Industry/TSTF Standard Technical Specification Change Traveler

Combine LCO 3.1.1 and 3.1.2

Priority/Classification 2) Consistency/Standardization

NUREGs Affected: ☐ 1430 ☑ 1431 ☑ 1432 ☐ 1433 ☐ 1434

Description:

TSTF-9, Relocate values for shutdown margin to COLR, removed the only difference between LCO 3.1.1, Shutdown Margin - Tavg > 200 F and LCO 3.1.2, Shutdown Margin - Tavg <= 200 F. This change combines those two specifications and renumbers the remaining specifications in Section 3.1 appropriately. References to the 3.1 Test Exceptions in LCO 3.0.7 and the LCO 3.0.7 Bases are also adjusted.

Justification:

Once TSTF-9 is implemented and specific shutdown margin values in LCO 3.1.1 and LCO 3.1.2 are relocated to the COLR, the two specifications are the same. The LCO, Actions, and Surveillances are the same. This change combines the two Specifications and their applicability to make one shutdown margin specification applicable from Mode 2 with Keff < 1.0 through Mode 5 without regard to temperature. Differences in shutdown margin above and below 200 F will be addressed in the COLR. This change eliminated unnecessary and confusing duplication that would result from the implementation of TSTF-9. Combining the Specifications is consistent with the ITS format and use.

Revision History

OG Revision 0 **Revision Status: Active** **Next Action:**

Revision Proposed by: Owners Group

Revision Description:
Original Issue

Owners Group Review Information

Date Originated by OG: 13-Jun-96

Owners Group Comments
(No Comments)

Owners Group Resolution: Approved Date: 13-Jun-96

TSTF Review Information

TSTF Received Date: 01-Jul-96 Date Distributed for Review 05-Aug-96

OG Review Completed: ☑ BWOG ☑ WOG ☑ CEOG ☑ BWROG

TSTF Comments:

CEOG - Applicable and approved.
BWOG - Not applicable, approved
BWROG - Not Applicable, approved

TSTF Resolution: Approved Date: 10-Oct-96

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NRC Review Information

NRC Received Date: 23-Jan-97 NRC Reviewer: Gilles, Tjader

NRC Comments:

3/11/97 - Reviewer recommends rejecting combining two SDM TSs for plants than have COLRs (plants that do not have a COLR will have two SDM TS; if combining the two SDM TSs, then should also include Reviewer's Note that informs plants without COLRs that they will need two SDM TSs. It is not cost-beneficial to incorporate this change.
4/17/97 - TSTF pointed out that the ITS NUREGs assume COLR adoption and that not other COLR items have Reviewer's Notes or options for non-COLR conversion. TSTF also pointed out the complexity of finding all 3.1.x references throughout the specifications. As most, if not all, converting plants would do this change plant-specifically, the NRC would have to review the change for each conversion. Also, there is a high likelihood that converting plants would miss some 3.1.x references, resulting in license amendments. TSB agreed to reconsider their position and the reviewer will recommend approval.
4/22/97 - R. Tjader recommended approval.
4/30/97 - to C. Grimes for disposition.
5/2/97 - C. Grimes approved changes.

Final Resolution: NRC Approves Final Resolution Date: 02-May-97

Incorporation Into the NUREGs

File to BBS/LAN Date: TSTF Informed Date: TSTF Approved Date:

NUREG Rev Incorporated:

Affected Technical Specifications

LCO 3.0.7	LCO Applicability		NUREG(s)- 1431 Only
LCO 3.0.7 Bases	LCO Applicability		NUREG(s)- 1431 Only
3.1.1	SDM - Tavg > 200 F		NUREG(s)- 1431 Only
	Change Description:	Title changed to "SDM"	
3.1.1 Bases	SDM - Tavg > 200 F		NUREG(s)- 1431 Only
	Change Description:	Title changed to "SDM"	
S/A 3.1.1 Bases	SDM - Tavg > 200 F		NUREG(s)- 1431 Only
Appl. 3.1.1	SDM - Tavg > 200 F		NUREG(s)- 1431 Only
Appl. 3.1.1 Bases	SDM - Tavg > 200 F		NUREG(s)- 1431 Only
3.1.2	SDM <= 200 F		NUREG(s)- 1431 Only
	Change Description:	Deleted	
3.1.2 Bases	SDM - Tavg <= 200 F		NUREG(s)- 1431 Only
	Change Description:	Deleted	
Bkgnd 3.1.2 Bases	SDM - Tavg <= 200 F		NUREG(s)- 1431 Only
	Change Description:	Deleted	

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S/A 3.1.2 Bases	SDM - Tavg <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
LCO 3.1.2	SDM <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
LCO 3.1.2 Bases	SDM - Tavg <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
Appl. 3.1.2	SDM <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
Appl. 3.1.2 Bases	SDM - Tavg <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
Ref. 3.1.2 Bases	SDM - Tavg <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
Action 3.1.2.A	SDM <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
Action 3.1.2.A Bases	SDM - Tavg <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
SR 3.1.2.1	SDM <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
SR 3.1.2.1 Bases	SDM - Tavg <= 200 F Change Description: Deleted	NUREG(s)- 1431 Only
3.1.3	Core Reactivity Change Description: Renumbered to 3.1.2	NUREG(s)- 1431 Only
3.1.3 Bases	Core Reactivity Change Description: Renumbered to 3.1.2	NUREG(s)- 1431 Only
Bkgnd 3.1.3 Bases	Core Reactivity	NUREG(s)- 1431 Only
LCO 3.1.3	Core Reactivity Change Description: Renumbered to 3.1.2	NUREG(s)- 1431 Only
SR 3.1.3.1	Core Reactivity Change Description: Renumbered to 3.1.2.1	NUREG(s)- 1431 Only
SR 3.1.3.1 Bases	Core Reactivity Change Description: Renumbered to 3.1.2.1	NUREG(s)- 1431 Only
3.1.4	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3	NUREG(s)- 1431 Only
3.1.4-1	Moderator Temperature Coefficient Change Description: Renumbered Figure 3.1.4-1 to 3.1.3-1	NUREG(s)- 1431 Only
3.1.4 Bases	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3	NUREG(s)- 1431 Only

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LCO 3.1.4	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3	NUREG(s)- 1431 Only
LCO 3.1.4 Bases	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3	NUREG(s)- 1431 Only
SR 3.1.4.1	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3.1	NUREG(s)- 1431 Only
SR 3.1.4.1 Bases	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3.1	NUREG(s)- 1431 Only
SR 3.1.4.2	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3.2	NUREG(s)- 1431 Only
SR 3.1.4.2 Bases	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3.2	NUREG(s)- 1431 Only
SR 3.1.4.3	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3.3	NUREG(s)- 1431 Only
SR 3.1.4.3 Bases	Moderator Temperature Coefficient Change Description: Renumbered to 3.1.3.3	NUREG(s)- 1431 Only
3.1.5	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4	NUREG(s)- 1431 Only
3.1.5 Bases	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4	NUREG(s)- 1431 Only
LCO 3.1.5	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4	NUREG(s)- 1431 Only
Appl. 3.1.5 Bases	Rod Group Alignment Limits	NUREG(s)- 1431 Only
Action 3.1.5.B Bases	Rod Group Alignment Limits	NUREG(s)- 1431 Only
SR 3.1.5.1	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4.1	NUREG(s)- 1431 Only
SR 3.1.5.1 Bases	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4.1	NUREG(s)- 1431 Only
SR 3.1.5.2	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4.2	NUREG(s)- 1431 Only
SR 3.1.5.2 Bases	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4.2 and revised references	NUREG(s)- 1431 Only
SR 3.1.5.3	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4.2	NUREG(s)- 1431 Only
SR 3.1.5.3 Bases	Rod Group Alignment Limits Change Description: Renumbered to 3.1.4.3	NUREG(s)- 1431 Only

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3.1.6	Shutdown Bank Insertion Limits Change Description: Renumbered to 3.1.5	NUREG(s)- 1431 Only
3.1.6 Bases	Shutdown Bank Insertion Limits Change Description: Renumbered to 3.1.5	NUREG(s)- 1431 Only
Bkgnd 3.1.6 Bases	Shutdown Bank Insertion Limits	NUREG(s)- 1431 Only
S/A 3.1.6 Bases	Shutdown Bank Insertion Limits	NUREG(s)- 1431 Only
LCO 3.1.6	Shutdown Bank Insertion Limits Change Description: Renumbered to 3.1.5	NUREG(s)- 1431 Only
Appl. 3.1.6	Shutdown Bank Insertion Limits Change Description: Revised Applicability Note	NUREG(s)- 1431 Only
Appl. 3.1.6 Bases	Shutdown Bank Insertion Limits	NUREG(s)- 1431 Only
SR 3.1.6.1	Shutdown Bank Insertion Limits Change Description: Renumbered to 3.1.5.1	NUREG(s)- 1431 Only
SR 3.1.6.1 Bases	Shutdown Bank Insertion Limits Change Description: Renumbered to 3.1.5.1	NUREG(s)- 1431 Only
3.1.7	Control Bank Insertion Limits Change Description: Renumbered to 3.1.6	NUREG(s)- 1431 Only
3.1.7 Bases	Control Bank Insertion Limits Change Description: Renumbered to 3.1.6	NUREG(s)- 1431 Only
3.1.7-1 Bases	Control Bank Insertion Limits Change Description: Rename Figure 3.1.7-1 to 3.1.6-1	NUREG(s)- 1431 Only
Bkgnd 3.1.7 Bases	Control Bank Insertion Limits	NUREG(s)- 1431 Only
LCO 3.1.7	Control Bank Insertion Limits Change Description: Renumbered to 3.1.6	NUREG(s)- 1431 Only
Appl. 3.1.7	Control Bank Insertion Limits Change Description: Revised Applicability Note	NUREG(s)- 1431 Only
Appl. 3.1.7 Bases	Control Bank Insertion Limits	NUREG(s)- 1431 Only
Action 3.1.7.A Bases	Control Bank Insertion Limits	NUREG(s)- 1431 Only
SR 3.1.7.1	Control Bank Insertion Limits Change Description: Renumbered to 3.1.6.1	NUREG(s)- 1431 Only
SR 3.1.7.1 Bases	Control Bank Insertion Limits Change Description: Renumbered to 3.1.6.1	NUREG(s)- 1431 Only
SR 3.1.7.2	Control Bank Insertion Limits Change Description: Renumbered to 3.1.6.2	NUREG(s)- 1431 Only

