From: Hamill, Carol L [clhamill@tva.gov]
Sent: Tuesday, October 12, 2010 12:47 PM
To: Wiebe, Joel; Raghavan, Rags; Milano, Patrick; Campbell, Stephen
Cc: Crouch, William D; Boyd, Desiree L; Lyons, Sharon K
Subject: 10-12-10_TS 3.6.11 and 3.1.8 Submittal_Final to NRC.pdf - Adobe Acrobat Professional
Attachments: image001.jpg; 10-12-10_TS 3.6.11 and 3.1.8 Submittal_Final to NRC.pdf

Please see attached letter that was sent to the NRC today.

Carol L. Hamill

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October 12, 2010 10 CFR 50.36

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

Watts Bar Nuclear Plant, Unit 2
NRC Docket No. 50-391

Subject: Watts Bar Nuclear Plant (WBN) - Unit 2 - Change to Developmental Technical Specification (TS) Sections 3.6.11, "Ice Bed," and 3.1.8, "Rod Position Indication"

References:
1. TVA letter to NRC, "Watts Bar Nuclear Plant (WBN) Unit 2 - Operating License Application Update," dated March 4, 2009
2. TVA letter to NRC, "Watts Bar Nuclear Plant (WBN) - Unit 2 - Developmental Revision B of the Technical Specifications (TS), TS Bases, Technical Requirements Manual (TRM), TRM Bases; and Pressure and Temperature Limits Report (PTLR)," dated February 2, 2010
3. TVA letter to NRC, "Watts Bar Nuclear Plant (WBN) - Unit 2 - Change to Developmental TS Section 4.2.2, 'Control Rod Assemblies,'" dated August 16, 2010

This letter transmits changes to WBN Unit 2 Developmental TS Section 3.6.11, "Ice Bed," Surveillance Requirement (SR) 3.6.11.2, SR 3.6.11.3, and the associated Bases to raise the minimum required average ice basket weight from 1,110 pounds to 1,237 pounds, and the corresponding total weight of the stored ice in the ice condenser from 2,158,000 pounds to 2,404,500 pounds. Enclosure 1 describes the change.

This letter also transmits changes to WBN Unit 2 Developmental TS Section 3.1.8, "Rod Position Indication," to reflect a change to include the word "indirectly" regarding verification of the position of the control rods using Power Distribution Monitoring System (PDMS) because it is not possible to "directly" confirm control rod position using the Westinghouse In-Core Information Surveillance & Engineering (WINCISE) system. The "indirect" PDMS method will be the method to verify rod position. Enclosure 2 describes the change.

On March 4, 2009 (Reference 1), as part of WBN Unit 2 operating license application update, TVA submitted Developmental Revision A WBN Unit 2 TS; and on February 2, 2010 (Reference 2), TVA submitted Developmental Revision B WBN Unit 2 TS. On August 16, 2010, TVA submitted a Revision C change to Developmental TS Section 4.2.2 (Reference 3).

Changes per this letter are reflected as Developmental Revision D changes.

There are no new commitments associated with this submittal. If you have any questions, please contact William Crouch at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 12th day of October 2010.

Respectfully,

M. Bajestani

Masoud Bajestani
Watts Bar Unit 2 Vice President

Enclosures:

1. Description of Change to Developmental TS Section 3.6.11, Ice Bed
2. Description of Change to Developmental TS Section 3.1.8, Rod Position Indication

Attachments to Enclosure 1:

1. Mark-up of Developmental WBN Unit 2 TS Section 3.6.11, Ice Bed, to Create Revision D
2. Retyped Version of Developmental Revision D WBN Unit 2 TS Section 3.6.11, Ice Bed
3. Mark-up of Developmental WBN Unit 2 TS Bases Section 3.6.11, Ice Bed, to Create Revision D

Attachments to Enclosure 2:

1. Mark-up of Developmental WBN Unit 2 TS Section 3.1.8, Rod Position Indication, to Create Revision D
2. Retyped Version of Developmental Revision D WBN Unit 2 TS Section 3.1.8, Rod Position Indication
3. Mark-up of Developmental WBN Unit 2 TS Bases Section 3.1.8, Rod Position Indication, to Create Revision D

cc (w/enclosures):

U. S. Nuclear Regulatory Commission
Region II
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Atlanta, Georgia 30303-1257

NRC Resident Inspector Unit 2
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

Enclosure 1

Description of Change to Developmental TS Section 3.6.11, Ice Bed

By letter dated December 15, 2005 (Reference 1 below), WBN Unit 1 requested the subject TS change to the ice basket and total ice weights due to the additional energy associated with the replacement steam generators installed in Unit 1. The NRC issued the amendment change July 25, 2006 (Reference 2 below).

