satisfy Criterion 3 of the NRC Policy Statement.

LCO

The three pressurizer safety valves are set to open at the RCS design pressure (2485 psig), and within the ASME specified tolerance, to avoid exceeding the maximum design pressure SL, to maintain accident analyses assumptions, and to comply with ASME requirements. The upper and lower pressure tolerance limits are based on the $\pm 1\%$ -tolerance

(continued)

BASES

LCO
(continued)

requirements (Ref. 1) for lifting pressures above 1000 psig. The limit protected by this Specification is the reactor coolant pressure boundary (RCPB) SL of 110% of design pressure. Inoperability of one or more valves could result in exceeding the SL if a transient were to occur. The consequences of exceeding the ASME pressure limit could include damage to one or more RCS components, increased leakage, or additional stress analysis being required prior to resumption of reactor operation.

APPLICABILITY

In MODES 1, 2, and 3, and portions of MODE 4 above the COMS arming temperature, OPERABILITY of three valves is required because the combined capacity is required to keep reactor coolant pressure below 110% of its design value during certain accidents. MODE 3 and portions of MODE 4 are conservatively included, although the listed accidents may not require the safety valves for protection.

The LCO is not applicable in MODE 4 with any RCS cold leg at or below 310°F or in MODE 5 because COMS is provided. Overpressure protection is not required in MODE 6 with reactor vessel head detensioned.

The Note allows entry into MODES 3 and 4 with the lift settings outside the LCO limits. This permits testing and examination of the safety valves at high pressure and temperature near their normal operating range, but only after the valves have had a preliminary cold setting. The cold setting gives assurance that the valves are OPERABLE near their design condition. Only one valve at a time will be removed from service for testing. The 54-hour exception is based on 18-hour outage time for each of the three valves. The 18-hour period is derived from operating experience that hot testing can be performed in this timeframe.

ACTIONS

A.1

With one pressurizer safety valve inoperable, restoration must take place within 15 minutes. The Completion Time of 15 minutes reflects the importance of maintaining the RCS Overpressure Protection System. An inoperable safety valve

(continued)

BASES

ACTIONS

A.1 (continued)

coincident with an RCS overpressure event could challenge the integrity of the pressure boundary.

B.1 and B.2

If the Required Action of A.1 cannot be met within the required Completion Time or if two or more pressurizer safety valves are inoperable, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 with at least one cold leg $\leq 310^{\circ}\text{F}$ within 12 hours. The allowed 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. With at least one cold leg at or below 310°F , overpressure protection is provided by the COMS. The change from MODE 1, 2, or 3 to MODE 4 reduces the RCS energy (core power and pressure), lowers the potential for large pressurizer insurges, and thereby removes the need for overpressure protection by three pressurizer safety valves.

SURVEILLANCE
REQUIREMENTS

SR 3.4.10.1

SRs are specified in the Inservice Testing Program. Pressurizer safety valves are to be tested in accordance with the requirements of Section XI of the ASME Code (Ref. 4), which provides the activities and Frequencies necessary to satisfy the SRs. No additional requirements are specified.

REFERENCES

1. ASME Boiler and Pressure Vessel Code, Section III, NB 7614.3, 1971 Edition through Summer 1973.
2. Watts Bar FSAR, Chapter 15, "Safety Analyses."
3. WCAP-7769, Rev. 1, "Topical Report on Overpressure Protection for Westinghouse Pressurized Water Reactors," June 1972.

(continued)

BASES

REFERENCES
(continued)

4. ASME Boiler and Pressure Vessel Code, Section XI,
"Rules for Inservice Inspection of Nuclear Power Plant
Components."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.11 Pressurizer Power-Operated Relief Valves (PORVs)

BASES

BACKGROUND

The pressurizer is equipped with two types of devices for pressure relief: pressurizer safety valves and PORVs. The PORVs are pilot-operated solenoid valves that are controlled to open at a specific set pressure when the pressurizer pressure increases and closes when the pressurizer pressure decreases. The PORVs may also be manually operated from the control room.

Block valves, which are normally open, are located between the pressurizer and the PORVs. The block valves are used to isolate the PORVs in case of excessive leakage or a stuck-open PORV. Block valve closure is accomplished manually using controls in the control room. A stuck-open PORV is, in effect, a small-break loss-of-coolant accident (LOCA). As such, block valve closure terminates the RCS depressurization and coolant inventory loss.

The PORVs and their associated block valves may be used by plant operators to depressurize the RCS to recover from certain transients if normal pressurizer spray is not available. Additionally, the series arrangement of the PORVs and their block valves permit performance of surveillances on the valves during power operation.

The PORVs may also be used for feed and bleed core cooling in the case of multiple equipment failure events that are not within the design basis, such as a total loss of feedwater.

The PORVs, their block valves, and their controls are powered from the vital buses that normally receive power from offsite power sources, but are also capable of being powered from emergency power sources in the event of a loss of offsite power. Two PORVs and their associated block valves are powered from two separate safety trains (Ref. 1).

The plant has two PORVs, each having a relief capacity of 210,000 lb/hr at 2324 psig. The functional design of the PORVs is based on maintaining pressure below the Pressurizer Pressure-High reactor trip setpoint following a step reduction of 50% of full load with steam dump. In addition,

(continued)

BASES

BACKGROUND
(continued)

the PORVs minimize challenges to the pressurizer safety valves and also may be used for low temperature overpressure protection (LTOP). See LCO 3.4.12, "Cold Overpressure Mitigation System (COMS)."

APPLICABLE
SAFETY ANALYSES

Plant operators employ the PORVs to depressurize the RCS in response to certain plant transients if normal pressurizer spray is not available. For the Steam Generator Tube Rupture (SGTR) event, the safety analysis assumes that manual operator actions are required to mitigate the event. A loss of offsite power is assumed to accompany the event, and thus, normal pressurizer spray is unavailable to reduce RCS pressure. The PORVs are assumed to be used for RCS depressurization, which is one of the steps performed to equalize the primary and secondary pressures in order to terminate the primary to secondary break flow and the radioactive releases from the affected steam generator.

The PORVs are used in safety analyses for events that result in increasing RCS pressure for which departure from nucleate boiling ratio (DNBR) criteria are critical. By assuming PORV manual actuation, the primary pressure remains below the high pressurizer pressure trip setpoint; thus, the DNBR calculation is more conservative. Events that assume this condition include a turbine trip and the loss of normal feedwater (Ref. 2).

Pressurizer PORVs satisfy Criterion 3 of the NRC Policy Statement.

LCO

The LCO requires the PORVs and their associated block valves to be OPERABLE for manual operation to mitigate the effects associated with a SGTR.

By maintaining two PORVs and their associated block valves OPERABLE, the single-failure criterion is satisfied. The block valves are available to isolate the flow path through either a failed open PORV or a PORV with excessive leakage. Satisfying the LCO helps minimize challenges to fission-product barriers.

(continued)

BASES (continued)

APPLICABILITY In MODES 1, 2, and 3, the PORV and its block valve are required to be OPERABLE to limit the potential for a small-break LOCA through the flow path. The most likely cause for a PORV small-break LOCA is a result of a pressure-increase transient that causes the PORV to open. Imbalances in the energy output of the core and heat removal by the secondary system can cause the RCS pressure to increase to the PORV opening setpoint. The most rapid increases will occur at the higher operating power and pressure conditions of MODES 1 and 2. The PORVs are also required to be OPERABLE in MODES 1, 2, and 3 to minimize challenges to the pressurizer safety valves.

Pressure increases are less prominent in MODE 3 because the core input energy is reduced, but the RCS pressure is high. Therefore, the LCO is applicable in MODES 1, 2, and 3. The LCO is not applicable in MODE 4 when both pressure and core energy are decreased and the pressure surges become much less significant. The PORV setpoint is reduced for LTOP in MODES 4, 5, and 6 with the reactor vessel head in place. LCO 3.4.12 addresses the PORV requirements in these MODES.

ACTIONS Note 1 has been added to clarify that all pressurizer PORVs are treated as separate entities, each with separate Completion Times (i.e., the Completion Time is on a component basis). The exception for LCO 3.0.4, Note 2, permits entry into MODES 1, 2, and 3 to perform cycling of the PORVs or block valves to verify their OPERABLE status. Testing is not performed in lower MODES.

A.1

With the PORVs inoperable and capable of being manually cycled, either the PORVs must be restored or the flow path isolated within 1 hour. The block valves should be closed but power must be maintained to the associated block valves, since removal of power would render the block valve inoperable. Although a PORV may be designated inoperable, it may be able to be manually opened and closed, and therefore, able to perform its function. PORV inoperability may be due to seat leakage, instrumentation problems,

(continued)

BASES

ACTIONS

A.1 (continued)

automatic control problems, or other causes that do not prevent manual use and do not create a possibility for a small-break LOCA. For these reasons, the block valve may be closed but the Action requires power be maintained to the valve. This Condition is only intended to permit operation of the plant for a limited period of time not to exceed the next refueling outage (MODE 6) so that maintenance can be performed on the PORVs to eliminate the problematic condition. Normally, the PORVs should be available for automatic mitigation of overpressure events and should be returned to OPERABLE status prior to entering startup (MODE 2).

Quick access to the PORV for pressure control can be made when power remains on the closed block valve. The Completion Time of 1 hour is based on plant operating experience that has shown that minor problems can be corrected or closure accomplished in this time period.

B.1, B.2, and B.3

If one PORV is inoperable and not capable of being manually cycled, it must be either restored or isolated by closing the associated block valve and removing the power to the associated block valve. The Completion Times of 1 hour are reasonable, based on challenges to the PORVs during this time period, and provide the operator adequate time to correct the situation. If the inoperable valve cannot be restored to OPERABLE status, it must be isolated within the specified time. Because there is at least one PORV that remains OPERABLE, an additional 72 hours is provided to restore the inoperable PORV to OPERABLE status. If the PORV cannot be restored within this additional time, the plant must be brought to a MODE in which the LCO does not apply, as required by Condition D.

C.1 and C.2

If one block valve is inoperable, then it is necessary to either restore the block valve to OPERABLE status within the Completion Time of 1 hour or place the associated PORV in manual control. The prime importance for the capability to

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

close the block valve is to isolate a stuck-open PORV. Therefore, if the block valve cannot be restored to OPERABLE status within 1 hour, the Required Action is to place the PORV in manual control to preclude its automatic opening for an overpressure event and to avoid the potential for a stuck-open PORV at a time that the block valve is inoperable. The Completion Time of 1 hour is reasonable, based on the small potential for challenges to the system during this time period and provides the operator time to correct the situation. Because at least one PORV remains OPERABLE, the operator is permitted a Completion Time of 72 hours to restore the inoperable block valve to OPERABLE status. The time allowed to restore the block valve is based upon the Completion Time for restoring an inoperable PORV in Condition B, since the PORVs are not capable of mitigating an overpressure event when placed in manual control. If the block valve is restored within the Completion Time of 72 hours, the power will be restored and the PORV restored to OPERABLE status. If it cannot be restored within this additional time, the plant must be brought to a MODE in which the LCO does not apply, as required by Condition D.

D.1 and D.2

If the Required Action of Condition A, B, or C is not met, then the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed 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. In MODES 4 and 5, maintaining PORV OPERABILITY may be required. See LCO 3.4.12, "Cold Overpressure Mitigation System (COMS)."

E.1, E.2, E.3, and E.4

If more than one PORV is inoperable and not capable of being manually cycled, it is necessary to either restore at least one valve within the Completion Time of 1 hour or isolate

(continued)

BASES

ACTIONS

E.1, E.2, E.3, and E.4 (continued)

the flow path by closing and removing the power to the associated block valves. The Completion Time of 1 hour is reasonable, based on the small potential for challenges to the system during this time and provides the operator time to correct the situation. If one PORV is restored and one PORV remains inoperable, then the plant will be in Condition B with the time clock started at the original declaration of having two PORVs inoperable. If no PORVs are restored within the Completion Time, then the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed 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. In MODES 4 and 5, maintaining PORV OPERABILITY may be required. See LCO 3.4.12.

F.1 and F.2

If both block valves are inoperable, it is necessary to either restore the block valves within the Completion Time of 1 hour, or place the associated PORVs in manual control and restore at least one block valve within 2 hours. The Completion Times are reasonable, based on the small potential for challenges to the system during this time and provide the operator time to correct the situation.

G.1 and G.2

If the Required Actions of Condition F are not met, then the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed 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. In MODES 4 and 5, maintaining PORV OPERABILITY may be required. See LCO 3.4.12.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.4.11.1

Block valve cycling verifies that the valve(s) can be closed if needed. The basis for the Frequency of 92 days is the American Society of Mechanical Engineers (ASME) Code, Section XI (Ref. 3). If the block valve is closed to isolate a PORV that is capable of being manually cycled, the OPERABILITY of the block valve is of importance, because opening the block valve is necessary to permit the PORV to be used for manual control of reactor pressure. If the block valve is closed to isolate an otherwise inoperable PORV, the maximum Completion Time to restore the PORV and open the block valve is 72 hours, which is well within the allowable limits (25%) to extend the block valve Frequency of 92 days. Furthermore, these test requirements would be completed by the reopening of a recently closed block valve upon restoration of the PORV to OPERABLE status (i.e., completion of the Required Actions fulfills the SR).

The Note modifies this SR by stating that it is not required to be met with the block valve closed, in accordance with the Required Action of this LCO.

SR 3.4.11.2

SR 3.4.11.2 requires a complete cycle of each PORV. Operating a PORV through one complete cycle ensures that the PORV can be manually actuated for mitigation of an SGTR. The Frequency of 18 months is based on a typical refueling cycle and industry-accepted practice.

REFERENCES

1. Regulatory Guide 1.32, "Criteria for Safety Related Electric Power Systems for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, February 1977.
 2. Watts Bar FSAR, Section 15.2, "Condition II - Faults of Moderate Frequency."
 3. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.12 Cold Overpressure Mitigation System (COMS)

BASES

BACKGROUND

The COMS controls RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G (Ref. 1). The reactor vessel is the limiting RCPB component for demonstrating such protection. The PTLR provides the maximum allowable actuation logic setpoints for the power-operated relief valves (PORVs) and the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Reference 1 requirements during the COMS MODES.

The reactor vessel material is less tough at low temperatures than at normal operating temperature. As the vessel neutron exposure accumulates, the material toughness decreases and becomes less resistant to pressure stress at low temperatures (Ref. 2). RCS pressure, therefore, is maintained low at low temperatures and is increased only as temperature is increased.

The potential for vessel overpressurization is most acute when the RCS is water solid, occurring only while shutdown; a pressure fluctuation can occur more quickly than an operator can react to relieve the condition. Exceeding the RCS P/T limits by a significant amount could cause brittle cracking of the reactor vessel. LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the PTLR limits.

This LCO provides RCS overpressure protection by having a minimum coolant input capability and having adequate pressure relief capacity. Limiting coolant input capability requires deactivating all but one centrifugal charging pump and isolating the accumulators. The pressure relief capacity requires either two redundant RCS relief valves or a depressurized RCS and an RCS vent of sufficient size. One RCS relief valve or the open RCS vent is the overpressure protection device that acts to terminate an increasing-pressure event.

(continued)

BASES

BACKGROUND
(continued)

With minimum coolant input capability, the ability to provide core coolant addition is restricted. The LCO does not require the makeup control system deactivated or the safety injection (SI) actuation circuits blocked. Due to the lower pressures in the COMS MODES and the expected core decay heat levels, the makeup system can provide adequate flow via the makeup control valve and, if needed, until the centrifugal charging pump is actuated by SI.

The COMS for pressure relief consists of two PORVs with reduced lift settings, or one PORV and the residual heat removal (RHR) suction relief valve, or a depressurized RCS and an RCS vent of sufficient size. Two RCS relief valves are required for redundancy. One RCS relief valve has adequate relieving capability to keep from overpressurization for the required coolant input capability.

PORV Requirements

As designed for the COMS, each PORV is signaled to open if the RCS pressure approaches a limit determined by the COMS actuation logic. The COMS actuation logic monitors both RCS temperature and RCS pressure and determines when a condition not acceptable in the PTLR limits is approached. The wide-range RCS temperature indications are auctioneered to select the lowest temperature signal.

The lowest temperature signal is processed through a function generator that calculates a pressure limit for that temperature. The calculated pressure limit is then compared with the indicated RCS pressure from a wide-range pressure channel. If the indicated pressure meets or exceeds the calculated value, a PORV is signaled to open.

The PTLR presents the PORV setpoints for COMS. The setpoints are normally staggered so only one valve opens during a low temperature overpressure transient. Having the setpoints of both valves within the limits in the PTLR ensures that the Reference 1 limits will not be exceeded in any analyzed event.

When a PORV is opened in an increasing pressure transient, the release of coolant will cause the pressure increase to slow and reverse. As the PORV releases coolant, the RCS

(continued)

BASES

BACKGROUND

PORV Requirements (continued)

pressure decreases until a reset pressure is reached and the valve is signaled to close. The pressure continues to decrease below the reset pressure as the valve closes.

RHR Suction Relief Valve Requirements

During COMS MODES, the RHR System is operated for decay heat removal and low pressure letdown control. Therefore, the RHR suction isolation valves are open in the piping from the RCS hot leg to the inlet header of the RHR pumps. While these valves are open, the RHR suction relief valve is exposed to the RCS and is able to relieve pressure transients in the RCS.

The RHR suction isolation valves must be open to make the RHR suction relief valve OPERABLE for RCS overpressure mitigation. Auto-closure interlocks are not permitted to cause the RHR suction isolation valves to close. The RHR suction relief valve is a spring-loaded, bellows-type water relief valve with pressure tolerances and accumulation limits established by Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 3) for Class 2 relief valves.

RCS Vent Requirements

Once the RCS is depressurized, a vent exposed to the containment atmosphere will maintain the RCS at containment ambient pressure in an RCS overpressure transient, if the relieving requirements of the transient do not exceed the capabilities of the vent. Thus, the vent path must be capable of relieving the flow resulting from the limiting COMS mass or heat input transient, and maintaining pressure below the P/T limits. The required vent capacity may be provided by one or more vent paths.

For an RCS vent to meet the flow capacity requirement, it requires removing a PORV's internals, and disabling its block valve in the open position, or opening the pressurizer manway. The vent path(s) must be above the level of reactor coolant, so as not to drain the RCS when open.

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BASES (continued)

APPLICABLE
SAFETY ANALYSES

Safety analyses (Ref. 4) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with RCS cold leg temperature exceeding 310°F, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. At about 310°F and below, overpressure prevention falls to two OPERABLE RCS relief valves or to a depressurized RCS and a sufficient-sized RCS vent. Each of these means has a limited overpressure relief capability.

The actual temperature at which the pressure in the P/T limit curve falls below the pressurizer safety valve setpoint increases as the reactor vessel material toughness decreases due to neutron embrittlement. Each time the PTLR curves are revised, the COMS must be re-evaluated to ensure its functional requirements can still be met using the RCS relief valve method or the depressurized and vented RCS condition.

The PTLR contains the acceptance limits that define the COMS requirements. Any change to the RCS must be evaluated against the Reference 4 analyses to determine the impact of the change on the COMS acceptance limits.

Transients that are capable of overpressurizing the RCS are categorized as either mass or heat input transients, examples of which follow:

Mass Input Type Transients

- a. Inadvertent safety injection; or
- b. Charging/letdown flow mismatch.

Heat Input Type Transients

- a. Inadvertent actuation of pressurizer heaters;
- b. Loss of RHR cooling; or
- c. Reactor coolant pump (RCP) startup with temperature asymmetry within the RCS or between the RCS and steam generators.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The following are required during the COMS MODES to ensure that mass and heat input transients do not occur, which either of the COMS overpressure protection means cannot handle:

- a. Deactivating all but one centrifugal charging pump OPERABLE;
- b. Deactivating the accumulator discharge isolation valves in their closed positions; and
- c. Disallowing start of an RCP if secondary temperature is more than [50]°F above primary temperature in any one loop. LCO 3.4.6, "RCS Loops-MODE 4," and LCO 3.4.7, "RCS Loops-MODE 5; Loops Filled," provide this protection.

The Reference 4 analyses demonstrate that either one RCS relief valve or the depressurized RCS and RCS vent can maintain RCS pressure below limits when only one centrifugal charging pump is actuated by SI. Thus, the LCO allows only one centrifugal charging pump OPERABLE during the COMS MODES. Since neither one RCS relief valve nor the RCS vent can handle a full SI actuation, the LCO also requires the accumulators isolated.

The isolated accumulators must have their discharge valves closed and the valve power supply breakers fixed in their open positions. The analyses show the effect of accumulator discharge is over a narrower RCS temperature range (175°F and below) than that of the LCO (310°F and below). Fracture mechanics analyses established the temperature of COMS Applicability at 310°F.

The consequences of a small-break loss-of-coolant accident (LOCA) in COMS MODE 4 conform to 10 CFR 50.46 and 10 CFR 50, Appendix K (Refs. 5 and 6) requirements by having a maximum of one centrifugal charging pump OPERABLE and SI actuation enabled.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)PORV Performance

The fracture mechanics analyses show that the vessel is protected when the PORVs are set to open at or below the limit shown in the PTLR. The setpoints are derived by analyses that model the performance of the COMS, assuming the limiting COMS transient of SI actuation of one charging pump. These analyses consider pressure overshoot and undershoot beyond the PORV opening and closing, resulting from signal processing and valve stroke times. The PORV setpoints at or below the derived limit ensures the Reference 1 P/T limits will be met.

The PORV setpoints in the PTLR will be updated when the revised P/T limits conflict with the COMS analysis limits. The P/T limits are periodically modified as the reactor vessel material toughness decreases due to neutron embrittlement caused by neutron irradiation. Revised limits are determined using neutron fluence projections and the results of examinations of the reactor vessel material irradiation surveillance specimens. The Bases for LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," discuss these examinations.

The PORVs are considered active components. Thus, the failure of one PORV is assumed to represent the worst-case, single active failure.

RHR Suction Relief Valve Performance

The RHR suction relief valve does not have variable pressure and temperature lift setpoints like the PORVs. Analyses must show that the RHR suction relief valve with a setpoint at or between 436.5 psig and 463.5 psig will pass flow greater than that required for the limiting COMS transient while maintaining RCS pressure less than the P/T limit curve. Assuming all relief flow requirements during the limiting COMS event, the RHR suction relief valve will maintain RCS pressure to within the valve rated lift setpoint, plus an accumulation no greater than 3% of the rated lift setpoint.

The RHR suction relief valve inclusion and location within

(continued)

BASES

APPLICABLE
SAFETY ANALYSES

RHR Suction Relief Valve Performance (continued)

the RHR System does not allow it to meet single failure criteria when spurious RHR suction isolation valve closure is postulated. Also, as the RCS P/T limits are decreased to reflect the loss of toughness in the reactor vessel materials due to neutron embrittlement, the RHR suction relief valve must be analyzed to still accommodate the design basis transients for COMS.

The RHR suction relief valve is considered an active component. Thus, the failure of this valve is assumed to represent the worst-case single active failure.

RCS Vent Performance

With the RCS depressurized, analyses show a vent capable of relieving at least 475 gpm water flow is capable of mitigating the allowed COMS overpressure transient. The capacity of 475 gpm is greater than the flow of the limiting transient for the COMS configuration, SI actuation with one centrifugal charging pump OPERABLE, maintaining RCS pressure less than the maximum pressure on the P/T limit curve.

Two vent flow paths have been identified in the Reactor Coolant System which could serve as pressure release (vent) paths. With one PORV removed, the open line could serve as one vent path. The pressurizer manway could serve as an alternative vent path with the manway cover removed. Both flow paths are capable of discharging 475 gpm at low pressure in the Reactor Coolant System. Thus, either one of the two openings can be used for relieving the pressure to prevent violating the P/T limits.

The RCS vent size will be re-evaluated for compliance each time the P/T limit curves are revised based on the results of the vessel material surveillance.

The RCS vent is passive and is not subject to active failure.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The COMS satisfies Criterion 2 of the NRC Policy Statement.

LCO

This LCO requires that the COMS is OPERABLE. The COMS is OPERABLE when the minimum coolant input and pressure relief capabilities are OPERABLE. Violation of this LCO could lead to the loss of low-temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient.

To limit the coolant input capability, the LCO requires one centrifugal charging pump capable of injecting into the RCS and all accumulator discharge isolation valves closed and immobilized. LCO 3.3.2, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," defines SI actuation OPERABILITY for the COMS MODE 4 small-break LOCA.

The elements of the LCO that provide low temperature overpressure mitigation through pressure relief are:

a. Two RCS relief valves, as follows:

1. Two OPERABLE PORVs; or

A PORV is OPERABLE for COMS when its block valve is open, its lift setpoint is set to the limit required by the PTLR and testing proves its ability to open at this setpoint, and motive power is available to the two valves and their control circuits.

2. One OPERABLE PORV and the OPERABLE RHR suction relief valve; or

The RHR suction relief valve is OPERABLE for COMS when both RHR suction isolation valves are open, its setpoint is at or between 436.5 psig and 463.5 psig, and testing has proven its ability to open at this setpoint.

(continued)

BASES

LCO
(continued)

b. A depressurized RCS and an RCS vent.

An RCS vent is OPERABLE when capable of relieving at least 475 gpm water flow.

Each of these methods of overpressure prevention is capable of mitigating the limiting COMS transient.

APPLICABILITY

This LCO is applicable in MODE 4 when any RCS cold leg temperature is at or below 310°F, in MODE 5, and in MODE 6 when the reactor vessel head is on. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above 310°F. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above 310°F.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

The Applicability is modified by a Note stating that accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing temperature, as allowed by the P/T limit curves. This Note permits the accumulator discharge isolation valve Surveillance performed only under these pressure and temperature conditions.

ACTIONS

A.1

With two or more charging pumps capable of injecting into the RCS, RCS overpressurization is possible.

(continued)

BASES

ACTIONS
(continued)

To immediately initiate action to restore restricted coolant input capability to the RCS reflects the urgency of removing the RCS from this condition.

B.1, C.1, and C.2

An unisolated accumulator requires isolation within 1 hour. This is only required when the accumulator pressure is at or more than the maximum RCS pressure for the existing temperature allowed by the P/T limit curves.

If isolation is needed and cannot be accomplished in 1 hour, Required Action C.1 and Required Action C.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to more than 310°F, an accumulator pressure of 661 psig cannot exceed the COMS limits if the accumulators are fully injected. — Depressurizing the accumulators below the COMS limit from the PTLR also gives this protection.

The Completion Times are based on operating experience that these activities can be accomplished in these time periods and on engineering evaluations indicating that an event requiring COMS is not likely in the allowed times.

Required Action B.1 is modified by a Note that permits two pumps capable of RCS injection for a brief period to allow for pump swaps.

D.1

In MODE 4 when any RCS cold leg temperature is at or below 310°F, with one required RCS relief valve inoperable, the RCS relief valve must be restored to OPERABLE status within a Completion Time of 7 days. Two RCS relief valves are required to provide low temperature overpressure mitigation while withstanding a single failure of an active component.

The Completion Time considers the facts that only one of the RCS relief valves is required to mitigate an overpressure transient and that the likelihood of an active failure of the remaining valve path during this time period is very low.

(continued)

BASES

ACTIONS
(continued)

E.1

The consequences of operational events that will overpressurize the RCS are more severe at lower temperature (Ref. 7). Thus, with one of the two RCS relief valves inoperable in MODE 5 or in MODE 6 with the head on, the Completion Time to restore two valves to OPERABLE status is 24 hours.

The Completion Time represents a reasonable time to investigate and repair several types of relief valve failures without exposure to a lengthy period with only one OPERABLE RCS relief valve to protect against overpressure events.

F.1

The RCS must be depressurized and a vent must be established within 8 hours when:

- a. Both required RCS relief valves are inoperable; or
- b. A Required Action and associated Completion Time of Condition A, C, D, or E, is not met; or
- c. The COMS is inoperable for any reason other than Condition A, B, C, D, or E.

This action is needed to protect the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time considers the time required to place the plant in this Condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.1 and SR 3.4.12.2

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, all but one

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.1 and SR 3.4.12.2 (continued)

centrifugal charging pump are verified deactivated with power removed and the accumulator discharge isolation valves are verified closed and locked out.

The Frequency of 12 hours is sufficient, considering other indications and alarms available to the operator in the control room to verify the required status of the equipment.

SR 3.4.12.3

The RCS vent capable of relieving at least 475 gpm water flow is proven OPERABLE by verifying its open condition either:

- a. Once every 12 hours for a valve that cannot be locked.
- b. Once every 31 days for an open line or a valve that is locked, sealed, or secured in position. A removed PORV fits this category.

The passive vent arrangement must only be open to be OPERABLE. This Surveillance is required to be performed if the vent is being used to satisfy the pressure relief requirements of the LCO 3.4.12b.

SR 3.4.12.4

The PORV block valve must be verified open every 72 hours to provide the flow path for each required PORV to perform its function when actuated. The valve must be remotely verified open in the main control room. This Surveillance is performed if the PORV satisfies the LCO.

The block valve is a remotely controlled, motor-operated valve. The power to the valve operator is not required removed, and the manual operator is not required locked in the inactive position. Thus, the block valve can be closed in the event the PORV develops excessive leakage or does not close (sticks open) after relieving an overpressure situation.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.4 (continued)

The 72-hour Frequency is considered adequate in view of other administrative controls, such as valve position indication, available to the operator in the control room that verify the PORV block valve remains open.

SR 3.4.12.5

The required RHR suction relief valve shall be demonstrated OPERABLE by verifying both RHR suction isolation valves are open and by testing it in accordance with the Inservice Testing Program. This Surveillance is only performed if the RHR suction relief valve is being used to satisfy this LCO.

Every 31 days both RHR suction isolation valves are verified locked open, with power to the valve operators removed, to ensure that accidental closure will not occur. The "locked open" valves must be locally verified in the open position with the manual actuator locked in its inactive position. The 31-day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve position.

The ASME Code, Section XI (Ref. 8), test per Inservice Testing Program verifies OPERABILITY by proving proper relief valve mechanical motion and by measuring and, if required, adjusting the lift setpoint.

SR 3.4.12.6

Performance of an ACOT is required within 12 hours after decreasing RCS temperature to $\leq 310^{\circ}\text{F}$ and every 31 days on each required PORV to verify and, as necessary, adjust its lift setpoint. The ACOT will verify the setpoint is within the PTLR allowed maximum limits in the PTLR. PORV actuation could depressurize the RCS and is not required.

The 12-hour Frequency considers the unlikelihood of a low temperature overpressure event during this time.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.12.6 (continued)

A Note has been added indicating that this SR is required to be met 12 hours after decreasing RCS cold leg temperature to $\leq 310^{\circ}\text{F}$. The ACOT cannot be performed until in the COMS MODES when the PORV lift setpoint can be reduced to the COMS setting. The test must be performed within 12 hours after entering the COMS MODES.

SR 3.4.12.7

Performance of a CHANNEL CALIBRATION on each required PORV actuation channel is required every 18 months to adjust the whole channel so that it responds and the valve opens within the required range and accuracy to known input.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix G, "Fracture Toughness Requirements."
 2. Generic Letter 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operation."
 3. ASME Boiler and Pressure Vessel Code, Section III.
 4. Watts Bar FSAR, Section 15.2, "Condition II - Faults of Moderate Frequency."
 5. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
 6. Title 10, Code of Federal Regulations, Part 50, Appendix K, "ECCS Evaluation Models."
 7. Generic Letter 90-06, "Resolution of Generic Issue 70, 'Power-Operated Relief Valve and Block Valve Reliability,' and Generic Issue 94, 'Additional Low-Temperature Overpressure Protection for Light Water Reactors,' pursuant to 10 CFR 50.44(f)."
 8. ASME Boiler and Pressure Vessel Code, Section XI.
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.13 RCS Operational LEAKAGE

BASES

BACKGROUND

Components that contain or transport the coolant to or from the reactor core make up the RCS. Component joints are made by welding, bolting, rolling, or pressure loading, and valves isolate connecting systems from the RCS.

During plant life, the joint and valve interfaces can produce varying amounts of reactor coolant LEAKAGE, through either normal operational wear or mechanical deterioration. The purpose of the RCS Operational LEAKAGE LCO is to limit system operation in the presence of LEAKAGE from these sources to amounts that do not compromise safety. This LCO specifies the types and amounts of LEAKAGE.

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

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting and monitoring reactor coolant LEAKAGE into the containment area is necessary. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE is necessary to provide quantitative information to the operators, allowing them to take corrective action should a leak occur detrimental to the safety of the facility and the public.

A limited amount of leakage inside containment is expected from auxiliary systems that cannot be made 100% leaktight. Leakage from these systems should be detected, located, and isolated from the containment atmosphere, if possible, to not interfere with RCS leakage detection.

This LCO deals with protection of the reactor coolant pressure boundary (RCPB) from degradation and the core from inadequate cooling, in addition to preventing the accident analyses radiation release assumptions from being exceeded. The consequences of violating this LCO include the possibility of a loss-of-coolant accident (LOCA).

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

Except for primary-to-secondary LEAKAGE, the safety analyses do not address operational LEAKAGE. However, other operational LEAKAGE is related to the safety analyses for LOCA; the amount of leakage can affect the probability of such an event. The safety analysis for an event resulting in steam discharge to the atmosphere assumes a 1-gpm primary-to-secondary LEAKAGE as the initial condition.

Primary-to-secondary LEAKAGE is a factor in the dose releases outside containment resulting from a steam line break (SLB) accident. To a lesser extent, other accidents or transients involve secondary steam release to the atmosphere, such as a steam generator tube rupture (SGTR). The leakage contaminates the secondary fluid.

The FSAR (Ref. 3) analysis for SGTR assumes the contaminated secondary fluid is only briefly released via safety valves and the majority is steamed to the condenser. The 1-gpm primary-to-secondary LEAKAGE is relatively inconsequential.

The SLB is more limiting for site radiation releases. The safety analysis for the SLB accident assumes 1-gpm primary-to-secondary LEAKAGE in one generator as an initial condition. The dose consequences resulting from the SLB accident are well within the limits defined in 10 CFR 100 or the staff-approved licensing basis (i.e., a small fraction of these limits).

The RCS operational LEAKAGE satisfies Criterion 2 of the NRC Policy Statement.

LCO

RCS operational LEAKAGE shall be limited to:

a. Pressure Boundary LEAKAGE

No pressure boundary LEAKAGE is allowed, being indicative of material deterioration. LEAKAGE of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher LEAKAGE. Violation of this LCO could result in continued degradation of the RCPB. LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE.

(continued)

BASES

LCO
(continued)

b. Unidentified LEAKAGE

One gallon per minute (gpm) of unidentified LEAKAGE is allowed as a reasonable minimum detectable amount that the containment air monitoring and containment pocket sump level monitoring equipment can detect within a reasonable time period. Violation of this LCO could result in continued degradation of the RCPB, if the LEAKAGE is from the pressure boundary.

c. Identified LEAKAGE

Up to 10 gpm of identified LEAKAGE is considered allowable because LEAKAGE is from known sources that do not interfere with detection of identified LEAKAGE and is well within the capability of the RCS Makeup System. Identified LEAKAGE includes LEAKAGE to the containment from specifically known and located sources, but does not include pressure boundary LEAKAGE or controlled reactor coolant pump (RCP) seal leakoff (a normal function not considered LEAKAGE). Violation of this LCO could result in continued degradation of a component or system.

d. Primary-to-Secondary LEAKAGE through All Steam Generators (SGs)

Total primary-to-secondary LEAKAGE amounting to 1-gpm through all SGs produces acceptable offsite doses in the SLB accident analysis. Violation of this LCO could exceed the offsite dose limits for this accident. Primary-to-secondary LEAKAGE must be included in the total allowable limit for identified LEAKAGE.

e. Primary-to-Secondary LEAKAGE through Any One SG

The 500-gallons-per-day limit on one SG is based on the assumption that a single crack leaking this amount would not propagate to a SGTR under the stress conditions of a LOCA or a main steam line rupture. If leaked through many cracks, the cracks are very small, and the above assumption is conservative.

(continued)

BASES (continued)

APPLICABILITY In MODES 1, 2, 3, and 4, the potential for RCPB LEAKAGE is greatest.

In MODES 5 and 6, LEAKAGE limits are not required because the reactor coolant pressure is far lower, resulting in lower stresses and reduced potentials for LEAKAGE.

LCO 3.4.14, "RCS Pressure Isolation Valve (PIV) Leakage," measures leakage through each individual PIV and can impact this LCO. Of the two PIVs in series in each isolated line, leakage measured through one PIV does not result in RCS LEAKAGE when the other is leak tight. If both valves leak and result in a loss of mass from the RCS, the loss must be included in the allowable identified LEAKAGE.

ACTIONS

A.1

Unidentified LEAKAGE, identified LEAKAGE, or primary-to-secondary LEAKAGE in excess of the LCO limits must be reduced to within limits within 4 hours. This Completion Time allows time to verify leakage rates and either identify unidentified LEAKAGE or reduce LEAKAGE to within limits before the reactor must be shut down. This action is necessary to prevent further deterioration of the RCPB.

B.1 and B.2

If any pressure boundary LEAKAGE exists, or if unidentified LEAKAGE, identified LEAKAGE, or primary-to-secondary LEAKAGE cannot be reduced to within limits within 4 hours, the reactor must be brought to lower pressure conditions to reduce the severity of the LEAKAGE and its potential consequences. It should be noted that LEAKAGE past seals and gaskets are not pressure boundary LEAKAGE. The reactor must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. This action reduces the LEAKAGE and also reduces the factors that tend to degrade the pressure boundary.

The allowed 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. In MODE 5, the pressure stresses

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

acting on the RCPB are much lower, and further deterioration is much less likely.

SURVEILLANCE
REQUIREMENTS

SR 3.4.13.1

Verifying RCS LEAKAGE to be within the LCO limits ensures the integrity of the RCPB is maintained. Pressure boundary LEAKAGE would at first appear as unidentified LEAKAGE and can only be positively identified by inspection. It should be noted that LEAKAGE past seals and gaskets are not pressure boundary LEAKAGE. Unidentified LEAKAGE and identified LEAKAGE are determined by performance of an RCS water inventory balance. Primary-to-secondary LEAKAGE is also measured by performance of an RCS water inventory balance in conjunction with effluent monitoring within the secondary-steam and feedwater systems.

The RCS water inventory balance must be met with the reactor at steady-state operating conditions and near operating pressure. Therefore, this SR is not required to be performed in MODES 3 and 4 until 12 hours of steady-state operation near operating pressure have been established.

Steady-state operation is required to perform a proper inventory balance; calculations during maneuvering are not useful and a Note requires the Surveillance to be met when steady state is established. For RCS operational LEAKAGE determination by water inventory balance, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, makeup and letdown, and RCP seal injection and return flows.

An early warning of pressure boundary LEAKAGE or unidentified LEAKAGE is provided by the automatic systems that monitor the containment atmosphere radioactivity and the containment pocket sump level. It should be noted that LEAKAGE past seals and gaskets are not pressure boundary LEAKAGE. These leakage detection systems are specified in LCO 3.4.15, "RCS Leakage Detection Instrumentation."

The 72 hour Frequency is a reasonable interval to trend LEAKAGE and recognizes the importance of early leakage

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.13.1 (continued)

detection in the prevention of accidents. A Note under the Frequency column states that this SR is required to be met during steady-state operation.

SR 3.4.13.2

This SR provides the means necessary to determine SG OPERABILITY in an operational MODE. The requirement to demonstrate SG tube integrity in accordance with the Steam Generator Tube Surveillance Program emphasizes the importance of SG tube integrity, even though this Surveillance cannot be performed at normal operating conditions.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criteria 30, "Quality of Reactor Coolant Boundary."
 2. Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," May 1973.
 3. Watts Bar FSAR, Section 15.4, "Condition IV - Limiting Faults."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.14 RCS Pressure Isolation Valve (PIV) Leakage

BASES

BACKGROUND

10 CFR 50.2, 10 CFR 50.55a(c), and GDC 55 of 10 CFR 50, Appendix A (Refs. 1, 2, and 3) define RCS PIVs as any two normally closed valves in series within the reactor coolant pressure boundary (RCPB), which separate the high pressure RCS from an attached low pressure system. During their lives, these valves can produce varying amounts of reactor coolant leakage through either normal operational wear or mechanical deterioration. The RCS PIV Leakage LCO allows RCS high pressure operation when leakage through these valves exists in amounts that do not compromise safety.

The PIV leakage limit applies to each individual valve. Leakage through both series PIVs in a line must be included as part of the identified LEAKAGE, governed by LCO 3.4.13, "RCS Operational LEAKAGE." This is true during operation only when the loss of RCS mass through two series valves is determined by a water inventory balance (SR 3.4.13.1). A known component of the identified LEAKAGE before operation begins is the least of the two individual leak rates determined for leaking series PIVs during the required surveillance testing; leakage measured through one PIV in a line is not RCS operational LEAKAGE if the other is leaktight.

Although this specification provides a limit on allowable PIV leakage rate, its main purpose is to prevent overpressure failure of the low pressure portions of connecting systems. The leakage limit is an indication that the PIVs between the RCS and the connecting systems are degraded or degrading. PIV leakage could lead to overpressure of the low pressure piping or components. Failure consequences could be a loss-of-coolant accident (LOCA) outside of containment, an unanalyzed accident, which could degrade the ability for low pressure injection.

The basis for this LCO is the 1975 NRC "Reactor Safety Study" (Ref. 4) that identified potential intersystem LOCAs as a significant contributor to the risk of core melt. A subsequent study (Ref. 5) evaluated various PIV configurations to determine the probability of intersystem LOCAs.

(continued)

BASES

BACKGROUND
(continued)

PIVs are provided to isolate the RCS from the following typically connected systems:

- a. Residual Heat Removal (RHR) System;
- b. Safety Injection System; and
- c. Chemical and Volume Control System.

The PIVs are listed in the FSAR, Section 3.9 (Ref. 6).

Violation of this LCO could result in continued degradation of a PIV, which could lead to overpressurization of a low pressure system and the loss of the integrity of a fission-product barrier.

APPLICABLE
SAFETY ANALYSES

Reference 4 identified potential intersystem LOCAs as a significant contributor to the risk of core melt. The dominant accident sequence in the intersystem LOCA category is the failure of the low pressure portion of the RHR System outside of containment. The accident is the result of a postulated failure of the PIVs, which are part of the RCPB, and the subsequent pressurization of the RHR System downstream of the PIVs from the RCS. Because the low pressure portion of the RHR System is typically designed for 600 psig, overpressurization failure of the RHR low pressure line would result in a LOCA outside containment and subsequent risk of core melt.

Reference 5 evaluated various PIV configurations, leakage testing of the valves, and operational changes to determine the effect on the probability of intersystem LOCAs. This study concluded that periodic leakage testing of the PIVs can substantially reduce the probability of an intersystem LOCA.

RCS PIV leakage satisfies Criterion 2 of the NRC Policy Statement.

LCO

RCS PIV leakage is identified LEAKAGE into closed systems connected to the RCS. Isolation valve leakage is usually on the order of drops per minute. Leakage that increases

(continued)

BASES

LCO
(continued)

significantly suggests that something is operationally wrong and corrective action must be taken.

The LCO PIV leakage limit is 0.5 gpm per nominal inch of valve size with a maximum limit of 5 gpm. The previous criterion of 1 gpm for all valve sizes imposed an unjustified penalty on the larger valves without providing information on potential valve degradation and resulted in higher personnel radiation exposures. A study concluded a leakage rate limit based on valve size was superior to a single allowable value.

Reference 7 permits leakage testing at a lower pressure differential than between the specified maximum RCS pressure and the normal pressure of the connected system during RCS operation (the maximum pressure differential) in those types of valves in which the higher service pressure will tend to diminish the overall leakage channel opening. In such cases, the observed rate may be adjusted to the maximum pressure differential by assuming leakage is directly proportional to the pressure differential to the one-half power.

APPLICABILITY

In MODES 1, 2, 3, and 4, this LCO applies because the PIV leakage potential is greatest when the RCS is pressurized.

In MODES 5 and 6, leakage limits are not provided because the lower reactor coolant pressure results in a reduced potential for leakage and for a LOCA outside the containment.

ACTIONS

The Actions are modified by three Notes. Note 1 provides clarification that each flow path allows separate entry into a Condition. This is allowed based upon the functional independence of the flow path. Note 2 requires an evaluation of affected systems if a PIV is inoperable. The leakage may have affected system operability or isolation of a leaking flow path with an alternate valve may have degraded the ability of the interconnected system to perform its safety function. Note 3 allows unisolating flow paths which have been isolated in accordance with the ACTIONS.

(continued)

BASES

ACTIONS
(continued)

This may be necessary to place systems in service to support necessary operations, such as unisolating RHR and placing decay heat removal system in service to support operation in MODE 4. The administrative controls assure the system's flowpath is not unisolated unless the RCS pressure is below the design pressure of the system.

A.1 and A.2

The flow path must be isolated. Required Actions A.1 and A.2 are modified by a Note that the valve used for isolation must meet the same leakage requirements as the PIVs and must be in the RCPB.

Required Action A.1 requires that the isolation with one valve must be performed within 4 hours. Four hours provides time to reduce leakage in excess of the allowable limit and to isolate the affected system if leakage cannot be reduced. The 4 hours allows the actions and restricts the operation with leaking isolation valves.

The 72 hour Completion Time after exceeding the limit allows for the restoration of the leaking PIV to OPERABLE status. This timeframe considers the time required to complete this Action and the low probability of a second valve failing during this period.

B.1 and B.2

If leakage cannot be reduced with the system isolated, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to MODE 3 within 6 hours and MODE 5 within 36 hours. This Action may reduce the leakage and also reduces the potential for a LOCA outside the containment. The allowed 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.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.4.14.1

Performance of leakage testing on each RCS PIV or isolation valve used to satisfy Required Action A.1 and Required Action A.2 is required to verify that leakage is below the specified limit and to identify each leaking valve. The leakage limit of 0.5 gpm per inch of nominal valve diameter up to 5 gpm maximum applies to each valve. Leakage testing requires a stable pressure condition.

For the two PIVs in series, the leakage requirement applies to each valve individually and not to the combined leakage across both valves. If the PIVs are not individually leakage tested, one valve may have failed completely and not be detected if the other valve in series meets the leakage requirement. In this situation, the protection provided by redundant valves would be lost.

Testing is to be performed every 18 months, a typical refueling cycle, if the plant does not go into MODE 5 for at least 7 days. The 18 month Frequency is required in 10 CFR 50.55a(g) (Ref. 8) as contained in the Inservice Inspection Program, is within the American Society of Mechanical Engineers (ASME) Code, Section XI (Ref. 9), and is based on the need to perform such surveillances under the conditions that apply during an outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power.

In addition, testing must be performed once after the valve has been opened by flow or exercised to ensure tight reseating. PIVs disturbed in the performance of this Surveillance should also be tested unless documentation shows that an infinite testing loop cannot practically be avoided. Testing must be performed within 24 hours after the valve has been resealed. Within 24 hours is a reasonable and practical time limit for performing this test after opening or resealing a valve.

The leakage limit is to be met at the RCS pressure associated with MODES 1 and 2. This permits leakage testing at high differential pressures with stable conditions not possible in the MODES with lower pressures.

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.14.1 (continued)

Entry into MODES 3 and 4 is allowed to establish the necessary differential pressures and stable conditions to allow for performance of this Surveillance. The Note that allows this provision is complementary to the Frequency of prior to entry into MODE 2 whenever the unit has been in MODE 5 for 7 days or more, if leakage testing has not been performed in the previous 9 months. In addition, this Surveillance is not required to be performed on the RHR System when the RHR System is aligned to the RCS in the shutdown cooling mode of operation. PIVs contained in the RHR shutdown cooling flow path must be leakage rate tested after RHR is secured and stable unit conditions and the necessary differential pressures are established.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Section 50.2, "Definitions—Reactor Coolant Pressure Boundary."
2. Title 10, Code of Federal Regulations, Part 50, Section 50.55a, "Codes and Standards," Subsection (c), "Reactor Coolant Pressure Boundary."
3. Title 10, Code of Federal Regulations, Part 50, Appendix A, Section V, "Reactor Containment," General Design Criterion 55, "Reactor Coolant Pressure Boundary Penetrating Containment."
4. U.S. Nuclear Regulatory Commission (NRC), "Reactor Safety Study—An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," Appendix V, WASH-1400 (NUREG-75/014), October 1975.
5. U.S. NRC, "The Probability of Intersystem LOCA: Impact Due to Leak Testing and Operational Changes," NUREG-0677, May 1980.
6. Watts Bar FSAR, Section 3.9, "Mechanical Systems and Components" (Table 3.9-17).
7. ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWV, "Inservice Testing of Valves in Nuclear Power Plants," paragraph IWV-3423(e).

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BASES

REFERENCES
(continued)

8. Title 10, Code of Federal Regulations, Part 50, Section 50.55a, "Codes and Standards," Subsection (g), "Inservice Inspection Requirements."
 9. ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWV, "Inservice Testing of Valves in Nuclear Power Plants," Paragraph IWV-3422.
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.15 RCS Leakage Detection Instrumentation

BASES

BACKGROUND

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

Leakage detection systems must have the capability to detect significant reactor coolant pressure boundary (RCPB) degradation as soon after occurrence as practical to minimize the potential for propagation to a gross failure. Thus, an early indication or warning signal is necessary to permit proper evaluation of all unidentified LEAKAGE.

Industry practice has shown that water flow changes of 0.5 to 1.0 gpm can be readily detected in contained volumes by monitoring changes in water level, in flow rate, or in the operating frequency of a pump. The containment pocket sump used to collect unidentified LEAKAGE is instrumented to alarm for increases of 0.5 to 1.0 gpm in the normal flow rates. This sensitivity is acceptable for detecting increases in unidentified LEAKAGE.

The reactor coolant contains radioactivity that, when released to the containment, can be detected by radiation monitoring instrumentation. Reactor coolant radioactivity levels will be low during initial reactor startup and for a few weeks thereafter, until activated corrosion products have been formed and fission products appear from fuel-element-cladding contamination or cladding defects. Instrument sensitivities of 10^{-9} $\mu\text{Ci/cc}$ radioactivity for particulate monitoring and of 10^{-6} $\mu\text{Ci/cc}$ radioactivity for gaseous monitoring are practical for these leakage detection systems. Radioactivity detection systems are included for monitoring both particulate and gaseous activities because of their sensitivities and rapid responses to RCS LEAKAGE.

APPLICABLE
SAFETY ANALYSES

The need to evaluate the severity of an alarm or an indication is important to the operators, and the ability to compare and verify with indications from other systems is

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

necessary. The system response times and sensitivities are described in the FSAR (Ref. 3).

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting, as well as monitoring, RCS LEAKAGE into the containment area are necessary. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE provides quantitative information to the operators, allowing them to take corrective action should a leak detrimental to the safety of the unit and the public occur.

RCS leakage detection instrumentation satisfies Criterion 1 of the NRC Policy Statement.

LCO

One method of protecting against large RCS leakage derives from the ability of instruments to rapidly detect extremely small leaks. This LCO requires instruments of diverse monitoring principles to be OPERABLE to provide a high degree of confidence that extremely small leaks are detected in time to allow actions to place the plant in a safe condition when RCS LEAKAGE indicates possible RCPB degradation.

The LCO is satisfied when monitors of diverse measurement means are available. Thus, the containment pocket sump level monitor, in combination with a gaseous and particulate radioactivity monitor, provides an acceptable minimum.

APPLICABILITY

Because of elevated RCS temperature and pressure in MODES 1, 2, 3, and 4, RCS leakage detection instrumentation is required to be OPERABLE.

In MODE 5 or 6, the temperature is to be $\leq 200^{\circ}\text{F}$ and pressure is maintained low or at atmospheric pressure. Since the temperatures and pressures are far lower than those for MODES 1, 2, 3, and 4, the likelihood of leakage and crack propagation are much smaller. Therefore, the requirements of this LCO are not applicable in MODES 5 and 6.

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BASES (continued)

ACTIONS

A.1 and A.2

With the required containment pocket sump level monitor inoperable, no form of grab sampling can provide the equivalent information; however, the containment atmosphere radioactivity monitor will provide indications of changes in leakage. Together with the atmosphere monitor, the periodic surveillance for RCS water inventory balance, SR 3.4.13.1, must be performed at an increased frequency of 24 hours to provide information that is adequate to detect leakage.

Restoration of the sump monitor to OPERABLE status in a Completion Time of 30 days is required to regain the function after the monitor's failure. This time is acceptable, considering the Frequency and adequacy of the RCS water inventory balance required by Required Action A.1.

Required Action A.1 is modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when the containment sump monitor is inoperable. This allowance is provided because other instrumentation is available to monitor RCS leakage.

B.1.1, B.1.2, and B.2

With both gaseous and particulate containment atmosphere radioactivity-monitoring instrumentation channels inoperable, alternative action is required. Either grab samples of the containment atmosphere must be taken and analyzed or water inventory balances, in accordance with SR 3.4.13.1, must be performed to provide alternate periodic information. With a sample obtained and analyzed or water inventory balance performed every 24 hours, the reactor may be operated for up to 30 days to allow restoration of at least one of the radioactivity monitors.

The 24 hour interval provides periodic information that is adequate to detect leakage. The 30 day Completion Time recognizes at least one other form of leakage detection is available.

(continued)

BASES

ACTIONS

B.1.1, B.1.2, and B.2 (continued)

Required Action B.1 and Required Action B.2 are modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when the gaseous and particulate containment atmosphere radioactivity monitor channel is inoperable. This allowance is provided because other instrumentation is available to monitor for RCS LEAKAGE.

C.1 and C.2

If a Required Action of Condition A or B cannot be met, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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.

D.1

With all required monitors inoperable, no automatic means of monitoring leakage are available, and immediate plant shutdown in accordance with LCO 3.0.3 is required.

SURVEILLANCE
REQUIREMENTS

SR 3.4.15.1

SR 3.4.15.1 requires the performance of a CHANNEL CHECK of the containment atmosphere radioactivity monitor. The check gives reasonable confidence that the channel is operating properly. The Frequency of 12 hours is based on instrument reliability and is reasonable for detecting off-normal conditions.

SR 3.4.15.2

SR 3.4.15.2 requires the performance of a COT on the required containment atmosphere radioactivity monitor. The test ensures that the monitor can perform its function in

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.15.2 (continued)

the desired manner. The test verifies the alarm setpoint and relative accuracy of the instrument string. The Frequency of 92 days considers instrument reliability, and operating experience has shown that it is proper for detecting degradation.

SR 3.4.15.3 and SR 3.4.15.4

These SRs require the performance of a CHANNEL CALIBRATION for each of the RCS leakage detection instrumentation channels. The calibration verifies the accuracy of the instrument string, including the instruments located inside containment. The Frequency of 18 months is a typical refueling cycle and considers channel reliability. Again, operating experience has proven that this Frequency is acceptable.

REFERENCES

1. 10 CFR 50, Appendix A, General Design Criterion 30, "Quality of Reactor Coolant Pressure Boundary."
 2. Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems," U.S. Nuclear Regulatory Commission.
 3. Watts Bar FSAR, Section 5.2.7, "RCPB Leakage Detection Systems."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 RCS Specific Activity

BASES

BACKGROUND

The maximum dose to the whole body and the thyroid an individual at the site boundary can receive for 2 hours during an accident is specified in 10 CFR 100 (Ref. 1). The limits on specific activity ensure that the doses are held to a small fraction of the 10 CFR 100 limits during analyzed transients and accidents.

The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite radioactivity dose consequences in the event of a steam generator tube rupture (SGTR) accident.

The LCO contains specific activity limits for both DOSE EQUIVALENT I-131 and gross specific activity. The allowable levels are intended to limit the 2 hour dose at the site boundary to a small fraction of the 10 CFR 100 dose guideline limits. The limits in the LCO are standardized, based on parametric evaluations of offsite radioactivity dose consequences for typical site locations.

The parametric evaluations showed the potential offsite dose levels for a SGTR accident were an appropriately small fraction of the 10 CFR 100 dose guideline limits. Each evaluation assumes a broad range of site applicable atmospheric dispersion factors in a parametric evaluation.

APPLICABLE
SAFETY ANALYSES

The LCO limits on the specific activity of the reactor coolant ensures that the resulting 2 hour doses at the site boundary will not exceed a small fraction of the 10 CFR 100 dose guideline limits following a SGTR accident. The SGTR safety analysis (Ref. 2) assumes the specific activity of the reactor coolant at the LCO limit and an existing reactor coolant steam generator (SG) tube leakage rate of 1 gpm. The safety analysis assumes the specific activity of the secondary coolant at its limit of 0.1 $\mu\text{Ci/gm}$ DOSE EQUIVALENT I-131 from LCO 3.7.14, "Secondary Specific Activity."

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The analysis for the SGTR accident establishes the acceptance limits for RCS specific activity. Reference to this analysis is used to assess changes to the unit that could affect RCS specific activity, as they relate to the acceptance limits.

The analysis is for two cases of reactor coolant specific activity. One case assumes specific activity at 1.0 $\mu\text{Ci/gm}$ DOSE EQUIVALENT I-131 with a concurrent large iodine spike that increases the I-131 activity in the reactor coolant by a factor of about 50 immediately after the accident. The second case assumes the initial reactor coolant iodine activity at 60.0 $\mu\text{Ci/gm}$ DOSE EQUIVALENT I-131 due to a preaccident iodine spike caused by an RCS transient. In both cases, the noble gas activity in the reactor coolant assumes 1% failed fuel, which approximates the LCO limit of 100/E $\mu\text{Ci/gm}$ for gross specific activity.

The analysis also assumes a loss of offsite power at the same time as the SGTR event. The SGTR causes a reduction in reactor coolant inventory. The reduction initiates a reactor trip from a low pressurizer pressure signal or an RCS overtemperature ΔT signal.

The coincident loss of offsite power causes the steam dump valves to close to protect the condenser. The rise in pressure in the ruptured SG discharges radioactively contaminated steam to the atmosphere through the SG power-operated relief valves and the main steam safety valves. The unaffected SGs remove core decay heat by venting steam to the atmosphere until the cooldown ends.

The safety analysis shows the radiological consequences of a SGTR accident are within a small fraction of the Reference 1 dose guideline limits. Operation with iodine-specific activity levels greater than the LCO limit is permissible, if the activity levels do not exceed the limits shown in Figure 3.4.16-1, in the applicable specification, for more than 48 hours. The safety analysis has concurrent and preaccident iodine spiking levels up to 60.0 $\mu\text{Ci/g}$ DOSE EQUIVALENT I-131.

The remainder of the above-limit permissible iodine levels shown in Figure 3.4.16-1 are acceptable because of the low

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

probability of a SGTR accident occurring during the established 48 hour time limit. The occurrence of a SGTR accident at these permissible levels could increase the site boundary dose levels, but still be within 10 CFR 100 dose guideline limits.

The limits on RCS specific activity are also used for establishing standardization in radiation shielding and plant personnel radiation protection practices.

RCS specific activity satisfies Criterion 2 of the NRC Policy Statement.

LCO

The specific iodine activity is limited to 1.0 $\mu\text{Ci/gm}$ DOSE EQUIVALENT I-131, and the gross specific activity in the reactor coolant is limited to the number of $\mu\text{Ci/gm}$ equal to 100 divided by \bar{E} (average disintegration energy of the sum of the average beta and gamma energies of the coolant nuclides). The limit on DOSE EQUIVALENT I-131 ensures the 2 hour thyroid dose to an individual at the site boundary during the Design Basis Accident (DBA) will be a small fraction of the allowed thyroid dose. The limit on gross specific activity ensures the 2 hour whole body dose to an individual at the site boundary during the DBA will be a small fraction of the allowed whole body dose.

The SGTR accident analysis (Ref. 2) shows that the 2 hour site boundary dose levels are within acceptable limits. Violation of the LCO may result in reactor coolant radioactivity levels that could, in the event of a SGTR, lead to site boundary doses that exceed the 10 CFR 100 dose guideline limits.

APPLICABILITY

In MODES 1 and 2, and in MODE 3 with RCS average temperature $\geq 500^\circ\text{F}$, operation within the LCO limits for DOSE EQUIVALENT I-131 and gross specific activity are necessary to contain the potential consequences of a SGTR to within the acceptable site boundary dose values.

For operation in MODE 3 with RCS average temperature $< 500^\circ\text{F}$, and in MODES 4 and 5, the release of radioactivity in the event of a SGTR is unlikely since the saturation

(continued)

BASES

APPLICABILITY (continued) pressure of the reactor coolant is below the lift pressure settings of the main steam safety valves.

ACTIONS

A.1 and A.2

With the DOSE EQUIVALENT I-131 greater than the LCO limit, samples at intervals of 4 hours must be taken to demonstrate that the limits of Figure 3.4.16-1 are not exceeded. The Completion Time of 4 hours is required to obtain and analyze a sample. Sampling is to continue to provide a trend.

The DOSE EQUIVALENT I-131 must be restored to within limits within 48 hours. The Completion Time of 48 hours is allowed, since the limit violation may have resulted from normal iodine spiking.

B.1 and B.2

With the gross specific activity in excess of the allowed limit, an analysis must be performed within 4 hours to determine DOSE EQUIVALENT I-131. The Completion Time of 4 hours is required to obtain and analyze a sample.

The change within 6 hours to MODE 3 and RCS average temperature < 500°F lowers the saturation pressure of the reactor coolant below the setpoints of the main steam safety valves and prevents venting the SG to the environment in an SGTR event. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 below 500°F from full power conditions in an orderly manner and without challenging plant systems.

C.1

If a Required Action and the associated Completion Time of Condition A are not met or if the DOSE EQUIVALENT I-131 is in the unacceptable region of Figure 3.4.16-1, the reactor must be brought to MODE 3 with RCS average temperature < 500°F within 6 hours. The Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 below 500°F from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.4.16.1

The Surveillance requires performing a gamma-isotopic analysis as a measure of the gross specific activity of the reactor coolant at least once every 7 days. While basically a quantitative measure of radionuclides with half lives longer than 15 minutes, excluding iodines, this measurement is the sum of the degassed gamma activities and the gaseous gamma activities in the sample taken. This Surveillance provides an indication of any increase in gross specific activity.

Trending the results of this Surveillance allows proper remedial action to be taken before reaching the LCO limit under normal operating conditions. The Surveillance is applicable in MODES 1 and 2, and in MODE 3 with T_{avg} at least 500°F. The 7 day Frequency considers the unlikelihood of a gross fuel failure during the time.

SR 3.4.16.2

This Surveillance is performed in MODE 1 only to ensure iodine remains within limit during normal operation and following fast power changes when fuel failure is more apt to occur. The 14 day Frequency is adequate to trend changes in the iodine-activity level, considering gross activity is monitored every 7 days. The Frequency, between 2 and 6 hours after a power change $\geq 15\%$ RTP within a 1 hour period, is established because the iodine levels peak during this time following fuel failure; samples at other times would provide inaccurate results.

SR 3.4.16.3

A radiochemical analysis for \bar{E} determination is required every 184 days (6 months) with the plant operating in MODE 1 equilibrium conditions. The \bar{E} determination directly relates to the LCO and is required to verify plant operation within the specified gross activity LCO limit. The analysis for \bar{E} is a measurement of the average energies per disintegration for isotopes with half lives longer than 15 minutes, excluding iodines. The Frequency of 184 days recognizes \bar{E} does not change rapidly.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.4.16.3 (continued)

This SR has been modified by a Note that indicates sampling is required to be performed within 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for at least 48 hours. This ensures that the radioactive materials are at equilibrium so the analysis for E is representative and not skewed by a crud burst or other similar abnormal event.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance," 1973.
 2. Watts Bar FSAR, Section 15.4, "Condition IV -- Limiting Faults."
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B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.17 RCS Loops - Test Exceptions

BASES

BACKGROUND

The primary purpose of this test exception is to provide an exception to LCO 3.4.4, "RCS Loops - MODES 1 and 2," to permit reactor criticality under no flow conditions during certain PHYSICS TESTS (natural circulation demonstration, station blackout, and loss of offsite power) to be performed while at low THERMAL POWER levels. Section XI of 10 CFR Part 50, Appendix B (Ref. 1), requires that a test program be established to ensure that structures, systems, and components will perform satisfactorily in service. All functions necessary to ensure that the specified design conditions are not exceeded during normal operation and anticipated operational occurrences must be tested. This testing is an integral part of the design, construction, and operation of the power plant as specified in GDC 1, Quality Standards and Records (Ref. 2).

The key objectives of a test program are to provide assurance that the facility has been adequately designed to validate the analytical models used in the design and analysis, to verify the assumptions used to predict plant response, to provide assurance that installation of equipment at the unit has been accomplished in accordance with the design, and to verify that the operating and emergency procedures are adequate. Testing is performed prior to initial criticality, during startup, and following low power operations.

The tests will include verifying the ability to establish and maintain natural circulation following a plant trip between 10% and 20% RTP, performing natural circulation cooldown on emergency power, and during the cooldown, showing that adequate boron mixture occurs and that pressure can be controlled using auxiliary spray and pressurizer heaters powered from the emergency power sources.

APPLICABLE
SAFETY ANALYSES

The tests described above require operating the plant without forced convection flow and as such are not bounded by any safety analyses. However, operating experience has

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

demonstrated this exception to be safe under the present applicability.

The RCS loops—test exceptions satisfies Criterion 3 of the NRC Policy Statement.

LCO

This LCO provides an exemption to the requirements of LCO 3.4.4, "RCS Loops—MODES 1 and 2."

The LCO is provided to allow for the performance of PHYSICS TESTS in MODE 2 (after a refueling), where the core cooling requirements are significantly different than after the core has been operating. Without the LCO, plant operations would be held bound to the normal operating LCOs for reactor coolant loops and circulation (MODES 1 and 2), and the appropriate tests could not be performed.

In MODE 2, where core power level is considerably lower and the associated PHYSICS TESTS must be performed, operation is allowed under no flow conditions provided THERMAL POWER \leq P-7 and the reactor trip setpoints of the OPERABLE power level channels are set \leq 25% RTP. This ensures, if some problem caused the plant to enter MODE 1 and start increasing plant power, the Reactor Trip System (RTS) would automatically shut it down before power became too high, and thereby prevent violation of fuel design limits.

The exemption is allowed even though there are no bounding safety analyses. However, these tests are performed under close supervision during the test program and provide valuable information on the plant's capability to cool down without offsite power available to the reactor coolant pumps.

APPLICABILITY

This LCO is applicable when performing low power PHYSICS TESTS without any forced convection flow. This testing is performed to establish that heat input from nuclear heat does not exceed the natural circulation heat removal capabilities. Therefore, no safety or fuel design limits will be violated as a result of the associated tests.

(continued)

BASES (continued)

ACTIONS

A.1

When THERMAL POWER is \geq the P-7 interlock setpoint 10%, the only acceptable action is to ensure the reactor trip breakers are opened immediately in accordance with Required Action A.1 to prevent operation of the fuel beyond its design limits. Opening the reactor trip breakers will shutdown the reactor and prevent operation of the fuel outside of its design limits.

SURVEILLANCE
REQUIREMENTS

SR 3.4.17.1

Verification that the power level is $<$ the P-7 interlock setpoint (10%) will ensure that the fuel design criteria are not violated during the performance of the PHYSICS TESTS. The Frequency of once per hour is adequate to ensure that the power level does not exceed the limit. Plant operations are conducted slowly during the performance of PHYSICS TESTS and monitoring the power level once per hour is sufficient to ensure that the power level does not exceed the limit.

SR 3.4.17.2

The power range and intermediate range neutron detectors and the P-7 interlock setpoint must be verified to be OPERABLE and adjusted to the proper value. An ACOT is performed within 12 hours prior to initiation of the PHYSICS TESTS. This will ensure that the RTS is properly aligned to provide the required degree of core protection during the performance of the PHYSICS TESTS. The time limit of 12 hours is sufficient to ensure that the instrumentation is OPERABLE shortly before initiating PHYSICS TESTS.

REFERENCES

1. Title 10 Code of Federal Regulations, Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plant and Fuel Reprocessing Plants."
 2. Title 10 Code of Federal Regulations, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," 1988.
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B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.1 Accumulators

BASES

BACKGROUND

The functions of the ECCS accumulators are to supply water to the reactor vessel during the blowdown phase of a loss-of-coolant accident (LOCA), to provide inventory to help accomplish the refill phase that follows thereafter, and to provide Reactor Coolant System (RCS) makeup for a small-break LOCA.

The blowdown phase of a large-break LOCA is the initial period of the transient during which the RCS departs from equilibrium conditions, and heat from fission-product decay, hot internals, and the vessel continues to be transferred to the reactor coolant. The blowdown phase of the transient ends when the RCS pressure falls to a value approaching that of the containment atmosphere.

In the refill phase of a LOCA, which immediately follows the blowdown phase, reactor coolant inventory has vacated the core through steam flashing and ejection out through the break. The core is essentially in adiabatic heatup. The balance of accumulator inventory is then available to help fill voids in the lower plenum and reactor vessel downcomer so as to establish a recovery level at the bottom of the core and ongoing re-flood of the core with the addition of safety injection (SI) water.

The accumulators are pressure vessels partially filled with borated water and pressurized with nitrogen gas. The accumulators are passive components, since no operator or control actions are required in order for them to perform their function. Internal accumulator tank pressure is sufficient to discharge the accumulator contents to the RCS, if RCS pressure decreases below the accumulator pressure.

Each accumulator is piped into an RCS cold leg via an accumulator line and is isolated from the RCS by a motor-operated isolation valve and two check valves in series. The motor-operated isolation valves are interlocked by P-11 with the pressurizer pressure measurement channels to ensure that the valves will automatically open as RCS pressure increases to above the permissive circuit P-11 setpoint.

(continued)

BASES

BACKGROUND
(continued)

This interlock also prevents inadvertent closure of the valves during normal operation prior to an accident. The valves will automatically open, however, as a result of an SI signal. These features ensure that the valves meet the requirements of the Institute of Electrical and Electronic Engineers (IEEE) Standard 279-1971 (Ref. 1) for "operating bypasses" and that the accumulators will be available for injection without reliance on operator action.

The accumulator size, water volume, and nitrogen cover pressure are selected so that three of the four accumulators are sufficient to partially cover the core before significant clad melting or zirconium-water reaction can occur following a LOCA. The need to ensure that three accumulators are adequate for this function is consistent with the LOCA assumption that the entire contents of one accumulator will be lost via the RCS pipe break during the blowdown phase of the LOCA.

APPLICABLE
SAFETY ANALYSES

The accumulators are assumed OPERABLE in both the large- and small-break LOCA analyses at full power (Ref. 2). These are the Design Basis Accidents (DBAs) that establish the acceptance limits for the accumulators. Reference to the analyses for these DBAs is used to assess changes in the accumulators as they relate to the acceptance limits.

In performing the LOCA calculations, conservative assumptions are made concerning the availability of ECCS flow. In the early stages of a LOCA, with or without a loss of offsite power, the accumulators provide the sole source of makeup water to the RCS. The assumption of loss of offsite power is required by regulations and conservatively imposes a delay wherein the ECCS pumps cannot deliver flow until the emergency diesel generators start, come to rated speed, and go through their timed loading sequence. In cold leg break scenarios, the entire contents of one accumulator are assumed to be lost through the break.

The limiting large-break LOCA is a double-ended guillotine break at the discharge of the reactor coolant pump. During this event, the accumulators discharge to the RCS as soon as RCS pressure decreases to below accumulator pressure.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

As a conservative estimate, no credit is taken for ECCS pump flow until an effective delay has elapsed. This delay accounts for the diesels starting and the pumps being loaded and delivering full flow. The delay time is conservatively set with an additional 2 seconds to account for SI signal generation. During this time, the accumulators are analyzed as providing the sole source of emergency core cooling. No operator action is assumed during the blowdown stage of a large-break LOCA.

The worst-case small-break LOCA analyses also assume a time delay before pumped flow reaches the core. For the larger range of small breaks, the rate of blowdown is such that the increase in fuel clad temperature is terminated solely by the accumulators, with pumped flow then providing continued cooling. As break size decreases, the accumulators and centrifugal charging pumps both play a part in terminating the rise in clad temperature. As break size continues to decrease, the role of the accumulators continues to decrease until they are not required and the centrifugal charging pumps become solely responsible for terminating the temperature increase.

This LCO helps to ensure that the following acceptance criteria established for the ECCS by 10 CFR 50.46 (Ref. 3) will be met following a LOCA:

- a. Maximum fuel element cladding temperature is $\leq 2200^{\circ}\text{F}$;
- b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;
- c. Maximum hydrogen generation from a zirconium-water reaction is ≤ 0.01 times the hypothetical amount that would be generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react; and
- d. Core is maintained in a coolable geometry;

Since the accumulators discharge during the blowdown phase of a LOCA, they do not contribute to the long-term cooling requirements of 10 CFR 50.46.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

For both the large- and small-break LOCA analyses, a nominal contained accumulator water volume is used. The contained water volume is the same as the deliverable volume for the accumulators, since the accumulators are emptied, once discharged. For small breaks, an increase in water volume is a peak clad temperature penalty. For large breaks, an increase in water volume can be either a peak clad temperature penalty or benefit, depending on downcomer filling and subsequent spill through the break during the core re-flooding portion of the transient. The analysis makes a conservative assumption with respect to ignoring or taking credit for line water volume from the accumulator to the check valve. The safety analysis assumes values of 7627 gallons and 8082 gallons. To allow for instrument inaccuracy, values of 7717 gallons and 7961 gallons are specified.

The minimum boron concentration setpoint is used in the post-LOCA boron concentration calculation. The calculation is performed to assure reactor subcriticality in a post-LOCA environment. Of particular interest is the large-break LOCA, since no credit is taken for control rod assembly insertion. A reduction in the accumulator minimum boron concentration would produce a subsequent reduction in the available containment sump concentration for post-LOCA shutdown and an increase in the maximum sump pH. The maximum boron concentration is used in determining the cold leg to hot leg recirculation injection switchover time and minimum sump pH.

The large- and small-break LOCA analyses are performed at the minimum nitrogen cover pressure, since sensitivity analyses have demonstrated that higher nitrogen cover pressure results in a computed peak clad temperature benefit. The maximum nitrogen cover pressure limit prevents accumulator relief valve actuation, and ultimately preserves accumulator integrity. The LOCA analysis assumes a value of 585 psig. To account for the accumulator tank design pressure rating, and to allow for instrument accuracy, values of ≥ 602 psig and ≤ 661 psig are specified.

The effects on containment mass and energy releases from the accumulators are accounted for in the appropriate analyses (Refs. 2 and 4).

The accumulators satisfy Criterion 3 of the NRC Policy Statement.

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BASES (continued)

LCO

The LCO establishes the minimum conditions required to ensure that the accumulators are available to accomplish their core cooling safety function following a LOCA. Four accumulators are required to ensure that 100% of the contents of three of the accumulators will reach the core during a LOCA. This is consistent with the assumption that the contents of one accumulator spills through the break. If fewer than three accumulators are injected during the blowdown phase of a LOCA, the ECCS acceptance criteria of 10 CFR 50.46 (Ref. 3) could be violated.

For an accumulator to be considered OPERABLE, the isolation valve must be fully open with power removed, and the limits established in the SRs for contained volume, boron concentration, and nitrogen cover pressure must be met.

APPLICABILITY

In MODES 1 and 2, and in MODE 3 with RCS pressure > 1000 psig, the accumulator OPERABILITY requirements are based on full power operation. Although cooling requirements decrease as power decreases, the accumulators are still required to provide core cooling as long as elevated RCS pressures and temperatures exist.

This LCO is only applicable at pressures > 1000 psig. At pressures \leq 1000 psig, the rate of RCS blowdown is such that the ECCS pumps can provide adequate injection to ensure that peak clad temperature remains below the 10 CFR 50.46 (Ref. 3) limit of 2200°F.

In MODE 3, with RCS pressure \leq 1000 psig, and in MODES 4, 5, and 6, the accumulator motor-operated isolation valves are closed to isolate the accumulators from the RCS. This allows RCS cooldown and depressurization without discharging the accumulators into the RCS or requiring depressurization of the accumulators.

ACTIONS

A.1

If the boron concentration of one accumulator is not within limits, it must be returned to within the limits within 72 hours. In this Condition, ability to maintain subcriticality or minimum boron precipitation time may be

(continued)

BASES

ACTIONS

A.1 (continued)

reduced. The boron in the accumulators contributes to the assumption that the combined ECCS water in the partially re-covered core during the early re-flooding phase of a large-break LOCA is sufficient to keep that portion of the core subcritical. One accumulator below the minimum boron concentration limit, however, will have no effect on available ECCS water and an insignificant effect on core subcriticality during re-flood. Boiling of ECCS water in the core during re-flood concentrates boron in the saturated liquid that remains in the core. In addition, current analysis techniques demonstrate that the accumulators do not discharge following a large main steam line break for the majority of plants. Even if they do discharge, their impact is minor and not a design limiting event. Thus, 72 hours is allowed to return the boron concentration to within limits.

B.1

If one accumulator is inoperable for a reason other than boron concentration, the accumulator must be returned to OPERABLE status within 1 hour. In this Condition, the required contents of three accumulators cannot be assumed to reach the core during a LOCA. Due to the severity of the consequences should a LOCA occur in these conditions, the 1-hour Completion Time to open the valve, remove power to the valve, or restore the proper water volume or nitrogen cover pressure ensures that prompt action will be taken to return the inoperable accumulator to OPERABLE status. The Completion Time minimizes the potential for exposure of the plant to a LOCA under these conditions.

C.1 and C.2

If the accumulator cannot be returned to OPERABLE status within the associated Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to MODE 3 within 6 hours and pressurizer pressure reduced to ≤ 1000 psig within 12 hours. The allowed Completion Times

(continued)

BASES

ACTIONS

C.1 (continued)

are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

D.1

If more than one accumulator is inoperable, the plant is in a condition outside the accident analyses; therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE
REQUIREMENTS

SR 3.5.1.1

Each accumulator valve should be verified to be fully open every 12 hours. This verification ensures that the accumulators are available for injection and ensures timely discovery if a valve should be less than fully open. If an isolation valve is not fully open, the rate of injection to the RCS would be reduced. Although a motor-operated valve position should not change with power removed, a closed valve could result in not meeting accident analyses assumptions. This Frequency is considered reasonable in view of other administrative controls that ensure a mispositioned isolation valve is unlikely.

SR 3.5.1.2 and SR 3.5.1.3

Every 12 hours, borated water volume and nitrogen cover pressure are verified for each accumulator. This Frequency is sufficient to ensure adequate injection during a LOCA. Because of the static design of the accumulator, a 12-hour Frequency usually allows the operator to identify changes before limits are reached. Operating experience has shown this Frequency to be appropriate for early detection and correction of off-normal trends.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)SR 3.5.1.4

The boron concentration should be verified to be within required limits for each accumulator every 31 days since the static design of the accumulators limits the ways in which the concentration can be changed. The 31-day Frequency is adequate to identify changes that could occur from mechanisms such as stratification or inleakage. Sampling the affected accumulator within 6 hours after a 77 gallon (1% volume) increase will identify whether inleakage has caused a reduction in boron concentration to below the required limit. It is not necessary to verify boron concentration if the added water inventory is from the refueling water storage tank (RWST), because the water contained in the RWST is within the accumulator boron concentration requirements. This is consistent with the recommendation of NUREG-1366 (Ref. 5).

SR 3.5.1.5

Verification every 31 days that power is removed from each accumulator isolation valve operator when the pressurizer pressure is ≥ 2000 psig ensures that an active failure could not result in the undetected closure of an accumulator motor-operated isolation valve. If this were to occur, only two accumulators would be available for injection given a single failure coincident with a LOCA. Since power is removed under administrative control, the 31-day Frequency will provide adequate assurance that power is removed.

The allowance that the Surveillance is only required when pressurizer pressure is ≥ 2000 psig allows power to be supplied to the motor-operated isolation valves when pressurizer pressure is < 2000 psig, thus allowing operational flexibility by avoiding unnecessary delays to manipulate the breakers during plant startups or shutdowns. Even with power supplied to the valves, inadvertent closure is prevented by the RCS pressure interlock associated with the valves.

Should closure of a valve occur in spite of the interlock, the SI signal provided to the valves would open a closed valve in the event of a LOCA.