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SR 3.1.7.2 Bases	Control Bank Insertion Limits	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.6.2	
SR 3.1.7.3	Control Bank Insertion Limits	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.6.3	
SR 3.1.7.3 Bases	Control Bank Insertion Limits	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.6.3	
3.1.8	Rod Position Indication	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.7	
3.1.8 Bases	Rod Position Indication	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.7	
Bkgnd 3.1.8 Bases	Rod Position Indication	NUREG(s)- 1431 Only
S/A 3.1.8 Bases	Rod Position Indication	NUREG(s)- 1431 Only
LCO 3.1.8	Rod Position Indication	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.7	
LCO 3.1.8 Bases	Rod Position Indication	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.7 and revised references	
Appl. 3.1.8 Bases	Rod Position Indication	NUREG(s)- 1431 Only
SR 3.1.8.1	Rod Position Indication	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.7.1	
SR 3.1.8.1 Bases	Rod Position Indication	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.7.1	
3.1.9	Physics Tests Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8	
3.1.9 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8	
Bkgnd 3.1.9 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
S/A 3.1.9 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
LCO 3.1.9	Physics Tests Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8	
LCO 3.1.9 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
Appl. 3.1.9 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
SR 3.1.9.1	Physics Tests Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.1	
SR 3.1.9.1 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.1	

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SR 3.1.9.2	Physics Tests Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.2	
SR 3.1.9.2 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.2	
SR 3.1.9.3	Physics Tests Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.3	
SR 3.1.9.3 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.3	
SR 3.1.9.4	Physics Tests Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.4	
SR 3.1.9.4 Bases	PHYSICS TESTS Exceptions - MODE 1	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.8.4	
3.1.10	Physics Tests Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.9	
3.1.10 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumber to 3.1.9	
Bkgnd 3.1.10 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
S/A 3.1.10 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
LCO 3.1.10	Physics Tests Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.9	
LCO 3.1.10 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
Appl. 3.1.10 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
SR 3.1.10.1	Physics Tests Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.9.1	
SR 3.1.10.1 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumber to 3.1.9.1	
SR 3.1.10.2	Physics Tests Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.9.2	
SR 3.1.10.2 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumber to 3.1.9.2	
SR 3.1.10.3	Physics Tests Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.9.3	
SR 3.1.10.3 Bases	PHYSICS TESTS Exceptions - MODE 2	NUREG(s)- 1431 Only
	Change Description: Renumber to 3.1.9.3	
3.1.11	SDM Test Exceptions	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.10	

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3.1.11 Bases	SDM Test Exceptions	NUREG(s)- 1431 Only
	Change Description: Renumber to 3.1.10	
LCO 3.1.11	SDM Test Exceptions	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.10	
SR 3.1.11.1	SDM Test Exceptions	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.10.1	
SR 3.1.11.1 Bases	SDM Test Exceptions	NUREG(s)- 1431 Only
	Change Description: Renumber to 3.1.10.1 and revised references	
SR 3.1.11.2	SDM Test Exceptions	NUREG(s)- 1431 Only
	Change Description: Renumbered to 3.1.10.2	
SR 3.1.11.2 Bases	SDM Test Exceptions	NUREG(s)- 1431 Only
	Change Description: Renumber to 3.1.10.2 and revised references	
Bkgnd 3.2.1B Bases	Fq(Z) (Fq Methodology)	NUREG(s)- 1431 Only
S/A 3.2.2 Bases	FndH	NUREG(s)- 1431 Only
Bkgnd 3.2.4 Bases	QPTR	NUREG(s)- 1431 Only
S/A 3.4.1 Bases	RCS Pressure, Temperature, and Flow DNB Limits	NUREG(s)- 1431 Only
Bkgnd 3.4.2 Bases	RCS Minimum Temperature for Criticality	NUREG(s)- 1431 Only
Appl. 3.4.2 Bases	RCS Minimum Temperature for Criticality	NUREG(s)- 1431 Only
Appl. 3.9.1 Bases	Boron Concentration	NUREG(s)- 1431 Only
3.1.1	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
	Change Description: Title changed to "SDM"	
3.1.1	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
	Change Description: Title changed to "SDM"	
3.1.1 Bases	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
	Change Description: Title changed to SDM (Analog)	
3.1.1 Bases	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
	Change Description: Title changed to "SDM"	
Bkgnd 3.1.1 Bases	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
Bkgnd 3.1.1 Bases	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
S/A 3.1.1 Bases	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
S/A 3.1.1 Bases	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
LCO 3.1.1	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
	Change Description: Title changed to "SDM"	

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LCO 3.1.1	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
Appl. 3.1.1	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
Appl. 3.1.1	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
Appl. 3.1.1 Bases	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
Appl. 3.1.1 Bases	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
SR 3.1.1.1	SDM - Tavg > 200 F (Analog)	NUREG(s)- 1432 Only
SR 3.1.1.1	SDM - Tavg > 200 F (Digital)	NUREG(s)- 1432 Only
3.1.2	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
3.1.2	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
3.1.2 Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
3.1.2 Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
Bkgnd 3.1.2 Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
Bkgnd 3.1.2 Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
S/A 3.1.2 Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
S/A 3.1.2 Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
LCO 3.1.2	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
LCO 3.1.2	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
LCO 3.1.2 Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
LCO 3.1.2 Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
Appl. 3.1.2	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
Appl. 3.1.2	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only

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Appl. 3.1.2 Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
Appl. 3.1.2 Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
Ref. 3.1.2 Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
Ref. 3.1.2 Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
Action 3.1.2.A	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
Action 3.1.2.A	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
Action 3.1.2.A Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
Action 3.1.2.A Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
SR 3.1.2.1	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
SR 3.1.2.1	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
SR 3.1.2.1 Bases	SDM - Tavg <= 200 F (Analog) Change Description: Deleted	NUREG(s)- 1432 Only
SR 3.1.2.1 Bases	SDM - Tavg <= 200 F (Digital) Change Description: Deleted	NUREG(s)- 1432 Only
3.1.3	Reactivity Balance (Analog) Change Description: Renumbered to 3.1.2	NUREG(s)- 1432 Only
3.1.3	Reactivity Balance (Digital) Change Description: Renumbered to 3.1.2	NUREG(s)- 1432 Only
3.1.3 Bases	Reactivity Balance (Analog) Change Description: Renumbered to 3.1.2	NUREG(s)- 1432 Only
3.1.3 Bases	Reactivity Balance (Digital) Change Description: Renumbered to 3.1.2	NUREG(s)- 1432 Only
Bkgnd 3.1.3 Bases	Reactivity Balance (Analog)	NUREG(s)- 1432 Only
Bkgnd 3.1.3 Bases	Reactivity Balance (Digital)	NUREG(s)- 1432 Only
SR 3.1.3.1	Reactivity Balance (Analog) Change Description: Renumbered to 3.1.2.1	NUREG(s)- 1432 Only

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SR 3.1.3.1	Reactivity Balance (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.2.1	
SR 3.1.3.1 Bases	Reactivity Balance (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.2.1 and references	
SR 3.1.3.1 Bases	Reactivity Balance (Digital)	NUREG(s)- 1432 Only
.	Change Description: Renumbered to 3.1.2.1 and references	
3.1.4-1	MTC (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered Figure to 3.1.3-1	
3.1.4	MTC (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3	
3.1.4	MTC (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3	
3.1.4 Bases	MTC (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3	
3.1.4 Bases	MTC (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3	
SR 3.1.4.1	MTC (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.1	
SR 3.1.4.1	MTC (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.1	
SR 3.1.4.1 Bases	MTC (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.1	
SR 3.1.4.1 Bases	MTC (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.1	
SR 3.1.4.2	MTC (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.2	
SR 3.1.4.2	MTC (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.2 and revised references	
SR 3.1.4.2 Bases	MTC (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.2	
Ref. 3.1.4.2 Bases	MTC (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.3.2	
3.1.5	CEA Alignment (Analog)	NUREG(s)- 1432 Only
	Change Description: Renumbered to 3.1.4	
3.1.5-1	CEA Alignment (Digital)	NUREG(s)- 1432 Only
	Change Description: Renumbered Figure to 3.1.4-1	

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3.1.5	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4	NUREG(s)- 1432 Only
3.1.5 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4	NUREG(s)- 1432 Only
3.1.5 Bases	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4	NUREG(s)- 1432 Only
Appl. 3.1.5 Bases	CEA Alignment (Analog)	NUREG(s)- 1432 Only
Appl. 3.1.5 Bases	CEA Alignment (Digital)	NUREG(s)- 1432 Only
Action 3.1.5.A	CEA Alignment (Analog)	NUREG(s)- 1432 Only
Action 3.1.5.A	CEA Alignment (Digital)	NUREG(s)- 1432 Only
Action 3.1.5.A Bases	CEA Alignment (Analog)	NUREG(s)- 1432 Only
Action 3.1.5.A Bases	CEA Alignment (Digital)	NUREG(s)- 1432 Only
Action 3.1.5.B	CEA Alignment (Digital)	NUREG(s)- 1432 Only
Action 3.1.5.B Bases	CEA Alignment (Digital)	NUREG(s)- 1432 Only
Action 3.1.5.C	CEA Alignment (Analog)	NUREG(s)- 1432 Only
Action 3.1.5.C	CEA Alignment (Digital)	NUREG(s)- 1432 Only
Action 3.1.5.C Bases	CEA Alignment (Analog)	NUREG(s)- 1432 Only
Action 3.1.5.D	CEA Alignment (Analog)	NUREG(s)- 1432 Only
Action 3.1.5.D Bases	CEA Alignment (Analog)	NUREG(s)- 1432 Only
Action 3.1.5.D Bases	CEA Alignment (Digital)	NUREG(s)- 1432 Only
SR 3.1.5.1	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.1	NUREG(s)- 1432 Only
SR 3.1.5.1	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.1	NUREG(s)- 1432 Only
SR 3.1.5.1 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.1	NUREG(s)- 1432 Only
SR 3.1.5.1 Bases	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.1	NUREG(s)- 1432 Only
SR 3.1.5.2	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.2	NUREG(s)- 1432 Only
SR 3.1.5.2	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.2	NUREG(s)- 1432 Only

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SR 3.1.5.2 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.2	NUREG(s)- 1432 Only
SR 3.1.5.2 Bases	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.2	NUREG(s)- 1432 Only
SR 3.1.5.3	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.3	NUREG(s)- 1432 Only
SR 3.1.5.3	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.3	NUREG(s)- 1432 Only
SR 3.1.5.3 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.3	NUREG(s)- 1432 Only
SR 3.1.5.3 Bases	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.3	NUREG(s)- 1432 Only
SR 3.1.5.4	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.4	NUREG(s)- 1432 Only
SR 3.1.5.4	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.4	NUREG(s)- 1432 Only
SR 3.1.5.4 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.4	NUREG(s)- 1432 Only
SR 3.1.5.4 Bases	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.4	NUREG(s)- 1432 Only
SR 3.1.5.5	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.5	NUREG(s)- 1432 Only
SR 3.1.5.5	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.5	NUREG(s)- 1432 Only
SR 3.1.5.5 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.5 and references	NUREG(s)- 1432 Only
SR 3.1.5.5 Bases	CEA Alignment (Digital) Change Description: Renumbered to 3.1.4.5	NUREG(s)- 1432 Only
SR 3.1.5.6	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.6	NUREG(s)- 1432 Only
SR 3.1.5.6 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.6	NUREG(s)- 1432 Only
SR 3.1.5.7	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.7	NUREG(s)- 1432 Only
SR 3.1.5.7 Bases	CEA Alignment (Analog) Change Description: Renumbered to 3.1.4.7	NUREG(s)- 1432 Only

