

3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM) - $T_{avg} > 93.3^{\circ}\text{C} (200^{\circ}\text{F})$

LCO 3.1.1 SDM shall be $\geq 1.77\% \Delta k/k$.

APPLICABILITY: MODE 2 with $k_{eff} < 1.0$,
MODES 3, 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 $\geq 1.77\% \Delta k/k$.	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) - $T_{\text{avg}} \leq 93.3^{\circ}\text{C}$ (200°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

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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 <u>AND</u> -----NOTE----- Only required after 60 EFPD ----- 31 EFPD thereafter</p>

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3.1.4 Moderator Temperature Coefficient (MTC)

LCO 3.1.4 The MTC shall be maintained within the following limits:

A. MTC Upper Limit: MTC shall be less positive than the limits shown in figure 3.1.4-1.

B. MTC Lower Limit: MTC shall be less negative than $-4.5 \times 10^{-4} \Delta k/k/^\circ F$ for all rods withdrawn, end of cycle life (EOL), RATED THERMAL POWER Conditions. | 4

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.	<p>-----NOTE----- The administrative rod withdrawal limits are observed as established above until a subsequent calculation verifies that the MTC has been restored to within its limit for all rods withdrawn, hot zero THERMAL POWER, Xenon-free conditions.</p> <p>-----</p> <p>A.1 Establish administrative withdrawal limits for control banks to maintain MTC within limit.</p>	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

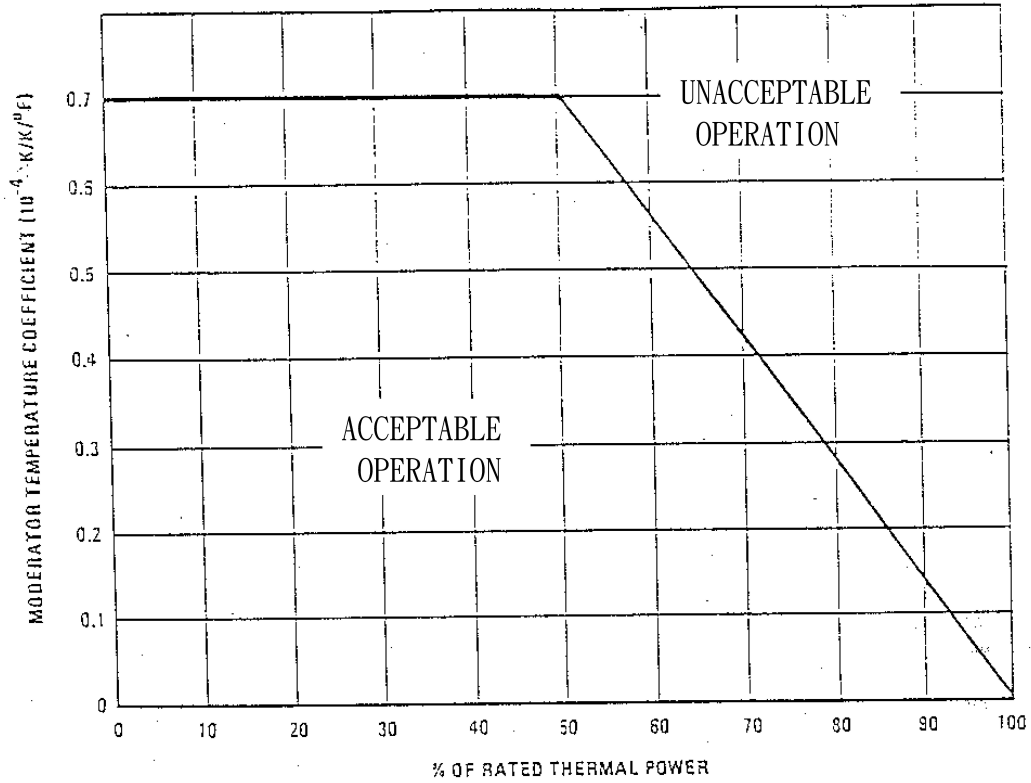
(continued)

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
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 -----NOTE----- 1. Not required to be performed until 7 effective full power days (EFPD) after reaching the equivalent of an equilibrium RTP all rods out (ARO) boron concentration of 300 ppm. 2. If the MTC is more negative than the 300 ppm surveillance limit of $-3.7 \times 10^{-4} \Delta k/k/^{\circ}F$, SR 3.1.4.2 Shall be repeated once per 14 EFPD during the remainder of the fuel cycle. ----- Verify MTC is within lower limit.	Once each cycle



