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10 CFR 50.90

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

R. E. Ginna Nuclear Power Plant
Renewed Facility Operating License No. DPR-18
NRC Docket No. 50-244

Subject: License Amendment Request: Revision to Technical Specifications to Adopt Technical Specifications Task Force TSTF-547, Revision 1, "Clarification of Rod Position Requirements"

In accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," Exelon Generation Company, LLC (EGC) requests approval of the enclosed proposed amendment to revise the Technical Specifications (TS) to adopt Technical Specifications Task Force (TSTF) change TSTF-547, "Clarification of Rod Position Requirements," for the R. E. Ginna Nuclear Power Plant (Ginna).

The proposed amendment revises the requirements on control and shutdown rods, and rod and bank position indication, consistent with NRC-approved TSTF-547 and the associated model application. Attachment 1 provided a description and assessment of the proposed changes. Attachment 2 provides existing Ginna TS pages marked up to show the proposed changes. Attachment 3 provides revised (clean) Ginna TS pages. Attachment 4 provides existing Ginna TS Bases pages marked up to show the proposed changes for information only.

The proposed change has been reviewed by the Ginna Plant Operations Review Committee in accordance with the requirements of the EGC Quality Assurance Program.

EGC requests approval of the proposed amendment by June 25, 2019. Once approved, the amendment shall be implemented within 120 days.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC is notifying the State of New York of this application for license amendment by transmitting a copy of this letter and its attachments to the designated State Official.

Should you have any questions concerning this letter, please contact Jessie Hodge at (610) 765-5532.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 25th day of June 2018.

Respectfully,

David T. Gudger for

James Barstow
Director - Licensing and Regulatory Affairs
Exelon Generation Company, LLC

Attachments:
1. Evaluation of Proposed Changes
2. Proposed Changes to Technical Specifications Pages
3. Final Technical Specifications Pages
4. Proposed Changes to Technical Specifications Bases Pages (For Information Only)

cc:	USNRC Region I, Regional Administrator	w/ attachments
	USNRC Project Manager, Ginna	"
	USNRC Senior Resident Inspector, Ginna	"
	A. L. Peterson, NYSERDA	"

ATTACHMENT 1

Evaluation of Proposed Changes

R. E. Ginna Nuclear Power Plant

Renewed Facility Operating License No. DPR-18

Docket No. 50-244

Subject: **License Amendment Request: Revision to Technical Specifications to Adopt Technical Specifications Task Force TSTF-547, Revision 1, "Clarification of Rod Position Requirements"**

1.0 DESCRIPTION

2.0 ASSESSMENT

2.1 Applicability of Safety Evaluation
2.2 Variations

3.0 REGULATORY EVALUATION

3.1 No Significant Hazards Consideration Analysis
3.2 Conclusions

4.0 ENVIRONMENTAL EVALUATION

1.0 DESCRIPTION

The proposed License Amendment Request (LAR) revises the requirements on control and shutdown rods, and rod and bank position indication in Technical Specifications (TS) 3.1.4, "Rod Group Alignment Limits," TS 3.1.5, "Shutdown Bank Insertion Limit," TS 3.1.6, "Control Bank Insertion Limits," and TS 3.1.7, "Rod Position Indication." The proposed changes will: 1) provide time to repair rod movement failures that do not affect rod operability; 2) provide an alternative to frequent use of the movable incore detector system when position indication for a rod is inoperable; 3) correct conflicts within the TS; 4) eliminate an unnecessary action; 5) increase consistency, and; 6) improve the presentation.

2.0 ASSESSMENT

2.1 Applicability of Safety Evaluation

Exelon Generation Company, LLC (EGC) has reviewed the Safety Evaluation for TSTF-547, Revision 1 (hereafter TSTF-547) provided to the Technical Specifications Task Force in a letter dated March 4, 2016. This review included a review of the NRC Staff's evaluation, as well as the information provided in TSTF-547. As described in the subsequent paragraphs, EGC has concluded that the justifications presented in the TSTF-547 proposal and the Safety Evaluation prepared by the NRC Staff are applicable to the R. E. Ginna Nuclear Power Plant (Ginna) and justify this amendment for the incorporation of the changes to the Ginna TS.

2.2 Variations

EGC is proposing the following variations from the TS changes described in TSTF-547 or the applicable parts of the NRC Staff's Safety Evaluation dated March 4, 2016. These differences are administrative and do not affect the applicability of TSTF-547 or the applicable parts of the NRC Staff's Safety Evaluation to the Ginna TS.

- SR 3.1.4.2 to be >= 8 steps instead of 10. The value of 8 steps corresponds to the minimum number of step that the rods must be moved to ensure correct performance of SR 3.1.4.2. This is due to the differences between Digital Rod Position Indication (DRPI) and Ginna's Microprocessor Rod Position Indication (MRPI)

- Ginna only has one shutdown bank. TSTF-547 assumes multiple shutdown banks. Ginna TS will be reworded to reflect the current plant design.

- The Pressurized Water Reactor Owner's Group (PWROG) notified Tennessee Valley Authority (TVA) <u>after</u> they submitted their LAR that newly created Required Action A.2.2 to the Standard TS for the Rod Position Indication (RPI) LCO (REQUIRED ACTION (RA) 2.2 requires the inoperable RPI to be returned to OPERABLE status prior to entering MODE 2 from MODE 3). This RA is made irrelevant, as the logical "<u>OR</u>"

connector would allow the licensee to transition from RA A.2.1 and RA A.2.2 into either RA A.1 or RA A.3 (which do not have that requirement), and thereby not have to restore the inoperable RPI to OPERABLE status. Reference TVA Supplemental Letter to NRC dated May 11, 2018, ML18135A340.

Ginna TS and TS Bases 3.1.7 will not include RA A.2.2 and will renumber RA A.2.1 to RA A.2.

3.0 REGULATORY EVALUATION

3.1 No Significant Hazards Consideration Analysis

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

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

Response: No.

Control and shutdown rods are assumed to insert into the core to shut down the reactor in evaluated accidents. Rod insertion limits ensure that adequate negative reactivity is available to provide the assumed shutdown margin (SDM). Rod alignment and overlap limits maintain an appropriate power distribution and reactivity insertion profile.

Control and shutdown rods are initiators to several accidents previously evaluated, such as rod ejection. The proposed change does not change the limiting conditions for operation for the rods or make any technical changes to the Technical Specifications (TS) Surveillance Requirements (SRs) governing the rods. Therefore, the proposed change has no effect on the probability of any accident previously evaluated.

Revising the TS Required Actions to provide a limited time to repair rod movement control has no effect on the SDM assumed in the accident analysis as the proposed Required Actions require verification that SDM is maintained. The effects on power distribution will not cause a significant increase in the consequences of any accident previously evaluated as all TS requirements on power distribution continue to be applicable.

Revising the TS Required Actions to provide an alternative to frequent use of the moveable incore detector system to verify the position of rods with an inoperable rod position indicator does not change the requirements for the rods to be aligned and within the insertion limits.

Therefore, the assumptions used in any accidents previously evaluated are unchanged and there is no significant increase in the consequences.

The proposed change to resolve the differences in the TS ensure that the intended Actions are followed when equipment is inoperable. Actions taken with inoperable equipment are not assumptions in the accidents previously evaluated and have no significant effect on the consequences.

The proposed change to eliminate an unnecessary action has no effect on the consequences of accidents previously evaluated as the analysis of those accidents did not consider the use of the actions.

The proposed change to increase consistency within the TS has no effect on the consequences of accidents previously evaluated as the proposed change clarifies the application of the existing requirements and does not change the intent.

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

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

Response: No.

The proposed change does not involve a physical alteration of the plant (i.e., no new or different type of equipment will be installed). The change does not alter assumptions made in the safety analyses. The proposed change does not alter the limiting conditions for operation for the rods or make any technical changes to the Surveillance Requirements governing the rods. The proposed change maintains or improves safety when equipment is inoperable and does not introduce new failure modes.