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3.1.6	Shutdown CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.5	NUREG(s)- 1432 Only
3.1.6	Shutdown CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.5	NUREG(s)- 1432 Only
3.1.6 Bases	Shutdown CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.5	NUREG(s)- 1432 Only
3.1.6 Bases	Shutdown CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.5	NUREG(s)- 1432 Only
S/A 3.1.6 Bases	Shutdown CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only
S/A 3.1.6 Bases	Shutdown CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
Appl. 3.1.6	Shutdown CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only
Appl. 3.1.6	Shutdown CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
Appl. 3.1.6 Bases	Shutdown CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only
Appl. 3.1.6 Bases	Shutdown CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
Action 3.1.6.A Bases	Shutdown CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only
SR 3.1.6.1	Shutdown CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.5.1	NUREG(s)- 1432 Only
SR 3.1.6.1	Shutdown CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.5.1	NUREG(s)- 1432 Only
SR 3.1.6.1 Bases	Shutdown CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.5.1	NUREG(s)- 1432 Only
SR 3.1.6.1 Bases	Shutdown CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.5.1	NUREG(s)- 1432 Only
3.1.7	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6	NUREG(s)- 1432 Only
3.1.7	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6	NUREG(s)- 1432 Only
3.1.7 Bases	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6	NUREG(s)- 1432 Only
3.1.7 Bases	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6	NUREG(s)- 1432 Only
Bkgnd 3.1.7 Bases	Regulating CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only
Bkgnd 3.1.7 Bases	Regulating CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
Appl. 3.1.7	Regulating CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only

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Appl. 3.1.7	Regulating CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
Appl. 3.1.7 Bases	Regulating CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only
Appl. 3.1.7 Bases	Regulating CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
Action 3.1.7.D	Regulating CEA Insertion Limits (Analog)	NUREG(s)- 1432 Only
Action 3.1.7.E	Regulating CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
Action 3.1.7.E Bases	Regulating CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
SR 3.1.7.1	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6.1	NUREG(s)- 1432 Only
SR 3.1.7.1	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6.1	NUREG(s)- 1432 Only
SR 3.1.7.1 Bases	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6.1	NUREG(s)- 1432 Only
SR 3.1.7.1 Bases	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6.1 and references	NUREG(s)- 1432 Only
SR 3.1.7.2	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6.2	NUREG(s)- 1432 Only
SR 3.1.7.2	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6.2	NUREG(s)- 1432 Only
SR 3.1.7.2 Bases	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6.2	NUREG(s)- 1432 Only
SR 3.1.7.2 Bases	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6.2	NUREG(s)- 1432 Only
SR 3.1.7.3	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6.3	NUREG(s)- 1432 Only
SR 3.1.7.3	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6.3	NUREG(s)- 1432 Only
SR 3.1.7.3 Bases	Regulating CEA Insertion Limits (Analog) Change Description: Renumbered to 3.1.6.3	NUREG(s)- 1432 Only
SR 3.1.7.3 Bases	Regulating CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.6.3	NUREG(s)- 1432 Only
3.1.8	Part Length CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.7	NUREG(s)- 1432 Only
3.1.8	STE - SDM (Analog) Change Description: Renumbered to 3.1.7	NUREG(s)- 1432 Only

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3.1.8 Bases	Part Length CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.7	NUREG(s)- 1432 Only
3.1.8 Bases	STE - SDM (Analog) Change Description: Renumbered to 3.1.7	NUREG(s)- 1432 Only
Bkgnd 3.1.8 Bases	Part Length CEA Insertion Limits (Digital)	NUREG(s)- 1432 Only
S/A 3.1.8 Bases	STE - SDM (Analog)	NUREG(s)- 1432 Only
LCO 3.1.8 Bases	STE - SDM (Analog)	NUREG(s)- 1432 Only
SR 3.1.8.1	Part Length CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.7.1	NUREG(s)- 1432 Only
SR 3.1.8.1	STE - SDM (Analog) Change Description: Renumbered to 3.1.7.1	NUREG(s)- 1432 Only
SR 3.1.8.1 Bases	Part Length CEA Insertion Limits (Digital) Change Description: Renumbered to 3.1.7.1	NUREG(s)- 1432 Only
SR 3.1.8.1 Bases	STE - SDM (Analog) Change Description: Renumbered to 3.1.7.1	NUREG(s)- 1432 Only
SR 3.1.8.2	STE - SDM (Analog) Change Description: Renumbered to 3.1.7.2	NUREG(s)- 1432 Only
SR 3.1.8.2 Bases	STE - SDM (Analog) Change Description: Renumbered to 3.1.7.2	NUREG(s)- 1432 Only
3.1.9	STE - MODES 1 and 2 (Analog) Change Description: Renumbered to 3.1.8	NUREG(s)- 1432 Only
3.1.9	STE-SDM (Digital) Change Description: Renumbered to 3.1.8	NUREG(s)- 1432 Only
3.1.9 Bases	STE - MODES 1 and 2 (Analog) Change Description: Renumbered to 3.1.8	NUREG(s)- 1432 Only
3.1.9 Bases	STE - SDM (Digital) Change Description: Renumbered to 3.1.8	NUREG(s)- 1432 Only
S/A 3.1.9 Bases	STE - MODES 1 and 2 (Analog)	NUREG(s)- 1432 Only
S/A 3.1.9 Bases	STE - SDM (Digital)	NUREG(s)- 1432 Only
LCO 3.1.9	STE - MODES 1 and 2 (Analog)	NUREG(s)- 1432 Only
LCO 3.1.9	STE-SDM (Digital)	NUREG(s)- 1432 Only
LCO 3.1.9 Bases	STE - MODES 1 and 2 (Analog)	NUREG(s)- 1432 Only
LCO 3.1.9 Bases	STE - SDM (Digital)	NUREG(s)- 1432 Only
Action 3.1.9.C Bases	STE - MODES 1 and 2 (Analog)	NUREG(s)- 1432 Only

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SR 3.1.9.1	STE - MODES 1 and 2 (Analog) Change Description: Renumbered to 3.1.8.1	NUREG(s)- 1432 Only
SR 3.1.9.1	STE-SDM (Digital) Change Description: Renumbered to 3.1.8.1	NUREG(s)- 1432 Only
SR 3.1.9.1 Bases	STE - MODES 1 and 2 (Analog) Change Description: Renumbered to 3.1.8.1	NUREG(s)- 1432 Only
SR 3.1.9.1 Bases	STE - SDM (Digital) Change Description: Renumbered to 3.1.8.1	NUREG(s)- 1432 Only
SR 3.1.9.2	STE - MODES 1 and 2 (Analog) Change Description: Renumbered to 3.1.8.2	NUREG(s)- 1432 Only
SR 3.1.9.2	STE-SDM (Digital) Change Description: Renumbered to 3.1.8.2	NUREG(s)- 1432 Only
SR 3.1.9.2 Bases	STE - MODES 1 and 2 (Analog) Change Description: Renumbered to 3.1.8.2	NUREG(s)- 1432 Only
SR 3.1.9.2 Bases	STE - SDM (Digital) Change Description: Renumbered to 3.1.8.2	NUREG(s)- 1432 Only
3.1.10	STE - MODES 1 and 2 (Digital) Change Description: Renumbered to 3.1.9	NUREG(s)- 1432 Only
3.1.10 Bases	STE - MODES 1 and 2 (Digital) Change Description: Renumbered to 3.1.9	NUREG(s)- 1432 Only
S/A 3.1.10 Bases	STE - MODES 1 and 2 (Digital)	NUREG(s)- 1432 Only
LCO 3.1.10	STE - MODES 1 and 2 (Digital)	NUREG(s)- 1432 Only
LCO 3.1.10 Bases	STE - MODES 1 and 2 (Digital)	NUREG(s)- 1432 Only
Action 3.1.10.C Bases	STE - MODES 1 and 2 (Digital)	NUREG(s)- 1432 Only
SR 3.1.10.1	STE - MODES 1 and 2 (Digital) Change Description: Renumbered to 3.1.9.1	NUREG(s)- 1432 Only
SR 3.1.10.1 Bases	STE - MODES 1 and 2 (Digital) Change Description: Renumbered to 3.1.9.1	NUREG(s)- 1432 Only
SR 3.1.10.2	STE - MODES 1 and 2 (Digital) Change Description: Renumbered to 3.1.9.2	NUREG(s)- 1432 Only
SR 3.1.10.2 Bases	STE - MODES 1 and 2 (Digital) Change Description: Renumbered to 3.1.9.2	NUREG(s)- 1432 Only
Bkgnd 3.2.1 Bases	LHR (Analog)	NUREG(s)- 1432 Only
Bkgnd 3.2.2 Bases	FxyT (Analog)	NUREG(s)- 1432 Only
Action 3.2.2.A	FxyT (Analog)	NUREG(s)- 1432 Only

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Action 3.2.2.A Bases	FxyT (Analog)	NUREG(s)- 1432 Only
Bkgnd 3.2.3 Bases	FrT (Analog)	NUREG(s)- 1432 Only
Action 3.2.3.A	FrT (Analog)	NUREG(s)- 1432 Only
Action 3.2.3.A Bases	FrT (Analog)	NUREG(s)- 1432 Only
Bkgnd 3.2.4 Bases	Tq (Analog)	NUREG(s)- 1432 Only
Bkgnd 3.2.5 Bases	ASI (Analog)	NUREG(s)- 1432 Only
S/A 3.3.1 Bases	RPS Instrumentation - Operating (Analog)	NUREG(s)- 1432 Only
Action 3.3.3.A	CEACs (Digital)	NUREG(s)- 1432 Only
Action 3.3.3.B	CEACs (Digital)	NUREG(s)- 1432 Only
Action 3.3.13.A	[Logarithmic] Power Monitoring Channels (Analog)	NUREG(s)- 1432 Only
Action 3.3.13.A	[Logarithmic] Power Monitoring Channels (Digital)	NUREG(s)- 1432 Only
S/A 3.4.1 Bases	RCS Pressure, Temperature, and Flow [DNB] Limits	NUREG(s)- 1432 Only
Appl. 3.9.1 Bases	Boron Concentration	NUREG(s)- 1432 Only

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3.0 LCO APPLICABILITY (continued)

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 5.5.15, "Safety Function Determination Program (SFDP)." 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.

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.

LCO 3.0.7

Test Exception LCOs [3.1.8, 3.1.9, 3.1.10, and 3.4.19] allow specified Technical Specification (TS) requirements to be changed to permit performance of special tests and operations. Unless otherwise specified, all other TS requirements remain unchanged. Compliance with Test Exception LCOs is optional. When a Test Exception LCO is desired to be met but is not met, the ACTIONS of the Test Exception LCO shall be met. When a Test Exception LCO is not desired to be met, entry into a MODE or other specified condition in the Applicability shall be made in accordance with the other applicable Specifications.

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BASES

LCO 3.0.6 (continued)

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.