WBN Unit 1 and Unit 2 are keeping the TS the same to reduce operator errors, so the Westinghouse safety analysis has been performed to the same ice weight and boron concentrations as Unit 1, even though Unit 2 does not have Tritium Producing Burnable Absorber Rods or Replacement Steam Generators.

The WBN containment ice bed consists of ice stored in 1,944 baskets within the ice condenser. The primary purpose of the ice condenser is to provide a large heat sink in the event of a release of energy from a design basis loss-of-coolant accident (LOCA) or other high energy line break in the containment. The LOCA requires the greatest amount of ice compared to other accident scenarios; therefore, the increase in ice weight is based on the LOCA containment integrity analysis. The increase in ice weight has no adverse impact on plant operation or accident/transient response.

The ice would absorb energy and limit the containment peak pressure and temperature during a postulated accident. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a design basis accident. The design basis ice mass is supported by the containment integrity analysis documented in the WBN Final Safety Analysis Report, Section 6.2, "Containment Systems." The TS surveillance limits on total ice weight, and average basket ice weight by row-group, are intended to ensure that sufficient ice is present in an appropriate distribution to perform this function. The TS surveillance limits are currently an "as-left" measurement and include margin for ice sublimation.

Attachments 1 and 2 contain the mark-up and the retyped version of the appropriate TS page. Attachment 3 contains the mark-up of the appropriate TS Bases pages for information only.

References:

1. TVA letter to NRC, “Watts Bar Nuclear Plant (WBN) - Unit 1 - Technical Specification (TS) Change No. TVA-WBN-TS-05-09 - Ice Condenser Ice Weight Increase Due to Replacement Steam Generators,” dated December 15, 2005

2. NRC letter to TVA, “Watts Bar Nuclear Plant, Unit 1 - Issuance of Amendment Regarding Technical Specification Change to Increase Containment Ice Condenser Ice Weight to Support Replacement Steam Generators (TAC No. MC9270), dated July 25, 2006

Attachment 1 to
Enclosure 1

Mark-up of

Developmental WBN Unit 2 TS

Section 3.6.11, Ice Bed

to Create Revision D

<u>Technical Specification Page</u>

3.6-26

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.11.2	Verify total weight of stored ice is greater than or equal to 2,404,5002,158,000 lb by: a. Weighing a representative sample of ≥ 144 ice baskets and verifying each basket contains greater than or equal to 12371110 lb of ice; and b. Calculating total weight of stored ice, at a 95 percent confidence level, using all ice basket weights determined in SR 3.6.11.2.a.	18 months
SR 3.6.11.3	Verify azimuthal distribution of ice at a 95 percent confidence level by subdividing weights, as determined by SR 3.6.11.2.a, into the following groups: a. Group 1-bays 1 through 8; b. Group 2-bays 9 through 16; and c. Group 3-bays 17 through 24. The average ice weight of the sample baskets in each group from radial rows 1, 2, 4, 6, 8, and 9 shall be greater than or equal to 12371110 lb.	18 months
SR 3.6.11.4	Verify, by visual inspection, accumulation of ice on structural members comprising flow channels through the ice bed is less than or equal to 15 percent blockage of the total flow area for each safety analysis section.	18 months

(continued)

Attachment 2 to
Enclosure 1

Retyped Version of

Developmental Revision D WBN Unit 2 TS

Section 3.6.11, Ice Bed

Technical Specification Page

3.6-26

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.11.2	Verify total weight of stored ice is greater than or equal to 2,404,500 lb by: a. Weighing a representative sample of ≥ 144 ice baskets and verifying each basket contains greater than or equal to 1237 lb of ice; and b. Calculating total weight of stored ice, at a 95 percent confidence level, using all ice basket weights determined in SR 3.6.11.2.a.	18 months
SR 3.6.11.3	Verify azimuthal distribution of ice at a 95 percent confidence level by subdividing weights, as determined by SR 3.6.11.2.a, into the following groups: a. Group 1-bays 1 through 8; b. Group 2-bays 9 through 16; and c. Group 3-bays 17 through 24. The average ice weight of the sample baskets in each group from radial rows 1, 2, 4, 6, 8, and 9 shall be greater than or equal to 1237 lb.	18 months
SR 3.6.11.4	Verify, by visual inspection, accumulation of ice on structural members comprising flow channels through the ice bed is less than or equal to 15 percent blockage of the total flow area for each safety analysis section.	18 months