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

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

Response: No.

The proposed change to provide time to repair rods that are operable but immovable does not result in a significant reduction in the margin of safety because all rods must be verified to be operable, and all other banks must be within the insertion limits. The remaining proposed changes to make the requirements internally consistent and to eliminate unnecessary actions do not affect the margin of safety as the changes do not affect the ability of the rods to perform their specified safety function.

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

Based on the above evaluation, EGC concludes that the proposed change does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of "no significant hazards consideration" is justified.

3.2 Conclusions

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

4.0 ENVIRONMENTAL EVALUATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

ATTACHMENT 2

Proposed Changes to Technical Specifications Pages

R. E. Ginna Nuclear Power Plant

Renewed Facility Operating License No. DPR-18

Docket No. 50-244

TS Pages

3.1.4-1, 2, and 3
3.1.5-1
add 3.1.5-2
3.1.6-1 and 2
add 3.1.6-3
3.1.7-1, 2, and 3
Removing 3.1.7-4

3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Rod Group Alignment Limits

LCO 3.1.4 All shutdown and control rods shall be OPERABLE.~~, with all individual indicated rod positions within 12 steps of their group step counter demand position.~~

AND

Individual indicated rod positions shall be within 12 steps of their group step counter demand position.

APPLICABILITY: MODES 1~~,~~ and 2.
~~MODE 2 with $K_{eff} \geq 1.0$.~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more rod(s) ~~untrippable~~ inoperable.	A.1.1 Verify SDM ~~is~~ to be within the limits specified in the COLR.	1 hour
	OR	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.2 Be in MODE ~~2 with K_{eff} < 1.0~~ 3.	6 hours

B. One rod not within alignment limits.	B.1.1 Verify SDM ~~is~~ to be within the limits specified in the COLR. OR B.1.2 Initiate boration to restore SDM to within limit. AND B.2 Reduce THERMAL POWER to ≤ 75% RTP. AND	1 hour 1 hour 2 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
	B.3 Verify SDM is within the limits specified in the COLR.	Once per 12 hours
	AND	
	B.4 Perform SR 3.2.1.1, SR 3.2.1.2, and SR 3.2.2.1.	72 hours
	~~AND~~	
	~~B.5 Perform SR 3.2.2.1.~~	~~72 hours~~
	AND	
	B.~~6~~ 5 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 ~~2 with K_{eff} $\leq$ 1.0~~ 3.	6 hours
D. More than one rod not within alignment limit.	D.1.1 Verify SDM is within the limits specified in the COLR.	1 hour
	OR	
	D.1.2 Initiate boration to restore required SDM to within limit.	1 hour
	AND	
	D.2 Be in MODE ~~2 with K_{eff} $\leq$ 1.0~~ 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.4.1	- NOTE - Not required to be performed for rods associated with inoperable rod position indicator or demand position indicator. Verify position of individual rods ~~positions~~ within alignment limit.	In accordance with the Surveillance Frequency Control Program
~~SR 3.1.4.2~~	~~- NOTE -~~ ~~Only required to be performed if the rod position deviation monitor is inoperable.~~ ~~Verify individual rod positions within alignment limit.~~	~~Once within 4 hours and in accordance with the Surveillance Frequency Control Program~~
SR 3.1.4.~~3~~ 2	Verify rod freedom of movement (trippability) by moving each rod not fully inserted in the core ~~to a MRPI transition~~ ≥ 8 steps in either direction.	In accordance with the Surveillance Frequency Control Program
SR 3.1.4.~~4~~ 3	Verify rod drop time of each rod, from the fully withdrawn position, is ≤ 1.8 seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with: a. T_{avg} ≥ 500°F; and b. All ~~Both~~ reactor coolant pumps operating.	~~Once p~~Prior to ~~reactor~~ criticality after each removal of the reactor head

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Shutdown Bank Insertion Limit

LCO 3.1.5 The shutdown bank shall be ~~at or above the~~ within insertion limit specified in the COLR.

- NOTE -

~~The shutdown bank may be outside the limit when required for performance of SR 3.1.4.3.~~

Not applicable to the shutdown bank inserted while performing SR 3.1.4.2

APPLICABILITY: MODES 1~~,~~ and 2.
~~MODE 2 with $K_{eff} \geq 1.0$.~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Shutdown bank inserted $\leq$ 8 steps beyond the insertion limit specified in the COLR.	A.1 Verify all control banks are within the insertion limits specified in the COLR.	1 hour
	AND	
	A.2.1 Verify SDM is within the limits specified in the COLR.	1 hour
	OR	
	A.2.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.3 Restore the shutdown bank to within the insertion limit specified in the COLR	24 hours

~~A~~B.	Shutdown bank not within limit~~.~~ for reasons other than Condition A.	~~A~~B.1.1 Verify SDM is within the limits specified in the COLR. OR ~~A~~B.1.2 Initiate boration to restore SDM to within limit. AND ~~A~~B.2 Restore shutdown bank to within limit.	1 hour 1 hour 2 hours
~~B~~C.	Required Action and associated Completion Time not met.	~~B~~C.1 Be in MODE ~~2 with K_{eff} < 1.0~~ 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.5.1	Verify the shutdown bank ~~insertion~~ is within the insertion limit specified in the COLR.	In accordance with the Surveillance Frequency Control Program

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.

- NOTE -

~~The control bank being tested may be outside the limits when required for the performance of SR 3.1.4.3.~~

Not applicable to control banks inserted while performing SR 3.1.4.2.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control bank A, B, or C inserted ≤ 8 steps beyond the insertion, sequence, or overlap limits specified in the COLR.	A.1 Verify the shutdown bank is within the insertion limit specified in the COLR	1 hour
	AND	
	A.2.1 Verify SDM is within the limits specified in the COLR.	1 hour
	OR	
	A.2.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.3 Restore the control bank to within the insertion, sequence, and overlap limits specified in the COLR.	24 hours

~~A~~B.	Control bank insertion limits not met for reasons other than Condition A.	~~A~~B.1.1	Verify SDM is within the limits specified in the COLR.	1 hour
			<u>OR</u>	
		~~A~~B.1.2	Initiate boration to restore SDM to within limit.	1 hour
		<u>AND</u> ~~A~~B.2	Restore control bank(s) to within limits.	2 hours
C.	Control bank sequence or overlap limits not met for reasons other than Condition A.	C.1.1	Verify SDM is within the limits specified in the COLR.	1 hour
			<u>OR</u>	
		C.1.2	Initiate boration to restore SDM to within limit.	1 hour
		<u>AND</u> C.2	Restore control bank sequence and overlap to within limits.	2 hours
~~B~~D.	Required Action and associated Completion Time not met.	~~B~~D.1	Be in MODE 2 with K_{eff} < 1.0.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.6.1	Verify estimated critical control bank position is within the limits specified in the COLR.	Within 4 hours prior to achieving criticality
SR 3.1.6.2	Verify each control bank insertion is within the insertion limits specified in the COLR.	In accordance with the Surveillance Frequency Control Program
~~SR 3.1.6.3~~	~~- NOTE -~~ ~~Only required to be performed if the rod insertion limit monitor is inoperable.~~ ~~Verify each control bank insertion is within the limits specified in the COLR.~~	~~Once within 4 hours and in accordance with the Surveillance Frequency Control Program~~
SR 3.1.6.43	Verify ~~each control bank~~ sequence and overlap limits specified in the COLR are met for control banks not fully withdrawn from the core. ~~is within the sequence and overlap limits specified in the COLR.~~	In accordance with the Surveillance Frequency Control Program

3.1 REACTIVITY CONTROL SYSTEMS

3.1.7 Rod Position Indication

LCO 3.1.7 The Microprocessor Rod Position Indication (MRPI) System and the Demand Position Indication System shall be OPERABLE.

APPLICABILITY: MODES 1~~,~~ and 2.
~~MODE 2 with $K_{eff} \geq 1.0$~~.