(continued)

BASES (continued)

REFERENCES

1. IEEE Standard 279-1971, Criteria for Protection Systems for Nuclear Power Generating Stations."
 2. Watts Bar FSAR, Section 6.3, "Emergency Core Cooling System."
 3. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Plants."
 4. Watts Bar FSAR, Section 15, "Accident Analysis."
 5. NUREG-1366, Improvements to Technical Specifications Surveillance Requirements, (DRAFT).
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B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.2 ECCS – Operating

BASES

BACKGROUND

The function of the ECCS is to provide core cooling and negative reactivity to ensure that the reactor core is protected after any of the following accidents:

- a. Loss-of-coolant accident (LOCA), coolant leakage greater than the capability of the normal charging system;
- b. Rod ejection accident;
- c. Loss of secondary coolant accident, including uncontrolled steam release or loss of feedwater; and
- d. Steam generator tube rupture (SGTR).

The addition of negative reactivity is designed primarily for the loss of secondary coolant accident where primary cooldown could add enough positive reactivity to achieve criticality and return to significant power.

There are three phases of ECCS operation: injection, cold leg recirculation, and hot leg recirculation. In the injection phase, water is taken from the refueling water storage tank (RWST) and injected into the Reactor Coolant System (RCS) through the cold legs. When sufficient water is removed from the RWST to ensure that enough boron has been added to maintain the reactor subcritical and the containment sumps have enough water to supply the required net positive suction head to the ECCS pumps, suction is switched to the containment sump for cold leg recirculation. After approximately 15 hours, the ECCS flow is shifted to the hot leg recirculation phase to provide a backflush, which would reduce the boiling in the top of the core and any resulting boron precipitation.

The ECCS consists of three separate subsystems: centrifugal charging (high head), safety injection (SI) (intermediate head), and residual heat removal (RHR) (low head). Each subsystem consists of two redundant, 100% capacity trains.

(continued)

BASES

BACKGROUND
(continued)

The ECCS accumulators and the RWST are also part of the ECCS, but are not considered part of an ECCS flow path as described by this LCO.

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the RWST can be injected into the RCS following the accidents described in this LCO. The major components of each subsystem are the centrifugal charging pumps, the RHR pumps, heat exchangers, and the SI pumps. Each of the three subsystems consists of two 100% capacity trains that are interconnected and redundant such that either train is capable of supplying 100% of the flow required to mitigate the accident consequences. This interconnecting and redundant subsystem design provides the operators with the ability to utilize components from opposite trains to achieve the required 100% flow to the core.

During the injection phase of LOCA recovery, a suction header supplies water from the RWST to the ECCS pumps. Separate piping supplies each subsystem and each train within the subsystem. The discharge from the SI and RHR pumps divides and feeds an injection line to each of the RCS cold legs. Throttle valves and piping hydraulic design are set to balance the flow to the RCS and prevent pump runout. This balance ensures sufficient flow to the core to meet the analysis assumptions following a LOCA in one of the RCS cold legs.

For LOCAs that are too small to depressurize the RCS below the shutoff head of the SI pumps, the centrifugal charging pumps supply water until the RCS pressure decreases below the SI pump shutoff head. During this period, the steam generators are used to provide part of the core cooling function.

During the recirculation phase of LOCA recovery, RHR pump suction is transferred to the containment sump. The RHR pumps then supply the other ECCS pumps. Initially, recirculation is through the same paths as the injection phase. Subsequently, recirculation provides injection to the hot and cold legs simultaneously.

(continued)

BASES

BACKGROUND
(continued)

The centrifugal charging subsystem of the ECCS also functions to supply borated water to the reactor core following increased heat removal events, such as a main steam line break (MSLB). The limiting design conditions occur when the negative moderator temperature coefficient is highly negative, such as at the end of each cycle.

During low temperature conditions in the RCS, limitations are placed on the maximum number of ECCS pumps that may be OPERABLE. Refer to the Bases for LCO 3.4.12, "Cold Overpressure Mitigation System (COMS)," for the basis of these requirements.

The ECCS subsystems are actuated upon receipt of an SI signal. The actuation of safeguard loads is accomplished in a programmed time sequence for a loss of offsite power. If offsite power is available, the safeguard loads start immediately. If offsite power is not available, the engineered safety feature buses shed normal operating loads and are connected to the emergency diesel generators (EDGs). Safeguard loads are then actuated in the programmed time sequence. The time delay associated with diesel starting, sequenced loading, and pump starting determines the time required before pumped flow is available to the core following a LOCA.

The active ECCS components, along with the passive accumulators and the RWST covered in LCO 3.5.1, "Accumulators," and LCO 3.5.4, "Refueling Water Storage Tank (RWST)," provide the cooling water necessary to meet GDC 35 (Ref. 1).

APPLICABLE
SAFETY ANALYSES

The LCO helps to ensure that the following acceptance criteria for the ECCS, established by 10 CFR 50.46 (Ref. 2), will be met following a LOCA:

- a. Maximum fuel element cladding temperature is $\leq 2200^{\circ}\text{F}$;
- b. Maximum cladding oxidation is ≤ 0.17 times the total cladding thickness before oxidation;

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

- c. Maximum hydrogen generation from a zirconium-water reaction is ≤ 0.01 times the hypothetical amount generated if all of the metal in the cladding cylinders surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react;
- d. Core is maintained in a coolable geometry; and
- e. Adequate long-term core cooling capability is maintained.

The LCO also limits the potential for a post-trip return to power following an MSLB event and ensures that containment temperature limits are met.

Each ECCS subsystem is taken credit for in a large-break LOCA event at full power (Refs. 3 and 4). This event establishes the requirement for runout flow for the ECCS pumps, as well as the maximum response time for their actuation. The centrifugal charging pumps and SI pumps are credited in a small-break LOCA event. This event establishes the flow and discharge head at the design point for the centrifugal charging pumps. The SGTR and MSLB events also credit the centrifugal charging pumps. The OPERABILITY requirements for the ECCS are based on the following LOCA analysis assumptions:

- a. A large-break LOCA event, with loss of offsite power and a single failure disabling one RHR pump (both EDG trains are assumed to operate due to requirements for modeling full active containment heat removal system operation); and
- b. A small-break LOCA event, with a loss of offsite power and a single failure disabling one ECCS train.

During the blowdown stage of a LOCA, the RCS depressurizes as primary coolant is ejected through the break into the containment. The nuclear reaction is terminated either by moderator voiding during large breaks or control rod insertion for small breaks. Following depressurization, emergency cooling water is injected into the cold legs, flows into the downcomer, fills the lower plenum, and re-floods the core.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The effects on containment mass and energy releases are accounted for in appropriate analyses (Refs. 3 and 4). The LCO ensures that an ECCS train will deliver sufficient water to match boiloff rates soon enough to minimize the consequences of the core being uncovered following a large LOCA. It also ensures that the centrifugal charging and SI pumps will deliver sufficient water and boron during a small LOCA to maintain core subcriticality. For smaller LOCAs, the centrifugal charging pump delivers sufficient fluid to maintain RCS inventory. For a small-break LOCA, the steam generators continue to serve as the heat sink, providing part of the required core cooling.

The ECCS trains satisfy Criterion 3 of the NRC Policy Statement.

LCO

In MODES 1, 2, and 3, two independent (and redundant) ECCS trains are required to ensure that sufficient ECCS flow is available, assuming a single failure affecting either train. Additionally, individual components within the ECCS trains may be called upon to mitigate the consequences of other transients and accidents.

In MODES 1, 2, and 3, an ECCS train consists of a centrifugal charging subsystem, an SI subsystem, and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and automatically transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the four cold leg injection nozzles. In the long term, this flow path may be switched to take its supply from the containment sump and to supply its flow to the RCS hot and cold legs.

The flow path for each train must maintain its designed independence to ensure that no single failure can disable both ECCS trains.

(continued)

BASES

APPLICABILITY

In MODES 1, 2, and 3, the ECCS OPERABILITY requirements for the limiting Design Basis Accident, a large-break LOCA, are based on full power operation. Although reduced power would not require the same level of performance, the accident analysis does not provide for reduced cooling requirements in the lower MODES. The centrifugal charging pump performance is based on a small-break LOCA, which establishes the pump performance curve and has less dependence on power. The SI pump performance requirements are based on a small-break LOCA. MODE 2 and MODE 3 requirements are bounded by the MODE 1 analysis.

This LCO is only applicable in MODE 3 and above. Below MODE 3, the SI signal setpoint is manually bypassed by operator control, and system functional requirements are relaxed as described in LCO 3.5.3, "ECCS - Shutdown."

As indicated in Note 1, the flow path may be isolated for 2 hours in MODE 3, under controlled conditions, to perform pressure isolation valve testing per SR 3.4.14.1. The flow path is readily restorable from the control room.

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "RHR and Coolant Circulation - High Water Level," and LCO 3.9.6, "RHR and Coolant Circulation - Low Water Level."

ACTIONS

A.1

With one or more trains inoperable and at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, the inoperable components must be returned to OPERABLE status within 72 hours. The 72-hour Completion Time is based on an NRC reliability evaluation (Ref. 6) and is a reasonable time for repair of many ECCS components.

(continued)

BASES

ACTIONS

A.1 (continued)

An ECCS train is inoperable if it is not capable of delivering design flow to the RCS. Individual components are inoperable if they are not capable of performing their design function or supporting systems are not available.

The LCO requires the OPERABILITY of a number of independent subsystems. Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS. The intent of this condition is to maintain a combination of equipment, such that 100% of the ECCS flow equivalent to a single OPERABLE ECCS train remains available. This allows increased flexibility in plant operations under circumstances when components in opposite trains are inoperable.

An event accompanied by a loss of offsite power and the failure of an EDG can disable one ECCS train until power is restored. A reliability analysis (Ref. 6) has shown that the impact of having one full ECCS train inoperable is sufficiently small to justify continued operation for 72 hours.

Reference 5 describes situations in which one component, such as an RHR crossover valve, can disable both ECCS trains. With one or more component(s) inoperable such that 100% of the flow equivalent to a single OPERABLE ECCS train is not available, the facility is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be immediately entered.

(continued)

BASES

ACTIONS
(continued)

B.1 and B.2

If the inoperable trains cannot be returned to OPERABLE status within the associated Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to MODE 3 within 6 hours and MODE 4 within 12 hours. The allowed Completion Times are 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 3.5.2.1

Verification of proper valve position ensures that the flow path from the ECCS pumps to the RCS is maintained. Misalignment of these valves could render both ECCS trains inoperable. Securing these valves in position by removal of power or by key-locking the control in the correct position ensures that they cannot change position as a result of an active failure or be inadvertently misaligned. These valves are of the type, described in Reference 5, that can disable the function of both ECCS trains and invalidate the accident analyses. A 12-hour Frequency is considered reasonable in view of other administrative controls that will ensure a mispositioned valve is unlikely.

SR 3.5.2.2

Verifying the correct alignment for manual, power-operated, and automatic valves in the ECCS flow paths provides assurance that the proper flow paths will exist for ECCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. A valve that receives an actuation signal is allowed to be in a non-accident position provided the valve will automatically reposition within the proper stroke time. This Surveillance does not require any testing or valve manipulation. Rather, it involves verification that those valves capable of being

(continued)

BASES

SURVEILLANCE
REQUIREMENTSSR 3.5.2.2 (continued)

mispositioned are in the correct position. The 31-day Frequency is appropriate because the valves are operated under administrative control, and an improper valve position would only affect a single train. This Frequency has been shown to be acceptable through operating experience.

SR 3.5.2.3

With the exception of the operating centrifugal charging pump, the ECCS pumps are normally in a standby, non-operating mode. As such, flow path piping has the potential to develop voids and pockets of entrained gases. Maintaining the piping from the ECCS pumps to the RCS full of water ensures that the system will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent water hammer, pump cavitation, and pumping of non-condensable gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling. The 31-day Frequency takes into consideration the gradual nature of gas accumulation in the ECCS piping and the procedural controls governing system operation.

SR 3.5.2.4

Periodic Surveillance testing of ECCS pumps to detect gross degradation caused by impeller structural damage or other hydraulic component problems is required by Section XI of the American Society of Mechanical Engineers (ASME) Code. This type of testing may be accomplished by measuring the pump developed head at only one point of the pump characteristic curve. This verifies both that the measured performance is within an acceptable tolerance of the original pump baseline performance and that the performance at the test flow is greater than or equal to the performance assumed in the plant safety analysis. SRs are specified in the Inservice Testing Program, which encompasses Section XI of the ASME Code. Section XI of the ASME Code provides the activities and Frequencies necessary to satisfy the requirements.

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BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.5.2.5 and SR 3.5.2.6

These Surveillances demonstrate that each automatic ECCS valve actuates to the required position on an actual or simulated SI signal and that each ECCS pump starts on receipt of an actual or simulated SI signal. The 18-month Frequency is based on the need to perform these Surveillances under the conditions that apply during a plant outage and the potential for unplanned plant transients if the Surveillances were performed with the reactor at power. The 18-month Frequency is also acceptable based on consideration of the design reliability (and confirming operating experience) of the equipment. The actuation logic is tested as part of Engineered Safety Feature Actuation System testing, and equipment performance is monitored as part of the Inservice Testing Program.

SR 3.5.2.7

Realignment of valves in the flow path on an SI signal is necessary for proper ECCS performance. These valves are secured in a throttled position for restricted flow to a ruptured cold leg, ensuring that the other cold legs receive at least the required minimum flow. The 18-month Frequency is based on the same reasons as those stated in SR 3.5.2.5 and SR 3.5.2.6.

SR 3.5.2.8

Periodic inspections of the containment sump suction inlet ensure that it is unrestricted and stays in proper operating condition. The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage, on the need to have access to the location, and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. This Frequency has been found to be sufficient to detect abnormal degradation and is confirmed by operating experience.

(continued)

BASES (continued)

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 35, "Emergency Core Cooling System."
 2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Plants."
 3. Watts Bar FSAR, Section 6.3, "Emergency Core Cooling System."
 4. Watts Bar FSAR, Section 15, "Accident Analyses."
 5. IE Information Notice No. 87-01, "RHR Valve Misalignment Causes Degradation of ECCS in PWRs," January 6, 1987.
 6. NRC Memorandum to V. Stello, Jr., from R.L. Baer, "Recommended Interim Revisions to LCOs for ECCS Components," December 1, 1975.
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B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.3 ECCS - Shutdown

BASES

BACKGROUND The Background section for Bases 3.5.2, "ECCS - Operating," is applicable to these Bases, with the following modifications.

In MODE 4, the required ECCS train consists of two separate subsystems: centrifugal charging (high head) and residual heat removal (RHR) (low head).

The ECCS flow paths consist of piping, valves, heat exchangers, and pumps such that water from the refueling water storage tank (RWST) can be injected into the Reactor Coolant System (RCS) following the accidents described in Bases 3.5.2.

APPLICABLE SAFETY ANALYSES The Applicable Safety Analyses section of Bases 3.5.2 also applies to this Bases section.

Due to the stable conditions associated with operation in MODE 4 and the reduced probability of occurrence of a Design Basis Accident (DBA), the ECCS operational requirements are reduced. It is understood in these reductions that certain automatic safety injection (SI) actuation is not available. In this MODE, sufficient time exists for manual actuation of the required ECCS to mitigate the consequences of a DBA.

Only one train of ECCS is required for MODE 4. This requirement dictates that single failures are not considered during this MODE of operation. The ECCS trains satisfy Criterion 3 of the NRC Policy Statement.

LCO In MODE 4, one of the two independent (and redundant) ECCS trains is required to be OPERABLE to ensure that sufficient ECCS flow is available to the core following a DBA.

(continued)

BASES

LCO
(continued)

In MODE 4, an ECCS train consists of a centrifugal charging subsystem and an RHR subsystem. Each train includes the piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST and transferring suction to the containment sump.

During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the four cold leg injection nozzles. In the long term, this flow path may be switched to take its supply from the containment sump and to deliver its flow to the RCS hot and cold legs.

APPLICABILITY

In MODES 1, 2, and 3, the OPERABILITY requirements for ECCS are covered by LCO 3.5.2, "ECCS - Operating."

In MODE 4 with RCS temperature below 350°F, one OPERABLE ECCS train is acceptable without single-failure consideration, on the basis of the stable reactivity of the reactor and the limited core cooling requirements.

In MODES 5 and 6, plant conditions are such that the probability of an event requiring ECCS injection is extremely low. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled." MODE 6 core cooling requirements are addressed by LCO 3.9.5, "RHR and Coolant Circulation - High Water Level," and LCO 3.9.6, "RHR and Coolant Circulation - Low Water Level."

ACTIONS

A.1

With no ECCS RHR subsystem OPERABLE, the plant is not prepared to respond to a loss-of-coolant accident or to continue a cooldown using the RHR pumps and heat exchangers. The immediate Completion Time to initiate actions that would restore at least one ECCS RHR subsystem to OPERABLE status ensures that prompt action is taken to restore the required

(continued)

BASES

ACTIONS

A.1 (continued)

cooling capacity. Normally, in MODE 4, reactor decay heat is removed from the RCS by an RHR loop. If no RHR loop is OPERABLE for this function, reactor decay heat must be removed by some alternate method, such as use of the steam generators. The alternate means of heat removal must continue until the inoperable RHR loop components can be restored to operation so that decay-heat removal is continuous.

With both RHR pumps and heat exchangers inoperable, it would be unwise to require the plant to go to MODE 5, where the only available heat removal system is the RHR. Therefore, the appropriate action is to initiate measures to restore one ECCS RHR subsystem and to continue the actions until the subsystem is restored to OPERABLE status.

B.1

With no ECCS centrifugal charging subsystem OPERABLE, due to the inoperability of the centrifugal charging pump or flow path from the RWST, the plant is not prepared to provide high-pressure response to Design Basis Events requiring SI. The 1-hour Completion Time to restore at least one ECCS centrifugal charging subsystem to OPERABLE status ensures that prompt action is taken to provide the required cooling capacity or to initiate actions to place the plant in MODE 5 where an ECCS train is not required.

C.1

When the Required Actions of Condition B cannot be completed within the required Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to MODE 5 within 24 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions in an orderly manner and without challenging unit systems.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.5.3.1

The applicable Surveillance descriptions from Bases 3.5.2 apply.

This SR is modified by a NOTE that allows an RHR train to be considered OPERABLE during alignment and operation for decay heat removal, if capable of being manually realigned (remote or local) to the ECCS mode of operation and not otherwise inoperable. This allows operation in the RHR mode during MODE 4, if necessary.

REFERENCES

The applicable references from Bases 3.5.2 apply.

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.4 Refueling Water Storage Tank (RWST)

BASES

BACKGROUND

The RWST supplies borated water to the Chemical and Volume Control System (CVCS) during abnormal operating conditions, to the refueling pool during refueling, and to the ECCS and the Containment Spray System during accident conditions.

The RWST supplies both trains of the ECCS and the Containment Spray System through a common supply header during the injection phase of a loss-of-coolant accident (LOCA) recovery. Motor-operated isolation valves are provided to isolate the RWST from the ECCS once the system has been transferred to the recirculation mode. The recirculation mode is entered when pump suction is transferred to the containment sump following receipt of the RWST-Low coincident with containment sump level-high signal. Use of a single RWST to supply both trains of the ECCS and Containment Spray System is acceptable since the RWST is a passive component, and passive failures are not required to be assumed to occur coincidentally with Design Basis Events until after transfer to the recirculation mode.

The switchover from normal operation to the injection phase of ECCS operation requires changing centrifugal charging pump suction from the CVCS volume control tank (VCT) to the RWST through the use of isolation valves. Each set of isolation valves is interlocked so that the VCT isolation valves will begin to close once the RWST isolation valves are fully open. Since the VCT is under pressure, the preferred pump suction will be from the VCT until the tank is isolated. This will result in a delay in obtaining the RWST borated water. The effects of this delay are discussed in the Applicable Safety Analyses section of these Bases.

During normal operation in MODES 1, 2, and 3, the safety injection (SI) and residual heat removal (RHR) pumps are aligned to take suction from the RWST.

The ECCS and Containment Spray System pumps are provided with recirculation lines that ensure each pump can maintain minimum flow requirements when operating at or near shutoff head conditions.

(continued)

BASES

BACKGROUND
(continued)

When the suction for the ECCS and Containment Spray System pumps is transferred to the containment sump, the RWST flow paths must be isolated to prevent a release of the containment sump contents to the RWST, which could result in a release of contaminants to the atmosphere and the eventual loss of suction head for the ECCS pumps.

This LCO ensures that:

- a. The RWST contains sufficient borated water to support the ECCS during the injection phase;
- b. Sufficient water volume exists in the containment sump to support continued operation of the ECCS and Containment Spray System pumps at the time of transfer to the recirculation mode of cooling; and
- c. The reactor remains subcritical following a LOCA.

Insufficient water in the RWST could result in insufficient cooling capacity when the transfer to the recirculation mode occurs. Improper boron concentrations could result in a reduction of SDM or excessive boric acid precipitation in the core following the LOCA, as well as excessive caustic stress corrosion of mechanical components and systems inside the containment.

APPLICABLE
SAFETY ANALYSES

During accident conditions, the RWST provides a source of borated water to the ECCS and Containment Spray System pumps. As such, it provides containment cooling and depressurization, core cooling, and replacement inventory, and is a source of negative reactivity for reactor shutdown (Ref. 1). The design basis transients and applicable safety analyses concerning each of these systems are discussed in the Applicable Safety Analyses section of Bases B 3.5.2, "ECCS-Operating"; B 3.5.3, "ECCS-Shutdown"; and B 3.6.6, "Containment Spray System." These analyses are used to assess changes to the RWST in order to evaluate their effects in relation to the acceptance limits in the analyses.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The RWST must also meet volume, boron concentration, and temperature requirements for non-LOCA events. The volume is not an explicit assumption in non-LOCA events since the required volume is a small fraction of the available volume. The deliverable volume limit is set by the LOCA and containment analyses. For the RWST, the deliverable volume is different from the total volume contained since, due to the design of the tank, more water can be contained than can be delivered. The minimum boron concentration is an explicit assumption in the main steam line break (MSLB) analysis to ensure the required shutdown capability. The maximum boron concentration is an explicit assumption in the inadvertent ECCS actuation analysis, although it is typically a non-limiting event and the results are very insensitive to boron concentrations. The maximum temperature is a conservative assumption that minimizes the cooling credited from the RWST during the heatup phase of the feedline break event analysis; the minimum is an assumption in both the MSLB and inadvertent ECCS actuation analyses, although the inadvertent ECCS actuation event is typically non-limiting.

The MSLB analysis has considered a delay associated with the interlock between the VCT and RWST isolation valves, and the results show that the departure from nucleate boiling design basis is met. The delay has been established as [28] seconds, with offsite power available, or [38] seconds without offsite power. This response time includes [3] seconds for electronics delay, a [15]-second stroke time for the RWST valves, and a [10]-second stroke time for the VCT valves.

For a large-break LOCA analysis, the minimum water volume limit of 370,000 gallons and the lower boron concentration limit of 2000 ppm are used to compute the post-LOCA sump boron concentration necessary to assure subcriticality. The large-break LOCA is the limiting case since the safety analysis assumes that all control rods are out of the core.

The upper limit on boron concentration of 2100 ppm is used to determine the maximum allowable time to switch to hot leg recirculation following a LOCA. The purpose of switching from cold leg to hot leg injection is to avoid boron precipitation in the core following the accident.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

In the ECCS analysis, the containment spray temperature is assumed to be equal to the RWST lower temperature limit of 60°F. If the lower temperature limit is violated, the containment spray further reduces containment pressure, which decreases the rate at which steam can be vented out the break and increases peak clad temperature. The upper temperature limit of 105°F is used in the small-break LOCA analysis and containment OPERABILITY analysis. Exceeding this temperature will result in a higher peak clad temperature, because there is less heat transfer from the core to the injected water for the small-break LOCA and higher containment pressures due to reduced containment spray cooling capacity. For the containment response following an MSLB, the lower limit on boron concentration and the upper limit on RWST water temperature are used to maximize the total energy release to containment.

The RWST satisfies Criterion 3 of the NRC Policy Statement.

LCO

The RWST ensures that an adequate supply of borated water is available to cool and depressurize the containment in the event of a Design Basis Accident (DBA), to cool and cover the core in the event of a LOCA, to maintain the reactor subcritical following a DBA, and to ensure adequate level in the containment sump to support ECCS and Containment Spray System pump operation in the recirculation mode.

To be considered OPERABLE, the RWST must meet the water volume, boron concentration, and temperature limits established in the SRs.

APPLICABILITY

In MODES 1, 2, 3, and 4, RWST OPERABILITY requirements are dictated by ECCS and Containment Spray System OPERABILITY requirements. Since both the ECCS and the Containment Spray System must be OPERABLE in MODES 1, 2, 3, and 4, the RWST must also be OPERABLE to support their operation. Core cooling requirements in MODE 5 are addressed by LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," and LCO 3.4.8, "RCS Loops - MODE 5, Loops Not Filled." MODE 6 core cooling

(continued)

BASES

APPLICABILITY
(continued)

requirements are addressed by LCO 3.9.5, "Residual Heat Removal and Coolant Circulation-High Water Level," and LCO 3.9.6, "Residual Heat Removal and Coolant Circulation-Low Water Level."

ACTIONS

A.1

With RWST boron concentration or borated water temperature not within limits, they must be returned to within limits within 8 hours. Under these Conditions neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE condition. The 8-hour limit to restore the RWST temperature or boron concentration to within limits was developed considering the time required to change either the boron concentration or temperature and the fact that the contents of the tank are still available for injection.

B.1

With the RWST inoperable for reasons other than Condition A, (e.g., water volume) it must be restored to OPERABLE status within 1 hour.

In this Condition, neither the ECCS nor the Containment Spray System can perform its design function. Therefore, prompt action must be taken to restore the tank to OPERABLE status or to place the plant in a MODE in which the RWST is not required. The short time limit of 1 hour to restore the RWST to OPERABLE status is based on this Condition simultaneously affecting redundant trains.

C.1 and C.2

If the RWST cannot be returned to OPERABLE status within the associated Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

power conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE
REQUIREMENTS

SR 3.5.4.1

The RWST borated water temperature should be verified every 24 hours to be within the limits assumed in the accident analyses band. This Frequency is sufficient to identify a temperature change that would approach either limit, and has been shown to be acceptable through operating experience.

The SR is modified by a Note that eliminates the requirement to perform this Surveillance when ambient air temperatures are within the operating limits of the RWST. With ambient air temperatures within the band, the RWST temperature should not exceed the limits.

SR 3.5.4.2

The RWST water volume should be verified every 7 days to be above the required minimum level in order to ensure that a sufficient initial supply is available for injection and to support continued ECCS and Containment Spray System pump operation on recirculation. Since the RWST volume is normally stable and is protected by an alarm, a 7-day Frequency is appropriate and has been shown to be acceptable through operating experience.

SR 3.5.4.3

The boron concentration of the RWST should be verified every 7 days to be within the required limits. This SR ensures that the reactor will remain subcritical following a LOCA. Further, it assures that the resulting sump pH will be maintained in an acceptable range so that boron precipitation in the core will not occur and the effect of chloride and caustic stress corrosion on mechanical systems and components will be minimized. Since the RWST volume is normally stable, a 7-day sampling Frequency to verify boron

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.5.4.3 (continued)

concentration is appropriate and has been shown to be acceptable through operating experience.

REFERENCES

1. Watts Bar FSAR, Section 6.3, "Emergency Core Cooling System" and Section 15, "Accident Analyses".
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B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.5 Seal Injection Flow

BASES

BACKGROUND

The function of the seal injection throttle valves during an accident is similar to the function of the ECCS throttle valves in that each restricts flow from the centrifugal charging pump header to the Reactor Coolant System (RCS).

The restriction on reactor coolant pump (RCP) seal injection flow limits the amount of ECCS flow that would be diverted from the injection path following an accident. This limit is based on safety analysis assumptions that are required because RCP seal injection flow is not isolated during SI.

APPLICABLE
SAFETY ANALYSES

All ECCS subsystems are taken credit for in the large-break loss-of-coolant accident (LOCA) at full power (Ref. 1). The LOCA analysis establishes the minimum flow for the ECCS pumps. The centrifugal charging pumps are also credited in the small-break LOCA analysis. This analysis establishes the flow and discharge head at the design point for the centrifugal charging pumps. The steam generator tube rupture and main steam line break event analyses also credit the centrifugal charging pumps, but are not limiting in their design. Reference to these analyses is made in assessing changes to the Seal Injection System for evaluation of their effects in relation to the acceptance limits in these analyses.

This LCO ensures that seal injection flow of ≤ 40 gpm, with centrifugal charging pump discharge header pressure ≥ 2430 psig and pressurizer level control valve fully open, will be sufficient for RCP seal integrity but limited so that the ECCS trains will be capable of delivering sufficient water to match boiloff rates soon enough to minimize uncovering of the core following a large LOCA. It also ensures that the centrifugal charging pumps will deliver sufficient water for a small LOCA and sufficient boron to maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to overcome the loss and maintain RCS inventory. Seal

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

injection flow satisfies Criterion 2 of the NRC Policy Statement.

LCO

The intent of the LCO limit on seal injection flow is to make sure that flow through the RCP seal water injection line is low enough to ensure that sufficient centrifugal charging pump injection flow is directed to the RCS via the injection points (Ref. 2).

The LCO is not strictly a flow limit, but rather a flow limit based on a flow line resistance. In order to establish the proper flow line resistance, a pressure and flow must be known. The flow line resistance is determined by assuming that the RCS pressure is at normal operating pressure and that the centrifugal charging pump discharge pressure is greater than or equal to the value specified in this LCO. The centrifugal charging pump discharge header pressure remains essentially constant through all the applicable MODES of this LCO. A reduction in RCS pressure would result in more flow being diverted to the RCP seal injection line than at normal operating pressure. The valve settings established at the prescribed centrifugal charging pump discharge header pressure result in a conservative valve position should RCS pressure decrease. The additional modifier of this LCO, the pressurizer level control valve being fully open, is required since the valve is designed to fail open for the accident condition. With the discharge pressure and control valve position as specified by the LCO, a flow limit is established. It is this flow limit that is used in the accident analyses.

The limit on seal injection flow, combined with the centrifugal charging pump discharge header pressure limit and an open wide condition of the pressurizer level control valve, must be met to render the ECCS OPERABLE. If these conditions are not met, the ECCS flow will not be as assumed in the accident analyses.

APPLICABILITY

In MODES 1, 2, and 3, the seal injection flow limit is dictated by ECCS flow requirements, which are specified for

(continued)

BASES

APPLICABILITY
(continued)

MODES 1, 2, 3, and 4. The seal injection flow limit is not applicable for MODE 4 and lower, however, because high seal injection flow is less critical as a result of the lower initial RCS pressure and decay heat removal requirements in these MODES. Therefore, RCP seal injection flow must be limited in MODES 1, 2, and 3 to ensure adequate ECCS performance.

ACTIONS

A.1

With the seal injection flow exceeding its limit, the amount of charging flow available to the RCS may be reduced. Under this Condition, action must be taken to restore the flow to below its limit. The operator has 4 hours from the time the flow is known to be above the limit to correctly position the manual valves and thus be in compliance with the accident analysis. The Completion Time minimizes the potential exposure of the plant to a LOCA with insufficient injection flow and ensures that seal injection flow is restored to below its limit. This time is conservative with respect to the Completion Times of other ECCS LCOs; it is based on operating experience, and is sufficient for taking corrective actions by operations personnel.

B.1 and B.2

When the Required Actions cannot be completed within the required Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE
REQUIREMENTS

SR 3.5.5.1

Verification every 31 days that the manual seal injection throttle valves are adjusted to give a flow within the limit

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.5.5.1 (continued)

ensures that proper manual seal injection throttle valve position, and hence, proper seal injection flow, is maintained. The Frequency of 31 days is based on engineering judgment and is consistent with other ECCS valve Surveillance Frequencies. The Frequency has proven to be acceptable through operating experience. As Noted, the Surveillance is not required to be performed until 4 hours after the RCS pressure has stabilized within a ± 20 psig range of normal operating pressure. The RCS pressure requirement is specified since this configuration will produce the required pressure conditions necessary to assure that the manual valves are set correctly. The exception is limited to 4 hours to ensure that the Surveillance is timely.

REFERENCES

1. Watts Bar FSAR, Section 6.3, "Emergency Core Cooling System", and Section 15, "Accident Analyses".
 2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Plants," 1974.
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.1 Containment

BASES

BACKGROUND

The containment is a free standing steel pressure vessel surrounded by a reinforced concrete shield building. The containment vessel, including all its penetrations, is a low leakage steel shell designed to contain the radioactive material that may be released from the reactor core following a Design Basis Accident (DBA). Additionally, the containment and shield building provide shielding from the fission products that may be present in the containment atmosphere following accident conditions.

The containment vessel is a vertical cylindrical steel pressure vessel with hemispherical dome and a concrete base mat with steel membrane. It is completely enclosed by a reinforced concrete shield building. An annular space exists between the walls and domes of the steel containment vessel and the concrete shield building to provide for the collection, mixing, holdup, and controlled release of containment out leakage. Ice Condenser containments utilize an outer concrete building for shielding and an inner steel containment for leak tightness.

Containment piping penetration assemblies provide for the passage of process, service, sampling, and instrumentation pipelines into the containment vessel while maintaining containment integrity. The shield building provides biological shielding and allows controlled filtered release of the annulus atmosphere under accident conditions, as well as environmental missile protection for the containment vessel and Nuclear Steam Supply System.

The inner steel containment and its penetrations establish the leakage limiting boundary of the containment. Maintaining the containment OPERABLE limits the leakage of fission product radioactivity from the containment to the environment. SR 3.6.1.1 leakage rate requirements comply with 10 CFR 50, Appendix J (Ref. 1), as modified by approved exemptions.

The isolation devices for the penetrations in the containment boundary are to maintain this leak tight

(continued)

BASES

BACKGROUND
(continued)

barrier.

- a. All penetrations required to be closed during accident conditions are either:
 1. capable of being closed by an OPERABLE automatic containment isolation system, or
 2. closed by manual valves, blind flanges, or deactivated automatic valves secured in their closed positions, except as provided in LCO 3.6.3.
 - b. Each air lock is OPERABLE except as provided in LCO 3.6.2.
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APPLICABLE
SAFETY ANALYSES

The safety design basis for the containment is that the containment must withstand the pressures and temperatures of the limiting DBA without exceeding the design leakage rates.

The DBAs that result in a challenge to containment OPERABILITY from high pressures and temperatures are a loss of coolant accident (LOCA), a steam line break (SLB), and a rod ejection accident (REA) (Ref. 2). In addition, release of significant fission product radioactivity within containment can occur from a LOCA or REA. In the DBA analyses, it is assumed that the containment is OPERABLE, such that, for the DBAs involving release of fission product radioactivity, release to the environment is controlled by the rate of containment leakage. The containment was designed with an allowable leakage rate of 0.25% of containment air weight per day (Ref. 3). This leakage rate, used in the evaluation of offsite doses resulting from accidents, is defined in 10 CFR 50, Appendix J (Ref. 1), as L_a : the maximum allowable containment leakage rate at the calculated peak containment internal pressure (P_a) resulting from the limiting DBA. The allowable leakage rate represented by L_a forms the basis for the acceptance criteria imposed on all containment leakage rate testing. $L_a = 0.25\%$ per day, and $P_a = 15.0$ psig, which bounds the calculated peak containment internal pressure resulting from the limiting design basis LOCA (Ref. 3). Satisfactory leakage rate test results are a requirement for the establishment of containment OPERABILITY.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The containment satisfies Criterion 3 of the NRC Policy Statement.

LCO

By limiting leakage to within the acceptance criteria of 10 CFR 50, Appendix J (Ref. 1), containment OPERABILITY is maintained.

Compliance with this LCO will ensure a containment configuration, including equipment hatches, that is structurally sound and will limit leakage to those leakage rates assumed in the safety analysis.

Individual leakage rates specified for the containment air lock (LCO 3.6.2), and purge valves with resilient seals and shield building bypass leakage (LCO 3.6.3) are not specifically part of the acceptance criteria of 10 CFR 50, Appendix J. Therefore, leakage rates exceeding these individual limits only result in the containment being inoperable when the leakage results in exceeding the acceptance criteria of Appendix J.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material into containment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, containment is not required to be OPERABLE in MODE 5 to prevent leakage of radioactive material from containment. The requirements for containment during MODE 6 are addressed in LCO 3.9.4, "Containment Penetrations."

ACTIONS

A.1

In the event containment is inoperable, containment must be restored to OPERABLE status within 1 hour. The 1 hour Completion Time provides a period of time to correct the

(continued)

BASES

ACTIONS

A.1 (continued)

problem commensurate with the importance of maintaining containment OPERABLE during MODES 1, 2, 3, and 4. This time period also ensures that the probability of an accident (requiring containment OPERABILITY) occurring during periods where containment is inoperable is minimal.

B.1 and B.2

If containment cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 operations.

SURVEILLANCE
REQUIREMENTS

SR 3.6.1.1

Maintaining the containment OPERABLE requires compliance with the visual examinations and leakage rate test requirements of 10 CFR 50, Appendix J (Ref. 1), as modified by approved exemptions. Failure to meet air lock leakage testing acceptance criteria (SR 3.6.2.1) does not necessarily result in a failure of this SR. The impact of the failure to meet this SR must be evaluated against the Type A, B and C leakage tests of 10 CFR 50, Appendix J. SR Frequencies are as required by Appendix J as modified by approved exceptions. Thus, SR 3.0.2 (which allows SR Frequency extensions) does not apply. These periodic testing requirements verify that the containment leakage rate does not exceed the leakage rate assumed in the safety analysis.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors."

(continued)

BASES

REFERENCES
(continued)

2. Watts Bar FSAR, Section 15, "Accident Analysis."
 3. Watts Bar FSAR, Section 6.2, "Containment Systems."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.2 Containment Air Locks

BASES

BACKGROUND

Containment air locks form part of the containment pressure boundary and provide a means for personnel access during all MODES of operation.

Each air lock is nominally a right circular cylinder, 9 feet in diameter, with a door at each end. The doors are interlocked to prevent simultaneous opening. During periods when containment is not required to be OPERABLE, the door interlock mechanism may be disabled, allowing both doors of an air lock to remain open for extended periods when frequent containment entry is necessary. Each air lock door has been designed and tested to certify its ability to withstand a pressure in excess of the maximum expected pressure following a Design Basis Accident (DBA) in containment. As such, closure of a single door supports containment OPERABILITY. Each of the doors contains double gasketed seals and local leakage rate testing capability to ensure pressure integrity. To effect a leak tight seal, the air lock design uses pressure seated doors (i.e., an increase in containment internal pressure results in increased sealing force on each door).

Each personnel air lock is provided with limit switches on both doors that provide control room indication of door position. Additionally, control room indication is provided to alert the operator whenever an air lock door interlock mechanism is defeated.

The containment air locks form part of the containment pressure boundary. As such, air lock integrity and leak tightness is essential for maintaining the containment leakage rates within limit in the event of a DBA. Not maintaining air lock integrity or leak tightness may result in a leakage rate in excess of that assumed in the plant safety analysis. SR 3.6.2.1 leakage rate requirements are in conformance with 10 CFR 50, Appendix J (Ref. 1), as modified by approved exemptions.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The DBAs that result in a release of radioactive material within containment are a loss of coolant accident and a rod ejection accident (Ref. 2). In the analysis of each of these accidents, it is assumed that containment is OPERABLE, such that release of fission products to the environment is controlled by the rate of containment leakage. The containment was designed with an allowable leakage rate of 0.25% of containment air weight per day (Ref. 2). This leakage rate is defined in 10 CFR 50, Appendix J (Ref. 1), as $L_a = 0.25\%$, the maximum allowable containment leakage rate at the calculated peak containment internal pressure (P_a) following a DBA. A P_a value of 15.0 psig is utilized which bounds the calculated peak containment internal pressure following a DBA. This allowable leakage rate forms the basis for the acceptance criteria imposed on the SRs associated with the air locks.

The containment air locks satisfy Criterion 3 of the NRC Policy Statement.

LCO

Each containment air lock forms part of the containment pressure boundary. As part of containment, the air lock safety function is related to control of offsite radiation exposures resulting from a DBA. Thus, each air lock's structural integrity and leak tightness are essential to the successful mitigation of such an event.

Each air lock is required to be OPERABLE. For the air lock to be considered OPERABLE, the air lock interlock mechanism must be OPERABLE, the air lock must be in compliance with the Type B air lock leakage test, and both air lock doors must be OPERABLE. The interlock allows only one air lock door of an air lock to be opened at one time. This provision ensures that a gross breach of containment does not exist when containment is required to be OPERABLE. Closure of a single door in each air lock is sufficient to provide a leak tight barrier following postulated events. Nevertheless, both doors are kept closed when the air lock is not being used for normal entry and exit from containment.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of

(continued)

BASES

APPLICABILITY
(continued)

radioactive material to containment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, the containment air locks are not required in MODE 5 to prevent leakage of radioactive material from containment. The requirements for the containment air locks during MODE 6 are addressed in LCO 3.9.4, "Containment Penetrations".

ACTIONS

The ACTIONS are modified by a Note that allows entry and exit to perform repairs on the affected air lock component. If the outer door is inoperable, then it may be easily accessed to repair. If the inner door is the one that is inoperable, however, then a short time exists when the containment boundary is not intact (during access through the outer door). The ability to open the OPERABLE door, even if it means the containment boundary is temporarily not intact, is acceptable due to the low probability of an event that could pressurize the containment during the short time in which the OPERABLE door is expected to be open. After each entry and exit, the OPERABLE door must be immediately closed.

An additional Note has been added to provide clarification that for this LCO separate Condition entry is allowed for each air lock.

In the event the air lock leakage results in exceeding the containment overall leakage rate, Note 3 directs entry into the applicable Conditions and Required Actions of LCO 3.6.1, "Containment".

A.1, A.2, and A.3

With one air lock door inoperable in one or more containment air locks, the OPERABLE door must be verified closed (Require Action A.1) in each affected containment air lock. This ensures a leak tight containment barrier is maintained by the use of an OPERABLE air lock door. This action must be completed within 1 hour. This specified time period is consistent with the ACTIONS of LCO 3.6.1, "Containment," which requires containment be restored to OPERABLE status within 1 hour.

(continued)

BASES

ACTIONS
(continued)

In addition, the affected air lock penetration must be isolated by locking closed the OPERABLE air lock door within the 24 hour Completion Time. The 24 hour Completion Time is reasonable for locking the OPERABLE air lock door, considering the OPERABLE door of the affected air lock is being maintained closed.

Required Action A.3 verifies that an air lock with an inoperable door has been isolated by the use of a locked closed OPERABLE air lock door. This ensures that an acceptable containment leakage boundary is maintained. The Completion Time of once per 31 days is based on engineering judgment and is considered adequate in view of the low likelihood of a locked door being mispositioned and other administrative controls.

The Required Actions have been modified by two Notes. Note 1 ensures that only the Required Actions and associated Completion Times of Condition C are required if both doors in the air lock are inoperable. With both doors in the air lock inoperable, the Required Action to lock an OPERABLE door closed is not applicable. Required Actions C.1 and C.2 are the appropriate remedial actions. Note 2 allows use of an air lock for entry and exit for 7 days, to perform activities related to Technical Specification systems, if both air locks are inoperable (i.e., one door inoperable in both air locks). Containment entry is normally required on a periodic basis to perform Technical Specification Surveillances and Required Actions, as well as other activities on equipment inside containment that is required by Technical Specifications or that supports Technical Specification required equipment. This Note is not intended to preclude performing other activities (i.e., non-Technical Specification related activities) if the containment was entered, using the inoperable air lock, to perform an allowed activity listed above. This allowance is acceptable due to the low probability of an event that could pressurize the primary containment during the short time in which the OPERABLE door is expected to be open.

B.1, B.2 and B.3

With an air lock door interlock mechanism inoperable in one or more air locks, the Required Actions and associated

(continued)

BASES

ACTIONS
(continued)

B.1, B.2, and B.3

Completion Times are consistent with those specified in Condition A.

The Required Actions have been modified by two Notes. Note 1 ensures that only the Required Actions and associated Completion Times of Condition C are required if both doors in the air lock are inoperable. With both doors in the air lock inoperable, an OPERABLE door is not available to be closed. Required Actions C.1 and C.2 are the appropriate remedial actions. Note 2 allows entry into and exit from containment under the control of a dedicated individual stationed at the air lock to ensure that only one door is opened at a time (i.e., the individual performs the function of the interlock).

C.1, C.2, and C.3

With one or more air locks inoperable for reasons other than those described in Condition A or B, Required Action C.1 requires action to be immediately initiated to evaluate previous combined leakage rates using current air lock test results. An evaluation is acceptable since it is overly conservative to immediately declare the containment inoperable if both doors in an air lock have failed a seal test or the overall air lock leakage is not within limits. In many instances (e.g., only one seal per door has failed) containment remains OPERABLE, yet only 1 hour (per LCO 3.6.1) would be provided to restore the air lock door to OPERABLE status prior to requiring a plant shutdown. In addition, even with both doors failing the seal test, the overall containment leakage rate can still be within limits.

Required Action C.2 requires one door in the containment air lock must be verified to be closed within 1 hour Completion Time. This specified time period is consistent with the ACTIONS of LCO 3.6.1, which requires that containment be restored to OPERABLE status within 1 hour.

(continued)

BASES

ACTIONS

C.1, C.2, and C.3 (continued)

Additionally, the affected air lock must be restored to OPERABLE status within the 24 hour Completion Time. The specified time period is considered reasonable for restoring inoperable air lock to OPERABLE status assuming that at least one door is maintained closed in each affected air lock.

D.1 and D.2

If the inoperable containment air lock cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours.

SURVEILLANCE
REQUIREMENTS

SR 3.6.2.1

Maintaining containment air locks OPERABLE requires compliance with the leakage rate test requirements of 10 CFR 50, Appendix J, as modified by approved exemptions. This SR reflects the leakage rate testing requirements with regard to air lock leakage (Type B leakage tests). The acceptance criteria were established during initial air lock and containment OPERABILITY testing. The periodic testing requirements verify that the air lock leakage does not exceed the allowed fraction of the overall containment leakage rate. The Frequency is required by Appendix J (Ref. 1), as modified by approved exemptions. Thus, SR 3.0.2 (which allows Frequency extensions) does not apply.

The SR has been modified by two Notes. Note 1 states that an inoperable air lock door does not invalidate the previous successful performance of an overall air lock leakage test. This is considered reasonable since either air lock door is capable of providing a fission product barrier in the event of a DBA. Note 2 has been added to this SR requiring the

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.6.2.1 (continued)

results to be evaluated against the acceptance criteria of SR 3.6.1.1. This ensures that air lock leakage is properly accounted for in determining the overall containment leakage rate.

SR 3.6.2.2

The air lock interlock is designed to prevent simultaneous opening of both doors in a single air lock. Since both the inner and outer doors of an air lock are designed to withstand the maximum expected post accident containment pressure, closure of either door will support containment OPERABILITY. Thus, the door interlock feature supports that containment OPERABILITY is maintained while the air lock is being used for personnel transit in and out of the containment. Periodic testing of this interlock demonstrates that the interlock will function as designed, and that simultaneous opening of the inner and outer doors will not inadvertently occur. Due to the purely mechanical nature of this interlock, and given that the interlock mechanism is only challenged when containment is entered, this test is only required to be performed upon entering containment, but is not required more frequently than every 184 days. The 184 day Frequency is based on engineering judgment and is considered adequate in view of other indications of door and interlock mechanism status available to operations personnel.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors."
 2. Watts Bar FSAR, Section 6.2, "Containment Systems."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.3 Containment Isolation Valves

BASES

BACKGROUND

The containment isolation valves form part of the containment pressure boundary and provide a means for fluid penetrations not serving as accident consequence limiting systems to be provided with two isolation barriers that are closed on a containment isolation signal. These isolation devices are either passive or active (automatic). Locked closed manual valves, deactivated automatic valves secured in their closed position (including check valves with flow through the valve secured), blind flanges, and closed systems are considered passive devices. Check valves, or other automatic valves designed to close without operator action following an accident, are considered active devices. Two barriers in series are provided for each penetration so that no single credible failure or malfunction of an active component can result in a loss of isolation or leakage that exceeds limits assumed in the safety analyses. One of these barriers may be a closed system. These barriers (typically containment isolation valves) make up the containment isolation system.

Automatic isolation signals are produced during accident conditions. Containment Phase "A" isolation occurs upon receipt of a safety injection signal. The Phase "A" isolation signal isolates nonessential process lines in order to minimize leakage of fission product radioactivity. Containment Phase "B" isolation occurs upon receipt of a containment pressure High-High signal and isolates the remaining process lines, except systems required for accident mitigation. In addition to the isolation signals listed above, the purge and exhaust valves receive an isolation signal on a containment high radiation condition. As a result, the containment isolation valves (and blind flanges) help ensure that the containment atmosphere will be isolated from the environment in the event of a release of fission product radioactivity to the containment atmosphere as a result of a Design Basis Accident (DBA).

The OPERABILITY requirements for containment isolation valves help ensure that containment is isolated within the time limits assumed in the safety analysis. Therefore, the

(continued)

BASES

BACKGROUND
(continued)

OPERABILITY requirements provide assurance that containment leakage rates assumed in the safety analysis will not be exceeded.

Reactor Building Purge Ventilation System

The Reactor Building Purge Ventilation System operates to supply outside air into the containment for ventilation and cooling or heating, to equalize internal and external pressures and to reduce the concentration of noble gases within containment prior to and during personnel access. The supply and exhaust lines each contain two isolation valves. Because of their large size and their exposure to higher containment pressure during accident conditions, the 24 inch containment lower compartment purge isolation valves are physically restricted to ≤ 50 degrees open.

Since the valves used in the Reactor Building Purge Ventilation System are designed to meet the requirements for automatic containment isolation valves, these valves may be opened as needed in MODES 1, 2, 3 and 4.

APPLICABLE
SAFETY ANALYSES

The containment isolation valve LCO was derived from the requirements related to the control of leakage from the containment during major accidents. This LCO is intended to ensure that the actual containment leakage rate does not exceed the value assumed in the safety analysis. As part of the containment boundary, containment isolation valve OPERABILITY supports containment OPERABILITY. Therefore, the safety analysis of any event requiring isolation of containment is applicable to this LCO.

The DBAs that result in a release of radioactive material within containment are a loss of coolant accident (LOCA) or a rod ejection accident (Ref. 1). In the analysis for each of these accidents, it is assumed that containment isolation valves are either closed or function to close within the required isolation time following event initiation. This ensures that potential leakage paths to the environment through containment isolation valves (including containment purge valves) are minimized.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The DBA analysis assumes that within 60 seconds after the accident, isolation of the containment is complete and leakage terminated except for the design leakage rate, L_a . The containment isolation total response time of 60 seconds includes signal delay, diesel generator startup (for loss of offsite power), and containment isolation valve stroke times.

The single failure criterion required to be imposed in the conduct of plant safety analysis was considered in the original design of the containment purge valves. Two valves in series on each purge line provide assurance that both the supply and exhaust lines could be isolated even if a single failure occurred. The inboard and outboard isolation valves on each line are provided with diverse power sources, motor operated and pneumatically operated spring closed, respectively. This arrangement was designed to preclude common mode failures from disabling both valves on a purge line.

The containment isolation valves satisfy Criterion 3 of the NRC Policy Statement.

LCO

Containment isolation valves form a part of the containment boundary. The containment isolation valves' safety function is related to control of containment leakage rates during a DBA. The automatic power operated isolation valves are considered OPERABLE when their isolation times are within limits and the valves actuate on an automatic isolation signal. The 24 inch purge containment lower compartment valves must be physically restricted (blocked) to ≤ 50 degrees open. Blocked purge valves also actuate on an automatic isolation signal. The valves covered by this LCO are listed along with their associated stroke times in the FSAR (Ref. 2).

The normally closed isolation valves are considered OPERABLE when manual valves are closed, automatic valves are deactivated and secured in their closed position, and blind flanges and closed systems are intact. These passive isolation valves/devices are those listed in Reference 1. Purge valves with resilient seals and Shield Building bypass valves must meet additional leakage rate requirements.

(continued)

BASES

LCO
(continued) This LCO provides assurance that the containment isolation valves will perform their designed safety functions to control leakage from the containment during accidents. The other containment isolation valve leakage rates are addressed by LCO 3.6.1, "Containment," as Type C testing.

APPLICABILITY In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, the containment isolation valves are not required to be OPERABLE in MODE 5. The requirements for containment isolation valves during MODE 6 are addressed in LCO 3.9.4, "Containment Penetrations."

ACTIONS The ACTIONS are modified by a Note allowing penetration flow paths to be opened intermittently under administrative control. These administrative controls consist of stationing a dedicated operator at the valve controls, who is in continuous communication with the control room. In this way, the penetration can be rapidly isolated when a need for containment isolation is indicated.

A second Note has been added to provide clarification for this LCO, separate condition entry is allowed for each penetration flow path.

ACTIONS are further modified by a third Note that ensures appropriate remedial actions are taken, if necessary, if the affected systems are rendered inoperable by an inoperable containment isolation valve.

In the event the air lock leakage results in exceeding the containment overall leakage rate, Note 4 directs entry into the applicable Conditions and Required Actions of LCO 3.6.1, "Containment".

A.1 and A.2

In the event one containment isolation valve in one or more penetration flow paths is inoperable, except for purge valve

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

or shield building bypass leakage not within limit, the affected penetration must be isolated. The method of isolation must include the use of at least one isolation barrier that cannot be adversely affected by a single active failure. Isolation barriers that meet this criterion are a closed and deactivated automatic containment isolation valve, a closed manual valve, a blind flange, and a check valve with flow through the valve secured. For a penetration isolated in accordance with Required Action A.1, the valve used to isolate the penetration should be the closest available one to containment. Required Action A.1 must be completed within 4 hours. The 4 hour Completion Time is reasonable considering the time required to isolate the penetration and the relative importance of supporting containment OPERABILITY during MODES 1, 2, 3, and 4.

For affected penetrations that cannot be restored to OPERABLE status within the 4 hour Completion Time and have been isolated in accordance with Required Action A.1, the affected penetrations must be verified to be isolated on a periodic basis. This is necessary to ensure that containment penetrations required to be isolated following an accident and are no longer capable of being automatically isolated, will be in the isolation position should an event occur. This Required Action does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown, that those isolation devices outside containment and capable of potentially being mispositioned are in the correct position. The Completion Time of "once every 31 days" for isolation devices outside containment is appropriate considering the fact that the valves are operated under administrative control and the probability of their misalignment is low. For the isolation devices inside containment, the time period specified as "prior to entering MODE 4 from MODE 5, if not performed within the previous 92 days," is based on engineering judgment and is considered reasonable in view of the inaccessibility of the isolation devices and other administrative controls that will ensure that isolation device misalignment is an unlikely possibility.

Condition A has been modified by a Note indicating that this Condition is only applicable to those penetration flow paths with two containment isolation valves. For penetration flow

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

paths with one containment isolation valve and a closed system, Condition C provides the appropriate actions.

Required Action A.2 is modified by a Note that applies to valves and blind flanges located in high radiation areas and allows these valves to be verified closed by use of administrative controls. Allowing verification by administrative controls is considered acceptable, since access to these areas is typically restricted. Therefore, the probability of misalignment of these valves, once they have been verified to be in the proper position, is small.

B.1

With two containment isolation valves in one or more flow paths inoperable, the affected penetration must be isolated within one hour. The method of isolation must include the use of at least one isolation barrier that cannot be adversely affected by a single active failure. Isolation barriers that meet this criterion are a closed and deactivated automatic valve, a closed manual valve, and a blind flange. The hour Completion Time is consistent with the ACTIONS of LCO 3.6.1. In the event the affected penetration is isolated in accordance with Required Action B.1, the affected penetration must be verified to be isolated on a periodic basis per Required Action A.2, which remains in effect. This periodic verification is necessary to provide assurance of containment leak tightness and that penetrations requiring isolation following an accident are isolated. The Completion Time of once per 31 days for verifying each affected penetration is isolated is appropriate considering the fact that the valves are operated under administrative control and the probability of their misalignment is low.

Condition B is modified by a Note indicating this Condition is only applicable to penetration flow paths with two isolation valves. Condition A of this LCO addresses the condition of one isolation valve inoperable in this type of penetration flow path.

(continued)

BASES

ACTIONS
(continued)

C.1 and C.2

With one or more penetration flow paths with one containment isolation valve inoperable, the inoperable valve must be restored to OPERABLE status or the affected penetration must be isolated. The method of isolation must include the use of at least one isolation barrier that cannot be adversely affected by a single active failure. Isolation barriers that meet this criterion are a closed and deactivated automatic valve, a closed manual valve, or a blind flange. A check valve may not be used to isolate the affected penetration. Required Action C.1 must be completed within the 4 hour Completion Time. The specified time period is reasonable considering the relative stability of the closed system (hence, reliability) to act as a penetration isolation boundary and the relative importance of maintaining containment integrity during MODES 1, 2, 3, and 4. In the event the affected penetration is isolated in accordance with Required Action C.1, the affected penetration must be verified to be isolated on a periodic basis. This periodic verification is necessary to assure containment integrity is maintained and provide assurance of containment leak tightness, and that penetrations requiring isolation following an accident are isolated. The Completion Time of once per 31 days for verifying that each affected penetration is isolated is appropriate because the valves are operated under administrative control and the probability of their misalignment is low.

Condition C is modified by a Note indicating that this Condition is only applicable to those penetrations with only one containment isolation valve and a closed system. This Note is necessary since this Condition is written to specifically address those penetration flow paths in a closed system.

Required Action C.2 is modified by a Note that applies to valves and blind flanges located in high radiation areas and allows these valves to be verified closed by use of administrative controls. Allowing verification by administrative controls is considered acceptable, since access to these areas is typically restricted. Therefore, the probability of misalignment of these valves, once they have been verified to be in the proper position, is small.

(continued)

BASES

ACTIONS
(continued)

D.1

With the Shield Building bypass leakage rate not within limits, the assumptions of the radiological analysis is not met. Therefore, the leakage must be restored to within limits within 4 hours. Restoration can be accomplished by isolating the penetrations that cause the limit to be exceeded, by use of closed and deactivated automatic valve, closed manual valve or blind flange. When a penetration is isolated, the leakage rate for the isolated penetration is assumed to be the actual pathway leakage through the isolation device. If two isolation devices are used to isolate the penetration, the leakage rate is assumed to be the lesser actual pathway leakage of the two devices. The 4 hour Completion Time is reasonable considering the time required to restore the leakage by isolating the penetration and relative importance of Shield Building bypass leakage to the overall containment functions.

E.1, E.2, and E.3

In the event one or more containment purge valves are not within the purge valve leakage limits, purge valve leakage must be restored to within limits or the affected penetration must be isolated. The method of isolation must be by the use of at least one isolation barrier that cannot be adversely affected by a single active failure. Isolation barriers that meet this criterion are a closed and deactivated automatic valve, a closed manual valve, or blind flange. A purge valve with resilient seals utilized to satisfy Required Action E.1 must have been demonstrated to meet the leakage requirements of SR 3.6.3.6. The specified Completion Time is reasonable, considering that one containment purge valve remains closed so that a gross breach of containment does not exist.

In accordance with Required Action E.2 this penetration flow path must be verified to be isolated on a periodic basis. The periodic verification is necessary to ensure that containment penetrations required to be isolated following an accident, which are no longer capable of being automatically isolated, will be in the isolation position should an event occur. This Required Action does not require any testing or valve manipulation. Rather, it

(continued)

BASES

ACTIONS

E.1, E.2, and E.3 (continued)

involves verification, through a system walkdown, that those isolation devices outside containment potentially capable of being mispositioned are in the correct position. For the isolation devices inside containment, the time period specified as "prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days" is based on engineering judgment and is considered reasonable in view of the inaccessibility of the isolation devices and other administrative controls that will ensure that isolation device misalignment is an unlikely possibility.

For the containment purge valve with resilient seal that is isolated in accordance with Required Action E.1, SR 3.6.3.6 must be performed at least once every 92 days. This assures that degradation of the resilient seal is detected and confirms that the leakage rate of the containment purge valve does not increase during the time the penetration is isolated. The normal Frequency for SR 3.6.3.6, 184 days, is based on an NRC initiative, Generic Issue B-20, "Containment Leakage Due to Seal Deterioration" (Ref. 3). Since more reliance is placed on a single valve while in this Condition, it is prudent to perform the SR more often. Therefore, a Frequency of once per 92 days was chosen and has been shown acceptable based on operating experience.

F.1 and F.2

If the Required Actions cannot be met within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 system.

SURVEILLANCE
REQUIREMENTS

SR 3.6.3.1

The 24 inch containment lower compartment purge supply and exhaust isolation valves are required to be verified to be physically restricted to ≤ 50 degrees open every 31 days.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.6.3.1 (continued)

This is to ensure that the proper closure times can be met upon receipt of an isolation signal. The 18 month frequency is based on ALARA radiation exposure considerations for personnel inspecting these remotely located valves, and on the very improbable chance that the mechanical device which physically restricts each valve will change position.

This SR ensures that the containment lower compartment purge valves are capable of closing during a DBA. Therefore, the site boundary dose guideline values of 10 CFR 100 would not be exceeded in the event of an accident during containment purge operation.

SR 3.6.3.2

This SR ensures that the purge valves are closed as required or, if open, open for an allowable reason. The SR is not required to be met when the purge valves are open for the reasons stated. The valves may be opened for pressure control, ALARA air quality considerations for personnel entry, and Surveillance tests that require the valve to be open. All purge valves are capable of closing in the environment following a LOCA. Therefore, these valves are allowed to be open for limited periods of time. The 31 day Frequency is consistent with other containment isolation valve requirements discussed in SR 3.6.3.3.

SR 3.6.3.3

This SR requires verification that each containment isolation manual valve and blind flange located outside containment and required to be closed during accident conditions is closed. The SR helps to ensure that post accident leakage of radioactive fluids or gases outside of the containment boundary is within design limits. This SR does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown, that those valves outside containment, capable of being mispositioned, are in the correct position. Since verification of valve position for valves outside containment is relatively easy, the 31 day Frequency is

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.6.3.3 (continued)

based on engineering judgement and was chosen to provide added assurance of the correct positions.

A Note applies to valves and blind flanges located in high radiation areas and allows these devices to be verified closed by use of administrative controls. Allowing verification by administrative controls is considered acceptable, since access to these areas is typically restricted during MODES 1, 2, 3, and 4 for ALARA reasons. Therefore, the probability of misalignment of these valves once they have been verified to be in the proper position, is small. The SR excludes valves that are open under administrative controls are not required to meet the SR during the time the valves are open.

SR 3.6.3.4

This SR requires verification that each containment isolation manual valve and blind flange located inside containment and required to be closed during accident conditions is closed. The SR helps to ensure that post accident leakage of radioactive fluids or gases outside of the containment boundary is within design limits. For valves inside containment, the Frequency of "prior to entering MODE 4 from MODE 5 if not performed within the previous 92 days" is appropriate since these valves and flanges are operated under administrative control and the probability of their misalignment is low.

A Note applies to valves and blind flanges located in high radiation areas, and allows these devices to be verified closed by use of administrative controls. Allowing verification by administrative controls is considered acceptable, since access to these areas is typically restricted during MODES 1, 2, 3, and 4 for ALARA reasons. Therefore, the probability of misalignment of these valves, once they have been verified to be in the proper position, is small. This SR excludes valves that are open under administrative controls are not required to meet the SR during the time they are open.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.6.3.5

Verifying that the isolation time of each power operated and automatic containment isolation valve is within limits is required to demonstrate OPERABILITY. The isolation time test ensures that the valve will isolate in a time period less than or equal to that assumed in the safety analysis. The isolation time and Frequency of this SR are in accordance with the Inservice Testing Program or 92 days.

SR 3.6.3.6

For containment purge valves with resilient seals, additional leakage rate testing beyond the test requirements of 10 CFR 50, Appendix J, is required to ensure OPERABILITY. Operating experience has demonstrated that this type of seal has the potential to degrade in a shorter time period than other seal types. Based on this observation, and the importance of maintaining this penetration leak tight (due to the direct path between containment and the environment), a Frequency of 184 days was established as part of the NRC resolution of Generic Issue B-20, "Containment Leakage Due to Seal Deterioration" (Ref. 3).

Additionally, this SR must be performed within 92 days after opening the valve. The 92 day Frequency was chosen recognizing that cycling the valve could introduce additional seal degradation (beyond that occurring to a valve that has not been opened). Thus, decreasing the interval (from 184 days) is a prudent measure after a valve has been opened.

A Note to this SR requires the results to be evaluated against the acceptance criteria of SR 3.6.1.1. This ensures that excessive containment purge valve leakage is properly accounted for in determining the overall containment leakage rate.

SR 3.6.3.7

Automatic containment isolation valves close on a containment isolation signal to prevent leakage of radioactive material from containment following a DBA. This SR ensures that each automatic containment isolation valve

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.6.3.7 (continued)

will actuate to its isolation position on a containment isolation signal. The 18 month Frequency was developed considering it is prudent that this SR be performed only during a plant outage since isolation of penetrations would eliminate cooling water flow and disrupt the normal operation of many critical components. Operating experience has shown that these components usually pass this Surveillance when performed on the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.3.8

This SR ensures that the leakage rate of shield building bypass leakage paths is less than the specified leakage rate. This provides assurance that the assumptions in the radiological evaluations of Reference 2 are met. The leakage rate of each bypass leakage path is assumed to be the maximum pathway leakage (leakage through the worse of the two isolation valves) unless the penetration is isolated by use of one closed and deactivated automatic valve, closed manual valve, or blind flange. In this case, the leakage rate of the isolated bypass leakage path is assumed to be the actual pathway leakage through the isolation device. If both isolation valves in the penetration are closed, the actual leakage rate is the lesser leakage rate of the two valves. This method of quantifying maximum pathway leakage is only to be used for this SR (i.e., Appendix J maximum pathway leakage limits are to be quantified in accordance with Appendix 5). The 18 month Frequency was developed considering it is prudent that this Surveillance be performed only during a plant outage. Operating experience has shown that these components usually pass this SR when performed on the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint. A Note has been added to this SR requiring the results to be evaluated against the acceptance criteria of SR 3.6.1.1. This ensures that shield building bypass leakage is properly accounted for in determining the overall primary containment leakage rate.

(continued)

BASES (continued)

REFERENCES

1. Watts Bar FSAR, Section 15, "Accident Analysis."
 2. Watts Bar FSAR, Section 6.2.4.2, "Containment Isolation System Design", and Table 6.2.4-1, "Containment Penetrations and Barriers."
 3. Generic Issue B-20 "Containment Leakage Due to Seal Deterioration."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.4 Containment Pressure

BASES

BACKGROUND

The containment pressure is limited during normal operation to preserve the initial conditions assumed in the accident analyses for a loss of coolant accident (LOCA) or steam line break (SLB). These limits also prevent the containment pressure from exceeding the containment design negative pressure differential (-2.0 psig) with respect to the Shield Building annulus atmosphere in the event of inadvertent actuation of the Containment Spray System.

Containment pressure is a process variable that is monitored and controlled. The containment pressure limits are derived from the input conditions used in the containment functional analyses and the containment structure external pressure analysis. Should operation occur outside these limits coincident with a Design Basis Accident (DBA), post accident containment pressure could exceed calculated values.

APPLICABLE
SAFETY ANALYSES

Containment internal pressure is an initial condition used in the DBA analyses to establish the maximum peak containment internal pressure. The limiting DBAs considered, relative to containment pressure, are the LOCA and SLB, which are analyzed using computer pressure transients. The worst case LOCA generates larger mass and energy release than the worst case SLB. Thus, the LOCA event bounds the SLB event from the containment peak pressure standpoint (Ref. 1).

The initial pressure condition used in the containment analysis was 15.0 psia (0.3 psig). This resulted in a maximum peak pressure from a LOCA of 11.21 psig. The containment analysis (Ref. 1) shows that the maximum peak containment pressure, P_a (15.0 psig), bounds the calculated results from the limiting LOCA.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The maximum containment pressure resulting from the worst case LOCA does not exceed the containment design pressure, 13.5 psig.

The containment was also designed for an external pressure load equivalent to 2.0 psig. The inadvertent actuation of the Containment Spray System was analyzed to determine the resulting reduction in containment pressure. The initial pressure condition used in this analysis was -0.1 psig. This resulted in a minimum pressure inside containment of -1.4 psig, which is less than the design load.

For certain aspects of transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the cooling effectiveness of the Emergency Core Cooling System during the core reflood phase of a LOCA analysis increases with increasing containment backpressure. Therefore, for the reflood phase, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the containment pressure response in accordance with 10 CFR 50, Appendix K (Ref. 2).

Containment pressure satisfies Criterion 2 of the NRC Policy Statement.

LCO

Maintaining containment pressure at less than or equal to the LCO upper pressure limit ensures that, in the event of a DBA, the resultant peak containment accident pressure will remain below the containment design pressure. Maintaining containment pressure at greater than or equal to the LCO lower pressure limit ensures that the containment will not exceed the design negative differential pressure following the inadvertent actuation of the Containment Spray System.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment. Since maintaining containment pressure within limits is essential to ensure initial conditions assumed in the accident analyses are maintained, the LCO is applicable in MODES 1, 2, 3 and 4.

(continued)

BASES

APPLICABILITY (continued) In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, maintaining containment pressure within the limits of the LCO is not required in MODES 5 and 6.

ACTIONS

A.1

When containment pressure is not within the limits of the LCO, it must be restored to within these limits within 1 hour. The Required Action is necessary to return operation to within the bounds of the containment analysis. The 1 hour Completion Time is consistent with the ACTIONS of LCO 3.6.1, "Containment," which requires that containment be restored to OPERABLE status within 1 hour.

B.1 and B.2

If containment pressure cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 3.6.4.1

Verifying that containment pressure is within limits ensures that unit operation remains within the limits assumed in the containment analysis. The 12 hour Frequency of this SR was developed based on operating experience related to trending of containment pressure variations during the applicable MODES. Furthermore, the 12 hour Frequency is considered adequate in view of other indications available in the control room, including alarms, to alert the operator to an abnormal containment pressure condition.

(continued)

BASES (continued)

- REFERENCES
1. Watts Bar FSAR, Section 6.2.1, "Containment Functional Design."
 2. Title 10, Code of Federal Regulations, Part 50, Appendix K, "ECCS Evaluation Models."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.5 Containment Air Temperature

BASES

BACKGROUND

The containment structure serves to contain radioactive material which may be released from the reactor core following a Design Basis Accident (DBA). The containment average air temperature is limited, during normal operation, to preserve the initial conditions assumed in the accident analyses for a loss of coolant accident (LOCA) or steam line break (SLB).

The containment average air temperature limit is derived from the input conditions used in the containment functional analyses and the containment structure external pressure analyses. This LCO ensures that initial conditions assumed in the analysis of containment response to a DBA are not violated during plant operations. The total amount of energy to be removed from containment by the containment spray and cooling systems during post accident conditions is dependent upon the energy released to the containment due to the event, as well as the initial containment temperature and pressure. The higher the initial temperature, the more energy that must be removed, resulting in a higher peak containment temperature. Exceeding containment design pressure may result in leakage greater than that assumed in the accident analysis. Operation with containment temperature in excess of the LCO limit violates an initial condition assumed in the accident analysis.

APPLICABLE
SAFETY ANALYSES

Containment average air temperature is an initial condition used in the DBA analyses that establishes the containment environmental qualification operating envelope for both pressure and temperature. The limit for containment average air temperature ensures that operation is maintained within the assumptions used in the DBA analyses for containment (Ref. 1).

The limiting DBAs considered relative to containment OPERABILITY are the LOCA and SLB. The DBA LOCA and SLB are analyzed using computer codes designed to predict the

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

resultant containment pressure transients. No two DBAs are assumed to occur simultaneously or consecutively. The postulated DBAs are analyzed with regard to Engineered Safety Feature (ESF) systems, assuming the loss of one ESF bus, which is the worst case single active failure, resulting in one train each of Containment Spray System, Residual Heat Removal System, and Air Return System being rendered inoperable.

The limiting DBA for the maximum peak containment air temperature is an SLB. For the upper compartment, the initial containment average air temperature assumed in the design basis analyses (Ref. 1) is 110°F. For the lower compartment, the initial average containment air temperature assumed in the design basis analyses is 120°F. This resulted in a maximum containment air temperature of 326°F. The design temperature is 250°F.

The temperature upper limits are used to establish the environmental qualification operating envelope for both containment compartments. The maximum peak containment air temperature for both containment compartments was calculated to exceed the containment design temperature for only a few seconds during the transient. The basis of the containment design temperature, however, is to ensure the performance of safety related equipment inside containment (Ref. 2). Thermal analyses showed that the time interval during which the containment air temperature exceeded the containment design temperature was short enough that the equipment surface temperatures remained below the design temperature. Therefore, it is concluded that the calculated transient containment air temperatures are acceptable for the DBA SLB.

The temperature upper limits are also used in the depressurization analyses to ensure that the minimum pressure limit is maintained following an inadvertent actuation of the Containment Spray System (Ref. 1) for both containment compartments.

The containment pressure transient is sensitive to the initial air mass in containment and, therefore, to the initial containment air temperature. The limiting DBA for establishing the maximum peak containment internal pressure is a LOCA. The temperature lower limits, 85°F for the upper compartment and 100°F for the lower compartment, are used in

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

this analysis to ensure that, in the event of an accident, the maximum containment internal pressure will not be exceeded in either containment compartment.

Containment average air temperature satisfies Criterion 2 of the NRC Policy Statement.

LCO

During a DBA, with an initial containment average temperature within the LCO temperature limits, the resultant peak accident temperature is maintained below the containment design temperature. As a result, the ability of containment to perform its design function is ensured. In MODES 2, 3, and 4, containment air temperature may be as low as 60°F, because the resultant calculated peak containment accident pressure would not exceed the design pressure due to a lesser amount of energy released from the pipe break in these MODES.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, maintaining containment average air temperature within the limit is not required in MODE 5 or 6.

ACTIONS

A.1

When containment average air temperature in the upper or lower compartment is not within the limit of the LCO, the average air temperature in the affected compartment must be restored within 8 hours. This Required Action is necessary to return operation to within the bounds of the containment analysis. The 8 hour Completion Time is acceptable considering the sensitivity of the analysis to variations in this parameter, and provides sufficient time to correct minor problems.

(continued)

BASES

ACTIONS
(continued)

B.1 and B.2

If the containment average air temperature cannot be restored to OPERABLE status in the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowable Completion Times are reasonable, based on operating experience, to reach the required MODES from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.6.5.1 and SR 3.6.5.2

Verifying that containment average air temperature is within the LCO limits ensures that containment operation remains within the limits assumed for the containment analyses. In order to determine the containment average air temperature, a weighted average is calculated using measurements taken at locations within the containment selected to provide a representative sample of the overall containment atmosphere. The 24 hour Frequency of these SRs is considered acceptable based on observed slow rates of temperature increase within containment as a result of environmental heat sources (due to the large volume of containments). Furthermore, the 24 hour Frequency is considered adequate in view of other indications available in the control room, including alarms, to alert the operator to an abnormal containment temperature condition.

REFERENCES

1. Watts Bar FSAR, Section 6.2, "Containment Systems."
 2. Title 10, Code of Federal Regulations, Part 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.6 Containment Spray System

BASES

BACKGROUND

The Containment Spray System provides containment atmosphere cooling to limit post accident pressure and temperature in containment to less than the design values. Reduction of containment pressure reduces the release of fission product radioactivity from containment to the environment, in the event of a Design Basis Accident (DBA). The Containment Spray System is designed to meet the requirements of 10 CFR 50, Appendix A (Ref. 1), GDC 38, "Containment Heat Removal," GDC 39, "Inspection of Containment Heat Removal System," GDC 40, "Testing of Containment Heat Removal Systems," GDC 41, "Containment Atmosphere Cleanup," GDB 43, "Testing of Containment Atmosphere Cleanup Systems," and GDC 50, "Containment Design Basis," or other documents that were appropriate at the time of licensing (identified on a plant specific basis).

The Containment Spray System consists of two separate trains of equal capacity, each capable of meeting the system design basis spray coverage. Each train includes a containment spray pump, one containment spray heat exchanger, a spray header, nozzles, valves, and piping. Each train is powered from a separate Engineered Safety Feature (ESF) bus. The refueling water storage tank (RWST) supplies borated water to the Containment Spray System during the injection phase of operation. In the recirculation mode of operation, containment spray pump suction is transferred from the RWST to the containment recirculation sump.

The diversion of a portion of the recirculation flow from each train of the Residual Heat Removal (RHR) System to additional redundant spray headers completes the Containment Spray System heat removal capability. Each RHR train is capable of supplying spray coverage, if required, to supplement the Containment Spray System.

The Containment Spray System and RHR System provide a spray of cold or subcooled borated water into the upper and lower regions of containment and in dead ended volumes to limit the containment pressure and temperature during a DBA. The

(continued)

BASES

BACKGROUND
(continued)

RWST solution temperature is an important factor in determining the heat removal capability of the Containment Spray System during the injection phase. In the recirculation mode of operation, heat is removed from the containment sump water by the Containment Spray System and RHR heat exchangers. Each train of the Containment Spray System, supplemented by a train of RHR spray, provides adequate spray coverage to meet the system design requirements for containment heat removal.

The Containment Spray System is actuated, automatically by a containment High-High pressure signal, or manually. An automatic actuation starts the two containment spray pumps, opens the containment spray pump discharge valves, and begins the injection phase. A manual actuation of the Containment Spray System requires the operator to actuate two separate switches on the main control board to begin the same sequence. The injection phase continues until an RWST level Low-Low alarm is received. The Low-Low alarm for the RWST signals the operator to manually align the system to recirculation mode. The Containment Spray System in recirculation mode maintains an equilibrium temperature between the containment atmosphere and the recirculated sump water. Operation of the Containment Spray System in the recirculation mode is controlled by the operator in accordance with the emergency operation procedures.

The RHR spray operation is initiated manually, when required by the emergency operating procedures, after the Emergency Core Cooling System (ECCS) is operating in the recirculation mode. The RHR sprays are available to supplement the Containment Spray System, if required, in limiting containment pressure. This additional spray capacity would typically be used after the ice bed has been depleted and in the event that containment pressure rises above a predetermined limit. The Containment Spray System is an ESF system. It is designed to ensure that the heat removal capability required during the post accident period can be attained.

The operation of the Containment Spray System, together with the ice condenser, is adequate to assure pressure suppression during the initial blowdown of steam and water from a DBA. During the post blowdown period, the Air Return System (ARS) is automatically started. The ARS returns

(continued)

BASES

BACKGROUND
(continued)

upper compartment air through the divider barrier to the lower compartment. This serves to equalize pressures in containment and to continue circulating heated air and steam through the ice condenser, where heat is removed by the remaining ice.

The Containment Spray System limits the temperature and pressure that could be expected following a DBA. Protection of containment integrity limits leakage of fission product radioactivity from containment to the environment.

APPLICABLE
SAFETY ANALYSES

The limiting DBAs considered relative to containment OPERABILITY are the loss of coolant accident (LOCA) and the steam line break (SLB). The DBA LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. No two DBAs are assumed to occur simultaneously or consecutively. The postulated DBAs are analyzed, in regard to containment ESF systems, assuming the loss of one ESF bus, which is the worst case single active failure, resulting in one train of the Containment Spray System, the RHR System, and the ARS being rendered inoperable (Ref. 2).

The DBA analyses show that the maximum peak containment pressure of 11.21 psig results from the LOCA analysis, and is calculated to be less than the containment design pressure. The maximum peak containment atmosphere temperature results from the SLB analysis and was calculated to exceed the containment design temperature for a few seconds during the DBA SLB. The basis of the containment design temperature, however, is to ensure OPERABILITY of safety related equipment inside containment (Ref. 3).

Thermal analyses showed that the time interval during which the containment atmosphere temperature exceeded the containment design temperature was short enough that the equipment surface temperatures remained below the design temperature. Therefore, it is concluded that the calculated transient containment atmosphere temperatures are acceptable for the DBA SLB.

The modeled Containment Spray System actuation from the

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

Containment analysis is based on a response time associated with exceeding the containment High-High pressure signal setpoint to achieving full flow through the containment spray nozzles. A delayed response time initiation provides conservative analyses of peak calculated Containment temperature and pressure responses. The Containment Spray System total response time of 221 seconds is composed of signal delay, diesel generator startup, and system startup time.