LCO 3.0.7

There are certain special tests and operations required to be performed at various times over the life of the unit. These special tests and operations are necessary to demonstrate select unit performance characteristics, to perform special maintenance activities, and to perform special evolutions. Test Exception LCOs [3.1.9, 3.1.10, 3.1.11, and 3.4.19] allow specified Technical Specification (TS) requirements to be changed to permit performances of these special tests and operations, which otherwise could not be performed if required to comply with the requirements of these TS. Unless otherwise specified, all the other TS requirements remain unchanged. This will ensure all appropriate requirements of the MODE or other specified condition not directly associated with or required to be changed to perform the special test or operation will remain in effect.

The Applicability of a Test Exception LCO represents a condition not necessarily in compliance with the normal requirements of the TS. Compliance with Test Exception LCOs is optional. A special operation may be performed either under the provisions of the appropriate Test Exception LCO or under the other applicable TS requirements. If it is desired to perform the special operation under the provisions of the Test Exception LCO, the requirements of the Test Exception LCO shall be followed.

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM) — T_{avg} > 200°F

LCO 3.1.1 SDM shall be ≥ [1.6]% $\Delta k/k$. within the limits provided in the COLR

From TSTF-9

APPLICABILITY: MODE 2 with k_{eff} < 1.0,
MODES 3, 4, [and 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 3.1.1.1 Verify SDM is ≥ [1.6]% $\Delta k/k$. to be within limits.	24 hours

From TSTF-9

TSTF-136

3.1 REACTIVITY CONTROL SYSTEMS

3.1.2 SHUTDOWN MARGIN (SDM)—T_{avg} ≤ 200°F

LCO 3.1.2 The SDM shall be ≥ [1.0]% Δk/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 ≥ [1.0]% Δk/k.	24 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.~~3~~ 2 Core Reactivity

LCO 3.1.~~3~~ 2 The measured core reactivity shall be within ± 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
SR 3.1.2.1	------------------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 ± 1% $\Delta k/k$ of predicted values.	Once prior to entering MODE 1 after each refueling AND -----NOTE------ Only required after 60 EFPD --------------- 31 EFPD thereafter

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 [≤ [ ] Δk/k°F at hot zero power] [that specified in Figure 3.1.4-1].

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.

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~~3.1	Verify MTC is within upper limit.	Once prior to entering MODE 1 after each refueling
SR 3.1.~~4~~3.2	Verify MTC is within 300 ppm Surveillance limit specified in the COLR.	-----NOTE------ 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 -------------- Once each cycle
SR 3.1.~~4~~3.3	--------------------NOTES-------------------- 1. If the MTC is more negative than the 300 ppm Surveillance limit (not LCO limit) specified in the COLR, SR 3.1.~~4~~3.3 shall be repeated once per 14 EFPD during the remainder of the fuel cycle. 2. SR 3.1.~~4~~3.3 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. -- Verify MTC is within lower limit.	-----NOTE------ Not required to be performed until 7 EFPD after reaching the equivalent of an equilibrium RTP-ARO boron concentration of 300 ppm -------------- Once each cycle

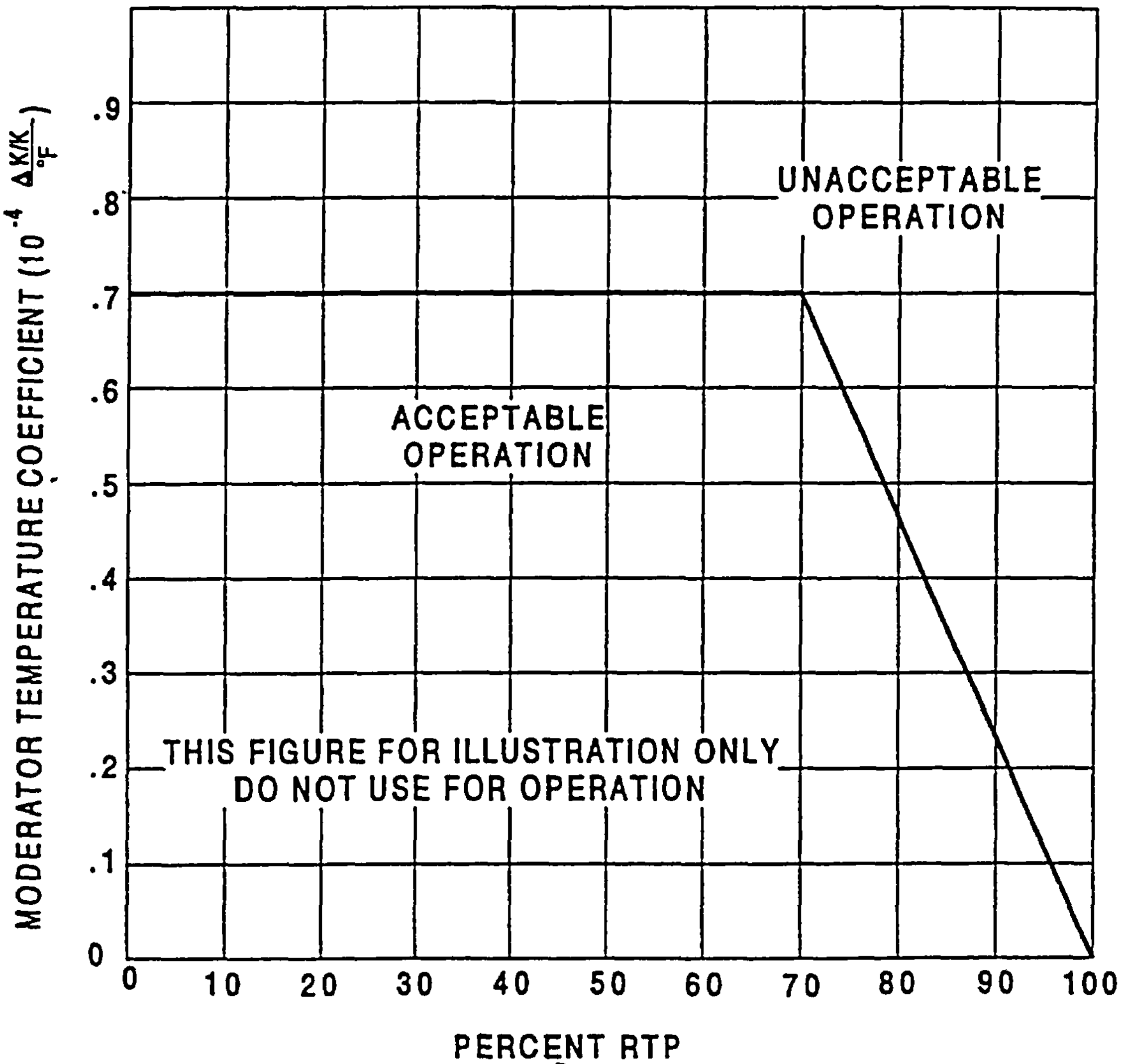

Figure 3.1.3-1 (page 1 of 1)
Moderator Temperature Coefficient vs. Power Level

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.(5) 4 Rod Group Alignment Limits

LCO 3.1.(5) 4 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 ≥ [1.6]% Δk/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 ≥ [1.6]% Δk/k.	1 hour
	<u>OR</u>	
		(continued)

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ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. (continued)	B.2.1.2 Initiate boration to restore SDM to within limit. AND	1 hour
	B.2.2 Reduce THERMAL POWER to ≤ 75% RTP. AND	2 hours
	B.2.3 Verify SDM is ≥ [1.6]% Δk/k. AND	Once per 12 hours
	B.2.4 Perform SR 3.2.1.1. AND	72 hours
	B.2.5 Perform SR 3.2.2.1. AND	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)

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. More than one rod not within alignment limit.	D.1.1 Verify SDM is ≥ [1.6]% $\Delta k/k$. OR D.1.2 Initiate boration to restore required SDM to within limit. AND D.2 Be in MODE 3.	1 hour 1 hour 6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.~~5~~4.1	Verify individual rod positions within alignment limit.	12 hours AND 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~~4.2	Verify rod freedom of movement (trippability) by moving each rod not fully inserted in the core ≥ 10 steps in either direction.	92 days
SR 3.1.~~5~~4.3	Verify rod drop time of each rod, from the fully withdrawn position, is ≤ [2.2] seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with: a. T_{avg} ≥ 500°F; and b. All reactor coolant pumps operating.	Prior to reactor criticality after each removal of the reactor head

3.1 REACTIVITY CONTROL SYSTEMS

3.1.~~6~~5 Shutdown Bank Insertion Limits

LCO 3.1.~~6~~5 Each shutdown bank shall be within 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~~4.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown banks not within limits.	A.1.1 Verify SDM is ≥ [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 5.1	Verify each shutdown bank is within the limits specified in the COLR.	12 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.6 Control Bank Insertion Limits

LCO 3.1.6 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 3.1.4.2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control bank insertion limits not met.	A.1.1 Verify SDM is ≥ [1.6]% Δk/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 ≥ [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 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.Ø6.1	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 3.1.6.2	Verify each control bank insertion is within the limits specified in the COLR.	12 hours AND Once within 4 hours and every 4 hours thereafter when the rod insertion limit monitor is inoperable
SR 3.1.6.3	Verify sequence and overlap limits specified in the COLR are met for control banks not fully withdrawn from the core.	12 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Rod Position Indication

LCO 3.1.8 7 The [Digital] Rod Position Indication ([D]RPI) 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 [D]RPI 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
	OR		
	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.	[4] hours
	OR		

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. (continued)	B.2	Reduce THERMAL POWER to ≤ 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 [D]RPIs 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 ≤ 12 steps apart.	Once per 8 hours
	<u>OR</u>		
	C.2	Reduce THERMAL POWER to ≤ 50% RTP.	8 hours
D. Required Action and associated Completion Time not met.	D.1	Be in MODE 3.	6 hours

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.~~8~~7.1	Verify each [D]RPI agrees within [12] steps of the group demand position for the [full indicated range] of rod travel.	[18 months]

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.~~9~~8 PHYSICS TESTS Exceptions—MODE 1

LCO 3.1.~~9~~8 During the performance of PHYSICS TESTS, the requirements of

LCO 3.1.~~5~~4, "Rod Group Alignment Limits";
LCO 3.1.~~6~~5, "Shutdown Bank Insertion Limits";
LCO 3.1.~~7~~6, "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
	AND	
	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 ≤ 10% above the PHYSICS TEST power level, or to ≤ 90% RTP, whichever is lower.	1 hour
	<u>OR</u>		
	C.2	Suspend PHYSICS TESTS exceptions.	1 hour

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.~~9~~ 8.1	Verify THERMAL POWER is ≤ 85% RTP.	1 hour
SR 3.1.~~9~~ 8.2	Verify Power Range Neutron Flux—High trip setpoints are ≤ 10% above the PHYSICS TEST power level, and ≤ 90% RTP.	Within 8 hours prior to initiation of PHYSICS TESTS
SR 3.1.~~9~~ 8.3	Perform SR 3.2.1.1 and SR 3.2.2.1.	12 hours
SR 3.1.~~9~~ 8.4	Verify SDM is ≥ [1.6]% Δk/k.	24 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.~~10~~9 PHYSICS TESTS Exceptions—MODE 2