ACTIONS

- NOTE -

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One MRPI per group inoperable ~~for~~ in one or more groups.	A.1 Verify the position of the rod with inoperable ~~position indicators~~ MRPI indirectly by using movable incore detectors.	Once per 8 hours
	OR	
	A.2 ~~Reduce THERMAL POWER to ≤ 50% RTP.~~ Verify the position of the rods with inoperable MRPI indirectly by using the moveable incore detectors.	8 hours AND Once per 31 EFPD thereafter AND 8 hours after discovery of each unintended rod movement AND 8 hours after each movement of rod with inoperable MRPI > 12 steps AND
	~~OR~~	

CONDITION	REQUIRED ACTION	COMPLETION TIME
		Prior to THERMAL POWER exceeding 50% RTP AND 8 hours after reaching RTP
	~~- NOTE -~~ ~~Rod position monitoring by Actions A.3.1 and A.3.2 may be applied to only one inoperable rod position indicator and shall only be allowed until an entry into MODE 5~~	
	~~A.3.1 Verify the position of the non-indicating rod indirectly by using movable incore detectors.~~	~~8 hours~~ ~~AND~~ ~~Once within 8 hours of rod control system indication of potential rod movement~~ ~~AND~~ ~~Once per 31 days thereafter~~
	OR	
	A.3 Reduce THERMAL POWER to ≤ 50% RTP.	8 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
	~~AND~~ ~~A.3.2 Review the parameters of the rod control system for indications of rod movement for the rod with an inoperable position indicator.~~	~~16 hours~~ ~~AND~~ ~~Once per 8 hours thereafter~~
B. More than one MRPI per group inoperable in one or more groups.	B.1 Place the control rods under manual control. AND B.2 Restore inoperable MRPIs to OPERABLE status such that a maximum of one MRPI per group is inoperable.	Immediately 24 hours
~~B~~C. One or more ~~rods with~~ MRPI inoperable ~~position indicators have~~ in one or more groups and associated rod has been moved > 24 steps in one direction since the last determination of the rod's position.	~~B~~C.1 Verify the position of the rods with inoperable ~~position indicators~~ MRPIs indirectly by using movable incore detectors. OR ~~B~~C.2 Reduce THERMAL POWER to $\leq$ 50% RTP.	4 hours 8 hours

~~C~~.D	One or more demand position indicators per bank inoperable ~~for~~ in one or more banks.	~~C~~D.1.1	Verify by administrative means all MRPIs for the affected banks are OPERABLE.	Once per 8 hours
			AND	
		~~C~~D.1.2	Verify the most withdrawn rod and the least withdrawn rod of the affected banks are ≤ 12 steps ~~from the OPERABLE demand position indicator for that bank~~ apart.	Once per 8 hours
		OR		
		~~C~~D.2	Reduce THERMAL POWER to ≤ 50% RTP.	8 hours
~~D~~E.	Required Action and associated Completion Time ~~of Condition A, Condition B or Condition C~~ not met.	~~D~~E.1	Be in MODE ~~2 with K_{eff} < 1.0~~3.	6 hours
~~E.~~	~~More than one MRPI per group inoperable for one or more groups.~~ ~~OR~~ ~~More than one demand position indicator per bank inoperable for one or more banks.~~	~~E.1~~	~~Enter LCO 3.0.3.~~	~~Immediately~~

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.7.1	- NOTE - Not required to be met for MRPIs associated with rods that do not meet LCO 3.1.4. Verify each MRPI agrees within 12 steps of the group demand position for the full indicated range of rod travel.	Once ~~P~~prior to ~~reactor~~ criticality after each removal of the reactor head

ATTACHMENT 3

Final Technical Specifications Pages

R. E. Ginna Nuclear Power Plant

Renewed Facility Operating License No. DPR-18

Docket No. 50-244

3.1 REACTIVITY CONTROL SYSTEMS

3.1.4 Rod Group Alignment Limits

LCO 3.1.4 All shutdown and control rods shall be OPERABLE.

AND

Individual indicated rod positions shall be 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) inoperable.	A.1.1 Verify SDM to be within the limits specified in the COLR.	1 hour
	OR	
	A.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.2 Be in MODE 3.	6 hours
B. One rod not within alignment limits.	B.1.1 Verify SDM to be within the limits specified in the COLR.	1 hour
	OR	
	B.1.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	B.2 Reduce THERMAL POWER to $\leq$ 75% RTP.	2 hours
	AND	

CONDITION	REQUIRED ACTION		COMPLETION TIME
	B.3	Verify SDM is within the limits specified in the COLR.	Once per 12 hours
	AND		
	B.4	Perform SR 3.2.1.1, SR 3.2.1.2, and SR 3.2.2.1.	72 hours
	AND		
	B.5	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
D. More than one rod not within alignment limit.	D.1.1	Verify SDM is within the limits specified in the COLR.	1 hour
	OR		
	D.1.2	Initiate boration to restore required SDM to within limit.	1 hour
	AND		
	D.2	Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.4.1	- NOTE - Not required to be performed for rods associated with inoperable rod position indicator or demand position indicator. Verify position of individual rods within alignment limit.	In accordance with the Surveillance Frequency Control Program
SR 3.1.4.2	Verify rod freedom of movement (trippability) by moving each rod not fully inserted in the core ≥ 8 steps in either direction.	In accordance with the Surveillance Frequency Control Program
SR 3.1.4.3	Verify rod drop time of each rod, from the fully withdrawn position, is ≤ 1.8 seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry, with: a. $T_{avg} \geq 500°F$; and b. All reactor coolant pumps operating.	Prior to criticality after each removal of the reactor head

3.1 REACTIVITY CONTROL SYSTEMS

3.1.5 Shutdown Bank Insertion Limit

LCO 3.1.5 The shutdown bank shall be within insertion limit specified in the COLR.

- NOTE -

Not applicable to the shutdown bank inserted while performing SR 3.1.4.2.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Shutdown bank inserted ≤ 8 steps beyond the insertion limit specified in the COLR.	A.1 Verify all control banks are within the insertion limits specified in the COLR.	1 hour
	<u>AND</u>	
	A.2.1 Verify SDM is within the limits specified in the COLR.	1 hour
	<u>OR</u>	
	A.2.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	A.3 Restore the shutdown bank to within the insertion limit specified in the COLR.	24 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Shutdown bank not within limit for reasons other than Condition A.	B.1.1 Verify SDM is within the limits specified in the COLR. OR B.1.2 Initiate boration to restore SDM to within limit. AND B.2 Restore shutdown bank to within limit.	1 hour 1 hour 2 hours
C. Required Action and associated Completion Time not met.	C.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.5.1	Verify the shutdown bank is within the insertion limit specified in the COLR.	In accordance with the Surveillance Frequency Control Program

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.

- NOTE –

Note applicable to control banks inserted while performing SR 3.1.4.2.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Control bank A, B, or C inserted ≤ 8 steps beyond the insertion, sequence, or overlap limits specified in the COLR.	A.1 Verify the shutdown bank is within the insertion limit specified in the COLR	1 hour
	AND	
	A.2.1 Verify SDM is within the limits specified in the COLR	1 hour
	OR	
	A.2.2 Initiate boration to restore SDM to within limit.	1 hour
	AND	
	A.3 Restore the control bank to within the insertion, sequence, and overlap limits specified in the COLR.	24 hours

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Control bank insertion limits not met for reasons other than Condition A.	B.1.1 Verify SDM is within the limits specified in the COLR.	1 hour
	<u>OR</u>	
	B.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	B.2 Restore control bank(s) to within limits.	2 hours
C. Control bank sequence or overlap limits not met for reasons other than Condition A.	C.1.1 Verify SDM is within the limits specified in the COLR.	1 hour
	<u>OR</u>	
	C.1.2 Initiate boration to restore SDM to within limit.	1 hour
	<u>AND</u>	
	C.2 Restore control bank sequence and overlap to within limits.	2 hours
D. Required Action and associated Completion Time not met.	D.1 Be in MODE 2 with K_{eff} < 1.0.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.6.1	Verify estimated critical control bank position is within the limits specified in the COLR.	Within 4 hours prior to achieving criticality
SR 3.1.6.2	Verify each control bank insertion is within the insertion limits specified in the COLR.	In accordance with the Surveillance Frequency Control Program
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.	In accordance with the Surveillance Frequency Control Program