For certain aspects of transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the ECCS cooling effectiveness during the core reflood phase of a LOCA analysis increases with increasing containment backpressure. For these calculations, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the calculated transient containment pressures in accordance with 10 CFR 50, Appendix K (Ref. 4).

Inadvertent actuation of the Containment Spray System is evaluated in the analysis, and the resultant reduction in containment pressure is calculated. The maximum calculated steady state pressure differential relative to the Shield Building Annulus is 1.4 psid, which is below the containment design external pressure load of 2.0 psid.

The Containment Spray System satisfies Criterion 3 of the NRC Policy Statement.

LCO

During a DBA, one train of Containment Spray System and RHR Spray System is required to provide the heat removal capability assumed in the safety analyses. To ensure that these requirements are met, two containment spray trains and two RHR spray trains must be OPERABLE with power from two safety related independent power supplies. Therefore, in the event of an accident, at least one train in each system operates.

Each containment spray train typically includes a spray pump, header, valves, a heat exchanger, nozzles, piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the RWST upon an ESF

(continued)

BASES

LCO
(continued) actuation signal and manually transferring suction to the containment sump.

Each RHR Spray train includes a pump, header, valves, a heat exchanger, nozzles, piping, instruments and controls to ensure an OPERABLE flow path capable of taking suction from the containment sump and supplying flow to the spray header.

APPLICABILITY In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment and an increase in containment pressure and temperature requiring the operation of the Containment Spray System. A Note has been added which states the RHR spray trains are not required in MODE 4. The containment spray system does not require supplemental cooling from RHR spray in MODE 4.

In MODES 5 and 6, the probability and consequences of these events are reduced because of the pressure and temperature limitations of these MODES. Thus, the Containment Spray System is not required to be OPERABLE in MODE 5 or 6.

ACTIONS

A.1

With one Containment Spray System train or one RHR Spray System train inoperable, the affected train must be restored to OPERABLE status within 72 hours. The components in this degraded condition are capable of providing 100% of the heat removal needs after an accident. The remaining train is capable of providing 100% of the heat removal needs after an accident. The 72 hour Completion Time was developed taking into account the redundant heat removal capabilities afforded by the OPERABLE train and the low probability of a DBA occurring during this period.

B.1 and B.2

If containment spray train or RHR spray train cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

brought to at least MODE 3 within 6 hours and to MODE 5 within 84 hours. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.6.6.1

Verifying the correct alignment of manual, power operated, and automatic valves, excluding check valves, in the Containment Spray System provides assurance that the proper flow path exists for Containment Spray System operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position since they were verified in the correct position prior to being secured. This SR does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown, that those valves outside containment and capable of potentially being mispositioned, are in the correct position.

SR 3.6.6.2

Verifying that each containment spray pump developed head at the flow test point is greater than or equal to the required developed head ensures that spray pump performance has not degraded during the cycle. Flow and differential head are normal tests of centrifugal pump performance required by Section XI of the ASME Code (Ref. 5). Since the containment spray pumps cannot be tested with flow through the spray headers, they are tested on bypass flow. This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice inspections confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The Frequency of this SR is in accordance with the Inservice Testing Program.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.6.6.3 and SR 3.6.6.4

These SRs require verification that each automatic containment spray valve actuates to its correct position and each containment spray pump starts upon receipt of an actual or simulated containment spray actuation signal. Containment spray pump start verification may be performed by testing breaker actuation without pump start (breaker is racked out in its "test position") and observation of the local or remote pump start lights (breaker energization light). The 18 month Frequency was developed considering it is prudent that many Surveillances be performed only during a plant outage. This is due to the plant conditions needed to perform the SR and the potential for unnecessary plant transients if the SR is performed with the reactor at power. Operating experience has shown these components usually pass the SR when performed on the 18-month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

The Surveillance of containment sump isolation valves is also required by SR 3.6.6.3. A single Surveillance may be used to satisfy both requirements.

SR 3.6.6.5

With the containment spray and RHR spray inlet valves closed and the spray header drained of any solution, low pressure air or smoke can be blown through test connections. This SR ensures that each spray nozzle is unobstructed and that spray coverage of the containment during an accident is not degraded. Because of the passive design of the nozzle, the first refueling outage and 10 year intervals are considered adequate to detect obstruction of the spray nozzles.

SR 3.6.6.6

The Surveillance descriptions from Bases 3.5.2 for SR 3.5.2.2 and 3.5.2.4 apply as applicable to the RHR spray system.

(continued)

BASES (continued)

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, "General Criteria for Nuclear Power Plants."
 2. Watts Bar FSAR, Section 6.2, "Containment Systems."
 3. Title 10, Code of Federal Regulations, Part 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants."
 4. Title 10, Code of Federal Regulations, Part 50, Appendix K, "ECCS Evaluation Models."
 5. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," American Society of Mechanical Engineers, New York.
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.7 Hydrogen Recombiners

BASES

BACKGROUND

The function of the hydrogen recombiners is to eliminate potential breach of containment due to a hydrogen oxygen reaction.

Hydrogen recombiners are required to reduce the hydrogen concentration in the containment following a loss of coolant accident (LOCA) or steam line break (SLB). The recombiners accomplish this by recombining hydrogen and oxygen to form water vapor. The vapor remains in containment, thus eliminating any discharge to the environment. The hydrogen recombiners are manually initiated since flammable limits would not be reached until several days after a Design Basis Accident (DBA).

Two 100% capacity independent hydrogen recombiner systems are provided. Each consists of controls located in the control room, a power supply and a recombiner. Recombination is accomplished by heating a hydrogen air mixture above 1150°F. The resulting water vapor and discharge gases are cooled prior to discharge from the recombiner. A single recombiner is capable of maintaining the hydrogen concentration in containment below the 4.1 volume percent (v/o) flammability limit. Two recombiners are provided to meet the requirement for redundancy and independence. Each recombiner is powered from a separate Engineered Safety Feature bus, and is provided with a separate power panel and control panel.

APPLICABLE
SAFETY ANALYSES

The hydrogen recombiners provide for the capability of controlling the bulk hydrogen concentration in containment to less than the lower flammable concentration of 4.1 v/o following a DBA. This control would prevent a containment wide hydrogen burn, thus ensuring the pressure and temperature assumed in the analysis are not exceeded. The limiting DBA relative to hydrogen generation is a LOCA.

Hydrogen may accumulate in containment following a LOCA as a result of:

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

- a. A metal-steam reaction between the zirconium fuel rod cladding and the reactor coolant;
- b. Radiolytic decomposition of water in the Reactor Coolant System (RCS) and the containment sump;
- c. Hydrogen in the RCS at the time of the LOCA (i.e., hydrogen dissolved in the reactor coolant and hydrogen gas in the pressurizer vapor space); or
- d. Corrosion of metals exposed to containment spray and Emergency Core Cooling System solutions.

To evaluate the potential for hydrogen accumulation in containment following a LOCA, the hydrogen generation as a function of time following the initiation of the accident is calculated. Conservative assumptions recommended by Reference 3 are used to maximize the amount of hydrogen calculated.

Based on the conservative assumptions used to calculate the hydrogen concentration versus time after a LOCA, the hydrogen concentration in the primary containment would reach 3.5 v/o about 6 days after the LOCA and 4.0 v/o about 2 days later if no recombiner was functioning (Ref. 3). Initiating the hydrogen recombiners when the primary containment hydrogen concentration reaches 3.5 v/o will maintain the hydrogen concentration in the primary containment below flammability limits.

The hydrogen recombiners are designed such that, with the conservatively calculated hydrogen generation rates discussed above, a single recombiner is capable of limiting the peak hydrogen concentration in containment to less than 4.0 v/o (Ref. 3). The Hydrogen Purge System is similarly designed such that one of two redundant trains is an adequate backup to the redundant hydrogen recombiners.

The hydrogen recombiners satisfy Criterion 3 of the NRC Policy Statement.

LCO

Two hydrogen recombiners must be OPERABLE. This ensures operation of at least one hydrogen recombiner in the event of a worst case single active failure.

(continued)

BASES

LCO
(continued) Operation with at least one hydrogen recombiner ensures that the post LOCA hydrogen concentration can be prevented from exceeding the flammability limit.

APPLICABILITY In MODES 1 and 2, two hydrogen recombiners are required to control the hydrogen concentration within containment below its flammability limit of 4.1 v/o following a LOCA assuming a worst case single failure.

In MODES 3 and 4, both the hydrogen production rate and the total hydrogen produced after a LOCA would be less than that calculated for the DBA LOCA. Also, because of the limited time in these MODES, the probability of an accident requiring the hydrogen recombiners is low. Therefore, the hydrogen recombiners are not required in MODE 3 or 4.

In MODES 5 and 6, the probability and consequences of a LOCA are low due to the pressure and temperature limitations in these MODES. Therefore, hydrogen recombiners are not required in these MODES.

ACTIONS

A.1

With one containment hydrogen recombiner inoperable, the inoperable recombiner must be restored to OPERABLE status within 30 days. In this condition, the remaining OPERABLE hydrogen recombiner is adequate to perform the hydrogen control function. However, the overall reliability is reduced because a single failure in the OPERABLE recombiner could result in reduced hydrogen control capability. The 30-day Completion Time is based on the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit); the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit; and the low probability of failure of the OPERABLE hydrogen recombiner.

Required Action A.1 has been modified by a Note states the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when one recombiner is inoperable.

(continued)

BASES

ACTIONS

A.1 (continued)

The 30-day Completion Time is based on the small probability of a LOCA or SLB occurring (that would generate an amount of hydrogen that exceeds the flammability limit); the amount of time available after a LOCA or SLB (should one occur) for operator action to prevent hydrogen accumulation from exceeding the flammability limit; and the low probability of failure of the OPERABLE hydrogen recombiner.

B.1 and B.2

With two hydrogen recombiners inoperable, the ability to perform the hydrogen control function via alternate capabilities must be verified by administrative means within 1 hour. The alternate hydrogen control capabilities are provided by the hydrogen mitigation system. The 1 hour Completion Time allows a reasonable period of time to verify that a loss of hydrogen control function does not exist. In addition, the alternate hydrogen control system capability must be verified every 12 hours thereafter to ensure its continued availability. Both the initial verification and all subsequent verifications may be performed as an administrative check by examining logs or other information to determine the availability of the alternate hydrogen control system. It does not mean to perform the Surveillances needed to demonstrate OPERABILITY of the alternate hydrogen control system. If the ability to perform the hydrogen control function is maintained, continued operation is permitted with two hydrogen recombiners inoperable for up to 7 days. Seven days is a reasonable time to allow two hydrogen recombiners to be inoperable because the hydrogen control function is maintained and the low probability of the occurrence of a LOCA that would generate hydrogen in the amounts capable of exceeding the flammability limit.

C.1

If the inoperable hydrogen recombiner(s) cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.6.7.1

Performance of a system functional test for each hydrogen recombiner ensures the recombiners are operational and can attain and sustain the temperature necessary for hydrogen recombination. In particular, this SR verifies that the minimum heater sheath temperature increases to $\geq 700^{\circ}\text{F}$ in ≤ 90 minutes. After reaching 700°F , the power is increased to maximum power for approximately 2 minutes and power is verified to be ≥ 60 kW.

The 18 month Frequency for this SR was developed considering the incidence of hydrogen recombiners failing the SR in the past is low.

SR 3.6.7.2

This SR ensures there are no physical problems that could affect recombiner operation. Since the recombiners are mechanically passive, they are not subject to mechanical failure. The only credible failure involves loss of power, blockage of the internal flow, missile impact, etc.

A visual inspection is sufficient to determine abnormal conditions that could cause such failures. The 18 month Frequency for this SR was developed considering the incidence of hydrogen recombiners failing the SR in the past is low.

SR 3.6.7.3

This SR requires performance of a resistance to ground test of each heater phase to ensure that there are no detectable grounds in any heater phase. This is accomplished by verifying that the resistance to ground for any heater phase is $\geq 10,000$ ohms.

The 18 month Frequency for this SR was developed considering the incidence of hydrogen recombiners failing the Surveillance in the past is low.

(continued)

BASES (continued)

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Power Reactors."
 2. Title 10, Code of Federal Regulations, Part 50, Appendix A, GDC 41, "Containment Atmosphere Cleanup."
 3. Regulatory Guide 1.7, Revision 1, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident," U.S. Nuclear Regulatory Commission.
 4. Watts Bar FSAR, Section 15, "Accident Analyses."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.8 Hydrogen Mitigation System (HMS)

BASES

BACKGROUND.

The HMS consists of two groups of 34 igniters distributed throughout the containment. The HMS reduces the potential for breach of primary containment due to a hydrogen oxide reaction in post accident environment. The HMS is required by 10 CFR 50.44, "Standards for Combustible Gas Control Systems in Light-Water-Cooled Reactors" (Ref. 1) and Appendix A, GDC 41, "Containment Atmosphere Cleanup" (Ref. 2), to reduce the hydrogen concentration in the primary containment following a degraded core accident. The HMS must be capable of handling, an amount of hydrogen equivalent to that generated from a metal water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the plenum volume).

10 CFR 50.44 (Ref. 1) requires plants with ice condenser containments to install suitable hydrogen control systems that would accommodate an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water. The HMS provides this required capability. This requirement was placed on ice condenser plants because of their small containment volume and low design pressure (compared with pressurized water reactor dry containments). Calculations indicate that if hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water were to collect in the primary containment, the resulting hydrogen concentration would be far above the lower flammability limit such that, if ignited from a random ignition source, the resulting hydrogen burn would seriously challenge the containment and safety systems in the containment.

The HMS is based on the concept of controlled ignition using thermal igniters, designed to be capable of functioning in a post accident environment, seismically supported, and capable of actuation from the control room. A total of 68 igniters are distributed throughout the various regions of containment in which hydrogen could be released or to which it could flow in significant quantities. The igniters are arranged in two independent trains such that each

(continued)

BASES

BACKGROUND
(continued)

containment region has at least two igniters, one from each train, controlled and powered redundantly so that ignition would occur in each region even if one train failed to energize.

When the HMS is initiated, the igniter elements are energized and heat up to a surface temperature $\geq 1700^{\circ}\text{F}$. At this temperature they ignite the hydrogen gas that is present in the airspace in the vicinity of the igniter. The HMS depends on the dispersed location of the igniters so that local pockets of hydrogen at increased concentrations would burn before reaching a hydrogen concentration significantly higher than the lower flammability limit. Hydrogen ignition in the vicinity of the igniters is assumed to occur when the local hydrogen concentration reaches 8.0 volume percent (v/o) and results in 85% of the hydrogen present being consumed.

APPLICABLE
SAFETY ANALYSES

The HMS causes hydrogen in containment to burn in a controlled manner as it accumulates following a degraded core accident (Ref. 3). Burning occurs at the lower flammability concentration, where the resulting temperatures and pressures are relatively benign. Without the system, hydrogen could build up to higher concentrations that could result in a violent reaction if ignited by a random ignition source after such a buildup.

The hydrogen igniters are not included for mitigation of a Design Basis Accident (DBA) because an amount of hydrogen equivalent to that generated from the reaction of 75% of the fuel cladding with water is far in excess of the hydrogen calculated for the limiting DBA loss of coolant accident (LOCA). The hydrogen concentration resulting from a DBA, can be maintained less than the flammability limit by only using the hydrogen recombiners. The hydrogen igniters, however, have been shown by probabilistic risk analysis to be a significant contributor to limiting the severity of accident sequences that are commonly found to dominate risk for plants with ice condenser containments. As such, the hydrogen igniters are considered to be risk significant in accordance with the NRC Policy Statement.

(continued)

BASES (continued)

LCO

Two HMS trains must be OPERABLE with power from two independent safety related power supplies.

For this plant, an OPERABLE HMS train consists of 33 of 34 igniters energized on the train.

Operation with at least one HMS train ensures that the hydrogen in containment can be burned in a controlled manner. Unavailability of both HMS trains could lead to hydrogen buildup to higher concentrations, which could result in a violent reaction if ignited. The reaction could take place fast enough to lead to high temperatures and overpressurization of containment and, as a result, breach containment or cause containment leakage rates above those assumed in the safety analyses. Damage to safety related equipment located in containment could also occur.

APPLICABILITY

Requiring OPERABILITY in MODES 1 and 2 for the HMS ensures its immediate availability after safety injection and scram actuated on a LOCA initiation. In the post accident environment, the two HMS subsystems are required to control the hydrogen concentration within containment to near its flammability limit of 4.1 v/o assuming a worst case single failure. This prevents overpressurization of containment and damage to safety related equipment and instruments located within containment.

In MODE 3 and 4, also, because of the limited time in the MODES, the probability of an accident requiring the HMS is low. Therefore, the HMS is not required in MODES 3 and 4.

In MODES 5 and 6, the probability and consequences of a LOCA are reduced due to the pressure and temperature limitations of these MODES. Therefore, the HMS is not required to be OPERABLE in MODES 5 and 6.

(continued)

BASES (continued)

ACTIONS

A.1

With one HMS train inoperable, the inoperable train must be restored to OPERABLE status within 7 days. The 7 day Completion Time is based on the low probability of the occurrence of a degraded core event that would generate hydrogen in amounts equivalent to a metal water reaction of 75% of the core cladding, the length of time after the event that operator action would be required to prevent hydrogen accumulation from exceeding this limit and the low probability of failure of the OPERABLE HMS train.

A.2

If the inoperable HMS train cannot be restored within the Completion time of 7 days, it is acceptable to continue operation provided SR 3.6.8.1 is performed on the OPERABLE train with the specified frequency of 7 days. This SR verifies at least one hydrogen igniter OPERABLE in each containment zone. The igniters are simple glow plug devices, not likely to fail between surveillance periods with a frequency of 7 days. As such, the frequency is based on engineering judgement, and has been shown to be acceptable through operating experience.

B.1

Condition B is one containment region with no OPERABLE hydrogen igniter. The only way this condition can exist in only one containment region is for each train of HMS to have only one igniter inoperable and the one inoperable igniter in each train to be in the same containment region. In this Condition, both trains of HMS would be OPERABLE per SR 3.6.8.1, and there would be two OPERABLE igniters in all other containment regions, including the regions adjacent to the region with no OPERABLE igniters. Furthermore, even if one train of HMS is inoperable (putting the plant into Conditions A and B simultaneously), the OPERABLE train would provide at least one igniter in each adjacent region. Lastly, if both trains of HMS are inoperable, or if more than one containment region has no OPERABLE igniter, LCO 3.0.3 would be immediately entered. Thus, while in the Condition B, there would always be ignition capability in the adjacent containment regions that would provide redundant capability by flame propagation to the region with no OPERABLE igniters.

(continued)

BASES

ACTIONS
(continued)

Required Action B.1 calls for the restoration of one hydrogen igniter in each region to OPERABLE status within 7 days. The 7 day Completion Time is based on the same reasons given under Required Action A.1.

C.1

If the HMS subsystem(s) cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours.

SURVEILLANCE
REQUIREMENTSSR 3.6.8.1

This SR confirms that ≥ 33 of 34 hydrogen igniters can be successfully energized in each train. The igniters are simple resistance elements. Therefore, energizing provides assurance of OPERABILITY. The allowance of one inoperable hydrogen igniter is acceptable because, although one inoperable hydrogen igniter in a region would compromise redundancy in that region, the containment regions are interconnected so that ignition in one region would cause burning to progress to the others (i.e., there is overlap in each hydrogen igniter's effectiveness between regions). The Frequency of 92 days is based on the Inservice Testing Program requirements for determining equipment OPERABILITY, and has been shown to be acceptable through operating experience.

SR 3.6.8.2

This SR confirms that the two inoperable hydrogen igniters allowed by SR 3.6.8.1 (i.e., one in each train) are not in the same containment region. The containment regions and hydrogen igniter locations are provided in Reference 4. As such, failure of this SR results in entry into Condition B. See Required Action B.1 for a discussion regarding how Conditions A and B and the associated Required Actions ensure that no more than one containment region can be without an OPERABLE hydrogen igniter for any length of time without commencing a shutdown.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)SR 3.6.8.3

A more detailed functional test is performed every 18 months to verify system OPERABILITY. Each glow plug is visually examined to ensure that it is clean, and that the electrical circuitry is energized. All igniters (glow plugs), including normally inaccessible igniters, are visually checked for a glow to verify that they are energized. Additionally, the surface temperature of each glow plug is measured to be $\geq 1700^{\circ}\text{F}$ to demonstrate that a temperature sufficient for ignition is achieved. The 18 month Frequency was developed considering it is prudent that many Surveillances be performed only during a plant outage. This is due to the plant conditions needed to perform the SR and the potential for an unplanned plant transient if the SR is performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed on 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. Title 10, Code of Federal Regulations, Part 50.44, "Standards for Combustible Gas Control Systems in Light Water-Cooled Power Reactors."
 2. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 41, "Containment Atmosphere Cleanup."
 3. Watts Bar FSAR, Section 6.2, "Containment Systems."
 4. Watts Bar FSAR, Section 6.2.5A.2, "Hydrogen Mitigation System Description."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.9 Emergency Gas Treatment System (EGTS)

BASES

BACKGROUND

The EGTS is required by 10 CFR 50 Appendix A, GDC 41, "Containment Atmosphere Cleanup," to ensure that radioactive materials that leak from the primary containment into the shield building (secondary containment) following a Design Basis Accident (DBA) are filtered and adsorbed prior to exhausting to the environment.

The containment has a secondary containment called the shield building, which is a concrete structure that surrounds the steel primary containment vessel. Between the containment vessel and the shield building inner wall is an annular space that collects any containment leakage that may occur following a loss of coolant accident (LOCA). This space also allows for periodic inspection of the outer surface of the steel containment vessel.

The EGTS establishes a negative pressure in the annulus following a DBA between the Shield Building and the steel containment vessel. Filters in the system then control the release of radioactive contaminants to the environment. Shield building OPERABILITY is required to ensure retention of primary containment leakage and proper operation of the EGTS.

The EGTS consists of two separate and redundant trains. Each train includes a moisture separator, a heater, a prefilter, a high efficiency particulate air (HEPA) filter, activated charcoal adsorber sections for removal of radioiodines, and a fan. Ductwork, valves and/or dampers and instrumentation also form part of the system. The moisture separators function to reduce the moisture content of the airstream. A second bank of HEPA filters follows the adsorber sections to collect carbon fines. Only the upstream HEPA filter and the charcoal adsorber sections are credited in the analysis. The system initiates and maintains a negative air pressure in the Shield Building by means of filtered exhaust ventilation of the shield building following receipt of a safety injection signal. The system is described in Reference 2.

(continued)

BASES

BACKGROUND
(continued)

The prefilters remove large particles in the air, and the moisture separators remove entrained water droplets present, to prevent excessive loading of the HEPA filters and charcoal adsorbers. Heaters are included to reduce the relative humidity of the airstream on systems that operate in high humidity. Continuous operation of each train, for at least 10 hours per month, with heaters on, reduces moisture buildup on their HEPA filters and adsorbers. Cross-over flow ducts are provided between the two trains to allow the active train to draw air through the inactive train and cool the air to keep the charcoal beds on the inactive train from becoming too hot due to absorption of fission products.

The containment annulus vacuum fans maintain the annulus at -5 inches water gauge vacuum during normal operations. During accident conditions, they are isolated from the air cleanup portion of the system.

The EGTS reduces the radioactive content in the shield building atmosphere following a DBA. Loss of the EGTS could cause site boundary doses, in the event of a DBA, to exceed the values given in the licensing basis.

APPLICABLE
SAFETY ANALYSES

The EGTS design basis is established by the consequences of the limiting DBA, which is a LOCA. The accident analysis (Ref. 3) assumes that only one train of the EGTS is functional due to a single failure that disables the other train. The accident analysis accounts for the reduction in airborne radioactive material provided by the remaining one train of this filtration system. The amount of fission products available for release from containment is determined for a LOCA.

The modeled EGTS actuation in the safety analysis assumes an initial annulus vacuum pressure of -5.0 inches water gauge upon receipt of the Phase A isolation signal. The fans automatically start within 20 seconds (excluding 10 seconds for diesel generator start) after receipt of the initiating signal. The analysis shows that after an initial step increase, the pressure will rise to a peak value of -0.13 inches water gauge in approximately 90 seconds after the LOCA and does not go positive. The annulus pressure then returns to the post accident setpoint of -0.5 inches water gauge.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The EGTS satisfies Criterion 3 of the NRC Policy Statement.

LCO

In the event of a DBA, one EGTS train is required to provide the minimum particulate iodine removal assumed in the safety analysis. Two trains of the EGTS must be OPERABLE to ensure that at least one train will operate, assuming that the other train is disabled by a single active failure.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could lead to fission product release to containment that leaks to the shield building. The large break LOCA, on which this system's design is based, is a full power event. Less severe LOCAs and leakage still require the system to be OPERABLE throughout these MODES. The probability and severity of a LOCA decrease as core power and Reactor Coolant System pressure decrease. With the reactor shut down, the probability of release of radioactivity resulting from such an accident is low.

In MODES 5 and 6, the probability and consequences of a DBA are low due to the pressure and temperature limitations in these MODES. Under these conditions, the filtration system is not required to be OPERABLE (although one or more trains may be operating for other reasons, such as habitability during maintenance in the shield building annulus).

ACTIONS

A.1

With one EGTS train inoperable, the inoperable train must be restored to OPERABLE status within 7 days. The components in this degraded condition are capable of providing 100% of the iodine-removal needs after a DBA. The 7 day Completion Time is based on consideration of such factors as the availability of the OPERABLE redundant EGTS train and the low probability of a DBA occurring during the period. The Completion Time is adequate to make most repairs.

(continued)

BASES

ACTIONS
(continued)B.1

With annulus pressure not within limits during normal operation, the initial conditions of the accident analysis are not met. The Completion Time of 8 hours is based on engineering judgment. A note has been provided which makes the requirement to maintain the annulus pressure within limits not applicable during venting operations, required annulus entries, or Auxiliary Building isolations not exceeding 1 hour in duration.

C.1 and C.2

If an EGTS train cannot be restored to OPERABLE status or annulus pressure restored to within limits by the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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
REQUIREMENTSSR 3.6.9.1

For systems with heaters, operation with the heaters on (automatic heater cycling to maintain temperature) for ≥ 10 hours eliminates moisture on the adsorbers and HEPA filters. Experience from filter testing at operating plants indicates that the 10 hour period is adequate for moisture elimination on the adsorbers and HEPA filters. The 31 day Frequency was developed in consideration of the known reliability of fan motors and controls and the two-train redundancy available.

SR 3.6.9.2

The Ventilation Filter Testing Program (VFTP) (Specification 5.7.2) encompasses all the EGTS filter tests consistent with Regulatory Guide 1.52 (Ref. 4). 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.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)SR 3.6.9.3

The automatic startup ensures that each EGTS train responds properly and achieves rated flow within the time assumed in the accident analyses which ensures annulus pressure remains negative. The 18 month Frequency was developed considering it is prudent that this Surveillance be performed only during a unit outage. This is due to the unit conditions needed to perform the SR and the potential for unplanned unit transients if the SR is performed with the reactor at power. Operating experience has shown that these components usually pass the SR when performed on the 18 month Frequency. Therefore the Frequency was concluded to be acceptable from a reliability standpoint. Furthermore, the SR interval was developed considering that the EGTS equipment OPERABILITY is demonstrated on a 31 day Frequency by SR 3.6.9.1.

SR 3.6.9.4

The proper functioning of the fans, dampers, filters, adsorbers, etc. as a system is verified by the ability to achieve total system flow rate of 4000 CFM \pm 10%, maintain the maximum inleakage \leq 250 CFM, and produce the required negative pressure equal to or more negative than -0.5 inch water gauge with respect to the El. 772' Mechanical Equipment Room during test operation. The negative pressure assures that the building is adequately sealed and that leakage from the building will be prevented, since outside air will be drawn in by the low pressure. The negative pressure must be established and verified under steady state conditions at the specified total system flow and leakage requirements to ensure that no significant quantity of radioactive materials leak from the shield building.

The Frequency on a staggered test basis 18 months is consistent with Regulatory Guide 1.52 (Ref. 4) guidance for functional testing.

SR 3.6.9.5

Verifying that shield building annulus pressure is within limits ensures that operation remains within the limits assumed in the containment analysis. The 24 hour Frequency of this SR was developed considering operating experience related to shield building annulus pressure variations and pressure instrument drift during the applicable MODES.

(continued)

BASES (continued)

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 41, "Containment Atmosphere Cleanup."
 2. Watts Bar FSAR, Section 6.5, "Fission Product Removal and Control Systems."
 3. Watts Bar FSAR, Section 15, "Accident Analysis."
 4. Regulatory Guide 1.52, Rev. 2, "Design, Testing and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmospheric Cleanup System Air Filtration and Absorption Units of Light-Water Cooled Nuclear Power Plants."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.10 Air Return System (ARS)

BASES

BACKGROUND

The ARS is designed to assure the rapid return of air from the upper to the lower containment compartment after the initial blowdown following a Design Basis Accident (DBA). The return of this air to the lower compartment and subsequent recirculation back up through the ice condenser assists in cooling the containment atmosphere and limiting post accident pressure and temperature in containment to less than design values. Limiting pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a DBA.

The ARS provides post accident mixing of air in selected areas of containment for hydrogen mitigation. The ARS draws air from the dome of the containment vessel, from the reactor cavity, and from the ten dead ended (pocketed) spaces in the containment where there is potential for the accumulation of hydrogen. The minimum design flow from each potential hydrogen pocket is sufficient to limit the local concentration of hydrogen.

The ARS consists of two separate trains of equal capacity, each capable of meeting the design bases. Each train includes a 100% capacity air return fan, associated backdraft damper, and hydrogen collection headers. Each train is powered from a separate Engineered Safety Feature (ESF) bus.

The ARS fans are automatically started by the containment pressure High-High signal 8 to 10 minutes after the containment pressure reaches the pressure setpoint. The time delay and backdraft damper ensure that no energy released during the initial phase of a DBA will bypass the ice bed through the ARS fans into the upper containment compartment.

After starting, the fans displace air from the upper compartment to the lower compartment, thereby returning the air that was displaced by the high energy line break blowdown from the lower compartment and equalizing pressures

(continued)

BASES

BACKGROUND
(continued)

throughout containment. After discharge into the lower compartment, air flows with steam produced by residual heat through the ice condenser doors into the ice condenser compartment where the steam portion of the flow is condensed. The air flow returns to the upper compartment through the top deck doors in the upper portion of the ice condenser compartment. The ARS fans operate continuously after actuation, circulating air through the containment volume and purging all potential hydrogen pockets in containment.

The ARS also functions, after all the ice has melted, to circulate any steam still entering the lower compartment to the upper compartment where the Containment Spray System can cool it.

The ARS is an ESF system. It is designed to ensure that the heat removal capability required during the post accident period can be attained. The operation of the ARS in conjunction with the ice bed, the Containment Spray System, and the Residual Heat Removal (RHR) Spray System, provide the required heat removal capability to limit post accident conditions to less than the containment design values.

APPLICABLE
SAFETY ANALYSES

The limiting DBAs considered relative to containment temperature and pressure are the loss of coolant accident (LOCA) and the steam line break (SLB). The LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are assumed not to occur simultaneously or consecutively. The postulated DBAs are analyzed, in regard to ESF systems, assuming the loss of one ESF bus, which is the worst case single active failure and results in one train each of the Containment Spray System, RHR Spray System, and ARS being inoperable (Ref. 1). The DBA analyses show that the maximum peak containment pressure results from the LOCA analysis and is calculated to be less than the containment design pressure.

For certain aspects of transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the cooling effectiveness of the Emergency Core Cooling System (ECCS) during the core

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

reflood phase of a LOCA analysis increases with increasing containment backpressure. For these calculations, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the calculated transient containment pressures, in accordance with 10 CFR 50, Appendix K (Ref. 2).

The maximum peak containment atmosphere temperature of 326°F results from the SLB analysis and was calculated to exceed the containment design temperature of 250° F for a short time. This analysis is discussed in the Bases for LCO 3.6.5, "Containment Air Temperature". Thermal analyses show that the time interval during which the containment atmosphere temperature exceeds the containment design temperature is short enough that equipment surface temperatures remain below the design temperature. Therefore, it is concluded that the calculated transient containment atmosphere temperatures are acceptable for the SLB.

The modeled ARS actuation from the containment analysis is based upon a response time associated with exceeding the containment pressure High-High signal setpoint to achieving full ARS air flow. A delayed response time initiation provides conservative analyses of peak calculated containment temperature and pressure responses. The ARS total response time of 540 ± 60 seconds consists of the built in signal delay.

The ARS satisfies Criterion 3 of the NRC Policy Statement.

LCO

In the event of a DBA, one train of the ARS is required to provide the minimum air recirculation for heat removal assumed in the safety analyses. To ensure this requirement is met, two trains of the ARS must be OPERABLE. This will ensure that at least one train will operate assuming the worst case single failure occurs, which is in the ESF power supply.

(continued)

BASES (continued)

APPLICABILITY In MODES 1, 2, 3, and 4, a DBA could cause an increase in containment pressure and temperature requiring the operation of the ARS. Therefore, the LCO is applicable in MODES 1, 2, 3, and 4.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, the ARS is not required to be OPERABLE in these MODES.

ACTIONS

A.1

If one of the required trains of the ARS is inoperable, it must be restored to OPERABLE status within 72 hours. The components in this degraded condition are capable of providing 100% of the heat removal capability after an accident. The 72 hour Completion Time was developed taking into account the redundant heat removal capability of the OPERABLE ARS train and the low probability of a DBA occurring in this period.

B.1 and B.2

If the ARS train cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 3.6.10.1

Verifying that each ARS fan starts on an actual or simulated actuation signal, after a delay of ≥ 8.0 minutes and ≤ 10.0 minutes, and operates for ≥ 15 minutes is sufficient to ensure that all fans are OPERABLE and that all associated controls and time delays are functioning properly. The 92 day Frequency was developed considering the known reliability of fan motors and controls and the two train redundancy available.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.6.10.2

Verifying fan motor current with the return air backdraft dampers closed confirms the operating condition of the fan. This test is indicative of overall fan motor performance. Such inservice tests confirm component OPERABILITY, trend performance, and detect incipient failures by indicating abnormal performance. The Frequency of 92 days conforms with the testing requirements for similar ESF equipment and considers the known reliability of fan motors and controls and the two train redundancy available.

SR 3.6.10.3

Verifying the OPERABILITY of the return air damper provides assurance that the proper flow path will exist when the fan is started. By applying the correct counterweight, the damper operation can be confirmed. The Frequency of 92 days was developed considering the importance of the dampers, their location, physical environment, and probability of failure. Operating experience has also shown this Frequency to be acceptable.

REFERENCES

1. Watts Bar FSAR, Section 6.2, "Containment Systems."
 2. Title 10, Code of Federal Regulations, Part 50, Appendix K, "ECCS Evaluation Models."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.11 Ice Bed

BASES

BACKGROUND

The ice bed consists of over 2,360,875 lb of ice stored in baskets within the ice condenser. Its primary purpose is to provide a large heat sink in the event of a release of energy from a Design Basis Accident (DBA) in containment. The ice would absorb energy and limit containment peak pressure and temperature during the accident transient. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a DBA.

The ice condenser is an annular compartment enclosing approximately 300° of the perimeter of the upper containment compartment, but penetrating the operating deck so that a portion extends into the lower containment compartment. The lower portion has a series of hinged doors exposed to the atmosphere of the lower containment compartment which, for normal plant operation, are designed to remain closed. At the top of the ice condenser is another set of doors exposed to the atmosphere of the upper compartment, which also remain closed during normal plant operation. Intermediate deck doors, located below the top deck doors, form the floor of a plenum at the upper part of the ice condenser. These doors also remain closed during normal plant operation. The upper plenum area is used to facilitate surveillance and maintenance of the ice bed.

The ice baskets held in the ice bed within the ice condenser are arranged to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a DBA.

In the event of a DBA, the ice condenser lower inlet doors (located below the operating deck) open due to the pressure rise in the lower compartment. This allows air and steam to flow from the lower compartment into the ice condenser. The resulting pressure increase within the ice condenser causes

(continued)

BASES

BACKGROUND
(continued)

the intermediate deck doors and the top deck doors to open, which allows the air to flow out of the ice condenser into the upper compartment. Steam condensation within the ice condenser limits the pressure and temperature buildup in containment. A divider barrier separates the upper and lower compartments and ensures that the steam is directed into the ice condenser.

The ice, together with the containment spray, is adequate to absorb the initial blowdown of steam and water from a DBA and the additional heat loads that would enter containment during several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators. During the post blowdown period, the Air Return System (ARS) returns upper compartment air through the divider barrier to the lower compartment. This serves to equalize pressures in containment and to continue circulating heated air and steam from the lower compartment through the ice condenser where the heat is removed by the remaining ice.

As ice melts, the water passes through the ice condenser floor drains into the lower compartment. Thus, a second function of the ice bed is to be a large source of borated water (via the containment sump) for long-term Emergency Core Cooling System (ECCS) and Containment Spray System heat removal functions in the recirculation mode.

A third function of the ice bed and melted ice is to remove fission product iodine that may be released from the core during a DBA. Iodine removal occurs during the ice melt phase of the accident and continues as the melted ice is sprayed into the containment atmosphere by the Containment Spray System. The ice is adjusted to an alkaline pH that facilitates removal of radioactive iodine from the containment atmosphere. The alkaline pH also minimizes the occurrence of the chloride and caustic stress corrosion on mechanical systems and components exposed to ECCS and Containment Spray System fluids in the recirculation mode of operation.

(continued)

BASES

BACKGROUND
(continued)

It is important for the ice to be uniformly distributed around the 24 ice condenser bays and for open flow paths to exist around ice baskets. This is especially important during the initial blowdown so that the steam and water mixture entering the lower compartment do not pass through only part of the ice condenser, depleting the ice there while bypassing the ice in other bays.

Two phenomena that can degrade the ice bed during the long service period are:

- a. Loss of ice by melting or sublimation; and
- b. Obstruction of flow passages through the ice bed due to buildup of frost or ice. Both of these degrading phenomena are reduced by minimizing air leakage into and out of the ice condenser.

The ice bed limits the temperature and pressure that could be expected following a DBA, thus limiting leakage of fission product radioactivity from containment to the environment.

APPLICABLE
SAFETY ANALYSES

The limiting DBAs considered relative to containment temperature and pressure are the loss of coolant accident (LOCA) and the steam line break (SLB). The LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are not assumed to occur simultaneously or consecutively.

Although the ice condenser is a passive system that requires no electrical power to perform its function, the containment Spray System and the ARS also function to assist the ice bed in limiting pressures and temperatures. Therefore, the postulated DBAs are analyzed in regards to containment Engineered Safety Feature (ESF) systems, assuming the loss of one ESF bus, which is the worst case single active failure and results in one train each of the Containment Spray System and ARS being inoperable.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The limiting DBA analyses (Ref. 1) show that the maximum peak containment pressure results from the LOCA analysis, and is calculated to be less than the containment design pressure.

For certain aspects of the transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the cooling effectiveness of the ECCS during the core reflood phase of a LOCA analysis increases with increasing containment backpressure. For these calculations, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the calculated transient containment pressures, in accordance with 10 CFR 50, Appendix K (Ref. 2).

The maximum peak containment atmosphere temperature results from the SLB analysis and is discussed in the Bases for Specification 3.6.5, "Containment Air Temperature."

In addition to calculating the overall peak containment pressures, the DBA analyses include calculation of the transient differential pressures that occur across subcompartment walls during the initial blowdown phase of the accident transient. The internal containment walls and structures are designed to withstand these local transient pressure differentials for the limiting DBAs.

The ice bed satisfies Criterion 3 of the NRC Policy Statement.

LCO

The ice bed LCO requires the existence of the required quantity of stored ice, appropriate distribution of the ice and the ice bed, open flow paths through the ice bed, and appropriate chemical content and pH of the stored ice. The stored ice functions to absorb heat during a DBA, thereby limiting containment air temperature and pressure. The chemical content and pH of the ice provide core shutdown margin (boron content) and remove radioactive iodine from the containment atmosphere when the melted ice is recirculated through the ECCS and the Containment Spray System, respectively.

(continued)

BASES (continued)

APPLICABILITY In MODES 1, 2, 3, and 4, a DBA could cause an increase in containment pressure and temperature requiring the operation of the ice bed. Therefore, the LCO is applicable in MODES 1, 2, 3, and 4.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Therefore, the ice bed is not required to be OPERABLE in these MODES.

ACTIONS

A.1

If the ice bed is inoperable, it must be restored to OPERABLE status within 48 hours. The Completion Time was developed based on operating experience, which confirms that due to the very large mass of stored ice, the parameters comprising OPERABILITY do not change appreciably in this time period. Because of this fact, the Surveillance Frequencies are long (months), except for the ice bed temperature, which is checked every 12 hours. If a degraded condition is identified, even for temperature, with such a large mass of ice it is improbable for the degraded condition to significantly degrade further in a 48 hour period. Therefore, 48 hours is a reasonable amount of time to correct a degraded condition before initiating a shutdown.

B.1 and B.2

If the ice bed cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner without challenging plant systems.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.6.11.1

Verifying that the maximum temperature of the ice bed is $\leq 27^{\circ}$ F ensures that the ice is kept well below the melting point. The 12 hour Frequency was based on operating experience, which confirmed that, due to the large mass of stored ice, it is improbable for the ice bed temperature to degrade significantly in a 12 hour period, and on assessing the proximity of the LCO limit to the melting temperature.

Furthermore, the 12 hour Frequency is considered adequate in view of indications in the control room, including the alarm, to alert the operator to an abnormal ice bed temperature condition. This SR may be satisfied by use of the Ice Bed Temperature Monitoring System.

SR 3.6.11.2

The weighing program is designed to obtain a representative sample of the ice baskets. The representative sample shall include 6 baskets from each of the 24 ice condenser bays, and consist of one basket from radial rows 1, 2, 4, 6, 8, and 9. If no basket from a designated row can be obtained for weighing, a basket from the same row of an adjacent bay shall be weighed.

The rows chosen include the rows nearest the inside and outside walls of the ice condenser (rows 1 and 2, and 8 and 9, respectively), where heat transfer into the ice condenser is most likely to influence melting or sublimation. Verifying the total weight of ice ensures that there is adequate ice to absorb the required amount of energy to mitigate the DBAs.

If a basket is found to contain < 1214 lb of ice, a representative sample of 20 additional baskets from the same bay shall be weighed. The average weight of ice in these 21 baskets (the discrepant basket and 20 additional baskets) shall be ≥ 1214 lb at a 95% confidence level.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

Weighing 20 additional baskets from the same bay in the event a Surveillance reveals that a single basket contains < 1214 lb ensures that no local zone exists that is grossly deficient in ice. Such a zone could experience early melt-out during a DBA transient, creating a path for steam to pass through the ice bed without being condensed. The Frequency of 9 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 9 month Frequency, the weight requirements are maintained with no significant degradation between Surveillances.

SR 3.6.11.3

This SR ensures that the azimuthal distribution of ice is reasonably uniform, by verifying that the average ice weight in each of three azimuthal groups of ice condenser bays is within the limit. The Frequency of 9 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 9-month Frequency, the weight requirements are maintained with no significant degradation between Surveillances.

SR 3.6.11.4

This SR ensures that the flow channels through the ice condenser have not accumulated an excessive amount of ice or frost blockage. The visual inspection shall be made for two or more flow channels per ice condenser bay and shall include the following specific locations along the flow channel:

- a. Past the lower inlet plenum support structures and turning vanes;
- b. Between ice baskets;
- c. Past lattice frames;
- d. Through the intermediate floor grating; and
- e. Through the top deck floor grating.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

The allowable 0.38 inch thick buildup of frost or ice is based on analysis of containment response to a DBA with partial blockage of the ice condenser flow passages. If a flow channel in a given bay is found to have an accumulation of frost or ice greater than 0.38 inches thick, a representative sample of 20 additional flow channels from the same bay shall be visually inspected.

If these additional flow channels are all found to be acceptable, the discrepant flow channel may be considered single, unique, and acceptable deficiency. More than one discrepant flow channel in a bay is not acceptable, however. These requirements are based on the sensitivity of the partial blockage analysis to additional blockage. The Frequency of 9 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses.

SR 3.6.11.5

Verifying the chemical composition of the stored ice ensures that the stored ice has a boron concentration of at least 1800 ppm as sodium tetraborate and a high pH, ≥ 9.0 and ≤ 9.5 , in order to meet the requirement for borated water when the melted ice is used in the ECCS recirculation mode of operation. Sodium tetraborate has been proven effective in maintaining the boron content for long storage periods, and it also enhances the ability of the solution to remove and retain fission product iodine. The high pH is required to enhance the effectiveness of the ice and the melted ice in removing iodine from the containment atmosphere. This pH range also minimizes the occurrence of chloride and caustic stress corrosion on mechanical systems and components exposed to ECCS and Containment Spray System fluids in the recirculation mode of operation. The Frequency of 18 months was developed considering these facts:

- a. Long term ice storage tests have determined that the chemical composition of the stored ice is extremely stable;
- b. Operating experience has demonstrated that meeting the boron concentration and pH requirements has never been a problem; and

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

- c. Someone would have to enter the containment to take the sample, and if the unit is at power, that person would receive a radiation dose.

SR 3.6.11.6

This SR ensures that a representative sampling of ice baskets, which are relatively thin walled perforated cylinders, have not been degraded by wear, cracks, corrosion, or other damage. Each ice basket shall be raised at least 10 feet for this inspection. However, for baskets where vertical lifting height is restricted due to overhead obstructions, a camera shall be used to perform the inspection. The Frequency of 40 months for a visual inspection of the structural soundness of the ice baskets is based on engineering judgment, and considers such factors as the thickness of the basket walls relative to corrosion rates expected in their service environment and the results of the long term ice storage testing.

REFERENCES

1. Watts Bar FSAR, Section 6.2, "Containment Systems."
 2. Title 10, Code of Federal Regulations, Part 50, Appendix K, "ECCS Evaluation Models."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.12 Ice Condenser Doors

BASES

BACKGROUND

The ice condenser doors consist of the inlet doors, the intermediate deck doors, and the top deck doors. The functions of the doors are to:

- a. Seal the ice condenser from air leakage during the lifetime of the unit; and
- b. Open in the event of a Design Basis Accident (DBA) to direct the hot steam-air mixture from the DBA into the ice bed, where the ice would absorb energy and limit Containment peak pressure and temperature during the accident transient.

Limiting the pressure and temperature following a DBA reduces the release of fission product radioactivity from containment to the environment.

The ice condenser is an annular compartment enclosing approximately 300° of the perimeter of the upper containment compartment, but penetrating the operating deck so a portion extends into the lower containment compartment. The inlet doors separate the atmosphere of the lower compartment from the ice bed inside the ice condenser. The top deck doors are above the ice bed and exposed to the atmosphere of the upper compartment. The intermediate deck doors, located below the top deck doors, form the floor of a plenum at the upper part of the ice condenser. This plenum area is used to facilitate surveillance and maintenance of the ice bed.

The ice baskets held in the ice bed within the ice condenser are arranged to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a DBA.

In the event of a DBA, the ice condenser inlet doors (located below the operating deck) open due to the pressure rise in the lower compartment. This allows air and steam to flow from the lower compartment into the ice condenser. The

(continued)

BASES

BACKGROUND
(continued)

resulting pressure increase within the ice condenser causes the intermediate deck doors and the top deck doors to open, which allows the air to flow out of the ice condenser into the upper compartment. Steam condensation within the ice condensers limits the pressure and temperature buildup in containment. A divider barrier separates the upper and lower compartments and ensures that the steam is directed into the ice condenser.

The ice, together with the containment spray, serves as a containment heat removal system and is adequate to absorb the initial blowdown of steam and water from a DBA as well as the additional heat loads that would enter containment during the several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators. During the post blowdown period, the Air Return System (ARS) returns upper compartment air through the divider barrier to the lower compartment. This serves to equalize pressures in containment, and to continue circulating heated air and steam from the lower compartment through the ice condenser, where the heat is removed by the remaining ice.

The water from the melted ice drains into the lower compartment where it serves as a source of borated water (via the containment sump) for the Emergency Core Cooling System (ECCS) and the Containment Spray System heat removal functions in the recirculation mode. The ice (via the Containment Spray System) and the recirculated ice melt also serve to clean up the containment atmosphere.

The ice condenser doors ensure that the ice stored in the ice bed is preserved during normal operation (doors closed), and that the ice condenser functions as designed if called upon to act as a passive heat sink following a DBA.

APPLICABLE
SAFETY ANALYSES

The limiting DBAs considered relative to containment pressure and temperature are the loss of coolant accident (LOCA) and the steam line break (SLB). The LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are assumed not to occur simultaneously or consecutively.

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BASES

APPLICABLE
SAFETY ANALYSES
(continued)

Although the ice condenser is a passive system that requires no electrical power to perform its function, the Containment Spray System and ARS also function to assist the ice bed in limiting pressures and temperatures. Therefore, the postulated DBAs are analyzed with respect to Engineered Safety Feature (ESF) systems, assuming the loss of one ESF bus, which is the worst case single active failure and results in one train each of the Containment Spray System and the ARS being rendered inoperable.

The limiting DBA analyses (Ref. 1) show that the maximum peak containment pressure results from the LOCA analysis and is calculated to be less than the containment design pressure. For certain aspects of transient accident analyses, maximizing the calculated containment pressure is not conservative. In particular, the ECCS's cooling effectiveness during the core reflood phase of a LOCA analysis increases with increasing containment backpressure. For these calculations, the containment backpressure is calculated in a manner designed to conservatively minimize, rather than maximize, the calculated transient containment pressures, in accordance with 10 CFR 50, Appendix K (Ref. 2).

The maximum peak containment atmosphere temperature results from the SLB analysis and is discussed in the Bases for Specification 3.6.5, "Containment Air Temperature."

An additional design requirement was imposed on the ice condenser door design for a small break accident in which the flow of heated air and steam is not sufficient to fully open the doors.

For this situation, the doors are designed so that all of the doors would partially open by approximately the same amount. Thus, the partially opened doors would modulate the flow so that each ice bay would receive an approximately equal fraction of the total flow.

This design feature ensures that the heated air and steam will not flow preferentially to some ice bays and deplete the ice there without utilizing the ice in the other bays.

In addition to calculating the overall peak containment pressures, the DBA analyses include the calculation of the
(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

transient differential pressures that would occur across subcompartment walls during the initial blowdown phase of the accident transient. The internal containment walls and structures are designed to withstand the local transient pressure differentials for the limiting DBAs.

The ice condenser doors satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO establishes the minimum equipment requirements to assure that the ice condenser doors perform their safety function. The ice condenser inlet doors, intermediate deck doors, and top deck doors must be closed to minimize air leakage into and out of the ice condenser, with its attendant leakage of heat into the ice condenser and loss of ice through melting and sublimation. The doors must be OPERABLE to ensure the proper opening of the ice condenser in the event of a DBA. OPERABILITY includes being free of any obstructions that would limit their opening, and for the inlet doors, being adjusted such that the opening and closing torques are within limits. The ice condenser doors function with the ice condenser to limit the pressure and temperature that could be expected following a DBA.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause an increase in containment pressure and temperature requiring the operation of the ice condenser doors. Therefore, the LCO is applicable in MODES 1, 2, 3, and 4.

The probability and consequences of these events in MODES 5 and 6 are reduced due to the pressure and temperature limitation of these MODES. Therefore, the ice condenser doors are not required to be OPERABLE in these MODES.

ACTIONS

A Note provides clarification that for this LCO, separate condition entry is allowed for each ice condenser door.

(continued)

BASES

ACTIONS
(continued)

A.1

If one or more inlet doors are physically restrained from opening, the door(s) must be restored to OPERABLE status within 1 hour. The Required Action is necessary to return operation to within the bounds of the containment analysis. The 1 hour Completion Time is consistent with the ACTIONS of LCO 3.6.1, "Containment," which requires containment to be restored to OPERABLE status in 1 hour.

B.1 and B.2

If one or more doors are determined to be partially open or otherwise inoperable for reasons other than Condition A, or a door is found that is not closed, it is acceptable to continue unit operation for up to 14 days provided the ice bed temperature instrumentation is monitored once per 4 hours to ensure that the open or inoperable door is not allowing enough air leakage to cause the maximum ice bed temperature to approach the melting point. The Frequency of 4 hours is based on the fact that temperature changes occur slowly in the ice bed because of the large mass of ice involved. The 14 day Completion Time is based on long term ice storage tests that indicate that if the temperature is maintained below 27°F, there would not be a significant loss of ice from sublimation. If the maximum ice bed temperature is > 27°F at any time, the situation reverts to Condition C and a Completion Time of 48 hours is allowed to restore the inoperable door to OPERABLE status or enter into Required Actions D.1 and D.2. Ice bed temperature must be verified to be within the specified Frequency as augmented by the provisions of SR 3.0.2. If this verification is not made, Required Actions D.1 and D.2, not Required Action C.1, must be taken.

C.1

If Required Actions B.1 or B.2 are not met, the doors must be restored to OPERABLE status within 48 hours. The 48 hour Completion Time is based on the fact that, with the very large mass of ice involved, it would be highly improbable for the temperature to decrease to the melting point and a significant amount of ice to melt in a 48 hour period. Condition C is entered from Condition B only when the Completion Time of Required Action B.2 is not met or the ice bed temperature has not been verified at the required Frequency.

(continued)

BASES

ACTIONS
(continued)

D.1 and D.2

If the ice condenser doors cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 3.6.12.1

Verifying, by means of the Inlet Door Position Monitoring System, that the inlet doors are in their closed positions makes the operator aware of an inadvertent opening of one or more doors. The Frequency of 12 hours ensures that operators on each shift are aware of the status of the doors.

SR 3.6.12.2

Verifying by visual inspection that each intermediate deck door is closed and not impaired by ice, frost, or debris provides assurance that the intermediate deck doors (which form the floor of the upper plenum where frequent maintenance on the ice bed is performed) have not been left open or obstructed. The Frequency of 7 days is based on engineering judgment and takes into consideration such factors as the frequency of entry into the intermediate ice condenser deck, the time required for significant frost buildup, and the probability that a DBA will occur.

SR 3.6.12.3

Verifying by visual inspection that the ice condenser inlet doors are not impaired by ice, frost, or debris provides assurance that the doors are free to open in the event of a DBA. For this facility, the Frequency of 18 months (3 months during the first year after receipt of license) is based on door design, which inhibits condensation to freeze, and operating experience, which indicates that the inlet doors usually meet their SR acceptance criteria. Because of high radiation in the vicinity of the inlet doors during power operation, this Surveillance is normally performed during a shutdown.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.6.12.4

Verifying the opening torque of the inlet doors provides assurance that no doors have become stuck in the closed position. The value of 675 inch·lb is based on the design opening pressure on the doors of 1.0 lb/ft². For this facility, the Frequency of 18 months (3 months during the first year after receipt of license) is based on the passive nature of the closing mechanism (i.e., once adjusted, there are no known factors that would change the setting, except possibly a buildup of ice; ice buildup is not likely, however, because of the door design, which inhibits condensation to freeze). Operating experience indicates that the inlet doors usually meet their SR acceptance criteria. Because of high radiation in the vicinity of the inlet doors during power operation, this Surveillance is normally performed during a shutdown.

SR 3.6.12.5

The torque test Surveillance ensures that the inlet doors have not developed excessive friction and that the return springs are producing a door return torque within limits. The torque test consists of the following:

1. Verify that the torque, T(OPEN), required to cause opening motion at the 40° open position, is ≤ 195 inch·lb;
2. Verify that the torque, T(CLOSE), required to hold the door stationary (i.e., keep it from closing) at the 40° open position, is ≥ 78 inch·lb; and
3. Calculate the frictional torque, $T(\text{FRICT}) = 0.5 \{T(\text{OPEN}) - T(\text{CLOSE})\}$, and verify that the T(FRICT) is ≤ 40 inch·lb.

The purpose of the friction and return torque specifications is to ensure that, in the event of a small break LOCA or SLB, all of the 24 door pairs open uniformly. This assures that, during the initial blowdown phase, the steam and water mixture entering the lower compartment does not pass through part of the ice condenser, depleting the ice there, while bypassing the ice in other bays. The Frequency of 18 months (3 months during the first year after receipt of license) is based on the passive nature of the closing mechanism (i.e., once adjusted, there are no known factors that would change

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.6.12.5 (continued)

the setting, except possibly a buildup of ice; ice buildup is not likely, however, because of the door design, which inhibits water condensation to freeze). Operating experience indicates that the inlet doors usually meet their SR acceptance criteria. Because of high radiation in the vicinity of the inlet doors during power operation, this Surveillance is normally performed during a shutdown.

SR 3.6.12.6

Verifying the OPERABILITY of the intermediate deck doors provides assurance that the intermediate deck doors are free to open in the event of a DBA. The verification consists of visually inspecting the intermediate doors for structural deterioration, verifying free movement of the vent assemblies, and ascertaining free movement of each door when lifted with the applicable force shown below:

<u>Door</u>	<u>Lifting Force</u>
a. Adjacent to crane wall 1b	≤ 37.4
b. Paired with door adjacent to crane wall 1b	≤ 33.8
c. Adjacent to containment wall 1b	≤ 31.8
d. Paired with door adjacent to containment 1b wall	≤ 31.0

The 18 month Frequency (3 months during the first year after receipt of license) is based on the passive design of the intermediate deck doors, the frequency of personnel entry into the intermediate deck, and the fact that SR 3.6.12.2 confirms on a 7 day Frequency that the doors are not impaired by ice, frost, or debris, which are ways a door would fail the opening force test (i.e., by sticking or from increased door weight).

SR 3.6.12.7

Verifying by visual inspection that the top deck doors are in place, not obstructed and verifying free movement of

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.6.12.7 (continued)

the vent assembly provides assurance that the doors are performing their function of keeping warm air out of the ice condenser during normal operation, and would not be obstructed if called upon to open in response to a DBA. The Frequency of 92 days is based on engineering judgment, which considered such factors as the following:

- a. The relative inaccessibility and lack of traffic in the vicinity of the doors make it unlikely that a door would be inadvertently left open;
- b. Excessive air leakage would be detected by temperature monitoring in the ice condenser; and
- c. The light construction of the doors would ensure that, in the event of a DBA, air and gases passing through the ice condenser would find a flow path, even if a door were obstructed.

REFERENCES

1. Watts Bar FSAR, Section 15, "Accident Analysis."
 2. Title 10, Code of Federal Regulations, Part 50, Appendix K, "ECCS Evaluation Models."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.13 Divider Barrier Integrity

BASES

BACKGROUND

The divider barrier consists of the operating deck and associated seals, personnel access doors, and equipment hatches that separate the upper and lower containment compartments. Divider barrier integrity is necessary to minimize bypassing of the ice condenser by the hot steam and air mixture released into the lower compartment during a Design Basis Accident (DBA). This ensures that most of the gases pass through the ice bed, which condenses the steam and limits pressure and temperature during the accident transient. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a DBA.

In the event of a DBA, the ice condenser inlet doors (located below the operating deck) open due to the pressure rise in the lower compartment. This allows air and steam to flow from the lower compartment into the ice condenser. The resulting pressure increase within the ice condenser causes the intermediate deck doors and the door panels at the top of the condenser to open, which allows the air to flow out of the ice condenser into the upper compartment. The ice condenses the steam as it enters, thus limiting the pressure and temperature buildup in containment. The divider barrier separates the upper and lower compartments and ensures that the steam is directed into the ice condenser. The ice, together with the containment spray, is adequate to absorb the initial blowdown of steam and water from a DBA as well as the additional heat loads that would enter containment over several hours following the initial blowdown. The additional heat loads would come from the residual heat in the reactor core, the hot piping and components, and the secondary system, including the steam generators. During the post blowdown period, the Air Return System (ARS) returns upper compartment air through the divider barrier to the lower compartment. This serves to equalize pressures in

(continued)

BASES

BACKGROUND
(continued)

containment and to continue circulating heated air and steam from the lower compartment through the ice condenser, where the heat is removed by the remaining ice.

Divider barrier integrity ensures that the high energy fluids released during a DBA would be directed through the ice condenser, and that the ice condenser would function as designed if called upon to act as a passive heat sink following a DBA.

APPLICABLE
SAFETY ANALYSES

Divider barrier integrity ensures the functioning of the ice condenser to the limiting containment pressure and temperature that could be experienced following a DBA. The limiting DBAs considered relative to containment temperature and pressure are the loss of coolant accident (LOCA) and the steam line break (SLB). The LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are assumed not to occur simultaneously or consecutively.

Although the ice condenser is a passive system that requires no electrical power to perform its function, the Containment Spray System and the ARS also function to assist the ice bed in limiting pressures and temperatures. Therefore, the postulated DBAs are analyzed, with respect to containment Engineered Safety Feature (ESF) systems, assuming the loss of one ESF bus, which is the worst case single active failure and results in the inoperability of one train in both the Containment Spray System and the ARS.

The limiting DBA analyses (Ref. 1) show that the maximum peak containment pressure results from the LOCA analysis and is calculated to be less than the containment design pressure. The maximum peak containment temperature results from the SLB analysis and is discussed in the Bases for Specification 3.6.5, "Containment Air Temperature."

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

In addition to calculating the overall peak containment pressures, the DBA analyses include calculation of the transient differential pressures that occur across subcompartment walls during the initial blowdown phase of the accident transient. The internal containment walls and structures are designed to withstand these local transient pressure differentials for the limiting DBAs.

The divider barrier satisfies Criterion 3 of the NRC Policy Statement.

LCO

This LCO establishes the minimum equipment requirements to ensure that the divider barrier performs its safety function of ensuring that bypass leakage, in the event of a DBA, does not exceed the bypass leakage assumed in the accident analysis. Included are the requirements that the personnel access doors and equipment hatches in the divider barrier are OPERABLE and closed, and that the divider barrier seal is properly installed and has not degraded with time. An exception to the requirement that the doors be closed is made to allow personnel transit entry through the divider barrier. The basis of this exception is the assumption that, for personnel transit, the time during which a door is open will be short (i.e., shorter than the Completion Time of 1 hour for Condition A). The divider barrier functions with the ice condenser to limit the pressure and temperature that could be expected following a DBA.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause an increase in containment pressure and temperature requiring the integrity of the divider barrier. Therefore, the LCO is applicable in MODES 1, 2, 3, and 4.

The probability and consequences of these events in MODES 5 and 6 are low due to the pressure and temperature limitations of these MODES. As such, divider barrier integrity is not required in these MODES.

(continued)

BASES (continued)

ACTIONS

A.1

If one or more personnel access doors or equipment hatches is inoperable or open, except for personnel transit entry, 1 hour is allowed to restore the door(s) to OPERABLE status and the closed position. The 1 hour Completion Time is consistent with LCO 3.6.1, "Containment," which requires that containment be restored to OPERABLE status within 1 hour.

Condition A has been modified by a Note to provide clarification that for this LCO, separate condition entry is allowed for each personnel access door and equipment hatch.

B.1

If the divider barrier seal is inoperable, 1 hour is allowed to restore the seal to OPERABLE status. The 1 hour Completion Time is consistent with LCO 3.6.1, which requires that containment be restored to OPERABLE status within 1 hour.

C.1 and C.2

If the Divider Barrier Integrity cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 3.6.13.1

Verification by visual inspection that all personnel access doors and equipment hatches between the upper and lower containment compartments are closed provides assurance that divider barrier integrity is maintained prior to the reactor being taken from MODE 5 to MODE 4. The visual inspection shall include the canal gate and control rod drive missile shield which penetrate the divider barrier. This SR is necessary because many of the doors and hatches may have been opened for maintenance during the shutdown.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.6.13.2

Verification that the personnel access door and equipment-hatch seals, sealing surfaces, and alignments are acceptable provides assurance that divider barrier integrity is maintained. This inspection cannot be made when the door or hatch is closed. Therefore, SR 3.6.13.2 is required for each door or hatch that has been opened, prior to the final closure. Some doors and hatches may not be opened for long periods of time. Those that use resilient materials in the seals must be opened and inspected at least once every 10 years to provide assurance that the seal material has not aged to the point of degraded performance. The Frequency of 10 years is based on the known resiliency of the materials used for seals, the fact that the openings have not been opened (to cause wear), and operating experience that confirms that the seals inspected at this Frequency have been found to be acceptable.

SR 3.6.13.3

Verification after each opening of a personnel access door or equipment hatch that it has been closed makes the operator aware of the importance for closing it and thereby provides additional assurance that divider barrier integrity is maintained while in applicable MODES.

SR 3.6.13.4

Conducting periodic physical property tests on divider barrier seal test coupons provides assurance that the seal material has not degraded in the containment environment, including the effects of irradiation with the reactor at power. The required test includes a tensile strength test. The Frequency of 18 months was developed considering such factors as the known resiliency of the seal material used, the inaccessibility of the seals and absence of traffic in their vicinity, and the plant conditions needed to perform the SR. Operating experience has shown that these components usually pass the SR when performed on the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.6.13.5

Visual inspection of the seal around the perimeter provides assurance that the seal is properly secured in place. The Frequency of 18 months was developed considering such factors as the inaccessibility of the seals and absence of traffic in their vicinity, the strength of the bolts and mechanisms used to secure the seal, and the plant conditions needed to perform the SR. Operating experience has shown that these components usually pass the Surveillance test when performed on the 18-month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

REFERENCES

1. Watts Bar FSAR, Section 6.2, "Containment Systems."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.14 Containment Recirculation Drains

BASES

BACKGROUND

The containment recirculation drains consist of the ice condenser drains and the refueling canal drains. The ice condenser is partitioned into 24 bays, each having a pair of inlet doors that open from the bottom plenum to allow the hot steam-air mixture from a Design Basis Accident (DBA) to enter the ice condenser. Twenty of the 24 bays have an ice condenser floor drain at the bottom to drain the melted ice into the lower compartment (in the 4 bays that do not have drains, the water drains through the floor drains in the adjacent bays). Each drain leads to a drain pipe that drops down several feet, then makes one or more 90° bends and exits into the lower compartment. A check (flapper) valve at the end of each pipe keeps warm air from entering during normal operation, but when the water exerts pressure, it opens to allow the water to spill into the lower compartment. This prevents water from backing up and interfering with the ice condenser inlet doors. The water delivered to the lower containment serves to cool the atmosphere as it falls through to the floor and provides a source of borated water at the containment sump for long term use by the Emergency Core Cooling System (ECCS) and the containment Spray System during the recirculation MODE of operation.

The two refueling canal drains are at low points in the refueling canal. During a refueling, plugs are installed in the drains and the canal is flooded to facilitate the refueling process. The water acts to shield and cool the spent fuel as it is transferred from the reactor vessel to storage. After refueling, the canal is drained and the plugs removed. In the event of a DBA, the refueling canal drains are the main return path to the lower compartment for Containment Spray System water sprayed into the upper compartment.

The ice condenser drains and the refueling canal drains function with the ice bed, the Containment Spray System, and the ECCS to limit the pressure and temperature that could be expected following a DBA.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The limiting DBAs considered relative to containment temperature and pressure are the loss of coolant accident (LOCA) and the steam line break (SLB). The LOCA and SLB are analyzed using computer codes designed to predict the resultant containment pressure and temperature transients. DBAs are assumed not to occur simultaneously or consecutively. Although the ice condenser is a passive system that requires no electrical power to perform its function, the Containment Spray System and the Air Return System (ARS) also function to assist the ice bed in limiting pressures and temperatures. Therefore, the analysis of the postulated DBAs, with respect to Engineered Safety Feature (ESF) systems, assumes the loss of one ESF bus, which is the worst case single active failure and results in one train of the Containment Spray System and one train of the ARS being rendered inoperable.

The limiting DBA analyses (Ref. 1) show that the maximum peak containment pressure results from the LOCA analysis and is calculated to be less than the containment design pressure. The maximum peak containment atmosphere temperature results from the SLB analysis and is discussed in the Bases for Specification 3.6.5, "Containment Air Temperature." In addition to calculating the overall peak containment pressures, the DBA analyses include calculation of the transient differential pressures that occur across subcompartment walls during the initial blowdown phase of the accident transient. The internal containment walls and structures are designed to withstand these local transient pressure differentials for the limiting DBAs.

The containment recirculation drains satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO establishes the minimum requirements to ensure that the containment recirculation drains perform their safety functions. The ice condenser floor drain valve disks must be closed to minimize air leakage into and out of the ice condenser during normal operation and must open in the event of a DBA when water begins to drain out. The refueling canal drains must have their plugs removed and remain clear to ensure the return of Containment Spray System water to the lower containment in the event of a DBA. The

(continued)

BASES

LCO
(continued) containment recirculation drains function with the ice condenser, ECCS, and Containment Spray System to limit the pressure and temperature that could be expected following a DBA.

APPLICABILITY In MODES 1, 2, 3, and 4, a DBA could cause an increase in containment pressure and temperature, which would require the operation of the containment recirculation drains. Therefore, the LCO is applicable in MODES 1, 2, 3, and 4.

The probability and consequences of these events in MODES 5 and 6 are low due to the pressure and temperature limitations of these MODES. As such, the containment recirculation drains are not required to be OPERABLE in these MODES.

ACTIONS

A.1

If one ice condenser floor drain is inoperable, 1 hour is allowed to restore the drain to OPERABLE status. The Required Action is necessary to return operation to within the bounds of the containment analysis. The 1 hour Completion Time is consistent with the ACTIONS of LCO 3.6.1, "Containment," which require that containment be restored to OPERABLE status within 1 hour.

B.1

If one refueling canal drain is inoperable, 1 hour is allowed to restore the drain to OPERABLE status. The Required Action is necessary to return operation to within the bounds of the containment analysis. The 1 hour Completion Time is consistent with the ACTIONS of LCO 3.6.1, "Containment," which require that containment be restored to OPERABLE status in 1 hour.

C.1 and C.2

If the affected drain(s) cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to in a MODE in which the LCO does not apply. To

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 3.6.14.1

Verifying the OPERABILITY of the refueling canal drains ensures that they will be able to perform their functions in the event of a DBA. This Surveillance confirms that the refueling canal drain plugs have been removed and that the drains are clear of any obstructions that could impair their functioning. In addition to debris near the drains, attention must be given to any debris that is located where it could be moved to the drains in the event that the Containment Spray System is in operation and water is flowing to the drains. SR 3.6.14.1 must be performed before entering MODE 4 from MODE 5 after every filling of the canal to ensure that the plugs have been removed and that no debris that could impair the drains was deposited during the time the canal was filled. The 92 day Frequency was developed considering such factors as the inaccessibility of the drains, the absence of traffic in the vicinity of the drains, and the redundancy of the drains.

SR 3.6.14.2

Verifying the OPERABILITY of the ice condenser floor drains ensures that they will be able to perform their functions in the event of a DBA. Inspecting the drain valve disk ensures that the valve is performing its function of sealing the drain line from warm air leakage into the ice condenser during normal operation, yet will open if melted ice fills the line following a DBA. Verifying that the drain lines are not obstructed ensures their readiness to drain water from the ice condenser. The 18 month Frequency was developed considering such factors as the inaccessibility of the drains during power operation; the design of the ice condenser, which precludes melting and refreezing of the

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.6.14.2 (continued)

ice; and operating experience that has confirmed that the drains are found to be acceptable when the Surveillance is performed on an 18 month Frequency. Because of high radiation in the vicinity of the drains during power operation, this Surveillance is normally done during a shutdown.

REFERENCES

1. Watts Bar FSAR, Section 6.2, "Containment Systems."
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B 3.6 CONTAINMENT SYSTEMS

B 3.6.15 Shield Building

BASES

BACKGROUND

The shield building is a concrete structure that surrounds the steel containment vessel. Between the containment vessel and the shield building inner wall is an annular space that collects containment leakage that may occur following a loss of coolant accident (LOCA). This space also allows for periodic inspection of the outer surface of the steel containment vessel.

The Emergency Gas Treatment System (EGTS) establishes a negative pressure in the annulus between the shield building and the steel containment vessel. Filters in the system then control the release of radioactive contaminants to the environment. The shield building is required to be OPERABLE to ensure retention of containment leakage and proper operation of the EGTS.

APPLICABLE
SAFETY ANALYSES

The design basis for shield building OPERABILITY is a LOCA. Maintaining shield building OPERABILITY ensures that the release of radioactive materials from the containment atmosphere is restricted to those leakage paths and associated leakage rates assumed in the accident analysis. This restriction, in conjunction with the operation of the EGTS, will limit the site boundary radiation doses to within limits.

The shield building satisfies Criterion 3 of the NRC Policy Statement.

LCO

Shield building OPERABILITY must be maintained to ensure proper operation of the EGTS and to limit radioactive leakage from the containment to those paths and leakage rates assumed in the accident analysis.

(continued)

BASES (continued)

APPLICABILITY Maintaining shield building OPERABILITY prevents leakage of radioactive material from the shield building. Radioactive material may enter the shield building from the containment following a LOCA. Therefore, shield building OPERABILITY is required in MODES 1, 2, 3, and 4 when a steam line break, LOCA, or rod ejection accident could release radioactive material to the containment atmosphere.

ACTIONS

A.1

In the event shield building OPERABILITY is not maintained, shield building OPERABILITY must be restored within 24 hours.

Twenty-four hours is a reasonable completion time considering the limited leakage design of containment and the low probability of a DBA occurring during this time period.

B.1 and B.2

If shield building cannot be restored to OPERABLE status within the required Completion Time, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed 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 3.6.15.1

Maintaining shield building OPERABILITY requires maintaining each door in the access opening closed, except when the access opening is being used for normal transient entry and exit. The 31 day Frequency of this SR is based on engineering judgment and is considered adequate in view of the other indications of door status that are available to the operator.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.6.15.2

This SR would give advance indication of gross deterioration of the concrete structural integrity of the shield building. The Frequency of this SR is the same as that of SR 3.6.1.1. The verification is done during shutdown and as part of Type A leakage tests associated with SR 3.6.1.1.

REFERENCES

None.

B 3.7 PLANT SYSTEMS

B 3.7.1 Main Steam Safety Valves (MSSVs)

BASES

BACKGROUND

The primary purpose of the MSSVs is to provide overpressure protection for the secondary system. The MSSVs also provide protection against overpressurizing the reactor coolant pressure boundary (RCPB) by providing a heat sink for the removal of energy from the Reactor Coolant System (RCS) if the preferred heat sink, provided by the Condenser and Circulating Water System, is not available.

Five MSSVs are located on each main steam header, outside containment, upstream of the main steam isolation valves, as described in the FSAR, Section 10.3.2 (Ref. 1). The MSSV capacity criteria is 105% of rated steam flow at 110% of the steam generator design pressure. This meets the requirements of the ASME Code, Section III (Ref. 2). The MSSV design includes staggered setpoints, according to Table 3.7.1-2 in the accompanying LCO, so that only the needed valves will actuate. Staggered setpoints reduce the potential for valve chattering that is due to steam pressure insufficient to fully open all valves following a turbine-reactor trip.

APPLICABLE SAFETY ANALYSES

The design basis for the MSSVs comes from Reference 2 and its purpose is to limit the secondary system pressure to $\leq 110\%$ of design pressure when passing 100% of design steam flow. This design basis is sufficient to cope with any anticipated operating occurrence (AOO) or accident considered in the Design Basis Accident (DBA) and transient analysis.

The events that challenge the relieving capacity of the MSSVs, and thus RCS pressure, are those characterized as decreased heat removal events, which are presented in the FSAR, Section 15.2 and 15.4 (Ref. 3). Of these, the full power turbine trip without steam dump is the limiting AOO. This event also terminates normal feedwater flow to the steam generators.

The transient response for turbine trip without a direct reactor trip presents no hazard to the integrity of the RCS

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

or the Main Steam System. If a minimum reactivity feedback is assumed, the reactor is tripped on high pressurizer pressure. In this case, the pressurizer safety valves open, and RCS pressure remains below 110% of the design value. The MSSVs also open to limit the secondary steam pressure.

If maximum reactivity feedback is assumed, the reactor is tripped on overtemperature ΔT . The departure from nucleate boiling ratio increases throughout the transient, and never drops below its initial value. Pressurizer relief valves and MSSVs are activated and prevent overpressurization in the primary and secondary systems. The MSSVs are assumed to have two active and one passive failure modes. The active failure modes are spurious opening, and failure to reclose once opened. The passive failure mode is failure to open upon demand.

The MSSVs satisfy Criterion 3 of the NRC Policy Statement.

LCO

The accident analysis requires four MSSVs per steam generator to provide overpressure protection for Design Basis transients occurring at 102% RTP. An MSSV will be considered inoperable if it fails to open on demand. The LCO requires that five MSSVs be OPERABLE in compliance with Reference 2, even though this is not a requirement of the DBA analysis. This is because operation with less than the full number of MSSVs requires limitations on allowable THERMAL POWER (to meet ASME Code requirements). These limitations are according to Table 3.7.1-1 in the accompanying LCO, and Required Action A.2.

The OPERABILITY of the MSSVs is defined as the ability to open within the setpoint tolerances, relieve steam generator overpressure, and reseal when pressure has been reduced. The OPERABILITY of the MSSVs is determined by periodic surveillance testing in accordance with the Inservice Testing Program.

The lift settings, according to Table 3.7.1-2 in the accompanying LCO, correspond to ambient conditions of the valve at nominal operating temperature and pressure.

(continued)

BASES

LCO
(continued) This LCO provides assurance that the MSSVs will perform their designed safety functions to mitigate the consequences of accidents that could result in a challenge to the RCPB.

APPLICABILITY In MODE 1 above 40% RTP, the number of MSSVs per steam generator required to be OPERABLE must be according to Table 3.7.1-1 in the accompanying LCO. Below 40% RTP in MODE 1, 2, and 3, only two MSSVs per steam generator are required to be OPERABLE.

In MODES 4 and 5, there are no credible transients requiring the MSSVs. The steam generators are not normally used for heat removal in MODES 5 and 6, and thus cannot be overpressurized; there is no requirement for the MSSVs to be OPERABLE in these MODES.

ACTIONS The Actions table is modified by a Note indicating that separate Condition entry is allowed for each MSSV.

A.1

With one or more MSSVs inoperable, reduce power so that the available MSSV relieving capacity meets Reference 2 requirements for the applicable THERMAL POWER.

Operation with less than all five MSSVs OPERABLE for each steam generator is permissible, if THERMAL POWER is proportionally limited to the relief capacity of the remaining MSSVs. This is accomplished by restricting THERMAL POWER so that the energy transfer to the most limiting steam generator is not greater than the available relief capacity in that steam generator. For example, if one MSSV is inoperable in one steam generator, the relief capacity of that steam generator is reduced by approximately 20%. To offset this reduction in relief capacity, energy transfer to that steam generator must be similarly reduced by at least 20%. This is accomplished by reducing THERMAL POWER by at least 20%, which conservatively limits the energy transfer to all steam generators to approximately 80% of total capacity, consistent with the relief capacity of the most limiting steam generator.

(continued)

BASES

ACTIONS

A.1 (continued)

For each steam generator, at a specified pressure, the fractional relief capacity (FRC) of each MSSV is determined as follows:

$$FRC = \frac{A}{B}$$

where:

A = the relief capacity of the MSSV; and

B = the total relief capacity of all the MSSVs of the steam generator

The FRC is the relief capacity necessary to address operation with reduced THERMAL POWER.

The reduced THERMAL POWER levels in the LCO prevent operation at power levels greater than the relief capacity of the remaining MSSVs. The reduced THERMAL POWER is determined as follows:

$$RP = \left[1 - (N_1 \times FRC_1 + N_2 \times FRC_2 + \dots + N_5 \times FRC_5) \right] \times 100\%$$

where:

RP = Reduced THERMAL POWER for the most limiting steam generator expressed as a percent of RTP;

N_1, N_2, \dots, N_5 represent the status of the MSSV 1, 2, ..., 5

= 0 if the MSSV is OPERABLE,
= 1 if the MSSV is inoperable;

$FRC_1, FRC_2, \dots, FRC_5$ = the relief capacity of the MSSV 1, 2, ..., 5 as defined above.

(continued)

BASES

ACTIONS
(continued)B.1 and B.2

If the MSSVs cannot be restored to OPERABLE status within the associated Completion Time, or if one or more SGs have less than two MSSVs OPERABLE, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 4 within 12 hours. The allowed Completion Times are 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
REQUIREMENTSSR 3.7.1.1

This SR verifies the OPERABILITY of the MSSVs by the verification of each MSSV lift setpoint in accordance with the Inservice Testing Program. The ASME Code, Section XI (Ref. 4), requires that safety- and relief-valve tests be performed in accordance with ANSI/ASME OM-1-1987 (Ref. 5). According to Reference 5, the following tests are required:

- a. Visual examination;
- b. Seat tightness determination;
- c. Setpoint pressure determination (lift setting);
- d. Compliance with owner's seat tightness criteria; and
- e. Verification of the balancing device integrity on balanced valves.