(continued)

Attachment 3 to
Enclosure 1

Mark-up of

Developmental WBN Unit 2 TS Bases

Section 3.6.11, Ice Bed

to Create Revision D

<u>Technical Specification Bases Pages</u>

B 3.6-64
B 3.6-69

B 3.6 CONTAINMENT SYSTEMS

B 3.6.11 Ice Bed

BASES

BACKGROUND

The ice bed consists of over 2,404,5002,158,000 lbs of ice stored in 1944 baskets within the ice condenser. Its primary purpose is to provide a large heat sink in the event of a release of energy from a Design Basis Accident (DBA) in containment. The ice would absorb energy and limit containment peak pressure and temperature during the accident transient. Limiting the pressure and temperature reduces the release of fission product radioactivity from containment to the environment in the event of a DBA.

The ice condenser is an annular compartment enclosing approximately 300° of the perimeter of the upper containment compartment, but penetrating the operating deck so that a portion extends into the lower containment compartment. The lower portion has a series of hinged doors exposed to the atmosphere of the lower containment compartment, which, for normal plant operation, are designed to remain closed. At the top of the ice condenser is another set of doors exposed to the atmosphere of the upper compartment, which also remain closed during normal plant operation. Intermediate deck doors, located below the top deck doors, form the floor of a plenum at the upper part of the ice condenser. These doors also remain closed during normal plant operation. The upper plenum area is used to facilitate surveillance and maintenance of the ice bed.

The ice baskets contain the ice within the ice condenser. The ice bed is considered to consist of the total volume from the bottom elevation of the ice baskets to the top elevation of the ice baskets. The ice baskets position the ice within the ice bed in an arrangement to promote heat transfer from steam to ice. This arrangement enhances the ice condenser's primary function of condensing steam and absorbing heat energy released to the containment during a DBA.

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.11.2

The weighing program is designed to obtain a representative sample of the ice baskets. The representative sample shall include 6 baskets from each of the 24 ice condenser bays and shall consist of one basket from radial rows 1, 2, 4, 6, 8, and 9. If no basket from a designated row can be obtained for weighing, a basket from the same row of an adjacent bay shall be weighed.

The rows chosen include the rows nearest the inside and outside walls of the ice condenser (rows 1 and 2, and 8 and 9, respectively), where heat transfer into the ice condenser is most likely to influence melting or sublimation. Verifying the total weight of ice ensures that there is adequate ice to absorb the required amount of energy to mitigate the DBAs.

If a basket is found to contain less than 12371100 lb of ice, a representative sample of 20 additional baskets from the same bay shall be weighed. The average weight of ice in these 21 baskets (the discrepant basket and the 20 additional baskets) shall be greater than or equal to 1237≥ 1100 lb at a 95% confidence level. [Value does not account for instrument error.]

Weighing 20 additional baskets from the same bay in the event a Surveillance reveals that a single basket contains less than 12371100 lb ensures that no local zone exists that is grossly deficient in ice. Such a zone could experience early melt out during a DBA transient, creating a path for steam to pass through the ice bed without being condensed. The Frequency of 18 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 18 month Frequency, the weight requirements are maintained with no significant degradation between surveillances.

SR 3.6.11.3

This SR ensures that the azimuthal distribution of ice is reasonably uniform, by verifying that the average ice weight in each of three azimuthal groups of ice condenser bays is within the limit. The Frequency of 18 months was based on ice storage tests and the allowance built into the required ice mass over and above the mass assumed in the safety analyses. Operating experience has verified that, with the 18-month Frequency, the weight requirements are maintained with no significant degradation between surveillances.

(continued)

Enclosure 2

Description of Change to Developmental TS Section 3.1.8, Rod Position Indication

The NRC has approved a change (Reference) to Unit 1 TS to be able to verify the position of a control rod with an inoperable Rod Position Indication (RPI) with either the Movable Incore Detector System (MIDS) or with the Power Distribution Monitoring System (PDMS).