3.1 REACTIVITY CONTROL SYSTEMS

3.1.7 Rod Position Indication

LCO 3.1.7 The Microprocessor Rod Position Indication (MRPI) 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 MRPI and each demand position indicator.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One MRPI per group inoperable in one or more groups.	A.1 Verify the position of the rod with inoperable MRPI indirectly by using movable incore detectors.	Once per 8 hours
	<u>OR</u>	
	A.2 Verify the position of the rods with inoperable MRPI indirectly by using the movable incore detectors.	8 hours <u>AND</u> Once per 31 EFPD thereafter <u>AND</u> 8 hours after discovery of each unintended rod movement <u>AND</u> 8 hours after each movement of rod with inoperable MRPI > 12 steps <u>AND</u>

CONDITION	REQUIRED ACTION	COMPLETION TIME
		Prior to THERMAL POWER exceeding 50% RTP AND 8 hours after reaching RTP
	OR	
	A.3 Reduce THERMAL POWER to ≤ 50% RTP.	8 hours
B. More than one MRPI per group inoperable in one or more groups.	B.1 Place the control rods under manual control.	Immediately
	AND	
	B.2 Restore inoperable MRPIs to OPERABLE status such that a maximum of one MRPI per group is inoperable.	24 hours
C. One or more MPRI inoperable in one or more groups and associated rod has been moved > 24 steps in one direction since the last determination of the rod's position.	C.1 Verify the position of the rods with inoperable MRPIs indirectly by using movable incore detectors.	4 hours
	OR	
	C.2 Reduce THERMAL POWER to ≤ 50% RTP.	8 hours
D. One or more demand position indicators per bank inoperable in one or more banks.	D.1.1 Verify by administrative means all MRPIs for the affected banks are OPERABLE.	Once per 8 hours
	AND	

CONDITION	REQUIRED ACTION	COMPLETION TIME
.	D.1.2 Verify the most withdrawn rod and the least withdrawn rod of the affected banks are ≤ 12 steps apart.	Once per 8 hours
	OR	
	D.2 Reduce THERMAL POWER to ≤ 50% RTP.	8 hours
E. Required Action and associated Completion Time not met.	E.1 Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.7.1	- NOTE – Not required to be met for MRPIs associated with rods that do not meet LCO 3.1.4. Verify each MRPI agrees within 12 steps of the group demand position for the full indicated range of rod travel.	Once prior to criticality after each removal of the reactor head

ATTACHMENT 4

Proposed Changes to Technical Specifications Bases Pages
(For Information Only)

R. E. Ginna Nuclear Power Plant

Renewed Facility Operating License No. DPR-18

Docket No. 50-244

TS Bases Pages

B 3.1.4-5, 6, 7, 8, and 9
B 3.1.5-4 and 5
add B 3.1.5-6
B 3.1.6-2, 4, 5, 6, and 7
B 3.1.7-4, 5, 6, and 7
add B 3.1.7-8

3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.4 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 SHUTDOWN MARGIN (SDM). The applicable criteria for these reactivity and power distribution design requirements are Atomic Industrial Forum (AIF) GDC 6, 14, 27 and 28(Ref. 1), and 10 CFR 50.46 (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 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 movable neutron absorbing devices which are moved out of the core (up or withdrawn) or into the core (down or inserted) 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 a shutdown bank. Control banks are used to compensate for changes in reactivity due to variations in operating conditions of the reactor such as coolant temperature, power level, boron or xenon concentration. The shutdown bank provides additional shutdown reactivity such that the total shutdown worth of the bank is adequate to provide shutdown for all operating and hot zero power conditions with the single RCCA of highest reactivity worth fully withdrawn. Each bank is further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. There are four control banks and one shutdown bank at Ginna Station.

The shutdown bank is maintained either in the fully inserted or fully withdrawn position. The fully withdrawn position is defined in the COLR. 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 fully withdrawn position, 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 near the fully withdrawn position at RTP. The insertion sequence is the opposite of the withdrawal sequence (i.e., bank D is inserted first) but follows the same overlap pattern. 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: the Bank Demand Position Indication System (commonly called group step counters) and the Microprocessor Rod Position Indication (MRPI) 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), but 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 MRPI System also provides a highly accurate indication of actual control rod position, but at a lower precision than the step counters. The MRPI system consists of one digital detector assembly per rod. All the detector assemblies consist of one coil stack which is multiplexed and becomes input to two redundant MRPI signal processors. Each signal processor independently monitors all rods and senses a rod bottom for any rod. The MRPI system directly senses rod position in intervals of 12 steps for each rod. The digital detector assemblies consist of 20 discrete coil pairs spaced at 12-step intervals. The true rod position is always within ±8 steps of the indicated position (±6 steps due to the 12-step interval and ±2 steps transition uncertainty due to processing and coil sensitivity). With an indicated deviation of 12 steps between the group step counter and MRPI, the maximum deviation between actual rod position and the demand position would be 20 steps, or 12.5 inches.

The safety concerns associated with the MRPI system is the ability to comply with the rod misalignment requirement. The automatic rod withdrawal function has been disabled, which effectively eliminated the MRPI rod drop rod stop function, which previously blocked auto rod withdrawal. The accident analysis conservatively assumes that the capability to automatically withdraw control rods is retained.

The bank demand position and the MRPI rod position signals are monitored by a rod deviation monitoring system that provides an alarm whenever the individual rod position signal deviates from the bank demand signal by > 12 steps. The rod deviation alarm will be generated by the Plant Process Computer System (PPCS).

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 (i.e., static rod misalignment). 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 remaining control rods to meet the SDM requirement, with the maximum worth rod stuck fully withdrawn.

Three types of analysis are performed in regard to static rod misalignment (Ref. 4). The first type of analysis considers the case where any one rod is completely inserted into the core with all other rods completely withdrawn. With control banks at their insertion limits, the second type of analysis considers the case when any one rod is completely inserted into the core. The third 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 all three of these cases bounds the situation when a rod is misaligned from its group by 12 steps.

The second 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 fully withdrawn following a main steam line break (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

All shutdown and control rods must be OPERABLE to provide the negative reactivity necessary to provide adequate shutdown for all operating and hot zero power conditions. Shutdown and control rod OPERABILITY is defined as being trippable such that the necessary negative reactivity assumed in the accident analysis is available. If a control rod(s) is discovered to be immovable but remains trippable and aligned, the control rod is considered to be OPERABLE.

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 of each individual rod position as indicated by MRPI to within plus or minus 12 steps of their group step counter demand position is conservative. The minimum misalignment assumed in safety analysis with respect to power distribution and SDM is 25 steps, while a total misalignment from fully withdrawn to fully inserted is assumed for the control rod misalignment accident.

Verification that the rod positions are within the alignment limit is made ~~every 12 hours~~ in accordance with the Surveillance Frequency Control Program (SR 3.1.4.1).

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 ~~MODE~~ 2 ~~with K_{eff} $\geq$1.0~~ 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 ~~MODE 2 with K_{eff} < 1.0 and~~ MODES 3, 4, 5, and 6, the alignment limits do not apply because the reactor is shut down and not producing fission power. In the shutdown MODES, the OPERABILITY of the shutdown and control rods has the potential to affect the required SDM, but this effect can be compensated for by an increase in the boron concentration of the RCS. See LCO 3.1.1, "SHUTDOWN MARGIN (SDM)," for SDM in ~~MODE 2 with K_{eff} < 1.0 and~~ MODES 3, 4, and 5 and LCO 3.9.1, "Boron Concentration," for boron concentration requirements during MODE 6.