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MODERATOR TEMPERATURE COEFFICIENT VS
POWER LEVEL
Fig. 3.1.4-1

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 $\geq 1.77\% \Delta k/k$.	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
B. One rod not within alignment limits.	B.1 Restore rod to within alignment limits.	1 hour
	<u>OR</u>	
	B.2.1.1 Verify SDM is $\geq 1.77\% \Delta k/k$.	1 hour
	<u>OR</u>	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2.1.2 Initiate boration to restore SDM to within limit. <u>AND</u>	1 hour
	B.2.2 Reduce THERMAL POWER to $\leq 75\%$ RTP. <u>AND</u>	2 hours
	B.2.3 Verify SDM is $\geq 1.77\% \Delta k/k$. <u>AND</u>	Once per 12 hours
	B.2.4 Perform SR 3.2.1.1. <u>AND</u>	72 hours
	B.2.5 Perform SR 3.2.2.1. <u>AND</u>	72 hours
	B.2.6 Re-evaluate safety analyses and confirm results remain valid for duration of operation under these conditions.	5 days
C. Required Action and associated Completion Time of Condition B not met.	C.1 Be in MODE 3.	6 hours

(continued)

ACTIONS(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. More than one rod not within alignment limit.	D.1.1 Verify SDM is $\geq 1.77\% \Delta k/k$.	1 hour
	<u>OR</u>	
	D.1.2 Initiate boration to restore required SDM to within limit.	1 hour
	<u>AND</u>	
	D.2 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.5.1 Verify individual rod positions within alignment limit.	12 hours <u>AND</u> Once within 4 hours and every 4 hours thereafter when the rod position deviation monitor is inoperable

(continued)

SURVEILLANCE REQUIREMENTS(continued)

SURVEILLANCE		FREQUENCY
SR 3.1.5.2	Verify rod freedom of movement (trippability) by moving each rod not fully inserted in the core ≥ 6 steps in either direction.	92 days
SR 3.1.5.3	Verify rod drop time of each rod, from the fully withdrawn position, is ≤ 2.4 seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with: <ul style="list-style-type: none"> a. $T_{avg} \geq 288.3^{\circ}\text{C}$ (551°F); and b. All reactor coolant pumps operating. 	Prior to reactor criticality after each removal of the reactor head

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3.1.6 Shutdown Bank Insertion Limits

LCO 3.1.6 Each shutdown bank shall be at the fully withdrawn position as specified in the RSE.

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. One or more shutdown banks not within limits.	A.1.1 Verify SDM is $\geq 1.77\% \Delta k/k$.	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 at the fully withdrawn position as specified in the RSE.	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 limits as shown in Figure 3.1.7-1.

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

-----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 $\geq 1.77\% \Delta k/k$.	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 bank sequence or overlap limits not met.	B.1.1 Verify SDM is $\geq 1.77\% \Delta k/k$.	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 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

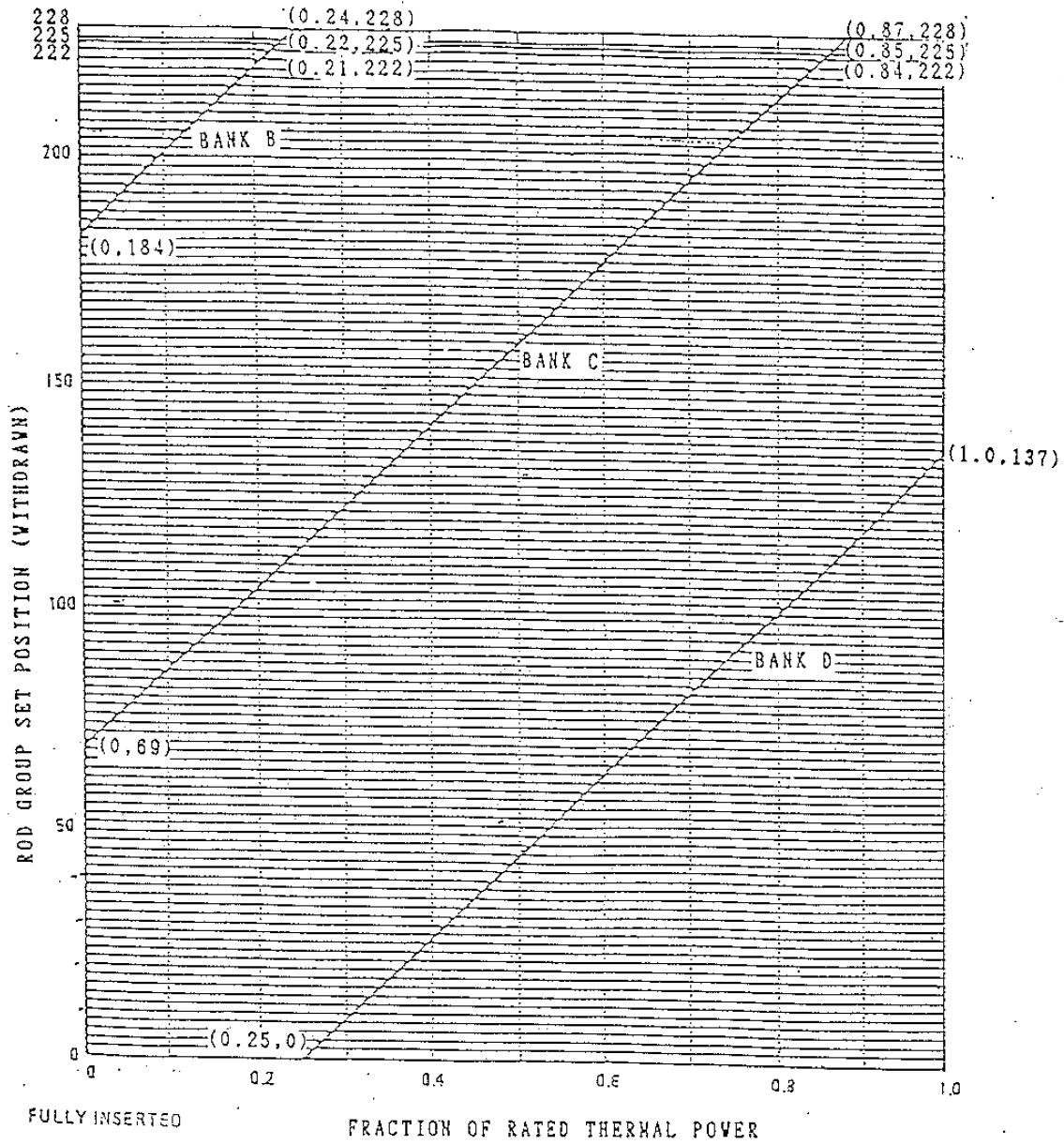
SURVEILLANCE	FREQUENCY
SR 3.1.7.1 Verify estimated critical control bank position is within the limits as shown in Fig. 3.1.7-1.	Within 4 hours prior to achieving criticality