LCO 3.1.~~10~~9 During the performance of PHYSICS TESTS, the requirements of

LCO 3.1.~~4~~,3 "Moderator Temperature Coefficient (MTC)";
LCO 3.1.~~5~~,4 "Rod Group Alignment Limits";
LCO 3.1.~~6~~,5 "Shutdown Bank Insertion Limits";
LCO 3.1.~~7~~,6 "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 ≥ [531]°F; and

b. SDM is ≥ [1.6]% Δk/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
	AND	
	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~~9.1	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~~9.2	Verify the RCS lowest loop average temperature is ≥ [531]°F.	30 minutes
SR 3.1.~~10~~9.3	Verify SDM is ≥ 1.6% Δk/k.	24 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.11 SHUTDOWN MARGIN (SDM) Test Exceptions

LCO 3.1.~~11~~ 10 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
A. One or more control rods not fully inserted. AND Available trip reactivity from OPERABLE control rods less than the highest estimated control rod worth.	A.1 Initiate boration to restore SDM to within limit.	15 minutes
B. All control rods fully inserted. AND Reactor subcritical by less than the highest estimated control rod worth.	B.1 Initiate boration to restore SDM to within limits.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.10.1	------------------NOTE------------------ Only required for control rods not fully inserted. -- Determine the position of each control rod.	2 hours
SR 3.1.10.2	------------------NOTE------------------ Only required for control rods not fully inserted. -- Trip each control rod from ≥ the 50% withdrawn position, and verify full control rod insertion.	Within 24 hours prior to reducing SDM outside limits

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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.1 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 scram 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 boration system, provides the SDM during power operation and 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 fully withdrawn and the control banks within the limits of LCO 3.1.~~8~~ 6, "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)

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.

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 (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)

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. Startup of an idle RCP cannot, therefore, produce a return to power from the hot standby condition.

The ejection of a control rod rapidly adds reactivity to the reactor core, causing both the core power level and heat flux to increase with corresponding increases in reactor

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

coolant temperatures and pressure. The ejection of a rod 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 and in MODES 3, and 4, [and 5,] 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} ≤ 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 [5], "Shutdown Bank Insertion Limits," and LCO 3.1.7 [6].

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

(continued)

ACTIONS

A.1 (continued)

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.

In determining the boration flow rate, the time in 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% Δk/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% Δk/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 (5) verified by (6) 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.

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;

(continued)

SURVEILLANCE REQUIREMENTS

SR 3.1.1.1 (continued)

c. RCS average temperature;

d. Fuel burnup based on gross thermal energy generation;

e. Xenon concentration;

f. Samarium concentration; and

g. 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. 10 CFR 50, Appendix A, GDC 26.
2. FSAR, Chapter [15].
3. FSAR, Chapter [15].
4. 10 CFR 100.

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 scram 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, provides SDM during power operation and 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 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.

(continued)

SDM—T_{avg} ≤ 200°F
B 3.1.2
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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 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)

SDM—T_{avg} ≤ 200°F
B 3.1.2

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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 MODE 2, with k_{eff} ≥ 1.0 and 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 MODE 1 and MODE 2, with k_{eff} ≥ 1.0, SDM is ensured by complying with LCO 3.1.6, "Shutdown Bank Insertion Limits," 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. 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.

In determining the boration flow rate the time in core life must be considered. For instance, the most difficult time

(continued)

SDM—T_{avg} ≤ 200°F
B 3.1.2

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ACTIONS

A.1 (continued)

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% Δk/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% Δk/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. 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

(continued)

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BASES

SURVEILLANCE REQUIREMENTS	SR 3.1.2.1 (continued) 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].

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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.2 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, 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°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)

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)

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 ± 1% $\Delta k/k$ has been established based on engineering judgment. A 1% deviation in reactivity from

(continued)

LCO (continued)

that predicted is larger than expected for normal operation and should therefore be evaluated.

When measured core reactivity is within 1% Δk/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.

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.

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)

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 3.1.2.1

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 (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, following the initial 60 EFPD 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. 10 CFR 50, Appendix A, GDC 26, GDC 28, and GDC 29.
2. FSAR, Chapter [15].

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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.3 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)

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.

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, Chapter 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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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 3.1.3 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 (ARO), 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)

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)

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 3.1.43.1

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 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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SURVEILLANCE REQUIREMENTS (continued)

SR 3.1.3.2 and SR 3.1.3.3

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 3.1.3.3 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. 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].

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 is an initial assumption 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 Control System Redundancy and Protection" (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 inch) 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)

that are moved in a staggered fashion, but always within one step of each other. All units have 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.

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 ± 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 DRPI System provides a 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 half

(continued)

BACKGROUND (continued)

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.

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.

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.

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APPLICABLE SAFETY ANALYSES (continued)

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 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 ($F^N_{\Delta H}$) 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 $F^N_{\Delta H}$ 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 $F^N_{\Delta H}$ 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 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) ~~$-T_{avg} \geq 200°F$~~," for SDM in MODES 3, 4, and 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 emergency 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.

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)

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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. (5) (6)

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 $F^N_{\Delta H}$) 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. 7). 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 $F^N_{\Delta H}$ 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 $F^N_{\Delta H}$.

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)

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)

ACTIONS

D.1 (continued)

conditions in an orderly manner and without challenging the plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.1.5.1 4

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 4

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 (4), which is performed more frequently and adds to the determination of OPERABILITY of the rods. Between required performances of (4) 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 3.1.4.3

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 ≥ 500°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. 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].

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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.8 5 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 Control System Redundancy and Protection," GDC 28, "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 plants have four control banks and at least two shutdown banks. See LCO 3.1.8 4, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.8 7, "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.

(continued)

BASES

BACKGROUND (continued)

Hence, they are not capable of adding a large amount of positive reactivity. Boration or dilution of the Reactor 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 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.

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 3.1.6, "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°F)" and LCO 3.1.2, "SHUTDOWN MARGIN (SDM) — T_{avg} ≤ 200°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:

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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.

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.

The Applicability requirements have been modified by a Note indicating the LCO requirement is suspended during SR 3.1.~~5~~ 4.2. This SR verifies the freedom of the rods to

(continued)

BASES

APPLICABILITY (continued)

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 the BASES for 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~~5.1

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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.5.1 (continued)

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, GDC 26, and GDC 28.
2. 10 CFR 50.46.
3. FSAR, Chapter [15].

3.1 REACTIVITY CONTROL SYSTEMS

3.1.7 6 Control Bank Insertion Limits

ASES

ACKGROUND

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 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 Control System Redundancy and Protection," GDC 28, "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 plants have four control banks and at least two shutdown banks. See LCO 3.1.5 (4), "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.8 (7), "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 (6)-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 travelled together by two control banks. The predetermined

(continued)

BASES

BACKGROUND (continued)

position of control bank C, at which control bank D will begin to move with bank C on a withdrawal, will be at 118 steps for a fully withdrawn position of 231 steps. The fully withdrawn position is 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 LOCA, loss of flow, ejected rod, or other accident requiring termination by an RTS trip function.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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.

As such, the shutdown and control bank insertion limits affect safety analysis involving core reactivity and power distributions (Ref. 3).

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. 4).

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. 5).

The insertion limits satisfy Criterion 2 of the NRC Policy Statement, in that they are initial conditions assumed in the safety analysis.

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

(continued)

BASES

LCO (continued)

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 3.1.6.2. 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 and shutdown bank insertion limits (see LCO 3.1.1, "SHUTDOWN MARGIN (SDM)~~(T_{avg} > 200°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 the BASES for SR 3.1.1.1.

(continued)

BASES

ACTIONS

A.1.1, A.1.2, A.2, B.1.1, B.1.2, and B.2 (continued)

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, sequence, and overlaps 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.Ø6.1

This Surveillance is required to ensure that the reactor does not achieve criticality with the control banks below their insertion limits.

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

(continued)

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BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.6.1 (continued)

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 3.1.6.2

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 3.1.6.3

When control banks are maintained within their insertion limits as checked by SR 3.1.6.2 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 3.1.6.2.

REFERENCES

1. 10 CFR 50, Appendix A, GDC 10, GDC 26, GDC 28.
2. 10 CFR 50.46.
3. FSAR, Chapter [15].
4. FSAR, Chapter [15].
5. FSAR, Chapter [15].

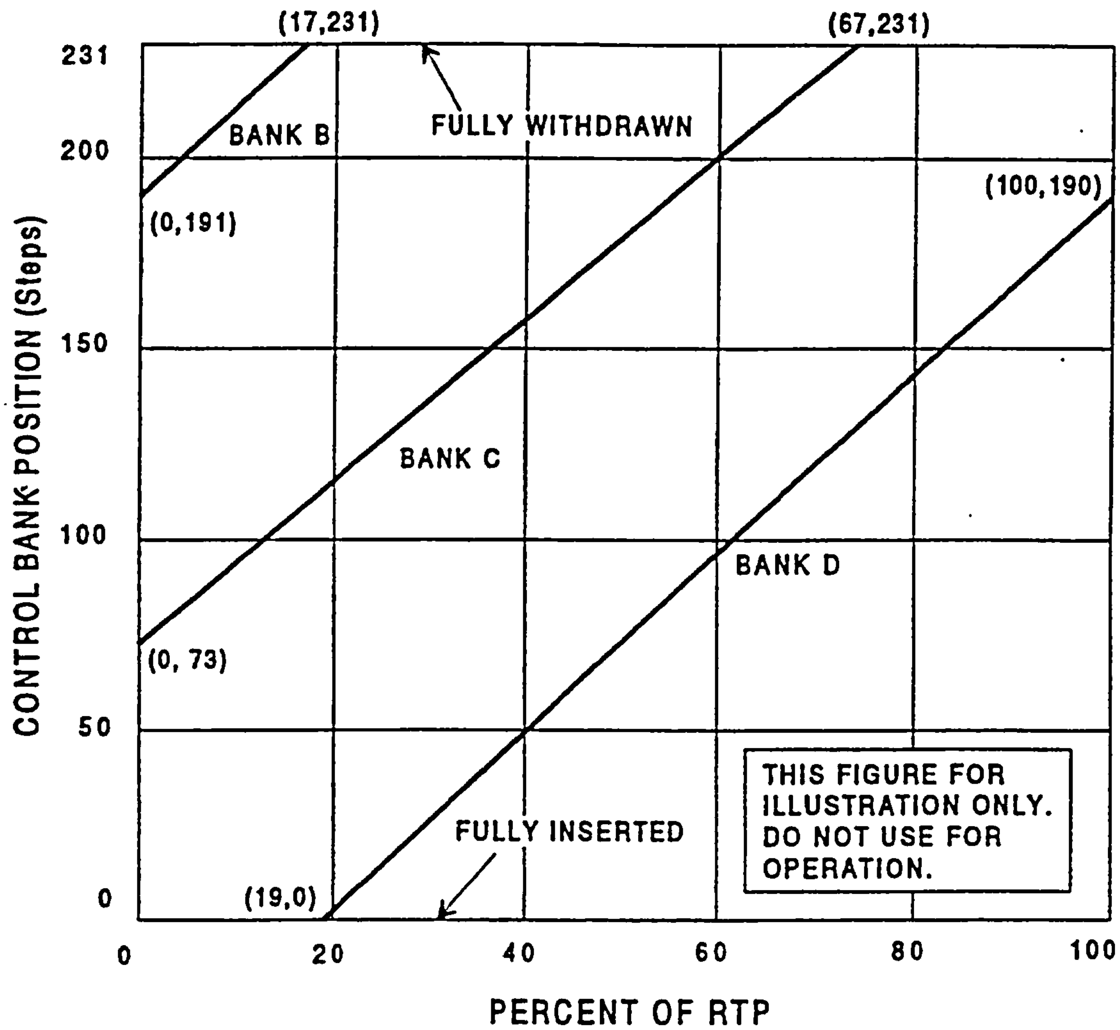

Figure B 3.1.6-1 (page 1 of 1)
Control Bank Insertion vs. Percent RTP

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B 3.1 REACTIVITY CONTROL SYSTEM

B 3.1.8 7 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 7 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 is an initial assumption 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 [Digital] Rod Position Indication (DRPI) 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 ± 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 DRPI System provides a 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 6 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 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.