ACTIONS

A.1.1 and A.1.2

When one or more rods are inoperable (i.e., untrippable), there is a possibility that the required SDM may be adversely affected. Under these conditions, it is important to determine the SDM, and if it is less than the required value, initiate boration until the required SDM is recovered. The Completion Time of 1 hour is adequate for determining SDM and, if necessary, for initiating boration to restore SDM. Boration is assumed to continue until the required SDM is restored.

In this situation, SDM verification must include the worth of the untrippable rod, as well as a remaining 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 this status, the plant must be brought to at least MODE 3 ~~2 with K_{eff} < 1.0~~ within 6 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3 ~~2 with K_{eff} < 1.0~~ from full power conditions in an orderly manner and without challenging plant systems.

B.1.1 and B.1.2

When a rod is misaligned, it can usually be moved and is still trippable. If the rod cannot be realigned within 1 hour, then SDM must be verified to be within the limits specified in the COLR or boration must be initiated to restore the SDM. The Completion Time of 1 hour gives the operator sufficient time to perform either action in an orderly manner.

B.2, B.3, B.4, and B.5, ~~and B.6~~

For continued operation with a misaligned rod, reactor power must be reduced, S~~O~~DM 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. 6). The Completion Time of 2 hours gives the operator sufficient time to accomplish an orderly power reduction without challenging the Reactor Protection System.

When a rod is known to be misaligned, there is a potential to impact the SDM. Since the core conditions can change with time, periodic verification of SDM is required. A Frequency of 12 hours is sufficient to ensure this requirement continues to be met.

Verifying that $F_Q(Z)$ and $F^N_{\Delta H}$ are within the required limits (i.e., SR 3.2.1.1, SR 3.2.1.2, and SR 3.2.2.1) 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 ~~FNH~~ $F^N_{\Delta H}$.

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 Accident for the duration of operation under these conditions. As a minimum, the following accident analyses shall be re-evaluated:

a. Rod insertion characteristics;

b. Rod misalignment;

c. Small break loss of coolant accidents (LOCAs);

d. Rod withdrawal at full power;

e. Large break LOCAs;

f. Main steamline break; and

g. Rod ejection.

A Completion Time of 5 days is sufficient time to obtain the required input data and to perform the analysis.

C.1

When Required Actions of Condition B cannot be completed within their Completion Time, the plant must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the plant must be brought to at least MODE 3~~2 with K_{eff} < 1.0~~ 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 ~~2 with K_{eff} < 1.0~~ from full power conditions in an orderly manner and without challenging plant systems.

D.1.1 and D.1.2

More than one control rod becoming misaligned from its group 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 of 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 is assumed to continue until the required SDM is restored.

D.2

If more than one rod is found to be misaligned or becomes misaligned because of bank movement, the plant conditions fall outside of the accident analysis assumptions. Since automatic bank sequencing would continue to cause misalignment, the plant must be brought to a MODE or Condition in which the LCO requirements are not applicable. To achieve this status, the plant must be brought to at least MODE 3~~2 with K_{eff} < 1.0~~ within 6 hours.

The allowed Completion Time is reasonable, based on operating experience, for reaching MODE 3~~2 with K_{eff} < 1.0~~ from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.1.4.1

Verification that the position of individual rods is within alignment limits at a Frequency in accordance with the Surveillance Frequency Control Program provides a history that allows the operator to detect a rod that is beginning to deviate from its expected position. 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.

The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

~~SR 3.1.4.2~~

~~When the rod position deviation monitor (i.e., the PPCS) is inoperable, no control room alarm is available between the normal Frequency to alert the operators of a rod misalignment. A reduction of the Frequency provides sufficient monitoring of the rod positions when the monitor is inoperable. This 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. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

~~This SR is modified by a Note that states that performance of this SR is only necessary when the rod position deviation monitor is inoperable.~~

SR 3.1.4.~~3~~2

Verifying each control rod is OPERABLE would require that each rod be tripped. However, in MODES 1 and 2 ~~with K_{eff} ≥ 1.0~~, tripping each control rod would result in radial or axial power tilts, or oscillations. Exercising each individual control rod 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 ~~to a MRPI transition~~ ≥ 8 steps and to the first MRPI transition will not cause radial or axial power tilts, or oscillations, to occur. Observing a MRPI transition guarantees the rods moved. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

During or between required performances of SR 3.1.4.~~3~~2 (determination of control rod OPERABILITY by movement), if a control rod(s) is discovered to be immovable, but remains trippable and aligned, the control rod(s) is considered to be OPERABLE. At any time, if a control rod(s) is immovable, a determination of the trippability (OPERABILITY) of the control rod(s) must be made, and appropriate action taken.

SR 3.1.4.~~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 ~~both~~ all RCPs operating and the average moderator temperature ≥ 500ºF to simulate a reactor trip under actual conditions.

This Surveillance is performed during a plant outage prior to criticality after each removal of the reactor head, 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. Atomic Industrial Forum (AIF) GDC 6, 14, 27, and 28, Issued for comment July 10, 1967.
2. 10 CFR 50.46.
3. UFSAR, Chapter 15.
4. UFSAR, Section 15.4.6.
5. UFSAR, Section 15.1.5.
6. UFSAR, Section 15.4.2.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.5 Shutdown Bank Insertion Limit

BASES

BACKGROUND

The insertion limits of the shutdown and control rods define the deepest insertion into the core with respect to core power which is allowed and 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, SHUTDOWN MARGIN (SDM), and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are Atomic Industrial Forum (AIF) GDC 27, 28, 29, and 32 (Ref. 1), and 10 CFR 50.46 (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 a shutdown bank. Each bank is further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. There are four control banks and one shutdown bank at Ginna Station. See LCO 3.1.4, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.7, "Rod Position Indication," for position indication requirements.

The shutdown bank insertion limit is defined in the COLR. The shutdown bank is required to be at or above the insertion limit ~~lines~~.

~~The control banks are used for precise reactivity control of the reactor. Control bank withdrawal is performed manually with normal control bank insertion automatically controlled by the Rod Control System. They are capable of adding negative reactivity very quickly (compared to borating or diluting). The control banks must be maintained above designed insertion limits and are typically near the fully withdrawn position during normal full power operations. Hence, they are not capable of adding a large amount of positive reactivity. Boration or dilution of the Reactor Coolant System (RCS) compensates for the reactivity change associated with large changes in RCS temperature.~~

The design calculations are performed with the assumption that the shutdown bank is withdrawn first. The shutdown bank can be fully withdrawn without the core going critical. The fully withdrawn position is defined in the COLR. This provides available negative reactivity in the event of boration errors. The shutdown bank is controlled manually by the control room operator. The shutdown bank is either fully withdrawn or fully inserted. The shutdown bank must be completely withdrawn from the core, prior to withdrawing any control banks during an approach to criticality. The shutdown bank is then left in this position until the reactor is shut down. The shutdown bank affects core power and burnup distribution, and adds negative reactivity to shut down the reactor upon receipt of a reactor trip signal.

The power density at any point in the core must be limited, so that the fuel design criteria are maintained. Together, LCO 3.1.4, "Rod Group Alignment Limits," LCO 3.1.5, "Shutdown Bank Insertion Limit," 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)," 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 shutdown and control bank insertion limits restrict the reactivity that could be added in the event of a rod ejection accident, and 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

On a reactor trip, all RCCAs (shutdown bank and control banks), except the most reactive RCCA, are assumed to insert into the core. The shutdown bank shall be at or above the insertion limit 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)") following a reactor trip from full power. The combination of control banks and the shutdown bank (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 bank insertion limits and inoperability or misalignment is that:

a. There be no violations of:

   1. Specified acceptable fuel design limits, or

   2. RCS pressure boundary integrity; and

b. The core remains subcritical after accident transients.

As such, the shutdown bank insertion limit affects safety analysis involving core reactivity and SDM (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 (Refs. 4, 5, 6, and 7).

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, together with AFD, QPTR and the control and shutdown bank alignment limits, ensure that safety analyses assumptions for SDM, ejected rod worth, and power distribution peaking factors are preserved (Refs. 4, 5, 6, and 7).