The ANSI/ASME standard requires that all valves be tested every 5 years, and a minimum of 20% of the valves be tested every 24 months. The ASME Code specifies the activities and frequencies necessary to satisfy the requirements.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

This SR is modified by a Note that allows entry into and operation in MODE 3 prior to performing the SR. The MSSVs may be either bench tested or tested in-situ at hot conditions using an assist device to simulate lift pressure. If the MSSVs are not tested at hot conditions, the lift setting pressure shall be corrected to ambient conditions of the valve at operating temperature and pressure.

REFERENCES

1. Watts Bar FSAR, Section 10.3, "Main Steam Supply System."
 2. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section III, Article NC-7000, "Overpressure Protection," Class 2 Components.
 3. Watts Bar FSAR, Section 15.2, Condition II - Faults of Moderate Frequency," and Section 15.4, "Condition IV - Limiting Faults."
 4. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section XI, Article IWV-3500, "Inservice Test: Category C Valves."
 5. ANSI/ASME OM-1-1987, "Requirements for Inservice Performance Testing of Nuclear Power Plant Pressure Relief Devices."
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B 3.7 PLANT SYSTEMS

B 3.7.2 Main Steam Isolation Valves (MSIVs)

BASES

BACKGROUND

The MSIVs isolate steam flow from the secondary side of the steam generators following a high energy line break (HELB). MSIV closure terminates break flow from the unaffected (intact) steam generators.

One MSIV is located in each main steam line outside, but close to, containment. The MSIVs are downstream from the main steam safety valves (MSSVs) and auxiliary feedwater (AFW) pump turbine steam supply, to prevent MSSV and AFW isolation from the steam generators by MSIV closure. Closing the MSIVs isolates each steam generator from the others, and isolates the turbine, Steam Dump System, and other auxiliary steam supplies from the steam generators.

The MSIVs close on a main steam isolation signal generated by either low steam line pressure, negative steam pressure rate (below P-11) or high-high containment pressure. The MSIVs fail closed on loss of control or actuation power.

Each MSIV has an MSIV bypass valve. Although these bypass valves are normally closed, they receive the same emergency closure signal as do their associated MSIVs. The MSIVs may also be actuated manually.

A description of the MSIVs is found in the FSAR, Section 10.3 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The design basis of the MSIVs is established by the containment analysis for the large steam line break (SLB) inside containment, discussed in the FSAR, Section 6.2 (Ref. 2). It is also affected by the accident analysis of the SLB events presented in the FSAR, Section 15.4.2.1 (Ref. 3). The design precludes the blowdown of more than one steam generator, assuming a single active component failure (e.g., the failure of one MSIV to close on demand).

The limiting case for the containment analysis is the SLB inside containment, with a loss of offsite power following turbine trip, and failure of the MSIV on the affected steam

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

generator to close. At lower powers, the steam generator inventory and temperature are at their maximum, maximizing the analyzed mass and energy release to the containment. Due to reverse flow and failure of the MSIV to close, the additional mass and energy in the steam headers downstream from the other MSIV contributes to the total release. With the most reactive rod cluster control assembly assumed stuck in the fully withdrawn position, there is an increased possibility that the core will become critical and return to power. The core is ultimately shut down by the boric acid injection delivered by the Emergency Core Cooling System.

The accident analysis compares several different SLB events against different acceptance criteria. The large SLB outside containment upstream of the MSIV is limiting for offsite dose, although a break in this short section of main steam header has a very low probability. The large SLB inside containment at hot zero power is the limiting case for a post trip return to power. The analysis includes scenarios with offsite power available, and with a loss of offsite power following turbine trip. With offsite power available, the reactor coolant pumps continue to circulate coolant through the steam generators, maximizing the Reactor Coolant System cooldown. With a loss of offsite power, the response of mitigating systems is delayed. Significant single failures considered include failure of an MSIV to close.

The MSIVs serve only a safety function and remain open during power operation. The bypass valves are closed during power operation, but may be open at hot zero power. These valves operate under the following situations:

- a. An HELB inside containment. In order to maximize the mass and energy release into containment, the analysis assumes that the MSIV in the affected steam generator remains open. For this accident scenario, steam is discharged into containment from all steam generators until the remaining MSIVs close. After MSIV closure, steam is discharged into containment only from the affected steam generator and from the residual steam in the main steam header downstream of the closed MSIVs in the unaffected loops. Closure of the MSIVs isolates the break from the unaffected steam generators.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

- b. A break outside of containment and upstream from the MSIVs is not a containment pressurization concern. The uncontrolled blowdown of more than one steam generator must be prevented to limit the potential for uncontrolled RCS cooldown and positive reactivity addition. Closure of the MSIVs isolates the break, and limits the blowdown to a single steam generator.
- c. A break downstream of the MSIVs will be isolated by the closure of the MSIVs.
- d. Following a steam generator tube rupture, closure of the MSIVs isolates the ruptured steam generator from the intact steam generators. In addition to minimizing radiological releases, this enables the operator to maintain the pressure of the steam generator with the ruptured tube below the MSSV setpoints, a necessary step toward isolating the flow through the rupture.
- e. The MSIVs are also utilized during other events such as a feedwater line break. This event is less limiting so far as MSIV OPERABILITY is concerned.

The MSIVs satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO requires that four MSIVs in the steam lines be OPERABLE. The MSIVs are considered OPERABLE when the isolation times are within limits, and they close on an isolation actuation signal.

This LCO provides assurance that the MSIVs will perform their design safety function to mitigate the consequences of accidents that could result in offsite exposures comparable to the 10 CFR 100 limits (Ref. 4) or the NRC staff-approved licensing basis.

APPLICABILITY

The MSIVs must be OPERABLE in MODE 1, and in MODES 2 and 3 except when closed and deactivated, when there is significant mass and energy in the RCS and steam generators. When the MSIVs are closed, they are

(continued)

BASES

APPLICABILITY
(continued)

already performing the safety function.

In MODE 4, normally most of the MSIVs are closed, and the steam generator energy is low.

In MODE 5 or 6, the steam generators do not contain much energy because their temperature is below the boiling point of water; therefore, the MSIVs are not required for isolation of potential high-energy secondary-system pipe breaks in these MODES.

ACTIONS

A.1

With one MSIV inoperable in MODE 1, action must be taken to restore OPERABLE status within 8 hours. Some repairs to the MSIV can be made with the unit hot. The 8-hour Completion Time is reasonable, considering the low probability of an accident occurring during this time period that would require a closure of the MSIVs.

The 8-hour Completion Time is greater than that normally allowed for containment isolation valves because the MSIVs are valves that isolate a closed system penetrating containment. These valves differ from other containment isolation valves in that the closed system provides an additional means for containment isolation.

B.1

If the MSIV cannot be restored to OPERABLE status within 8 hours, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed into MODE 2 within 6 hours and Condition C would be entered. The Completion Times are reasonable, based on operating experience, to reach MODE 2 and to close the MSIVs in an orderly manner and without challenging unit systems.

C.1 and C.2

Condition C is modified by a Note indicating that separate Condition entry is allowed for each MSIV.

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

Since the MSIVs are required to be OPERABLE in MODES 2 and 3, the inoperable MSIVs may either be restored to OPERABLE status or closed. When closed, the MSIVs are already in the position required by the assumptions in the safety analysis.

The 8-hour Completion Time is consistent with that allowed in Condition A.

For inoperable MSIVs that cannot be restored to OPERABLE status within the specified Completion Time, but are closed, the inoperable MSIVs must be verified on a periodic basis to be closed. This is necessary to ensure that the assumptions in the safety analysis remain valid. The 7-day Completion Time is reasonable, based on engineering judgment, in view of MSIV status indications available in the control room, and other administrative controls, to ensure that these valves are in the closed position.

D.1 and D.2

If the MSIVs cannot be restored to OPERABLE status, or are not closed within the associated Completion Time the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed at least in MODE 3 within 6 hours, and in MODE 4 within 12 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from MODE 2 conditions in an orderly manner and without challenging unit systems.

SURVEILLANCE
REQUIREMENTSSR 3.7.2.1

This SR verifies that MSIV closure time is ≤ 5.0 seconds on an actual or simulated actuation signal. The MSIV closure time is assumed in the accident and containment analyses. This Surveillance is normally performed upon returning the unit to operation following a refueling outage. The MSIVs should not be tested at power, since even a part-stroke

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.7.2.1 (continued)

exercise increases the risk of a valve closure when the unit is generating power. As the MSIVs are not tested at power, they are exempt from the ASME Code, Section XI (Ref. 5) requirements during operation in MODE 1 or 2.

The Frequency is in accordance with the Inservice Testing Program or 18 months. The 18-month Frequency for valve closure time is based on the refueling cycle. Operating experience has shown that these components usually pass the surveillance when performed at the 18-month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

This test is conducted in MODE 3 with the unit at operating temperature and pressure, as discussed in Reference 5 exercising requirements. This SR is modified by a Note that allows entry into and operation in MODE 3 prior to performing the SR. This allows a delay of testing until MODE 3, to establish conditions consistent with those under which the acceptance criterion was generated.

REFERENCES

1. Watts Bar FSAR, Section 10.3, "Main Steam Supply System."
 2. Watts Bar FSAR, Section 6.2, "Containment Systems."
 3. Watts Bar FSAR, Section 15.4.2.1, "Major Rupture of a Main Steam Line."
 4. 10 CFR 100.11.
 5. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section XI, Inservice Inspection, Article IWV-3400, "Inservice Tests - Category A and B Valves."
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B 3.7 PLANT SYSTEMS

B 3.7.3 Main Feedwater Isolation and Regulation Valves (MFIVs and MFRVs) and Associated Bypass Valves

BASES

BACKGROUND

The MFIVs isolate main feedwater (MFW) flow to the secondary side of the steam generators following a high energy line break (HELB). The safety related function of the MFRVs is to provide the second isolation of MFW flow to the secondary side of the steam generators following an HELB. Closure of the MFIVs and associated bypass valves or MFRVs and associated bypass valves terminates flow to the steam generators, terminating the event for feedwater line breaks (FWLBs) occurring upstream of the MFIVs or MFRVs. The consequences of events occurring in the main steam lines or in the MFW lines downstream from the MFIVs will be mitigated by their closure. Closure of the MFIVs and associated bypass valves, or MFRVs and associated bypass valves, effectively terminates the addition of normal feedwater to an affected steam generator, limiting the mass and energy release for steam line breaks (SLBs) or FWLBs inside containment, and reducing the cooldown effects for SLBs.

The MFIVs and associated bypass valves isolate the non-safety-related portions from the safety-related portions of the system. In the event of a secondary side pipe rupture inside containment, the valves limit the quantity of high energy fluid that enters containment through the break, and provide a pressure boundary for the controlled addition of auxiliary feedwater (AFW) to the intact loops.

One MFIV and one MFRV are located on each 16-inch MFW line. One bypass MFRV and one bypass MFIV are located on a smaller 6-inch startup and tempering flow feedwater line. Both the MFIV and bypass MFIV are located in the main steam valve vault close to containment. The AFW injection point is located downstream of the bypass MFIV so that AFW may be supplied to the steam generators following a bypass MFIV or MFRV closure. The piping volume between the check valve and the steam generators must be accounted for in calculating mass and energy releases, and refilled prior to AFW reaching the steam generator following either an SLB or FWLB.

(continued)

BASES

BACKGROUND
(continued)

The MFIVs and associated bypass valves, and MFRVs and associated bypass valves close on receipt of a T_{avg} -Low coincident with reactor trip (P-4), safety injection signal, or steam generator water level-high-high signal. They may also be closed manually except for the bypass MFIV which has no handswitch. In addition to the MFIVs and associated bypass valves, and the MFRVs and associated bypass valves, a check valve is located just outside containment in the main steam valve vault. The check valve terminates flow from the SG for breaks upstream of the check valve.

A description of the MFIVs and MFRVs is found in the FSAR, Section 10.4.7 (Ref. 1).

APPLICABLE
SAFETY ANALYSES

The design basis of the MFIVs and MFRVs and associated bypass valves is established by the analyses for the large SLB. It is also influenced by the accident analysis for the large FWLB. Closure of the MFIVs and associated bypass valves, or MFRVs and associated bypass valves, may also be relied on to terminate an SLB for core response analysis and excess feedwater event.

Failure of an MFIV, MFRV, or the associated bypass valves in a single flow path to close following an SLB or FWLB, can result in additional mass and energy being delivered to the steam generators, contributing to cooldown. This failure also results in additional mass and energy releases following an SLB or FWLB event.

The MFIVs and MFRVs satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO ensures that the MFIVs and the MFRVs and their associated bypass valves will isolate main feedwater flow to the steam generators, following an FWLB or SLB. The MFIVs and bypass MFIVs will also isolate the non-safety-related portions from the safety-related portions of the system.

(continued)

BASES

LCO
(continued)

This LCO requires that four MFIVs and associated bypass valves, and four MFRVs and associated bypass valves, in the feedwater lines be OPERABLE. The MFIVs and MFRVs and the associated bypass valves are considered OPERABLE when isolation times are within limits and they close on an isolation actuation signal.

Failure to meet the LCO requirements can result in additional mass and energy being released to containment following an SLB or FWLB inside containment. If a feedwater isolation signal on high-high steam generator level is relied on to terminate an excess feedwater flow event, failure to meet the LCO may result in the introduction of water into the main steam lines.

APPLICABILITY

The MFIVs and MFRVs and the associated bypass valves must be OPERABLE whenever there is significant mass and energy in the Reactor Coolant System and steam generators. This ensures that, in the event of an HELB, a single failure cannot result in the blowdown of more than one steam generator. In MODES 1, 2, and 3, the MFIVs and MFRVs and the associated bypass valves are required to be OPERABLE, except when closed and deactivated, to limit the amount of available fluid that could be added to containment in the case of a secondary system pipe break inside containment. When the valves are closed and deactivated or isolated by a closed manual valve, they are already performing their safety function.

In MODES 4, 5, and 6 steam generator energy is low. Therefore, the MFIVs and MFRVs and the associated bypass valves are normally closed since MFW is not required.

ACTIONS

The Actions table is modified by a Note indicating that separate Condition entry is allowed for each valve.

A.1 and A.2

With one MFIV in one or more flow paths inoperable, action must be taken to restore the affected valves to OPERABLE status, or to close or isolate inoperable affected valves

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

within 72 hours. When these valves are closed or isolated, they are performing their required safety function.

The 72-hour Completion Time takes into account the redundancy afforded by the remaining OPERABLE valves and the low probability of an event occurring during this time period that would require isolation of the main feedwater flow paths. The 72-hour Completion Time is reasonable, based on operating experience.

Inoperable MFIVs, that are closed or isolated, must be verified on a periodic basis that they are closed or isolated. This is necessary to ensure that the assumptions in the safety analysis remain valid. The 7-day Completion Time is reasonable, based on engineering judgment, in view of valve status indications available in the control room, and other administrative controls, to ensure that these valves are closed or isolated.

B.1 and B.2

With one MFRV in one or more flow paths inoperable, action must be taken to restore the affected valves to OPERABLE status, or to close or isolate inoperable affected valves within 72 hours. When these valves are closed or isolated, they are performing their required safety function.

The 72-hour Completion Time takes into account the redundancy afforded by the remaining OPERABLE valves and the low probability of an event occurring during this time period that would require isolation of the main feedwater flow paths. The 72-hour Completion Time is reasonable, based on operating experience.

Inoperable MFRVs, that are closed or isolated, must be verified on a periodic basis that they are closed or isolated. This is necessary to ensure that the assumptions in the safety analysis remain valid. The 7-day Completion Time is reasonable, based on engineering judgment, in view of valve status indications available in the control room, and other administrative controls to ensure that the valves are closed or isolated.

(continued)

BASES

ACTIONS
(continued)

C.1

With one MFIV or MFRV bypass valve in one or more flow paths inoperable, action must be taken to restore the affected valves to OPERABLE status. The inoperable valve should not be closed and isolated for long periods of time since the 6-inch bypass line provides a small tempering flow to the upper SG nozzle. This limits the temperature difference between the SG and condensate storage tank fluid which would be supplied by the AFW system. The 6-inch line may be isolated for short periods of time to support calorimetric flow measurements.

The 72-hour Completion Time takes into account the redundancy afforded by the remaining OPERABLE valves and the low probability of an event occurring during this time period that would require isolation of the main feedwater flow paths. The 72-hour Completion Time is reasonable, based on operating experience.

D.1

With an MFIV and MFRV in the same flow path inoperable, there may be no redundant system to operate automatically and perform the required safety function. Although the containment can be isolated with the failure of two valves in parallel in the same flow path, the double failure can be an indication of a common mode failure in the valves of this flow path, and as such, is treated the same as a loss of the isolation capability of this flow path. Under these conditions, affected valves in each flow path must be restored to OPERABLE status, or the affected flow path isolated within 8 hours. This action returns the system to the condition where at least one valve in each flow path is performing the required safety function. The 8-hour Completion Time is reasonable, based on operating experience, to complete the actions required to close the MFIV, or MFRV, or otherwise isolate the affected flow path.

E.1

With two bypass valves in the same flow path inoperable, there may be no redundant system to operate automatically and perform the required safety function. Under these conditions, at least one valve in the flow path must be

(continued)

BASES

ACITONS

E.1 (continued)

restored to OPERABLE status within 8 hours. The Completion Time of 8 hours is consistent with Condition D.

F.1 and F.2

If the MFIV(s) and MFRV(s) and the associated bypass valve(s) cannot be restored to OPERABLE status, or the MFIV(s) or MFRV(s) closed or isolated within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 4 within 12 hours. The allowed Completion Times are 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 3.7.3.1

This SR verifies that the closure time of each MFIV, MFRV, and associated bypass valves is ≤ 6.5 seconds on an actual or simulated actuation signal. The MFIV and MFRV closure times are assumed in the accident and containment analyses. This Surveillance is normally performed upon returning the unit to operation following a refueling outage. These valves should not be tested at power since even a part-stroke exercise increases the risk of a valve closure with the unit generating power. As these valves are not tested at power, they are exempt from the ASME Code, Section XI (Ref. 2) requirements during operation in MODES 1 and 2.

The Frequency for this SR is in accordance with the Inservice Testing Program or 18 months. The 18-month Frequency for valve closure is based on the refueling cycle. Operating experience has shown that these components usually pass the SR when performed at the 18-month Frequency.

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BASES

REFERENCES

1. FSAR, Section 10.4.7, "Condensate and Feedwater Systems."
 2. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section XI.
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B 3.7 PLANT SYSTEMS

B 3.7.4 Atmospheric Dump Valves (ADVs)

BASES

BACKGROUND

The ADVs provide a method for cooling the unit to residual heat removal (RHR) entry conditions should the preferred heat sink via the Steam Dump System to the condenser not be available, as discussed in the FSAR, Section 10.3 (Ref. 1). This is done in conjunction with the Auxiliary Feedwater System providing cooling water from the condensate storage tank (CST). The ADVs may also be used to meet the design cooldown rate during a normal cooldown if the condenser is not available to permit use of the Steam Dump System.

One ADV line for each of the four steam generators is provided. Each ADV line consists of one ADV and an associated block valve.

The ADVs are provided with upstream block valves to permit their being tested at power, and to provide an alternate means of isolation. The ADVs are equipped with pneumatic controllers to permit control of the cooldown rate.

The ADVs are provided with a pressurized air supply from the auxiliary air compressors that, on a loss of pressure in the normal instrument air supply, automatically supplies backup air to operate the ADVs.

A description of the ADVs is found in Reference 1. The ADVs are OPERABLE with a dc-power source and control air available. In addition, handwheels are provided for local manual operation.

APPLICABLE SAFETY ANALYSES

The design basis of the ADVs is established by the capability to cool the unit to RHR entry conditions. The maximum design rate of 50°F per hour is applicable for two steam generators, each with one ADV. This rate is adequate to cool the unit to RHR entry conditions utilizing the cooling water supply available in the CST.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

In the accident analysis presented in Reference 1, the ADVs are assumed to be used by the operator to cool down the unit to RHR entry conditions for accidents accompanied by a loss of offsite power. Prior to operator actions to cool down the unit, the ADVs and main steam safety valves (MSSVs) are assumed to operate automatically to relieve steam and maintain the steam generator pressure below the design value. For the recovery from a steam generator tube rupture (SGTR) event, the operator is also required to perform a limited cooldown to establish adequate subcooling as a necessary step to terminate the primary-to-secondary break flow into the ruptured steam generator. The time required to terminate the primary-to-secondary break flow for a SGTR is more critical than the time required to cool down to RHR conditions for this event and also for other accidents. Thus, the SGTR is the limiting event for the ADVs. Three ADVs are required to be OPERABLE to satisfy the SGTR accident analysis requirements. This considers any single failure assumptions regarding the failure of one ADV to open on demand.

The ADVs are equipped with block valves in the event an ADV spuriously fails to open or fails to close during use.

The ADVs satisfy Criterion 3 of the NRC Policy Statement.

LCO

Three ADV lines are required to be OPERABLE. One ADV line is required from each of three steam generators to ensure that at least one ADV line is available to conduct a unit cooldown following an SGTR, in which one steam generator becomes unavailable, accompanied by a single, active failure of a second ADV line on an unaffected steam generator. The block valves must be OPERABLE to isolate a failed open ADV line.

Failure to meet the LCO can result in the inability to cool the unit to RHR entry conditions following an event in which

(continued)

BASES

LCO
(continued)

the condenser is unavailable for use with the Steam Dump System.

An ADV is considered OPERABLE when it is capable of providing controlled relief of the main steam flow and capable of fully opening and closing on demand.

APPLICABILITY

In MODES 1, 2, and 3, and in MODE 4, when steam generator is being relied upon for heat removal, the ADVs are required to be OPERABLE.

In MODE 5 or 6, an SGTR is not a credible event.

ACTIONS

A.1

With one required ADV line inoperable, action must be taken to restore OPERABLE status within 7 days. The 7-day Completion Time allows for the redundant capability afforded by the remaining OPERABLE ADV lines, a non-safety-grade backup in the Steam Dump System, and MSSVs. Required Action A.1 is modified by a Note indicating that LCO 3.0.4 does not apply.

B.1

With two or more ADV lines inoperable, action must be taken to restore all but one ADV line to OPERABLE status. Since the block valve can be closed to isolate an ADV, some repairs may be possible with the unit at power. The 24-hour Completion Time is reasonable to repair inoperable ADV lines, based on the availability of the Steam Dump System and MSSVs, and the low probability of an event occurring during this period that would require the ADV lines.

C.1 and C.2

If the ADV lines cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

MODE 3 within 6 hours, and in MODE 4, without reliance upon steam generator for heat removal, within 18 hours. The allowed Completion Times are 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 3.7.4.1

To perform a controlled cooldown of the RCS, the ADVs must be able to be opened either remotely or locally and throttled through their full range. This SR ensures that the ADVs are tested through a full-control cycle at least once per fuel cycle. Performance of inservice testing or use of an ADV during a unit cooldown may satisfy this requirement. Operating experience has shown that these components usually pass the Surveillance when performed at the 18-month Frequency. The Frequency is acceptable from a reliability standpoint.

SR 3.7.4.2

The function of the block valve is to isolate a failed open ADV. Cycling the block valve both closed and open demonstrates its capability to perform this function. Performance of inservice testing or use of the block valve during unit cooldown may satisfy this requirement. Operating experience has shown that these components usually pass the Surveillance when performed at the 18-month Frequency. The Frequency is acceptable from a reliability standpoint.

REFERENCES

1. Watts Bar FSAR, Section 10.3, "Main Steam Supply System."
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B 3.7 PLANT SYSTEMS

B 3.7.5 Auxiliary Feedwater (AFW) System

BASES

BACKGROUND

The AFW System automatically supplies feedwater to the steam generators to remove decay heat from the Reactor Coolant System upon the loss of normal feedwater supply. The AFW pumps take suction through separate and independent suction lines from the condensate storage tank (CST) (LCO 3.7.6, "Condensate Storage Tank (CST)") and pump to the steam generator secondary side via separate and independent connections to the main feedwater (MFW) bypass line piping. The steam generators function as a heat sink for core decay heat. The heat load is dissipated by releasing steam to the atmosphere from the steam generators via the main steam safety valves (MSSVs) (LCO 3.7.1, "Main Steam Safety Valves (MSSVs)") or atmospheric dump valves (LCO 3.7.4, "Atmospheric Dump Valves (ADVs)"). If the main condenser is available, steam may be released via the steam dump valves and recirculated to the CST.

The AFW System consists of two motor-driven AFW pumps and steam turbine-driven pump configured into three trains. Each motor-driven pump provides 410 gpm of AFW flow, and the turbine-driven pump provides 720 gpm to the steam generators, as assumed in the accident analysis. The pumps are equipped with independent recirculation lines to prevent pump operation against a closed system. Each motor-driven AFW pump is powered from an independent Class 1E power supply and feeds two steam generators. The steam turbine-driven AFW pump receives steam from one of two main steam lines upstream of the main steam isolation valves. Each of the steam feed lines will supply 100% of the requirements of the turbine-driven AFW pump.

The AFW System is capable of supplying feedwater to the steam generators during normal unit startup, shutdown, and hot standby conditions, however, the main feedwater system will normally perform these functions.

The turbine-driven AFW pump supplies a common header capable of feeding all steam generators. One pump at full flow is

(continued)

BASES

BACKGROUND
(continued)

sufficient to remove decay heat and cool the unit to residual heat removal (RHR) entry conditions. Thus, the requirement for diversity in motive power sources for the AFW System is met.

The AFW System is designed to supply sufficient water to the steam generator(s) to remove decay heat with steam generator pressure at the lowest setpoint of the MSSVs. Subsequently, the AFW System supplies sufficient water to cool the unit to RHR entry conditions, with steam released through the ADVs.

The AFW System actuates automatically on steam generator water level-low-low by the ESFAS (LCO 3.3.2, "Engineered Safety Feature Activation System (ESFAS)"). The system also actuates on loss of offsite power, safety injection, and trip of both turbine-driven MFW pumps.

The AFW System is discussed in the FSAR, Section 10.4.9 (Ref. 1).

APPLICABLE
SAFETY ANALYSES

The AFW System mitigates the consequences of any event with loss of normal feedwater.

The design basis of the AFW System is to supply water to the steam generator to remove decay heat and other residual heat by delivering at least the minimum required flow rate to the steam generators at pressures corresponding to the lowest steam generator safety valve set-pressure plus 1% for setpoint tolerance and 3% for accumulation.

In addition, the AFW System must supply enough makeup water to replace steam generator secondary inventory lost as the unit cools to MODE 4 conditions. Sufficient AFW flow must also be available to account for flow losses such as pump recirculation and line breaks.

The limiting Design Basis Accidents (DBAs) and transients for the AFW System are as follows:

- a. Feedwater Line Break (FWLB); and
- b. Loss of main feedwater.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

In addition, the minimum available AFW flow and system characteristics are considerations in the analysis of a small break loss-of-coolant accident (LOCA).

The AFW System design is such that it can perform its function following an FWLB between the main feedwater isolation valves and containment, combined with a loss of offsite power following turbine trip, and a single active failure of the steam turbine-driven AFW pump. One motor-driven AFW pump would deliver to the broken MFW header until the problem was detected, and flow terminated by the operator within 10 minutes. Sufficient flow would be delivered to the intact steam generator by the redundant AFW pump.

The ESFAS automatically actuates the AFW turbine-driven pump and associated power operated valves and controls when required to ensure an adequate feedwater supply to the steam generators during loss of power.

Each motor-driven auxiliary feedwater pump (one Train A and one Train B) supplies flow paths to two steam generators. Each flow path contains automatic air-operated level control valves (LCVs). The LCVs have the same train designation as the associated pump and are provided trained air. The turbine-driven auxiliary feedwater pump supplies flow paths to all four steam generators. Each of these flow paths contains an automatic air-operated LCV, two of which are designated as Train A, receive A-train air and provide flow to the same steam generators that are supplied by the B-train motor-driven auxiliary feedwater pump. The remaining two LCVs are designated as Train B, receive B-train air, and provide flow to the same steam generators that are supplied by the A-train motor-driven pump. This design provides the required redundancy to ensure that at least two steam generators receive the necessary flow assuming any single failure. It can be seen from the description provided above that the loss of a single train of air (A or B) will not prevent the auxiliary feedwater system from performing its intended safety function and is no more severe than the loss of a single auxiliary feedwater pump. Therefore, the loss of a single train of auxiliary air only affects the capability of a single motor-driven auxiliary feedwater pump because the turbine-driven pump is

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

still capable of providing flow to the two steam generators that are separated from the other motor-driven pump.

The AFW System satisfies the requirements of Criterion 3 of the NRC Policy Statement.

LCO

This LCO provides assurance that the AFW System will perform its design safety function to mitigate the consequences of accidents that could result in overpressurization of the reactor coolant pressure boundary. Three independent AFW pumps in three diverse trains are required to be OPERABLE to ensure the availability of residual heat removal capability for all events accompanied by a loss of offsite power and a single failure. This is accomplished by powering two of the pumps from independent emergency buses. The third AFW pump is powered by a different means, a steam-driven turbine supplied with steam from a source that is not isolated by closure of the MSIVs.

The AFW System is considered OPERABLE when the components and flow paths required to provide redundant AFW flow to the steam generators are OPERABLE. This requires that the two motor-driven AFW pumps be OPERABLE in two diverse paths, each supplying AFW to separate steam generators. The turbine-driven AFW pump is required to be OPERABLE with redundant steam supplies from each of two main steam lines upstream of the MSIVs, and shall be capable of supplying AFW to any of the steam generators. The piping, valves, instrumentation, and controls in the required flow paths also are required to be OPERABLE.

The LCO is modified by a Note indicating that one AFW train, which includes a motor-driven pump, is required to be OPERABLE in MODE 4. This is because of the reduced heat removal requirements and short period of time in MODE 4 during which the AFW is required and the insufficient steam available in MODE 4 to power the turbine-driven AFW pump.

APPLICABILITY

In MODES 1, 2, and 3, the AFW System is required to be OPERABLE in the event that it is called upon to function

(continued)

BASES

APPLICABILITY
(continued)

when the main feedwater is lost. In addition, the AFW System is required to supply enough makeup water to replace the steam generator secondary inventory, lost as the unit cools to MODE 4 conditions.

In MODE 4 the AFW System may be used for heat removal via the steam generators.

In MODE 5 or 6, the steam generators are not normally used for heat removal, and the AFW System is not required.

ACTIONS

A.1

If one of the two steam supplies to the turbine-driven AFW train is inoperable, action must be taken to restore OPERABLE status within 7 days. The 7-day Completion Time is reasonable, based on the following reasons:

- a. The redundant OPERABLE steam supply to the turbine-driven AFW pump;
- b. The availability of redundant OPERABLE motor-driven AFW pumps; and
- c. The low probability of an event occurring that requires the inoperable steam supply to the turbine-driven AFW pump.

The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any single continuous occurrence of failing to meet this LCO.

The 10-day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 7 days and 10 days dictate that both Completion Times apply simultaneously, and the more restrictive must be met.

(continued)

BASES

ACTIONS
(continued)

B.1

With one of the required AFW trains (pump or flow path) inoperable in MODE 1, 2, or 3 for reasons other than Condition A, action must be taken to restore OPERABLE status within 72 hours. This Condition includes the loss of two steam supply lines to the turbine-driven AFW pump. The 72-hour Completion Time is reasonable, based on redundant capabilities afforded by the AFW System, time needed for repairs, and the low probability of a DBA occurring during this time period.

The second Completion Time for Required Action B.1 establishes a limit on the maximum time allowed for any combination of Conditions to be inoperable during any single continuous occurrence of failing to meet this LCO.

The 10-day Completion Time provides a limitation time allowed in this specified Condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The AND connector between 72 hours and 10 days dictates that both Completion Times apply simultaneously, and the more restrictive must be met.

C.1 and C.2

When Required Action A.1 or B.1 cannot be completed within the required Completion Time, or if two AFW trains are inoperable in MODE 1, 2, or 3, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 4 within 18 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full-power conditions in an orderly manner and without challenging unit systems.

In MODE 4 with two AFW trains inoperable, operation is allowed to continue because only one motor-driven pump AFW train is required in accordance with the Note that modifies the LCO. Although not required, the unit may continue to cool down and initiate RHR.

(continued)

BASES

ACTIONS
(continued)

D.1

If all three AFW trains are inoperable in MODE 1, 2, or 3, the unit is in a seriously degraded condition with no safety related means for conducting a cooldown, and only limited means for conducting a cooldown with non-safety-related equipment. In such a condition, the unit should not be perturbed by any action, including a power change, that might result in a trip. The seriousness of this condition requires that action be started immediately to restore one AFW train to OPERABLE status.

Required Action D.1 is modified by a Note indicating that all required MODE changes or power reductions are suspended until one AFW train is restored to OPERABLE status. In this case, LCO 3.0.3 is not applicable because it could force the unit into a less safe condition.

E.1

In MODE 4, either the RCPs or the RHR loops can be used to provide forced circulation. This is addressed in LCO 3.4.6, "RCS Loops - MODE 4." With one required AFW train inoperable, action must be taken to immediately restore the inoperable train to OPERABLE status. The immediate Completion Time is consistent with LCO 3.4.6.

SURVEILLANCE
REQUIREMENTS

SR 3.7.5.1

Verifying the correct alignment for manual, power-operated, and automatic valves in the AFW System water and steam supply flow paths, provides assurance that the proper flow paths will exist for AFW operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since they are verified to be in the correct position prior to locking, sealing, or securing. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This Surveillance does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.7.5.1 (continued)

The 31-day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.5.2

This SR verifies that the AFW pumps develop sufficient discharge pressure to deliver the required flow at the lowest set pressure of the MSSVs plus 1% for setpoint tolerance and 3% accumulation. Because it is undesirable to introduce cold AFW into the steam generators while they are operating, this testing is performed on recirculation flow. Periodically comparing the reference differential pressure, developed at this reduced flow, detects trends that might be indicative of incipient failure. Performance of inservice testing discussed in the ASME Code, Section XI (Ref. 2) (only required at 3-month intervals) satisfies this requirement. The 31-day Frequency on a STAGGERED TEST BASIS results in testing each pump once every 3 months, as required by Reference 2.

This SR is modified by a Note indicating that the SR be deferred until suitable test conditions are established. This deferral is required because there is insufficient steam pressure to perform the test.

SR 3.7.5.3

This SR verifies that AFW can be delivered to the appropriate steam generator in the event of any accident or transient that generates an ESFAS, by demonstrating that each automatic valve in the flow path actuates to its correct position on an actual or simulated actuation signal in MODES 1, 2, and 3. In MODE 4 the required AFW train is already aligned and operating, therefore, this SR is not required.

(continued)

BASES

SURVEILLANCE
REQUIREMENTSSR 3.7.5.3 (continued)

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. The 18-month Frequency is acceptable based on operating experience and the design reliability of the equipment.

SR 3.7.5.4

This SR verifies that the AFW pumps will start in the event of any accident or transient that generates an ESFAS by demonstrating that each AFW pump starts automatically on an actual or simulated actuation signal in MODES 1, 2, and 3. In MODE 4, the required pump is already operating and the auto start function is not required. 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.

This SR is modified by a Note indicating that the SR be deferred until suitable test conditions are established. This deferral is required because there is insufficient steam pressure to perform the test.

SR 3.7.5.5

This SR verifies that the AFW is properly aligned by verifying the flow paths from the CST to each steam generator prior to entering MODE 2 after more than 30 days in MODE 5 or 6. OPERABILITY of AFW flow paths must be verified before sufficient core heat is generated that would require the operation of the AFW System during a subsequent shutdown. The Frequency is reasonable, based on engineering judgment, and other administrative controls ensuring that flow paths remain OPERABLE. To further ensure AFW System alignment, flow-path OPERABILITY is verified, following extended outages to determine no misalignment of valves has occurred. This SR ensures that the flow path from the CST to the steam generators is properly aligned.

(continued)

BASES (continued)

REFERENCES

1. Watts Bar FSAR, Section 10.4.9, "Auxiliary Feedwater System."
 2. American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, Inservice Inspection, Article IWV-3400, "Inservice Tests - Category A and B Valves."
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B 3.7 PLANT SYSTEMS

B 3.7.6 Condensate Storage Tank (CST)

BASES

BACKGROUND

The CST provides a preferred source of water to the steam generators for removing decay and sensible heat from the Reactor Coolant System (RCS). The CST provides a passive flow of water, by gravity, to the Auxiliary Feedwater (AFW) System (LCO 3.7.5, "Auxiliary Feedwater (AFW) System"). The steam produced is released to the atmosphere by the main steam safety valves or the atmospheric dump valves. The AFW pumps operate with a continuous recirculation to the CST.

When the main steam isolation valves are open, the preferred means of heat removal is to discharge steam to the condenser by the non-safety-grade path of the steam dump valves. The condensed steam is returned to the CST by condenser level control valves. This has the advantage of conserving condensate while minimizing releases to the environment.

Because the CST is not designed to withstand earthquakes and other natural phenomena, including missiles that might be generated by natural phenomena, feedwater is also available from the Essential Raw Cooling Water (ERCW) system as the safety grade water source.

A description of the CST is found in the FSAR, Section 9.2.6 (Ref. 1).

APPLICABLE
SAFETY ANALYSES

The CST provides the preferred cooling water to remove decay heat and to cool down the unit following all events in the accident analysis as discussed in the FSAR, Chapters 6 and 15 (Refs. 2 and 3, respectively). However, the ERCW System provides the safety grade water source to meet a DBA should the CST become unavailable. For anticipated operational occurrences and accidents that do not affect the OPERABILITY of the steam generators, the analysis assumption is generally 2 hours at MODE 3, steaming through the MSSVs, followed by a cooldown to residual heat removal (RHR) entry conditions at the design cooldown rate.

The limiting event for the condensate volume is the large feedwater line break coincident with a loss of offsite

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

power. Single failures that also affect this event include the following:

- a. Failure of the diesel generator powering the motor-driven AFW pump to the unaffected steam generator (requiring additional steam to drive the remaining AFW pump turbine); and
- b. Failure of the steam-driven AFW pump (requiring a longer time for cooldown using only one motor-driven AFW pump).

These are not usually the limiting failures in terms of consequences for these events.

A nonlimiting event considered in CST inventory determinations is a break in either the main feedwater bypass line, or AFW line near where the two join. This break has the potential for dumping condensate until terminated by operator action. This loss of condensate inventory is partially compensated for by the retention of steam generator inventory.

The CST does not satisfy any Criterion of the NRC Policy Statement.

LCO

As the preferred water source to satisfy accident analysis assumptions, the CST must contain sufficient cooling water to remove decay heat for 2 hours following a reactor trip from 102% RTP, and then to cooldown the RCS to RHR entry conditions, assuming a coincident loss of offsite power and the most adverse single failure. In doing this, it must retain sufficient water to ensure adequate net positive suction head for the AFW pumps during cooldown, as well as account for any losses from the steam-driven AFW pump turbine, or before isolating AFW to a broken line.

The CST level required is equivalent to a usable volume of $\geq 210,000$ gallons, which is based on holding the unit in MODE 3 for 2 hours, followed by a cooldown to RHR entry conditions at 50°F/hour. This basis is established in Reference 4 and exceeds the volume required by the accident analysis.

(continued)

BASES

LCO
(continued) The OPERABILITY of the CST is determined by maintaining the tank level at or above the minimum required level.

APPLICABILITY In MODES 1, 2, and 3, and in MODE 4, when steam generator is being relied upon for heat removal, the CST is required to be OPERABLE.

In MODE 5 or 6, the CST is not required because the AFW System is not required.

ACTIONS

A.1 and A.2

If the CST level is not within limits, the OPERABILITY of the backup supply should be verified by administrative means within 4 hours and once every 12 hours thereafter. OPERABILITY of the backup feedwater supply must include verification that the flow paths from the backup water supply to the AFW pumps are OPERABLE. The CST must be restored to OPERABLE status within 7 days, because the backup supply may be performing this function in addition to its normal functions. The 4-hour Completion Time is reasonable, based on operating experience to verify the OPERABILITY of the backup water supply. The 7-day Completion Time is reasonable, based on an OPERABLE backup water supply being available, and the low probability of an event occurring during this time period requiring the CST.

B.1 and B.2

If the CST cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 4, without reliance on the steam generator for heat removal, within 18 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full-power conditions in an orderly manner and without challenging unit systems.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.7.6.1

This SR verifies that the CST contains the required volume of cooling water. The 12-hour Frequency is based on operating experience and the need for operator awareness of unit evolutions that may affect the CST inventory between checks. Also, the 12-hour Frequency is considered adequate in view of other indications in the control room, including alarms, to alert the operator to abnormal deviations in the CST level.

REFERENCES

1. Watts Bar FSAR, Section 9.2.6, "Condensate Storage Facilities."
 2. Watts Bar FSAR, Chapter 6, "Engineered Safety Features."
 3. Watts Bar FSAR, Chapter 15, "Accident Analyses."
 4. TVA Calculation HCG-LCS-043085, "Minimum CST Water Level Required to Support the AFW System."
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B 3.7 PLANT SYSTEMS

B 3.7.7 Component Cooling System (CCS)

BASES

BACKGROUND

The CCS provides a heat sink for the removal of process and operating heat from safety related components during a Design Basis Accident (DBA) or transient. During normal operation, the CCS also provides this function for various nonessential components, as well as the spent fuel storage pool. The CCS serves as a barrier to the release of radioactive byproducts between potentially radioactive systems and the Essential Raw Cooling Water System, and thus to the environment.

The CCS is arranged as two independent, full-capacity cooling trains. Separate Train A equipment is provided in each unit, whereas Train B is shared by both units. Train A in unit 1 is served by CCS Hx A and CCS pump 1A-A. Pump 1B-B, which is actually Train B equipment, is also normally aligned to the Train A header in unit 1. However, pump 1B-B can be realigned to Train B on loss of Train A.

Similarly, Train A in unit 2 is served by CCS Hx B and CCS pump 2A-A with support from pump 2B-B.

Train B in both units is served by CCS Hx C. Normally, only CCS pump C-S is aligned to the Train B headers since few nonessential, normally-operating loads are assigned to Train B. However, pumps 1B-B and 2B-B can be realigned to the Train B headers on a loss of the C-S pump.

Each safety related train is powered from a separate bus. An open surge tank in the system provides pump trip protective functions to ensure that sufficient net positive suction head is available. The pump in each train is automatically started on receipt of a safety injection (SI) signal, and all nonessential components are isolated.

Additional information on the design and operation of the system, along with a list of the components served, is presented in the FSAR, Section 9.2.2 (Ref. 1). The principal safety-related function of the CCS is the removal of decay heat from the reactor via the Residual Heat

(continued)

BASES

BACKGROUND (continued) Removal (RHR) System. This may be during a normal or post-accident cooldown and shutdown.

APPLICABLE SAFETY ANALYSES

The design basis of the CCS is for one CCS train to remove the post loss-of-coolant accident (LOCA) heat load from the containment sump during the recirculation phase, with a maximum CCS temperature of 120°F (Ref. 2). The Emergency Core Cooling System (ECCS) LOCA and containment OPERABILITY LOCA, each, model the maximum and minimum performance of the CCS, respectively. The normal temperature of the CCS is 95°F and, during unit cooldown to MODE 5 ($T_{cold} < 200^{\circ}\text{F}$), a maximum temperature of 120°F is assumed. The CCS design based on these values, bounds the post-accident conditions such that the sump fluid will not increase in temperature after alignment of the RHR heat exchangers during the recirculation phase following a LOCA, and provides a gradual reduction in the temperature of this fluid as it is supplied to the Reactor Coolant System (RCS) by the ECCS pumps.

The CCS is designed to perform its function with a single failure of any active component, assuming a loss of offsite power.

The CCS also functions to cool the unit from RHR entry conditions ($T_{cold} < 350^{\circ}\text{F}$), to MODE 5 ($T_{cold} < 200^{\circ}\text{F}$) during normal and post-accident operations. The time required to cool from 350 to 200°F is a function of the number of CCS and RHR trains operating. One CCS train is sufficient to remove decay heat during subsequent operations with $T_{cold} < 200^{\circ}\text{F}$. This assumes a maximum ERCW temperature of 85°F occurring simultaneously with the maximum heat loads on the system.

The CCS satisfies Criterion 3 of the NRC Policy Statement.

LCO

The CCS trains are independent of each other to the degree that each has separate controls and power supplies, and the operation of one does not depend on the other. In the event of a DBA, one CCS train is required to provide the minimum heat removal capability assumed in the safety analysis for the systems to which it supplies cooling water. To ensure

(continued)

BASES

LCO
(continued)

this requirement is met, two trains of CCS must be OPERABLE. At least one CCS train will operate assuming the worst-case single active failure occurs coincident with a loss of offsite power.

A CCS train is considered OPERABLE when:

- a. The pump and associated surge tank are OPERABLE; and
- b. The associated piping, valves, heat exchanger, and instrumentation and controls required to perform the safety-related function are OPERABLE.

The isolation of CCS from other components or systems not required for safety may render those components or system inoperable, but does not affect the OPERABILITY of the CCS.

APPLICABILITY

In MODES 1, 2, 3, and 4, the CCS is a normally operating system, which must be prepared to perform its post-accident safety functions, primarily RCS heat removal, which is achieved by cooling the RHR heat exchanger.

In MODE 5 or 6, the OPERABILITY requirements of the CCS are determined by the systems it supports.

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that the applicable conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," be entered if an inoperable CCS train results in an inoperable RHR loop. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

If one CCS train is inoperable, action must be taken to restore OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE CCS train is adequate to perform the heat removal function. The 72-hour Completion Time is reasonable, based on the redundant capabilities afforded by the OPERABLE train, and the low probability of a DBA occurring during this period.

(continued)

BASES

ACTIONS
(continued)

B.1 and B.2

If the CCS train cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours.

The allowed Completion Times are 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

This SR is modified by a Note indicating that the isolation of the CCS flow to individual components may render these components inoperable, but does not affect the OPERABILITY of the CCS. Verifying the correct alignment for manual, power-operated, and automatic valves in the CCS flow path provides assurance that the proper flow paths exist for CCS operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves are verified to be in the correct position prior to locking, sealing, or securing. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This Surveillance does not require any testing or valve manipulation; rather, it involves verification that those valves capable of being mispositioned are in the correct position.

The 31-day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.7.2

This SR verifies proper automatic operation of the CCS valves on an actual or simulated actuation signal. The CCS System is a normally operating system that cannot be fully actuated as part of routine testing during normal operation. The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit

(continued)

BASES

SURVEILLANCE
REQUIREMENTSSR 3.7.7.2 (continued)

outage and because of the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed on the 18-month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.7.7.3

This SR verifies proper automatic operation of the CCS pumps on an actual or simulated actuation signal. The CCS is a normally operating system that cannot be fully actuated as part of routine testing during normal operation. 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 shown that these components usually pass the Surveillance when performed on the 18-month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.7.7.4

This SR verifies that the C-S pump is powered from the normal power source when it is aligned for OPERABLE status. Verification of the correct power alignment ensures that the two CCS trains remain independent. The 7-day Frequency is based on engineering judgment, is consistent with procedural controls governing breaker operation, and ensures correct breaker position.

REFERENCES

1. Watts Bar FSAR, Section 9.2.2, "Component Cooling System."
 2. Watts Bar FSAR, Section 6.2, "Containment Systems."
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B 3.7 PLANT SYSTEMS

B 3.7.8 Essential Raw Cooling Water (ERCW) System

BASES

BACKGROUND

The ERCW System provides a heat sink for the removal of process and operating heat from safety-related components during a Design Basis Accident (DBA) or transient. During normal operation, and a normal shutdown, the ERCW System also provides this function for various safety related and non-safety-related components. The safety-related function is covered by this LCO.

The shared ERCW system consists of eight 50% ERCW pumps, four traveling water screens, four screen wash pumps, four strainers, associated piping, valves, and instrumentation.

Water for the ERCW system enters two separate sump areas of the pumping station through four traveling water screens, two for each sump. Four ERCW pumping units, all on the same plant train, take suction from one of the sumps, and four more on the opposite plant train take suction from the other sump. One set of pumps and associated equipment is designated Train A, and the other Train B. These trains are redundant and are normally maintained separate and independent of each other. Each set of four pumps discharges into a common manifold, from which two separate headers (1A and 2A for Train A, and 1B and 2B for Train B) each with its own automatic backwashing strainer, supply water to the various system users. Two pumps per train are adequate to supply worst case conditions. Two pumps per train are aligned to receive power from different diesel generators. Operator designated pumps and valves are remote and manually aligned, except in the unlikely event of a loss-of-coolant accident (LOCA). The pumps are automatically started upon receipt of a safety injection (SI) signal, and all essential valves are aligned to their post-accident positions. The ERCW System also provides emergency makeup to the Component Cooling System (CCS) and is the backup water supply to the Auxiliary Feedwater System.

Additional information about the design and operation of the ERCW System, along with a list of the components served, is presented in the FSAR, Section 9.2.1 (Ref. 1). The

(continued)

BASES

BACKGROUND (continued) principal safety-related function of the ERCW System is the removal of decay heat from the reactor via the CCS.

APPLICABLE SAFETY ANALYSES The design basis of the ERCW System is for one ERCW System train, in conjunction with the CCS and a 100% capacity containment spray system and residual heat removal system, to remove core decay heat following a design basis LOCA as discussed in the FSAR, Section 9.2.1 (Ref. 1). This prevents the containment sump fluid from increasing in temperature during the recirculation phase following a LOCA and provides for a gradual reduction in the temperature of this fluid as it is supplied to the Reactor Coolant System by the ECCS pumps. The ERCW System is designed to perform its function with a single failure of any active component, assuming the loss of offsite power.

The ERCW System, in conjunction with the CCS, also cools the unit from residual heat removal, as discussed in the FSAR, Section 5.5.7 (Ref. 2) entry conditions to MODE 5 during normal and post-accident operations. The time required for this evolution is a function of the number of CCS and RHR System trains that are operating. One ERCW train is sufficient to remove decay heat during subsequent operations in MODES 5 and 6. This assumes a maximum ERCW temperature of 85°F occurring simultaneously with maximum heat loads on the system.

The ERCW System satisfies Criterion 3 of the NRC Policy Statement.

LCO Two ERCW trains are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post-accident heat loads, assuming that the worst-case, single active failure occurs coincident with the loss of offsite power.

An ERCW train is considered OPERABLE during MODES 1, 2, 3, and 4 when:

- a. Two pumps are OPERABLE; and

(continued)

BASES

LCO
(continued)

- b. The associated piping, valves, heat exchanger, and instrumentation and controls required to perform the safety-related function are OPERABLE.
-

APPLICABILITY

In MODES 1, 2, 3, and 4, the ERCW System is a normally operating system that is required to support the OPERABILITY of the equipment serviced by the ERCW System and required to be OPERABLE in these MODES.

In MODES 5 and 6, the OPERABILITY requirements of the ERCW System are determined by the systems it supports.

ACTIONS

A.1

If one ERCW System train is inoperable, action must be taken to restore OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE ERCW train is adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE ERCW train could result in loss of ERCW System function. Required Action A.1 is modified by two Notes. The first Note indicates that the applicable Conditions and Required Actions of LCO 3.8.1, "AC Sources - Operating," be entered if an inoperable ERCW train results in an inoperable emergency diesel generator. The second Note indicates that the applicable Conditions and Required Actions of LCO 3.4.6, "RCS Loops - MODE 4," be entered if an inoperable ERCW train results in an inoperable residual heat removal train. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components. The 72-hour Completion Time is based on the redundant capabilities afforded by the OPERABLE train, and the low probability of a DBA occurring during this time period.

B.1 and B.2

If the ERCW train cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours and in MODE 5 within 36 hours.

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

The allowed Completion Times are 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 3.7.8.1

This SR is modified by a Note indicating that the isolation of the ERCW System components or systems may render those components inoperable, but does not affect the OPERABILITY of the ERCW System.

Verifying the correct alignment for manual, power-operated, and automatic valves in the ERCW System flow path provides assurance that the proper flow paths exist for ERCW System operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since they are verified to be in the correct position prior to being locked, sealed, or secured. 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.

The 31-day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

SR 3.7.8.2

This SR verifies proper automatic operation of the ERCW System valves on an actual or simulated actuation signal. The ERCW System is a normally operating system that cannot be fully actuated as part of normal testing. 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.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.7.8.2 (continued)

Operating experience has shown that these components usually pass the Surveillance when performed on the 18-month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.7.8.3

This SR verifies proper automatic operation of the ERCW System pumps on an actual or simulated actuation signal. The ERCW System is a normally operating system that cannot be fully actuated as part of normal testing during normal operation. 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 shown that these components usually pass the Surveillance when performed on the 18-month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

REFERENCES

1. Watts Bar FSAR, Section 9.2.1, "Essential Raw Cooling Water."
 2. Watts Bar FSAR, Section 5.5.7, "Residual Heat Removal System."
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B 3.7 PLANT SYSTEMS

B 3.7.9 Ultimate Heat Sink (UHS)

BASES

BACKGROUND.

The UHS provides a heat sink for processing and operating heat from safety related components during a transient or accident, as well as during normal operation. This is done by utilizing the Essential Raw Cooling Water (ERCW) System and the Component Cooling System (CCS).

The UHS is defined as the Tennessee River, including the TVA controlled dams upstream of the intake structure, Chicamauga Dam (the nearest downstream dam), and the plant intake channel, not including the intake structure, as discussed in FSAR Section 9.2.5 (Ref. 1). The maximum UHS temperature of 85°F ensures adequate heat load removal capacity for a minimum of 30 days after reactor shutdown or a shutdown following an accident, including a Loss of Coolant Accident (LOCA).

Additional information on the design and operation of the system, along with a list of components served, can be found in Reference 1.

APPLICABLE SAFETY ANALYSES

The UHS is the sink for heat removed from the reactor core following all accidents and anticipated operational occurrences in which the unit is cooled down and placed on residual heat removal (RHR) operation. Its maximum post-accident heat load occurs approximately 20 minutes after a design basis LOCA. Near this time, the unit switches from injection to recirculation and the containment cooling systems and RHR are required to remove the core decay heat.

The operating limits are based on conservative heat transfer analyses for the worst-case LOCA. Reference 1 provides the details of the assumptions used in the analysis, which include worst-expected meteorological conditions, conservative uncertainties when calculating decay heat, and worst-case single active failure (e.g., single failure of a man-made structure). The UHS is designed in accordance with Regulatory Guide 1.27 (Ref. 2), which requires a 30-day supply of cooling water in the UHS.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The UHS satisfies Criterion 3 of the NRC Policy Statement.

LCO

The UHS is required to be OPERABLE and is considered OPERABLE if it contains water at or below the maximum temperature that would allow the ERCW System to operate for at least 30 days following the design basis LOCA without the loss of net positive suction head (NPSH), and without exceeding the maximum design temperature of the equipment served by the ERCW System. To meet this condition, the UHS temperature should not exceed 85°F.

APPLICABILITY

In MODES 1, 2, 3, and 4, the UHS is required to support the OPERABILITY of the equipment serviced by the UHS and required to be OPERABLE in these MODES.

In MODE 5 or 6, the OPERABILITY requirements of the UHS are determined by the systems it supports.

ACTIONS

A.1 and A.2

If the UHS is inoperable, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours.

The allowed Completion Times are 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 3.7.9.1

This SR verifies that the ERCW System is available to cool the CCS to at least its maximum design temperature with the maximum accident or normal design heat loads for 30 days following a DBA. The 24-hour Frequency is based on industry

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.7.9.1 (continued)

operating experience related to trending of the parameter variations during the applicable MODES. This SR verifies that the average water temperature of the UHS is $\leq 85^{\circ}\text{F}$.

REFERENCES

1. Watts Bar FSAR, Section 9.2.5, "Ultimate Heat Sink."
 2. Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 1, March 1974.
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B 3.7 PLANT SYSTEMS

B 3.7.10 Control Room Emergency Ventilation System (CREVS)

BASES

BACKGROUND

The CRFVS provides a protected environment from which operators can control the unit following an uncontrolled release of radioactivity.

The CREFS consists of two independent, redundant trains that recirculate and filter the control room air. Each train consists of a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of gaseous activity (principally iodines), and a fan. Ductwork, valves or dampers, and instrumentation also form part of the system.

The CREVS is an emergency system, parts of which also operate during normal unit operations. Actuation of the CREVS occurs automatically upon receipt of a safety injection signal on either unit or upon indication of high radiation in the outside air supply. Actuation of the system to the emergency mode of operation, closes the unfiltered outside air intake and unfiltered exhaust dampers, and aligns the system for recirculation of the control room air through the redundant trains of air handling units, with a portion of the stream of air directed through HEPA and the charcoal filters. The emergency mode also initiates pressurization and filtered ventilation of the air supply to the control room.

Pressurization of the control room prevents infiltration of unfiltered air from the surrounding areas of the building. A single train will pressurize the control room to about 0.125 inches water gauge, and provide an air exchange rate in excess of [7.5]% per hour. The CREVS operation in maintaining the control room habitable is discussed in the FSAR, Section 6.4 (Ref. 1).

Redundant supply and recirculation trains provide the required filtration should an excessive pressure drop develop across the other filter train. Normally open isolation dampers are arranged in series pairs so that the

(continued)

BASES

BACKGROUND
(continued)

failure of one damper to shut will not result in a breach of isolation. The CREVS is designed in accordance with Seismic Category I requirements.

The CREVS is designed to maintain the control room environment for 30 days of continuous occupancy after a Design Basis Accident (DBA) without exceeding a 5-rem-whole-body dose.

APPLICABLE
SAFETY ANALYSES

The CREVS components are arranged in redundant, safety-related ventilation trains. The location of components and ducting within the control room envelope ensures an adequate supply of filtered air to all areas requiring access. The CREVS provides airborne radiological protection for the control room operators, as demonstrated by the control room accident dose analyses for the most limiting design basis loss-of-coolant accident (LOCA), fission-product release presented in the FSAR, Section 15.5.3 (Ref. 2).

The analysis of toxic-gas releases demonstrates that the toxicity limits are not exceeded in the control room following a toxic chemical release, as presented in Reference 1.

The worst-case single active failure of a component of the CREVS, assuming a loss of offsite power, does not impair the ability of the system to perform its design function.

The CREVS satisfies Criterion 3 of the NRC Policy Statement.

LCO

Two independent and redundant CREVS trains are required to be OPERABLE to ensure that at least one is available assuming a single failure disables the other train. Total system failure could result in exceeding a dose of 5 rem to the control room operator in the event of a large radioactive release.

The CREVS is considered OPERABLE when the individual components necessary to limit operator exposure are OPERABLE

(continued)

BASES

LCO
(continued)

in both trains. A CREVS train is OPERABLE when the associated:

- a. Fan is OPERABLE;
- b. HEPA filters and charcoal adsorbers are not excessively restricting flow, and are capable of performing their filtration functions; and
- c. Ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.

In addition, the control room boundary must be maintained, including the integrity of the walls, floors, ceilings, ductwork, and access doors.

APPLICABILITY

In MODES 1, 2, 3, 4, and during movement of irradiated fuel assemblies, CREVS must be OPERABLE to control operator exposure during and following a DBA.

During movement of irradiated fuel assemblies, the CREVS must be OPERABLE to cope with the release from a fuel-handling accident.

ACTIONS

A.1

When one CREVS train is inoperable, action must be taken to restore OPERABLE status within 7 days. In this Condition, the remaining OPERABLE CREVS train is adequate to perform the control room protection function. However, the overall reliability is reduced because a single failure in the OPERABLE CREVS train could result in loss of CREVS function. The 7-day Completion Time is based on the low probability of a DBA occurring during this time period, and that the remaining train can provide the required capability.

B.1 and B.2

In MODE 1, 2, 3, or 4, if the inoperable CREVS train cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE that

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

minimizes accident risk. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full-power conditions in an orderly manner and without challenging unit systems.

C.1, C.2.1, and C.2.2

During movement of irradiated fuel assemblies, if the inoperable CREVS train cannot be restored to OPERABLE status within the required Completion Time, action must be taken to immediately place the OPERABLE CREVS train in the emergency mode. This action ensures that the remaining train is OPERABLE, that no failures preventing automatic actuation will occur, and that any active failure would be readily detected.

An alternative to Required Action C.1 is to immediately suspend activities that could result in a release of radioactivity that might require isolation of the control room. This places the unit in a condition that minimizes risk. This does not preclude the movement of fuel to a safe position.

D.1

If both CREVS trains are inoperable in MODE 1, 2, 3, or 4, the CREVS may not be capable of performing the intended function and the unit is in a condition outside the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

E.1 and E.2

During movement of irradiated fuel assemblies with two CREVS trains inoperable, action must be taken immediately to suspend activities which could result in a release of radioactivity that might enter the control room. This places the unit in a condition that minimizes accident risk. This does not preclude the movement of fuel to a safe position.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.7.10.1

Standby systems should be checked periodically to ensure that they function properly. As the environment and normal operating conditions on this system are not too severe, testing each train once every month provides an adequate check of this system. Monthly heater operations dry out any moisture accumulated in the charcoal from humidity in the ambient air. The 31-day Frequency is based on the reliability of the equipment and the two-train redundancy availability.

SR 3.7.10.2

This SR verifies that the required CREVS testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The CREVS filter tests are in accordance with Regulatory Guide 1.52 (Ref. 3). The VFTP includes testing the performance of the HEPA filter, charcoal adsorber efficiency, minimum flow rate, and the physical properties of the activated charcoal. Specific test Frequencies and additional information are discussed in detail in the VFTP.

SR 3.7.10.3

This SR verifies that each CREVS train starts and operates on an actual or simulated actuation signal. The Frequency of 18 months is specified in Regulatory Guide 1.52 (Ref. 3).

SR 3.7.10.4

This SR verifies the integrity of the control room enclosure, and the assumed inleakage rates of the potentially contaminated air. The control room positive pressure, with respect to potentially contaminated adjacent areas, is periodically tested to verify proper functioning of the CREVS. During the emergency mode of operation, the CREVS is designed to pressurize the control room ≥ 0.125 inches water gauge positive pressure with respect to the outside atmosphere in order to prevent unfiltered inleakage. The CREVS is designed to maintain this positive

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.7.10.4 (continued)

pressure with one train at a makeup flow rate of 325 cfm and a recirculation flow rate of $3675 \pm 10\%$ cfm. The Frequency of 18 months on a STAGGERED TEST BASIS is consistent with the guidance provided in NUREG-0800 (Ref. 4).

REFERENCES

1. Watts Bar FSAR, Section 6.4, "Habitability Systems."
 2. Watts Bar FSAR, Section 15.5.3, "Environmental Consequences of a Postulated Loss of Coolant Accident."
 3. Regulatory Guide 1.52, Rev. 02.
 4. NUREG-0800, Standard Review Plan, Section 6.4, "Control Room Habitability System," Rev. 2, July 1981.
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B 3.7 PLANT SYSTEMS

B 3.7.11 Control Room Emergency Air Temperature Control System (CREATCS)

BASES

BACKGROUND

The CREATCS provides temperature control for the control room following isolation of the control room.

The CREATCS consists of two independent and redundant trains that provide cooling of recirculated control room air. Each train consists of an air handling unit (AHU), water chiller, chilled-water pump, and associated piping, ductwork, instrumentation, and controls to provide for control room temperature control. The CREATCS is a subsystem providing air temperature control for the control room.

The CREATCS is an emergency system, parts of which also operate during normal unit operations. A single train will provide the required temperature control to maintain the control room between 60 and 104°F. The CREATCS operation in maintaining the control room temperature is discussed in the FSAR, Section 9.4.1 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The design basis of the CREATCS is to maintain the control room temperature for 30 days of continuous occupancy.

The CREATCS components are arranged in redundant, safety-related trains. During emergency operation, the CREATCS maintains the temperature between 60 and 104°F. A single-active failure of a component of the CREATCS, with a loss of offsite power, does not impair the ability of the system to perform its design function. Redundant detectors and controls are provided for control room temperature control. The CREATCS is designed in accordance with Seismic Category I requirements. The CREATCS is capable of removing sensible and latent-heat loads from the control room, which include consideration of equipment heat loads and personnel occupancy requirements, to ensure equipment OPERABILITY.

The CREATCS satisfies Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

Two independent and redundant trains of the CREATCS are required to be OPERABLE to ensure that at least one is available, assuming a single failure disabling the other train. Total system failure could result in the equipment operating temperature exceeding limits in the event of an accident.

The CREATCS is considered to be OPERABLE when the individual components necessary to maintain the control room temperature are OPERABLE in both trains. These components include the chillers, AHUs, and associated temperature control instrumentation. In addition, the CREATCS must be operable to the extent that air circulation can be maintained.

APPLICABILITY

In MODES 1, 2, 3, 4, and during movement of irradiated fuel assemblies, the CREATCS must be OPERABLE to ensure that the control room temperature will not exceed equipment operational requirements following isolation of the control room.

ACTIONS

A.1

With one CREATCS train inoperable, action must be taken to restore OPERABLE status within 30 days. In this Condition, the remaining OPERABLE CREATCS train is adequate to maintain the control room temperature within limits. However, the overall reliability is reduced because a single failure in the OPERABLE CREATCS train could result in loss of CREATCS function. The 30-day Completion Time is based on the low probability of an event requiring control room isolation, the consideration that the remaining train can provide the required protection, and that alternate safety- or non-safety-related cooling means are available.

B.1 and B.2

In MODE 1, 2, 3, or 4, if the inoperable CREATCS train cannot be restored to OPERABLE status within the required Completion Time, the unit must be placed in a MODE that

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

minimizes the risk. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full-power conditions in an orderly manner and without challenging unit systems.

C.1, C.2.1, and C.2.2

During movement of irradiated fuel, if the inoperable CREATCS train cannot be restored to OPERABLE status within the required Completion Time, the OPERABLE CREATCS train must be placed in operation immediately. This action ensures that the remaining train is OPERABLE, that no failures preventing automatic actuation will occur, and that active failures will be readily detected.

An alternative to Required Action C.1 is to immediately suspend activities that present a potential for releasing radioactivity that might require isolation of the control room. This places the unit in a condition that minimizes accident risk. This does not preclude the movement of fuel to a safe position.

D.1

If both CREATCS trains are inoperable in MODE 1, 2, 3, or 4 the control room CREATCS may not be capable of performing its intended function. Therefore, LCO 3.0.3 must be entered immediately.

E.1 and E.2

During movement of irradiated fuel assemblies, with two CREATCS trains inoperable, action must be taken immediately to suspend activities that could result in a release of radioactivity that might require isolation of the control room. This places the unit in a condition that minimizes risk. This does not preclude the movement of fuel to a safe position.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.7.11.1

This SR verifies that the heat removal capability of the system is sufficient to remove the assumed heat load in the control room. This SR consists of a combination of testing and calculations. This is accomplished by verifying that the system has not degraded. The only measurable parameters that could degrade undetected during normal operation is the system air flow and chilled water flow rate. Verification of these two flow rates will provide assurance that the heat removal capacity of the system is still adequate. The 18-month Frequency is appropriate since significant degradation of the CREATCS is slow and is not expected over this time period.

REFERENCES

1. FSAR, Section 9.4.1, "Control Room Area Ventilation System."
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B 3.7 PLANT SYSTEMS

B 3.7.12 Auxiliary Building Gas Treatment System (ABGTS)

BASES

BACKGROUND

The ABGTS filters airborne radioactive particulates from the area of the fuel pool following a fuel handling accident and from the area of active Unit 1 Emergency Core Cooling System (ECCS) Components and Unit 1 penetration rooms following a loss-of-coolant accident (LOCA).

The ABGTS consists of two independent and redundant trains. Each train consists of a heater, a prefilter, moisture separator, a high efficiency particulate air (HEPA) filter, an activated charcoal adsorber section for removal of gaseous activity (principally iodines), and a fan. Ductwork, valves or dampers, and instrumentation also form part of the system. A second bank of HEPA filters follows the adsorber section to collect carbon fines and provide backup in case the main HEPA filter bank fails. The downstream HEPA filter is not credited in the analysis. The system initiates filtered ventilation of the Auxiliary Building Secondary Containment Enclosure (ABSCE) following receipt of Phase A Containment Isolation signal or a high radiation signal from the spent fuel pool area.

The ABGTS is a standby system, not in use during normal plant operations. During emergency operations, the ABSCE dampers are realigned and ABGTS fans are started to begin filtration. Air is exhausted from the Unit 1 ECCS pump rooms, Unit 1 penetration rooms, and fuel handling area through the filter trains. The prefilters or moisture separators remove any large particles in the air, and any entrained water droplets present, to prevent excessive loading of the HEPA filters and charcoal adsorbers.

The ABGTS is discussed in the FSAR, Sections 6.5.1, 9.4.2, 15 and 6.2.3 (Refs. 1, 2, 3, and 4, respectively).

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The ABGTS design basis is established by the consequences of the limiting Design Basis Accident (DBA), which is a fuel-handling accident. The analysis of the fuel-handling accident, given in Reference 3, assumes that all fuel rods in an assembly are damaged. The analysis of the LOCA assumes that radioactive materials leaked from the Emergency Core Cooling System (ECCS) are filtered and adsorbed by the ABGTS. The DBA analysis of the fuel-handling accident assumes that only one train of the ABGTS is functional due to a single failure that disables the other train. The accident analysis accounts for the reduction in airborne radioactive material provided by the one remaining train of this filtration system. The amount of fission products available for release from the ABSCE is determined for a fuel-handling accident and for a LOCA. These assumptions and the analysis follow the guidance provided in Regulatory Guides 1.25 (Ref. 5) and 1.4 (Ref. 6).

The ABGTS satisfies Criterion 3 of the NRC Policy Statement.

LCO

Two independent and redundant trains of the ABGTS are required to be OPERABLE to ensure that at least one train is available, assuming a single failure that disables the other train, coincident with a loss of offsite power. Total system failure could result in the atmospheric release from the ABSCE exceeding the 10 CFR 100 limits (Ref. 7) in the event of a fuel-handling accident or LOCA.

The ABGTS is considered OPERABLE when the individual components necessary to control exposure in the fuel-handling building are OPERABLE in both trains. An ABGTS train is considered OPERABLE when its associated:

- a. Fan is OPERABLE;
 - b. HEPA filter and charcoal adsorber are not excessively restricting flow, and are capable of performing their filtration function; and
 - c. Heater, moisture separator, ductwork, valves, and dampers are OPERABLE, and air circulation can be maintained.
-

(continued)

BASES (continued)

APPLICABILITY In MODE 1, 2, 3, or 4, the ABGTS is required to be OPERABLE to provide fission-product removal associated with ECCS leaks due to a LOCA and leakage from containment and annulus.

In MODE 5 or 6, the ABGTS is not required to be OPERABLE since the ECCS is not required to be OPERABLE.

During movement of irradiated fuel in the fuel handling area, the ABGTS is required to be OPERABLE to alleviate the consequences of a fuel-handling accident.

ACTIONS

A.1

With one ABGTS train inoperable, action must be taken to restore OPERABLE status within 7 days. During this period, the remaining OPERABLE train is adequate to perform the ABGTS function. The 7-day Completion Time is based on the risk from an event occurring requiring the inoperable ABGTS train, and the remaining ABGTS train providing the required protection.

B.1 and B.2

In MODE 1, 2, 3, or 4, when Required Action A.1 unit cannot be completed within the associated Completion Time, or when both ABGTS trains are inoperable, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in MODE 3 within 6 hours, and in MODE 5 within 36 hours. The Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full-power conditions in an orderly manner and without challenging unit systems.

C.1 and C.2

When Required Action A.1 cannot be completed within the required Completion Time, during movement of irradiated fuel assemblies in the fuel handling area, the OPERABLE ABGTS train must be started immediately or fuel movement

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

suspended. This action ensures that the remaining train is OPERABLE, that no undetected failures preventing system operation will occur, and that any active failure will be readily detected.

If the system is not placed in operation, this action requires suspension of fuel movement, which precludes a fuel-handling accident. This does not preclude the movement of fuel assemblies to a safe position.

D.1

When two trains of the ABGTS are inoperable during movement of irradiated fuel assemblies in the fuel handling area, action must be taken to place the unit in a condition in which the LCO does not apply. Action must be taken immediately to suspend movement of irradiated fuel assemblies in the fuel handling area. This does not preclude the movement of fuel to a safe position.

SURVEILLANCE
REQUIREMENTS

SR 3.7.12.1

Standby systems should be checked periodically to ensure that they function properly. As the environmental and normal operating conditions on this system are not severe, testing each train once every month provides an adequate check on this system. Monthly heater operation dries out any moisture accumulated in the charcoal from humidity in the ambient air. The 31-day Frequency is based on the known reliability of the equipment and the two-train redundancy available.

SR 3.7.12.2

This SR verifies that the required ABGTS testing is performed in accordance with the Ventilation Filter Testing Program (VFTP). The ABGTS filter tests are in accordance with Regulatory Guide 1.52 (Ref. 8). The VFTP includes testing HEPA filter performance, charcoal adsorber

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.7.12.2 (continued)

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 3.7.12.3

This SR verifies that each ABGTS train starts and operates on an actual or simulated actuation signal. The 18-month Frequency is consistent with Reference 8.

SR 3.7.12.4

This SR verifies the integrity of the ABSCE. The ability of the ABSCE to maintain negative pressure with respect to potentially uncontaminated adjacent areas is periodically tested to verify proper function of the ABGTS. During the post-accident mode of operation, the ABGTS is designed to maintain a slight negative pressure in the ABSCE, to prevent unfiltered LEAKAGE. The ABGTS is designed to maintain a negative pressure between -0.25 and -0.5 inches water gauge in the ABSCE with respect to atmospheric pressure at a nominal flow rate of 9000 \pm 10% cfm while maintaining a vacuum relief rate \geq 2000 cfm. The Frequency of 18 months is consistent with the guidance provided in NUREG-0800, Section 6.5.1 (Ref. 9).

This test is conducted with the tests for filter penetration; thus, an 18-month Frequency (on a STAGGERED TEST BASIS) is consistent with Reference 8.

REFERENCES

1. Watts Bar FSAR, Section 6.5.1, "Engineered Safety Feature (ESF) Filter Systems."
2. Watts Bar FSAR, Section 9.4.2, "Fuel Handling Area Ventilation System."

(continued)

BASES

REFERENCES
(continued)

3. Watts Bar FSAR, Chapter 15, "Accident Analysis."
 4. Watts Bar FSAR, Section 6.2.3, "Secondary Containment Functional Design."
 5. Regulatory Guide 1.25, March 1972, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors."
 6. Regulatory Guide 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors."
 7. Title 10, Code of Federal Regulations, Part 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance."
 8. Regulatory Guide 1.52 (Rev. 2), "Design, Testing and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmospheric Cleanup System Air Filtration and Adsorption Units of Light-Water Cooled Nuclear Power Plants."
 9. NUREG-0800, Section 6.5.1, "Standard Review Plan," Rev. 2, "ESF Atmosphere Cleanup System," July 1981.
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B 3.7 PLANT SYSTEMS

B 3.7.13 Fuel Storage Pool Water Level

BASES

BACKGROUND

The minimum water level in the fuel storage pool meets the assumptions of iodine-decontamination factors following a fuel-handling accident. The specified water level shields and minimizes the general area dose when the storage racks are filled to their maximum capacity. The water also provides shielding during the movement of spent fuel.

A general description of the fuel storage pool design is given in the FSAR, Section 9.1.2, Reference 1. A description of the Spent Fuel Pool Cooling and Cleanup System is given in the FSAR, Section 9.1.3, Reference 2. The assumptions of the fuel-handling accident are given in the FSAR, Section 15.4.5, Reference 3.

APPLICABLE
SAFETY ANALYSES

The minimum water level in the fuel storage pool meets the assumptions of the fuel handling accident described in Regulatory Guide 1.25 (Ref. 4). The resultant 2-hour thyroid dose per person at the exclusion area boundary is a small fraction of the 10 CFR 100 (Ref. 5) limits.

According to Reference 4, there is 23 ft of water between the top of the damaged fuel bundle and the fuel pool surface during a fuel-handling accident. With 23 ft of water, the assumptions of Reference 4 can be used directly. In practice, this LCO preserves this assumption for the bulk of the fuel in the storage racks. In the case of a single bundle dropped and lying horizontally on top of the spent fuel racks, however, there may be < 23 ft of water above the top of the fuel bundle and the surface, indicated by the width of the bundle. To offset this small nonconservatism, the analysis assumes that all fuel rods fail, although analysis shows that only the first few rows fail from a hypothetical maximum drop.

The fuel storage pool water level satisfies Criterion 2 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO The fuel storage pool water level is required to be ≥ 23 ft over the top of irradiated fuel assemblies seated in the storage racks. The specified water level preserves the assumptions of the fuel-handling accident analysis (Ref. 3). As such, it is the minimum required for fuel storage and movement within the fuel storage pool.

APPLICABILITY This LCO applies during movement of irradiated fuel assemblies in the fuel storage pool, since the potential for a release of fission products exists.

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the initial conditions for prevention of an accident cannot be met, steps should be taken to preclude the accident from occurring. When the fuel storage pool water level is lower than the required level, the movement of irradiated fuel assemblies in the fuel storage pool is immediately suspended to a safe position. This action effectively precludes the occurrence of a fuel-handling accident. This does not preclude movement of a fuel assembly to a safe position.

If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODES 1, 2, 3, and 4, the fuel movement is independent of reactor operations. Therefore, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE
REQUIREMENTS

SR 3.7.13.1

This SR verifies sufficient fuel pool storage water is available in the event of a fuel-handling accident. The water level in the fuel storage pool must be checked periodically. The 7-day Frequency is appropriate because

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.7.13.1 (continued)

the volume in the pool is normally stable. Water level changes are controlled by plant procedures and are acceptable based on operating experience.

During refueling operations, the level in the fuel storage pool is in equilibrium with the refueling canal, and the level in the refueling canal is checked daily in accordance with SR 3.9.6.1.

REFERENCES

1. Watts Bar FSAR, Section 9.1.2, "Spent Fuel Storage."
 2. Watts Bar FSAR, Section 9.1.3, "Spent Fuel Pool Cooling and Cleanup System."
 3. Watts Bar FSAR, Section 15.4.5, "Fuel Handling Accident."
 4. Regulatory Guide 1.25, March 1972, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors."
 5. Title 10, Code of Federal Regulations, Part 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance."
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B 3.7 PLANT SYSTEMS

B 3.7.14 Secondary Specific Activity

BASES

BACKGROUND

Activity in the secondary coolant results from steam generator tube leakage from the Reactor Coolant System (RCS). Under steady-state conditions, the activity is primarily iodines with relatively short half-lives and, thus, indicates current conditions. During transients, I-131 spikes have been observed as well as increased releases of some noble gases. Other fission-product isotopes, as well as activated corrosion products in lesser amounts, may also be found in the secondary coolant.

A limit on secondary coolant specific activity during power operation minimizes releases to the environment because of normal operation, anticipated operational occurrences, and accidents.

This limit is lower than the activity value that might be expected from a 1 gpm tube leak (LCO 3.4.13, "RCS Operational LEAKAGE") of primary coolant at the limit of 1.0 $\mu\text{Ci/gm}$ (LCO 3.4.16, "RCS Specific Activity"). The steam line failure is assumed to result in the release of the noble gas and iodine activity contained in the steam generator inventory, the feedwater, and the reactor coolant LEAKAGE. Most of the iodine isotopes have short half-lives, (i.e., < 20 hours). I-131, with a half-life of 8.04 days, concentrates faster than it decays, but does not reach equilibrium because of blowdown and other losses.

With the specified activity limit, the resultant 2-hour thyroid dose to a person at the exclusion area boundary (EAB) would be about 0.58 rem if the main steam safety valves (MSSVs) open for 2 hours following a trip from full power.

Operating a unit at the allowable limits could result in a 2-hour EAB exposure of a small fraction of the 10 CFR 100 (Ref. 1) limits, or the limits established as the NRC staff-approved licensing basis.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The accident analysis of the main steam line break (MSLB), as discussed in the FSAR, Chapter 15 (Ref. 2) assumes the initial secondary coolant specific activity to have a radioactive isotope concentration of 0.10 $\mu\text{Ci/gm}$ DOSE EQUIVALENT I-131. This assumption is used in the analysis for determining the radiological consequences of the postulated accident. The accident analysis, based on this and other assumptions, shows that the radiological consequences of an MSLB do not exceed a small fraction of the unit EAB limits (Ref. 1) for whole-body and thyroid dose rates.