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), 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 5, "Shutdown Bank Insertion Limits," and

(continued)

APPLICABLE SAFETY ANALYSES (continued)

LCO 3.1.7, "Control Bank Insertion Limits"). The rod 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 one DRPI System and one Bank Demand Position Indication System be OPERABLE for each control rod. For the control rod position indicators to be OPERABLE requires meeting the SR of the LCO and the following:

a. The DRPI System indicates within 12 steps of the group step counter demand position as required by LCO 3.1.5, "Rod Group Alignment Limits";

b. For the DRPI 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 DRPI System.

The 12 step agreement limit between the Bank Demand Position Indication System and the DRPI System indicates that the Bank Demand Position Indication System is adequately calibrated, and can be used for indication of the measurement of control rod bank position.

A deviation of less than the allowable limit, given in LCO 3.1.5, 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.

(continued)

LCO (continued)

OPERABILITY of the position indicator channels ensures that 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 (6) DRPI and step counters are only applicable in MODES 1 and 2 (consistent with LCO 3.1.5, 4 LCO 3.1.6 (5), 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 DRPI 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 ≤ 50% RTP puts the core into a condition where rod position is not significantly affecting core peaking factors (Ref. 3).

The allowed Completion Time of 8 hours is reasonable, based on operating experience, for reducing power to ≤ 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 [4] hours, the rod positions have not been determined, THERMAL POWER must be reduced to ≤ 50% RTP within 8 hours 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 [4] 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 DRPI 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 ≤ 50% RTP puts the core into a condition where rod position is not significantly affecting core peaking factor limits (Ref. 3). 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 ≤ 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 3.1.7.1

Verification that the DRPI agrees with the demand position within [12] steps ensures that the DRPI is operating correctly. Since the DRPI does not display the actual shutdown rod positions between 18 and 210 steps, only points within the indicated ranges are required in comparison.

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 usually 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. 10 CFR 50, Appendix A, GDC 13.
2. FSAR, Chapter [15].
3. FSAR, Chapter [15].

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B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.8 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 ≥ 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 ≤ 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.

]

(continued)

BASES

BACKGROUND (continued)

[c. The Power Distribution—Full Power Test measures the power distribution of the reactor core at ≥ 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, there are two currently required tests that violate the referenced LCO. The pseudo ejected rod test, performed at approximately 30% RTP, and the pseudo dropped rod test, performed at approximately 50% RTP, require individual rod misalignments 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. Tables [14.1-1 and 14.1-2] (Ref. 6) 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 3.1.5,4 "Rod Group Alignment Limits";
LCO 3.1.6,5 "Shutdown Bank Insertion Limits";
LCO 3.1.7,6 "Control Bank Insertion Limits";
LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)"; or

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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 ($F_Q(Z)$)," and LCO 3.2.2, "Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)," are satisfied, power level is maintained ≤ 85% RTP, and SDM is ≥ [1.6]% Δk/k. Therefore, LCO 3.1.8 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 ≤ 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 3.1.4, LCO 3.1.5, LCO 3.1.6, 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 requirements of LCO 3.2.1 and LCO 3.2.2 are satisfied and provided:

(continued)

BASES

LCO (continued)

a. THERMAL POWER is maintained ≤ 85% RTP;

b. Power Range Neutron Flux—High trip setpoints are ≤ 10% RTP above the THERMAL POWER at which the test is performed, with a maximum setting of 90% RTP; and

c. SDM is ≥ [1.6]% $\Delta k/k$.

Operation with THERMAL POWER ≤ 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 setpoint 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 ≤ 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 9, "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.

(continued)

BASES

ACTIONS (continued)

B.1 and B.2

When THERMAL POWER is > 85% RTP, the only acceptable actions are to reduce THERMAL POWER to ≤ 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~~8.1

Verification that the THERMAL POWER level is ≤ 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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.1.8.2

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 3.1.8.3

The performance of SR 3.2.1.1 and SR 3.2.2.1 measures the core $F_Q(Z)$ and the $F^N_{\Delta H}$, 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 3.1.8.4

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;

f. Samarium concentration; and

g. 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.

(continued)

BASES (continued)

REFERENCES

1. 10 CFR 50, Appendix B, Section XI.
2. 10 CFR 50.59.
3. Regulatory Guide 1.68, Revision 2, August 1978.
4. ANSI/ANS-19.6.1-1985, December 13, 1985.
5. WCAP-9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology Report", July 1985.
6. FSAR, Section [14].
7. WCAP-11618, November 1987, and Addendum 1, April 1989.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.10 9 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 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% Δk/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 then inserted to make up for the decreasing boron
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(continued)

BACKGROUND (continued)

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 4 "Rod Group Alignment Limits"; LCO 3.1.6 5 "Shutdown Bank Insertion Limit"; or LCO 3.1.7 6, "Control Bank Insertion Limits."

c. The Control Rod 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 4, LCO 3.1.6 5, or LCO 3.1.7 6.

d. The ITC Test measures the ITC of the reactor. This test is performed at HZP and has two methods of

(continued)

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 ≤ 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.[illegible], LCO 3.1.[illegible], or LCO 3.1.[illegible]. The Flux Distribution Method uses the incore flux detectors to measure the azimuthal flux distribution at selected locations with the core at ≤ 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

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APPLICABLE SAFETY ANALYSES (continued)

problems, may require the operating control or process variables to deviate from their LCO limitations.

The FSAR defines requirements for initial testing of the facility, including PHYSICS TESTS. Tables [14.1-1 and 14.1-2] 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 ≤ 5% RTP, the reactor coolant temperature is kept ≥ 531°F, and SDM is ≥ [1.6]% Δk/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.~~6~~ 3, LCO 3.1.~~7~~ 4, LCO 3.1.~~8~~ 5, (6) LCO 3.1.~~12~~ and LCO 3.4.2 may be suspended during the performance of PHYSICS TESTS provided:

a. RCS lowest loop average temperature is ≥ [531] °F; and

b. SDM is ≥ [1.6]% Δk/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.~~10~~ 8, "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 (RTBs) to prevent operation of the reactor beyond its design limits. Immediately opening the RTBs will shut down the reactor and prevent operation of the reactor outside of its design limits.

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BASES

ACTIONS (continued)

C.1

When the RCS lowest T_{avg} is < 531°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 531°F could violate the assumptions for accidents analyzed in the safety analyses.

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 an additional 15 minutes. The Completion Time of 15 additional minutes is reasonable, based on operating experience, for reaching MODE 3 in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.1.10 9.1

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 9.2

Verification that the RCS lowest loop T_{avg} is ≥ 531°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

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.~~10~~ 9.2 (continued)

performance of the PHYSICS TESTS will ensure that the initial conditions of the safety analyses are not violated.

SR 3.1.~~10~~ 9.3

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;

f. Samarium concentration; and

g. 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. 10 CFR 50, Appendix B, Section XI.

2. 10 CFR 50.59.

3. Regulatory Guide 1.68, Revision 2, August, 1978.

4. ANSI/ANS-19.6.1-1985, December 13, 1985.

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BASES

REFERENCES (continued)

5. WCAP-9273-NP-A, "Westinghouse Reload Safety Evaluation Methodology Report," July 1985.

6. WCAP-11618, including Addendum 1, April 1989.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.11 10 SHUTDOWN MARGIN (SDM) Test Exception

BASES

BACKGROUND

The primary purpose of the SDM test exception is to permit relaxation of the SDM requirements during the measurement of control rod worths in MODE 2 during PHYSICS TESTS.

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 operating and emergency procedures are adequate.

To achieve these objectives, testing is performed prior to initial criticality, during startup, low power, power 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 TEST procedures are written and approved, in accordance with established formats. The procedures include

(continued)

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.

During the PHYSICS TESTS measurements of control rod worth, it may be necessary to align individual rods and banks in certain configurations and utilize boron concentrations that do not provide sufficient SDM to meet the normal requirements. In this situation, it is necessary to invoke special test exceptions (STEs) to allow the necessary PHYSICS TESTS to be completed.

APPLICABLE SAFETY ANALYSES

Special PHYSICS TESTS may require operating the core under controlled conditions for short periods of time with less than the normally required SDM. As such, these tests are not covered by any safety analysis calculations.

Under the acceptance criteria to allow suspension of certain LCOs for PHYSICS TESTS, fuel damage criteria are not to be exceeded. Even if an accident occurs during PHYSICS TESTS with one or more LCOs suspended, fuel damage criteria are preserved because adequate limits on power distribution and shutdown capability are maintained during PHYSICS TESTS.

Reference 5 defines the requirements for initial testing of the facility, including PHYSICS TESTS. Requirements for reload fuel cycle PHYSICS TESTS are defined in ANSI/ANS-19.6.1-1985 (Ref. 4). PHYSICS TESTS for reload fuel cycles are given in Table 1 of ANSI/ANS-19-6.1-1985. Although these PHYSICS TESTS are generally accomplished within the limits of 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. As long as the linear heat rate remains within its limit, fuel design criteria are preserved.

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.

(continued)

BASES (continued)

LCO

This LCO provides an exemption to the SDM requirements under controlled conditions. These conditions require that at least the highest estimated control rod worths be available for trip insertion. It is assumed that this available negative reactivity will be sufficient to shut down the core if required, assuming there is not a concurrent boron dilution or cooldown event. This exemption is allowed even though there are no bounding safety analyses, because the tests are performed under close supervision and provide valuable information on control rod worth and core SDM.

APPLICABILITY

This LCO is only applicable in MODE 2, and then only during actual measurement of control rod worths because this is the only time the exception is required.

ACTIONS

A.1

If one or more control rods are not fully inserted and the available trip reactivity from OPERABLE control rods is less than the highest estimated control rod worth, the SDM, assumed for the test conditions, may not be available. Under these conditions, it is necessary to promptly restore the SDM to within limits.