The shutdown bank insertion limit preserves an initial condition assumed in the safety analyses and, as such, satisfies Criterion 2 of the NRC Policy Statement.

LCO

The shutdown bank must be at or above the insertion limit, as specified in the COLR, any time the reactor is critical and prior to withdrawal of any control rod. 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 LCO is modified by a Note indicating the LCO requirement is suspended during SR 3.1.4.~~3~~2. This SR verifies the freedom of the rods to move, and requires the shutdown bank to move below the LCO limits, which would normally violate the LCO.

The shutdown bank insertion limit is defined in the COLR.

APPLICABILITY

The shutdown bank must be within the insertion limit, with the reactor in MODES 1 and ~~MODE~~ 2 ~~with $K_{eff} \geq .0$~~. 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. In ~~MODE 2 with K_{eff} < 1.0 and~~ MODE 3, 4, 5, or 6, the shutdown bank insertion limit does not apply because the reactor is shutdown and not producing fission power. In shutdown MODES the OPERABILITY of the shutdown 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. Refer to LCO 3.1.1 for SDM requirements in ~~MODE 2 with K_{eff} < 1.0 and~~ MODES 3, 4, and 5. LCO 3.9.1, "Boron Concentration," ensures adequate SDM in MODE 6.

ACTIONS

A.1, A.2.1, A.2.2, and A.3

If the shutdown bank is inserted less than or equal to 8 steps below the insertion limit, as specified in the COLR, 24 hours is allowed to restore the shutdown bank to within the limit. This is necessary because the available SDM may be reduced with a shutdown bank not within its insertion limit. 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 the shutdown bank is not within its insertion limit, SDM will be verified by performing a reactivity balance calculation, considering the effects listed in the BASES for SR 3.1.1.1.

While the shutdown bank is outside the insertion limit, as specified in the COLR, all control banks must be within their insertion limits to ensure sufficient shutdown margin is available within 1 hour. The 24 hour Completion Time is sufficient to repair most rod control failures that would prevent movement of a shutdown bank.

~~A~~B.1.1, ~~A~~B.1.2, and ~~A~~B.2

When the shutdown bank is not within the insertion limit for reasons other than Condition A, verification of SDM or initiation of boration to regain SDM within 1 hour is required, since the SDM in MODE 1 and MODE 2 ~~with $K_{eff} \geq 1.0$~~ is ensured by adhering to the control and shutdown bank insertion limits (see LCO 3.1.1, "SHUTDOWN MARGIN (SDM)"). If the shutdown bank is not within the insertion limit, then SDM will be verified by performing a reactivity balance calculation, taking into account RCS boron concentration, core power defect, control bank position, RCS average temperature, fuel burnup based on gross thermal energy generation, xenon concentration, samarium concentration, and isothermal temperature coefficient (ITC).

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. Two hours is allowed to restore the shutdown bank to within the insertion limit. This time limit is necessary because the available SDM may be significantly reduced, with the shutdown bank not within the insertion limit. 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~~C.1

If Required Actions ~~A.1 and A.2~~ cannot be completed within the associated Completion Times, the plant must be brought to a MODE where the LCO is not applicable. ~~To achieve this status, the plant must be placed in MODE 2 with k_{eff} < 1.0 within a Completion Time of 6 hours.~~ 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 3.1.5.1

Verification that the shutdown bank is within the insertion limit, as specified in the COLR, prior to an approach to criticality ensures that when the reactor is critical, or being taken critical, the shutdown bank will be available to shut down the reactor, and the required SDM will be maintained following a reactor trip. This SR and Frequency ensure that the shutdown bank is withdrawn before the control banks are withdrawn during plant startup.

Since the shutdown bank is positioned manually by the control room operator, a verification of shutdown bank position at a Frequency in accordance with the Surveillance Frequency Control Program is adequate to ensure that the bank is within the insertion limit. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. Atomic Industrial Forum (AIF) GDC 27, 28, 29, and 32, Issued for comment July 10, 1967.
2. 10 CFR 50.46.
3. UFSAR, Chapter 15.
4. UFSAR, Section 15.1.5.

5. UFSAR, Section 15.4.1.

6. UFSAR, Section 15.4.2.

7. UFSAR, Section 15.4.6.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.6 Control Bank Insertion Limits

BASES

BACKGROUND

The insertion limits of the shutdown and control rods define the deepest insertion into the core with respect to core power which is allowed and 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, SHUTDOWN MARGIN (SDM), and initial reactivity insertion rate.

The applicable criteria for these reactivity and power distribution design requirements are Atomic Industrial Forum (AIF) GDC 27, 28, 29, and 32 (Ref. 1), and 10 CFR 50.46 (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 a shutdown bank. Each bank is further subdivided into two groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. There are four control banks and one shutdown bank at Ginna Station. See LCO 3.1.4, "Rod Group Alignment Limits," for control and shutdown rod OPERABILITY and alignment requirements, and LCO 3.1.7, "Rod Position Indication," for position indication requirements.

The control bank insertion limits are specified in the COLR. The control banks are required to be at or above the insertion limit lines.

The insertion limits figure in the COLR also indicates how the control banks are moved in an overlap pattern. Overlap is the distance travelled together by two control banks.

The control banks are used for precise reactivity control of the reactor. Control bank withdrawal is performed manually with normal control bank insertion automatically controlled by the Rod Control System. They are capable of adding negative reactivity very quickly (compared to borating or diluting). The control banks must be maintained above designed insertion limits and are typically near the fully withdrawn position during normal full power operations. The fully withdrawn position is defined in the COLR. Boration or dilution of the Reactor Coolant System (RCS) compensates for the reactivity changes associated with large changes in RCS temperature.

The rod insertion limit monitor is used to verify control rod insertion on a continuous basis and will provide an alarm whenever the control bank insertion deviates from the rod insertion limits specified in the COLR. Verification that the control banks are within the insertion limits is in accordance with the Surveillance Frequency Control Program ~~made every 12 hours~~ (SR 3.1.6.2). ~~When the rod insertion limit monitor is inoperable a verification that the rod positions are within the limit must be made more frequently (SR 3.1.6.3).~~

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 fully withdrawn position, 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 near the fully withdrawn position at RTP. The insertion sequence is the opposite of the withdrawal sequence (i.e., bank D is inserted first) but follows the same overlap pattern. 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 power density at any point in the core must be limited, so that the fuel design criteria are maintained. Together, LCO 3.1.4, "Rod Group Alignment Limits," LCO 3.1.5, "Shutdown Bank Insertion Limit," 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)," 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 shutdown and control bank insertion limits restrict the reactivity that could be added in the event of a rod ejection accident, and ensure the required SDM is maintained.

Operation within the AFD, QPTR, shutdown and control bank insertion and alignment 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

On a reactor trip, all RCCAs (shutdown bank and control banks), except the most reactive RCCA, are assumed to insert into the core. The shutdown bank shall be at or above the insertion limit 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)") following a reactor trip from full power. The combination of control banks and the shutdown bank (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 control bank insertion limits also limit the reactivity worth of an ejected control bank rod.

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 control bank insertion limits affect safety analysis involving core reactivity and power distributions (Refs. 4, 5, 6, and 7).

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 (Refs. 4, 5, 6, and 7).

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, together with AFD, QPTR and the control and shutdown bank alignment limits, ensure that safety analyses assumptions for SDM, ejected rod worth, and power distribution peaking factors are preserved (Refs. 4, 5, 6, and 7).

The control bank insertion, sequence and overlap 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 bank~~s~~ insertion, sequence, overlap, and ~~insertion,~~ as ~~defined~~ specified 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 limited, and ensuring adequate negative reactivity insertion is available on trip. The overlap between control banks provides more uniform rates of reactivity insertion and withdrawal and is imposed to maintain acceptable power peaking during control bank motion.