With the loss of offsite power, the remaining steam generators are available for core-decay-heat dissipation by venting steam to the atmosphere through the MSSVs and steam generator atmospheric dump valves (ADV's). The Auxiliary Feedwater System supplies the necessary makeup to the steam generators. Venting continues until the reactor coolant temperature and pressure have decreased sufficiently for the Residual Heat Removal System to complete the cooldown.

In the evaluation of the radiological consequences of this accident, the activity released from the steam generator connected to the failed steam line, is assumed to be released directly to the environment. The unaffected steam generator is assumed to discharge steam and any entrained activity through the MSSVs and ADVs during the event. Since no credit is taken in the analysis for activity plateout or retention, the resultant radiological consequences represent a conservative estimate of the potential integrated dose due to the postulated steam line failure.

Secondary specific activity limits satisfy Criterion 2 of the NRC Policy Statement.

LCO

As indicated in the Applicable Safety Analyses, the specific activity of the secondary coolant is required to be $\leq 0.10 \mu\text{Ci/gm}$ DOSE EQUIVALENT I-131 to limit the radiological consequences of a Design Basis Accident (DBA) to a small fraction of the required limit (Ref. 1).

Monitoring the specific activity of the secondary coolant ensures that when secondary specific activity limits are exceeded, appropriate actions are taken in a timely manner

(continued)

BASES

LCO
(continued) to place the unit in an operational MODE that would minimize the radiological consequences of a DBA.

APPLICABILITY In MODES 1, 2, 3, and 4, the limits on secondary specific activity apply due to the potential for secondary steam releases to the atmosphere.

In MODES 5 and 6, the steam generators are not being used for heat removal. Both the RCS and steam generators are depressurized, and primary-to-secondary LEAKAGE is minimal. Therefore, monitoring of secondary specific activity is not required.

ACTIONS A.1 and A.2

DOSE EQUIVALENT I-131 exceeding the allowable value in the secondary coolant, is an indication of a problem in the RCS and contributes to increased post accident doses. If the secondary specific activity cannot be restored to within limits within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 6 hours, and in MODE 5 within 36 hours. The allowed Completion Times are 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 3.7.14.1

This SR verifies that the secondary specific activity is within the limits of the accident analysis. A gamma isotopic analysis of the secondary coolant, which determines DOSE EQUIVALENT I-131, confirms the validity of the safety analysis assumptions as to the source terms in post-accident releases. It also serves to identify and trend any unusual isotopic concentrations that might indicate changes in reactor coolant activity or LEAKAGE. The 31-day Frequency is based on the detection of increasing trends of the level of DOSE EQUIVALENT I-131, and allows for appropriate action to be taken to maintain levels below the LCO limit.

(continued)

BASES (continued)

- REFERENCES
1. 10 CFR 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance."
 2. Watts Bar FSAR, Chapter 15, "Accident Analyses."
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.1 AC Sources-Operating

BASES

BACKGROUND

The unit electrical power distribution system AC sources consist of the offsite power sources (preferred power sources, normal and alternate(s)) and the onsite standby power sources (Train A and Train B diesel generators (DGs)). As required by 10 CFR 50, Appendix A, GDC 17, (Ref. 1), the design of the AC electrical power system provides independence and redundancy to ensure an available source of power to the Engineered Safety Feature (ESF) systems.

The onsite Class 1E AC Distribution System supplies electrical power to four power trains, shared between the two units, with each train powered by an independent Class 1E 6.9 kV shutdown board. Power trains 1A and 2A comprise load group A, and power trains 1B and 2B comprise load Group B. Two DGs associated with one load group can provide all safety related functions to mitigate a loss-of-coolant accident (LOCA) in one unit and safely shutdown the opposite unit. Each 6.9 kV shutdown board has two separate and independent offsite sources of power as well as a dedicated onsite DG source. The A and B train ESF systems each provide for the minimum safety functions necessary to shut down the unit and maintain it in a safe shutdown condition.

Offsite power is supplied to the Watts Bar 161 kv transformer yard by two dedicated lines from the Watts Bar Hydro Plant switchyard. This is described in more detail in FSAR Chapter 8 (Ref. 3). From the 161 kv transformer yard, two electrically and physically separated circuits provide AC power, through step-down common station service transformers, to the 6.9 kV shutdown boards. The two offsite AC electrical power sources are designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. A detailed description of the offsite power network and circuits to the onsite Class 1E shutdown boards is found in Reference 3.

An offsite circuit consists of all breakers, transformers, switches, interrupting devices, cabling, and controls

(continued)

BASES

BACKGROUND
(continued)

required to transmit power from the offsite transmission network (i.e., the Watts Bar Hydro Plant Switchyard) to the onsite Class 1E ESF buses (i.e., 6.9 kV Shutdown Boards).

A single offsite circuit is capable of providing the ESF loads. Both of these circuits are required to meet the Limiting Condition for Operation.

The onsite standby power source for each 6.9 kV shutdown board is a dedicated DG. WBN uses 4 DG sets for Unit 1 operation. These same DGs will be shared for Unit 2 operation. WBN also utilizes a C-S DG that can be manually aligned (electrically and mechanically) to any 6.9 kV shutdown board to replace an existing DG. A DG starts automatically on a safety injection (SI) signal (i.e., low pressurizer pressure or high containment pressure signals) or on a 6.9 kV shutdown board degraded voltage or loss-of-voltage signal. After the DG has started, it will automatically tie to its respective 6.9 kV shutdown board after offsite power is tripped as a consequence of 6.9 kV shutdown board loss-of-voltage or degraded voltage, independent of or coincident with an SI signal. The DGs will also start and operate in the standby mode without tying to the 6.9 kV shutdown board on an SI signal alone. Following the trip of offsite power, a loss-of-voltage signal strips all non-permanent loads from the 6.9 kV shutdown board. When the DG is tied to the 6.9 kV shutdown board, loads are then sequentially connected to their respective 6.9 kV shutdown board by the automatic load sequencer. The sequencing logic controls the permissive and starting signals to motor breakers to prevent overloading the DG by automatic load application.

In the event of a loss of preferred power, the 6.9 kV shutdown boards are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA) such as a LOCA.

Certain required unit loads are returned to service in a predetermined sequence in order to prevent overloading of the DGs in the process. Within the required interval (FSAR Table 8.3-3) after the initiating signal is received, all automatic and permanently connected loads needed to recover the unit or maintain it in a safe condition are returned to service.

(continued)

BASES

BACKGROUND
(continued)

Ratings for Train 1A, 1B, 2A, and 2B DGs satisfy the requirements of Regulatory Guide 1.9, (Ref. 2). The continuous service rating of each DGs is 4400 kW with 10% overload permissible for up to 2 hours in any 24-hour period. The ESF loads that are powered from the 6.9 kV shutdown boards are listed in Reference 3.

Control power for the DGs is provided by five DG battery systems, one per DG. Each system is comprised of a battery, a battery charger, distribution center, cabling, and cable ways. The DG 125V DC control power and field-flash circuits have power supplied from their respective 125V distribution panel. The normal supply of DC current is from the associated charger. The battery provides control and field-flash power when the charger is unavailable. The charger supplies the normal DC loads, maintains the battery in a fully charged condition, and recharges (480V AC available) the battery while supplying the required loads regardless of the status of the unit. The batteries are physically and electrically independent. The battery has sufficient capacity when fully charged to supply required loads for a minimum of 30 minutes following a loss of normal power. Each battery is normally required to supply loads during the time interval between loss of normal feed to its charger and the receipt of emergency power to the charger from its respective DG.

APPLICABLE
SAFETY ANALYSES

The initial conditions of DBAs and transient analyses in the FSAR, Chapter 6, (Ref. 10) and Chapter 15, (Ref. 8), assume ESF systems are OPERABLE. The AC electrical power sources are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System (RCS) and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Specifications 3.2 "Power Distribution Limits", 3.4 "Reactor Coolant System", and 3.6 "Containment Systems."

The OPERABILITY of the AC electrical power sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This results in maintaining at least two trains of onsite or one train of offsite AC sources OPERABLE during accident conditions in the event of:

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

- a. An assumed loss of all offsite power or all onsite AC power; and
- b. A worst-case single failure.

AC sources satisfy Criterion 3 of NRC Policy Statement.

LCO

Two qualified circuits between the Watts Bar Hydro 161-kV Switchyard and the onsite Class 1E Distribution System; and separate and independent DG for each train ensure availability of the required power to shutdown the reactor and maintain it in a safe shutdown condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Qualified offsite circuits are those which are described in the FSAR, have been reviewed and accepted by the NRC staff as meeting the requirements of GDC 17 (Ref. 1), and are part of the licensing basis for the unit.

Each offsite circuit must be capable of maintaining rated frequency and voltage, and accepting required loads during an accident, while connected to the 6.9 kV shutdown board. Offsite power from the Watts Bar Hydro 161-kV switchyard to the onsite Class 1E distribution system is from two independent immediate access circuits. Each of the two circuits are routed from the switchyard through a 161-kV transmission line and 161- to 6.9-kV transformer (common station service transformers) to the onsite Class 1E distribution system. The low and medium voltage power system starts at the high-side of the common station service transformers.

Each DG must be capable of starting, accelerating to rated speed and voltage, connecting to its respective 6.9 kV shutdown board on detection of loss-of-voltage, and accepting required loads. This will be accomplished within 10 seconds. Each DG must also be capable of accepting required loads within the assumed loading sequence intervals, and continue to operate until offsite power can be restored to the 6.9 kV shutdown boards. These capabilities are required to be met from a variety of

(continued)

BASES

LCO
(continued)

initial conditions such as: DG in standby with the engine hot, DG in standby at ambient conditions, and DG operating in parallel test mode.

Proper sequencing of loads, including tripping of non essential loads is a required function for DG OPERABILITY.

A Note has been added to indicate that the C-S DG may be substituted for any of the required DGs. However, the C-S DG cannot be declared OPERABLE until it is connected electrically in place of another DG, and it has satisfied applicable Surveillance Requirements.

The AC sources in one train must be separate and independent (to the extent possible) of the AC sources in the other train. For the onsite DGs, the separation and independence is complete.

For the offsite AC sources, the separation and independence is to the extent practical. It is acceptable for a single circuit to be cross-tied between trains providing the second circuit and associated interrupting devices or protective relaying is OPERABLE. This allows loads from both trains to be supplied from a single offsite source. However, if interrupting devices or protective relaying that normally serves to provide electrical independence between the two circuits are inoperable, it is not acceptable to conclude that all offsite circuits are still OPERABLE.

APPLICABILITY

The AC sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

- a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOs or abnormal transients; and
- b. Adequate core cooling is provided and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

AC power requirements for MODES 5 and 6 are covered in LCO 3.8.2, "AC Sources—Shutdown."

(continued)

BASES (continued)

ACTIONS

A.1

To ensure a highly reliable power source remains with one offsite circuit inoperable, it is necessary to verify the OPERABILITY of the remaining required offsite circuit on a more frequent basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 acceptance criteria will not result in a Required Action not met. However, if a second required circuit fails SR 3.8.1.1, the second offsite circuit is inoperable, and Condition C, for two offsite circuits inoperable, is entered.

A.2

Required Action A.2, which only applies if the train cannot be powered from an offsite source, is intended to provide assurance that an event coincident with a single failure of the associated DG will not result in a complete loss of safety function of critical redundant required features. The features encompassed by Required Action A.2 are determined in accordance with Specification 5.8, "Safety Function Determination Program (SFDP)." These features are powered from the redundant AC electrical power trains. This includes motor driven auxiliary feedwater pumps. Single train systems, such as the turbine driven auxiliary feedwater pump, may not be included.

The Completion Time for Required Action A.2 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". In this Required Action, the Completion Time only begins on discovery that both:

- a. the train has no offsite power supplying its loads, and
- b. a required feature on the other train is inoperable.

If at any time during the existence of Condition A (one offsite circuit inoperable) a redundant required feature subsequently becomes inoperable, this Completion Time would begin to be tracked.

(continued)

BASES

ACTIONS

A.2 (continued)

Discovering no offsite power to one train of the onsite Class 1E Power Distribution System coincident with one or more inoperable required support or supported features, or both, that are associated with the other train that has offsite power, results in starting the Completion Times for the Required Action. Twenty four hours is acceptable because it minimizes risk while allowing time for restoration before subjecting the unit to transients associated with shutdown.

The remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to Train A and Train B of the onsite Class 1E Distribution System. The 24 hour Completion Time takes into account the component OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 24 hour Completion Time takes into account the capacity and capability of the remaining AC sources, reasonable time for repairs, and the low probability of a DBA occurring during this period.

A.3

According to Regulatory Guide 1.93 (Ref. 4) operation may continue in Condition A for a period that should not exceed 72 hours. With one offsite circuit inoperable, the reliability of the offsite system is degraded, and the potential for a loss of offsite power is increased, with attendant potential for a challenge to the unit safety systems. In this Condition, however, the remaining OPERABLE offsite circuit and DGs are adequate to supply electrical power to the onsite Class 1E Distribution System.

The Completion Time takes into account the capacity and capability of the remaining AC sources, reasonable time for repairs, and the low probability of a DBA occurring during this period.

The second Completion Time for Required Action A.3 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition A is entered while, for instance, a

(continued)

BASES

ACTIONS

A.3 (continued)

DG is inoperable and that DG is subsequently returned OPERABLE, the LCO may already have been not met for up to 72 hours. This could lead to a total of 144 hours, since initial failure of the LCO, to restore the offsite circuit. At this time a DG could again become inoperable, the circuit restored OPERABLE, and an additional 72 hours allowed (for a total of 9 days) prior to complete restoration of the LCO. The 6 day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between 72 hours and 6 days means that both Completion Times apply simultaneously, and the more restrictive must be met.

As in Required Action A.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed-outage-time "clock". This will result in establishing the "time zero" at the time that LCO was initially not met, instead of the time Condition A was entered.

B.1

To ensure a highly reliable power source remains with one or more DG(s) inoperable in Train A or Train B, it is necessary to verify the availability of the offsite circuits on a more frequent basis. Since the Required Action only specifies "perform," a failure of SR 3.8.1.1 acceptance criteria will not result in a Required Action being not met. However, if a circuit fails to pass SR 3.8.1.1, it is inoperable. Upon offsite circuit inoperability, additional Conditions and Required Actions must then be entered.

B.2

Required Action B.2 is intended to provide assurance that a loss of offsite power, during the period that a DG is inoperable, will not result in a complete loss of safety function of critical systems. The redundant required features encompassed by Required Action B.2 are determined in accordance with Specification 5.8. These features are

(continued)

BASES

ACTIONS

B.2 (continued)

designed with redundant safety related trains. This includes motor driven auxiliary feedwater pumps. Single train systems, such as the turbine driven auxiliary feedwater pump, are not included. Redundant required feature failures consist of inoperable features associated with a train redundant to the train which has inoperable DG(s).

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". In this Required Action the Completion Time only begins on discovery that both:

- a. An inoperable DG exists, and
- b. A required feature on the other train is inoperable.

If at any time during the existence of this Condition (one or more DG(s) in Train A inoperable or one or more DG(s) in Train B inoperable) a required feature subsequently becomes inoperable, this Completion Time would begin to be tracked.

Discovering one or more required DG(s) in Train A inoperable or one or more DG(s) in Train B inoperable coincident with one or more inoperable required support or supported features, or both, that are associated with the OPERABLE DG, results in starting the Completion Time for the Required Action. Four hours from the discovery of these events existing concurrently, is acceptable because it minimizes risk while allowing time for restoration before subjecting the unit to transients associated with shutdown.

The remaining OPERABLE DG's and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. Thus, on a component basis single-failure protection for the required feature's function may have been lost; however function has not been lost. The 4 hour Completion Time takes into account the component OPERABILITY of the redundant counterpart to the inoperable required feature. Additionally, the 4 hour Completion Time takes into account the capacity and capability of the remaining AC sources, reasonable time for repairs, and the

(continued)

BASES

ACTIONS

B.2 (continued)

low probability of a DBA occurring during this period.

B.3.1 and B.3.2

Condition B is modified by a Note indicating that Required Action B.3.1 or B.3.2 must be completed if Condition B is entered. The intent is that all DG inoperabilities must be investigated for common cause failures regardless of how long the DG inoperability persists.

Required Action B.3.1 provides an allowance to avoid unnecessary testing of OPERABLE DGs. If it can be determined that the cause of the inoperable DGs does not exist on the OPERABLE DGs, SR 3.8.1.2 does not have to be performed. If the cause of inoperability exists on other DG(s), the other DG(s) would be declared inoperable upon discovery and Condition E of LCO 3.8.1 would be entered if the other inoperable DG(s) are not on the same train, otherwise, if the other inoperable DG(s) are on the same train, the unit remains in Condition B. Once the failure is repaired, and the common cause failure no longer exists, Required Action B.3.1 is satisfied. If the cause of the initial inoperable DG(s) cannot be confirmed not to exist on the remaining DG(s), performance of SR 3.8.1.2 will suffice to provide assurance of continued OPERABILITY of those DGs.

According to Generic Letter 84-15 (Ref. 9), 24 hours is reasonable to confirm that the OPERABLE DG(s) are not affected by the same problem as the inoperable DG(s).

B.4

According to Regulatory Guide 1.93, (Ref. 4), operation may continue in Condition B for a period that should not exceed 72 hours.

In Condition B, the remaining OPERABLE DGs and offsite circuits are adequate to supply electrical power to the onsite Class 1E Distribution System. The 72-hour Completion Time takes into account the capacity and capability of the remaining AC sources, reasonable time for repairs, and the low probability of a DBA occurring during this period.

(continued)

BASES

ACTIONS

B.4 (continued)

The second Completion Time for Required Action B.4 establishes a limit on the maximum time allowed for any combination of required AC power sources to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an offsite circuit is inoperable and that circuit is subsequently returned OPERABLE, the LCO may already have been not met for up to 72 hours. This could lead to a total of 144 hours, since initial failure to meet the LCO, to restore the DGs. At this time an offsite circuit could again become inoperable, the DGs restored OPERABLE, and an additional 72 hours (for a total of 9 days) allowed prior to complete restoration of the LCO. The 6 day Completion Time provides a limit on time allowed in a specified condition after discovery of failure to meet the LCO. This limit is considered reasonable for situations in which Conditions A and B are entered concurrently. The "AND" connector between 72 hours and 6 days means that both Completion Times apply simultaneously, and the more restrictive must be met.

As in Required Action B.2, the Completion Time allows for an exception to the normal "time zero" for beginning the allowed time "clock." This will result in establishing the "time zero" at the time that LCO was initially not met, instead of the time Condition B was entered.

C.1 and C.2

Required Action C.1, which applies when two offsite circuits are inoperable, is intended to provide assurance that an event with a coincident single failure will not result in a complete loss of redundant required safety functions. The Completion Time for this failure of redundant required features is reduced to 12 hours from that allowed for one train without offsite power (Required Action A.2). The rationale for the reduction to 12 hours is that Regulatory Guide 1.93 (Ref. 4) allows a Completion Time of 24 hours for two required offsite circuits inoperable, based upon the assumption that two complete safety trains are OPERABLE.

When a concurrent redundant required feature failure exists, this assumption is not the case, and a shorter Completion Time of 12 hours is appropriate. The features encompassed by Required Action C.1 are determined in accordance with

(continued)

BASES

ACTIONS

C.1 and C.2 (continued)

Specification 5.8. These features are powered from redundant AC safety trains. This includes motor driven auxiliary feedwater pumps. Single train features, such as the turbine driven auxiliary feedwater pump, are not included.

The Completion Time for Required Action C.1 is intended to allow the operator time to evaluate and repair any discovered inoperabilities. The Completion Time also allows for an exception to the normal "time zero" for beginning the allowed outage time "clock". In this Required Action the Completion Time only begins on discovery that both:

- a. All required offsite circuits are inoperable; and
- b. A required feature is inoperable.

If at any time during the existence of Condition C (two offsite circuits inoperable) a required feature becomes inoperable, this Completion Time would begin to be tracked.

According to Regulatory Guide 1.93, (Ref. 4), operation may continue in Condition C for a period that should not exceed 24 hours. This level of degradation means that the offsite electrical power system does not have the capability to effect a safe shutdown and to mitigate the effects of an accident; however, the onsite AG sources have not been degraded. This level of degradation generally corresponds to a total loss of the immediately accessible offsite power sources.

Because of the normally high availability of the offsite sources, this level of degradation may appear to be more severe than other combinations of two AC sources inoperable (e.g., combinations that involve an offsite circuit and one DG inoperable, or one or more DG(s) in each train inoperable). However, two factors tend to decrease the severity of this level of degradation:

- a. The configuration of the redundant AC electrical power system that remains available is not susceptible to a single bus or switching failure; and

(continued)

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ACTIONS

C.1 and C.2 (continued)

- b. The time required to detect and restore an unavailable offsite power source is generally much less than that required to detect and restore an unavailable onsite AC source.

With both of the required offsite circuits inoperable, sufficient onsite AC sources are available to maintain the unit in a safe shutdown condition in the event of a DBA or transient. In fact, a simultaneous loss of offsite AC sources, a LOCA, and a worst-case single failure were postulated as a part of the design basis in the safety analysis. Thus, the 24 hour Completion Time limit provides a period of time to effect restoration of one of the offsite circuits commensurate with the importance of maintaining an AC electrical power system capable of meeting its design criteria.

According to Reference 4, with the available offsite AC sources, two less than required by the LCO, operation may continue for 24 hours. If two offsite sources are restored within 24 hours, unrestricted operation may continue. If only one offsite source is restored within 24 hours, power operation would continue in accordance with Condition A.

D.1 and D.2

Pursuant to LCO 3.0.6, the Distribution System ACTIONS would not be entered even if all AC sources to it were inoperable resulting in de-energization. Therefore, the Required Actions of Condition D are modified by a Note to indicate that when Condition D is entered the Conditions and Required Actions for LCO 3.8.9, "Distribution System-Operating" must be immediately entered. This allows Condition D to provide requirements for the loss of the offsite circuit and one DG without regard to whether a train is de-energized. LCO 3.8.9 provides the appropriate restrictions for a de-energized train.

According to Regulatory Guide 1.93, (Ref. 4), operation may continue in Condition D for a period that should not exceed 12 hours. In Condition D, individual redundancy is lost in both the offsite electrical power system and the onsite AC electrical power system. Since power system redundancy is

(continued)

BASES

ACTIONS

D.1 and D.2 (continued)

provided by two diverse sources of power, however, the reliability of the power systems in this Condition may appear higher than that in Condition C (loss of both required offsite circuits). This difference in reliability is offset by the susceptibility of this power system configuration to a single bus or switching failure. The 12-hour Completion Time takes into account the capacity and capability of the remaining AC sources, reasonable time for repairs, and the low probability of a DBA occurring during this period.

E.1

With one or more required DG(s) in Train A inoperable simultaneous with one or more required DG(s) in Train B inoperable, there are no remaining standby AC sources. Thus with an assumed loss of offsite electrical power, insufficient standby AC sources are available to power the minimum required ESF functions. Since the offsite electrical power system is the only source of AC power for this level of degradation, the risk associated with continued operation for a very short time could be less than that associated with an immediate controlled shutdown (the immediate shutdown could cause grid instability, which could result in a total loss of AC power). Since any inadvertent generator trip could also result in a total loss of offsite AC power, however, the time allowed for continued operation is severely restricted. The intent here is to avoid the risk associated with an immediate controlled shutdown and to minimize the risk associated with this level of degradation.

According to Reference 4, with one or more required DG(s) in Train A inoperable simultaneous with one or more required DG(s) in Train B inoperable, operation may continue for a period that should not exceed 2 hours.

F.1 and F.2

If the inoperable AC electrical power sources cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are

(continued)

BASES

ACTIONS

F.1 and F.2 (continued)

reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems.

G.1 and H.1

Condition G and Condition H correspond to a level of degradation in which all redundancy in the AC electrical power supplies cannot be guaranteed. At this severely degraded level, any further losses in the AC electrical power system will cause a loss of function. Therefore, no additional time is justified for continued operation. The unit is required to commence a controlled shutdown by LCO 3.0.3.

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The AC sources are designed to permit inspection and testing of all important areas and features, especially those that have a standby function, in accordance with 10CFR50 GDC 18 (Ref. 5). Periodic component tests are supplemented by extensive functional tests during refueling outages (under simulated accident conditions). The SRs for demonstrating the OPERABILITY of the DGs are in accordance with the recommendations of Regulatory Guide 1.9, (Ref. 2); Regulatory Guide 1.108 (Ref. 6); and Regulatory Guide 1.137 (Ref. 7), as addressed in the FSAR.

Where the SRs discussed herein specify voltage and frequency tolerances, the following is applicable. The minimum steady-state output voltage of [TBD] V is [bases to be provided]. The specified maximum steady-state output voltage of [TBD] V is [bases to be provided]. The specified minimum transient value of 6555V is 95% of the nominal bus voltage of 6900V and is the minimum voltage required for the DG supply breaker to close on the 6.9 Kv Shutdown Board. The specified maximum transient value of 7260V is 110% of the nameplate rating of 6600V motors. The specified minimum and maximum frequencies of the DG are 58.8Hz and 61.2Hz, respectively.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.1.1

These values are equal to $\pm 2\%$ of the 60Hz nominal frequency and is derived from the recommendations given in Reference 2.

This SR assures proper circuit continuity for the offsite AC electrical power supply to the onsite distribution network and availability of offsite AC electrical power. The breaker alignment verifies that each breaker is in its correct position to ensure that distribution buses and loads are connected to their preferred power source, and that appropriate independence of offsite circuits is maintained. The 7-day Frequency is adequate since breaker position is not likely to change without the operator being aware of it and its status is displayed in the control room.

SR 3.8.1.2 and SR 3.8.1.7

These SRs help to ensure the availability of the standby electrical power supply to mitigate DBAs and transients and maintain the unit in a safe shutdown condition.

For the purposes of SR 3.8.1.2 and SR 3.8.1.7 testing, the DGs shall be started from standby conditions. The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby. Standby conditions for a DG means the diesel engine coolant and oil are being continuously circulated and temperature maintained consistent with manufacturer recommendations.

In order to reduce stress and wear on diesel engines, the manufacturer recommends a modified start in which the starting speed of DGs is limited, warmup is limited to this lower speed, and the DGs are gradually accelerated to synchronous speed prior to loading. This is the intent of Note 2, which is only applicable when such modified start procedures are recommended by the manufacturer.

SR 3.8.1.7 requires that, on a 184-day Frequency, the DG start from standby conditions and achieve required voltage and frequency within 10 seconds. The 10-second start requirement supports the assumptions of the design basis LOCA analysis (Ref. 8).

(continued)

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SURVEILLANCE
REQUIREMENTS

SR 3.8.1.2 and SR 3.8.1.7 (continued)

The 10-second start requirement is not applicable to SR 3.8.1.2 (see Note 2).

Since SR 3.8.1.7 requires a 10-second start, it is more restrictive than SR 3.8.1.2, and it may be performed in lieu of SR 3.8.1.2. This is the intent of Note 1 of SR 3.8.1.2.

The normal 31-day Frequency for SR 3.8.1.2 (see Table 3.8.1-1, Diesel Generator Test Schedule in the accompanying in LCO) is consistent with Regulatory Guide 1.9 (Ref. 2). The 184-day Frequency for SR 3.8.1.7 is a reduction in cold testing consistent with Generic Letter 84-15 (Ref. 9). These Frequencies provide adequate assurance of DG OPERABILITY, while minimizing degradation resulting from testing.

SR 3.8.1.3

This Surveillance verifies that the DGs are capable of synchronizing with the offsite electrical system and accepting loads greater than or equal to the equivalent of the maximum expected accident loads. A minimum run time of 60 minutes is required to stabilize engine temperatures, while minimizing the time that the DG is connected to the offsite source.

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing shall be performed using a power factor ≤ 0.8 . This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience. The load band 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.

The normal 31-day Frequency for this Surveillance (Table 3.8.1-1) is consistent with Regulatory Guide 1.9 (Ref. 2).

Note 1 modifies this Surveillance to indicate that diesel engine runs for this Surveillance may include gradual loading, as recommended by the manufacturer, so that mechanical stress and wear on the diesel engine are minimized (Ref. 9).

(continued)

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SURVEILLANCE
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SR 3.8.1.3 (continued)

Note 2 modifies this Surveillance by stating that momentary transients because of changing bus loads do not invalidate this test. Similarly, momentary power factor transients above the limit will not invalidate the test.

Note 3 indicates that this Surveillance should be conducted on only one DG at time in order to avoid common cause failures that might result from offsite circuit or grid perturbations.

Note 4 stipulates a prerequisite requirement for performance of this SR. A successful DG start must precede this test to credit satisfactory performance.

SR 3.8.1.4

This SR provides verification that the level of fuel oil in each skid-mounted DG day tank is at or above the level at which fuel oil is automatically added. The level is expressed as an equivalent volume in gallons, and is selected to ensure adequate fuel oil for a minimum of 1 hour of operation at full load plus 10%.

The 31-day Frequency is adequate to assure that a sufficient supply of fuel oil is available, since low-level alarms are provided and facility operators would be aware of any large uses of fuel oil during this period.

SR 3.8.1.5

Microbiological fouling is a major cause of fuel-oil degradation. There are numerous bacteria that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Removal of water from the fuel-oil day tanks once every 31 days will eliminate the necessary environment for bacterial survival. This is the most effective means of controlling microbiological fouling. In addition, it will eliminate the potential for water entrainment in the fuel oil during DG operation. Water may come from any of several sources, including condensation, ground water, rain water, contaminated fuel oil, and from breakdown of the fuel oil by bacteria. Frequent checking for and removal of accumulated water will minimize fouling as well as provide data regarding the watertight integrity

(continued)

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SURVEILLANCE
REQUIREMENTS

SR 3.8.1.5 (continued)

of the fuel-oil system. The Surveillance Frequencies are established by Regulatory Guide 1.137 (Ref. 7). This SR is for preventative maintenance. The presence of water does not necessarily represent a failure of this SR, provided the accumulated water is removed during performance of this Surveillance.

SR 3.8.1.6

This Surveillance demonstrates that each required fuel-oil transfer pump operates and transfers fuel oil from its associated storage tank to its associated skid-mounted day tank. This is required to support continuous operation of standby power sources. This Surveillance provides assurance that the fuel-oil transfer pump is OPERABLE, the fuel-oil piping system is intact, the fuel-delivery piping is not obstructed, and the controls and control systems for automatic fuel transfer systems are OPERABLE.

The Frequency for this SR is 92 days. The 92-day Frequency corresponds to the testing requirements for pumps as contained in the ASME Section XI code.

SR 3.8.1.7

See SR 3.8.1.2.

SR 3.8.1.8

Transfer of each 6.9 kV shutdown board power supply from the normal offsite circuit to the alternate offsite circuit demonstrates the 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 18-month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

This SR is modified by two Notes. The reason for Note 1 is that during operation with the reactor critical, performance

(continued)

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SURVEILLANCE
REQUIREMENTSSR 3.8.1.8 (continued)

of this Surveillance could cause perturbations to the electrical distribution systems that challenge continued steady-state operation and, as a result, unit safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1 or 2, and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is included in this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.9

Each DG is provided with an engine overspeed trip to prevent damage to the engine. Recovery from the transient caused by the loss of a large load could cause diesel engine overspeed, which, if excessive, might result in a trip of the engine. This Surveillance demonstrates the DG load response characteristics and capability to reject the largest single load, while maintaining the remaining loads (e.g., the normal 480 VAC shutdown board loads), without exceeding predetermined voltage and frequency and while maintaining a specified margin to the overspeed trip. The largest single load for each DG is the essential raw cooling water pump at 800 HP. As required by IEEE-308 (Ref. 12), the load rejection test is acceptable if the increase in diesel speed does not exceed 75% of the difference between synchronous speed and the overspeed trip setpoint, or 15% above synchronous speed, whichever is lower.

The time, voltage, and frequency tolerances specified in this SR are derived from Regulatory Guide 1.9 (Ref. 2) recommendations for response during load sequence intervals. The 3 seconds specified is equal to 60% of a typical 5-second load sequence interval associated with sequencing of this largest load. The voltage and frequency specified are consistent with the design range of the equipment powered by the DG. SR 3.8.1.9a corresponds to the maximum frequency excursion, while SR 3.8.1.9b and SR 3.8.1.9c are steady-state voltage and frequency values the system must recover following load rejection. The 18-month Frequency is consistent with the recommendation of Regulatory Guide 1.108 (Ref. 6).

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.9 (continued)

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing shall be performed using a power factor ≤ 0.8 . This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience.

This SR is modified by two Notes. The reason for Note 1 is that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that challenge continued steady-state operation and, as a result, unit safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1 or 2, and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is included in this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.10

This Surveillance demonstrates the DG capability to reject a full load without overspeed tripping or exceeding the predetermined voltage limits. The DG full-load rejection may occur because of a system fault or inadvertent breaker tripping. This Surveillance ensures proper engine-generator load response under the simulated test conditions. This test simulates the loss of the total connected load that the DG experiences following a full-load rejection and verifies that the DG will not trip upon loss of the load. These acceptance criteria provide DG damage protection. While the DG is not expected to experience this transient during an event and continue to be available, this response ensures that the DG is not degraded for future application, including reconnection to the bus if the trip initiator can be corrected or isolated.

In order to ensure that the DG is tested under load conditions that are as close to design basis conditions as possible, testing shall be performed using a power factor

(continued)

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SR 3.8.1.10 (continued)

≤ 0.8. This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience.

The 18-month Frequency is consistent with the recommendation of Regulatory Guide 1.108 (Ref. 6) and is intended to be consistent with expected fuel-cycle lengths.

This SR is modified by two Notes. The reason for Note 1 is that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that challenge continued steady-state operation and, as a result, unit safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1 or 2, and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.11

As required by Regulatory Guide 1.108 (Ref. 6), paragraph 2.a.(1), this Surveillance demonstrates the as-designed operation of the standby power sources during loss of the offsite source. This test verifies all actions encountered from the loss of offsite power, including shedding of the non-essential loads and energization of the emergency buses and respective loads from the DG. It further demonstrates the capability of the DG to automatically achieve the required voltage and frequency within the specified time.

The DG-auto start time of 10 seconds is derived from requirements of the accident analysis to respond to a design basis large-break LOCA. The frequency should be restored to within 2% of nominal following a load sequence step. 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.

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SURVEILLANCE
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SR 3.8.1.11 (continued)

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 can not actually be connected or loaded without undue hardship or potential for undesired operation. For instance, Emergency Core Cooling System (ECCS) injection valves are desired not to be stroked open, or high pressure injections systems are not capable of being operated at full flow, or RHR systems performing a decay heat removal function are not desired to be realigned to the ECCS mode of operation. In lieu of actual demonstration of connection and 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 months is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 6), paragraph 2.a.(1), takes into consideration unit conditions required to perform the Surveillance, and is intended to be consistent with expected fuel-cycle lengths.

This SR is modified by two Notes. For the purpose of this testing, the DGs shall be started from standby conditions, that is, with the engine coolant and oil being continuously circulated and temperature maintained consistent with manufacturer recommendations. The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby. The reason for Note 1 is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution systems, and challenge safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1, 2, 3, or 4 and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

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SURVEILLANCE
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(continued)

SR 3.8.1.12

This Surveillance demonstrates that the DG automatically starts and achieves the required voltage and frequency within the specified time (10 seconds) from the design basis actuation signal (LOCA signal) and operates for ≥ 5 minutes. The 5-minute period provides sufficient time to demonstrate stability. SR 3.8.1.12d and SR 3.8.1.12e ensure that permanently connected loads and emergency loads are energized from the offsite electrical power system on an ESF signal without loss of offsite power.

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 can not actually be connected or loaded without undue hardship or potential for undesired operation. For instance, ECCS injection valves are desired not to be stroked open, or high pressure injections systems are not capable of being operated at full flow, or RHR systems performing a decay heat removal function are not desired to be realigned to the ECCS mode of operation. In lieu of actual demonstration of connection and 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 months takes into consideration unit conditions required to perform the Surveillance and is intended to be consistent with the expected fuel-cycle lengths. Operating experience has shown that these components usually pass the SR when performed at the 18-month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

This SR is modified by two Notes. For the purpose of this testing, the DGs shall be started from standby conditions, that is, with the engine coolant and oil being continuously circulated and temperature maintained consistent with manufacturer recommendations. The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby. The reason for Note 1 is

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REQUIREMENTSSR 3.8.1.12 (continued)

that during operation with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that challenge continued steady-state operation and, as a result, unit safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1 or 2 and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.13

This Surveillance demonstrates that DG non-critical protective functions (e.g., high jacket water temperature) are bypassed on a loss-of-voltage signal concurrent with an ESF actuation test signal and critical protective functions (engine overspeed and generator differential current) trip the DG to avert substantial damage to the DG unit. Verification of the DG trip/trip bypass functions should be done by testing of the control circuits only; running of the DG during adverse conditions (engine overspeed, generator differential current) is not prudent or necessary. The non-critical trips are bypassed during DBAs and provide an alarm on an abnormal engine condition. This alarm provides the operator with sufficient time to react appropriately. The DG availability to mitigate the DBA is more critical than protecting the engine against minor problems that are not immediately detrimental to emergency operation of the DG.

The 18-month Frequency is based on engineering judgment, taking into consideration unit 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 at the 18-month Frequency, therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

The SR is modified by two Notes. The reason for Note 1 is that performing the Surveillance would remove a required DG from service. Since the DGs are shared between the two

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SR 3.8.1.13 (continued)

units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1, 2, 3, or 4 and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.14

Regulatory Guide 1.108 (Ref. 6), paragraph 2.a.(3), 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 24 hours, ≥ 2 hours of which is at a load equivalent to 110% of the continuous duty rating and the remainder of the time at a load equivalent to 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.

In order to assure that the DG is tested under load conditions that are as close to design conditions as possible, testing shall be performed using a power factor of ≤ 0.8 . This power factor is chosen to be representative of the actual design basis inductive loading that the DG would experience. The load band 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.

The 18-month Frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 6), paragraph 2.a.(3), takes into consideration unit conditions required to perform the Surveillance and is intended to be consistent with expected fuel-cycle lengths.

This SR is 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 power factor limits will not invalidate the test. The reason for Note 2 is that during operation

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SR 3.8.1.14 (continued)

with the reactor critical, performance of this Surveillance could cause perturbations to the electrical distribution systems that challenge continued steady-state operation and, as a result, unit safety systems. Since the DGs are shared between the two units, the requirement of Note 2 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1 or 2 and the appropriate ACTIONS will be entered for the other operating unit. Note 3 is included in this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.15

This Surveillance demonstrates that the diesel engine can restart from a hot condition, such as subsequent to shutdown from normal Surveillances, and achieve the required voltage and frequency within 10 seconds. The 10-second time is derived from the requirements of the accident analysis to respond to a design basis large-break LOCA.

The 18-month Frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 6), paragraph 2.a.(5).

This SR is modified by a Note. The reason for the Note is to ensure that the test is performed with the diesel sufficiently hot. The requirement that the diesel have operated for at least 2 hours at full-load conditions prior to performance of the Surveillance is based on manufacturers recommendations for achieving hot conditions. Momentary transients due to changing bus loads do not invalidate this test. The load band is provided to avoid routine overloading of the DG. Routine overloads may result in more frequent teardown inspections in accordance with vendor recommendations in order to maintain DG OPERABILITY.

The DG engines for WBN have an oil circulation and soakback system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.1.16

As required by Regulatory Guide 1.108 (Ref.6), paragraph 2.a.(6), this Surveillance ensures that the manual synchronization and automatic load transfer from the DG to the offsite source can be made and that the DG can be returned to ready-to-load status when offsite power is restored. It also ensures that the auto-start logic is reset to allow the DG to reload if a subsequent loss of offsite power occurs. The DG is considered to be in ready-to-load status when the DG is at rated speed and voltage, the output breaker is open and can receive and auto-close signal on bus undervoltage, and the load sequence timers are reset.

The Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 6), paragraph 2.1.(6), and takes into consideration unit conditions required to perform the Surveillance.

This SR is modified by two Notes. The reason for Note 1 is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution systems, and challenge safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1, 2, 3, or 4 and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.17

As required by Regulatory Guide 1.108 (Ref. 6), paragraph 2.a.(2), each DG is required to demonstrate proper operation for the DBA loading sequence to ensure that voltage and frequency are maintained within the required limits. Under accident conditions, prior to connecting the DGs to their respective 6.9 kV shutdown board, all large loads are shed except load center feeders and those motor control centers that power Class 1E loads (referred to as "permanently connected" loads). Upon reaching a minimum of 95% rated voltage and frequency, the DGs are then connected to their

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.17 (continued)

respective 6.9 kV shutdown board. Loads are then sequentially connected to the 6.9 kV shutdown board by the automatic load sequencer. 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 load-sequence time interval specified in FSAR Table 8.3-3 ensures that sufficient time exists for the DG to restore frequency and voltage prior to applying the next load and that safety analysis assumptions regarding ESF equipment time delays are not violated. Reference 3 provides a summary of the automatic loading of 6.9 kV shutdown boards.

The Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 6), 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 two Notes. The reason for Note 1 is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution systems, and challenge safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1, 2, 3, or 4 and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.18

In the event of 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 the DG operation, as discussed in the Bases for SR 3.8.1.11, during a loss of offsite power actuation test signal in conjunction with an ESF actuation signal. In lieu of actual demonstration of connection and loading of loads, testing that adequately shows the capability of the DG system to perform these

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.18 (continued)

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 months takes into consideration unit conditions required to perform the Surveillance and is intended to be consistent with an expected fuel-cycle length of 18 months.

This SR is modified by two Notes. For the purpose of this testing, the DGs must be started from standby conditions; that is, with the engine coolant and oil being continuously circulated and temperature maintained consistent with manufacturer recommendations. The reason for Note 1 is that performing the Surveillance would remove a required offsite circuit from service, perturb the electrical distribution systems, and challenge safety systems. Since the DGs are shared between the two units, the requirement of Note 1 cannot be accomplished completely without taking both units out of operation. Therefore, DG testing will be performed when the unit associated with the DG is not in MODE 1, 2, 3, or 4 and the appropriate ACTIONS will be entered for the other operating unit. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.19

This Surveillance demonstrates that the DG starting independence has not been compromised. Also, this Surveillance demonstrates that each engine can achieve proper speed within the specified time when the DGs are started simultaneously.

The 10-year Frequency is consistent with the recommendations of Regulatory Guide 1.108 (Ref. 6), paragraph 2.b.

For the purpose of this testing, the DGs must be started from standby conditions, that is, with the engine coolant and oil being continuously circulated and temperature maintained consistent with manufacturer recommendations. The DG engines for WBN have an oil circulation and soakback

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.19 (continued)

system that operates continuously to preclude the need for a prelube and warmup when a DG is started from standby.

SR 3.8.1.20

This SR demonstrates that the DG 125V DC distribution panel and associated charger are functioning properly, with all required circuit breakers closed and buses energized from normal power. The 7 day Frequency takes into account the redundant DG capability and other indications available in the control room that will alert the operator to system malfunctions.

SR 3.8.1.21

Verifying battery terminal voltage while on float charge for the DG batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the critical cell voltage as specified by the manufacturer. The 7 day Frequency is consistent with the manufacturers recommendations and IEEE-450 (Ref. 13).

SR 3.8.1.22

Visual inspections to detect corrosion of the battery cells and connections, or measurement of the resistance of each inter-cell, inter-rack, inter-tier, and terminal connections, provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance. The 92-day Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.1.23

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.23 (continued)

This SR is consistent with IEEE-450 (Ref.13) which recommends detailed visual inspection of cell condition and rack integrity on a yearly basis.

SR 3.8.1.24 and SR 3.8.1.25

Visual inspection and resistance measurements of inter-cell, inter-rack, inter-tier, and terminal connections provides an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-corrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection. For the purposes of trending, inter-cell and inter-tier connections are measured from battery post to battery post and inter-rack and terminal connections are measured from the terminal log to battery post.

The Surveillance Frequency of 12 months is consistent with IEEE-450 (Ref.13), which recommends cell-to-cell and terminal connection resistance measurement on a yearly basis.

SR 3.8.1.26

A battery-service test is a special test of battery capability, "as found," to satisfy the design requirements (battery duty cycle) of the DG battery subsystem. The discharge rate and test length corresponds to the design duty cycle requirements as specified in Reference 14. The Surveillance Frequency of 18 months is consistent with the recommendations of Regulatory Guide 1.32 (Ref. 15) and Regulatory Guide 1.129 (Ref. 16), 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 three Notes. The reason for Note 1 is to allow the once-per-60-months performance of SR 3.8.1.27 in lieu of SR 3.8.1.26. This substitution is acceptable because SR 3.8.1.27 represents a more severe test of battery capacity than SR 3.8.1.26. The reason for Note 2

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BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.1.26 (continued)

is that performing the Surveillance would remove a required DG battery subsystem from service. Note 3 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.1.27

A battery-performance test is a test of constant current capacity of a battery after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 13) and IEEE-485 (Ref. 17). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

The Surveillance Frequency for this test is 60 months, or every 12 months if the battery shows degradation or has reached 85% of its expected life. However, if the battery has reached 85% of its expected life, shows no degradation, and retains 100% capacity, a Surveillance Frequency of 24 months is permitted. Degradation is indicated, according to IEEE-450 (Ref. 13), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 13).

This SR is modified by two Notes. The reason for Note 1 is that performing the Surveillance would remove a required DG battery subsystem from service. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

Diesel Generator Test Schedule

The DG test schedule (Table 3.8.1-1) implements the recommendations of Revision 3 to Regulatory Guide 1.9 (Ref. 2). The purpose of this test schedule is to provide

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BASES

SURVEILLANCE
REQUIREMENTS

Diesel Generator Test Schedule (continued)

timely test data to establish a confidence level associated with the goal to maintain DG reliability above 0.975 per test demand.

According to Regulatory Guide 1.9, Revision 3, each DG unit should be tested at least once every 31 days. Whenever a DG has experienced 4 or more valid failures in the last 25 valid tests, the maximum time between tests is reduced to 7 days. Four failures in 25 valid tests is a failure rate of 0.16, or the threshold of acceptable DG performance, and hence may be an early indication of the degradation of DG reliability. When considered in the light of a long history of tests, however, 4 failures in the last 25 valid tests may only be a statistically probable distribution of random events. Increasing the test Frequency will allow for a more timely accumulation of additional test data upon which to base judgment of the reliability of the DG. The increased test Frequency must be maintained until seven consecutive, failure-free tests have been performed.

The Frequency for accelerated testing is 7 days, but not less than 24 hours. Therefore, the interval between tests should not be less than 24 hours, and no more than 7 days.

A successful test at an interval less than 24 hours should be considered an invalid test and not count towards the seven consecutive failure free starts. A test interval in excess of 7 days constitutes a failure to meet SRs.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17, "Electric Power Systems."
2. Regulatory Guide 1.9, Rev. 3, "Selection, Design, and Qualification of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," January 1992 (Draft).
3. Watts Bar FSAR, Section 8.2, "Offsite Power System," and Tables 8.3-1 to 8.3-3, "Safety-Related Standby Power sources and Distribution Boards," "Shutdown Board Loads Automatically Stripped Following a Loss of Nuclear Unit and Preferred Power," and "Diesel Generator Load Sequentially Applied Following a Loss of Nuclear Unit and Preferred Power."

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BASES

REFERENCES
(continued)

4. Regulatory Guide 1.93, Rev. 0, "Availability of Electric Power Sources," December 1974.
 5. 10 CFR 50, Appendix A GDC 18, "Inspection and Testing of Electric Power Systems."
 6. Regulatory Guide 1.108, Rev. 1, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," August 1977.
 7. Regulatory Guide 1.137, Rev. 1 "Fuel Oil Systems for Standby Diesel Generators," October 1979.
 8. Watts Bar FSAR, Section 15.4, "Condition IV-Limiting Faults."
 9. Generic Letter 84-15, "Proposed Staff Actions to Improve and Maintain Diesel Generator Reliability," July 2, 1984.
 10. Watts Bar FSAR Section 6, "Engineered Safety Features."
 11. ANSI C84.1-1970, "Voltage Ratings for Electric Power Systems and Equipment."
 12. IEEE-308-1971, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations."
 13. IEEE-450-198, "IEEE Recommended Practice for Maintenance Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Subsystems."
 14. Watts Bar FSAR, Section 8.3.1.1, "Standby AC Power System."
 15. Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants," February 1977, U.S. Nuclear Regulatory Commission.
 16. Regulatory Guide 1.129, "Maintenance Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Subsystems," U.S. Nuclear Regulatory Commission, December 1974.
 17. IEEE-485-1978, "Recommended Practices for Sizing Large Lead Storage Batteries for Generating Stations and Substations."
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.2 AC Sources-Shutdown

BASES

BACKGROUND A description of the AC sources is provided in the Bases for LCO 3.8.1, "AC Sources—Operating."

APPLICABLE SAFETY ANALYSIS The OPERABILITY of the minimum AC Sources during MODES 5 and 6, ensures that:

- a. The facility can be maintained in the shutdown or refueling condition for extended periods;
- b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and
- c. Adequate AC electrical power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel-handling accident.

In general, when the unit is shut down, the Technical Specification requirements ensure that the unit has the capability to mitigate the consequences of postulated accidents. However, assuming a single failure and concurrent loss of all offsite or loss of all onsite power is not required. The rationale for this is based on the fact that many Design Basis Accidents (DBAs), which are analyzed in MODES 1, 2, 3, and 4 have no specific analyses in MODES 5 and 6. Worst-case bounding events are deemed not-credible in MODES 5 and 6 because the energy contained within the reactor pressure boundary, reactor coolant temperature and pressure, and the corresponding stresses result in the probabilities of occurrence being significantly reduced or eliminated, and minimal in consequences. These deviations from DBA analysis assumptions and design requirements during shutdown conditions are allowed by the LCO for required systems.

During MODES 1, 2, 3, and 4 various deviations from the analysis assumptions and design requirements are allowed

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BASES

APPLICABLE
SAFETY ANALYSIS
(continued)

within the Required Actions. This allowance is in recognition that certain testing and maintenance activities must be conducted provided an acceptable level of risk is not exceeded. During MODES 5 and 6, performance of a significant number of required testing and maintenance activities is also required. In MODES 5 and 6 the activities are generally planned and administratively controlled. Relaxations from MODE 1, 2, 3, and 4 LCO requirements are acceptable during shutdown MODES based on:

- a. The fact that time in an outage is limited. This is a risk-prudent goal as well as a utility economic consideration.
- b. Requiring appropriate compensatory measures for certain conditions. These may include administrative controls and/or reliance on systems which do not necessarily meet typical design requirements applied to systems credited in operating MODE analyses.
- c. Prudent utility considerations of the risk associated with multiple activities which could affect multiple systems.
- d. Maintaining, to the extent practical, the ability to perform required functions (even if not meeting MODE 1, 2, 3, and 4 OPERABILITY requirements) with systems assumed to function during an event.

In the event of an accident during shutdown, this LCO ensures the capability to support systems necessary to avoid immediate difficulty, assuming either a loss of all offsite power or a loss of all onsite diesel generator (DG) power.

The AC sources satisfy Criterion 3 of the NRC Policy Statement.

LCO

One offsite circuit capable of supplying the onsite Class 1E power distribution subsystems of LCO 3.8.10, "Distribution Systems - Shutdown," ensures that all required loads are powered from offsite power. Two OPERABLE DGs, associated with a distribution system train required to be OPERABLE by LCO 3.8.10, ensures a diverse power source is available to provide electrical power support assuming a loss of the

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BASES

LCO
(continued)

offsite circuit. Together, OPERABILITY of the required offsite circuit and the two DGs ensure the availability of sufficient AC sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel-handling accidents and reactor vessel draindown).

The qualified offsite circuit must be capable of maintaining rated frequency and voltage, and accepting required loads during an accident, while connected to the 6.9 kV shutdown boards. Qualified offsite circuits are those that are described in the FSAR, have been reviewed and accepted by the staff as meeting the requirements of GDC 17, and are part of the licensing basis for the unit. Offsite power from the Watts Bar Hydro 161-kV switchyard to the onsite Class 1E distribution system is from two independent immediate access circuits. Each of the two circuits are routed from the switchyard through a 161-kV transmission line and 161- to 6.9-kV transformer (common station service transformers) to the onsite Class 1E distribution system. The low and medium voltage power system starts at the high-side of the common station service transformers.

The DG must be capable of starting, accelerating to rated speed and voltage, and connecting to its respective 6.9 kV shutdown board on detection of bus loss-of-voltage. This sequence must be accomplished within 10 seconds. Each DG bus must be capable of accepting required loads within the assumed loading sequence intervals, and continue to operate until offsite power can be restored to the 6.9 kV shutdown boards. These capabilities are required to be met from a variety of initial conditions such as: DG in standby with the engine hot, DG in standby at ambient conditions, and DG operating in parallel test mode.

Proper sequencing of loads, including tripping of nonessential loads is a required function for DG OPERABILITY.

It is acceptable for trains to be cross-tied during shutdown conditions, allowing a single offsite power circuit to supply all required trains.

A Note has been added to indicate that the C-S DG may be substituted for any of the required DGs. However, the

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BASES

LCO
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C-S DG cannot be declared OPERABLE until it is connected electrically in place of another DG, and it has satisfied applicable Surveillance Requirements.

APPLICABILITY

The AC sources required to be OPERABLE in MODES 5 and 6, and during movement of irradiated fuel assemblies provide assurance that:

- a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;
- b. Systems needed to mitigate a fuel-handling accident are available;
- c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

AC power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.1.

ACTIONS

A.1

An offsite circuit would be considered inoperable if it were not available to one required ESF train. In cases where two trains are required per LCO 3.8.10, the one train with offsite power available may be capable of supporting sufficient required features to allow continuation of CORE ALTERATION, fuel movement, and operations with a potential for draining the reactor vessel. By the allowance of the option to declare required features inoperable with no offsite power available, appropriate restrictions will be implemented in accordance with the affected required features LCO's ACTIONS.

(continued)

BASES

ACTIONS
(continued)

A.2.1, A.2.2, A.2.3, A.2.4, A.2.5, B.1, B.2, B.3, B.4, and B.5

With the offsite circuit not available to all required trains, the option would still exist to declare all required features inoperable. Since this option may involve undesired administrative efforts, the allowance for sufficiently conservative actions is made. With either required DG inoperable, the minimum required diversity of AC power sources is not available. It is therefore, required to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, any activities that could potentially result in inadvertent draining of the reactor vessel, and operations involving positive reactivity additions. Required Actions A.2.4 and B.4 preclude operations involving systems that contain large volumes of water at reduced boron concentrations with respect to the RCS that could dilute the boron concentration of the RCS to less than that required to maintain the SDM requirements of LCO 3.1.2 in MODE 5 or less than the boron concentration specified in the COLR in MODE 6. This Required Action does not preclude positive reactivity additions that cannot reduce the SDM or boron concentration to less than the limits specified in LCO 3.1.2 or the COLR. The addition of water with a boron concentration greater than that required to maintain the reactor shutdown within the requirements of LCO 3.1.2 or the COLR, but less than the RCS, is permitted. Positive reactivity additions such as small volume chemical additions and normal plant cooldowns are also permitted as long as the SDM limits are met.

Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required AC sources and to continue this action until restoration is accomplished in order to provide the necessary AC power to the unit safety systems.

Notwithstanding performance of the above conservative Required Actions, the unit is still without sufficient AC power sources to operate in a safe manner. Therefore, action must be initiated to restore the minimum required AC power sources and continue until the LCO requirements are restored.

(continued)

BASES

ACTIONS

A.2.1, A.2.2, A.2.3, A.2.4, A.2.5, B.1, B.2, B.3, B.4, and B.5 (continued)

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required AC electrical power sources should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

Pursuant to LCO 3.0.6, the distribution system ACTIONS are not entered even if all AC sources to it are inoperable resulting in deenergization. Therefore, the Required Actions of Condition A are modified by a Note to indicate that when Condition A is entered with no AC power to one 6.9 KV Shutdown Board, ACTIONS for LCO 3.8.10 must immediately entered. This Note allows Condition A to provide requirements for the loss of the offsite circuit whether or not a train is deenergized. LCO 3.8.10 provides the appropriate restrictions for the situation involving a deenergized train.

SURVEILLANCE
REQUIREMENTS

SR 3.8.2.1

SR 3.8.2.1 lists SRs from LCO 3.8.1 that are required to be performed. Refer to the corresponding Bases for LCO 3.8.1 for a discussion of each SR.

REFERENCES

1. Watts Bar FSAR, Section 8.0, "Electric Power."
 2. 10 CFR 50, Appendix A, GDC 17, "General Design Criteria for Nuclear Power Plants."
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air

BASES

BACKGROUND

Each diesel generator (DG) is provided with four interconnected storage tanks embedded in the building foundation having a fuel oil capacity sufficient to operate that diesel for a period of 7 days while the DG is supplying maximum post loss-of-coolant accident (LOCA) load demand discussed in the FSAR, Section 8.0 (Ref. 1). The maximum load demand is calculated using the assumption that a minimum of any two DGs are available. This onsite fuel oil capacity is sufficient to operate the DGs for longer than the time to replenish the onsite supply from outside sources.

An approximately 550 gal skid-mounted day tank is provided for each diesel engine. Each DG incorporates two diesel engines operating in tandem and directly coupled to the generator. Each skid-mounted day tank has fuel capacity for approximately 2 hours of full-load operations (Ref. 1). Fuel oil is transferred from the 7-day storage tanks to the skid-mounted day tanks by pump located on each skid-mounted day tank. Redundancy of pumps and piping precludes the failure of one pump or the rupture of any pipe, valve, or tank to result in the loss of more than one diesel engine. In the event that the piping between the last isolation valve and the skid-mounted day tank breaks, the use of one DG can be lost. This occurs only after the two hour supply of fuel in the skid-mounted day tank has been used.

During operation of the DGs, fuel oil pumps driven by the diesel engines transfer fuel from the day tanks to the skid-mounted diesel engine fuel manifolds. Level controls mounted on the skid-mounted day tanks automatically start and stop the storage tank transfer pumps.

In addition, alarms both locally and in the control room annunciate low level and high level in any skid-mounted day tank.

In the unlikely event of a failure in one of the supply trains, the associated skid-mounted day tank low-level alarm annunciates when the fuel oil remaining in the tank provides approximately 1 hour of full-load operation, thus allowing

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BASES

BACKGROUND
(continued)

the operator to take corrective action to prevent the loss of the diesel.

For proper operation of the standby DGs, it is necessary to ensure the proper quality of the fuel oil. Regulatory Guide 1.137 (Ref. 2) addresses the recommended fuel oil practices as supplemented by ANSI N195-1976 (Ref. 3). The fuel oil properties governed by these SRs are the appearance, the kinematic viscosity, specific gravity (or API gravity), impurity level, and flashpoint.

Each of the engines in the tandem generator sets is provided with its own lube oil system, which is an integral part of each of the five DG units. The piping and components for the skid-mounted lubrication system are vendor supplied, safety-related, ANSI B31.1, Seismic Category I. The diesel engine lubrication system for each diesel engine is a combination of four subsystems (Ref. 4): the main lubricating subsystem, the piston cooling subsystem, and the scavenging oil subsystem and the motor-driven circulating pump, and soak back pump system. The main lubricating subsystem supplies oil under pressure to the various moving parts of the diesel engine. The piston cooling subsystem supplies oil for piston cooling and lubrication of the piston pin bearing surfaces. The scavenging oil subsystem supplies the other systems with cooled and filtered oil. Oil is drawn from the engine sump by the scavenging pump through a strainer in the strainer housing located on the front side of the engine. From the strainer the oil is pumped through oil filters and a cooler. The filters are located on the accessory racks of the engines. The oil is cooled in the lube oil cooler by the closed circuit cooling water system in order to maintain proper oil temperature during engine operation.

Each engine crankcase sump contains 330 gal of lube oil, ample for at least 7 days of DG unit full load operation without requiring replenishment. The established oil consumption rate is 0.83 gal per hour. An additional standby oil reserve of approximately 935 gallons is stored onsite to replenish the engines for longer periods of operation and after their periodic test operations.

(continued)

BASES

BACKGROUND
(continued)

Each DG has an air start system with adequate capacity for five successive start attempts on the DG without recharging the air start receiver(s).

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR Chapter 6 (Ref. 5), and Chapter 15, assume all engineered safety features (ESF) systems are OPERABLE. The DGs are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that fuel, Reactor Coolant System, and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Specifications 3.2 "Power Distribution Limits," 3.4 "Reactor Coolant System (RCS)," and 3.6 "Containment Systems".

Since Diesel Fuel Oil, Lube Oil, and Air Start Subsystem support the operation of the standby AC power sources, they satisfy Criterion 3 of the NRC Policy Statement.

LCO

Stored diesel fuel oil is required to have sufficient supply for 7 days of full load operation. It is also required to meet specific standards for quality. Additionally, sufficient lube oil supply must be available to ensure the capability to operate at full load for 7 days. This requirement, in conjunction with an ability to obtain replacement supplies within 7 days, supports the availability of DG(s) required to shutdown the reactor and to maintain it in a safe condition for an anticipated operational occurrence (AOO) or a postulated DBA with loss of offsite power. DG day tank fuel oil requirements, as well as transfer capability from the 7 day storage tank to the skid-mounted day tank, are addressed in LCO 3.8.1, "AC Sources - Operating," and LCO 3.8.2, "AC Sources - Shutdown".

The starting air system is required to have a minimum capacity for five successive DG start attempts without recharging the air start receivers.

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BASES (continued)

APPLICABILITY AC Sources (LCO 3.8.1 and 3.8.2) are required to ensure the availability of the required power to shutdown the reactor and maintain it in a safe condition after an AOO or a postulated DBA. Since stored diesel fuel oil, lube oil, and starting air subsystem support LCO 3.8.1 and LCO 3.8.2, stored diesel fuel oil, lube oil, and starting air subsystem are required to be within limits when the associated DG is required to be OPERABLE.

ACTIONS

A.1

In this Condition, the 7 days fuel oil supply for a DG is not available. However, the Condition is restricted to fuel oil level reductions that maintain at least a 6-day supply. These circumstances may be caused by events such as; a) full load operation after an inadvertent start while at minimum required level or; b) feed-and-bleed operations which may be necessitated by increasing particulate levels or any number of other oil quality degradations. This restriction allows sufficient time for obtaining the requisite replacement volume and performing the analyses required prior to addition of the fuel oil to the tank. A period of 48 hours is considered sufficient to complete restoration of the required level prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (>6 days), the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this period.

B.1

With lube oil inventory < 300 gal per diesel engine, sufficient lube oil to support 7 days of continuous DG operation at full load conditions may not be available. However, the Condition is restricted to lube oil volume reductions that maintain at least a 6-day supply. This restriction allows sufficient time to obtain the requisite replacement volume. A period of 48 hours is considered sufficient to complete restoration of the required volume prior to declaring the DG inoperable. This period is acceptable based on the remaining capacity (>6 days), the low rate of usage, the fact that procedures will be initiated to obtain replenishment, and the low probability of an event during this brief period.

(continued)

BASES

ACTIONS
(continued)

C.1

This Condition is entered as a result of a failure to meet the acceptance criterion of SR 3.8.3.5. Normally, trending of particulate levels allows sufficient time to correct high particulate levels prior to reaching the limit of acceptability. Poor sample procedures (bottom sampling), contaminated sampling equipment, and errors in laboratory analysis can produce failures that do not follow a trend. Since the presence of particulates does not mean failure of the fuel oil to burn properly in the diesel engine, and particulate concentration is unlikely to change significantly between Surveillance Frequency intervals, and proper engine performance has been recently demonstrated (within 31 days), it is prudent to allow a brief period prior to declaring the associated DG inoperable. The 7-day Completion Time allows for further evaluation, resampling and reanalysis of the DG fuel oil.

D.1

With the new fuel oil properties defined in the Bases for SR 3.8.3.4 not within the required limits, a period of 30 days is allowed for restoring the stored fuel oil properties. This provides sufficient time to test the stored fuel oil to determine that the new fuel oil, when mixed with previously stored fuel oil, remains acceptable and restore the stored fuel oil properties. This restoration may involve feed-and-bleed procedures, filtering, or combinations of these procedures. Even if a DG start and load was required during this time interval and the fuel oil properties were outside limits, there is a high likelihood that the DG would still be capable of performing its intended function.

E.1

With starting air receiver pressure less than 200 psig, sufficient capacity for five successive DG start attempts does not exist. However, as long as the receiver pressure is greater than [] psig, there is adequate capacity for at least one start attempt, and the DG can be considered OPERABLE while the air start receiver pressure is restored to the required limit. A period of 48 hours is considered sufficient to complete restoration to the required pressure

(continued)

BASES

ACTIONS

E.1 (continued)

prior to declaring the DG inoperable. This period is acceptable based on the remaining air start capacity, the fact that most DG starts are accomplished on the first attempt, and the low probability of an event during this period.

F.1

With a Required Action and associated Completion Time not met, or one or more DGs fuel oil, lube oil, or starting air subsystem not within limits for reasons other than addressed by Conditions A through E, the associated DG may be incapable of performing its intended function and must be immediately declared inoperable. This declaration also requires an entry into applicable Conditions and Required Actions for LCO 3.8.1 or LCO 3.8.2.

SURVEILLANCE
REQUIREMENTS

SR 3.8.3.1

This SR provides verification that there is an adequate inventory of fuel oil in the storage tanks to support each DG operation for 7 days at full load. The 7-day period is sufficient time to place the unit in a safe shutdown condition and to bring in replenishment fuel from an offsite location.

The 31-day Frequency is adequate to ensure that a sufficient supply of fuel oil is available, since low-level alarms are provided and facility operators would be aware of any large uses of fuel oil during this period.

SR 3.8.3.2

This Surveillance ensures that sufficient lube oil inventory is available to support at least 7 days of full-load operation for each DG. The 300 gal requirement is based on the DG manufacturer's consumption values for the run time of the diesel plus the manufacturer's recommended minimum oil level. The DG lube oil sump is designed to hold adequate inventory for 7 days of full-load operation without the level reaching the manufacturer's recommended minimum level.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.3.2 (continued)

A 31-day Frequency is adequate to ensure that a sufficient lube oil supply is onsite, since DG starts and run times are closely monitored by the unit staff.

SR 3.8.3.3

The tests listed below are a means of determining whether fuel oil that is to be transferred to the 7-day storage tank is of the appropriate grade and has not been contaminated with substances that would have an immediate, detrimental impact on diesel engine combustion. If results from these tests are within acceptable limits, the fuel oil may be added to the storage tanks without concern for contaminating the entire volume of fuel oil in the storage tanks. These tests are to be conducted prior to adding the new fuel to the 7-day storage tank(s), but in no case is the time between transfer of new fuel to the 7-day storage tanks and conducting the tests to exceed 31 days. The tests, limits, and applicable American Society for Testing Materials (ASTM) standards are as follows:

- a. Sample the new fuel oil in accordance with ASTM D4057-1990 (Ref. 6);
- b. Verify in accordance with the tests specified in ASTM D975-1990 (Ref. 6) that the sample has an absolute specific gravity at 60/60°F of ≥ 0.83 and ≤ 0.89 or an API gravity at 60°F of $\geq 27^\circ$ and $\leq 39^\circ$, a kinematic viscosity at 40°C of ≥ 1.9 centistokes and ≤ 4.1 centistokes, and a flash point $\geq 125^\circ\text{F}$; and
- c. Verify that the new fuel oil has a clear and bright appearance with proper color when tested in accordance with ASTM D4176-1986 (Ref. 6).

Failure to meet any of the above limits is cause for rejecting the new fuel oil, but does not represent a failure to meet the LCO concern since the fuel oil is not added to the storage tanks.

Within 31 days following the addition of new fuel-oil, the sample is analyzed to establish that the other properties specified in Table 1 of ASTM D975-1990 (Ref. 6) are met for new fuel oil when tested in accordance with ASTM D975-1990 (Ref. 6), except that the analysis for sulfur may

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.3.3 (continued)

be performed in accordance with ASTM D1552-1990 or ASTM D2622-1987 (Ref. 6). The 31-day period is acceptable because the fuel-oil properties of interest, even if they were not within stated limits, would not have an immediate effect on DG operation. This Surveillance ensures the availability of high-quality fuel oil for the DGs.

Fuel-oil degradation during long-term storage shows up as an increase in particulate, due mostly to oxidation. The presence of particulate does not mean the fuel oil will not burn properly in a diesel engine. The particulate can cause fouling of filters and fuel-oil injection equipment, however, which can cause engine failure.

Particulate concentrations should be determined in accordance with ASTM D2276-1989, Method A (Ref. 6). This method involves a gravimetric determination of total particulate concentration in the fuel oil and has a limit of 10 mg/l. It is acceptable to obtain a field sample for subsequent lab testing in lieu of field testing. Each of the four interconnected tanks which comprise a 7-day tank must be considered and tested separately. The Frequency of this test takes into consideration fuel-oil degradation trends that indicate that particulate concentration is unlikely to change significantly between Frequency intervals.

SR 3.8.3.4

This Surveillance ensures that, without the aid of the refill compressor, sufficient air-start capacity for each DG is available. The system design requirements provide for a minimum of five engine start cycles without recharging. A start cycle is defined by the DG vendor, but usually is measured in terms of time (seconds of cranking) or engine cranking speed. The pressure specified in this SR is intended to reflect the lowest value at which the five starts can be accomplished.

The 31-day Frequency takes into account the capacity, capability, redundancy, and diversity of the AC sources and other indications available in the control room, including alarms, to alert the operator to below normal air-start pressure.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.3.5

Microbiological fouling is a major cause of fuel-oil degradation. There are numerous bacteria that can grow in fuel oil and cause fouling, but all must have a water environment in order to survive. Removal of water from storage tanks once every 31 days eliminates the necessary environment for bacterial survival. This is the most effective means of controlling microbiological fouling. In addition, it eliminates the potential for water entrainment in the fuel oil during DG operation. Water may come from any of several sources, including condensation, ground water, rain water, contaminated fuel oil, and from breakdown of the fuel oil by bacteria. Frequent checking for and removal of accumulated water minimizes fouling and provides data regarding the watertight integrity of the fuel-oil system. The Surveillance Frequencies are established by Regulatory Guide 1.137 (Ref. 2). This SR is for preventative maintenance. The presence of water does not necessarily represent a failure of this SR provided accumulated water is removed during the performance of the surveillance.

SR 3.8.3.6

This SR verifies by visual inspection, that the exposed fuel oil system piping is free of leaks. This test is performed while the DG is running to provide adequate assurance of piping leak tightness and weld integrity. The 18 month Frequency is based on engineering judgement and is consistent with the refueling cycle testing performed on the DGs.

SR 3.8.3.7

Draining of the fuel oil stored in the supply tanks, removal of accumulated sediment, and tank cleaning are required at 10-year intervals by Regulatory Guide 1.137 (Ref. 2), paragraph 2.f. To preclude the introduction of surfactants in the fuel system, the cleaning should be accomplished using sodium hypochlorite solutions, or their equivalent, rather than soap or detergents. This SR is for preventative maintenance. The presence of sediment does not necessarily represent a failure of this SR provided that accumulated sediment is removed during the performance of the Surveillance.

(continued)

BASES (continued)

REFERENCES

1. Watts Bar FSAR, Section 8.3, "Onsite (Standby) Power System".
 2. Regulatory Guide 1.137, "Fuel Oil Systems for Standby Diesel Generators," Revision 1, October, 1979.
 3. ANSI N195-[1976], "Fuel Oil Systems for Standby Diesel Generators," Appendix B.
 4. Watts Bar FSAR, Section 9.5.7, "Diesel Engine Lubrication System."
 5. Watts Bar FSAR, Section 15, "Accident Analysis" and Section 6 "Engineered Safety Features".
 6. ASTM Standards:
D4057-1990
D975-1990
D4176-1986
D1552-1990
D2622-1987
D2276-1989
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.4 DC Sources-Operating

BASES

BACKGROUND

The station DC electrical power system provides the AC emergency power system with control power. It also provides both motive and control power to selected safety-related equipment and preferred AC Vital Bus power (via inverters). As required by 10 CFR 50, Appendix A, GDC 17 (Ref. 1), the DC electrical power system is designed to have sufficient independence, redundancy, and testability to perform its safety functions, assuming a single failure. The DC electrical power system also conforms to the recommendations of Regulatory Guide 1.6 (Ref. 2) and IEEE-308 (Ref. 3).

The vital 125V DC electrical power system is a Class IE system whose safety function is to provide control power for engineered safety features equipment, emergency lighting, vital inverters, and other safety-related DC powered equipment for the entire unit. The system capacity is sufficient to supply these loads during normal operation and to permit safe shutdown and isolation of the reactor for the "loss of all AC power" condition. The system is designed to perform its safety function subject to a single failure.

The 125V DC vital power system is composed of the four redundant channels (Channels I and III compose Train A and Channels II and IV compose Train B) and consists of four lead-acid-calcium batteries, six battery chargers (including two spare chargers), four distribution boards, battery racks, and the required cabling, instrumentation and protective features. Each channel is electrically and physically independent from the equipment of all other channels so that a single failure in one channel will not cause a failure in another channel. Each channel consists of a battery charger which supplies normal DC power, a battery for emergency DC power, and a battery board which facilitates load grouping and provides circuit protection. These four channels are used to provide emergency power to the 120V AC vital power system which furnishes control power to the reactor protection system. No automatic connections are used between the four redundant channels.

(continued)

BASES

BACKGROUND
(continued)

Battery boards I, II, III, and IV have a charger normally connected to them and also have manual access to a spare (backup) charger for use upon loss of the normal charger. Additionally, battery boards I, II, III, and IV have manual access to the fifth vital battery system. The fifth 125V DC Vital Battery System is intended to serve as a temporary replacement for any one of the four 125V DC vital batteries during their testing, maintenance, and outages with no loss of system reliability under any mode of operation.

Each of the Train A and B DC electrical power subsystems provides the control power for its associated Class 1E AC-power-load group, 6.9 kV switchgear, and 480V load centers. The DC electrical power subsystems also provide DC electrical power to the inverters, which in turn power the AC vital buses. Additionally, they power the emergency DC lighting system.

The DC-power distribution system is described in more detail in Bases for LCO 3.8.9, "Distribution System- Operating," and LCO 3.8.10, "Distribution System-Shutdown."

Each battery has adequate storage capacity to carry the required load continuously for at least 2 hours (Ref. 4).

Each 125V DC battery subsystem is separately housed in a ventilated room apart from its charger and distribution centers. Each subsystem is located in an area separated physically and electrically from the other subsystems to ensure that a single failure in one subsystem does not cause a failure in a redundant subsystem. There is no sharing between redundant Class 1E subsystems such as batteries, battery chargers, or distribution panels.

The batteries for Train A and B DC electrical power subsystem are sized to produce required capacity at [80]% of nameplate rating, corresponding to warranted capacity at end-of-life cycles, derating for minimum ambient temperature, and the 100% design demand. The voltage limit is 2.13V per cell, which corresponds to a total minimum voltage output of 129V per battery (133.6 for vital Battery V) (Ref. 8). The battery design complies with the criteria for sizing large lead storage batteries are defined in IEEE-485 (Ref. 5).

(continued)

BASES

BACKGROUND
(continued)

Each Train A and B DC electrical power subsystem has ample power-output capacity for the steady-state operation of connected loads required during normal operation, while at the same time maintaining its battery bank fully charged.

Each battery charger has sufficient capacity to restore the battery bank from the design minimum charge to its fully charged state within 12 hours (with accident loads being supplied) following a 30 minute AC power outage, and in approximately 36 hours (while supplying normal steady state loads following a 2 hour AC power outage) (Ref. 8).

APPLICABLE
SAFETY ANALYSES

The initial conditions of design basis accident (DBA) transient analyses in the FSAR, Chapter 6, (Ref. 10) "Safety Features" and Chapter 15, (Ref. 10) assume that Engineered Safety Feature (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

- a. An assumed loss of all offsite AC power or all onsite AC power; and
- b. A worst-case single failure.

DC sources satisfy Criterion 3 of the NRC Policy Statement.

LCO

The DC electrical power subsystem channels (each channel consisting of a battery bank, associated battery charger and the corresponding control equipment and interconnecting cabling within the channel) are required to be OPERABLE to ensure the availability of the required power to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. Loss of any DC electrical channel does not prevent the minimum safety function from being performed (Ref. 4).

(continued)

BASES

LCO
(continued)

An OPERABLE DC electrical power subsystem requires 125 VDC Vital batteries I-IV and respective chargers to be operating and connected to the associated DC buses.

The LCO is modified by a Note which indicates that Vital Battery V may be substituted for any of the required vital batteries. However, the fifth battery cannot be declared OPERABLE until it is connected electrically in place of another battery and it has satisfied applicable Surveillance Requirements.

APPLICABILITY

The DC electrical power sources are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure safe unit operation and to ensure that:

- a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOs or abnormal transients; and
- b. Adequate core cooling is provided, and containment integrity and other vital functions are maintained in the event of a postulated DBA.

DC electrical power requirements for MODES 5 and 6 are addressed in the Bases for LCO 3.8.5, "DC Sources—Shutdown."

ACTIONS

A.1

Condition A represents one train with a loss of ability to completely respond to an event, and a potential loss of ability to remain energized during normal operation. It is therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for complete loss of DC power to the affected train. The 2 hour limit is consistent with the allowed time for an inoperable DC Distribution System train.

If one of the required DC electrical power subsystems is inoperable (e.g., inoperable battery, inoperable battery charger(s), or inoperable battery charger and associated

(continued)

BASES

ACTIONS

A.1 (continued)

inoperable battery), the remaining DC electrical power subsystem has the capacity to support a safe shutdown and to mitigate an accident condition. Since a subsequent worst-case single failure on the OPERABLE subsystem would, however, result in a situation where the ability of the 125V DC electrical power subsystem to support its required ESF function is not assured, continued power operation should not exceed 2 hours. The 2-hour Completion Time is based on Regulatory Guide 1.93 (Ref. 6) and reflects a reasonable time to assess unit status as a function of the inoperable DC electrical power subsystem and, if the DC electrical power subsystem is not restored to OPERABLE status, prepare to effect an orderly and safe unit shutdown.

B.1 and B.2

If the inoperable DC electrical power subsystem cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The Completion Times are reasonable, based on operating experience to reach the required unit conditions from full power in an orderly manner and without challenging unit systems. The Completion Time to bring the unit to MODE 5 is consistent with the time required in Regulatory Guide 1.93 (Ref. 6).

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.1

Verifying battery terminal voltage while on float charge for the batteries helps to ensure the effectiveness of the charging system and the ability of the batteries to perform their intended function. Float charge is the condition in which the charger is supplying the continuous charge required to overcome the internal losses of a battery (or battery cell) and maintain the battery (or a battery cell) in a fully charged state. The voltage requirements are based on the critical design voltage of the battery and are consistent with the initial voltages assumed in the battery

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.1 (continued)

sizing calculations. The 7-day Frequency is consistent with manufacturers recommendations and IEEE-450 (Ref. 7).

SR 3.8.4.2

Verifying that the alternate feeder breakers to each required battery charger is open ensures that independence between the power trains is maintained. The 7-day Frequency is based on engineering judgement, is consistent with procedural controls governing breaker operation, and ensures correct breaker position.

SR 3.8.4.3

Visual inspection to detect corrosion of the battery cells and connections, or measurement of the resistance of each inter-cell, inter-rack, inter-tier, and terminal connection, provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

The Surveillance Frequency for these inspections, which can detect conditions that can cause power losses due to resistance heating, is 92 days. This Frequency is considered acceptable based on operating experience related to detecting corrosion trends.

SR 3.8.4.4

Visual inspection of the battery cells, cell plates, and battery racks provides an indication of physical damage or abnormal deterioration that could potentially degrade battery performance.

This SR is consistent with IEEE-450 (Ref. 7), which recommends detailed visual inspection of cell condition and rack integrity on a yearly basis.