(continued)

SURVEILLANCE REQUIREMENTS(continued)

SURVEILLANCE	FREQUENCY
SR 3.1.7.2 Verify each control bank insertion is within the limits as shown in Fig. 3.1.7-1.	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, as shown in Fig. 3.1.7-1, are met for control banks not fully withdrawn from the core.	12 hours

FULLY WITHDRAWN



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ROD GROUP INSERTION LIMITS VS THERMAL
POWER – THREE LOOP OPERATION
Figure 3.1.7-1

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Rod Position Indication

LCO 3.1.8 The Digital Rod Position Indication (DRPI) 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 DRPI 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. <u>OR</u> A.2 Reduce THERMAL POWER to $\leq 50\%$ RTP.	Once per 8 hours 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. <u>OR</u>	8 hours

(continued)

ACTIONS (continued)

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 DRPIs for the affected banks are OPERABLE. <u>AND</u>	Once per 8 hours
	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 not met.	D.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.8.1 Verify each DRPI 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"; 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 $\geq 1.77\% \Delta k/k$.

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
B. THERMAL POWER not within limit.	B.1 Reduce THERMAL POWER to within limit.	1 hour
	<u>OR</u> B.2 Suspend PHYSICS TESTS exceptions.	1 hour
C. Power Range Neutron Flux-High trip setpoints > 10% RTP above the PHYSICS TEST power level. <u>OR</u> Power Range Neutron Flux-High trip setpoints > 90% RTP.	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.	1 hour
	<u>OR</u> C.2 Suspend PHYSICS TESTS exceptions.	1 hour

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 TEST 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 $\geq 1.77\% \Delta k/k$.	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 $\geq 282.8^{\circ}\text{C}$ (541°F); and
- b. SDM is $\geq 1.77\% \Delta k/k$.

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

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.10.1 Perform a CHANNEL OPERATIONAL TEST on power range and intermediate range channels per SR 3.3.1.7, SR 3.3.1.8, and Table 3.3.1-1.	Within 12 hours prior to initiation of PHYSICS TESTS
SR 3.1.10.2 Verify the RCS lowest loop average temperature is $\geq 282.8^{\circ}\text{C}$ (541°F).	30 minutes
SR 3.1.10.3 Verify SDM is $\geq 1.77\% \Delta k/k$.	24 hours
SR 3.1.10.4 Verify the THERMAL POWER is $\leq 5\%$ of RATED THERMAL POWER.	At least once per hour during PHYSICS TESTS

3.1 REACTIVITY CONTROL SYSTEMS

3.1.11 SHUTDOWN MARGIN (SDM) Test Exceptions

LCO 3.1.11 The SDM requirements in MODE 2 may be suspended, provided the reactivity equivalent to at least the highest estimated control rod worth is available for trip insertion from OPERABLE control rod(s).

APPLICABILITY: MODE 2 when measuring control rod worth and SDM.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. One or more control rods not fully inserted.</p> <p style="text-align: center;"><u>AND</u></p> <p>Available trip reactivity from OPERABLE control rods less than the highest estimated control rod worth.</p>	<p>A.1 Initiate boration to restore SDM to within limit.</p>	<p>15 minutes</p>
<p>B. All control rods fully inserted.</p> <p style="text-align: center;"><u>AND</u></p> <p>Reactor subcritical by less than the highest estimated control rod worth.</p>	<p>B.1 Initiate boration to restore SDM to within limits.</p>	<p>15 minutes</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.1.11.1 -----NOTE----- Only required for control rods not fully inserted. ----- Determine the position of each control rod.	2 hours
SR 3.1.11.2 -----NOTE----- Only required for control rods not fully inserted. ----- Trip each control rod from \geq the 50% withdrawn position, and verify full control rod insertion.	Within 24 hours prior to reducing SDM outside limits