~~The rod insertion limit monitor is used to verify control rod insertion on a continuous basis and will provide an alarm whenever the control bank insertion deviates from the rod insertion limits specified in the COLR. Verification that the control banks are within the insertion limit is made every 12 hours (SR 3.1.6.2). When the rod insertion limit monitor is inoperable a verification that the rod positions are within the limit must be made more frequently (SR 3.1.6.3).~~

The LCO is modified by a Note indicating the LCO requirement~~s are suspended during the performance of~~ is not applicable to control banks being inserted while performing SR 3.1.4.~~3~~2. This SR verifies the freedom of the rods to move, and may require~~s~~ the control bank to move below the LCO limits, which would normally violate the LCO. This Note applies to each control bank as it is moved below the insertion limit to perform the SR. This Note is not applicable should a malfunction stop performance of the SR.

APPLICABILITY

The control bank insertion, sequence, and overlap limits shall be maintained with the reactor in MODE 1 and MODE 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 MODE 2 with $k_{eff} < 1.0$ and MODES 3, 4, 5, and 6 is not required, since neither the power distribution nor ejected rod worth assumptions would be exceeded in these MODES.

ACTIONS

A.1, A.2.1, A.2.2, and A.3

If Control Bank A, B, or C is inserted less than or equal to 8 steps below the insertion, sequence, or overlap limits, 24 hours in allowed to restore the control bank to within the limits. 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. If a Control bank is not within its insertion limit, SDM will be verified by performing a reactivity balance calculation, considering the effects listed in the BASES for SR 3.1.1.1.

While the control bank is outside the insertion, sequence, or overlap limits, the shutdown bank must be within its insertion limit within 1 hour to ensure sufficient shutdown margin is available and that the power distribution is controlled. The 24 hour Completion Time is sufficient to repair most rod control failures that would prevent movement of a control bank.

Condition A is limited to Control banks A, B, or C. The allowance is not required for Control Bank D because the full power bank insertion limit can be met during performance of the SR 3.1.4.2 control rod freedom of movement (trippability) testing.

~~A~~B.1.1, ~~A~~B.1.2, ~~and A~~B.2, C.1.1, C.1.2, and C.2

When the control banks are outside the acceptable insertion limits, out of sequence, or in the wrong overlap configuration for reasons other than Condition A, 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 within 1 hour is required, since the SDM in MODES 1 and 2 with $k_{eff} \geq 1.0$ is normally ensured by adhering to the control and shutdown bank insertion limits ~~(see LCO 3.1.1, "SHUTDOWN MARGIN (SDM)")~~. If control banks are not within their limits, then SDM will be verified by performing a reactivity balance calculation, taking into account RCS boron concentration, core power defect, control bank position, RCS average temperature, fuel burnup based on gross thermal energy generation, xenon concentration, samarium concentration, and isothermal temperature coefficient (ITC).

Operation beyond the LCO limits is allowed for a short time period in order to take conservative action because the 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. Thus, the allowed Completion Time of 2 hours for restoring the banks to within the insertion, sequence, and overlap limits provides an acceptable time for evaluating and repairing minor problems.

~~B~~D.1

If Required Actions ~~A.1 and A.2~~ cannot be completed within the associated Completion Times, the plant must be brought to MODE 2 with K_{eff} < 1.0, where the LCO is not applicable. The allowed Completion Time of 6 hours is reasonable, based on operating experience, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.1.6.1

This Surveillance is required to ensure that the reactor does not achieve criticality with the control banks below their insertion limits. The Frequency of within 4 hours prior to achieving criticality ensures that the estimated control bank position is within the limits specified in the COLR shortly before criticality is reached.

SR 3.1.6.2

Verification of the control bank insertion limits at a Frequency in accordance with the Surveillance Frequency Control Program is sufficient to detect control banks that may be approaching the insertion limits.

~~The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

~~SR 3.1.6.3~~

~~When the insertion limit monitor becomes inoperable, no control room alarm is available to alert the operators of a control bank not within the insertion limits. A reduction of the Frequency to every 4 hours provides sufficient monitoring of control rod insertion when the monitor is inoperable. Verification of the control bank position at a Frequency in accordance with the Surveillance Frequency Control Program is sufficient to detect control banks that may be approaching the insertion limits. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

~~This SR is modified by a Note that states that performance of this SR in only necessary when the rod insertion limit monitor is inoperable.~~

SR 3.1.6.~~4~~3

When control banks are maintained within their insertion limits as required by SR 3.1.6.2 ~~and SR 3.1.6.3~~ above, it is unlikely that their sequence and overlap will not be in accordance with requirements approaching provided in the COLR. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

REFERENCES

1. Atomic Industrial Forum (AIF) GDC 27, 28, 29, and 32, Issued for comment July 10, 1967.
2. 10 CFR 50.46.
3. UFSAR, Chapter 15.
4. UFSAR, Section 15.1.5.
5. UFSAR, Section 15.4.1.
6. UFSAR, Section 15.4.2.
7. UFSAR, Section 15.4.6.

B 3.1 REACTIVITY CONTROL SYSTEMS

B 3.1.7 Rod Position Indication

BASES

BACKGROUND

The OPERABILITY (i.e., trippability), 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 SHUTDOWN MARGIN (SDM). Rod position indication is required to assess OPERABILITY and misalignment.

According to the Atomic Industrial Forum (AIF) GDC 12 and 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 3.1.7 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.

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 movable neutron absorbing devices which are moved out of the core (up or withdrawn) or into the core (down or inserted) 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 a shutdown bank. Control banks are used to compensate for changes in reactivity due to variations in operating conditions of the reactor such as coolant temperature, power level, boron or xenon concentration. The shutdown bank provides additional shutdown reactivity such that the total shutdown worth of the bank is adequate to provide shutdown for all operating and hot zero power conditions with the single RCCA of highest reactivity worth fully withdrawn. Each bank is further subdivided into groups to provide for precise reactivity control. A group consists of two or more RCCAs that are electrically paralleled to step simultaneously. A bank of RCCAs consists of two groups that are moved in a staggered fashion but always within one step of each other. There are four control banks and one shutdown bank at Ginna Station.

The axial position of shutdown rods and control rods is indicated by two separate and independent systems: the Bank Demand Position Indication System (commonly called group step counters) and the Microprocessor Rod Position Indication (MRPI) 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), but 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 MRPI System also provides a highly accurate indication of actual control rod position, but at a lower precision than the step counters. The MRPI system consists of one digital detector assembly per rod. All the detector assemblies consist of one coil stack which is multiplexed and becomes input to two redundant MRPI signal processors. Each signal processor independently monitors all rods and senses a rod bottom for any rod. The MRPI system directly senses rod position in intervals of 12 steps for each rod. The digital detector assemblies consist of 20 discrete coil pairs spaced at 12-step intervals. The true rod position is always within ±8 steps of the indicated position (±6 steps due to the 12-step interval and ±2 steps transition uncertainty due to processing and coil sensitivity). With an indicated deviation of 12 steps between the group step counter and MRPI, the maximum deviation between actual rod position and the demand position would be 20 steps, or 12.5 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 limits, and with minimum SDM (LCO 3.1.5, "Shutdown Bank Insertion Limit," and LCO 3.1.6, "Control Bank Insertion Limits"). The rod positions must also be known in order to verify the alignment limits are preserved (LCO 3.1.4, "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 3.1.7 specifies that the MRPI System and the Bank Demand Position Indication System be OPERABLE. For the control rod position indicators to be OPERABLE requires the following:

a. For the MRPI System there are no failed coils and rod position indication is available on the MRPI screen (in either the control room or relay room) or the plant process computer system. In addition, individual rod position indication for a single rod can be determined using an engineered hand held device when connected to the MRPI Display Cabinet in the relay room; and

b. The Bank Demand Indication System has been calibrated either in the fully inserted position or to the MRPI System.

   The 12 step agreement limit between the Bank Demand Position Indication System and the MRPI System as required by SR 3.1.7.1 indicates that the Bank Demand Position Indication System is adequately calibrated, and can be used for indication of control rod bank position. A deviation of less than the allowable 12 step agreement limit, 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.