SR 3.8.4.5 and SR 3.8.4.6

Visual inspection and resistance measurements of inter-cell, inter-rack, inter-tier, and terminal connections provide an indication of physical damage or abnormal deterioration that could indicate degraded battery condition. The anti-

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.5 and SR 3.8.4.6 (continued)

corrosion material is used to help ensure good electrical connections and to reduce terminal deterioration. The visual inspection for corrosion is not intended to require removal of and inspection under each terminal connection. The removal of visible corrosion is a preventative maintenance SR. The presence of visible corrosion does not necessarily represent a failure of this SR provided visible corrosion is removed during performance of SR 3.8.4.5. For the purposes of trending, inter-cell and inter-tier connections are measured from battery post to battery post and inter-rack and terminal connections are measured from the terminal log to battery post.

The Surveillance Frequency of 12 months is consistent with IEEE-450 (Ref. 7), which recommends cell-to-cell and terminal connection resistance measurement on a yearly basis.

SR 3.8.4.7

This SR requires that each battery charger be capable of supplying 150 amps and 125V for ≥ 4 hours. These requirements are based on the expected worst case loading of 132 amps plus a margin of approximately 15% (Ref. 4). 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.

This SR is modified by two Notes. The reason for Note 1 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.7 (continued)

The Surveillance 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 18-month intervals. In addition, this Frequency is intended to be consistent with expected fuel-cycle lengths.

SR 3.8.4.8

A battery-service test is a special test of battery 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 Reference 11. The Surveillance Frequency of 18 months is consistent with 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 three Notes. The reason for Note 1 is to allow the once-per-60-months performance of SR 3.8.4.9 in lieu of SR 3.8.4.8. This substitution is acceptable because SR 3.8.4.9 represents a more severe test of battery capacity than SR 3.8.4.8. The reason for Note 2 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Note 3 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

SR 3.8.4.9

A battery-performance test is a test of constant current capacity of a battery, after having been in service, to detect any change in the capacity determined by the acceptance test. The test is intended to determine overall battery degradation due to age and usage.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.4.9 (continued)

The acceptance criteria for this Surveillance are consistent with IEEE-450 (Ref. 7) and IEEE-485 (Ref. 5). These references recommend that the battery be replaced if its capacity is below 80% of the manufacturer's rating. A capacity of 80% shows that the battery rate of deterioration is increasing, even if there is ample capacity to meet the load requirements.

The Surveillance Frequency for this test is 60 months, or every 12 months if the battery shows degradation or has reached 85% of its expected life. However, if the battery has reached 85% of its expected life, shows no degradation, and retains 100% capacity, a Surveillance Frequency of 24 months is permitted. Degradation is indicated, according to IEEE-450 (Ref. 7), when the battery capacity drops by more than 10% relative to its capacity on the previous performance test or when it is below the manufacturer's rating. All these Frequencies are consistent with the recommendations in IEEE-450 (Ref. 7).

This SR is modified by two Notes. The reason for Note 1 is that performing the Surveillance would remove a required DC electrical power subsystem from service, perturb the electrical distribution system, and challenge safety systems. Note 2 is added to this SR to acknowledge that credit may be taken for unplanned events that satisfy this SR.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 17, "Electric Power System."
2. Regulatory Guide 1.6; "Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems," U.S. Nuclear Regulatory Commission, March 10, 1971.
3. IEEE-308-1971, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronic Engineers.
4. Watts Bar FSAR, Section 8.3.2, "DC Power System."

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BASES

REFERENCES
(continued)

5. IEEE-485-1983, "Recommended Practices for Sizing Large Lead Storage Batteries for Generating Stations and Substations," Institute of Electrical and Electronic Engineers.
 6. Regulatory Guide 1.93, "Availability of Electric Power Sources," U.S. Nuclear Regulatory Commission, December 1974.
 7. IEEE-450-1980, "IEEE Recommended Practice for Maintenance Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Subsystems," Institute of Electrical and Electronic Engineers.
 8. Regulatory Guide 1.32, "Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants," February 1977, U.S. Nuclear Regulatory Commission.
 9. Regulatory Guide 1.129, "Maintenance Testing and Replacement of Large Lead Storage Batteries for Generating Stations and Subsystems," U.S. Nuclear Regulatory Commission, December 1974.
 10. Watts Bar FSAR, Section 15, "Accident Analysis" and Section 6 "Engineered Safety Features."
 11. TVA Calculation EEB-MS-TI11-0003, "125 VDC Vital Battery and Charger Evaluation."
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.5 DC Sources-Shutdown

BASES

BACKGROUND A description of the DC sources is provided in the Bases for LCO 3.8.4, "DC Sources-Operating."

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analysis in the FSAR, Chapter 6 (Ref. 2), and Chapter 15 (Ref. 2), assume that engineered safety features (ESF) systems are OPERABLE. The DC Electrical Power System provides normal and emergency DC electrical power for the emergency auxiliaries and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum electrical power sources during MODE 5 and 6 and during movement of irradiated fuel assemblies ensures that:

- a. The facility can be maintained in the shutdown or refueling condition for extended periods;
- b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and
- c. Adequate DC electrical power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel-handling accident.

The DC sources satisfy Criterion 3 of the NRC Policy Statement.

LCO

DC electrical power subsystem channels, each channel consisting of a battery bank, associated battery charger, and the corresponding control equipment and interconnecting

(continued)

BASES

LCO
(continued)

cabling within the channel, are required to be OPERABLE to support required trains of Distribution System required OPERABLE by LCO 3.8.10, "Distribution Systems-Shutdown." As a minimum, one train (i.e., channels I and III, or II and IV) shall be OPERABLE. This ensures the availability of sufficient DC electrical power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel-handling accidents and inadvertent reactor vessel draindown).

The LCO is modified by a Note which indicates that Vital Battery V may be substituted for any of the required vital batteries. However, the fifth battery cannot be declared OPERABLE until it is connected electrically in place of another battery and it has satisfied applicable Surveillance Requirements.

APPLICABILITY

The DC electrical power subsystems are required to be OPERABLE in MODES 5 and 6, and during movement of irradiated fuel assemblies, provide assurance that:

- a. Required features to provide adequate coolant inventory makeup are available for the irradiated fuel assemblies in the core in case of an inadvertent draindown of the reactor vessel;
- b. Required features needed to mitigate a fuel-handling accident are available;
- c. Required features necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

DC electrical power requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.4.

(continued)

BASES (continued)

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5

If two trains are required per LCO 3.8.10, the remaining train with DC power available may be capable of supporting sufficient systems to allow continuation of CORE ALTERATIONS, fuel movement, or operations with a potential for draining the reactor vessel. By allowing the option to declare required features inoperable with associated DC power source(s) inoperable, appropriate restrictions will be implemented in accordance with the affected system LCO's ACTIONS. In many instances this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., ...to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, any activities that could result in inadvertent draining of the reactor vessel, and operations involving positive reactivity additions). Required Action A.2.4 precludes operations involving systems that contain large volumes of water (i.e. CVCS, SIS, and RWST) at reduced boron concentrations with respect to the RCS that could dilute the boron concentration of the RCS to less than that required to maintain the SDM requirements of LCO 3.1.2 in MODE 5 or less than the boron concentration specified in the COLR in MODE 6. This Required Action does not preclude positive reactivity that cannot reduce the SDM or boron concentration to less than the limits specified in LCO 3.1.2 or the COLR. The addition of water with a boron concentration greater than that required to maintain the reactor shutdown within the requirements of LCO 3.1.2 or the COLR, but less than the RCS, is permitted. Positive reactivity additions such as small volume chemical additions and normal plant cooldowns are also permitted as long as the SDM limits are met.

Notwithstanding performance of the above conservative Required Actions, the unit is still without sufficient DC power sources to operate in a safe manner. Therefore, action must be initiated to restore the minimum required DC power sources and continue until the LCO requirements are restored.

Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required DC electrical power

(continued)

BASES

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5 (continued)

subsystems and to continue this action until restoration is accomplished in order to provide the necessary DC electrical power to the unit's safety systems.

The Completion Time of immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required DC electrical power subsystems should be completed as quickly as possible in order to minimize the time during which the unit safety systems may be without sufficient power.

SURVEILLANCE
REQUIREMENTS

SR 3.8.5.1

SR 3.8.5.1 requires performance of all Surveillances required by SR 3.8.4.1 through SR 3.8.4.9. Therefore, see the corresponding Bases for LCO 3.8.4 for a discussion of each SR.

REFERENCES

1. Watts Bar FSAR, Section 8.0, "Electric Power."
 2. Watts Bar FSAR, Section 15, "Accident Analysis" and Section 6 "Engineered Safety Features."
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.6 Battery Cell Parameters

BASES

BACKGROUND This LCO delineates the limits on electrolyte temperature, level, float voltage and specific gravity for the DC power subsystem and diesel generator (DG) batteries. A discussion of the 125V vital batteries and their OPERABILITY requirements is provided in the Bases for LCO 3.8.4, "DC Sources - Operating," and LCO 3.8.5, "DC Sources - Shutdown." A discussion of the DG batteries is provided in the Bases for LCO 3.8.1, "AC Sources - Operating."

APPLICABLE SAFETY ANALYSES The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6, (Ref. 2), and Chapter 15, (Ref. 2), assume engineered safety features (ESF) systems are OPERABLE. The DC electrical power system provides normal and emergency DC electrical power for emergency auxiliaries, and control and switching during all MODES of operation.

The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining at least one train of DC sources OPERABLE during accident conditions, in the event of:

- a. An assumed loss of all offsite AC power or all onsite AC power; and
- b. A worst-case single failure.

Battery cell parameters satisfy Criterion 3 of the NRC Policy Statement.

LCO Battery cell parameters must remain within acceptable limits to ensure availability of the required DC power to shutdown the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated

(continued)

BASES

LCO
(continued)

DBA. Electrolyte limits are conservatively established, allowing continued DC electrical system function even with Category A and Category B limits not met.

APPLICABILITY

The battery cell parameters are required for the support of the associated DC electrical power subsystems and DGs. Therefore, battery electrolyte is only required when the DC electrical power subsystems and DGs are required to be OPERABLE. Refer to the Applicability discussion in Bases for LCO 3.8.1, LCO 3.8.2, LCO 3.8.4, and LCO 3.8.5.

ACTIONS

A.1, A.2, and A.3

With one or more cells in one or more batteries not within limits (i.e., Category A limits not met, or Category B limits not met, or Category A and B limits not met) but within the Allowable Value (Category C limits are met) specified in Table 3.8.6-1 in the accompanying LCO, operation is permitted for a limited period since sufficient capacity exists to perform the intended function.

The pilot cell electrolyte level and float voltage are required to be verified to meet the Category C Allowable Values within 1 hour (Required Action A.1). This check will provide a quick indication of the status of the remainder of the battery cells. One hour provides time to inspect the electrolyte level and to confirm the float voltage of the pilot cells. One hour is considered a reasonable amount of time to perform the required verification.

Verification that the Category C Allowable Values are met (Required Action A.2) provides assurance that during the time needed to restore the parameters to the Category A and Category B limits, the battery will still be capable of performing its intended function. A period of 24 hours is allowed to complete the required verification because specific gravity measurements must be obtained for each connected cell. Taking into consideration both the time required to perform the required verification and the assurance that the battery cell parameters are not severely degraded, this time is considered reasonable.

(continued)

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

In the event the battery cell parameter is out of limits and a battery recharge is desired as corrective action, footnote "c" of Table 3.8.6-1 may be utilized in lieu of specific gravity measurements. In this event, once Required Action A.2 has been satisfied using float current in lieu of specific gravity, the footnote does not require additional specific gravity testing.

Continued operation is only permitted for 31 days before battery cell parameters must be restored to within Category A and Category B limits. With the consideration that, while battery capacity is degraded, sufficient capacity exists to perform the intended function and to allow time to fully restore the battery cell parameters to normal limits, this time is acceptable prior to declaring the battery inoperable.

B.1

With one or more batteries with one or more battery cell parameters outside the Category C Allowable Value for any connected cell, sufficient capacity to supply the maximum expected load requirement is not assured and the corresponding DC electrical power subsystem or DG must be declared inoperable. Additionally, other potentially extreme conditions; such as not completing the Required Actions of Condition A within the required Completion Time or average electrolyte temperature of representative cells falling below 60°F for the vital batteries or 50°F for DG batteries, will also be cause for immediately declaring the associated DC electrical power subsystem or DG inoperable.

SURVEILLANCE
REQUIREMENTS

SR 3.8.6.1

This SR verifies that Category A battery cell parameters are consistent with IEEE-450 (Ref. 1), which recommends regular battery inspections (at least one per month) including voltage, specific gravity, and electrolyte temperature of pilot cells.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.8.6.2

The quarterly inspection of specific gravity and voltage is consistent with IEEE-450 (Ref. 1). In addition, within 24 hours of a battery discharge < 110V or an inadvertent battery overcharge > 150V (143V for DG Battery), the battery must be demonstrated to meet Category B limits. This inspection is also consistent with IEEE-450 (Ref. 1), which recommends special inspections following a severe discharge or overcharge, to ensure that no significant degradation of the battery occurred as a consequence of such discharge or overcharge.

SR 3.8.6.3

This Surveillance, verification that the average temperature of representative cells is $\geq 60^{\circ}\text{F}$ for the vital batteries and $\geq 50^{\circ}\text{F}$ for the DG batteries, is consistent with a recommendation of IEEE-450 (Ref. 1), that states that the temperature of electrolytes in representative cells should be determined on a quarterly basis.

Lower-than-normal temperatures act to inhibit or reduce battery capacity. This SR ensures that the operating temperatures remain within an acceptable operating range. This limit is based on manufacturer's recommendations.

Table 3.8.6-1

This table delineates the limits on electrolyte level, float voltage, and specific gravity for three different categories. The meaning of each category is discussed below.

Category A defines the normal parameter limit for each designated pilot cell in each battery. The cells selected as pilot cells are those whose temperature, voltage and electrolyte specific gravity approximate the state of charge of the entire battery.

The Category A limits specified for electrolyte level are based on manufacturer recommendations and are consistent with the guidance in IEEE-450 (Ref. 1), with the extra

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

Table 3.8.6-1 (continued)

1/4 inch allowance above the high-water-level indication for operating margin to account for temperatures and charge effects. In addition to this allowance, Footnote "a" to Table 3.8.6-1 permits the electrolyte level to be above the specified maximum level during equalizing charge, provided it is not overflowing. These limits ensure that the plates suffer no physical damage, and that adequate electron transfer capability is maintained in the event of transient conditions.

The Category A limit specified for float voltage is ≥ 2.13 V per cell. This value is based on the recommendations of IEEE-450 (Ref. 1), that state that prolonged operation of cells < 2.13 V can reduce the life expectancy of cells.

The Category A limit specified for specific gravity for each pilot cell is ≥ 1.200 (0.015 below the manufacturer's fully charged nominal specific gravity or a battery charging current that had stabilized at a low value). This value is characteristic of a charged cell with adequate capacity. According to IEEE-450 (Ref. 1), the specific gravity readings are based on a temperature of 77°F (25°C).

The specific gravity readings are corrected for actual electrolyte temperature and level. For each 3°F (1.67°C) above 77°F (25°C), 1 point (0.001) is added to the reading; 1 point is subtracted for each 3°F below 77°F. The specific gravity of the electrolyte in a cell will increase with a loss of water due to electrolysis or evaporation.

Footnote "b" to Table 3.8.6-1 requires the above-mentioned correction for electrolyte level and temperature, with the exception that level correction is not required when battery charging current is < 2 amps on float charge. This current provides, in general, an indication of overall battery condition.

Because of specific-gravity gradients that are produced during the recharging process, delays of several days may occur while waiting for the specific gravity to stabilize. A stabilized charger current is an acceptable alternative to

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

Table 3.8.6-1 (continued)

specific-gravity measurement for determining the state of charge of the designated pilot cell. This phenomenon is discussed in IEEE-450 (Ref. 1). Footnote "c" to Table 3.8.6-1 allows the float charge current to be used as an alternate to specific gravity for up to 31 days following a battery equalizing recharge.

Recharge as used in this footnote is synonymous with a battery equalizing charge. The allowance to utilize charging current is limited to 31 days after the completion of the equalizing charge and return to float charge. The 31 days allows time for the specific gravity to stabilize and is consistent with Required Action A.3.

Condition B defines the normal parameter limits for each connected cell. The term "connected cell" excludes any battery cell that may be jumpered out.

The category B limits specified for electrolyte level and float voltage are the same as those specified for Category A and have been discussed above. The Category B limit specified for specific gravity for each connected cell is ≥ 1.195 (0.020 below the manufacturer's fully charged, nominal specific gravity) with the average of all connected cells > 1.205 (0.010 below the manufacturer's fully charged, nominal specific gravity). These values are based on manufacturer recommendations. The minimum specific-gravity value required for each cell ensures that the effects of a highly charged or newly installed cell will not mask overall degradation of the battery. Footnote "b" to Table 3.8.6-1 requires correction of specific gravity for electrolyte temperature and level. This level correction is not required when battery charging current is < 2 amps on float charge.

Category C defines the Allowable Values for each connected cell. These values, although reduced, provide assurance that sufficient capacity exists to perform the intended function and maintain a margin of safety. When any battery parameter is outside the Category C Allowable Value, the assurance of sufficient capacity described above no longer exists and the battery must be declared inoperable.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

Table 3.8.6-1 (continued)

The Category C Allowable Values specified for electrolyte level (above the top of the plates and not overflowing) ensure that the plates suffer no physical damage and maintain adequate electron transfer capability. The Category C Allowable Value for float voltage is based on IEEE-450 (Ref. 1), which states that a cell voltage of 2.07 V or below, under float conditions and not caused by elevated temperature of the cell, indicates internal cell problems and may require cell replacement.

The Category C Allowable Value of average specific gravity ≥ 1.195 is based on manufacturer recommendations (0.020 below the manufacturer recommended fully charged, nominal specific gravity). In addition to that limit, it is required that the specific gravity for each connected cell must be no less than 0.020 below the average of all connected cells. This limit ensures that the effect of a highly charged or new cell will not mask overall degradation of the battery. The footnotes to Table 3.8.6-1 that apply to Category A specific gravity are also applicable to Category C specific gravity.

REFERENCES

1. IEEE-450-1980, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations."
 2. Watts Bar FSAR, Section 15, "Accident Analysis," and Section 6, "Engineered Safety Features."
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.7 Inverters-Operating

BASES

BACKGROUND

The inverters are the preferred source of power for the AC vital buses because of the stability and reliability they achieve in being powered from the 120V DC battery source. There is one inverter per AC vital bus making a total of four inverters per unit. The function of the inverter is to convert DC electrical power to AC electrical power, thus providing an uninterruptible power source for the instrumentation and controls for the Reactor Protection System (RPS) and the Engineered Safety Feature Actuation System (ESFAS). Specific details on inverters and their operating characteristics are found in the FSAR, Chapter 8 (Ref. 1).

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in the FSAR, Chapter 6, (Ref. 2) and Chapter 15, (Ref. 2) assume engineered safety features (ESF) systems are OPERABLE. The DC to AC inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the RPS and ESFAS instrumentation and controls so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Specifications 3.2 "Power Distribution Limits," 3.4 "Reactor Coolant System," and 3.6 "Containment Systems."

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the unit. This includes maintaining required AC vital buses OPERABLE during accident conditions in the event of:

- a. An assumed loss of all offsite AC electrical power or all onsite AC electrical power; and
- b. A worst-case single failure.

Inverters are a part of Distribution Systems and as such satisfy Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

The inverters ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.

Maintaining the required inverters OPERABLE ensures that the redundancy incorporated into the design of the RPS and ESFAS instrumentation and controls is maintained. The eight battery-powered inverters ensure an uninterruptible supply of AC electrical power to the AC vital buses even if the 6.9 kV Shutdown Boards are de-energized.

OPERABLE inverters require the associated AC vital bus to be powered by the inverter via its associated 480 V shutdown board and vital battery board, which has the correct DC voltage (125 V) applied from a battery to the inverter input, and inverter output AC voltages and frequency within tolerances.

APPLICABILITY

The inverters are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

- a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and
- b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Inverter requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.8, "Inverters-Shutdown."

ACTIONS

A.1 and A.2

With a required inverter inoperable, its associated AC vital bus becomes inoperable until it is manually re-energized from its associated 120V AC instrument power distribution panel. Required Action A.1 allows up to 2 hours to perform this task.

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

The 2-hour Completion Time is consistent with the 2-hour Completion Time for an inoperable DC bus, and an inoperable AC vital bus (see LCO 3.8.9, "Distribution Systems-Operating"). Required Action A.2 allows 24 hours to fix the inoperable inverter and return it to service. The 24-hour limit is based upon engineering judgment, taking into consideration the time required to repair an inverter and the additional risk to which the unit is exposed because of the inverter inoperability. This has to be balanced against the risk of an immediate shutdown, along with the potential challenges to safety systems such a shutdown might entail. When the AC vital bus is powered from its associated 120V AC instrument power distribution panel, it is relying upon interruptible AC electrical power sources (offsite and onsite). The uninterruptible, battery-backed, inverter source to the AC vital buses is the preferred source for powering instrumentation trip setpoint devices.

B.1 and B.2

If the inoperable devices or components cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are 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 3.8.7.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed including those from the associated vital battery boards, and 480 V shutdown boards and AC vital buses energized from the inverter. The verification of proper voltage and frequency output ensures that the required power is readily available for the instrumentation of the RPS and ESFAS connected to the AC vital buses. The 7-day Frequency

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.7.1 (continued)

takes into account the redundant capability of the inverters and other indications available in the control room that will alert the operator to inverter malfunctions.

REFERENCES

1. Watts Bar FSAR, Section 8.3.1, "AC Power System."
 2. Watts Bar FSAR, Section 15, "Accident Analysis" and Section 6 "Engineered Safety Features."
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.8 Inverters-Shutdown

BASES

BACKGROUND A description of the inverters is provided in the Bases for LCO 3.8.5, "Inverters-Operating."

APPLICABLE SAFETY ANALYSES The initial conditions of Design Basis Accident (DBA) and transient analysis in the FSAR, Chapter 6 (Ref. 1), and Chapter 15 (Ref. 1), assume engineered safety features (ESF) systems are OPERABLE. The DC to AC inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the Reactor Protection System (RPS), and Engineered Safety Features Actuation System (ESFAS) instrumentation and controls so that the fuel, Reactor Coolant System (RCS), and containment design limits are not exceeded.

The OPERABILITY of the inverters is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum inverters to each AC vital bus during MODES 5 and 6 ensures that (Ref. 1):

- a. The facility can be maintained in the shutdown or refueling condition for extended periods;
- b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and
- c. Adequate power is available to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel-handling accident.

The inverters were previously identified as part of the Distribution System and as such, satisfy Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

The inverters ensure the availability of electrical power for the instrumentation for systems required to shutdown the reactor and maintain it in a safe condition after an anticipated operational occurrence or a postulated DBA. The battery-powered inverters provide uninterruptible supply of AC electrical power to the AC vital buses even if the 6.9 kV Shutdown Boards are deenergized. OPERABILITY of the inverters requires that the AC vital bus be powered by the inverter via its associated 480V shutdown board and vital battery board. As a minimum, either the channel I and III or II and IV inverters shall be OPERABLE to support the distribution systems required by LCO 3.8.10, "Distribution Systems-Shutdown." This ensures the availability of sufficient inverter power sources to operate the unit in a safe manner and to mitigate the consequences of postulated events during shutdown (e.g., fuel-handling accidents and inadvertent reactor vessel draindown).

APPLICABILITY

The inverters required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

- a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core in-case of an inadvertent draindown of the reactor vessel;
- b. Systems needed to mitigate a fuel-handling accident are available;
- c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition or refueling condition.

Inverter requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.7.

(continued)

BASES (continued)

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5

If two trains are required per LCO 3.8.10, the remaining OPERABLE inverters may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, operations with a potential for draining the reactor vessel, or operations with a potential for positive reactivity additions. By the allowance of the option to declare required features inoperable with associated Inverter(s) inoperable, appropriate restrictions will be implemented in accordance with the affected required features LCO's Required Actions. In many instances this option may involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, movement of irradiated fuel assemblies, any activities that could potentially result in inadvertent draining of the reactor vessel, and operations involving positive reactivity additions).

Required Action A.2.4 precludes operations involving systems that contain large volumes of water (i.e. CVCS, SIS, and RWST) at reduced boron concentrations with respect to the RCS that could dilute the boron concentration of the RCS to less than that required to maintain the SDM requirements of LCO 3.1.2 in MODE 5 or less than the boron concentration specified in the COLR in MODE 6. This Required Action does not preclude positive reactivity additions that cannot reduce the SDM or boron concentration to less than the limits specified in LCO 3.1.2 or the COLR. The addition of water with a boron concentration greater than that required to maintain the reactor shutdown within the requirements of LCO 3.1.2 or the COLR, but less than the RCS, is permitted. Positive reactivity additions such as small volume chemical additions and normal plant cooldowns are also permitted as long as the SDM limits are met.

Suspension of these activities shall not preclude completion of actions to establish a safe conservative condition. These actions minimize the probability of the occurrence of postulated events. It is further required to immediately initiate action to restore the required inverters and to continue this action until restoration is accomplished in order to provide the necessary inverter power to the unit safety systems.

(continued)

BASES

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, A.2.4, and A.2.5 (continued)

Notwithstanding performance of the above conservative Required Actions, the unit is still without sufficient inverters to operate in a safe manner. Therefore, action must be initiated to restore the minimum required inverters and continue until the LCO requirements are restored.

The Completion Time of Immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required inverters should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power or powered from its associated 120V AC instrument power distribution panel.

SURVEILLANCE
REQUIREMENTS

SR 3.8.8.1

This Surveillance verifies that the inverters are functioning properly with all required circuit breakers closed, including those from the associated vital battery boards and 480V shutdown boards, and AC vital buses energized from the inverter. The verification of proper voltage and frequency output ensures that the required power is readily available for the instrumentation of the RPS and ESFAS connected to the AC vital buses. The 7-day Frequency takes into account the redundant capability of the inverters and other indications available in the control room that will alert the operator to inverter malfunctions.

REFERENCES

1. Watts Bar FSAR, Section 15 "Accident Analysis" and Section 6 "Engineered Safety Features".
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B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.9 Distribution Systems-Operating

BASES

BACKGROUND

The onsite Class 1E AC, DC, and AC Vital Bus Electrical Power Distribution systems are divided by trains into two redundant and independent AC, DC, and AC Vital Bus Electrical Power Distribution subsystems.

The AC electrical power subsystem includes four 6.9 kV shutdown boards. Each 6.9 kV shutdown board has access to the two separate and independent preferred offsite sources of power as well as a dedicated onsite diesel generator (DG) source. Each 6.9 kV shutdown board is normally connected to a preferred offsite circuit. During loss of this normal power source to the 6.9 kV shutdown boards, the onsite emergency power system will supply power to the 6.9 kV shutdown boards. Control power for the 6.9 kV breakers is supplied from the Class 1E batteries. Additional description of this system may be found in the Bases for LCO 3.8.1, "AC Sources-Operating," and the Bases for LCO 3.8.4, "DC Sources-Operating."

The AC Distribution System includes the 480V shutdown boards and associated supply transformers, load centers and protective devices shown in Table B 3.8.9-1.

The 120V AC vital buses are arranged in four load groups and are normally powered from Inverters and DC boards I, II, III, and IV. The alternate power supply for the vital buses is a 120V AC instrument power distribution panel powered from the same train as the associated inverter, and its use is governed by LCO 3.8.7, "Inverters-Operating." Each transformer is powered from the 480 V shutdown boards 1A1-A or 1B1-B and 1B2-B or 1A2-A.

There are four independent 125V DC trains (labeled I, II, III and IV) associated electrical power distribution subsystems. Each train receives normal power from an independent 480V AC shutdown board via its associated battery charger. Upon loss of 480V AC shutdown board power, the DC buses are energized by their connected battery banks.

The list of all required distribution buses is located in Table B 3.8.9-1.

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The initial conditions of Design Basis Accident (DBA) and transient analyses in FSAR Chapter 6, (Ref. 2) and Chapter 15, (Ref. 2), assume engineered safety features (ESF) systems are OPERABLE. The AC, DC and AC Vital Bus Electrical Power Distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System (RCS) and containment design limits are not exceeded. These limits are discussed in more detail in the Bases for Specifications 3.2 "Power Distribution Limits," 3.4 "Reactor Coolant System," and 3.6 "Containment Systems."

The OPERABILITY of the AC, DC, and AC Vital Bus Electrical Power Distribution systems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This includes maintaining power distribution systems OPERABLE during accident conditions in the event of:

- a. An assumed loss of all offsite power or all onsite AC electrical power; and
- b. A worst-case single failure.

Distribution Systems satisfy Criterion 3 of the NRC Policy Statement.

LCO

The required power distribution subsystems listed in Table B 3.8.9-1 ensure the availability of AC, DC, and AC vital bus electrical power for the systems required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA. The train A and B AC, AC vital bus, and DC electrical power distribution subsystems are required to be OPERABLE.

Maintaining the Train A and Train B AC, DC, and AC vital bus electrical power distribution subsystems OPERABLE ensures that the redundancy incorporated into the design of ESF is not defeated. Therefore, a single failure within a system or within the electrical power distribution subsystems will not prevent safe shutdown of the reactor.

(continued)

BASES

LCO
(continued)

OPERABLE AC, DC and AC vital bus electrical power distribution subsystems, require the associated buses, transformers, load centers, motor control centers, and electrical circuits to be energized to their proper voltages and frequencies.

In addition, tie breakers between redundant safety related AC, DC, and AC Vital Bus power distribution subsystems, if they exist, must be open. This will prevent any electrical malfunction in any power distribution subsystem from propagating to the redundant subsystem which could cause the failure of redundant subsystem and possibly cause a loss of essential safety function(s). If any tie breakers are closed, the affected redundant electrical power distribution subsystems are considered inoperable. This applies to the onsite, safety related redundant electrical power distribution subsystems. It does not, however, preclude redundant 6.9 kV shutdown boards from being powered from the same offsite circuit.

APPLICABILITY

The electrical power distribution subsystems are required to be OPERABLE in MODES 1, 2, 3, and 4 to ensure that:

- a. Acceptable fuel design limits and reactor coolant pressure boundary limits are not exceeded as a result of AOOs or abnormal transients; and
- b. Adequate core cooling is provided, and containment OPERABILITY and other vital functions are maintained in the event of a postulated DBA.

Electrical power distribution subsystem requirements for MODES 5 and 6 are covered in the Bases for LCO 3.8.10, "Distribution Systems-Shutdown."

ACTIONS

A.1

With one AC electrical power distribution subsystems inoperable, the remaining AC electrical power distribution subsystem in the other train is capable of supporting the minimum safety functions necessary to shut down the reactor

(continued)

BASES

ACTIONS

A.1 (continued)

and maintain it in a safe shutdown condition, assuming no single failure. The overall reliability is reduced, however, because a single failure in the remaining power distribution subsystem could result in the minimum required ESF functions not being supported. Therefore, the required AC buses and shutdown boards must be restored to OPERABLE status within 8 hours.

Condition A worst scenario is one train without AC power (i.e., no offsite power to the train and the associated DG inoperable). In this condition the unit is more vulnerable to a complete loss of all AC power. It is therefore, imperative that the unit operator's attention be focused on minimizing the potential for loss of power to the remaining train by stabilizing the unit and on restoring power to the affected train. The 8 hour time limit before requiring a unit shutdown is acceptable because:

1. There is a potential for decreased safety if the unit operator's attention is diverted from the evaluations/actions necessary to restore power to the affected train, to the actions associated with taking the unit to shutdown with this time limit.
2. The potential for an event in conjunction with a single failure of a redundant component in the train with AC power (the redundant component is verified OPERABLE in accordance with Specification 5.8, "Safety Function Determination Program" (SFDP)).

The second Completion Time for Required Action A.1 establishes a limit on the maximum time allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence to failing to meet the LCO. If Condition A is entered while, for instance, a DC bus is inoperable and subsequently returned OPERABLE, the LCO may already have been not met for up to 2 hours. This could lead to a total of 10 hours, since initial failure of the LCO, to restore the AC distribution system. At this time a DC circuit could again become inoperable, and AC distribution restored OPERABLE. This could continue indefinitely.

(continued)

BASES

ACTIONS

A.1 (continued)

This Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock". This will result in establishing the "time zero" at the time the LCO was initially not met, instead of the time Condition A was entered. The 16-hour Completion Time is an acceptable limitation of this potential to fail to meet the LCO indefinitely.

B.1

With one AC vital bus inoperable, the remaining OPERABLE AC vital buses are capable of supporting the minimum safety functions necessary to shut down the unit and maintain it in the safe shutdown condition. Overall reliability is reduced, however, since an additional single failure could result in the minimum required ESF functions not being supported. Therefore, the required AC vital bus must be restored to OPERABLE status within 2 hours.

Condition B represents one AC vital Bus without power; potentially both the DC source and the associated AC source non-functioning. In this situation the unit is significantly more vulnerable to a complete loss of all noninterruptible power. It is therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining Vital Buses and restoring power to the affected Vital Bus.

This 2-hour limit is more conservative than Completion Times allowed for the vast majority of components which would be without power. Taking exception to LCO 3.0.2 for components without adequate DC power, which would have the Required Action Completion Times shorter than 2 hours if declared inoperable, is acceptable in consideration of competing concerns:

- a. The potential for decreased safety by requiring a change in unit conditions (i.e., requiring a shutdown) and not allowing stable operations to continue;
- b. The potential for decreased safety by requiring entry into numerous Applicable Conditions and Required Actions

(continued)

BASES

ACTIONS

B.1 (continued)

for components without adequate vital AC power, and not providing sufficient time for the operators to perform the necessary evaluations and actions to restore power to the affected train;

- c. The potential for an event in conjunction with a single failure of a redundant component. This redundant component is verified OPERABLE in accordance with Specification 5.8.

The 2-hour Completion Time takes into account the importance to safety of restoring the AC vital bus to OPERABLE status, the redundant capability afforded by the other OPERABLE vital buses, and the low probability of a DBA occurring during this period.

The second Completion Time for Required Action B.1 establishes a limit on the maximum time allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence of failing to meet the LCO. If Condition B is entered while, for instance, an AC bus is inoperable and subsequently returned OPERABLE, the LCO may already have been not met for up to 8 hours. This could lead to a total of 10 hours, since initial failure of the LCO, to restore the Vital Bus Distribution System. At this time an AC train could again become inoperable, and the AC Vital Bus distribution restored OPERABLE. This could continue indefinitely.

This Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock." This will result in establishing the "time zero" at the time the LCO was initially not met, instead of the time Condition B was entered. The 16-hour Completion Time is an acceptable limitation on this potential to fail to meet the LCO indefinitely.

C.1

With one DC bus inoperable the remaining DC electrical power distribution subsystem is capable of supporting the minimum safety functions necessary to shut down the reactor and maintain it in a safe shutdown condition, assuming no single

(continued)

BASES

ACITONS

C.1 (continued)

failure. The overall reliability is reduced, however, because a single failure in the remaining DC electrical power distribution subsystem could result in the minimum required ESF functions not being supported. Therefore, the required DC buses must be restored to OPERABLE status within 2 hours.

Condition C represents one train without adequate DC power; potentially both the battery significantly degraded and the associated charger non-functioning. In this situation the unit is significantly more vulnerable to a complete loss of all DC power. It is, therefore, imperative that the operator's attention focus on stabilizing the unit, minimizing the potential for loss of power to the remaining trains and restoring power to the affected train.

This 2-hour limit is more conservative than Completion Times allowed for the vast majority of components which would be without power. Taking exception to LCO 3.0.2 for components without adequate DC power, which would have Required Action Completion Times shorter than 2 hours, is acceptable in consideration of competing concerns:

- a. The potential for decreased safety by requiring a change in unit conditions (i.e., requiring a shutdown) and not allowing stable operations to continue;
- b. The potential for decreased safety by requiring entry into numerous Applicable Conditions and Required Actions for components without DC power, and not providing sufficient time for the operators to perform the necessary evaluations and actions to restore power to the affected train.
- c. The potential for an event in conjunction with a single failure of a redundant component. This redundant component is assured OPERABLE in accordance with Specification 5.8.

The 2-hour Completion Time for DC buses is consistent with Regulatory Guide 1.93 (Ref. 1).

(continued)

BASES

ACITONS

C.1 (continued)

The second Completion Time for Required Action C.1 establishes a limit on the maximum time allowed for any combination of required distribution subsystems to be inoperable during any single contiguous occurrence to failing to meet the LCO. If Condition C is entered while, for instance, an AC bus is inoperable and subsequently returned OPERABLE, the LCO may already have been not met for up to 8 hours. This could lead to a total of 10 hours, since initial failure of the LCO, to restore the DC Distribution System. At this time an AC train could again become inoperable, and DC distribution restored OPERABLE. This could continue indefinitely.

This Completion Time allows for an exception to the normal "time zero" for beginning the allowed outage time "clock". This will result in establishing the "time zero" at the time the LCO was initially not met, instead of the time Condition C was entered. The 16-hour Completion Time is an acceptable limitation of this potential to fail to meet the LCO indefinitely.

D.1 and D.2

If the inoperable Distribution System cannot be restored to OPERABLE status within the required Completion Time, the unit must be brought to a MODE in which the LCO does not apply. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours and in MODE 5 within 36 hours. The allowed Completion Times are 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 3.8.9.1

This Surveillance verifies that the AC, AC Vital Bus, and DC Electrical Power Distribution systems are functioning properly, with all the required circuit breakers closed and the buses energized from normal power. The verification of proper voltage availability on the buses ensures that the required power is readily available for motive as well as

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.9.1 (continued)

control functions for critical system loads connected to these buses. The 7-day Frequency takes into account the redundant capability of the AC, AC Vital Bus, and DC electrical power distribution subsystems, and other indications available in the control room that will alert the operator to subsystem malfunctions.

REFERENCES

1. Regulatory Guide 1.93, "Availability of Electric Power Sources," U.S. Nuclear Regulatory Commission, December 1974.
 2. Watts Bar FSAR, Chapter 6 "Engineering Safety Features," Chapter 8 "Electric Power," and Chapter 15 "Accident Analysis."
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Table B 3.8.9-1 (page 1 of 1)

AC and DC Electrical Power Distribution System

TYPE	VOLTAGE	Train A *	Train B *
AC safety buses	6900 V 480 V	Shdn Bd 1A-A 2A-A Shdn Bd 1A1-A, 1A2-A 2A1-A, 2A2-A	Shdn Bd 1B-B 2B-B Shdn Bd 1B1-B, 1B2-B 2B1-B, 2B2-B
DC buses	125 V	Board I from Vital Battery Bank I** Board III from Vital Battery Bank III**	Board II from Vital Battery Bank II** Board IV from Vital Battery Bank IV**
AC vital buses	120 V	Vital channel 1-I Vital channel 2-I from inverter and DC Board I Vital channel 1-III Vital channel 2-III from inverter and DC Board III	Vital channel 1-II Vital channel 2-II from inverter and DC Board II Vital channel 1-IV Vital channel 2-IV from inverter and DC Board IV

* Each train of the AC and DC electrical power distribution system is a subsystem.

** Vital Battery Bank V may be substituted for any of the required Vital Batteries.

B 3.8 ELECTRICAL POWER SYSTEMS

B 3.8.10 Distribution Systems-Shutdown

BASES

BACKGROUND A description of the AC, DC and AC Vital Bus electrical power distribution systems is provided in the Bases for LCO 3.8.9, "Distribution Systems-Operating."

APPLICABLE SAFETY ANALYSES The initial conditions of Design Basis Accident (DBA) and transient analysis in the FSAR, Chapter 6 (Ref. 1), and Chapter 15 (Ref. 1), assume engineered safety features (ESF) systems are OPERABLE. The AC, DC, and AC Vital Bus Electrical Power Distribution systems are designed to provide sufficient capacity, capability, redundancy, and reliability to ensure the availability of necessary power to ESF systems so that the fuel, Reactor Coolant System (RCS) and containment design limits are not exceeded.

The OPERABILITY of the AC, DC, and AC Vital Bus electrical power distribution system is consistent with the initial assumptions of the accident analyses and the requirements for the supported systems' OPERABILITY.

The OPERABILITY of the minimum AC, DC and AC Vital Bus electrical power distribution subsystems during MODES 5 and 6 ensures that:

- a. The facility can be maintained in the shutdown or refueling condition for extended periods;
- b. Sufficient instrumentation and control capability is available for monitoring and maintaining the unit status; and
- c. Adequate power is provided to mitigate events postulated during shutdown, such as an inadvertent draindown of the vessel or a fuel-handling accident.

The AC and DC Electrical Power Distribution system satisfies Criterion 3 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO

Various combinations of subsystems, equipment, and components will be required OPERABLE by other Technical Specification (TS) LCOs, depending on the specific unit condition. Implicit in those requirements is the required OPERABILITY of necessary supported required features. The Distribution System-Shutdown LCO explicitly requires energization of the portions of the electrical distribution system necessary to support OPERABILITY of TS required systems, equipment and components - all specifically addressed in each LCO, and implicitly required via the definition of OPERABILITY.

Maintaining these portions of the distribution system energized will ensure the availability of sufficient power to operate the unit in a safe manner to mitigate the consequences of postulated events during shutdown (e.g., fuel-handling accidents and inadvertent reactor vessel draindown).

APPLICABILITY

The AC and DC electrical power distribution subsystems required to be OPERABLE in MODES 5 and 6 and during movement of irradiated fuel assemblies provide assurance that:

- a. Systems to provide adequate coolant inventory makeup are available for the irradiated fuel in the core in case of an inadvertent draindown of the reactor vessel;
- b. Systems needed to mitigate a fuel-handling accident are available;
- c. Systems necessary to mitigate the effects of events that can lead to core damage during shutdown are available; and
- d. Instrumentation and control capability is available for monitoring and maintaining the unit in a cold shutdown condition and refueling condition.

The AC, DC, and AC vital bus electrical power distribution subsystem requirements for MODES 1, 2, 3, and 4 are covered in LCO 3.8.9.

(continued)

BASES (continued)

ACTIONS

A.1, A.2.1, A.2.2, A.2.3, A.2.4, A.2.5, and A.2.6

Although redundant required features may require redundant trains of electrical power distribution subsystems to be OPERABLE, one OPERABLE distribution subsystem train may be capable of supporting sufficient required features to allow continuation of CORE ALTERATIONS, fuel movement, and operations with a potential for draining the reactor vessel. By allowing the option to declare required features associated with an inoperable distribution subsystem inoperable, appropriate restrictions will be implemented in accordance with the affected distribution subsystems LCO's Required Actions. In many instances this would likely involve undesired administrative efforts. Therefore, the allowance for sufficiently conservative actions is made (i.e., to suspend CORE ALTERATIONS, handling of irradiated fuel assemblies, any activities that could potentially result in inadvertent draining of the reactor vessel, operations involving positive reactivity additions and to declare associated required features inoperable and enter applicable Conditions and Required Actions for LCO 3.4.7, "RCS Loops - MODES, Loops Filled," LCO 3.4.8, "RCS Loops - MODE 5 Loops Not Filled," LCO 3.9.5, "RHR and Coolant Circulation - High Water Level," and LCO 3.9.6, "RHR and Coolant Circulation - Low Water Level."

Notwithstanding performance of the above conservative Required Actions, the unit is still without sufficient AC and DC electrical power distribution subsystem to operate in a safe manner. Therefore, action must be initiated to restore the minimum required AC and DC electrical power distribution subsystems and continue until the LCO requirements are restored.

The Completion Time of Immediately is consistent with the required times for actions requiring prompt attention. The restoration of the required distribution subsystems should be completed as quickly as possible in order to minimize the time the unit safety systems may be without power.

SURVEILLANCE
REQUIREMENTS

SR 3.8.10.1

This Surveillance verifies that the AC, DC, and AC vital bus electrical power distribution subsystems are functioning

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.8.10.1 (continued)

properly, with the buses energized. The verification of proper voltage availability on the buses ensures that the required power is readily available for motive as well as control functions for critical system loads connected to these buses. The 7-day Frequency takes into account the capability of the electrical power distribution subsystems, as well as other indications available in the control room that will alert the operator to subsystem malfunctions.

REFERENCES

1. Watts Bar FSAR, Section 8.0, "Electric Power," Section 15, "Accident Analysis," and Section 6, "Engineered Safety Features."
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B 3.9 REFUELING OPERATIONS

B 3.9.1 Boron Concentration

BASES

BACKGROUND

The limit on the boron concentrations of the Reactor Coolant System (RCS), the refueling canal, and the refueling cavity during refueling ensures that the reactor remains subcritical during MODE 6. Refueling boron concentration is the soluble boron concentration in the coolant in each of these volumes having direct access to the reactor core during refueling.

The soluble boron concentration offsets the core reactivity and is measured by chemical analysis of a representative sample of the coolant in each of the volumes. The refueling boron concentration limit is specified in the COLR. Plant procedures ensure the specified boron concentration in order to maintain an overall core reactivity of $K_{eff} \leq 0.95$ during fuel handling, with control rods and fuel assemblies assumed to be in the most adverse configuration (least negative reactivity) allowed by plant procedures.

GDC 26 of 10 CFR 50, Appendix A, requires that two independent reactivity control systems of different design principles be provided (Ref. 1). One of these systems must be capable of holding the reactor core subcritical under cold conditions. The Chemical and Volume Control System (CVCS) is the system capable of maintaining the reactor subcritical in cold conditions by maintaining the boron concentration.

The reactor is brought to shutdown conditions before beginning operations to open the reactor vessel for refueling. After the RCS is cooled and depressurized and the vessel head is unbolted, the head is slowly removed to form the refueling cavity. The refueling canal and the refueling cavity are then flooded with borated water from the refueling water storage tank through the open reactor vessel by gravity feeding or by the use of the Residual Heat Removal (RHR) System pumps.

(continued)

BASES

BACKGROUND
(continued)

The pumping action of the RHR System in the RCS, and the natural circulation due to thermal driving heads in the reactor vessel and refueling cavity mix the added concentrated boric acid with the water in the refueling canal. The RHR System is in operation during refueling (see LCO 3.9.5 and LCO 3.9.6) to provide forced circulation in the RCS and assist in maintaining the boron concentrations in the RCS, the refueling canal, and the refueling cavity above the COLR limit.

APPLICABLE
SAFETY ANALYSES

During refueling operations, the reactivity condition of the core is consistent with the initial conditions assumed for the boron dilution accident in the accident analysis and is conservative for MODE 6. The boron concentration limit specified in the COLR is based on the core reactivity at the beginning of each fuel cycle (the end of refueling) and includes an uncertainty allowance.

The required boron concentration and the plant refueling procedures that verify the correct fuel-loading plan (including full-core mapping) ensure that the K_{eff} of the core will remain ≤ 0.95 during the refueling operation. Hence, at least a 5% $\Delta k/k$ margin of safety is established during refueling.

During refueling, the water volume in the spent fuel pool, the transfer canal, the refueling canal, the refueling cavity and the reactor vessel form a single mass. As a result, the soluble boron concentration is relatively the same in each of these volumes.

The limiting boron dilution accident analyzed occurs in MODE 5 (Ref. 2). A detailed discussion of this event is provided in Bases B 3.1.2, "SHUTDOWN MARGIN - $T_{avg} \leq 200^\circ\text{F}.$ "

The RCS boron concentration satisfies Criterion 2 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO The LCO requires that a minimum boron concentration be maintained in the RCS, the refueling canal, and the refueling cavity while in MODE 6. The boron concentration limit specified in the COLR ensures that a core K_{off} of ≤ 0.95 is maintained during fuel-handling operations. Violation of the LCO could lead to an inadvertent criticality during MODE 6.

APPLICABILITY This LCO is applicable in MODE 6 to ensure that the fuel in the reactor vessel will remain subcritical. The required boron concentration ensures a $K_{\text{off}} \leq 0.95$. Above MODE 6, LCO 3.1.1 and LCO 3.1.2, "SHUTDOWN MARGIN," ensure that an adequate amount of negative reactivity is available to shut down the reactor and maintain it subcritical.

ACTIONS

A.1 and A.2

Continuation of CORE ALTERATIONS or positive reactivity additions (including actions to reduce boron concentration) is contingent upon maintaining the plant in compliance with the LCO. If the boron concentration of any coolant volume in the RCS, the refueling canal, or the refueling cavity is less than its limit, all operations involving CORE ALTERATIONS or positive reactivity additions must be suspended immediately.

Suspension of CORE ALTERATIONS and positive reactivity additions shall not preclude moving a component to a safe position.

A.3

In addition to immediately suspending CORE ALTERATIONS or positive reactivity additions, boration to restore the concentration must be initiated immediately.

In determining the required combination of boration flow rate and concentration, no unique design basis event must be satisfied. The only requirement is to restore the boron concentration to its required value as soon as possible. In

(continued)

BASES

ACTIONS

A.3 (continued)

order to raise the boron concentration as soon as possible, the operator should begin boration with the best source available for plant conditions.

Once actions have been initiated, they must be continued until the boron concentration is restored. The restoration time depends on the amount of boron that must be injected to reach the required concentration.

SURVEILLANCE
REQUIREMENTS

SR 3.9.1.1

This SR ensures that the coolant boron concentration in the RCS, the refueling canal, and the refueling cavity is within the COLR limits. The boron concentration of the coolant in each volume is determined periodically by chemical analysis.

A minimum Frequency of once every 72 hours is a reasonable amount of time to verify the boron concentration of representative samples. The Frequency is based on operating experience, which has shown 72 hours to be adequate.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, Section VI, GDC 26, "Reactivity Control System Redundancy and Capability."
 2. Watts Bar FSAR, Section 15, "Accident Analysis."
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B 3.9 REFUELING OPERATIONS

B 3.9.2 Unborated Water Source Isolation Valves

BASES

BACKGROUND

During MODE 6 operations, all isolation valves for reactor makeup water sources containing unborated water that are connected to the Reactor Coolant System (RCS) must be closed to prevent unplanned boron dilution of the reactor coolant. The isolation valves must be secured in the closed position.

The Chemical and Volume Control System is capable of supplying borated and unborated water to the RCS through various flow paths. Since a positive reactivity addition made by reducing the boron concentration is inappropriate during MODE 6, isolation of all unborated water sources prevents an unplanned boron dilution.

APPLICABLE
SAFETY ANALYSES

The possibility of an inadvertent boron dilution event (Ref. 1) occurring during MODE 6 refueling operations is precluded by adherence to this LCO, which requires that potential dilution sources be isolated. Closing the required valves during refueling operations prevents the flow of unborated water to the filled portion of the RCS. The valves are used to isolate unborated water sources. These valves have the potential to indirectly allow dilution of the RCS boron concentration in MODE 6. By isolating unborated water sources, a safety analysis for an uncontrolled boron dilution accident in accordance with the Standard Review Plan (Ref. 2) is not required for MODE 6.

The RCS boron concentration satisfies Criterion 2 of the NRC Policy Statement.

LCO

This LCO requires that flow paths to the RCS from unborated water sources be isolated to prevent unplanned boron dilution during MODE 6 and, thus, avoid a reduction in SHUTDOWN MARGIN.

(continued)

BASES (continued)

APPLICABILITY In MODE 6, this LCO is applicable to prevent an inadvertent boron dilution event by ensuring isolation of all sources of unborated water to the RCS.

For all other MODES, the boron dilution accident was analyzed and was found to be capable of being mitigated.

ACTIONS The ACTIONS Table has been modified by a Note which allows separate Condition entry for each unborated water source isolation valve.

A.1

Continuation of CORE ALTERATIONS is contingent upon maintaining the unit in compliance with this LCO. With any valve used to isolate unborated water sources not secured in the closed position, all operations involving CORE ALTERATIONS must be suspended immediately. The Completion Time of "immediately" for performance of Required Action A.1, shall not preclude moving a component to a safe position.

Condition A has been modified by a Note to require that Required Action A.3 must be completed whenever Condition A is entered.

A.2

Preventing inadvertent dilution of the reactor coolant boron concentration is dependent on maintaining the unborated water isolation valves secured closed. Securing the valves in the closed position ensures that the valves cannot be inadvertently opened. The Completion Time of "immediately" requires an operator to initiate actions to close an open valve and secure the isolation valve in the closed position immediately. Once actions are initiated, they must be continued until the valves are secured in the closed position.

(continued)

BASES

ACTIONS
(continued)

A.3

Due to the potential of having diluted the boron concentration of the reactor coolant, SR 3.9.1.1 (verification of boron concentration) must be performed whenever Condition A is entered to demonstrate that the required boron concentration exists. The Completion Time of 4 hours is sufficient to obtain and analyze a reactor coolant sample for boron concentration.

SURVEILLANCE
REQUIREMENTS

SR 3.9.2.1

These valves are to be secured closed to isolate possible dilution paths. The likelihood of a significant reduction in the boron concentration during MODE 6 operations is remote due to the large mass of borated water in the refueling cavity and the fact that all unborated water sources are isolated, precluding a dilution. The boron concentration is checked every 72 hours during MODE 6 under SR 3.9.1.1. This surveillance demonstrates that the valves are closed through a system walkdown. The 31-day Frequency is based on engineering judgment and is considered reasonable in view of other administrative controls that will ensure that the valve opening is an unlikely possibility.

REFERENCES

1. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."
 2. NUREG-0800, Standard Review Plan, Section 15.4.6, "Chemical and Volume Control System Malfunction that Results in a Decrease in Boron Concentration in the RCS."
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B 3.9 REFUELING OPERATIONS

B 3.9.3 Nuclear Instrumentation

BASES

BACKGROUND

The source range neutron flux monitors are used during refueling operations to monitor the core reactivity changes. The installed source range neutron flux monitors are part of the Neutron Monitoring System (NMS). These detectors are located external to the reactor vessel and detect neutrons leaking from the core.

The installed primary source range neutron flux monitors are fission chambers. The detectors monitor the neutron flux in counts per second. The instrument range covers six decades of neutron flux ($1E+6$ cps). The detectors also provide continuous visual indication in the control room and an audible alarm to alert operators to a possible dilution accident. The NMS is designed in accordance with the criteria presented in Reference 1.

APPLICABLE SAFETY ANALYSES

Two OPERABLE source range neutron flux monitors are required to provide a signal to alert the operator to unexpected changes in core reactivity such as with a boron dilution accident (Ref. 2) or an improperly loaded fuel assembly. The need for a safety analysis for an uncontrolled boron dilution accident is eliminated by isolating all unborated water sources as required by LCO 3.9.2.

The source range neutron flux monitors satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO requires that two source range neutron flux monitors must be OPERABLE to ensure that redundant monitoring capability is available to detect changes in core reactivity.

(continued)

BASES (continued)

APPLICABILITY In MODE 6, the source range neutron flux monitors must be OPERABLE to determine changes in core reactivity. There are no other direct means available to check core reactivity levels. In MODES 2, 3, 4, and 5, these same installed source range detectors and circuitry are also required to be OPERABLE by LCO 3.3.1, "Reactor Trip System Instrumentation."

ACTIONS A.1 and A.2

With only one source range neutron flux monitor OPERABLE, redundancy has been lost. Since these instruments are the only direct means of monitoring core reactivity conditions, CORE ALTERATIONS and positive reactivity additions that would reduce the boron concentration to less than the limit specified in the COLR must be suspended immediately. Performance of Required Action A.1 shall not preclude moving a component to a safe position.

Required Action A.2 does not preclude positive reactivity additions that cannot reduce the boron concentration to less than the limit specified in the COLR. The addition of water with a boron concentration greater than that required to maintain the reactor shutdown within the requirements of the COLR, but less than the RCS, is permitted. Positive reactivity additions, such as small volume chemical additions and normal cooldowns are also permitted provided the boron concentration in the COLR is maintained.

B.1

With no source range neutron flux monitor OPERABLE, actions to restore a monitor to OPERABLE status shall be initiated immediately. Once initiated, actions shall be continued until a source range neutron flux monitor is restored to OPERABLE status.

(continued)

BASES

ACTIONS
(continued)

B.2

With no source range neutron flux monitor OPERABLE, there is no direct means of detecting changes in core reactivity. However, since CORE ALTERATIONS and positive reactivity additions are not to be made, the core reactivity condition is stabilized until the source range neutron flux monitors are OPERABLE. This stabilized condition is determined by performing SR 3.9.1.1 to ensure that the required boron concentration exists.

The Completion Time of 4 hours is sufficient to obtain and analyze a reactor coolant sample for boron concentration. The Frequency of once per 12 hours ensures that unplanned changes in boron concentration would be identified. The 12-hour Frequency is reasonable, considering the low probability of a change in core reactivity during this time period.

SURVEILLANCE
REQUIREMENTS

SR 3.9.3.1

SR 3.9.3.1 is the performance of a CHANNEL CHECK, which is a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that the two indication channels should be consistent with core conditions. Changes in fuel loading and core geometry can result in significant differences between source range channels, but each channel should be consistent with its local conditions.

The Frequency of 12 hours is consistent with the CHANNEL CHECK Frequency specified similarly for the same instruments in LCO 3.3.1, "Reactor Trip System Instrumentation."

SR 3.9.3.2

SR 3.9.3.2 is the performance of a CHANNEL CALIBRATION every 18 months. This SR is modified by a Note stating that neutron detectors are excluded from the CHANNEL CALIBRATION. The CHANNEL CALIBRATION for the source range neutron flux monitor consists of verifying equipment outputs to known electrical inputs.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.9.3.2 (continued)

The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage. Operating experience has shown that these components usually pass the Surveillance when performed on the 18-month Frequency.

REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants:"
 - GDC 13, "Instrumentation and Control,"
 - GDC 26, "Reactivity Control System Redundancy and Capability,"
 - GDC 28, "Reactivity Limits," and
 - GDC 29, "Protection Against Anticipated Operational Occurrences."
 2. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."
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B 3.9 REFUELING OPERATIONS

B 3.9.4 Containment Penetrations

BASES

BACKGROUND

During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, a release of fission-product radioactivity within containment will be restricted from escaping to the environment when the LCO requirements are met. In MODES 1, 2, 3, and 4, this is accomplished by maintaining containment OPERABLE as described in LCO 3.6.1, "Containment." In MODE 6, the potential for containment pressurization as a result of an accident is not likely; therefore, requirements to isolate the containment from the outside atmosphere can be less stringent. The LCO requirements are referred to as "containment closure" rather than "containment OPERABILITY." Containment closure means that all potential escape paths are closed or capable of being closed. Since there is no potential for containment pressurization, the Appendix J leakage criteria and tests are not required.

The containment serves to contain fission-product radioactivity that may be released from the reactor core following an accident, such that offsite radiation exposures are maintained well within the requirements of 10 CFR 100. Additionally, the containment provides radiation shielding from the fission products that may be present in the containment atmosphere following accident conditions.

The containment equipment hatch, which is part of the containment pressure boundary, provides a means for moving large equipment and components into and out of containment. During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, the equipment hatch must be held in place by at least four bolts. Good engineering practice dictates that the bolts required by this LCO be approximately equally spaced.

The containment air locks, which are also part of the containment pressure boundary, provide a means for personnel access during MODES 1, 2, 3, and 4 unit operation in accordance with LCO 3.6.2, "Containment Air Locks." Each air lock has a door at both ends. The doors are normally interlocked to prevent simultaneous opening when containment

(continued)

BASES

BACKGROUND
(continued)

OPERABILITY is required. During periods of unit shutdown when containment closure is not required, the door interlock mechanism may be disabled, allowing both doors of an air lock to remain open for extended periods when frequent containment entry is necessary. During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, containment closure is required; therefore, the door interlock mechanism may remain disabled, but one air lock door must always remain closed.

The requirements for containment penetration closure ensure that a release of fission-product radioactivity within containment will be restricted from escaping to the environment. The closure restrictions are sufficient to restrict fission-product radioactivity release from containment due to a fuel-handling accident during refueling.

The Reactor Building Purge Ventilation System operates to supply outside air into the containment for ventilation and cooling or heating, to equalize internal and external pressures, and to reduce the concentration of noble gases within containment prior to and during personnel access. The supply and exhaust lines each contain two isolation valves. Because of their large size, the 24-inch containment lower compartment purge valves are physically restricted to ≤ 50 degrees open. The Reactor Building Purge and Ventilation System valves can be opened in MODES 5 and 6, but are closed automatically by the Engineered Safety Features Actuation System (ESFAS). In MODE 6, large air exchanges are necessary to conduct refueling operations. The normal 24-inch purge system is used for this purpose. The ventilation system must be either isolated or capable of being automatically isolated upon detection of high radiation levels within containment.

The other containment penetrations that provide direct access from containment atmosphere to outside atmosphere must be isolated on at least one side. Isolation may be achieved by an OPERABLE automatic isolation valve, or by a manual isolation valve, blind flange, or equivalent. Equivalent isolation methods must be NRC approved and may include use of a material that can provide a temporary, atmospheric pressure, ventilation barrier for the other containment penetrations during fuel movements (Ref. 1).

(continued)

BASES

APPLICABLE
SAFETY ANALYSES

During CORE ALTERATIONS or movement of irradiated fuel assemblies within containment, the most severe radiological consequences result from a fuel-handling accident. The fuel-handling accident is a postulated event that involves damage to irradiated fuel (Ref. 2). Fuel-handling accidents, analyzed in Reference 3, include dropping a single irradiated fuel assembly and handling tool or a heavy object onto other irradiated fuel assemblies. The requirements of LCO 3.9.7, "Refueling Cavity Water Level," and the minimum decay time of 100 hours prior to CORE ALTERATIONS ensure that the release of fission-product radioactivity, subsequent to a fuel-handling accident, results in doses that are well within the guideline values specified in 10 CFR 100. Standard Review Plan Section 15.7.4, Rev. 1 (Ref. 3), defines "well within" 10 CFR 100 to be 25% or less of the 10 CFR 100 values. The acceptance limits for offsite radiation exposure will be 25% of 10 CFR 100 values or the NRC staff-approved licensing basis (e.g., a specified fraction of 10 CFR 100 limits).

Containment penetrations satisfy Criterion 3 of the NRC Policy Statement.

LCO

This LCO limits the consequences of a fuel-handling accident in containment by limiting the potential escape paths for fission-product radioactivity released within containment. The LCO requires any penetration providing direct access from the containment atmosphere to the outside atmosphere to be closed except for the OPERABLE reactor building purge and ventilation system penetrations. For the OPERABLE reactor building purge and ventilation system penetrations, this LCO ensures that these penetrations are isolable by the Containment Ventilation Isolation System. The OPERABILITY requirements for this LCO ensure that the automatic purge and exhaust valve closure times specified in the FSAR can be achieved and, therefore, meet the assumptions used in the safety analysis to ensure that releases through the valves are terminated, such that radiological doses are within the acceptance limit.

(continued)

BASES

APPLICABILITY The containment penetration requirements are applicable during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment because this is when there is a potential for a fuel-handling accident. In MODES 1, 2, 3, and 4, containment penetration requirements are addressed by LCO 3.6.1, "Containment." In MODES 5 and 6, when CORE ALTERATIONS or movement of irradiated fuel assemblies within containment are not being conducted, the potential for a fuel-handling accident does not exist. Therefore, under these conditions no requirements are placed on containment penetration status.

ACTIONS A.1 and A.2

If the containment equipment hatch, air locks, or any containment penetration that provides direct access from the containment atmosphere to the outside atmosphere is not in the required status, including the Containment Ventilation Isolation System not capable of automatic actuation when the purge and exhaust valves are open, the plant must be placed in a condition where the isolation function is not needed. This is accomplished by immediately suspending CORE ALTERATIONS and movement of irradiated fuel assemblies within containment. Performance of these actions shall not preclude moving a component to a safe position.

SURVEILLANCE REQUIREMENTS SR 3.9.4.1

This surveillance demonstrates that each of the containment penetrations required to be in its closed position is in that position. The surveillance on the open purge and exhaust valves will demonstrate that the valves are not blocked from closing. Also the surveillance will demonstrate that each valve operator has motive power, which will ensure that each valve is capable of being closed by an OPERABLE automatic containment ventilation isolation signal.

The surveillance is performed every 7 days during CORE ALTERATIONS or movement of irradiated fuel assemblies within containment. The surveillance interval is selected to be

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.9.4.1 (continued)

commensurate with the normal duration of time to complete fuel-handling operations. As such, this surveillance ensures that a postulated fuel-handling accident that releases fission-product radioactivity within the containment will not result in a release of fission-product radioactivity to the environment.

SR 3.9.4.2

This surveillance demonstrates that each containment purge and exhaust valve actuates to its isolation position on manual initiation or on an actual or simulated high radiation signal. The 18-month Frequency maintains consistency with other similar ESFAS instrumentation and valve testing requirements. LCO 3.3.6, "Containment Vent Isolation Instrumentation," requires a CHANNEL CHECK every 12 hours and a CHANNEL OPERATIONAL TEST every 31 days to ensure the channel OPERABILITY during refueling operations. Every 18 months a CHANNEL CALIBRATION is performed. The system actuation response time is demonstrated every 18 months, during refueling, on a STAGGERED TEST BASIS. SR 3.6.3.5 demonstrates that the isolation time of each valve is in accordance with the Inservice Testing Program requirements. These surveillances performed during MODE 6 will ensure that the valves are capable of closing after a postulated fuel-handling accident to limit a release of fission-product radioactivity from the containment.

REFERENCES

1. "Use of Silicone Sealant to Maintain Containment Integrity - ITS," GPU Nuclear Safety Evaluation SE-0002000-001, Rev. 0, May 20, 1988.
 2. Watts Bar FSAR, Section 15.4.5, "Design Basis Fuel Handling Accidents."
 3. NUREG-0800, Standard Review Plan, Section 15.7.4, "Radiological Consequences of Fuel Handling Accidents," Rev. 1, July 1981.
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B 3.9 REFUELING OPERATIONS

B 3.9.5 Residual Heat Removal (RHR) and Coolant Circulation—High Water Level

BASES

BACKGROUND

The purposes of the RHR System in MuDE 6 are to remove decay heat and sensible heat from the Reactor Coolant System (RCS), as required by GDC 34, to provide mixing of borated coolant, and to prevent boron stratification (Ref. 1). Heat is removed from the RCS by circulating reactor coolant through the RHR heat exchanger(s); where the heat is transferred to the Component Cooling Water System. The coolant is then returned to the RCS via the RCS cold leg(s). Operation of the RHR System for normal cooldown or decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of reactor coolant through the RHR heat exchanger(s) and the bypass. Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.

APPLICABLE SAFETY ANALYSES

If the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to a loss of coolant in the reactor vessel. Additionally, boiling of the reactor coolant could lead to a reduction in boron concentration in the coolant due to boron plating out on components near the areas of the boiling activity. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant would eventually challenge the integrity of the fuel cladding which is a fission-product barrier. One train of the RHR System is required to be operational in MODE 6, with the water level ≥ 23 ft above the top of the reactor vessel flange, to prevent this challenge. The LCO does permit de-energizing the RHR pump for short durations, under the condition that the boron concentration is not diluted. This conditional de-energizing of the RHR pump does not result in a challenge to the fission-product barrier.

Although the RHR System does not meet a specific criterion of the NRC Policy Statement, it was identified in the NRC Policy Statement as an important contributor to risk

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

reduction. Therefore, the RHR System is retained as a Specification.

LCO

Only one RHR loop is required for decay heat removal in MODE 6, with the water level \geq 23 ft above the top of the reactor vessel flange. Only one RHR loop is required to be OPERABLE because the volume of water above the reactor vessel flange provides backup decay heat removal capability. At least one RHR loop must be OPERABLE and in operation to provide:

- a. Removal of decay heat;
- b. Mixing of borated coolant to minimize the possibility of criticality; and
- c. Indication of reactor coolant temperature.

An OPERABLE RHR loop includes an RHR pump, a heat exchanger, valves, piping, instruments, and controls to ensure an OPERABLE flow path and to determine the low-end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs.

The LCO is modified by a Note that allows the required operating RHR loop to be removed from service for up to 1 hour per 8-hour period. This permits operations such as core mapping or alterations in the vicinity of the reactor vessel hot-leg nozzles, and RCS-to-RHR isolation valve testing. During this 1-hour period, decay heat is removed by natural convection to the large mass of water in the refueling cavity.

APPLICABILITY

One RHR loop must be OPERABLE and in operation in MODE 6, with the water level \geq 23 ft above the top of the reactor vessel flange, to provide decay heat removal. The 23-ft water level was selected because it corresponds to the 23-ft requirement established for fuel movement in LCO 3.9.7, "Refueling Cavity Water Level." Requirements for the RHR

(continued)

BASES

APPLICABILITY
(continued)

System in other MODES are covered by LCOs in Section 3.4, "Reactor Coolant System," and in Section 3.5, "Emergency Core Cooling Systems." RHR loop requirements in MODE 6, with the water level < 23 ft, are located in LCO 3.9.6, "Residual Heat Removal and Coolant Circulation—Low Water Level."

ACTIONS

RHR loop requirements are met by having one RHR loop OPERABLE and in operation, except as permitted in the Note to the LCO.

A.1

If RHR loop requirements are not met, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Reduced boron concentrations cannot occur by the addition of water with a lower boron concentration than that contained in the RCS because all of unborated water sources are isolated.

A.2

If RHR loop requirements are not met, actions shall be taken immediately to suspend loading irradiated fuel assemblies in the core. With no forced circulation cooling, decay heat removal from the core occurs by natural convection to the heat sink provided by the water above the core. A minimum refueling water level of 23 ft above the reactor vessel flange provides an adequate available heat sink. Suspending any operation that would increase decay heat load, such as loading a fuel assembly, is a prudent action under this condition.

A.3

If RHR loop requirements are not met, actions shall be initiated and continued in order to satisfy RHR loop requirements. With the unit in MODE 6 and the refueling water level \geq 23 ft above the top of the reactor vessel flange, corrective actions shall be initiated.

(continued)

BASES

ACTIONS
(continued)

A.4

If RHR loop requirements are not met, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed within 4 hours. With the RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures dose limits are not exceeded.

The Completion Time of 4 hours is reasonable, based on the low probability of the coolant boiling in that time.

SURVEILLANCE
REQUIREMENTS

SR 3.9.5.1

This surveillance demonstrates that the RHR loop is in operation and circulating reactor coolant. The flow rate is determined by the flow rate necessary to provide sufficient decay heat removal capability and to prevent thermal and boron stratification in the core. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator in the control room for monitoring the RHR System.

REFERENCES

1. Watts Bar FSAR, Section 5.5.7, "Residual Heat Removal System."
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B 3.9 REFUELING OPERATIONS

B 3.9.6 Residual Heat Removal (RHR) and Coolant Circulation—Low Water Level

BASES

BACKGROUND

The purposes of the RHR System in MODE 6 are to remove decay heat and sensible heat from the Reactor Coolant System (RCS), as required by GDC 34, to provide mixing of borated coolant, and to prevent boron stratification (Ref. 1). Heat is removed from the RCS by circulating reactor coolant through the RHR heat exchangers where the heat is transferred to the Component Cooling Water System. The coolant is then returned to the RCS via the RCS cold leg(s). Operation of the RHR System for normal cooldown decay heat removal is manually accomplished from the control room. The heat removal rate is adjusted by controlling the flow of reactor coolant through the RHR heat exchanger(s) and the bypass lines. Mixing of the reactor coolant is maintained by this continuous circulation of reactor coolant through the RHR System.

APPLICABLE SAFETY ANALYSES

If the reactor coolant temperature is not maintained below 200°F, boiling of the reactor coolant could result. This could lead to a loss of coolant in the reactor vessel. Additionally, boiling of the reactor coolant could lead to a reduction in boron concentration in the coolant due to the boron plating out on components near the areas of the boiling activity. The loss of reactor coolant and the reduction of boron concentration in the reactor coolant will eventually challenge the integrity of the fuel cladding, which is a fission-product barrier. Two trains of the RHR System are required to be OPERABLE, and one train in operation, in order to prevent this challenge.

Although the RHR System does not meet a specific criterion of the NRC Policy Statement, it was identified in the NRC Policy Statement as an important contributor to risk reduction. Therefore, the RHR system is retained as a Specification.

(continued)

BASES (continued)

LCO In MODE 6, with the water level < 23 ft above the top of the reactor vessel flange, both RHR loops must be OPERABLE. Additionally, one loop of RHR must be in operation in order to provide:

- a. Removal of decay heat;
- b. Mixing of borated coolant to minimize the possibility of criticality; and
- c. Indication of reactor coolant temperature.

An OPERABLE RHR loop consists of an RHR pump, a heat exchanger, valves, piping, instruments and controls to ensure an OPERABLE flow path and to determine the low-end temperature. The flow path starts in one of the RCS hot legs and is returned to the RCS cold legs.

The LCO is modified by a note that allows only one RHR loop to be OPERABLE and in operation prior to the initial criticality of the unit. The note also allows the loop to be removed from service for up to 1 hour per 8-hour period provided no operations are permitted that would cause a dilution of RCS boron concentration. This allowance is provided only for the initial criticality since there is no decay heat present.

APPLICABILITY Two RHR loops are required to be OPERABLE, and one RHR loop must be in operation in MODE 6, with the water level < 23 ft above the top of the reactor vessel flange, to provide decay heat removal. Requirements for the RHR System in other MODES are covered by LCOs in Section 3.4, "Reactor Coolant System," and in Section 3.5, "Emergency Core Cooling Systems." RHR loop requirements in MODE 6, with the water level \geq 23 ft, are located in LCO 3.9.5, "Residual Heat Removal and Coolant Circulation - High Water Level."

ACTIONS A.1 and A.2

If fewer than the required number of RHR loops are OPERABLE, actions shall be immediately initiated and continued until

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

the RHR loop is restored to OPERABLE status and to operation, or until ≥ 23 ft of water level is established above the reactor vessel flange. When the water level is ≥ 23 ft above the reactor vessel flange, the Applicability changes to that of LCO 3.9.5, "Residual Heat Removal and Coolant Circulation - High Water Level," and only one RHR loop is required to be OPERABLE and in operation. An immediate Completion Time is necessary for an operator to initiate corrective actions.

B.1

If no RHR loop is in operation, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Reduced boron concentrations cannot occur by the addition of water with a lower boron concentration than that contained in the RCS because all of the unborated water sources are isolated.

B.2

If no RHR loop is in operation, actions shall be initiated immediately and continued to restore one RHR loop to operation. Since the unit is in Conditions A and B concurrently, the restoration of two OPERABLE RHR loops and one operating RHR loop should be accomplished expeditiously.

B.3

If no RHR loop is in operation, all containment penetrations providing direct access from the containment atmosphere to the outside atmosphere must be closed within 4 hours. With the RHR loop requirements not met, the potential exists for the coolant to boil and release radioactive gas to the containment atmosphere. Closing containment penetrations that are open to the outside atmosphere ensures that dose limits are not exceeded.

The Completion Time of 4 hours is reasonable, based on the low probability of the coolant boiling in that time.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.9.6.1

This surveillance demonstrates that one RHR loop is in operation and circulating reactor coolant. The flow rate is determined by the flow rate necessary to provide sufficient decay heat removal capability, and to prevent thermal and boron stratification in the core. In addition, during operation of the RHR loop, with the water level in the vicinity of the reactor vessel nozzles, the RHR pump suction requirements must be met. The Frequency of 12 hours is sufficient, considering the flow, temperature, pump control, and alarm indications available to the operator for monitoring the RHR System in the control room.

REFERENCES

1. Watts Bar FSAR, Section 5.5.7, "Residual Heat Removal System."
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B 3.9 REFUELING OPERATIONS

B 3.9.7 Refueling Cavity Water Level

BASES

BACKGROUND

The movement of irradiated fuel assemblies or performance of CORE ALTERATIONS within containment requires a minimum water level of 23 ft above the top of the reactor vessel flange. During refueling, this maintains sufficient water level in the containment, refueling canal, fuel transfer canal, refueling cavity, and spent fuel pool. Sufficient water is necessary to retain iodine fission-product activity in the water in the event of a fuel-handling accident (Refs. 1 and 2). Sufficient iodine activity would be retained to limit offsite doses from the accident to < 25% of 10 CFR 100 limits, as provided by the guidance of Reference 3.

APPLICABLE
SAFETY ANALYSES

During CORE ALTERATIONS and during movement of irradiated fuel assemblies, the water level in the refueling canal and the refueling cavity is an initial condition design parameter in the analysis of a fuel-handling accident in containment, as postulated by Regulatory Guide 1.25 (Ref. 1). A minimum water level of 23 ft (Regulatory Position C.1.c of Ref. 1) allows a decontamination factor of 100 (Regulatory Position C.1.g of Ref. 1) to be used in the accident analysis for iodine. This relates to the assumption that 99% of the total iodine released from the pellet to cladding gap of all the dropped fuel-assembly rods is retained by the refueling cavity water. The fuel pellet to cladding gap is assumed to contain 10% of the total fuel-rod iodine inventory (Ref. 1).

The fuel-handling accident analysis inside containment is described in Reference 2. With a minimum water level of 23 ft and a minimum decay time of 100 hours prior to fuel handling, the analysis and test programs demonstrate that the iodine release due to a postulated fuel-handling accident is adequately captured by the water and offsite doses are maintained within allowable limits (Ref. 4 and 5).

Refueling cavity water level satisfies Criterion 2 of the NRC Policy Statement.

(continued)

BASES (continued)

LCO A minimum refueling cavity water level of 23 ft above the reactor vessel flange is required to ensure that the radiological consequences of a postulated fuel-handling accident inside containment are within acceptable limits, as provided by the guidance of Reference 3.

A Note has been added which states that the LCO is not applicable for the initial core loading. In this specific case, the fuel assemblies and core components are not irradiated and the postulated fuel handling accident is not credible. The water level in the initial fuel loading will be maintained just below the reactor vessel flange to allow the refueling cavity and spent fuel pool to remain dry.

APPLICABILITY LCO 3.9.7 "Refueling Cavity Water Level," is applicable during CORE ALTERATIONS and when moving irradiated fuel assemblies within containment. The LCO minimizes the possibility of a fuel-handling accident in containment that is beyond the assumptions of the safety analysis. If irradiated fuel assemblies are not present in containment, there can be no significant radioactivity release as a result of a postulated fuel-handling accident. Requirements for fuel-handling accidents in the spent-fuel pool are covered by LCO 3.7.13, "Fuel Storage Pool Water Level."

ACTIONS

A.1 and A.2

With a water level of < 23 ft above the top of the reactor vessel flange, all operations involving CORE ALTERATIONS or movement of irradiated fuel assemblies within the containment shall be suspended immediately to ensure that a fuel-handling accident cannot occur.

The suspension of CORE ALTERATIONS and fuel movement shall not preclude moving a component to a safe position.

A.3

In addition to immediately suspending CORE ALTERATIONS or movement of irradiated fuel, actions to restore refueling cavity water level must be initiated immediately.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.9.7.1

Verification of a minimum water level of 23 ft above the top of the reactor vessel flange ensures that the design basis for the analysis of the postulated fuel-handling accident during refueling operations is met. Water at the required level above the top of the reactor vessel flange limits the consequences of damaged fuel rods that are postulated to result from a fuel-handling accident inside containment (Ref. 2).

The Frequency of 24 hours is based on engineering judgment and is considered adequate in view of the large volume of water and the normal procedural controls of valve positions, which make significant unplanned level changes unlikely.

REFERENCES

1. Regulatory Guide 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel-Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors," U.S. Nuclear Regulatory Commission, March 23, 1972.
 2. Watts Bar FSAR, Section 15.4.5 "Fuel Handling Accident."
 3. NUREG-0800, "Standard Review Plan," Section 15.7.4, "Radiological Consequences of Fuel-Handling Accidents," U.S. Nuclear Regulatory Commission.
 4. Title 10, Code of Federal Regulations, Part 20.101(a), "Radiation Dose Standards for Individuals in Restricted Areas."
 5. Malinowski, D. D., Bell, M. J., Duhn, E., and Locante, J., WCAP-7828, Radiological Consequences of a Fuel Handling Accident, December, 1971.
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B 3.9 REFUELING OPERATIONS

B 3.9.8 Reactor Building Purge Air Cleanup Units

BASES

BACKGROUND

The Reactor Building Purge Air Cleanup Units are an engineered safety feature of the Reactor Building Purge Ventilation System which is a non-safety feature ventilation system. The air cleanup units contain prefilters, HEPA filters, 2-inch-thick charcoal adsorbers, housings and ductwork. Anytime fuel handling operations are being carried on inside the primary containment, either the containment ventilation will be isolated or the Reactor Building Purge air cleanup units will be OPERABLE (Ref. 1).