The allowed Completion Time of 15 minutes ensures prompt action and provides an acceptable time for initiating boration to restore SDM, without allowing the core to remain in an unacceptable condition for an extended period of time.

B.1

If all control rods are fully inserted, and the reactor is subcritical by less than the highest estimated control rod worth, the SDM, assumed for the test conditions, may not be available. Under these conditions, it is necessary to promptly restore the SDM to within limits.

The allowed Completion Time of 15 minutes provides an acceptable time for initiating boration to restore SDM, without allowing the core to remain in an unacceptable condition for an extended period of time.

(continued)

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BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.1.10.1

In order to establish an acceptable SDM during the measurement of control rod worths, it is necessary to know the position of each control rod. A test Frequency of 2 hours is reasonable, based on normal control rod motion during control rod worth measurements.

SR 3.1.10.1 has been modified by a Note establishing that the position of only those control rods not fully inserted must be determined. It is assumed that the position and worth of fully inserted control rods is known.

SR 3.1.10.2

One of the assumptions made in granting an STE for SDM, is that all control rods not fully inserted will fully insert when tripped. This Surveillance is performed to verify that fact.

The Frequency of 24 hours prior to reducing the plant SDM below the normal requirements is acceptable, based on the assumption that the control rods will remain OPERABLE and trippable for 24 hours and during the performance of the test.

SR 3.1.10.2 has been modified by a Note establishing that this Surveillance is only required for control rods not fully inserted. During the performance of control rod worth measurements, certain control rods remain fully inserted. Since these rods are not relied on to trip, there is no need to demonstrate that they will fully insert when tripped.

REFERENCES

1. 10 CFR 50, Appendix B, Section XI.
2. 10 CFR 50.59.
3. Regulatory Guide 1.68, Revision 2, August 1978.
4. ANSI/ANS-19.6.1-1985, December 13, 1985.
5. FSAR, Chapter [14].

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B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.1B Heat Flux Hot Channel Factor ($F_Q(Z)$) (F_Q Methodology)

BASES

BACKGROUND

The purpose of the limits on the values of $F_Q(Z)$ is to limit the local (i.e., pellet) peak power density. The value of $F_Q(Z)$ varies along the axial height (Z) of the core.

$F_Q(Z)$ is defined as the maximum local fuel rod linear power density divided by the average fuel rod linear power density, assuming nominal fuel pellet and fuel rod dimensions. Therefore, $F_Q(Z)$ is a measure of the peak fuel pellet power within the reactor core.

During power operation, the global power distribution is limited by LCO 3.2.3, "AXIAL FLUX DIFFERENCE (AFD)," and LCO 3.2.4, "QUADRANT TILT POWER RATIO (QPTR)," which are directly and continuously measured process variables. These LCOs, along with LCO 3.1.7 (6), "Control Bank Insertion Limits," maintain the core limits on power distributions on a continuous basis.

$F_Q(Z)$ varies with fuel loading patterns, control bank insertion, fuel burnup, and changes in axial power distribution.

$F_Q(Z)$ is measured periodically using the incore detector system. These measurements are generally taken with the core at or near steady state conditions.

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 nonsteady state conditions are accomplished by operating the core within the limits of

(continued)

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BASES

APPLICABLE SAFETY ANALYSES (continued)

this variable value of $F^N_{\Delta H}$ in the analyses. Likewise, all transients that may be DNB limited are assumed to begin with an initial $F^N_{\Delta H}$ as a function of power level defined by the COLR limit equation.

The LOCA safety analysis indirectly models $F^N_{\Delta H}$ 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~~ 6, "Control Bank Insertion Limits," LCO 3.2.2, "Nuclear Enthalpy Rise Hot Channel Factor ($F^N_{\Delta H}$)," and LCO 3.2.1, "Heat Flux Hot Channel Factor ($F_Q(Z)$)."

$F^N_{\Delta H}$ 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.

$F^N_{\Delta H}$ satisfies Criterion 2 of the NRC Policy Statement.

LCO

$F^N_{\Delta H}$ shall be maintained within the limits of the relationship provided in the COLR.

The $F^N_{\Delta H}$ 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 $F^N_{\Delta H}$, 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)

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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 3.1.8, "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.

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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 energy deposition 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).

The LCO limits on the AFD, the QPTR, the Heat Flux Hot Channel Factor ($F_Q(Z)$), the Nuclear Enthalpy Rise Hot

(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 3.1.6, "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 [2200] psig and the RCS average temperature limit of [581]°F correspond to analytical limits of [2205] psig and [595]°F used in the safety analyses, with allowance for measurement uncertainty.

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 [2.0]% 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 [2.1]% 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)

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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 transient 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 hot

(continued)

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BASES

APPLICABLE SAFETY ANALYSES (continued)

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 ≥ the HZP temperature of 547°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 ($k_{eff} \geq 1.0$) 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 MODE 1 and MODE 2 with $k_{eff} \geq 1.0$, LCO 3.4.2 is applicable since the reactor can only be critical ($k_{eff} \geq 1.0$) in these MODES.

The special test exception of LCO 3.1.~~10~~ 9, "MODE 2 PHYSICS TESTS Exceptions," permits PHYSICS TESTS to be performed at ≤ 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 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

(continued)

LCO (continued)

$\leq$ 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 $k_{eff} \leq 0.95$. Above MODE 6, LCO 3.1.1, "SHUTDOWN MARGIN (SDM)—T_{avg} > 200°F," and LCO 3.1.2, "SHUTDOWN MARGIN (SDM)—$T_{avg} \leq$ 200°F," 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 unit 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 order to raise the boron concentration as soon as possible, the operator should begin boration with the best source available for unit conditions.

(continued)

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM)—T_{avg} > 200°F (Analog)

LCO 3.1.1 SDM shall be ≥ [4.5]% ΔK/k within the limits provided in the COLR ← from TSTF-9

APPLICABILITY: MODES 3 and, 4, and 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 3.1.1.1 Verify SDM is ≥ [4.5]% ΔK/k to be within limits. ← from TSTF-9	24 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.2 SHUTDOWN MARGIN (SDM)—T_{avg} ≤ 200°F (Analog)

LCO 3.1.2 SDM shall be ≥ [3.0]% Δk/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 ≥ [3.0]% Δk/k.	24 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.3 2 Reactivity Balance (Analog)

LCO 3.1.3 2 The core reactivity balance shall be within ± 1% Δk/k of predicted values.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Core reactivity balance 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

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.2.1	-------NOTES------- 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. 2. This Surveillance is not required to be performed prior to entry into MODE 2. ------------------------------	
	Verify overall core reactivity balance is within ± 1% $\Delta k/k$ of predicted values.	Prior to entering MODE 1 after fuel loading <u>AND</u> -----NOTE------ Only required after 60 EFPD -------------- 31 EFPD

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.3 Moderator Temperature Coefficient (MTC) (Analog)

LCO 3.1.3 The MTC shall be maintained within the limits specified in the COLR. The maximum positive limit shall be that specified in Figure 3.1.3-1.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MTC not within limits.	A.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.3.1	-------------------NOTE------------------- This Surveillance is not required to be performed prior to entry into MODE 2. -- Verify MTC is within the upper limits specified in the COLR.	Prior to entering MODE 1 after each fuel loading

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.~~4~~3.2	-------------------NOTES------------------- 1. This Surveillance is not required to be performed prior to entry into MODE 1 or 2. 2. If the MTC is more negative than the COLR limit when extrapolated to the end of cycle, SR 3.1.~~4~~3.2 may be repeated. Shutdown must occur prior to exceeding the minimum allowable boron concentration at which MTC is projected to exceed the lower limit. -- Verify MTC is within the lower limit specified in the COLR.	Each fuel cycle within 7 effective full power days (EFPD) of reaching 40 EFPD core burnup <u>AND</u> Each fuel cycle within 7 EFPD of reaching $\frac{2}{3}$ of expected core burnup

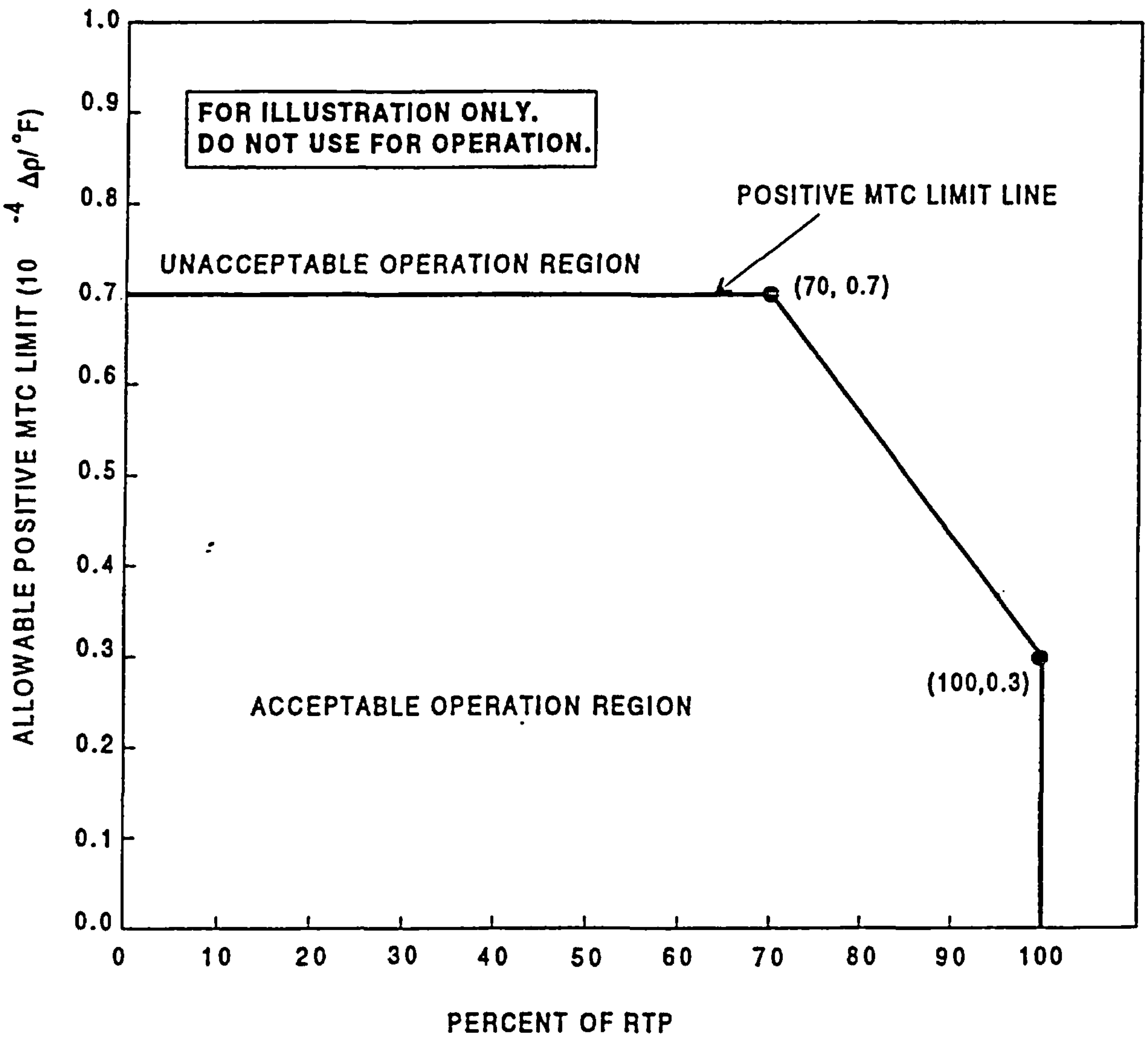

Figure 3.1.3-1 (page 1 of 1)
Allowable Positive MTC Limit

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 4 Control Element Assembly (CEA) Alignment (Analog)

LCO 3.1.8 4 All CEAs shall be OPERABLE and aligned to within [7] inches (indicated position) of their respective group [, and the CEA motion inhibit and the CEA deviation circuit shall be OPERABLE].