The MRPI system is designed with error detection such that when a fault occurs in the binary data received from the coil stacks or processing unit an alarm is annunciated at the MRPI display. When the fault clears, the system provides self validation of data integrity and returns to its normal display mode. Because of the digital nature of the system and its inherent diagnostic features, intermittent data alarms can mask position indication and generate the perception that a single rod position is unmonitored. For a single rod position indication failure, MRPI is considered OPERABLE if a fault occurs and clears within five minutes and the indicated position is within expected values.

These requirements ensure that control rod position indication during power operation and PHYSICS TESTS is accurate, and that design assumptions are not challenged. OPERABILITY of the position indicator channels ensures that 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 MRPI and step counters are only applicable in MODES 1 and ~~MODE~~ 2 ~~with K_{eff} ≥1.0~~ (consistent with LCO 3.1.4 and LCO 3.1.5, and LCO 3.1.6), because these are the only MODES in which the reactor is critical, 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. See LCO 3.1.1, "SHUTDOWN MARGIN (SDM)," for SDM requirements in ~~MODE 2 with K_{eff} < 1.0 and~~ MODES 3, 4, and 5 and LCO 3.9.1, "Boron Concentration," for boron concentration requirements during MODE 6.

ACTIONS

The ACTIONS table is modified by a Note indicating that a separate Condition entry is allowed for each inoperable MRPI ~~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 and A.2

When one MRPI per group in one or more groups fails, the position of the rod can still be determined by use of the movable incore 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~~C.1 or ~~B~~C.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.

Required Action A.1 requires verification of the position of a rod with an inoperable MRPI once per 8 hours which may put excessive wear and tear on the moveable incore detector system, Required Action A.2 provides an alternative. Required Action A.2 requires verification of rod position using the moveable incore detectors every 31 EFPD, which coincides with the normal use of the system to verify core power distribution.

Required Action A.2 includes six distinct requirements for verification of the position of rods associated with an inoperable MRPI using the movable incore detectors:

a. Initial verification within 8 hours of the inoperability of the MRPI;

b. Re-verification once every 31 Effective Full Power Days (EFPD) thereafter;

c. Verification within 8 hours if rod control system parameters indicate unintended rod movement. An unintended rod movement is defined as the release of the rod's stationary gripper when no action was demanded either manually or automatically from the rod control system, or a rod motion in a direction other than the direction demanded by the rod control system. Verifying that no unintended rod movement has occurred is performed by monitoring the rod control system stationary gripper coil current for indications of rod movement;

d. Verification within 8 hours if the rod with an inoperable MRPI is intentionally moved greater than 12 steps;

e. Verification prior to exceeding 50% RTP if power is reduced below 50% RTP; and

f. Verification within 8 hours of reaching 100% RTP if power is reduced to less than 100% RTP.

Should the rod with the inoperable MRPI be moved more than 12 steps, or if reactor power is changed, the position of the rod with the inoperable MRPI must be verified.

A.~~2~~3

Reduction of THERMAL POWER to ≤ 50% RTP puts the core into a condition where rod position is not significantly affecting core peaking factors.

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.

~~The REQUIRED ACTIONS portion of the ACTIONS table is modified by a note indicating the option of using the temporary alternate method of control rod position monitoring while in modes 1-4. This allows for valid monitoring during the limited troubleshooting and/or repairs while above cold shutdown. Should the technical problem with MRPI components occur to the inside-containment-components, repairs cannot be safely implemented until the unit is in cold shutdown conditions (MODE 5) due to adverse radiological and temperature conditions inside containment near the reactor head area. The alternate method of monitoring will allow for the valid monitoring required while preventing the possible excessive wear of the incore monitoring system due to the use of the incore detectors every 8 hours that would otherwise be required to comply with Action A.1 of T.S. 3.1.7.~~

~~A.3.1~~

~~When one MRPI fails, the position of the rod can still be determined by use of the movable incore 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 control rod 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. To provide verification of reliability of alternate monitoring, rod position will be verified by moveable incore detectors every 31 days. The 31-day frequency minimizes use of the movable incore monitoring system and can be performed concurrently with existing surveillance requirements for Hot Channel Factors.~~

~~A.3.2~~

~~Review control rod gripper coil current using alternate monitoring method for indication of control rod(s) movement for the rod with inoperable position indicator within 16 hours and then every 8 hours thereafter. Verification of control rod 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.~~

~~Should gripper coil current of the control rod(s) indicate movement, a determination of the control rod positions will be made using the moveable incore detectors within 8 hours. To provide verification of reliability of alternate monitoring, rod position will be verified by moveable incore detectors every 31 days. The 31-day frequency minimizes use of the movable incore monitoring system and can be performed concurrently with existing surveillance requirements for Hot Channel Factors.~~

B.1 and B.2

When more than one MRPI per group in one or more groups fail, additional actions are necessary. Placing the Rod Control System in manual assures unplanned rod motion will not occur. The immediate Completion Time for placing the Rod Control System in manual reflects the urgency with which unplanned rod motion must be prevented while in the Condition.

The inoperable MRPIs must be restored, such that a maximum of one MRPI per group is inoperable, within 24 hours. The 24 hour Completion Time provides sufficient time to troubleshoot and restore the MRPI system to operation while avoiding the plant challenges associated with the shutdown without full rod position indication.

Based on operating experience, normal power operation does not require excessive rod movement. If one or more rods has been significantly moved, the Required Action of C.1 or C.2 below is required.

~~B~~C.1 and ~~B~~C.2

~~When one or more rods with inoperable position indicators (i.e., MRPI) have been moved > 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~~ With one MRPI inoperable in one or more groups and the affected groups have moved greater than 24 steps in one direction since the last determination of rod position, additional actions are needed to verify the position of rods within inoperable MRPI. Within 4 hours, the position of the rods with inoperable position indication must be determined using the moveable incore detectors to verify these rods are still properly positioned, relative to their group positions. The allowed Completion Time of 4 hours provides an acceptable period of time to verify the rod positions.

~~Acceptable verification of rod position within 4 hours re-initiates the clock for Required Action A.1.~~

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.

~~C~~D.1.1 and ~~C~~D.1.2

With one or more demand position indicators per bank inoperable in one or more banks, the rod positions can be determined by the MRPI 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 ~~from the OPERABLE demand position indicator for that bank apart~~ within the allowed Completion Time of once every 8 hours is adequate. ~~This ensures that most withdrawn and least withdrawn rod are no more than 24 steps apart which is less than the accident analysis assumption of 25 steps. This verification can be an examination of logs, administrative controls, or other information that shows that all MRPIs in the affected bank are OPERABLE.~~

~~C~~D.2

Reduction of THERMAL POWER to ≤ 50% RTP puts the core into a condition where rod position will not cause core peaking to approach the core peaking factor limits.

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.

~~D~~E.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 ~~2 with K_{eff} < 1.0~~ 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.

~~E.1~~

~~With more than one MRPI per group inoperable for one or more groups or more than one demand position indicator per bank inoperable for one or more banks, an immediate plant shutdown in accordance with LCO 3.0.3 is required.~~

SURVEILLANCE REQUIREMENTS

SR 3.1.7.1

Verification that the MRPI agrees with the group demand position within 12 steps for the full indicated range of rod travel ensures that the MRPI is operating correctly. Since the MRPI does not display the actual shutdown rod positions between 0 and 230 steps, only points within the indicated ranges are required in comparison.

This Surveillance is performed during a plant outage or during plant startup, prior to reactor criticality after each removal of the reactor head 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.

The Surveillance is modified by a Note which states it is not required to be met for MRPIs associated with rods that do not meet LCO 3.1.4. If a rod is known to not be within 12 steps of the group demand position, the ACTIONS of LCO 3.1.4 provide the appropriate Actions.

REFERENCES

1. Atomic Industrial Forum (AIF) GDC 12 and 13, Issued for comment July 10, 1967.

2. UFSAR, Chapter 15.