The Reactor Building Purge Ventilation System provides mechanical ventilation of the primary containment, the instrument room located within the containment, and the annulus. The system is designed to supply fresh air for breathing and contamination control to allow personnel access for maintenance and refueling operations. The exhaust air is filtered by the Reactor Building Purge Air Cleanup Units to limit the release of radioactivity to the environment.

The containment upper and lower compartments are purged with fresh air by the Reactor Building Purge Ventilation System before occupancy. The annulus can be purged with fresh air during reactor shutdown or at times when the annulus vacuum control system of the Emergency Gas Treatment System is shut down. The instrument room is purged with fresh air during operation of the Reactor Building Purge Ventilation System or is separately purged by the Instrument Room Purge Subsystem. All purge ventilation functions are non-safety related.

The Reactor Building Purge Ventilation System is sized to provide adequate ventilation for personnel to perform work inside the primary containment and the annulus during all normal operations. In the event of a fuel handling accident, the Reactor Building Purge Ventilation System is isolated. The Reactor Building Purge Air Cleanup Units are always available as passive inline components to perform their function immediately after a fuel handling accident to

(continued)

BASES

BACKGROUND
(continued)

process activity contained in exhaust air before it reaches the outside environment.

The Primary containment exhaust is monitored by a radiation detector which provides automatic containment purge ventilation system isolation upon detecting the setpoint radioactivity in the exhaust air stream. The containment purge ventilation isolation valves will be automatically closed upon the actuation of a Containment Vent Isolation signal whenever the primary containment is being purged during normal operation or upon manual actuation from the Main Control Room (Ref. 2). Requirements for Containment Vent Isolation Instrumentation are covered by LCO 3.3.6.

APPLICABLE
SAFETY ANALYSES

The Reactor Building Purge Ventilation System air cleanup units ensure that the release of radioactivity to the environment is limited by cleaning up containment exhaust during a fuel handling accident before the containment purge exhaust valves are isolated. Reactor Building Purge Ventilation System filter efficiency is one of the inputs for the analysis of the environmental consequences of a fuel handling accident. Containment isolation can only result in smaller releases of radioactivity to the environment (Ref. 1). The Containment Vent Isolation System ensures that the containment vent and purge penetrations will be automatically isolated upon detection of high radiation levels within the containment (Ref. 2). Containment Vent Isolation Instrumentation is addressed by LCO 3.3.6.

The Reactor Building Purge Air Cleanup Units satisfy Criterion 3 of the NRC Policy Statement.

LCO

The safety function of the Reactor Building Purge Air Cleanup Unit is related to the initial control of offsite radiation exposures resulting from a fuel handling accident inside containment. During a fuel handling accident inside containment, the Reactor Building Purge Air Cleanup Unit provides a filtered path for cleaning up any air leaving the containment until the containment ventilation is isolated.

(continued)

BASES (continued)

APPLICABILITY An initial assumption in the analysis of a fuel handling accident inside containment is that the accident occurs while irradiated fuel is being handled or CORE ALTERATIONS are being made. Therefore, LCO 3.9.8 is applicable only at these times.

ACTIONS

A.1 and A.2

If one Reactor Building Purge Air Cleanup Unit is inoperable, that air cleanup unit must be isolated. This places the system in the required accident configuration, thus allowing refueling to continue after verifying the remaining air cleanup unit is aligned and OPERABLE.

The immediate Completion Time is consistent with the required times for actions to be performed without delay and in a controlled manner.

B.1 and B.2

With two Reactor Building Purge Air Cleanup Units inoperable, both CORE ALTERATIONS and movement of irradiated fuel assemblies within containment must be suspended. This precludes the possibility of a fuel handling accident in containment with both Reactor Building Purge Air Cleanup Units inoperable. Performance of these actions shall not preclude moving a component to a safe position.

The immediate Completion Time is consistent with the required times for actions to be performed without delay and in a controlled manner.

SURVEILLANCE
REQUIREMENTS

SR 3.9.8.1

The Ventilation Filter Testing Program (VFTP) encompasses the Reactor Building Purge Air Cleanup Unit filter tests in accordance with Regulatory Guide 1.52 (Ref. 3). The VFTP includes testing the performance of the HEPA filter, charcoal adsorber efficiency, minimum flow rate, and the physical properties of the activated charcoal. Specific test Frequencies and additional information are discussed in detail in the VFTP.

(continued)

BASES (continued)

REFERENCES

1. Watts Bar FSAR, Section 15.5.6, "Environmental Consequences of a Postulated Fuel Handling Accident."
 2. Watts Bar FSAR, Section 9.4.6, "Reactor Building Purge Ventilating System ."
 3. Regulatory Guide 1.52 (Rev. 02), "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."
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ENCLOSURE 4

MARKUP OF NUREG-1431 (DRAFT) TO REFLECT WBN SPECIFIC CHANGES

1.0 USE AND APPLICATION

1.1 Definitions

-----NOTE-----

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

<u>Term</u>	<u>Definition</u>
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
ACTUATION LOGIC TEST	An ACTUATION LOGIC TEST shall be the application of various simulated input combinations in conjunction with each possible interlock logic state and the verification of the required logic output. The ACTUATION LOGIC TEST, as a minimum, shall include a continuity check of output devices. <i>(or actual) (A)</i>
ANALOG CHANNEL OPERATIONAL TEST (ACOT)	An ACOT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify the OPERABILITY of required alarm, interlock, and trip functions. The ACOT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints so that the setpoints are within the required range and accuracy. <i>delete space (A) display</i>
AXIAL FLUX DIFFERENCE (AFD)	AFD shall be the difference in normalized flux signals between the top and bottom halves of a two-section excore neutron detector. <i>top bottom</i>
CHANNEL CALIBRATION	A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel so that it responds within the required range and accuracy to known input. The CHANNEL CALIBRATION shall encompass the entire channel, including the required sensor, alarm, interlock, display, and trip functions. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors. <i>(3)</i>

(continued)

CHANNEL CALIBRATION
(continued)

shall consist of an in place cross calibration of the sensing elements and normal calibration of the remaining adjustable devices in the channel. Whenever a sensing element is replaced, the next required in place cross calibration consists of comparing the other sensing elements with the recently installed sensing element. The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping calibrations or total channel steps so that the entire channel is calibrated.

CHANNEL CHECK

A CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.

CORE ALTERATION

CORE ALTERATION shall be the movement of any fuel, sources, reactivity control components, or other components affecting reactivity within the reactor vessel with the vessel head removed and fuel in the vessel. Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.

CORE OPERATING LIMITS
REPORT (COLR)

The COLR is the unit-specific document that provides ~~core operating~~ limits for the current reload cycle. These cycle-specific ~~core operating~~ limits shall be determined for each reload cycle in accordance with Specification 5.9.1.6. Plant operation within these ~~core operating~~ limits is addressed in individual Specifications.

cycle specific parameters

4 (A)

DOSE EQUIVALENT I-131

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844,

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(continued)

DOSE EQUIVALENT I-131
(continued)

~~AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites" [or those listed in Table E-7 of Regulatory Guide 1.109, Rev. 1, NRC, 1977].~~

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\bar{E} - AVERAGE
DISINTEGRATION ENERGY

\bar{E} shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives > [15] minutes, making up at least 95% of the total non-iodine activity in the coolant.

ENGINEERED SAFETY
FEATURE (ESF) RESPONSE
TIME

^{delete space}
The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include diesel generator starting and sequence loading delays, where applicable. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured.

LEAKAGE

LEAKAGE shall be:

a. Identified LEAKAGE

1. LEAKAGE, such as that from pump seals or valve packing (except reactor coolant pump seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank; (A)
2. LEAKAGE into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of LEAKAGE detection systems or not to be pressure boundary LEAKAGE; or (A) (A)

(continued)

LEAKAGE
(continued)

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

↑
tube (A)

3.c Pressure Boundary LEAKAGE

(A)

LEAKAGE (except SG tube LEAKAGE) through a non-isolable fault in a RCS component body, pipe wall, or vessel wall;

3.b Unidentified LEAKAGE

All LEAKAGE (except reactor coolant pump seal water injection or leakoff) that is not identified LEAKAGE.

MASTER RELAY TEST

A MASTER RELAY TEST shall consist of energizing each master relay and verifying the OPERABILITY of each relay. The MASTER RELAY TEST shall include a continuity check of each associated slave relay.

MODE

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

OPERABLE - OPERABILITY

A system, subsystem, train, component, or device shall be OPERABLE when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified function(s) are also capable of performing their related support function(s).

(A) safety

PHYSICS TESTS

PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation. These tests are:

- a. Described in Chapter 14, Initial Test Program of the FSAR;

(continued)

PHYSICS TESTS
(continued)

- b. Authorized under the provisions of 10 CFR 50.59; or
- c. Otherwise approved by the Nuclear Regulatory Commission.

PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR) (A)

LCO 3.4.3, RCS Pressure and Temperature (P/T) Limits and LCO 3.4.12, Low Temperature Overpressure Protection (LTOP) System

The PTLR is the unit specific document that provides the reactor vessel pressure and temperature limits, including heatup and cooldown rates, for the current reactor vessel fluence period. These pressure and temperature limits shall be determined for each fluence period in accordance with Specification 5.9.1.7. Plant operation within these operating limits is addressed in individual Specifications.

QUADRANT POWER TILT RATIO (QPTR)

A,5 upper power
Quadrant power

QPTR shall be the ratio of the maximum upper Quadrant power ~~excure detector calibrated output~~ to the average ~~of the upper excure detector calibrated outputs,~~ or the ratio of the maximum lower ~~excure detector calibrated output,~~ to the average of the lower ~~power excure detector calibrated outputs,~~ whichever is greater. If one excure detector is inoperable, the remaining three detectors shall be used for computing the average.

RATED THERMAL POWER (RTP)

RTP shall be a total reactor core heat transfer rate to the reactor coolant of 2893 Mwt. (1)

REACTOR TRIP SYSTEM (RTS) RESPONSE TIME (A)

The RTS RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its RTS trip setpoint at the channel sensor until loss of stationary gripper coil voltage. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured.

SHUTDOWN MARGIN (SDM)

SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:

- a. All rod cluster control assemblies (RCCAs) are fully inserted except for the single RCCA of highest reactivity worth, which is assumed to be fully withdrawn; and

(continued)

SHUTDOWN MARGIN (SDM)
(continued)

b. In MODES 1 and 2, the fuel and moderator temperatures are changed to the (nominal zero power design level).

(A) With any RCCA not capable of being fully inserted, the reactivity worth of the RCCA must be accounted for in the determination of SDM.

SLAVE RELAY TEST

A SLAVE RELAY TEST shall consist of energizing each slave relay and verifying the OPERABILITY of each slave relay. The SLAVE RELAY TEST shall include, as a minimum, a continuity check of associated testable actuation devices.

STAGGERED TEST BASIS

A STAGGERED TEST BASIS shall consist of the testing of one of the systems, subsystems, channels, or other designated components during the interval specified by the Surveillance Frequency so that all systems, subsystems, channels, or other designated components are tested during n Surveillance Frequency intervals, where n is the total number of systems, subsystems, channels, or other designated components in the associated function.

THERMAL POWER

THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

TRIP ACTUATING DEVICE
OPERATIONAL TEST
(TADOT)

TADOT shall consist of operating the trip actuating device and verifying the OPERABILITY of required alarm, interlock, display, and trip functions. The TADOT shall include adjustment, as necessary, of the trip actuating device so that it actuates at the required setpoint within the required accuracy.

Table 1.1-1 (page 1 of 1)
MODES

MODE	TITLE	REACTIVITY CONDITION (K_{eff})	% RATED THERMAL POWER ^(a)	AVERAGE REACTOR COOLANT TEMPERATURE (°F)
1	Power Operation	≥ 0.99	> 5	NA
2	Startup	≥ 0.99	≤ 5	NA
3	Hot Standby	< 0.99	NA	NA
4	Hot Shutdown ^(b)	< 0.99	NA	≥ 350 $350 > T_{avg} > 200$
5	Cold Shutdown ^(b)	< 0.99	NA	≤ 200
6	Refueling ^{(b), (c)}	NA	NA	NA

(a) Excluding decay heat.

^C
~~(b) Fuel in the reactor vessel with one or more reactor vessel head closure bolts less than fully tensioned or with the head removed.~~

(b) All reactor vessel head closure bolts fully tensioned.

1.0 USE AND APPLICATION

1.2 Logical Connectors

PURPOSE

The purpose of this section is to explain the meaning of logical connectors.

Logical connectors are used in Technical Specifications (TS) to discriminate between, and yet connect, discrete Conditions, Required Actions, Completion Times, Surveillances, and Frequencies. The only logical connectors that appear in TS are AND and OR. The physical arrangement of these connectors constitutes logical conventions with specific meanings.

BACKGROUND

Several levels of logic may be used to state Required Actions. These levels are identified by the placement (or nesting) of the logical connectors and by the number assigned to each Required Action. The first level of logic is identified by the first digit of the number assigned to a Required Action and the placement of the logical connector in the first level of nesting (i.e., left justified with the number of the Required Action). The successive levels of logic are identified by additional digits of the Required Action number and by successive indentions of the logical connectors.

When logical connectors are used to state a Condition, usually only the first level of logic is used, and the logical connector is left justified with the Condition statement. In a few cases, successive levels of logic are used. This is identified solely by indenting the logical connector, since subparts of a Condition statement are not numbered separately.

When logical connectors are used to state a Completion Time, Surveillance, or Frequency, only the first level of logic is used, and the logical connector is left justified with the statement of the Completion Time, Surveillance, or Frequency.

(continued)

(continued)

EXAMPLES

The following examples illustrate the use of logical connectors.

EXAMPLE 1.2-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Verify . . . <u>AND</u> A.2 Restore . . .	

In this example the logical connector AND is used to ~~demonstrate~~ that when in Condition A, both Required Actions A.1 and A.2 must be completed.
indicate

(continued)

EXAMPLES
(continued)

EXAMPLE 1.2-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Trip . . . <u>OR</u> A.2.1 Verify . . . <u>AND</u> . A.2.2.1 Reduce . . . ⓐ ← <u>OR</u> A.2.2.2 Perform . . . <u>OR</u> A.3 Align . . .	

This example represents a more complicated use of logical connectors. Required Actions A.1, A.2, and A.3 are alternative choices, only one of which must be performed as indicated by the use of the logical connector OR and the left justified placement. Any one of these three Actions may be chosen. If A.2 is chosen, then both A.2.1 and A.2.2 must be performed as indicated by the logical connector AND. Required Action A.2.2 is met by performing A.2.2.1 or A.2.2.2. The indented position of the logical connector OR indicates that A.2.2.1 and A.2.2.2 are alternative choices, only one of which must be performed.

1.0 USE AND APPLICATION

1.3 Completion Times

PURPOSE The purpose of this section is to establish the Completion Time convention and to provide guidance for its use.

BACKGROUND LCOs specify minimum requirements for ensuring safe operation of the unit. The ACTIONS associated with an LCO state Conditions that typically describe the ways in which the requirements of the LCO can fail to be met. Specified with each stated Condition are Required Action(s) and Completion Times(s).

DESCRIPTION The Completion Time is the amount of time allowed for completing a Required Action. It is referenced to the time of discovery of a situation (e.g., inoperable equipment or variable not within limits) that requires entering an ACTIONS Condition unless otherwise specified, providing the unit is in a MODE or specified condition stated in the Applicability of the LCO. Required Actions must be completed prior to the expiration of the specified Completion Time. An ACTIONS Condition remains in effect and the Required Actions apply until the Condition no longer exists or the unit is not within the LCO Applicability.

If situations are discovered that require entry into more than one Condition at a time within a single LCO (multiple Conditions), the Required Actions for each Condition must be performed within the associated Completion Time. When in multiple Conditions, separate Completion Times are tracked for each Condition starting from the time of discovery of the situation that required entry into the Condition. (A)

Once a Condition has been entered, subsequent trains, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits, will not result in separate entry into the Condition. The ~~DESCRIPTION~~ Required Actions of the Condition continue to apply to each additional failure, with Completion Times based on initial entry into the Condition. (A) unless specifically stated

(2) (A)

(continued)

DESCRIPTION
(continued)

However, when a subsequent train, subsystem, component, or variable, expressed in the Condition, is discovered to be inoperable or not within limits, the Completion Time(s) may be extended. To apply this Completion Time extension two criteria must first be met. The subsequent inoperability:

- a. Must exist concurrent with the first inoperability;
and
- b. Must remain inoperable or not within limits after the first inoperability is resolved.

The total Completion Time allowed for completing a Required Action to address the subsequent inoperability shall be limited to the more restrictive of either:

- a. The stated Completion Time, as measured from the initial entry into the Condition, plus an additional 24 hours; or
- b. The stated Completion Time as measured from discovery of the subsequent inoperability.

The above Completion Time extensions do not apply to those Specifications that have exceptions that allow completely separate re-entry into the Condition (for each train, subsystem, component or variable expressed in the Condition) and separate tracking of Completion Times based on this re-entry. These exceptions are stated in individual Specifications.

The above Completion Time extension does not apply to a Completion Time with a modified "time zero." This modified "time zero" may be expressed as a repetitive time (i.e., "once per 8 hours," where the Completion Time is referenced from a previous completion of the Required Action versus the time of Condition entry) or as a time modified by the phrase "from discovery . . ." Example 1.3-3 illustrates one use of this type of Completion Time. The 10-day Completion Time specified for Condition A and B in Example 1.3-3 may not be extended.

(continued)

(continued)

EXAMPLES

The following examples illustrate the use of Completion Times with different types of Conditions and changing Conditions.

EXAMPLE 1.3-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

Condition B has two Required Actions. Each Required Action has its own separate Completion Time. Each Completion Time is referenced to the time that Condition B is entered.

The Required Actions of Condition B are to be in MODE 3 in 6 hours AND in MODE 5 in 36 hours. A total of 6 hours is allowed for reaching MODE 3 and a total of 36 hours (not 42 hours) is allowed for reaching MODE 5 from the time that Condition B was entered. If MODE 3 is reached in 3 hours, the time allowed for reaching MODE 5 is the next 33 hours because the total time allowed for reaching MODE 5 is 36 hours.

②-①

42 →

48

If Condition B is entered while in MODE 3, the time allowed for reaching MODE 5 is the next 36 hours.

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One pump inoperable.	A.1 Restore pump to OPERABLE status.	7 days
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

When a pump is declared inoperable, Condition A is entered. If the pump is not restored to OPERABLE status within 7 days, Condition B is entered and the Completion Time clocks for Required Actions B.1 and B.2 start. If the inoperable pump is restored to OPERABLE status after Condition B is entered, the Required Actions of Condition B may be terminated.

When a second pump is declared inoperable while the first pump is still inoperable, Condition A is not re-entered for the second pump. LCO 3.0.3 is entered, since the ACTIONS do not include a Condition for more than one inoperable pump. The Completion Time clock for Condition A does not stop after LCO 3.0.3 is entered, but continues to be tracked from the time Condition A was initially entered.

While in LCO 3.0.3, if one of the inoperable pumps is restored to OPERABLE status and the Completion Time for Condition A has not expired, LCO 3.0.3 may be exited and operation continued in accordance with Condition A.

While in LCO 3.0.3, if one of the inoperable pumps is restored to OPERABLE status and the Completion Time for Condition A has expired, LCO 3.0.3 may be exited and

(continued)

EXAMPLES

EXAMPLE 1.3-2 (continued)

operation continued in accordance with Condition B. The Completion Time for Condition B is tracked from the time the Condition A Completion Time expired.

On restoring one of the pumps to OPERABLE status the Condition A Completion Time is not reset, but continues from the time the first pump was declared inoperable. This Completion Time may be extended if the pump restored to OPERABLE status was the first inoperable pump. A 24-hour extension to the stated 7 days is allowed, provided this does not result in the second pump being inoperable for > 7 days. (which could only occur if the second pump became inoperable < 24 hours after the first pump).

(A)

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-3

ACTIONS

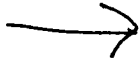
CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One Function X train inoperable.	A.1 Restore Function X train to OPERABLE status.	7 days <u>AND</u> 10 days from discovery of failure to meet the LCO
B. One Function Y train inoperable.	B.1 Restore Function Y train to OPERABLE status.	72 hours (A) 7 days <u>AND</u> 10 days from discovery of failure to meet the LCO
C. One Function X train inoperable. <u>AND</u> One Function Y train inoperable.	C.1 Restore Function X train to OPERABLE status. <u>OR</u> C.2 Restore Function Y train to OPERABLE status.	72 hours 72 hours

(continued)

EXAMPLES

EXAMPLES 1.3-3 (continued)

②-①



When one Function X train and one Function Y train are inoperable, Condition A and Condition B are concurrently applicable. The Completion Times for Condition A and Condition B are tracked separately for each train starting from the time each train was declared inoperable and the Condition was entered. A separate Completion Time is established for Condition C and tracked from the time the second train was declared inoperable (i.e., the time the situation described in Condition C was discovered).

If Required Action C.2 is completed within the specified Completion Time, Conditions B and C are exited. If the Completion Time for Required Action A.1 has not expired, operation may continue in accordance with Condition A. The remaining Completion Time in Condition A is measured from the time the affected train was declared inoperable (i.e., initial entry into Condition A).

The Completion Times of Conditions A and B are modified by a logical connector with a separate 10-day Completion Time measured from the time it was discovered the LCO was not met. In this example, without the separate Completion Time, it would be possible to alternate between Conditions A, B, and C in such a manner that operation could continue indefinitely without ever restoring systems to meet the LCO. The separate Completion Time modified by the phrase "from discovery of failure to meet the LCO" is designed to prevent indefinite continued operation while not meeting the LCO. This Completion Time allows for an exception to the normal "time zero" for beginning the Completion Time "clock". In this instance, the Completion Time "time zero" is specified as commencing at the time the LCO was initially not met, instead of at the time the associated Condition was entered.

(continued)

EXAMPLES
(continued)

EXAMPLE 1.3-4

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve(s) to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 4.	12 hours

A single Completion Time is used for any number of valves inoperable at the same time. The Completion Time associated with Condition A is based on the initial entry into Condition A and is not tracked on a per valve basis. Declaring subsequent valves inoperable, while Condition A is still in effect, does not trigger the tracking of separate Completion Times.

Once one of the valves has been restored to OPERABLE status, the Condition A Completion Time is not reset, but continues from the time the first valve was declared inoperable. The Completion Time may be extended if the valve restored to OPERABLE status was the first inoperable valve. The Condition A Completion Time may be extended for up to 4 hours provided this does not result in any subsequent valve being inoperable for > 4 hours.

If the Completion Time of 4 hours (including any extensions) expires while one or more valves are still inoperable, Condition B is entered.

(continued)

EXAMPLE
(continued)

EXAMPLE 1.3-5

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each inoperable valve.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more valves inoperable.	A.1 Restore valve to OPERABLE status.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> (A) B.2 Be in MODE 4.	12 hours

The Note above the ACTIONS table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to Condition A, the Note may appear in the Condition column.

The Note allows Condition A to be entered separately for each inoperable valve, and Completion Times tracked on a per valve basis. When a valve is declared inoperable, Condition A is entered and its Completion Time starts. If subsequent valves are declared inoperable, Condition A is entered for each valve and separate Completion Times start and are tracked for each valve.

If the Completion Time associated with a valve in Condition A expires, Condition B is entered for that valve. If the Completion Times associated with subsequent valves in

(continued)

EXAMPLES

EXAMPLE 1.3-5 (continued)

Condition A expire, Condition B is entered separately for each valve and separate Completion Times start and are tracked for each valve. If a valve that caused entry into Condition B is restored to OPERABLE status, Condition B is exited for that valve.

Since the Note in this example allows multiple Condition entry and tracking of separate Completion Times, Completion Time extensions do not apply.

EXAMPLE 1.3-6

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One channel inoperable.	A.1 Perform SR 3.x.x.x.	Once per 8 hours
	<u>OR</u> A.2 Reduce THERMAL POWER to $\leq 50\%$ RTP.	8 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

Entry into Condition A offers a choice between Required Action A.1 or A.2. Required Action A.1 has a "once per" (A) Completion Time, which qualifies for the 25% extension, per SR 3.0.2, to each performance after the initial performance. If Required Action A.1 is followed, and the Required Action

(continued)

EXAMPLES

EXAMPLE 1.3-6 (continued)

is not met within the Completion Time (including the 25% extension allowed by SR 3.0.2), Condition B is entered. If Required Action A.2 is followed and the Completion Time of 8 hours is not met, Condition B is entered.

If after entry into Condition B, Required Action A.1 or A.2 is met, Condition B is exited and operation may then continue in Condition A.

EXAMPLE 1.3-7

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One subsystem inoperable.	A.1 Verify affected subsystem isolated.	1 hour <u>AND</u> Once per 8 hours thereafter
	<u>AND</u> A.2 Restore subsystem to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours
	<u>AND</u> B.2 Be in MODE 5.	36 hours

(A)
Insert 1 blank line

(continued)

EXAMPLES

EXAMPLE 1.3-7 (continued)

Required Action A.1 has two Completion Times. The 1-hour Completion Time begins at the time the Condition is entered and each "Once per 8 hours thereafter" interval begins upon performance of Required Action A.1.

If after Condition A is entered, Required Action A.1 is not met within either the initial 1 hour, or any subsequent 8-hour interval from the previous performance (including ^{25%} extension allowed by SR 3.0.2) Condition B is entered. The Completion Time clock for Condition A does not stop after Condition B is entered, but continues from the time Condition A was initially entered. If Required Action A.1 is met after Condition B is entered, Condition B is exited and operation may continue in accordance with Condition A, provided the Completion Time for Required Action A.2 has not expired. Since the second Completion Time of Required Action

^(A) A.1 has a modified "time zero" (i.e. after the initial 1 hour;

IMMEDIATE
COMPLETION TIME

not from time of Condition entry), the allowance for a
When "Immediately" is used as a Completion Time, the Required Action should be pursued without delay and in a controlled manner.

Completion Time extension does not apply.

1.0 USE AND APPLICATION

1.4 Frequency

PURPOSE

The purpose of this section is to define the proper use and application of Frequency requirements. Each Surveillance Requirement (SR) has a specified Frequency in which the Surveillance must be met in order to meet the associated LCO. An understanding of the correct application of the specified Frequency is necessary for compliance with the SR.

A.7

Insert A (PWP) →

EXAMPLES

The following examples illustrate the various ways that Frequencies are specified. In these examples, the Applicability of the LCO (LCO not shown) is MODES 1, 2, and 3.

EXAMPLE 1.4-1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Perform CHANNEL CHECK.	12 hours

Example 1.4-1 contains the type of SR most often encountered in the Technical Specifications (TS). The Frequency specifies an interval (12 hours) during which the associated Surveillance must be performed at least one time. Performance of the Surveillance initiates the subsequent interval. Although the Frequency is stated as 12 hours, an extension of the time interval to 1.25 times the stated Frequency is allowed by SR 3.0.2 for operational flexibility. The measurement of this interval continues at all times, even when the SR is not required to be met per SR 3.0.1 (such as when the equipment is inoperable, a variable is outside specified limits, or the unit is outside the Applicability of the LCO). If the interval specified by SR 3.0.2 is exceeded while the unit is in a MODE or other specified condition in the Applicability of the LCO, and the

(continued)

INSERT A(PWR)

The "specified Frequency" is referred to throughout this section and each of the Specifications of Section 3.0, "Surveillance Requirement (SR) Applicability." The "specified Frequency" consists of the requirements of the Frequency column of each Surveillance Requirement, as well as certain Notes in the Surveillance column which modify performance requirements.

Situations where a Surveillance could be required (i.e., its Frequency could expire), but it is not possible or not desired to be performed until sometime after the associated LCO is within its Applicability, represent potential SR 3.0.4 conflicts. To avoid these conflicts, the Surveillance Requirement (i.e., the Surveillance and/or the Frequency) is stated such that it is only "required" when it can be and should be performed. With a Surveillance Requirement satisfied, SR 3.0.4 imposes no restriction.

EXAMPLES

EXAMPLE 1.4-1 (continued)

performance of the Surveillance is not otherwise modified (refer to Examples 1.4-3 and 1.4-5), then SR 3.0.3 becomes applicable.

If the interval as specified by SR 3.0.2 is exceeded while the unit is not in a MODE or other specified condition in the Applicability of the LCO for which performance of the SR is required, the Surveillance must be performed within the Frequency requirements of SR 3.0.2 prior to entry into the MODE or other specified condition. Failure to do so would result in a violation of SR 3.0.4.

(A,8) Sometimes special conditions dictate when a Surveillance is to be met. These conditions apply to the Surveillance or to the Frequency or both. They are "otherwise stated" conditions allowed by SR 3.0.1. They may be stated as clarifying Notes in the Surveillance, in the Frequency, or both. The remaining examples discuss these special conditions.

EXAMPLE 1.4-2

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify flow is within limits.	Once within 12 hours after $\geq 25\%$ RTP <u>AND</u> 24 hours thereafter

Example 1.4-2 has two Frequencies. The first is a one-time performance Frequency, and the second is of the type shown in Example 1.4-1. The logical connector "AND" indicates

(continued)

EXAMPLES

EXAMPLE 1.4-2 (continued)

that both Frequency requirements must be met. Each time reactor power is increased from a power level $< 25\%$ RTP to $\geq 25\%$ RTP, the Surveillance must be performed within 12 hours.

The use of "once" indicates a single performance will satisfy the specified Frequency (assuming no other Frequencies are connected by "AND"). This type of Frequency does not qualify for the 25% extension allowed by SR 3.0.2. "Thereafter" indicates future performances must be established per SR 3.0.2, but only after a specified condition is first met (i.e., the "once" performance in this example). If reactor power decreases to $< 25\%$ RTP, the measurement of both intervals stops. New intervals start upon reactor power reaching 25% RTP.

EXAMPLE 1.4-3

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>-----NOTE----- Not required to be performed until 12 hours after $\geq 25\%$ RTP. -----</p> <p>(A) Perform Verify monitor channel adjustment.</p>	<p>7 days</p>

The Surveillance shown in Example 1.4-3 need only be performed at $\geq 25\%$ RTP. The interval measurement for the Frequency of this Surveillance continues at all times, as described in Example 1.4-1. If the Surveillance was not performed within the 7-day (plus 25% per SR 3.0.2) interval, but operation was $< 25\%$ RTP, it would not constitute a failure of the SR or failure to meet the LCO. ~~Therefore, no violation of SR 3.0.4 occurs when changing MODES, even with the 7-day Frequency not met, provided operation is~~ Also

does not exceed 12 hours with power \geq 25% RTP.

Insert B

(A,9)
(continued)

INSERT B

The 7-day interval measurement shown in the Frequency column of Example 1.4-3, continues at all times (as described in Example 1.4-1). This Surveillance may be satisfactorily performed within the interval specified by SR 3.0.2, whether or not the unit operation is $< 25\%$ RTP between performances.

As the Note modifies the require performance of the Surveillance, it is construed to be part of the "specified Frequency." Should the 7-day interval specified by SR 3.0.2 be exceeded while operation is $< 25\%$ RTP, this Note allows 12 hours after $\geq 25\%$ RTP to perform the Surveillance and still consider the performance to be within the "specified Frequency." Therefore, if....

EXAMPLES

EXAMPLE 1.4-3 (continued)

Once the unit reaches 25% RTP, 12 hours would be allowed for completing the Surveillance. If the Surveillance were not performed within this 12-hour interval, there would then be a failure to perform a Surveillance within the specified Frequency; then MODE changes would be restricted in accordance with SR 3.0.4 and the provisions of SR 3.0.3 apply.

(A, B)

EXAMPLE 1.4-4

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p style="text-align: center;">-----NOTE----- Not required to be met until in MODE 1. -----</p>	
<p>Verify leakage rates are within limits.</p>	<p>24 hours</p>

Example 1.4-4 specifies that the requirements of this Surveillance do not have to be met until the unit is in MODE 1. The interval measurement for the Frequency of this Surveillance continues at all times, as described in Example 1.4-1. If the Surveillance was not performed within the 24-hour (plus 25% per SR 3.0.2) interval, but the unit is not in MODE 1, there would be no failure of the SR nor failure to meet the LCO. Therefore, no violation of SR 3.0.4 occurs when changing MODES, even with the 24-hour Frequency not met, provided the MODE change was not made into MODE 1. Prior to entering MODE 1 (assuming again that the 24-hour Frequency were not met), SR 3.0.4 would require satisfying the SR.

This example, specifying when the Surveillance is "required to be met," differs from the other examples, which only specified performance allowances/requirements. When a Surveillance is not required to be "met," the acceptance criteria is not required to be applied to consideration of

(continued)

EXAMPLE

EXAMPLE 1.4-4 (continued)

(A,B)

OPERABILITY. That is, SR 3.0.1 requires "failure to meet a Surveillance, whether such failure is experienced during performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO." Therefore, when the Surveillance is not required to be met, failure does not constitute failure to meet the LCO.

JUSTIFICATIONS FOR DEVIATIONS FROM STS 1.0

- A. This change reflects comments made by the industry to the NRC at the RSTS P&R review meeting held in Irvine, CA July 13-20, 1992.
 1. Change to reflect Watts Bar specific parameter values.
 2. Change to correct error in the STS.
 3. In the definition for CHANNEL CALIBRATION, a comma is needed after the word "display" to separate it from "and trip functions."
 4. The term "cycle specific parameter" is used instead of "core operating" to clarify that the content of the report includes more than "core operating" limits.
 5. The action addressing an inoperable excore detector has been relocated to a Note in the QPTR SR 3.2.4.1. This action applies only when the SR is performed and should be located in the SR.
 6. Mode Table clarifications:
 - a) "Fuel in the reactor vessel" is redundant to the same phrase in the definition of Mode.
 - b) The phrase "or with the head removed" is not required "bolts less than fully tensioned" envelope the head removed.
 - c) New footnote (b) added to clarify and define when a particular Mode exists. This is consistent with the BWROG Mode Table footnotes.
 7. Reformat of section to make it consistent with other 1.0 Sections. This reformatting resulted in combining paragraphs and moving them to the appropriate subsections, i.e., general explanations of specified Frequency moved from specific example to Description. These changes clarify the frequency of performance issue and how it is addressed in Surveillance column.
 8. This paragraph applies to Example 1.4-4. Example 1.4-4 is not applicable to WOG and has been deleted from WOG 1.4 section. Also, Example 1.4-4 is deleted. This type of SR notation is not used in WOG STS.
 9. These change are from "White Paper" provided to and discussed with NRC. These clarifications provide additional details on SR 3.0.4 exceptions and allowances for Mode changes.

2.0 SAFETY LIMITS (SLs)

2.1 SLs

2.1.1 Reactor Core SLs

In MODES 1 and 2, the combination of THERMAL POWER, Reactor Coolant System (RCS) highest-loop average temperature, and pressurizer pressure shall not exceed the SLs specified in Figure 2.1.1.-1.

2.1.2 RCS Pressure SL

In MODES 1, 2, 3, 4, and 5, the RCS pressure shall be maintained ≤ 2735 psig.

2.2 SL Violations

2.2.1 If SL 2.1.1 is violated, restore compliance and be in MODE 3 within 1 hour.

2.2.2 If SL 2.1.2 is violated:

2.2.2.1 a. In MODE 1 or 2, restore compliance and be in MODE 3 within 1 hour.

2.2.2.2 b. In MODE 3, 4, or 5, restore compliance within 5 minutes.

2.2.3 Within 1 hour, notify the NRC Operations Center, in accordance with 10 CFR 50.72.

2.2.4 Within 24 hours, notify the ^gPlant ^{Manager} Superintendent and ^{Site}Vice President ~~(Nuclear Operations)~~ and the ~~onsite plant reviewers~~ specified in Specification 5.5.1, "Plant Reviews".

①

Plant Operations Review Committee (PORC).

(continued)

(continued)

Replace with plant specific figure.

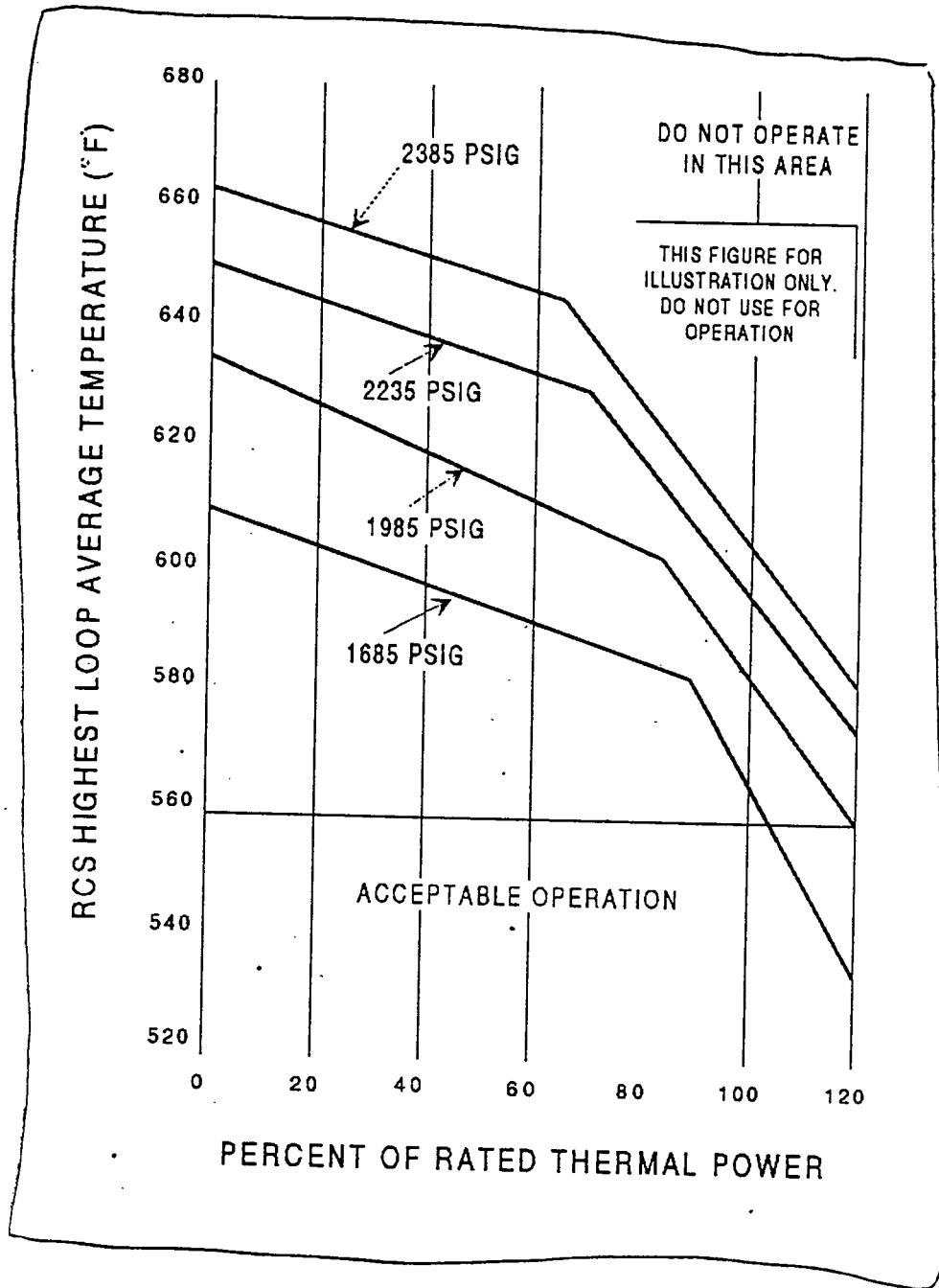


Figure 2.1.1-1 (page 1 of 1)
Reactor Core Safety Limits

(continued)

2.2 . SL Violations (continued)

2.2.5 Within 30 days a Licensee Event Report (LER) shall be prepared pursuant to 10 CFR 50.73. The LER shall be submitted to the NRC, the ~~onsite plant reviewers specified in Specification 5.5.1], and the [Plant Superintendent and Vice President - Nuclear Operations].~~ ^① PORC, Plant Manager, and the Site Vice President.

2.2.6 Operation of the unit shall not be resumed until authorized by the NRC.

B 2.0 SAFETY LIMITS (SLs)

B 2.1.1 Reactor Core SLs

BASES

BACKGROUND

GDC 10 (Ref. 1) requires that specified acceptable fuel design limits are not to be exceeded during steady-state operation, normal operational transients, and anticipated operational occurrences (AOOs). This is accomplished by having a departure from nucleate boiling (DNB) design basis, which corresponds to a 95% probability at a 95% confidence level (the 95/95 DNB criterion) that DNB will not occur and by requiring that fuel-centerline temperature stays below the melting temperature.

The restrictions of this SL prevent overheating of the fuel and cladding, as well as possible cladding perforation, that would result in the release of fission products to the reactor coolant. Overheating of the fuel is prevented by maintaining the steady-state peak linear heat rate (LHR) below the level at which fuel-centerline melting occurs. Overheating of the fuel cladding is prevented by restricting fuel operation to within the nucleate boiling regime, where the heat-transfer coefficient is large and the cladding-surface temperature is slightly above the coolant-saturation temperature.

Fuel-centerline melting occurs when the local LHR, or power peaking, in a region of the fuel is high enough to cause the fuel-centerline temperature to reach the melting point of the fuel. Expansion of the pellet upon centerline melting may cause the pellet to stress the cladding to the point of failure, allowing an uncontrolled release of activity to the reactor coolant.

Operation above the boundary of the nucleate boiling regime could result in excessive cladding temperature because of the onset of DNB and the resultant sharp reduction in heat-transfer coefficient. Inside the steam film, high cladding temperatures are reached, and a cladding-water (zirconium-water) reaction may take place. This chemical reaction results in oxidation of the fuel cladding to a structurally weaker form. This weaker form may lose its integrity, resulting in an uncontrolled release of activity to the reactor coolant.

(continued)

BASES

BACKGROUND
(continued)

The proper functioning of the Reactor Protection System (RPS) and steam generator safety valves prevents violation of the reactor core SLs.

APPLICABLE
SAFETY ANALYSES

The fuel cladding must not sustain damage as a result of normal operation and AOOs. The reactor core SLs are established to preclude violation of the following fuel design criteria:

- a. There must be at least 95% probability at a 95% confidence level (the 95/95 DNB criterion) that the hot fuel rod in the core does not experience DNB; and
- b. The hot fuel pellet in the core must not experience centerline fuel melting.

The Reactor Trip System (RTS) setpoints (Ref. 2), in combination with all the LCOs, are designed to prevent any anticipated combination of transient conditions for Reactor Coolant System (RCS) temperature, pressure, and THERMAL POWER level that would result in a departure from nucleate boiling ratio (DNBR) of less than the DNBR limit and preclude the existence of flow instabilities.

Automatic enforcement of these reactor core SLs is provided by the following functions:

- a. High pressurizer pressure trip;
- b. Low pressurizer pressure trip;
- c. Overtemperature ΔT trip;
- d. Overpower ΔT trip;
- e. Power Range Neutron Flux trip; and
- f. Steam generator safety valves.

The limitation that the average enthalpy in the hot leg be less than or equal to the enthalpy of saturated liquid also ensures that the ΔT measured by instrumentation, used in the RPS design as a measure of core power, is proportional to core power.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The SLs represent a design requirement for establishing the RPS trip setpoints identified previously. LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits," or the assumed initial conditions of the safety analyses (as indicated in the FSAR, Ref. 2) provide more restrictive limits to ensure that the SLs are not exceeded.

SAFETY LIMITS

The curves provided in Figure B 2.1.1-1 show the loci of points of THERMAL POWER, RCS pressure, and average temperature for which the minimum DNBR is not less than the safety analyses limit, that fuel centerline temperatures remain below melting, that the average enthalpy in the hot leg is less than or equal to the enthalpy of saturated liquid, or that the exit quality is within the limits defined by the DNBR correlation.

The curves are based on enthalpy hot channel factor limits provided in the COLR. The dashed line of Figure B 2.1.1-1 shows an example of a limit curve at 2235 psig. In addition, it illustrates the various RPS functions that are designed to prevent the unit from reaching the limit.

The SL is higher than the limit calculated when the AFD is within the limits of the $F_1(\Delta I)$ function of the overtemperature ΔT reactor trip. When the AFD is not within the tolerance, the AFD effect on the overtemperature ΔT reactor trips will reduce the setpoints to provide protection consistent with the reactor core SLs (Refs. 3 and 4).

APPLICABILITY

SL 2.1.1 only applies in MODES 1 and 2 because these are the only MODES in which the reactor is critical. Automatic protection functions are required to be OPERABLE during MODES 1 and 2 to ensure operation within the reactor core SLs. The steam generator safety valves or automatic protection actions serve to prevent RCS heatup to the reactor core SL conditions or to initiate a reactor trip function, which forces the unit into MODE 3. Setpoints for

(continued)

BASES (continued)

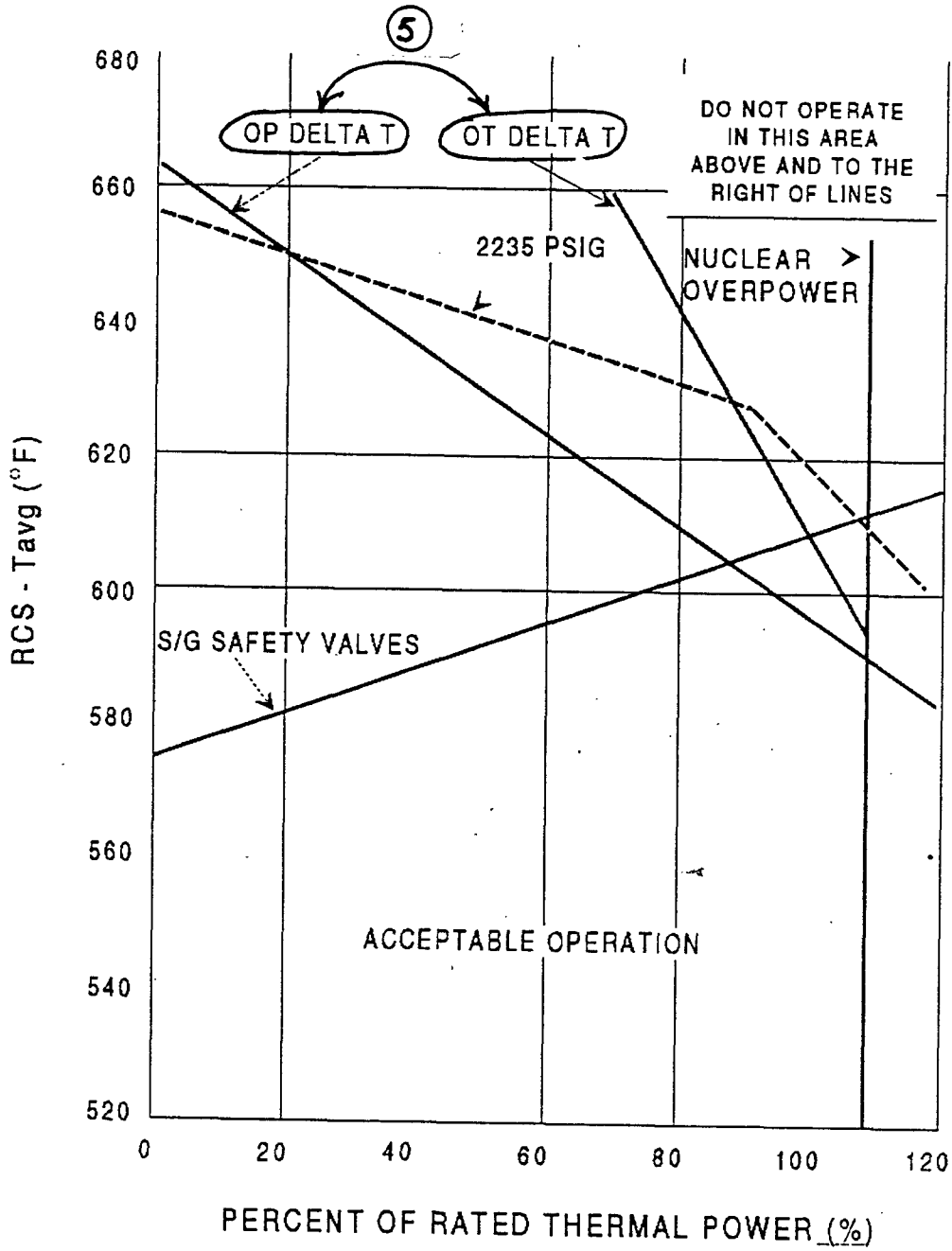


Figure B 2.1.1-1 (page 1 of 1)
Reactor Core Safety Limits vs. Boundary of Protection

(continued)

BASES

APPLICABILITY
(continued)

the reactor trip functions are specified in LCO 3.3.1, "Reactor Trip System (RTS) Instrumentation." In MODES 3, 4, 5, and 6, Applicability is not required since the reactor is not generating significant THERMAL POWER.

SAFETY LIMIT
VIOLATIONS

The following SL violation responses are applicable to the reactor core SLs.

2.2.1

If SL 2.1.1 is violated, the requirement to go to MODE 3 places the unit in a MODE in which this SL is not applicable.

The allowed Completion Time of 1 hour recognizes the importance of bringing the unit to a MODE of operation where this SL is not applicable, and reduces the probability of fuel damage.

2.2.3

If SL 2.1.1 is violated, the NRC Operations Center must be notified within 1 hour, in accordance with 10 CFR 50.72 (Ref. 5).

2.2.4

① If SL 2.1.1 is violated, the Plant ^{Manager} ~~Superintendent~~ and the Site Vice President ~~Nuclear Operations~~ shall be notified within 24 hours. This 24-hour period provides time for the plant operators and staff to take the appropriate immediate action and assess the condition of the unit before reporting to the senior management.

2.2.5

① If SL 2.1.1 is violated, a Licensee Event Report shall be prepared and submitted within 30 days to the NRC, the Plant ~~Superintendent~~ ^{Manager} and the Vice President ~~Nuclear Operations~~ ^{Site}.

(continued)

BASES

SAFETY LIMIT
VIOLATIONS

2.2.5 (continued)

This requirement is in accordance with 10 CFR 50.73 (Ref. 6).

2.2.6

If SL 2.1.1 is violated, restart of the unit shall not commence until authorized by the NRC. This requirement ensures the NRC that all necessary reviews, analyses, and actions are completed before the unit begins its restart to normal operation.

REFERENCES

3



- 1. 10 CFR 50, Appendix A, GDC 10, 1988.
- 2. FSAR, Section [7.2].
- 3. WCAP-8746-A, March 1977.
- 4. WCAP-9273-NP-A, July 1985.
- 5. 10 CFR 50.72.
- 6. 10 CFR 50.73.

-
- 1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 10, "Reactor Design," 1988.
 - 2. Watts Bar FSAR, Section 7.2, "Reactor Trip System".
 - 3. WCAP-8746-A, "Design Bases for the Overtemperature ΔT and the Overpower ΔT Trips," March 1977.
 - 4. WCAP-9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
 - 5. Title 10, Code of Federal Regulations, Part 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors."
 - 6. Title 10, Code of Federal Regulations, Part 50.73, "Licensee Event Report System."

B 2.0 SAFETY LIMITS (SLs)

B 2.1.2 Reactor Coolant System (RCS) Pressure SL

BASES

BACKGROUND

The SL on RCS pressure protects the integrity of the RCS against overpressurization. In the event of fuel cladding failure, fission products are released into the reactor coolant. The RCS then serves as the primary barrier in preventing the release of fission products into the atmosphere. By establishing an upper limit on RCS pressure, the continued integrity of the RCS is ensured. According to 10 CFR 50, Appendix A, GDC 14, "Reactor Coolant Pressure Boundary," and GDC 15, "Reactor Coolant System Design" (Ref. 1), the reactor pressure coolant boundary (RCPB) design conditions are not to be exceeded during normal operation and anticipated operational occurrences (AOOs). Also, in accordance with GDC 28, "Reactivity Limits" (Ref. 1), reactivity accidents, including rod ejection, do not result in damage to the RCPB greater than limited local yielding.

The design pressure of the RCS is 2500 psia. During normal operation and AOOs, RCS pressure is limited from exceeding the design pressure by more than 10%, in accordance with Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 2). To ensure system integrity, all RCS components are hydrostatically tested at 125% of design pressure, according to the ASME Code requirements prior to initial operation pressure when there is no fuel in the core. Following inception of unit operation, RCS components shall be pressure tested, in accordance with the requirements of ASME Code, Section XI (Ref. 3).

Overpressurization of the RCS could result in a breach of the RCPB. If such a breach occurs in conjunction with a fuel cladding failure, fission products could enter the containment atmosphere, raising concerns relative to limits on radioactive releases specified in 10 CFR 100, "Reactor Site Criteria" (Ref. 4).

4

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The RCS pressurizer safety valves, the main steam safety valves (MSSVs), and the reactor high-pressure trip have settings established to ensure that the RCS pressure SL will not be exceeded.

The RCS pressurizer safety valves are sized to prevent system pressure from exceeding the design pressure by more than 10%, as specified in Section III of the ASME Code for Nuclear Power Plant Components (Ref. 2). The transient that establishes the required relief capacity, and hence valve size requirements and lift settings, is a complete loss of external load without a direct reactor trip. During the transient, no control actions are assumed, except that the safety valves on the secondary plant are assumed to open when the steam pressure reaches the secondary plant safety valve settings, and nominal feedwater supply is maintained.

②

The Reactor Trip System (RTS) ^(Ref. 9) setpoints (Ref. 4) ^⑤, together with the settings of the MSSVs, provide pressure protection for normal operation and AOs. The reactor high-pressure trip setpoint is specifically set to provide protection against overpressurization (Ref. 5). The safety analyses for both the high-pressure trip and the RCS pressurizer safety valves are performed, using conservative assumptions relative to pressure control devices. ^④

More specifically, no credit is taken for operation of the following:

a. Pressurizer power-operated relief valves (PORVs);

⑥ b. ~~Steam line relief valve;~~ ^{Steamline Line Power Operated Relief Valves (PORVs);}

c. Steam Dump System;

d. Reactor Control System;

e. Pressurizer Level Control System; or

f. Pressurizer spray valve.

~~Steam line (PORVs)~~

(continued)

BASES (continued)

SAFETY LIMITS

The maximum transient pressure allowed in the RCS pressure vessel under the ASME Code, Section III, is 110% of design pressure. The maximum transient pressure allowed in the RCS piping, valves, and fittings under [USAS, Section B31.1 (Ref. 6)] is 120% of design pressure. The most limiting of these two allowances is the 110% of design pressure; therefore, the SL on maximum allowable RCS pressure is 2735 psig.

APPLICABILITY

SL 2.1.2 applies in MODES 1, 2, 3, 4, and 5 because this SL could be approached or exceeded in these MODES due to overpressurization events. The SL is not applicable in MODE 6 because the reactor vessel head closure bolts are not fully tightened, making it unlikely that the RCS can be pressurized.

SAFETY LIMIT VIOLATIONS

The following SL violations are applicable to the RCS pressure SL.

2.2.2.1 (a)

If the RCS pressure SL is violated when the reactor is in MODE 1 or 2, the requirement is to restore compliance and be in MODE 3 within 1 hour.

Exceeding the RCS pressure SL may cause immediate RCS failure and create a potential for radioactive releases in excess of 10 CFR 100, "Reactor Site Criteria" (Ref. 4).

The allowable Completion Time of 1 hour recognizes the importance of reducing power level to a MODE of operation where the potential for challenges to safety systems is minimized.

2.2.2.2 (b)

If the RCS pressure SL is exceeded in MODE 3, 4, or 5, RCS pressure must be restored to within the SL value within 5 minutes. Exceeding the RCS pressure SL in MODE 3, 4, or 5 is more severe than exceeding this SL in MODE 1 or 2, since the reactor vessel temperature may be lower and the vessel

(continued)

BASES

SAFETY LIMIT
VIOLATIONS

~~2.2.2.2~~ (continued)

b.

material, consequently, less ductile. As such, pressure must be reduced to less than the SL within 5 minutes. The action does not require reducing MODES, since this would require reducing temperature, which would compound the problem by adding thermal gradient stresses to the existing pressure stress.

2.2.3

If the RCS pressure SL is violated, the NRC Operations Center must be notified within 1 hour, in accordance with 10 CFR 50.72 (Ref. 7).

2.2.4

Site

If the RCS pressure SL is violated, the Plant Superintendent and the Vice President ~~Nuclear Operations~~ shall be notified within 24 hours. The 24-hour period provides time for the plant operators and staff to take the appropriate immediate action and assess the condition of the unit before reporting to senior management.

Manager

2.2.5

Manager

If the RCS pressure SL is violated, a Licensee Event Report shall be prepared and submitted within 30 days to the NRC, the Plant Superintendent and the Vice-President, ~~Nuclear Operations~~. This requirement is in accordance with 10 CFR 50.73 (Ref. 8).

Site

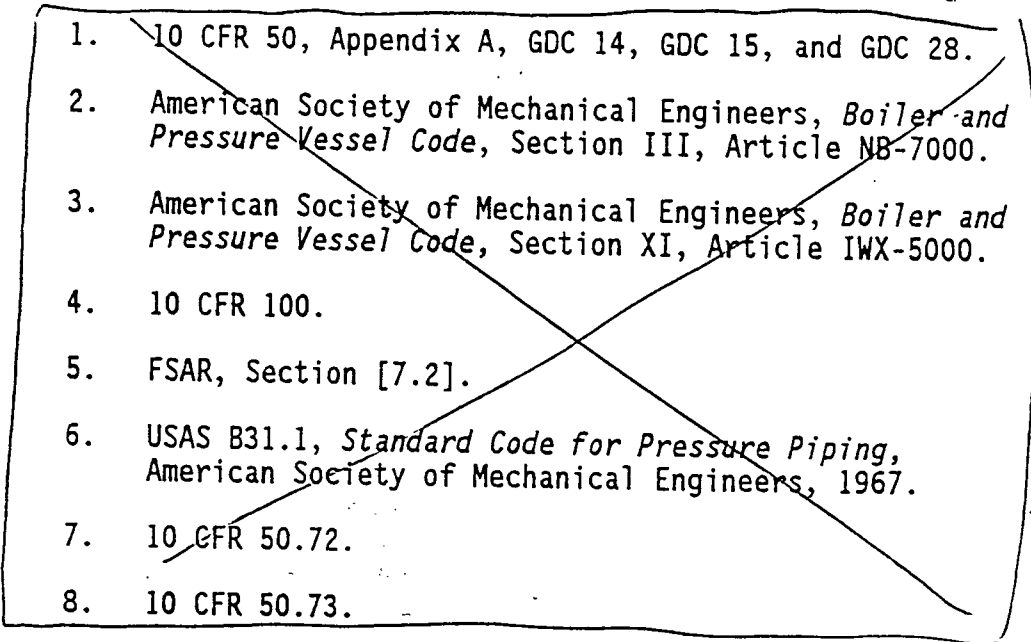
2.2.6

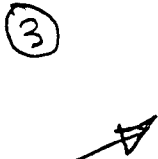
If the RCS pressure SL is violated, restart of the unit shall not commence until authorized by the NRC. This requirement ensures the NRC that all necessary reviews, analyses, and actions are completed before the unit begins its restart to normal operation.

(continued)

BASES (continued)

REFERENCES

- 
1. 10 CFR 50, Appendix A, GDC 14, GDC 15, and GDC 28.
2. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section III, Article NB-7000.
3. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section XI, Article IWX-5000.
4. 10 CFR 100.
5. FSAR, Section [7.2].
6. USAS B31.1, *Standard Code for Pressure Piping*, American Society of Mechanical Engineers, 1967.
7. 10 CFR 50.72.
8. 10 CFR 50.73.

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1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 14, "Reactor Coolant Pressure Boundary"; General Design Criterion 15, "Reactor Coolant System Design"; and General Design Criterion 28, "Reactivity Limits."
 2. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section III, "Nuclear Power Plant Components," Article NB-7000, "Protection Against Overpressure."
 3. American Society of Mechanical Engineers, *Boiler and Pressure Vessel Code*, Section XI, IWX-5000, "System Pressure Tests".
 4. Title 10, Code of Federal Regulations, Part 100, "Reactor Site Criteria".
 5. Watts Bar FSAR, Section 7.2, "Reactor Trip System".
 6. USAS B31.1, "Standard Code for Pressure Piping," American Society of Mechanical Engineers, 1967.
 7. Title 10, Code of Federal Regulations, Part 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors."
 8. Title 10, Code of Federal Regulations, Part 50.73, "Licensee Event Report System."
 9. Watts Bar FSAR, Section 10.3, "Main Steam Supply System."

JUSTIFICATIONS FOR DEVIATIONS FROM STS 2.0

1. Change to reflect Watts Bar specific terminology.
2. Change to reflect Watts Bar specific parameter values.
3. Watts Bar prefers to use the expanded reference description in the Bases.
4. Change to correct error in the STS.
5. On Figure B 2.1.1-1, "OP DELTA T" and "OT DELTA T" are annotated in error. They should be indicated just the opposite.
6. In the Applicable Safety Analyses section, Item b. should read, "Steam Line PORVs." A steam line relief valve could mean a safety valve or PORV. A steam Line would better describe what is intended.

3.0 LIMITING CONDITIONS FOR OPERATION (LCOs) AND SURVEILLANCE REQUIREMENTS (SRs)

LCOs

LCO 3.0.1

LCOs shall be met during the MODES or other specified conditions in the Applicability, except as provided in LCO 3.0.2.

LCO 3.0.2

Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as ^(A) provided in LCO 3.0.6.

If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required unless otherwise stated.

LCO 3.0.3

When an LCO is not met and the associated ACTIONS are not met or an associated ACTION is not provided, the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable. Action shall be initiated within 1 hour to place the unit, as applicable, in:

- a. MODE 3 within 7 hours;
- b. MODE 4 within 13 hours; and
- c. MODE 5 within 37 hours.

Exceptions to this Specification are stated in the individual Specifications.

Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the actions required by LCO 3.0.3 is not required.

LCO 3.0.3 is applicable in MODES 1, 2, 3, and 4.

(continued)

LCOs
(continued)

LCO 3.0.4

When an LCO is not met, entry into a MODE or other specified condition in the Applicability shall not be made except when the associated ACTIONS to be entered permit continued operation in the MODE or other specified condition in the Applicability for an unlimited period of time. This Specification shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS.

Exceptions to this Specification are stated in the individual Specifications. These exceptions allow entry into MODES or other specified conditions in the Applicability when the associated ACTIONS to be entered allow unit operation in the MODE or other specified condition in the Applicability only for a limited period of time.

LCO 3.0.5

Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY of other equipment. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate OPERABILITY.

LCO 3.0.6

When a supported system LCO is not met solely due to a support system LCO not being met, the Conditions and Required Actions associated with this supported system are not required to be entered. Only the support system LCO ACTIONS are required to be entered. This is an exception to LCO 3.0.2 for the supported system. In this event, additional evaluations and limitations may be required in accordance with Specification 5.8, "Safety Function Determination Program." If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

(continued)

LCOs LCO 3.0.6 (continued)

When a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

SRs SR 3.0.1

SRs shall be met during the MODES or other specified conditions in the Applicability for individual LCOs, unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in SR 3.0.3. Surveillances do not have to be performed on inoperable equipment or variables outside specified limits.

SR 3.0.2

The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met.

For Frequencies specified as "once," the above interval extension does not apply.

If a Completion Time requires periodic performance on a "once per..." basis, the above Frequency extension applies to each performance after the initial performance.

Exceptions to this Specification are stated in the individual Specifications.

(continued)

SRs
(continued)

SR 3.0.3

If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance.

If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered. The Completion Times of the Required Actions begin immediately upon expiration of the delay period.

When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered. The Completion Times of the Required Actions begin immediately upon failure to meet the Surveillance.

SR 3.0.4

Entry into a MODE or other specified condition in the Applicability of an LCO shall not be made unless the LCO's Surveillances have been met within their specified Frequency. This provision shall not prevent passage through or to MODES or other specified conditions in compliance with Required Actions.

B 3.0 LIMITING CONDITIONS FOR OPERATION (LCOs) AND SURVEILLANCE REQUIREMENTS (SRs)

BASES

The format for the 3.0 Bases has been changed in accordance to the P+R RSTs - (A)

LCOs

LCO 3.0.1 through LCO 3.0.6 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.

(A) in Chapter 3.0

LCO 3.0.1

LCO 3.0.1 establishes the Applicability statement within each individual Specification as the requirement for when the LCO is required to be met (i.e., when the unit is in the MODES or other specified conditions of the Applicability statement of each Specification).

LCO 3.0.2

LCO 3.0.2 establishes that upon discovery of a failure to meet an LCO, the associated ACTIONS shall be met. The Completion Time of each Required Action for an ACTIONS Condition is applicable from the point in time that an ACTIONS Condition is entered. The Required Actions establish those remedial measures that must be taken within specified Completion Times when the requirements of an LCO are not met. This Specification establishes that:

- a. Completion of the Required Actions within the specified Completion Times constitutes compliance with a Specification; and
- b. Completion of the Required Actions is not required when an LCO is met within the specified Completion Time, unless otherwise specified.

There are two basic types of Required Actions. The first type of Required Action specifies a time limit in which the LCO must be met. This time limit is the Completion Time to restore an inoperable system or component to OPERABLE status or to restore variables to within specified limits. If this type of Required Action is not completed within the specified Completion Time, a shutdown may be required to

(continued)

BASES

LCOs

LCO 3.0.2 (continued)

place the unit in a MODE or condition in which the Specification is not applicable. (Whether stated as a Required Action or not, correction of the entered Condition is an action that may always be considered upon entering ACTIONS.) The second type of Required Action specifies the remedial measures that permit continued operation of the unit that is not further restricted by the Completion Time. In this case, compliance with the Required Actions provides an acceptable level of safety for continued operation.

(A) Completing the Required Actions is not required when an LCO is met or is no longer applicable ~~within the associated Completion Time~~, unless otherwise stated in the individual Specifications.

The nature of some Required Actions of some Conditions necessitates that, once the Condition is entered, the Required Actions must be completed even though the ~~associated Conditions are resolved~~. The individual LCO's ACTIONS specify the Required Actions where this is the case. An example of this is in LCO 3.8.1, "AC Sources - Operating."

(A) *no longer exist*

The Completion Times of the Required Actions are also applicable when a system or component is removed from service intentionally. The reasons for intentionally relying on the ACTIONS include, but are not limited to, performance of Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering ACTIONS for these reasons must be done in a manner that does not compromise safety. Intentional entry into ACTIONS should not be made for operational convenience. Alternatives that would not result in redundant equipment being inoperable should be used instead. Doing so limits the time both subsystems/trains of a safety function are inoperable and limits the time other conditions exist which result in LCO 3.0.3 being entered. Individual Specifications may specify a time limit for performing an SR when equipment is removed from service or bypassed for testing. In this case, the Completion Times of the Required Actions are applicable when this time limit expires, if the ~~SR has not been completed~~.

(A) *equipment remains removed from service or bypassed*

(continued)

BASES

LCOs

LCO 3.0.2 (continued)

When a change in MODE or other specified condition is required to comply with Required Actions, the unit may enter a MODE or other specified condition in which ~~a new~~ ← another Specification becomes applicable. In this case, the Completion Times of the associated Required Actions would apply from the point in time that the new Specification becomes applicable, and the ACTIONS Condition(s) are entered. (A)

LCO 3.0.3

LCO 3.0.3 establishes the actions that must be implemented when an LCO is not met and:

- a. An associated Required Action and Completion Time is not met and no other Condition applies; or
- b. The condition of the unit is not specifically addressed by the associated ACTIONS. This means that no combination of Conditions stated in the ACTIONS can be made that exactly corresponds to the actual condition of the unit. Sometimes, possible combinations of Conditions are such that entering LCO 3.0.3 is warranted; in such cases, the ACTIONS specifically state a Condition corresponding to such combinations and also that LCO 3.0.3 be entered immediately.

This Specification delineates the time limits for placing the unit in a safe MODE or other specified condition when operation cannot be maintained within the limits for safe operation as defined by the LCO and its ACTIONS. It is not intended to be used as an operational convenience that permits routine voluntary removal of redundant systems or components from service in lieu of other alternatives that would not result in redundant systems or components being inoperable.

Upon entering LCO 3.0.3, 1 hour is allowed to prepare for an orderly shutdown before initiating a change in unit operation. This includes time to permit the operator to

(continued)

BASES

LCOs

LCO 3.0.3 (continued)

coordinate the reduction in electrical generation with the load dispatcher to ensure the stability and availability of the electrical grid. The time limits specified to reach lower MODES of operation permit the shutdown to proceed in a controlled and orderly manner that is well within the specified maximum cooldown rate and within the capabilities of the unit, assuming that only the minimum required equipment is OPERABLE. This reduces thermal stresses on components of the Reactor Coolant System and the potential for a plant upset that could challenge safety systems under conditions to which this Specification applies. The use and interpretation of specified times to complete the actions of ~~LCO 3.0.3 shall be~~ consistent with the discussion of Section 1.3, Completion Times.

(A)

is

A unit shutdown required in accordance with LCO 3.0.3 may be terminated and LCO 3.0.3 exited if any of the following occurs:

- a. The LCO is now met.
- b. A Condition exists for which the Required Actions have now been performed.
- c. ACTIONS exist that do not have expired Completion Times. These Completion Times are applicable from the point in time that the Condition is initially entered and not from the time LCO 3.0.3 is exited.

The time limits of Specification 3.0.3 allow 37 hours for the unit to be in MODE 5 when a shutdown is required during MODE 1 operation. If the unit is in a lower MODE of operation when a shutdown is required, the time limit for reaching the next lower MODE applies. If a lower MODE is reached in less time than allowed, however, the total allowable time to reach MODE 5, or other applicable MODE, is not reduced. For example, if MODE 3 is reached in 2 hours, then the time allowed for reaching MODE 4 is the next 11 hours, because the total time for reaching MODE 4 is not reduced from the allowable limit of 13 hours. Therefore, if remedial measures are completed that would permit a return

(continued)

BASES

LCOs LCO 3.0.3 (continued)

to MODE 1, a penalty is not incurred by having to reach a lower MODE of operation in less than the total time allowed.

In MODES 1, 2, 3, and 4, LCO 3.0.3 provides actions for Conditions not covered in other Specifications. The requirements of LCO 3.0.3 do not apply in MODES 5 and 6 because the unit is already in the most restrictive Condition required by LCO 3.0.3. The requirements of LCO 3.0.3 do not apply in other specified conditions of the Applicability (unless in MODE 1, 2, 3, or 4) because the ACTIONS of individual Specifications sufficiently define the remedial measures to be taken.

Exceptions to LCO 3.0.3 are provided in instances where requiring a unit shutdown, in accordance with LCO 3.0.3, would not provide appropriate remedial measures for the associated condition of the unit. An example of this is in LCO 3.7.15, "Fuel Storage Pool Water Level." LCO 3.7.15 has an Applicability of "During movement of irradiated fuel assemblies in the fuel storage pool." Therefore, this LCO can be applicable in any or all MODES. If the LCO and the Required Actions of LCO 3.7.15 are not met while in MODE 1, 2, or 3, there is no safety benefit to be gained by placing the unit in a shutdown condition. The Required Action of LCO 3.7.15 of "Suspend movement of irradiated fuel assemblies in the fuel storage pool" is the appropriate Required Action to complete in lieu of the actions of LCO 3.0.3. These exceptions are addressed in the individual Specifications.

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LCO 3.0.4

LCO 3.0.4 establishes limitations on changes in MODES or other specified conditions in the Applicability when an LCO is not met. It precludes placing the unit in a different MODE or other specified condition when the following exist:

- a. The requirements of an LCO, in the MODE or other specified condition to be entered, are not met; and

A

(continued)

BASES

LCOs

LCO 3.0.4 (continued)

(A) LCO

- b. Continued noncompliance with these requirements would result in the unit being required to be placed in a MODE or other specified condition in which the LCO does not apply to comply with the Required Actions.

Compliance with Required Actions that permit continued operation of the unit for an unlimited period of time in a MODE or other specified condition provides an acceptable level of safety for continued operation. This is without regard to the status of the unit before or after the MODE change. Therefore, in such cases, entry into a MODE or other specified condition in the Applicability may be made in accordance with the provisions of the Required Actions. The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components to OPERABLE status before unit startup.

The provisions of LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS. In addition, the provisions of LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that result from a normal shutdown.

Exceptions to LCO 3.0.4 are stated in the individual Specifications. Exceptions may apply to all the ACTIONS or to a specific Required Action of a Specification.

(A) ^{either} When changing MODES or other specified conditions while in an ACTIONS Condition, in compliance with LCO 3.0.4, or where an exception to LCO 3.0.4 is stated, the ACTIONS define the remedial measures that apply. Surveillances do not have to be performed on the associated inoperable equipment (or on variables outside the specified limits), as permitted by SR 3.0.1. Therefore, a change in MODE or other specified condition in this situation does not violate SR 3.0.1 or SR 3.0.4 for those Surveillances that do not have to be performed due to the associated inoperable equipment. However, SRs must be met to demonstrate OPERABILITY prior to IS not a violation of assure

(continued)

BASES

LCOs

LCO 3.0.4 (continued)

declaring the associated equipment OPERABLE (or variable within limits) and restoring compliance with the affected LCO.

LCO 3.0.5

LCO 3.0.5 establishes the allowance ^{(A) for} of restoring equipment to service under administrative controls when it has been removed from service or declared inoperable to comply with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 to allow the performance of SRs to demonstrate:

- a. The OPERABILITY of the equipment being returned to service; or
- b. The OPERABILITY of other equipment. ^(A) (e.g. to not comply with the applicable Required Action(s))

The administrative controls ^(A) are to ensure the time the equipment is returned to service in conflict with the requirements of the ACTIONS is limited to the time absolutely necessary to perform the allowed SRs. This Specification does not provide time to perform any other preventive or corrective maintenance.

An example of demonstrating the OPERABILITY of the equipment being returned to service is reopening a containment isolation valve that has been closed to comply with Required Actions, and must be reopened to perform the SRs.

An example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to prevent the trip function from occurring during the performance of an SR on another channel in the other trip system. A similar example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to permit the logic to function and indicate the appropriate response during the performance of an SR on another channel in the same trip system.

(continued)

BASES

LCOs
(continued)

LCO 3.0.6

(A) provided

LCO 3.0.6 establishes an exception to LCO 3.0.2 for support systems that have an LCO specified in the Technical Specifications (TS). This exception is ~~necessary~~ because LCO 3.0.2 would require that the Conditions and Required Actions of the associated inoperable supported system LCO be entered solely due to the inoperability of the support system. This exception is justified because the actions that are required to ensure the unit is maintained in a safe condition are specified in the support system LCO's Required Actions. These Required Actions may include entering the supported system's Conditions and Required Actions or may specify other Required Actions.

When a support system is inoperable and there is an LCO specified for it in the TS, the supported system(s) are required to be declared inoperable if determined to be inoperable as a result of the support system inoperability. However, it is not necessary to enter into the supported systems' Conditions and Required Actions unless directed to do so by the support system's Required Actions. The ~~confusion and inconsistency of interpretation of~~ ^{potential} requirements related to the entry into multiple LCOs' Conditions and Required Actions are eliminated by providing all the actions that are necessary to ensure the unit is maintained in a safe condition in the support system's Required Actions. (A)

Support and supported systems

However, there are instances where a support system's Required Action may either direct a supported system to be declared inoperable or direct entry into Conditions and Required Actions for the supported system. This may occur immediately or after some specified delay to perform some other Required Action. Regardless of whether it is immediate or after some delay, when a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

Specification 5.8, "Safety Function Determination Program" (SFDP), ensures loss of safety function is detected and

(continued)

BASES

LCOs

LCO 3.0.6 (continued)

appropriate actions are taken. ^{Concurrently (A)} Upon failure to meet two or more LCOs ~~at the same time~~, an evaluation shall be made to determine if loss of safety function exists. Additionally, other limitations, remedial actions, or compensatory actions may be identified as a result of the support system inoperability and corresponding exception to entering supported system Conditions and Required Actions. The SFDP implements the requirements of LCO 3.0.6.

(A) Cross train checks to ^{identify} verify a loss of safety function for those support systems that support ~~multiple and redundant~~ safety systems are required. The cross train check verifies that the supported systems of the ~~remaining~~ OPERABLE support systems are OPERABLE, thereby ensuring safety function is retained. If this evaluation determines that a loss of safety function exists, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered. ^{redundant}

SRs

SR 3.0.1 through SR 3.0.4 establish the general requirements applicable to all Specifications, and apply at all times, unless otherwise stated.

in Chapter 3.0

SR 3.0.1

SR 3.0.1 establishes the requirement that SRs must be met during the MODES or other specified conditions in the Applicability for which the requirements of the LCO apply, unless otherwise specified in the individual SRs. This Specification is to ensure that Surveillances are performed to verify the OPERABILITY of systems and components, and that variables are within specified limits. Failure to meet a Surveillance within the specified Frequency, in accordance with SR 3.0.2, constitutes a failure to meet an LCO.

Systems and components are assumed to be OPERABLE when the associated SRs have been met. Nothing in this

(continued)

BASES

SRs

SR 3.0.1 (continued)

Specification, however, is to be construed as implying that systems or components are OPERABLE when:

- a. The systems or components are known to be inoperable, although still meeting the SRs; or
- b. The requirements of the Surveillance(s) are known ^(A) not to be met between required Surveillance performances.

Surveillances do not have to be performed when the unit is in a MODE or other specified condition for which the requirements of the associated LCO are not applicable, unless otherwise specified. The SRs associated with a test exception are only applicable when the test exception is used as an allowable exception to the requirements of a Specification.

Surveillances, including Surveillances invoked by Required Actions, do not have to be performed on inoperable equipment because the ACTIONS define the remedial measures that apply. ~~SRs~~ have to be met in accordance with SR 3.0.2 prior to returning equipment to OPERABLE status.

(A)
Surveillances
Performed
and
Assuring

Upon completion of maintenance, appropriate post maintenance testing is required to declare equipment OPERABLE. This includes meeting applicable ^(A) SRs in accordance with SR 3.0.2. Post maintenance testing may not be possible in the current MODE or other specified conditions in the Applicability due to the necessary unit parameters not having been established. In these situations, the equipment may be considered OPERABLE provided testing has been satisfactorily completed to the extent possible and the equipment is not otherwise believed to be incapable of performing its function. This will allow operation to proceed to a MODE or other specified condition where other necessary post maintenance tests can be completed.

are not failed and their most recent performance is

SR 3.0.2

SR 3.0.2 establishes the requirements for meeting the specified Frequency for Surveillances and any Required

(continued)

BASES

SRs

SR 3.0.2 (continued)

Action with a Completion Time that requires the periodic performance of the Required Action on a "once per . . ." interval.

SR 3.0.2 permits a 25% extension of the interval specified in the Frequency. This extension facilitates Surveillance scheduling and considers plant operating conditions that may not be suitable for conducting the Surveillance (e.g., transient conditions or other ongoing Surveillance or maintenance activities).

The 25% extension does not significantly degrade the reliability that results from performing the Surveillance at its specified Frequency. This is based on the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the SRs. The exceptions to SR 3.0.2 are those Surveillances for which the 25% extension of the interval specified in the Frequency does not apply. These exceptions are stated in the individual Specifications. An example of where SR 3.0.2 does not apply is a Surveillance with a Frequency of "in accordance with 10 CFR 50, Appendix J, as modified by approved exemptions." The requirements of regulations take precedence over the TS. The TS cannot in and of themselves extend a test interval specified in the regulations.

Therefore, there would be a Note in the Frequency stating, "SR 3.0.2 is not applicable."

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is

As stated in SR 3.0.2, the 25% extension also does not apply to the initial portion of a periodic Completion Time that requires performance on a "once per . . ." basis. The 25% extension applies to each performance after the initial performance of the Required Action, whether it is a particular Surveillance or some other remedial action, is considered a single action with a single Completion Time. One reason for not allowing the 25% extension to this Completion Time is that such an action usually verifies that no loss of function has occurred by checking the status of redundant or diverse components or accomplishes the function of the inoperable equipment in an alternative manner.

(continued)

BASES

SRs

SR 3.0.2 (continued)

The provisions of SR 3.0.2 are not intended to be used repeatedly merely as an operational convenience to extend Surveillance intervals or periodic Completion Time intervals beyond those specified.