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more regulating CEAs trippable and misaligned from its group by > [7 inches] and ≤ [15 inches]. OR One regulating CEA trippable and misaligned from its group by > [15 inches].	A.1 Reduce THERMAL POWER to ≤ 70% RTP.	1 hour
	AND	
	A.2.1 Verify SDM is ≥ [4.5]% Δk/k.	1 hour
	OR	
	A.2.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.3.1 Restore the misaligned CEA(s) to within [7 inches] (indicated position) of its group.	2 hours
	OR	
		(continued)

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ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. (continued)	A.3.2	Align the remainder of the CEAs in the group to within [7 inches] (indicated position) of the misaligned CEA(s) while maintaining the insertion limit of LCO 3.1.7, 6 "Regulating Control Element Assembly (CEA) Insertion Limits."	2 hours
B. One or more shutdown CEAs trippable and misaligned from its group by > [7 inches] and ≤ [15 inches]. OR One shutdown CEA trippable and misaligned from its group by > [15 inches].	B.1	Reduce THERMAL POWER to ≤ 70% RTP.	1 hour
	AND		
	B.2.1	Verify SDM is ≥ [4.5]% Δk/k.	1 hour
	OR		
	B.2.2	Initiate boration to restore SDM to within limit.	1 hour
	AND		
	B.3	Restore the misaligned CEA(s) to within [7 inches] (indicated position) of its group.	2 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. CEA motion inhibit inoperable.	C.1	Perform SR 3.1.5.1.	1 hour AND Every 4 hours thereafter
	AND		
	C.2.1	Restore CEA motion inhibit to OPERABLE status.	6 hours
	OR		
	C.2.2	--------NOTE--------- Performance of Required Action C.2.2 is allowed only when not in conflict with Required Action A.1, A.3.1, A.3.2, B.1, B.3, or D.1. --------------------- Place and maintain the CEA drive switch in either the "off" or "manual" position [, and fully withdraw all CEAs in groups 3 and 4 and withdraw all CEAs in group 5 to < 5% insertion].	6 hours
D. CEA deviation circuit inoperable.	D.1	Perform SR 3.1.5.1.	1 hour AND Every 4 hours thereafter

(continued)

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ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. Required Action and associated Completion Time not met. OR One or more CEAs untrippable. OR Two or more CEAs misaligned by > [15 inches].	E.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.~~5~~ 4.1	Verify the indicated position of each CEA to be within [7 inches] of all other CEAs in its group.	12 hours
SR 3.1.~~5~~ 4.2	Verify that, for each CEA, the OPERABLE CEA position indicator channels, reed switch, and plant computer CEA position indication indicate within [5 inches] of each other.	12 hours
SR 3.1.~~5~~ 4.3	Verify the CEA motion inhibit is OPERABLE.	31 days

(continued)

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SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.1.4.4	Verify the CEA deviation circuit is OPERABLE.	31 days
SR 3.1.4.5	Verify CEA freedom of movement (trippability) by moving each individual CEA that is not fully inserted into the reactor core [5 inches] in either direction.	92 days
SR 3.1.4.6	Perform a CHANNEL FUNCTIONAL TEST of the reed switch position transmitter channel.	18 months
SR 3.1.4.7	Verify each CEA drop time is ≤ [3.1] seconds.	Prior to reactor criticality, after each removal of the reactor head

3.1 REACTIVITY CONTROL SYSTEMS

3.1.~~6~~5 Shutdown Control Element Assembly (CEA) Insertion Limits (Analog)

LCO 3.1.~~6~~5 All shutdown CEAs shall be withdrawn to ≥ [129] inches.

APPLICABILITY: MODE 1,
MODE 2 with any regulating CEA not fully inserted.

---------------------------NOTE---------------------------
This LCO is not applicable while performing SR 3.1.~~5~~4.5.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more shutdown CEAs not within limit.	A.1.1 Verify SDM ≥ [4.5]% Δk/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 CEA(s) to within limit.	2 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1 (5)	Verify each shutdown CEA is withdrawn ≥ [129] inches.	12 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.6 Regulating Control Element Assembly (CEA) Insertion Limits (Analog)

LCO 3.1.6 The power dependent insertion limit (PDIL) alarm circuit shall be OPERABLE, and the regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits specified in the COLR.

APPLICABILITY: MODES 1 and 2.

------------------------------NOTE------------------------------
This LCO is not applicable while performing SR 3.1.4.5 [or during reactor power cutback operation].

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Regulating CEA groups inserted beyond the transient insertion limit.	A.1.1 Verify SDM ≥ [4.5]% Δk/k.	1 hour
	<u>OR</u>	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.2.1 Restore regulating CEA groups to within limits.	2 hours
	<u>OR</u>	
		(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.2 Reduce THERMAL POWER to less than or equal to the fraction of RTP allowed by the CEA group position and insertion limits specified in the COLR.	2 hours
B. Regulating CEA groups inserted between the long term steady state insertion limit and the transient insertion limit for > 4 hours per 24 hour interval.	B.1 Verify short term steady state insertion limits are not exceeded. OR B.2 Restrict increases in THERMAL POWER to ≤ 5% RTP per hour.	15 minutes 15 minutes
C. Regulating CEA groups inserted between the long term steady state insertion limit and the transient insertion limit for intervals > 5 effective full power days (EFPD) per 30 EFPD interval or > 14 EFPD per 365 EFPD.	C.1 Restore regulating CEA groups to within limits.	2 hours
D. PDIL alarm circuit inoperable.	D.1 Perform SR 3.1.06.1.	1 hour AND (continued)

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ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. (continued)		Once per 4 hours thereafter
E. Required Action and associated Completion Time not met.	E.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.1.6.1	-------------------NOTE------------------- This Surveillance is not required to be performed prior to entry into MODE 2. -- Verify each regulating CEA group position is within its insertion limits.	12 hours
SR 3.1.6.2	Verify the accumulated times during which the regulating CEA groups are inserted beyond the steady state insertion limits but within the transient insertion limits.	24 hours
SR 3.1.6.3	Verify PDIL alarm circuit is OPERABLE.	31 days

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 7 Special Test Exception (STE)—SHUTDOWN MARGIN (SDM) (Analog)

LCO 3.1.8 7 The SDM requirements of LCO 3.1.1, 6 "SHUTDOWN MARGIN (SDM) T_{avg} > 200°F," and the regulating control element assembly (CEA) insertion limits of LCO 3.1.7, "Regulating Control Element Assembly (CEA) Insertion Limits," may be suspended for measurement of CEA worth and the SDM, provided shutdown reactivity equivalent to at least the highest estimated CEA worth (of those CEAs actually withdrawn) is available for trip insertion.

APPLICABILITY: MODES 2 and 3 during PHYSICS TESTS.

---NOTE---
Operation in MODE 3 shall be limited to 6 consecutive hours.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Any CEA not fully inserted and less than the above shutdown reactivity equivalent available for trip insertion. OR All CEAs inserted and the reactor subcritical by less than the above shutdown reactivity equivalent.	A.1 Initiate boration to restore required shutdown reactivity.	15 minutes

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1 (7)	Verify that the position of each CEA not fully inserted is within the acceptance criteria for available negative reactivity addition.	2 hours
SR 3.1.8.2 (7)	Verify that each CEA not fully inserted is capable of full insertion when tripped from at least the 50% withdrawn position.	Within [7 days] prior to reducing SDM to less than the limits of LCO 3.1.1

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Special Test Exception (STE)—MODES 1 and 2 (Analog)

LCO 3.1.8 During the performance of PHYSICS TESTS, the requirements of

LCO 3.1.3, "Moderator Temperature Coefficient (MTC)";
LCO 3.1.4, "Control Element Assembly (CEA) Alignment";
LCO 3.1.5, "Shutdown Control Element Assembly (CEA) Insertion Limits";
LCO 3.1.6, "Regulating Control Element Assembly (CEA) Insertion Limits";
LCO 3.2.2, "Total Planar Radial Peaking Factor (F^T_{XY})";
LCO 3.2.3, "Total Integrated Radial Peaking Factor (F^T_r)"; and
LCO 3.2.4, "AZIMUTHAL POWER TILT (T_q)"

may be suspended, provided:

a. THERMAL POWER is restricted to the test power plateau, which shall not exceed 85% RTP; and

b. SDM is ≥ [4.5]% $\Delta k/k$.

APPLICABILITY: MODES 1 and 2 during PHYSICS TESTS.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Test power plateau exceeded.	A.1 Reduce THERMAL POWER to less than or equal to test power plateau.	15 minutes

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. SDM not within limit.	B.1	Initiate boration to restore SDM to within limit.	15 minutes
	AND		
	B.2	Suspend PHYSICS TESTS.	1 hour
C. Required Action and associated Completion Time not met.	C.1	Suspend PHYSICS TESTS.	1 hour
	AND		
	C.2	Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.8.1	Verify THERMAL POWER is equal to or less than the test power plateau.	1 hour
SR 3.1.8.2	Verify SDM is $\geq$ [4.5]% $\Delta k/k$.	24 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.1 SHUTDOWN MARGIN (SDM)—T_{avg} > 200°F (Digital)

LCO 3.1.1 SDM shall be ≥ [5.0]% Δk/k. within the limits provided in the COLR. from TSTF-9

APPLICABILITY: MODES 3 and 4. , and 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 3.1.1.1 Verify SDM is ≥ [5.0]% Δk/k. to be within limits from TSTF-9	24 hours

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3.1 REACTIVITY CONTROL SYSTEMS

3.1.2 SHUTDOWN MARGIN (SDM)—T_{avg} ≤ 200°F (Digital)

LCO 3.1.2 SDM shall be ≥ [2.0]% Δk/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 ≥ [2.0]% Δk/k.	24 hours

3.1 REACTIVITY CONTROL SYSTEMS

3.1.~~3~~ 2 Reactivity Balance (Digital)

LCO 3.1.~~3~~ 2 The core reactivity balance shall be within ± 1% Δk/k of predicted values.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Core reactivity balance 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
	AND	
	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