SR 3.0.3

②

or up to a limit of the specified Frequency, whichever is less,

SR 3.0.3 establishes the flexibility to defer declaring affected equipment inoperable or an affected variable outside the specified limits when a Surveillance has not been completed within the specified Frequency. A delay period of up to 24 hours applies from the point in time that it is discovered that the Surveillance has not been performed in accordance with SR 3.0.2, and not at the time that the specified Frequency was not met.

This delay period provides an adequate time limit to complete Surveillances that have been missed. This delay period permits the completion of a Surveillance before complying with Required Actions or other remedial measures ~~would be required~~ that might preclude completion of the Surveillance.

The basis for this delay period includes consideration of unit conditions, adequate planning, availability of personnel, the time required to perform the Surveillance, the safety significance of the delay in completing the required Surveillance, and the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the SRs requirements.

When a Surveillance with a Frequency based not on time intervals, but upon specified unit conditions or operational situations, is discovered not to have been performed when specified, SR 3.0.3 allows the full delay period of 24 hours to perform the Surveillance.

SR 3.0.3 also provides a time limit for completion of Surveillances that become applicable as a consequence of MODE changes imposed by Required Actions.

(continued)

BASES

SRs

SR 3.0.3 (continued)

Failure to comply with specified Frequencies for SRs is expected to be an infrequent occurrence. Use of the delay period established by SR 3.0.3 is a flexibility which is not intended to be used as an operational convenience to extend Surveillance intervals.

If a Surveillance is not completed within the allowed delay period, then the equipment is considered inoperable or the variable is considered outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon expiration of the delay period. If a Surveillance is failed within the delay period, then the equipment is inoperable, or the variable is outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon the failure of the Surveillance.

Completion of the Surveillance within the delay period allowed by this Specification, or within the Completion Time of the ACTIONS, restores compliance with SR 3.0.1.

SR 3.0.4

SR 3.0.4 establishes the requirement that all applicable SRs must be met before entry into a MODE or other specified condition in the Applicability.

This Specification ensures that system and component OPERABILITY requirements and variable limits are met before entry into MODES or other specified conditions in the Applicability for which these systems and components ensure safe operation of the unit. This Specification applies to changes in MODES or other specified conditions in the Applicability associated with unit shutdown as well as startup.

The provisions of SR 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS.

(continued)

BASES

SRs

SR 3.0.4 (continued)

The precise requirements for performance of SRs are specified such that exceptions to SR 3.0.4 are not necessary. The specific time frames and conditions necessary for meeting the SRs ~~in accordance with the requirements of SR 3.0.4~~ are specified in the Frequency, in the Surveillance, or both. This allows performance of Surveillances when the prerequisite condition(s) specified in a Surveillance procedure require entry into the MODE or other specified condition in the Applicability of the associated LCO prior to the performance or completion of a Surveillance. A Surveillance that could not be performed until after entering the LCO Applicability, would have its Frequency specified such that it is not "due" until the specific conditions needed are met. Alternately, the Surveillance may be stated in the form of a Note as not required (to be met or performed) until a particular event, condition, or time has been reached. The SRs are annotated ^{ion} ~~consistent with the requirements of~~ Section 1.4, Frequency.

A

are found in

Further discussion
of the specific
formats of

JUSTIFICATIONS FOR DEVIATIONS FROM STS 3.0

- A. This change reflects comments made by the industry to the NRC at the RSTS P&R review meeting held in Irvine, CA July 13-20, 1992.
 - 1. Change to reflect Watts Bar specific LCO references.
 - 2. This change makes the bases consistent with the SR 3.0.3.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM) - T_{avg} > 200°F

LCO 3.1.1

SDM shall be \geq 1.6% $\Delta k/k$. (1)

MODE 2 with $K_{eff} < 1.0$, (7)

AND

APPLICABILITY: MODES 3, 4, [and 5]. (2)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SDM not within limit.	A.1 Initiate boration to restore SDM to within limit.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.1.1 Verify SDM is \geq <u>1.6%</u> $\Delta k/k$. (1)	24 hours

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.1 SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}F$

BASES

BACKGROUND

According to GDC 26 (Ref. 1), the reactivity control systems must be redundant and capable of holding the reactor core subcritical when shut down under cold conditions. Maintenance of the SDM ensures that postulated reactivity events will not damage the fuel.

SDM requirements provide sufficient reactivity margin to ensure that acceptable fuel design limits will not be exceeded for normal shutdown and anticipated operational occurrences (AOOs). As such, the SDM defines the degree of subcriticality that would be obtained immediately following the insertion or ~~scram~~ of all shutdown and control rods, assuming that the single rod cluster assembly of highest reactivity worth is fully withdrawn ^{trip} ⑧

The system design requires that two independent reactivity control systems be provided, and that one of these systems be capable of maintaining the core subcritical under cold conditions. These requirements are provided by the use of movable control assemblies and soluble boric acid in the Reactor Coolant System (RCS). The Control Rod System can compensate for the reactivity effects of the fuel and water temperature changes accompanying power level changes over the range from full-load to no-load. In addition, the Control Rod System, together with the ~~boron~~ ^{soluble boron} system, provide the SDM during power operation and are capable of making the core subcritical rapidly enough to prevent exceeding acceptable fuel damage limits, assuming that the rod of highest reactivity worth remains fully withdrawn. The soluble boron system can compensate for fuel depletion during operation and all xenon burnout reactivity changes and maintain the reactor subcritical under cold conditions. ^{The Control Rod System is}

③ During power operation, SDM control is ensured by operating with the shutdown banks ^{fully withdrawn} and the control banks within the limits of LCO 3.1.7, "Control Bank Insertion Limits." When the unit is in the shutdown and refueling modes, the SDM requirements are met by means of adjustments to the RCS boron concentration.

within the limits of LCO 3.1.6, "Shutdown Bank Insertion Limits,"

(continued)

BASES (continued)

APPLICABLE
SAFETY ANALYSES

The minimum required SDM is assumed as an initial condition in safety analyses. The safety analysis (Ref. 2) establishes an SDM that ensures specified acceptable fuel design limits are not exceeded for normal operation and AOOs, with the assumption of the highest worth rod stuck out on scram.

↳ trip. (S)
The acceptance criteria for the SDM requirements are that specified acceptable fuel design limits are maintained. This is done by ensuring that:

- a. The reactor can be made subcritical from all operating conditions, transients, and Design Basis Events;
- b. The reactivity transients associated with postulated accident conditions are controllable within acceptable limits (departure from nucleate boiling ratio (DNBR), fuel-centerline temperature limits for AOOs, and ≤ 280 cal/gm energy deposition for the rod ejection accident); and
- c. The reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

The most limiting accident for the SDM requirements is based on a main steam line break (MSLB), as described in the accident analysis (Ref. 2). The increased steam flow resulting from a pipe break in the main steam system causes an increased energy removal from the affected steam generator (SG), and consequently the RCS. This results in a reduction of the reactor coolant temperature. The resultant coolant shrinkage causes a reduction in pressure. In the presence of a negative moderator temperature coefficient, this cooldown causes an increase in core reactivity. As RCS temperature decreases, the severity of an MSLB decreases until the MODE 5 value is reached. The most limiting MSLB, with respect to potential fuel damage before a reactor trip occurs, is a guillotine break of a main steam line inside containment initiated at the end of core life. The positive reactivity addition from the moderator temperature decrease will terminate when the affected SG boils dry, thus terminating RCS heat removal and cooldown. Following the MSLB, a post-trip return to power may occur; however, no fuel damage occurs as a result of the post-trip return to

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

power, and THERMAL POWER does not violate the Safety Limit (SL) requirement of SL 2.1.1.

In addition to the limiting MSLB transient, the SDM requirement must also protect against:

- a. Inadvertent boron dilution;
- b. An uncontrolled rod withdrawal from subcritical or low power condition;
- c. Startup of an inactive reactor coolant pump (RCP); and
- d. Rod ejection.

Each of these events is discussed below.

In the boron dilution analysis, the required SDM defines the reactivity difference between an initial subcritical boron concentration and the corresponding critical boron concentration. These values, in conjunction with the configuration of the RCS and the assumed dilution flow rate, directly affect the results of the analysis. This event is most limiting at the beginning of core life, when critical boron concentrations are highest.

Depending on the system initial conditions and reactivity insertion rate, the uncontrolled rod withdrawal transient is terminated by either a high power level trip, or a high pressurizer pressure trip. In all cases, power level, RCS pressure, linear heat rate, and the DNBR do not exceed allowable limits.

The startup of an inactive RCP will not result in a "cold water" criticality, even if the maximum difference in temperature exists between the SG and the core. The maximum positive reactivity addition that can occur due to an inadvertent RCP start is less than half the minimum required SDM. An idle RCP cannot, therefore, produce a return to power from the hot standby condition.

The withdrawal of control rods from subcritical or low power conditions adds reactivity to the reactor core, causing both the core power level and heat flux to increase with corresponding increases in reactor coolant temperatures and

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

pressure. The withdrawal of rods also produces a time-dependent redistribution of core power.

SDM satisfies Criterion 2 of the NRC Policy Statement. Even though it is not directly observed from the control room, SDM is considered an initial condition process variable because it is periodically monitored to ensure that the unit is operating within the bounds of accident analysis assumptions.

LCO

SDM is a core design condition that can be ensured during operation through control rod positioning (control and shutdown banks) and through the soluble boron concentration.

The MSLB (Ref. 2) and the boron dilution (Ref. 3) accidents are the most limiting analyses that establish the SDM value of the LCO. For MSLB accidents, if the LCO is violated, there is a potential to exceed the DNBR limit and to exceed 10 CFR 100, "Reactor Site Criteria," limits (Ref. 4). For the boron dilution accident, if the LCO is violated, the minimum required time assumed for operator action to terminate dilution may no longer be applicable.

APPLICABILITY

⑦

MODE 2 with $k_{eff} < 1.0$, and In MODES 3 and 4, the SDM requirements are applicable to provide sufficient negative reactivity to meet the assumptions of the safety analyses discussed above. In MODE 5, SDM is addressed by LCO 3.1.2, "SHUTDOWN MARGIN (SDM) - $T_{avg} \leq 200^{\circ}F$." In MODE 6, the shutdown reactivity requirements are given in LCO 3.9.1, "Boron Concentration." In MODES 1 and 2, SDM is ensured by complying with LCO 3.1.6, "Shutdown Bank Insertion Limits," and LCO 3.1.7.

①

④

ACTIONS

A.1

If the SDM requirements are not met, boration must be initiated promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. It is assumed that boration will be continued until the SDM requirements are met.

(continued)

BASES

ACTIONS

A.1 (continued)

In the determination of the required combination of boration flow rate and boron concentration, there is no unique requirement that must be satisfied.

Since it is imperative to raise the boron concentration of the RCS as soon as possible, the boron concentration should be a highly concentrated solution, such as that normally found in the boric acid storage tank, or the borated water storage tank. The operator should borate with the best source available for the plant conditions.

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In determining the boration flow rate, the time core life must be considered. For instance, the most difficult time in core life to increase the RCS boron concentration is at the beginning of cycle when the boron concentration may approach or exceed 2000 ppm. Assuming that a value of 1% $\Delta k/k$ must be recovered and a boration flow rate of [] gpm, it is possible to increase the boron concentration of the RCS by 100 ppm in approximately 35 minutes. If a boron worth of 10 pcm/ppm is assumed, this combination of parameters will increase the SDM by 1% $\Delta k/k$. These boration parameters of [] gpm and [] ppm represent typical values and are provided for the purpose of offering a specific example.

SURVEILLANCE REQUIREMENTS

SR 3.1.1.1

In MODES 1 and 2, SDM is verified by observing that the requirements of LCO 3.1.6 and LCO 3.1.7 are met. In the event that a rod is known to be untrippable, however, SDM verification must account for the worth of the untrippable rod as well as another rod of maximum worth.

INSERT

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In MODES 3, 4, and 5, the SDM is verified by performing a reactivity balance calculation, considering the listed reactivity effects:

- a. RCS boron concentration;
- b. Control bank position;
- c. RCS average temperature;

(continued)

INSERT

After a reactor trip, the combination of control banks and shutdown banks (less the most reactive RCCA, which is assumed to be fully withdrawn) is sufficient to take the reactor from full-power conditions at rated temperature to zero power, and to maintain the required SDM at rated no-load temperature.

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.1.1.1 (continued)

- d. Fuel burnup based on gross thermal energy generation;
- e. Xenon concentration;
- f. Samarium concentration; and
- g. ^{Design} Isothermal temperature coefficient (ITC).

⑧

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as the RCS.

The Frequency of 24 hours is based on the generally slow change in required boron concentration and the low probability of an accident occurring without the required SDM. This allows time for the operator to collect the required data, which includes performing a boron concentration analysis, and complete the calculation.

REFERENCES

- 1. ~~10 CFR 50, Appendix A, GDC 26.~~
- 2. ~~FSAR, Chapter [15].~~
- 3. ~~FSAR, Chapter [15].~~
- 4. ~~10 CFR 100.~~

⑥

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 26, "Reactivity Control System Redundancy and Capability."

2. Watts Bar FSAR, Section 15.4.2, "Major Secondary System Pipe Rupture."

3. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."

4. Title 10, Code of Federal Regulations, Part 100, "Reactor Site Criteria."

JUSTIFICATIONS FOR DEVIATIONS FROM NRC STS 3.1.1

1. Format change to delete brackets that identify plant specific information/values.
2. Corrects error in STS (i.e., MODE 5 is $\leq 200^{\circ}\text{F}$, but this LCO is for $T_{\text{avg}} > 200^{\circ}\text{F}$).
3. The COLR specifies the withdrawal location of the shutdown banks (per LCO 3.1.6) and they are not always required to be fully withdrawn.
4. Format change in text due to earlier text addition for Justification 3.
5. Text deleted since WBN believes that the content of the text is more properly described in operator training and procedures, not technical specifications. The previous paragraph indicates that boration should be from the best available source for the existing plant conditions. It is up to the operator to make that determination using training and procedures rather than an example in the tech specs.
6. Change to specify WBN specific reference information and format.
7. This change reflects comments made by the industry to the NRC at the Proof and Review meeting on the RSTS in Irvine, CA July 13 - July 20, 1992.
8. Plant specific terminology.
9. This statement is technically incorrect and has been reworded. The boration system does not activate on a trip and therefore does not "make the core subcritical rapidly" - this is the function of the control rod system. The soluble boron and control rods do contribute to SDM, however.
10. Paragraph was added to SR 3.1.1.1 to clarify that immediately following a trip, SDM is ensured by the control rods and the SR would then be performed on its regular frequency for modes 3 and 4.

$$\text{SDM} - T_{\text{avg}} \leq 200^{\circ}\text{F}$$

3.1.2

3.1 REACTIVITY CONTROL SYSTEMS

3.1.2 SHUTDOWN MARGIN (SDM) - $T_{\text{avg}} \leq 200^{\circ}\text{F}$

LCO 3.1.2 The SDM shall be \geq ~~1.0~~ $\% \Delta k/k$.

APPLICABILITY: MODE 5.

①

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. SDM not within limit.	A.1 Initiate boration to restore SDM to within limit.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.2.1 Verify SDM is \geq 1.0 $\% \Delta k/k$.	24 hours

①

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.2 SHUTDOWN MARGIN (SDM) - $T_{avg} \leq 200^{\circ}F$

BASES

BACKGROUND

According to GDC 26 (Ref. 1), the reactivity control systems must be redundant and capable of holding the reactor core subcritical when shut down under cold conditions. Maintenance of the SDM ensures that postulated reactivity events will not damage the fuel.

SDM requirements provide sufficient reactivity margin to ensure that acceptable fuel design limits will not be exceeded for normal shutdown and anticipated operational occurrences (AOOs). As such, the SDM defines the degree of subcriticality that would be obtained immediately following the insertion or ~~scram~~ ^{trip} of all shutdown and control rods, assuming the single rod cluster assembly of highest reactivity worth is fully withdrawn.

The system design requires that two independent reactivity control systems be provided, and that one of these systems be capable of maintaining the core subcritical under cold conditions. These requirements are provided by the use of movable control assemblies and soluble boric acid in the Reactor Coolant System (RCS). The Control Rod System can compensate for the reactivity effects of the fuel and water temperature changes accompanying power level changes over the range from full-load to no-load. In addition, the Control Rod System, together with the ~~boration system~~ ^{soluble boron}, provide SDM during power operation, ~~and are~~ ^{capable of making} the core subcritical rapidly enough to prevent exceeding acceptable fuel damage limits assuming that the rod of highest reactivity worth remains fully withdrawn. The soluble boron system can compensate for fuel depletion during operation and all xenon burnout reactivity changes, and maintain the reactor subcritical under cold conditions. ^{The Control Rod System IS}

During power operation, SDM control is ensured by operating with the shutdown banks, ~~fully withdrawn~~ and the control banks within the limits of LCO 3.1.7, "Control Bank Insertion Limits." When the unit is in the shutdown and refueling modes, the SDM requirements are met by means of adjustments to the RCS boron concentration.

within the limits of LCO 3.1.6, "Shutdown Bank Insertion Limits"

(continued)

BASES (continued)

APPLICABLE
 SAFETY ANALYSES

a trip
 7

The minimum required SDM is assumed as an initial condition in the safety analysis. The safety analysis (Ref. 2) establishes an SDM that ensures specified acceptable fuel design limits are not exceeded for normal operation and AOOs with the assumption of the highest worth rod stuck out on scram. Specifically, for MODE 5, the primary safety analysis that relies on the SDM limits is the boron dilution analysis.

The acceptance criteria for the SDM requirements are that specified acceptable fuel design limits are maintained. This is done by ensuring that:

- a. The reactor can be made subcritical from all operating conditions, transients, and Design Basis Events;
- b. The reactivity transients associated with postulated accident conditions are controllable within acceptable limits (departure from nucleate boiling ratio, fuel-centerline temperature limits for AOOs, and ≤ 280 cal/gm energy deposition for the rod ejection accident); and
- c. The reactor will be maintained sufficiently subcritical to preclude inadvertent criticality in the shutdown condition.

In the boron dilution analysis, the required SDM defines the reactivity difference between an initial subcritical boron concentration and the corresponding critical boron concentration. These values, in conjunction with the configuration of the RCS and the assumed dilution flow rate, directly affect the results of the analysis. This event is most limiting at the beginning of core life when critical boron concentrations are highest.

SDM satisfies Criterion 2 of the NRC Policy Statement. Even though it is not directly observed from the control room, SDM is considered an initial condition process variable because it is periodically monitored to ensure that the unit is operating within the bounds of accident analysis assumptions.

(continued)

BASES (continued)

LCO

SDM is a core design condition that can be ensured during operation through control rod positioning (control and shutdown banks) and through the soluble boron concentration.

The boron dilution accident (Ref. 2) is the most limiting analysis that establishes the SDM value of the LCO. For the boron dilution accident, if the LCO is violated, then the minimum required time assumed for operator action to terminate dilution may no longer be applicable.

APPLICABILITY

In MODE 5, the SDM requirements are applicable to provide sufficient negative reactivity to meet the assumptions of the safety analyses discussed above. In MODES 3 and 4, the SDM requirements are given in LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - T_{avg} > 200°F." In MODE 6, the shutdown reactivity requirements are given in LCO 3.9.1, "Boron Concentration." In MODES 1 and 2, SDM is ensured by complying with LCO 3.1.6, "Shutdown Bank Insertion Limits," and LCO 3.1.7.

3

ACTIONS

A.1

If the SDM requirements are not met, boration must be initiated promptly. A Completion Time of 15 minutes is adequate for an operator to correctly align and start the required systems and components. It is assumed that boration will be continued until the SDM requirements are met.

In the determination of the required combination of boration flow rate and boron concentration, there is no unique requirement that must be satisfied.

Since it is imperative to raise the boron concentration of the RCS as soon as possible, the boron concentration should be a highly concentrated solution, such as that normally found in the boric acid storage tank or the borated water storage tank

The operator should borate with the best source available for the plant conditions.

4

In determining the boration flow rate the time core life must be considered. For instance, the most difficult time in core life to increase the RCS boron concentration is at the beginning of cycle, when the boron concentration may

(continued)

BASES

ACTIONS

(4)

A.1 (continued)

approach or exceed 2000 ppm. Assuming that a value of 1% $\Delta k/k$ must be recovered and a boration flow rate of [] gpm, it is possible to increase the boron concentration of the RCS by 100 ppm in approximately 35 minutes. If a boron worth of 10 pcm/ppm is assumed, this combination of parameters will increase the SDM by 1% $\Delta k/k$. These boration parameters of [] gpm and [] ppm represent typical values and are provided for the purpose of offering a specific example.

SURVEILLANCE
 REQUIREMENTS

SR 3.1.2.1

In MODE. 5, the SDM is verified by performing a reactivity balance calculation, considering the following reactivity effects:

- a. RCS boron concentration;
- b. Control bank position;
- c. RCS average temperature;
- d. Fuel burnup based on gross thermal energy generation;
- e. Xenon concentration;
- f. Samarium concentration; and
- g. ^{Design} Isothermal temperature coefficient (ITC).

(7)

Using the ITC accounts for Doppler reactivity in this calculation because the reactor is subcritical, and the fuel temperature will be changing at the same rate as the RCS.

The Frequency of 24 hours is based on the generally slow change in required boron concentration and on the low probability of an accident occurring without the required SDM. This allows time enough for the operator to collect the required data, which includes performing a boron concentration analysis, and complete the calculation.

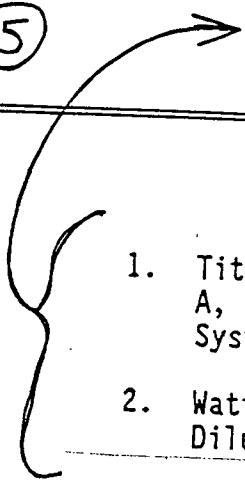
(continued)

BASES (continued)

REFERENCES

1. ~~10 CFR 50, Appendix A, GDC 20.~~
2. ~~FSAR, Chapter [15].~~

⑤



1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 26, "Reactivity Control System Redundancy and Capability."
2. Watts Bar FSAR, Section 15.2.4, "Uncontrolled Boron Dilution."

JUSTIFICATIONS FOR DEVIATIONS FROM NRC STS 3.1.2

1. Format change to delete brackets that identify plant specific information/values.
2. The COLR specifies the withdrawal location of the shutdown banks (per LCO 3.1.6) and they are not always required to be fully withdrawn.
3. Format change in text due to earlier text addition for Justification 2.
4. Text deleted since WBN believes that the content of the text is more properly described in operator training and procedures, not technical specifications. The previous paragraph indicates that boration should be from the best available source for the existing plant conditions. It is up to the operator to make that determination using training and procedures rather than an example in the tech specs.
5. Change to specify WBN specific reference information and format.
6. This statement is technically incorrect and has been reworded. The boration system does not activate on a trip and therefore does not "make the core subcritical rapidly" - this is the function of the control rod system. The soluble boron and control rods do contribute to SDM, however.
7. Plant specific terminology.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.3 Core Reactivity

LCO 3.1.3 The measured core reactivity shall be within $\pm 1\% \Delta k/k$ of predicted values.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Measured core reactivity not within limit.	A.1 Re-evaluate core design and safety analysis, and determine that the reactor core is acceptable for continued operation. <u>AND</u> A.2 Establish appropriate operating restrictions and SRs.	72 hours 72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.1.3.1</p> <p>-----NOTES-----</p> <p>1. ← The predicted reactivity values may be adjusted (normalized) to correspond to the measured core reactivity prior to exceeding a fuel burnup of 60 effective full power days (EFPD) after each fuel loading.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>2. This Surveillance is not required to be performed prior to entry into MODE 2.</p> </div> <p>-----</p> <p>Verify measured core reactivity is within $\pm 1\% \Delta k/k$ of predicted values.</p>	<p style="text-align: center;">④</p> <p>Once Prior to entering MODE 1 after fuel each loading refueling</p> <p><u>AND</u></p> <p>-----NOTE----- Only required after 60 EFPD -----</p> <p>31 EFPD thereafter</p>

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.3 Core Reactivity

BASES

BACKGROUND

According to GDC 26, GDC 28, and GDC 29 (Ref. 1), reactivity shall be controllable, such that, subcriticality is maintained under cold conditions, and acceptable fuel design limits are not exceeded during normal operation and anticipated operational occurrences. Therefore, reactivity balance is used as a measure of the predicted versus measured core reactivity during power operation. The periodic confirmation of core reactivity is necessary to ensure that Design Basis Accident (DBA) and transient safety analyses remain valid. A large reactivity difference could be the result of unanticipated changes in fuel, or control rod worth, or operation at conditions not consistent with those assumed in the predictions of core reactivity, and could potentially result in a loss of SDM or violation of acceptable fuel design limits. Comparing predicted versus measured core reactivity validates the nuclear methods used in the safety analysis and supports the SDM demonstrations (LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}F$ ") in ensuring the reactor can be brought safely to cold, subcritical conditions.

When the reactor core is critical or in normal power operation, a reactivity balance exists and the net reactivity is zero. A comparison of predicted and measured reactivity is convenient under such a balance, since parameters are being maintained relatively stable under steady-state power conditions. The positive reactivity inherent in the core design is balanced by the negative reactivity of the control components, thermal feedback, neutron leakage, and materials in the core that absorb neutrons, such as burnable absorbers producing zero net reactivity. Excess reactivity can be inferred from the boron letdown curve (or critical boron curve), which provides an indication of the soluble boron concentration in the Reactor Coolant System (RCS) versus cycle burnup. Periodic measurement of the RCS boron concentration for comparison with the predicted value with other variables fixed (such as rod height, temperature, pressure, and power), provides a convenient method of ensuring that core reactivity is within design expectations and that the

(continued)

BASES

BACKGROUND
(continued)

calculational models used to generate the safety analysis are adequate.

In order to achieve the required fuel cycle energy output, the uranium enrichment, in the new fuel loading and in the fuel remaining from the previous cycle, provides excess positive reactivity beyond that required to sustain steady-state operation throughout the cycle. When the reactor is critical at RTP and moderator temperature, the excess positive reactivity is compensated by burnable absorbers (if any), control rods, whatever neutron poisons (mainly xenon and samarium) are present in the fuel, and the RCS boron concentration.

When the core is producing THERMAL POWER, the fuel is being depleted and excess reactivity is decreasing. As the fuel depletes, the RCS boron concentration is reduced to decrease negative reactivity and maintain constant THERMAL POWER. The boron letdown curve is based on steady-state operation at RTP. Therefore, deviations from the predicted boron letdown curve may indicate deficiencies in the design analysis, deficiencies in the calculational models, or abnormal core conditions, and must be evaluated.

APPLICABLE
SAFETY ANALYSES

The acceptance criteria for core reactivity are that the reactivity balance limit ensures plant operation is maintained within the assumptions of the safety analyses.

Accurate prediction of core reactivity is either an explicit or implicit assumption in the accident analysis evaluations. Every accident evaluation (Ref. 2) is, therefore, dependent upon accurate evaluation of core reactivity. In particular, SDM and reactivity transients, such as control rod withdrawal accidents or rod ejection accidents, are very sensitive to accurate prediction of core reactivity. These accident analysis evaluations rely on computer codes that have been qualified against available test data, operating plant data, and analytical benchmarks. Monitoring reactivity balance additionally ensures that the nuclear methods provide an accurate representation of the core reactivity.

Design calculations and safety analyses are performed for each fuel cycle for the purpose of predetermining reactivity

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

behavior and the RCS boron concentration requirements for reactivity control during fuel depletion.

The comparison between measured and predicted initial core reactivity provides a normalization for the calculational models used to predict core reactivity. If the measured and predicted RCS boron concentrations for identical core conditions at beginning-of-cycle (BOC) do not agree, then the assumptions used in the reload cycle design analysis or the calculational models used to predict soluble boron requirements may not be accurate. If reasonable agreement between measured and predicted core reactivity exists at BOC, then the prediction may be normalized to the measured boron concentration. Thereafter, any significant deviations in the measured boron concentration from the predicted boron letdown curve that develop during fuel depletion may be an indication that the calculational model is not adequate for core burnups beyond BOC, or that an unexpected change in core conditions has occurred.

The normalization of predicted RCS boron concentration to the measured value is typically performed after reaching RTP following startup from a refueling outage, with the control rods in their normal positions for power operation. The normalization is performed at BOC conditions, so that core reactivity relative to predicted values can be continually monitored and evaluated as core conditions change during the cycle.

Core reactivity satisfies Criterion 2 of the NRC Policy Statement.

LCO

Long-term core reactivity behavior is a result of the core physics design and cannot be easily controlled once the core design is fixed. During operation, therefore, the LCO can only be ensured through measurement and tracking, and appropriate actions taken as necessary. Large differences between actual and predicted core reactivity may indicate that the assumptions of the DBA and transient analyses are no longer valid, or that the uncertainties in the Nuclear Design Methodology are larger than expected. A limit on the reactivity balance of $\pm 1\% \Delta k/k$ has been established based on engineering judgment. A 1% deviation in reactivity from

(continued)

BASES

LCO
(continued)

that predicted is larger than expected for normal operation and should therefore be evaluated.

When measured core reactivity is within $1\% \Delta k/k$ of the predicted value at steady-state thermal conditions, the core is considered to be operating within acceptable design limits. Since deviations from the limit are normally detected by comparing predicted and measured steady-state RCS critical boron concentrations, the difference between measured and predicted values would be approximately 100 ppm (depending on the boron worth) before the limit is reached. These values are well within the uncertainty limits for analysis of boron concentration samples, so that spurious violations of the limit due to uncertainty in measuring the RCS boron concentration are unlikely.

⑤ dependent

APPLICABILITY

The limits on core reactivity must be maintained during MODES 1 and 2 because a reactivity balance must exist when the reactor is critical or producing THERMAL POWER. As the fuel depletes, core conditions are changing, and confirmation of the reactivity balance ensures the core is operating as designed. This Specification does not apply in MODES 3, 4, and 5 because the reactor is shut down, and the reactivity balance is ~~not changing~~. used only as a comparison of predicted versus measured reactivity when the reactor is critical.

①

In MODE 6, fuel loading results in a continually changing core reactivity. Boron concentration requirements (LCO 3.9.1, "Boron Concentration") ensure that fuel movements are performed within the bounds of the safety analysis. An SDM demonstration is required during the first startup following operations that could have altered core reactivity (e.g., fuel movement, control rod replacement, control rod shuffling).

ACTIONS

A.1 and A.2

Should an anomaly develop between measured and predicted core reactivity, an evaluation of the core design and safety analysis must be performed. Core conditions are evaluated to determine their consistency with input to design calculations. Measured core and process parameters are evaluated to determine that they are within the bounds of

(continued)

BASES

ACTIONS

A.1 and A.2 (continued)

the safety analysis, and safety analysis calculational models are reviewed to verify that they are adequate for representation of the core conditions. The required Completion Time of 72 hours is based on the low probability of a DBA occurring during this period, and allows sufficient time to assess the physical condition of the reactor and complete the evaluation of the core design and safety analysis.

Following evaluations of the core design and safety analysis, the cause of the reactivity anomaly may be resolved. If the cause of the reactivity anomaly is a mismatch in core conditions at the time of RCS boron concentration sampling, then a recalculation of the RCS boron concentration requirements may be performed to demonstrate that core reactivity is behaving as expected. If an unexpected physical change in the condition of the core has occurred, it must be evaluated and corrected, if possible. If the cause of the reactivity anomaly is in the calculation technique, then the calculational models must be revised to provide more accurate predictions. If any of these results are demonstrated, and it is concluded that the reactor core is acceptable for continued operation, then the boron letdown curve may be renormalized and power operation may continue. If operational restriction or additional SRs are necessary to ensure the reactor core is acceptable for continued operation, then they must be defined.

The required Completion Time of 72 hours is adequate for preparing whatever operating restrictions or Surveillances that may be required to allow continued reactor operation.

B.1

If the core reactivity cannot be restored to within the 1% $\Delta k/k$ limit, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. If the SDM for MODE 3 is not met, then the boration required by SR 3.1.1.1 would occur. The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.1.3.1

Core reactivity is verified by periodic comparisons of measured and predicted RCS boron concentrations. The comparison is made, considering that other core conditions are fixed or stable, including control rod position, moderator temperature, fuel temperature, fuel depletion, xenon concentration, and samarium concentration. The Surveillance is performed prior to entering MODE 1 as an initial check on core conditions and design calculations at BOC. The SR is modified by ~~two~~ ^{two} Notes. The ~~first~~ ^{first} Note indicates that the normalization of predicted core reactivity to the measured value must take place within the first 60 effective full power days (EFPD) after each fuel loading. This allows sufficient time for core conditions to reach steady state, but prevents operation for a large fraction of the fuel cycle without establishing a benchmark for the design calculations. The required subsequent Frequency of 31 EFPD^s following the initial 60 EFPD^s after entering MODE 1, is acceptable, based on the slow rate of core changes due to fuel depletion and the presence of other indicators (QPTR, AFD, etc.) for prompt indication of an anomaly. The second Note indicates that the performance of SR 3.1.3.1 is not required for entering MODE 2.

(2)

(4)

(4)

REFERENCES

1. ~~10 CFR 50, Appendix A, GDC 26, GDC 28, and GDC 29.~~
2. ~~FSAR, Chapter [15].~~

(3)

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 26, "Reactivity Control System Redundancy and Capability"; General Design Criterion 28, "Reactivity Limits"; and General Design Criterion 29, "Protection Against Anticipated Operational Occurrences."
2. Watts Bar FSAR, Section 15.0, "Accident Analyses."

JUSTIFICATIONS FOR DEVIATIONS FROM NRC STS 3.1.3

1. Change to correct inaccurate STS text (i.e., reactivity balance can change in MODES 3, 4 and 5).
2. Change to correct editorial errors in STS.
3. Change to specify WBN specific reference information and format.
4. This change reflects comments made by the industry to the NRC at the Proof and Review meeting on the RSTS in Irvine, CA July 13 - July 20, 1992.
5. Wording changed to remove implication that boron worth is always 100 ppm. This will vary over core life and from cycle to cycle.

① 3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Moderator Temperature Coefficient (MTC)

LCO 3.1.4 The MTC shall be maintained within the limits specified in the COLR. The maximum upper limit shall be $\leq 0.0 \Delta k/k^* F$ at hot zero power ~~[that specified in Figure 3.1.4-1]~~.
 (Handwritten annotations: ②, ③, ④, ①)

APPLICABILITY: MODE 1, and MODE 2, with $k_{eff} \geq 1.0$ for the upper MTC limit, MODES 1, 2, and 3 for the lower MTC limit.

NOTE
LCO 3.0.4 is not applicable. (Handwritten annotation: ⑦)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MTC not within upper limit.	A.1 <div style="border: 1px dashed black; padding: 5px; margin: 5px 0;"> -----NOTE----- Subsequent operation is permitted. The requirements of LCO 3.1.7, "Control Bank Insertion Limits," remain applicable. </div> Establish administrative withdrawal limits for control banks to maintain MTC within limit.	24 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 2 with $k_{eff} < 1.0$.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. MTC not within lower limit.	C.1 Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.1.4.1</p> <p style="border: 1px dashed black; padding: 5px; margin: 5px 0;">-----NOTE----- This Surveillance is not required to be performed prior to entry into MODE 2.</p> <p>Verify MTC is within upper limit.</p>	<p style="text-align: center;">(7)</p> <p>Once Prior to entering MODE 1 after each refueling</p>
<p>SR 3.1.4.2</p> <p style="border: 1px dashed black; padding: 5px; margin: 5px 0;">-----NOTE----- This Surveillance is not required to be performed prior to entry into MODE 1, 2, or 3.</p> <p>Verify MTC is within 300 ppm Surveillance limit (not LCO limit) specified in the COLR.</p>	<p>Not Required until to be performed</p> <p style="text-align: center;">(7)</p> <p>(5) s</p> <p>-----</p> <p>Once Each cycle</p> <p style="text-align: center;">(7)</p>

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE	FREQUENCY
<p>SR 3.1.4.3</p> <p style="text-align: center;">-----NOTES-----</p> <p>⑦ 1. This Surveillance is not required to be performed prior to entry into MODE 1, 2, or 3.</p> <p>⑤ 1/2. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.4.3 shall be repeated once per 14 EFPS during the remainder of the fuel cycle.</p> <p>2. SR 3.1.4.3 need not be repeated if the MTC measured at the equivalent of equilibrium RTP-ARO boron concentration of ≤ 60 ppm is less negative than the 60 ppm Surveillance limit specified in the COLR.</p> <p>-----</p> <p>Verify MTC is within lower limit.</p>	<p>Not ⑦ to be performed until</p> <p>NOTE</p> <p>Required within 7 EFPS after reaching the equivalent of an equilibrium RTP-ARO boron concentration of 300 ppm</p> <p>-----</p> <p>⑦</p> <p>Once</p> <p>Each cycle</p>

4

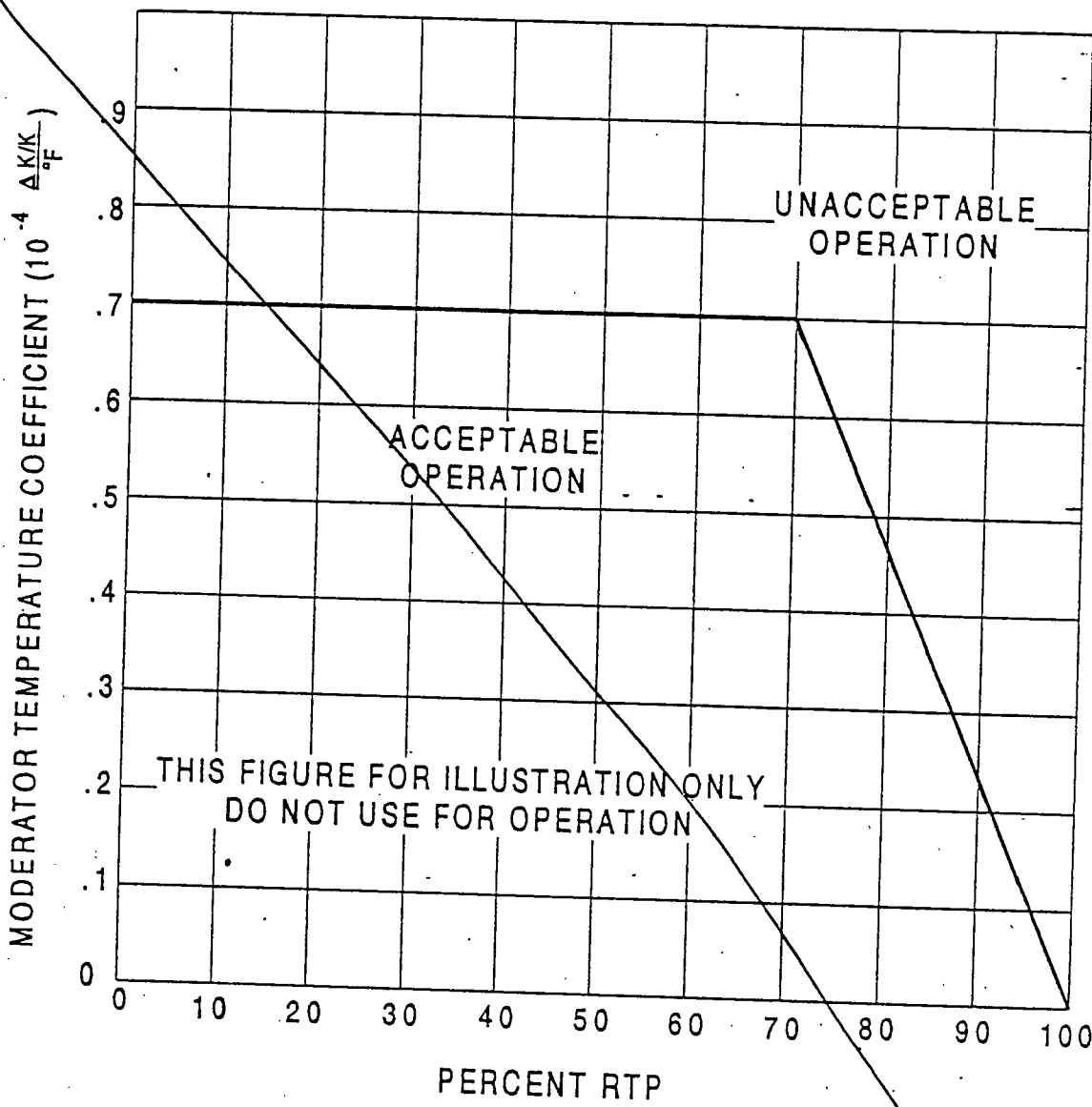


Figure 3.1.4-1 (page 1 of 1)
Moderator Temperature Coefficient vs. Power Level

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.4 Moderator Temperature Coefficient (MTC)

BASES

BACKGROUND

According to GDC 11 (Ref. 1), the reactor core and its interaction with the Reactor Coolant System (RCS) must be designed for inherently stable power operation, even in the possible event of an accident. In particular, the net reactivity feedback in the system must compensate for any unintended reactivity increases.

The MTC relates a change in core reactivity to a change in reactor coolant temperature (a positive MTC means that reactivity increases with increasing moderator temperature; conversely, a negative MTC means that reactivity decreases with increasing moderator temperature). The reactor is designed to operate with a negative MTC over the largest possible range of fuel cycle operation. Therefore, a coolant temperature increase will cause a reactivity decrease, so that the coolant temperature tends to return toward its initial value. Reactivity increases that cause a coolant temperature increase will thus be self-limiting, and stable power operation will result.

MTC values are predicted at selected burnups during the safety evaluation analysis and are confirmed to be acceptable by measurements. Both initial and reload cores are designed so that the beginning-of-cycle (BOC) MTC is less than zero when THERMAL POWER is at RTP. The actual value of the MTC is dependent on core characteristics, such as fuel loading and reactor coolant soluble boron concentration. The core design may require additional fixed distributed poisons to yield an MTC at BOC within the range analyzed in the plant accident analysis. The end-of-cycle (EOC) MTC is also limited by the requirements of the accident analysis. Fuel cycles that are designed to achieve high burnups or that have changes to other characteristics are evaluated to ensure that the MTC does not exceed the EOC limit.

The limitations on MTC are provided to ensure that the value of this coefficient remains within the limiting conditions assumed in the FSAR accident and transient analyses.

(continued)

BASES

BACKGROUND
(continued)

If the LCO limits are not met, the unit response during transients may not be as predicted. The core could violate criteria that prohibit a return to criticality, or the departure from nucleate boiling ratio criteria of the approved correlation may be violated, which could lead to a loss of the fuel cladding integrity. (8)
during non-MSLB events

The SRs for measurement of the MTC at the beginning and near the end of the fuel cycle are adequate to confirm that the MTC remains within its limits, since this coefficient changes slowly, due principally to the reduction in RCS boron concentration associated with fuel burnup.

APPLICABLE
SAFETY ANALYSES

The acceptance criteria for the specified MTC are:

- a. The MTC values must remain within the bounds of those used in the accident analysis (Ref. 2); and
- b. The MTC must be such that inherently stable power operations result during normal operation and accidents, such as overheating and overcooling events.

The FSAR, Section 15 (Ref. 2), contains analyses of accidents that result in both overheating and overcooling of the reactor core. MTC is one of the controlling parameters for core reactivity in these accidents. Both the most positive value and most negative value of the MTC are important to safety, and both values must be bounded. Values used in the analyses consider worst-case conditions to ensure that the accident results are bounding (Ref. 3).

The consequences of accidents that cause core overheating must be evaluated when the MTC is positive. Such accidents include the rod withdrawal transient from either zero (Ref. 4) or RTP, loss of main feedwater flow, and loss of forced reactor coolant flow. The consequences of accidents that cause core overcooling must be evaluated when the MTC is negative. Such accidents include sudden feedwater flow increase and sudden decrease in feedwater temperature.

In order to ensure a bounding accident analysis, the MTC is assumed to be its most limiting value for the analysis conditions appropriate to each accident. The bounding value is determined by considering rodded and unrodded conditions,

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

whether the reactor is at full or zero power, and whether it is the BOC or EOC life. The most conservative combination appropriate to the accident is then used for the analysis (Ref. 2).

MTC values are bounded in reload safety evaluations assuming steady-state conditions at BOC and EOC. An EOC measurement is conducted at conditions when the RCS boron concentration reaches approximately 300 ppm. The measured value may be extrapolated to project the EOC value, in order to confirm reload design predictions.

MTC satisfies Criterion 2 of the NRC Policy Statement. Even though it is not directly observed and controlled from the control room, MTC is considered an initial condition process variable because of its dependence on boron concentration.

LCO

LCO 3.1.4 requires the MTC to be within specified limits of the COLR to ensure that the core operates within the assumptions of the accident analysis. During the reload core safety evaluation, the MTC is analyzed to determine that its values remain within the bounds of the original accident analysis during operation.

Assumptions made in safety analyses require that the MTC be less positive than a given upper bound and more positive than a given lower bound. The MTC is most positive at BOC; this upper bound must not be exceeded. This maximum upper limit occurs at BOC, all rods out, hot zero power conditions. At EOC the MTC takes on its most negative value, when the lower bound becomes important. This LCO exists to ensure that both the upper and lower bounds are not exceeded.

During operation, therefore, the conditions of the LCO can only be ensured through measurement. The Surveillance checks at BOC and EOC on MTC provide confirmation that the MTC is behaving as anticipated so that the acceptance criteria are met.

The LCO establishes a maximum positive value that cannot be exceeded. The BOC positive limit and the EOC negative limit are established in the COLR to allow specifying limits for each particular cycle. This permits the unit to take

(continued)

BASES

LCO (continued) advantage of improved fuel management and changes in unit operating schedule.

APPLICABILITY Technical Specifications place both LCO and SR values on MTC, based on the safety analysis assumptions described above.

In MODE 1, the limits on MTC must be maintained to ensure that any accident initiated from THERMAL POWER operation will not violate the design assumptions of the accident analysis. In MODE 2 with the reactor critical, the upper limit must also be maintained to ensure that startup and subcritical accidents (such as the uncontrolled CONTROL ROD assembly or group withdrawal) will not violate the assumptions of the accident analysis. The lower MTC limit must be maintained in MODES 2 and 3, in addition to MODE 1, to ensure that cooldown accidents will not violate the assumptions of the accident analysis. In MODES 4, 5, and 6, this LCO is not applicable, since no Design Basis Accidents using the MTC as an analysis assumption are initiated from these MODES. The Applicability is modified by a Note stating that LCO 3.0.4 is not applicable, since MTC limits are not always met in non-applicable MODES.

7

ACTIONS

A.1

If the BOC MTC limit is violated, administrative withdrawal limits for control banks must be established to maintain the MTC within its limits. The MTC becomes more negative with control bank insertion and decreased boron concentration. A Completion Time of 24 hours provides enough time for evaluating the MTC measurement and computing the required bank withdrawal limits.

As cycle burnup is increased, the RCS boron concentration will be reduced. The reduced boron concentration causes the MTC to become more negative. Using physics calculations, the time in cycle life at which the calculated MTC will meet the LCO requirement can be determined. At this point in core life Condition A no longer exists. The unit is no longer in the Required Action, so the administrative withdrawal limits are no longer in effect.

(continued)

BASES

ACTIONS

A.1 (continued)

Required Action A.1 is modified by a Note indicating continued operation may be allowed if Required Action A.1 is completed and the requirements of LCO 3.1.7 are met. e
⑦

B.1

If the required administrative withdrawal limits at BOC are not established within 24 hours, the unit must be brought to MODE 2 with $k_{\text{eff}} < 1.0$ to prevent operation with an MTC that is more positive than that assumed in safety analyses.

The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

C.1

Exceeding the EOC MTC limit means that the safety analysis assumptions for the EOC accidents that use a bounding negative MTC value may be invalid. If the EOC MTC limit is exceeded, the plant must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 4 within 12 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.4.1

This SR requires measurement of the MTC at BOC prior to entering MODE 1 in order to demonstrate compliance with the most positive MTC LCO. Meeting the limit prior to entering MODE 1 ensures that the limit will also be met at higher power levels.

(continued)

BASES

SURVEILLANCE
REQUIREMENTSSR 3.1.4.1 (continued)

The BOC MTC value for all rods out (ARO) will be inferred from isothermal temperature coefficient measurements obtained during the physics tests after refueling. The ARO value can be directly compared to the BOC MTC limit of the LCO. If required, measurement results and predicted design values can be used to establish administrative withdrawal limits for control banks.

This SR is modified by a Note stating that performance of the Surveillance is not required prior to entry into MODE 2. ^e (7)

SR 3.1.4.2 and SR 3.1.4.3

In similar fashion, the LCO demands that the MTC be less negative than the specified value for EOC full power conditions. This measurement may be performed at any THERMAL POWER, but its results must be extrapolated to the conditions of RTP and all banks withdrawn in order to make a proper comparison with the LCO value. Because the RTP MTC value will gradually become more negative with further core depletion and boron concentration reduction, a 300 ppm SR value of MTC should necessarily be less negative than the EOC LCO limit. The 300 ppm SR value is sufficiently less negative than the EOC LCO limit value to ensure that the LCO limit will be met when the 300 ppm Surveillance criterion is met.

These SRs are modified by a Note stating that performance of these Surveillances is not required prior to entry into MODE 1, 2, or 3. ^e (7)

SR 3.1.4.3 is modified by a Note that includes the following requirements:

- a. If the 300 ppm Surveillance limit is exceeded, it is possible that the EOC limit on MTC could be reached before the planned EOC. Because the MTC changes slowly with core depletion, the Frequency of 14 effective full power days is sufficient to avoid exceeding the EOC limit.
- b. The Surveillance limit for RTP boron concentration of 60 ppm is conservative. If the measured MTC at 60 ppm

(continued)

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.1.4.2 and SR 3.1.4.3 (continued)

is more positive than the 60 ppm Surveillance limit, the EOC limit will not be exceeded because of the gradual manner in which MTC changes with core burnup.

REFERENCES

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1. ~~10 CFR 50, Appendix A, GDC 11.~~
 2. ~~FSAR, Chapter [15].~~
 3. WCAP 9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology," July 1985.
 4. ~~FSAR, Chapter [15].~~
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1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 11, "Reactor Inherent Protection."
2. Watts Bar FSAR, Section 15.0, "Accident Analyses."
4. Watts Bar FSAR, Section 15.2.1, "Uncontrolled Rod Cluster Control Assembly Bank Withdrawal From a Subcritical Condition."

JUSTIFICATIONS FOR DEVIATIONS FROM NRC STS 3.1.4

1. Change to correct typographical error in STS.
2. Format change to delete brackets that identify plant specific information/values.
3. Change to reflect WBN specific parameter value.
4. WBN utilizes the same maximum moderator temperature coefficient upper limit for all power levels. Therefore, Figure 3.1.4-1 is unnecessary.
5. Change to correct editorial error(s) in STS.
6. Change to specify WBN specific reference information and format.
7. This change reflects comments made by the industry to the NRC at the Proof and Review meeting on the RSTS in Irvine, CA July 13 - July 20, 1992.
8. Revised this statement since for MSLB events the core briefly returns to criticality.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Rod Group Alignment Limits

LCO 3.1.5 All shutdown and control rods shall be OPERABLE, with all individual indicated rod positions within 12 steps of their group step counter demand position.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more rod(s) untrippable.	A.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$. OR ①	1 hour
	A.1.2 Initiate boration to restore SDM to within limit. AND	1 hour
	A.2 Be in MODE 3.	6 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. One rod not within alignment limits.</p>	<p>B.1</p> <div style="border: 1px dashed black; padding: 5px; margin: 10px 0;"> <p>-----NOTE----- Maintain bank sequence and insertion limits of LCO 3.1.6, "Shutdown Bank Insertion Limits," and LCO 3.1.7, "Control Bank Insertion Limits," with changes to rod position or THERMAL POWER level, during subsequent operation.</p> </div> <p>②</p> <div style="border: 1px solid black; padding: 2px; margin: 10px 0;"> <p>Realign remainder of rods in the group with the misaligned</p> </div> <p>Restore → rod to within alignment limit.</p> <p>②</p> <p>OR</p> <p>B.2.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$.</p> <p>OR ①</p> <p>B.2.1.2 Initiate boration to restore SDM to within limit.</p> <p>AND</p> <p>B.2.2 Reduce THERMAL POWER to $\leq 75\%$ RTP.</p> <p>AND</p>	<p>1 hour</p> <p>1 hour</p> <p>1 hour</p> <p>2 hours</p> <p>(continued)</p>

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	<p>B.2.3 Verify SDM is $\geq 1.6\% \Delta k/k$ <u>AND</u> $\textcircled{1}$</p> <p>B.2.4 Perform SR 3.2.1.1. <u>AND</u></p> <p>B.2.5 Perform SR 3.2.2.1. <u>AND</u></p> <p>B.2.6 Re-evaluate safety analyses and confirm results remain valid for duration of operation under these conditions.</p>	<p>Once per 12 hours</p> <p>72 hours</p> <p>72 hours</p> <p>5 days</p>
C. More than one rod not within alignment limit.	<p>C.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$. <u>OR</u> $\textcircled{1}$</p> <p>C.1.2 Initiate boration to restore required SDM to within limit. <u>AND</u></p> <p>C.2 Be in MODE 3.</p>	<p>1 hour</p> <p>1 hour</p> <p>6 hours</p>
D. Required Action and associated Completion Time of Condition B not met.	D.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
<p>SR 3.1.5.1 Verify individual rod positions within alignment limit. are as follows.</p> <p>(11) a. With the rod position deviation monitor inoperable; or</p> <p>b. With the rod position deviation monitor OPERABLE</p>	<p>(11) 4 hours</p> <p>9 12 hours</p>
<p>SR 3.1.5.2 Verify rod freedom of movement (trippability) by moving each rod not fully inserted in the core ≥ 10 steps in either direction.</p>	<p>92 days</p>
<p>SR 3.1.5.3 Demonstrate ^{(11) Verify} rod drop time of each rod, from the fully withdrawn position, is $\leq [2.2]$ seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with:</p> <p>(2) a. $T_{avg} \geq \overset{SSI}{500}^{\circ}F$; and</p> <p>b. All reactor coolant pumps operating.</p>	<p>Prior to reactor criticality after each removal of the reactor head</p>

12 hours
AND
Once within 4 hours and every 4 hours thereafter when the rod position deviation monitor is inoperable.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.5 Rod Group Alignment Limits

BASES

BACKGROUND

The OPERABILITY (e.g., trippability) of the shutdown and control rods are initial assumptions in all safety analyses that assume rod insertion upon reactor trip. Maximum rod misalignment is an initial assumption in the safety analysis that directly affects core power distributions and assumptions of available SDM.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Plants" (Ref. 2).

Mechanical or electrical failures may cause a control rod to become inoperable or to become misaligned from its group. Control rod inoperability or misalignment may cause increased power peaking, due to the asymmetric reactivity distribution and a reduction in the total available rod worth for reactor shutdown. Therefore, control rod alignment and OPERABILITY are related to core operation in design power peaking limits and the core design requirement of a minimum SDM.

Limits on control rod alignment have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

Rod cluster control assemblies (RCCAs), or rods, are moved by their control rod drive mechanisms (CRDMs). Each CRDM moves its RCCA one step (approximately $\frac{5}{8}$ inches) at a time, but at varying rates (steps per minute) depending on the signal output from the Rod Control System.

The RCCAs are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups

(continued)

BASES

BACKGROUND
(continued)

②

that are moved in a staggered fashion, but always within one step of each other. ~~All units have~~ ^{There ARE} four control banks and ~~at least two~~ shutdown banks.

The shutdown banks are maintained either in the fully inserted or fully withdrawn position. The control banks are moved in an overlap pattern, using the following withdrawal sequence: When control bank A reaches a predetermined height in the core, control bank B begins to move out with control bank A. Control bank A stops at the position of maximum withdrawal, and control bank B continues to move out. When control bank B reaches a predetermined height, control bank C begins to move out with control bank B. This sequence continues until control banks A, B, and C are at the fully withdrawn position, and control bank D is approximately halfway withdrawn. The insertion sequence is the opposite of the withdrawal sequence. The control rods are arranged in a radially symmetric pattern, so that control bank motion does not introduce radial asymmetries in the core power distributions.

The axial position of shutdown rods and control rods is indicated by two separate and independent systems, which are the Bank Demand Position Indication System (commonly called group step counters) and the ~~Digital~~ Rod Position Indication (DRPI) System. ^A ③ ~~Digital~~ Analog

The Bank Demand Position Indication System counts the pulses from the rod control system that moves the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Bank Demand Position Indication System is considered highly precise (± 1 step or $\pm \frac{1}{8}$ inch). If a rod does not move one step for each demand pulse, the step counter will still count the pulse and incorrectly reflect the position of the rod.

③

^A The DRPI System provides a ^N highly accurate indication of actual control rod position, but at a lower precision than the step counters. This system is based on inductive analog signals from a series of coils spaced along a hollow tube with a center-to-center distance of 3.75 inches, which is six steps. ~~To increase the reliability of the system, the inductive coils are connected alternately to data system A or B. Thus, if one system fails, the DRPI will go on~~

⑤

(continued)

BASES

BACKGROUND
(continued)

5

~~half accuracy with an effective coil spacing of 7.5 inches, which is 12 steps. Therefore,~~ the normal indication accuracy of the DRPI System is ± 6 steps (± 3.75 inches), and the maximum uncertainty is ± 12 steps (± 7.5 inches). With an indicated deviation of 12 steps between the group step counter and DRPI, the maximum deviation between actual rod position and the demand position could be 24 steps, or 15 inches.

A 3

APPLICABLE
SAFETY ANALYSES

Control rod misalignment accidents are analyzed in the safety analysis (Ref. 3). The acceptance criteria for addressing control rod inoperability or misalignment are that:

- a. There be no violations of:
 1. specified acceptable fuel design limits, or
 2. Reactor Coolant System (RCS) pressure boundary integrity; and
- b. The core remains subcritical after accident transients, other than a main steam line break (MSLB). 12

Two types of misalignment are distinguished. During movement of a control rod group, one rod may stop moving, while the other rods in the group continue. This condition may cause excessive power peaking. The second type of misalignment occurs if one rod fails to insert upon a reactor trip and remains stuck fully withdrawn. This condition requires an evaluation to determine that sufficient reactivity worth is held in the control rods to meet the SDM requirement, with the maximum worth rod stuck fully withdrawn.

Two types of analysis are performed in regard to static rod misalignment (Ref. 4). With control banks at their insertion limits, one type of analysis considers the case when any one rod is completely inserted into the core. The second type of analysis considers the case of a completely withdrawn single rod from a bank inserted to its insertion limit. Satisfying limits on departure from nucleate boiling ratio in both of these cases bounds the situation when a rod is misaligned from its group by 12 steps.

(continued)

BASES

⑥ IN RESPONSE TO A MAINSTREAM PIPE RUPTURE

APPLICABLE
SAFETY ANALYSES
(continued)

⑥

Another type of misalignment occurs if one RCCA fails to insert upon a reactor trip and remains stuck fully withdrawn. This condition is assumed in the evaluation to determine that the required SDM is met with the maximum worth RCCA also fully withdrawn (Ref. 5). *The reactor is shutdown by the boric acid injection delivered by the ECCS.*

The Required Actions in this LCO ensure that either deviations from the alignment limits will be corrected or that THERMAL POWER will be adjusted so that excessive local linear heat rates (LHRs) will not occur, and that the requirements on SDM and ejected rod worth are preserved.

Continued operation of the reactor with a misaligned control rod is allowed if the heat flux hot channel factor ($F_{\Delta H}^N$) (7) ($F_Q(Z)$) and the nuclear enthalpy hot channel factor ($F_{\Delta H}^N$) are verified to be within their limits in the COLR, ~~(Ref. 6)~~ and the safety analysis is verified to remain valid. When a control rod is misaligned, the assumptions that are used to determine the rod insertion limits, AFD limits, and quadrant power tilt limits are not preserved. Therefore, the limits may not preserve the design peaking factors, and $F_Q(Z)$ and $F_{\Delta H}^N$ must be verified directly by incore mapping. Bases Section 3.2 (Power Distribution Limits) contains more complete discussions of the relation of $F_Q(Z)$ and $F_{\Delta H}^N$ to the operating limits. (8)

Shutdown and control rod OPERABILITY and alignment are directly related to power distributions and SDM, which are initial conditions assumed in safety analyses. Therefore they satisfy Criterion 2 of the NRC Policy Statement.

LCO

The limits on shutdown or control rod alignments ensure that the assumptions in the safety analysis will remain valid. The requirements on OPERABILITY ensure that upon reactor trip, the assumed reactivity will be available and will be inserted. The OPERABILITY requirements also ensure that the RCCAs and banks maintain the correct power distribution and rod alignment.

The requirement to maintain the rod alignment to within plus or minus 12 steps is conservative. The minimum misalignment assumed in safety analysis is 24 steps (15 inches), and in some cases a total misalignment from fully withdrawn to fully inserted is assumed.

(continued)

BASES

LCO
(continued)

Failure to meet the requirements of this LCO may produce unacceptable power peaking factors and LHRs, or unacceptable SDMs, all of which may constitute initial conditions inconsistent with the safety analysis.

APPLICABILITY

The requirements on RCCA OPERABILITY and alignment are applicable in MODES 1 and 2 because these are the only MODES in which neutron (or fission) power is generated, and the OPERABILITY (i.e., trippability) and alignment of rods have the potential to affect the safety of the plant. In MODES 3, 4, 5, and 6, the alignment limits do not apply because the control rods are bottomed, and the reactor is shut down and not producing fission power. In the shutdown MODES, the OPERABILITY of the shutdown and control rods has the potential to affect the required SDM, but this effect can be compensated for by an increase in the boron concentration of the RCS. See LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}\text{F}$," for SDM in MODES 3, 4, and 5, and LCO 3.9.1, "Boron Concentration," for boron concentration requirements during refueling.

⑨

②

LCO 3.1.2 "shutdown Margin (SDM) - $T_{avg} \leq 200^{\circ}\text{F}$ " for SDM in MODES 3, 4, and 5

ACTIONS

A.1.1 and A.1.2

When one or more rods are untrippable, there is a possibility that the required SDM may be adversely affected. Under these conditions, it is important to determine the SDM, and if it is less than the required value, initiate boration until the required SDM is recovered. The Completion Time of 1 hour is adequate for determining SDM and, if necessary, for initiating emergency boration and restoring SDM.

⑬

In this situation, SDM verification must include the worth of the untrippable rod, as well as a rod of maximum worth.

A.2

If the untrippable rod(s) cannot be restored to OPERABLE status, the plant must be brought to a MODE or condition in which the LCO requirements are not applicable. To achieve

(continued)

BASES

ACTIONS

A.2 (continued)

this status, the unit must be brought to at least MODE 3 within 6 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3 from full-power conditions in an orderly manner and without challenging plant systems.

B.1

When a rod becomes misaligned, it can usually be moved and is still trippable. If the rod can be realigned within the Completion Time of 1 hour, local xenon redistribution during this short interval will not be significant, and operation may proceed without further restriction.

An alternative to realigning a single misaligned RCCA to the group average position is to align the remainder of the group to the position of the misaligned RCCA. However, this must be done without violating the bank sequence, overlap, and insertion limits specified in LCO 3.1.6, "Shutdown Bank Insertion Limits," and LCO 3.1.7, "Control Bank Insertion Limits." The Completion Time of 1 hour gives the operator sufficient time to adjust the rod positions in an orderly manner.

B.2.1.1 and B.2.1.2

With a misaligned rod, SDM must be verified to be within limit or boration must be initiated to restore SDM to within limit.

In many cases, realigning the remainder of the group to the misaligned rod may not be desirable. For example, realigning control bank B to a rod that is misaligned 15 steps from the top of the core would require a significant power reduction, since control bank D must be moved fully in and control bank C must be moved in to approximately 100 to 115 steps.

Power operation may continue with one RCCA trippable but misaligned, provided that SDM is verified within 1 hour.

(continued)

BASES

ACTIONS

B.2.1.1 and B.2.1.2 (continued)

The Completion Time of 1 hour represents the time necessary for determining the actual unit SDM and, if necessary, aligning and starting the necessary systems and components to initiate boration.

B.2.2, B.2.3, B.2.4, B.2.5, and B.2.6

For continued operation with a misaligned rod, RTP must be reduced, SDM must periodically be verified within limits, hot channel factors ($F_q(Z)$ and $F_{\Delta H}^N$) must be verified within limits, and the safety analyses must be re-evaluated to confirm continued operation is permissible.

8 Reduction of power to 75% RTP ensures that local LHR increases due to a misaligned RCCA will not cause the core design criteria to be exceeded (Ref. 6X). The Completion Time of 2 hours gives the operator sufficient time to accomplish an orderly power reduction without challenging the Reactor Protection System.

When a rod is known to be misaligned, there is a potential to impact the SDM. Since the core conditions can change with time, periodic verification of SDM is required. A Frequency of 12 hours is sufficient to ensure this requirement continues to be met.

Verifying that $F_q(Z)$ and $F_{\Delta H}^N$ are within the required limits ensures that current operation at 75% RTP with a rod misaligned is not resulting in power distributions that may invalidate safety analysis assumptions at full power. The Completion Time of 72 hours allows sufficient time to obtain flux maps of the core power distribution using the incore flux mapping system and to calculate $F_q(Z)$ and $F_{\Delta H}^N$.

Once current conditions have been verified acceptable, time is available to perform evaluations of accident analysis to determine that core limits will not be exceeded during a Design Basis Event for the duration of operation under these conditions. A Completion Time of 5 days is sufficient time to obtain the required input data and to perform the analysis.

(continued)

BASES

ACTIONS
(continued)

C.1.1 and C.1.2

More than one control rod becoming misaligned from its group average position is not expected, and has the potential to reduce SDM. Therefore, SDM must be evaluated. One hour allows the operator adequate time to determine SDM. Restoration of the required SDM, if necessary, requires increasing the RCS boron concentration to provide negative reactivity, as described in the Bases or LCO 3.1.1. The required Completion Time of 1 hour for initiating boration is reasonable, based on the time required for potential xenon redistribution, the low probability of an accident occurring, and the steps required to complete the action. This allows the operator sufficient time to align the required valves and start the boric acid pumps. Boration will continue until the required SDM is restored.

C.2

If more than one rod is found to be misaligned or becomes misaligned because of bank movement, the unit conditions fall outside of the accident analysis assumptions. Since automatic bank sequencing would continue to cause misalignment, the unit must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3 from full-power conditions in an orderly manner and without challenging plant systems.

D.1

When Required Actions cannot be completed within their Completion Time, the unit must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the unit must be brought to at least MODE 3 within 6 hours, which obviates concerns about the development of undesirable xenon or power distributions. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching MODE 3 from full-power

(continued)

BASES

ACTIONS

D.1 (continued)

conditions in an orderly manner and without challenging the plant systems.

SURVEILLANCE
REQUIREMENTS

SR 3.1.5.1

Verification that individual rod positions are within alignment limits at a Frequency of 12 hours provides a history that allows the operator to detect a rod that is beginning to deviate from its expected position. If the rod position deviation monitor is inoperable, a Frequency of 4 hours accomplishes the same goal. The specified Frequency takes into account other rod position information that is continuously available to the operator in the control room, so that during actual rod motion, deviations can immediately be detected.

SR 3.1.5.2

Verifying each control rod is OPERABLE would require that each rod be tripped. However, in MODES 1 and 2, tripping each control rod would result in radial or axial power tilts, or oscillations. Exercising each individual control rod every 92 days provides increased confidence that all rods continue to be OPERABLE without exceeding the alignment limit, even if they are not regularly tripped. Moving each control rod by 10 steps will not cause radial or axial power tilts, or oscillations, to occur. The 92-day Frequency takes into consideration other information available to the operator in the control room and SR 3.1.5.1, which is performed more frequently and adds to the determination of OPERABILITY of the rods. Between required performances of SR 3.1.5.2 (determination of control rod OPERABILITY by movement), if a control rod(s) is discovered to be immovable, but remains trippable and aligned, the control rod(s) is considered to be OPERABLE. At any time, if a control rod(s) is immovable, a determination of the trippability (OPERABILITY) of the control rod(s) must be made, and appropriate action taken.

(continued)

BASES

SURVEILLANCE
REQUIREMENTS
(continued)

SR 3.1.5.3

Verification of rod drop times allows the operator to determine that the maximum rod drop time permitted is consistent with the assumed rod drop time used in the safety analysis. Measuring rod drop times prior to reactor criticality, after reactor vessel head removal, ensures that the reactor internals and rod drive mechanism will not interfere with rod motion or rod drop time, and that no degradation in these systems has occurred that would adversely affect control rod motion or drop time. This testing is performed with all RCPs operating and the average moderator temperature $\geq 500^{\circ}\text{F}$ to simulate a reactor trip under actual conditions. ^{SSI} (2)

This Surveillance is performed during a plant outage, due to the plant conditions needed to perform the SR and the potential for an unplanned plant transient if the Surveillance were performed with the reactor at power.

REFERENCES

Input
INSERT
From
Page
B 3.1-34A

1. ~~10 CFR 50, Appendix A, GDC 10 and GDC 26.~~
2. ~~10 CFR 50.46.~~
3. ~~FSAR, Chapter [15].~~
4. ~~FSAR, Chapter [15].~~
5. ~~FSAR, Chapter [15].~~
6. ~~FSAR, Chapter [15].~~
7. ~~FSAR, Chapter [15].~~

(10)

10

INSERT

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 10, "Reactor Design," General Design Criterion 26, "Reactivity Limits."
2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
3. Watts Bar FSAR, Section 15.0, "Accident Analyses."
4. Watts Bar FSAR, Section 15.2.3, "Rod Cluster Control Assembly Misalignment."
- 6.7. Watts Bar FSAR; Section 15.3.6, "Single RCCA Withdrawal at Full Power."
- ~~6. NUREG 1866 "Improvements to Technical Specification Surveillance Requirements."~~
- 5.7. Watts Bar FSAR, Section 15.4.2, "Major Secondary System Pipe Rupture."

JUSTIFICATIONS FOR DEVIATIONS FROM NRC STS 3.1.5

1. Format change to delete brackets that identify plant specific information/values.
2. Change to reflect WBN specific parameter values/information.
3. WBN utilizes an Analog Rod Position Indication System, not a Digital Rod Position Indication System.
4. WBN does not consider the ARPI System to be "highly" accurate.
5. Deleted text that does not apply to WBN's ARPI System.
6. Additional text more accurately describes the worst case rod misalignment event at WBN and required actions as a result of it.
7. Change to correct typographical error in STS.
8. Change to correct editorial error in STS (i.e., the COLR is not referenced).
9. At WBN, control rods are not bottomed in MODE 3 just prior to entry into MODE 2. Therefore, "rod bottom" phrase for MODES 3, 4, 5 and 6 deleted from text.
10. Change to specify WBN specific reference information and format.
11. This change reflects comments made by the industry to the NRC at the Proof and Review meeting on the RSTS in Irvine, CA July 13 - July 20, 1992.
12. This statement is incorrect for the MSLB event when the core briefly returns critical.
13. Change to correct error in the STS. Required Action A.1.2 does not specify "emergency" boration. The operator will utilize the appropriate boration for the plant conditions.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.6 Shutdown Bank Insertion Limits

LCO 3.1.6 Each shutdown bank shall be within its physical insertion limits specified in the COLR.

APPLICABILITY: MODE 1,
 (S) MODE 2, with any control bank not fully inserted.

-----NOTE-----
 This LCO is not applicable while performing SR 3.1.5.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown banks not within limit(s). (S)	A.1.1 Verify SDM is $\geq 1.6\% \Delta k/k$. (1)	1 hour
	OR	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.2 Restore shutdown banks to within limit(s). (S)	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

Shutdown Bank Insertion Limits
3.1.6

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.6.1 Verify each shutdown bank is within ^{the} limits. (S) <u>Specified in the CoLR.</u>	12 hours

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.6 Shutdown Bank Insertion Limits

BASES

BACKGROUND

The insertion limits of the shutdown and control rods are initial assumptions in all safety analyses that assume rod insertion upon reactor trip. The insertion limits directly affect core power and fuel burnup distributions and assumptions of available ejected rod worth, SDM and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are 10 CFR 50, Appendix A, GDC 10, "Reactor Design," GDC 26, "Reactivity Limits" (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2). Limits on control rod insertion have been established, and all rod positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking and SDM limits are preserved.

The rod cluster control assemblies (RCCAs) are divided among control banks and shutdown banks. Each bank may be further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. ~~All~~ There ^{Are} plants have four control banks and ~~at least two~~ shutdown banks. See LCO 3.1.5, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.8, "Rod Position Indication," for position indication requirements. ^{four}

The control banks are used for precise reactivity control of the reactor. The positions of the control banks are normally automatically controlled by the Rod Control System, but they can also be manually controlled. They are capable of adding negative reactivity very quickly (compared to borating). The control banks must be maintained above designed insertion limits and are typically near the fully withdrawn position during normal full power operations. Hence, they are not capable of adding a large amount of positive reactivity. Boration or dilution of the Reactor

(continued)

BASES

BACKGROUND
(continued)

Coolant System (RCS) compensates for the reactivity changes associated with large changes in RCS temperature. The design calculations are performed with the assumption that the shutdown banks are withdrawn first. The shutdown banks can be fully withdrawn without the core going critical. This provides available negative reactivity for SDM in the event of boration errors. The shutdown banks are controlled manually by the control room operator. During normal unit operation, the shutdown banks are either fully withdrawn or fully inserted. The shutdown banks must be completely withdrawn from the core, prior to withdrawing any control banks during an approach to criticality. The shutdown banks are then left in this position until the reactor is shut down. They ~~affect core power and burnup distribution, and~~ add negative reactivity to shut down the reactor upon receipt of a reactor trip signal.

⑧

⑦

APPLICABLE
SAFETY ANALYSES

On a reactor trip, all RCCAs (shutdown banks and control banks), except the most reactive RCCA, are assumed to insert into the core. The shutdown banks shall be at or above their insertion limits and available to insert the maximum amount of negative reactivity on a reactor trip signal. The control banks may be partially inserted in the core, as allowed by LCO 3.1.7, "Control Bank Insertion Limits." The shutdown bank and control bank insertion limits are established to ensure that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM (see LCO 3.1.1, "SHUTDOWN MARGIN (SDM) - $T_{avg} > 200^{\circ}F$," and LCO 3.1.2, "SHUTDOWN MARGIN (SDM) - $T_{avg} \leq 200^{\circ}F$ ") following a reactor trip from full power. The combination of control banks and shutdown banks (less the most reactive RCCA, which is assumed to be fully withdrawn) is sufficient to take the reactor from full-power conditions at rated temperature to zero power, and to maintain the required SDM at rated no-load temperature (Ref. 3). The shutdown bank insertion limit also limits the reactivity worth of an ejected shutdown rod.

(continued)

BASES

APPLICABLE
SAFETY ANALYSES
(continued)

The acceptance criteria for addressing shutdown and control rod bank insertion limits and inoperability or misalignment is that:

- a. There be no violations of:
 1. specified acceptable fuel design limits, or
 2. RCS pressure boundary integrity; and
- b. The core remains subcritical after accident transients, *other than a main steam line break (MSLB)* (6)

As such, the shutdown bank insertion limits affect safety analysis involving core reactivity and SDM (Ref. 3).

The shutdown bank insertion limits preserve an initial condition assumed in the safety analyses and, as such, satisfy Criterion 2 of the NRC Policy Statement.

LCO

The shutdown banks must be within their insertion limits any time the reactor is critical or approaching criticality. This ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip.

The shutdown bank insertion limits are defined in the COLR.

APPLICABILITY

The shutdown banks must be within their insertion limits, with the reactor in MODES 1 and 2. The applicability in MODE 2 begins prior to initial control bank withdrawal, during an approach to criticality, and continues throughout MODE 2, until all control bank rods are again fully inserted by reactor trip or by shutdown. This ensures that a sufficient amount of negative reactivity is available to shut down the reactor and maintain the required SDM following a reactor trip. The shutdown banks do not have to be within their insertion limits in MODE 3, unless an approach to criticality is being made. In MODE 3, 4, 5, or 6, the shutdown banks are fully inserted in the core and contribute to the SDM. Refer to LCO 3.1.1 and LCO 3.1.2 for SDM requirements in MODES 3, 4, and 5. LCO 3.9.1, "Boron Concentration," ensures adequate SDM in MODE 6.

(continued)

BASES

APPLICABILITY
(continued)

The Applicability requirements have been modified by a Note indicating the LCO requirement is suspended during SR 3.1.5.2. This SR verifies the freedom of the rods to move, and requires the shutdown bank to move below the LCO limits, which would normally violate the LCO.

ACTIONS

A.1.1, A.1.2 and A.2

When one or more shutdown banks is not within insertion limits, 2 hours is allowed to restore the shutdown banks to within the insertion limits. This is necessary because the available SDM may be significantly reduced, with one or more of the shutdown banks not within their insertion limits. Also, verification of SDM or initiation of boration within 1 hour is required, since the SDM in MODES 1 and 2 is ensured by adhering to the control and shutdown bank insertion limits (see LCO 3.1.1). If shutdown banks are not within their insertion limits, then SDM will be verified by performing a reactivity balance calculation, considering the effects listed in SR 3.1.1.1.

The allowed Completion Time of 2 hours provides an acceptable time for evaluating and repairing minor problems without allowing the plant to remain in an unacceptable condition for an extended period of time.

In the event that the shutdown rod position indication systems are found to be inoperable, the shutdown rods are considered to be not within limits, and Required Action A.2 applies.

④

B.1

If the shutdown banks cannot be restored to within their insertion limits within 2 hours, the unit must be brought to a MODE where the LCO is not applicable. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full-power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.1.6.1

Verification that the shutdown banks are within their insertion limits prior to an approach to criticality ensures that when the reactor is critical, or being taken critical, the shutdown banks will be available to shut down the reactor, and the required SDM will be maintained following a reactor trip. This SR and Frequency ensure that the shutdown banks are withdrawn before the control banks are withdrawn during a unit startup.

Since the shutdown banks are positioned manually by the control room operator, a verification of shutdown bank position at a Frequency of 12 hours, after the reactor is taken critical, is adequate to ensure that they are within their insertion limits. Also, the 12-hour Frequency takes into account other information available in the control room for the purpose of monitoring the status of shutdown rods.

REFERENCES

1. ~~10 CFR 50, Appendix A, GDC 10 and GDC 26.~~
2. ~~10 CFR 50.46.~~
3. ~~FSAR, Chapter [15].~~

③

1. Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 10, "Reactor Design," General Design Criterion 26, "Reactivity Limits."
2. Title 10, Code of Federal Regulations, Part 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors."
3. Watts Bar FSAR, Section 15.0, "Accident Analyses."

JUSTIFICATIONS FOR DEVIATIONS FROM NRC STS 3.1.6

1. Format change to delete brackets that identify plant specific information/values.
2. Change to reflect WBN specific parameter values.
3. Change to specify WBN specific reference information and format.
4. Text was deleted. Watts Bar believes this conclusion to be overly conservative when considering the action statements that must be taken in LCO 3.1.8 upon a failure of the ARPI System. These actions include a verification of rod position using the incore detectors within 8 hours allowing continued operation. This paragraph would eliminate the 8 hour completion time provided by LCO 3.1.8. Additionally, the SR for S/D bank insertion is performed once per 12 hours. This is based on the fact that the S/D banks are not normally moved and therefore are expected to be where they were last positioned.
5. This change reflects comments made by the industry to NRC during the Proof and Review meeting on the RSTS in Irvine, CA July 13 - July 20, 1992.
6. This statement is incorrect for the MSLB event when the core briefly returns critical.
7. Sentence deleted since it is not always true and does not contribute significantly to the discussion.
8. This change was made for clarity since under extreme off normal conditions, the core could be taken critical during shutdown bank withdrawal.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.7 Control Bank Insertion Limits

LCO 3.1.7 Control banks shall be within the insertion, sequence, and overlap limits specified in the COLR.

APPLICABILITY: MODES 1, and 2 with $k_{eff} \geq 1.0$.

⑧

-----NOTE-----
This LCO is not applicable while performing SR 3.1.5.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control bank insertion limit(s) not met. ⑧	A.1.1 Verify SDM is $\geq 1\% \Delta k/k$. ⑧ 1.6 ①	1 hour
	OR A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND A.2 Restore control bank(s) to within limit(s). ⑧	2 hours

(continued)

ENCLOSURE 1

TECHNICAL SPECIFICATION CRITERIA APPLICATION REPORT