The MIDS is able to “directly” verify the position of a control rod with an inoperable RPI by comparing the profile of a 61-point axial trace associated with that control rod against the profile of an axial trace associated with a symmetric control rod with an operable RPI. The PDMS develops a detailed 3-dimensional power distribution via its nodal code coupled with updates from plant instrumentation. The monitored power distribution, which includes radial adjustments from the core exit thermocouples, can be compared to the reference power distribution expected with all control rods properly aligned. In this way, agreement between the two power distributions can be used to indirectly verify the control rod with the inoperable RPI is aligned.

There is a fundamental difference, however, between WBN Unit 1 and Unit 2. Unit 1 has the MIDS, and Unit 2 will have the Westinghouse In-Core Information Surveillance & Engineering (WINCISE) system. The MIDS collects 61 axial points from top to bottom of the core, each point representing about 2.4” each or 3.8 control rod steps. WINCISE has fixed incore detectors with only 5 axial nodes of about 28.8” each or 46 control rod steps. These large axial nodes prevent the use of raw detector data to be used to “directly” verify the position of the rod on Unit 2.

The indirect PDMS method would necessarily be used to verify the position of a control rod with an inoperable RPI on Unit 2. The PDMS assimilates the fixed incore detector signals into its nodal code to generate a fine mesh 3D power distribution which is used in the same manner as on Unit 1 to verify the position of the control rod.

In addition, an editorial change is being made to remove the word “Analog” from the description of the rod position indication system, which uses the digital Computer Enhanced Rod Position Indication (CERPI) system, and drop the “A” from the “ARPI” (Analog Rod Position Indication) abbreviation.

Attachments 1 and 2 contain the mark-up and the retyped version of the appropriate TS pages. Attachment 3 contains the mark-up of the appropriate TS Bases pages for information only.

Reference:

1. NRC to TVA, “Watts Bar Nuclear Plant, Unit 1 - Issuance of Amendment Regarding the Application to Implement Beacon Core Power Distribution and Monitoring System (TAC No. ME1698),” dated October 27, 2009 [ML092710381]

Attachment 1 to
Enclosure 2

Mark-up of

Developmental WBN Unit 2 TS

Section 3.1.8, Rod Position Indication

to Create Revision D

<u>Technical Specification Pages</u>

3.1-15
3.1-16
3.1-17

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Rod Position Indication

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

APPLICABILITY: MODES 1 and 2

ACTIONS

---NOTE---

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
----------------NOTE----------------- Rod position monitoring by Required Actions A.2.1 and A.2.2 may only be applied to one inoperable ARPI and shall only be allowed: (1) until the end of the current cycle, or (2) until an entry into MODE 5 of sufficient duration, whichever occurs first, when the repair of the inoperable ARPI can safely be performed. Required Actions A.2.1, A.2.2 and A.2.3 shall not be allowed after the plant has been in MODE 5 or other plant condition, for a sufficient period of time, in which the repair of the inoperable ARPI could have safely been performed. --	A.1 Verify the position of the rods with inoperable position indicators indirectly by using the PDMS.	Once per 8 hours
	<u>OR</u>	
	A.2.1 Verify the position of the rod with the inoperable position indicator indirectly by using the PDMS.	8 hours <u>AND</u> Once every 31 days thereafter <u>AND</u> 8 hours, if rod control system parameters indicate unintended movement
A. One ARPI per group inoperable for one or more groups.	<u>AND</u>	(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.2 Review the parameters of the rod control system for indications of unintended rod movement for the rod with an inoperable position indicator. AND A.2.3 Verify the position of the rod with an inoperable position indicator indirectly by using the PDMS. OR A.3 Reduce THERMAL POWER to less than or equal to 50% RTP.	16 hours AND Once per 8 hours thereafter 8 hours, if the rod with an inoperable position indicator is moved greater than 12 steps. AND Prior to increasing THERMAL POWER above 50% RTP and within 8 hours of reaching 100% RTP 8 hours
B. One or more rods with inoperable position indicators have been moved in excess of 24 steps in one direction since the last determination of the rod's position.	B.1 Verify the position of the rods with inoperable position indicators indirectly by using the PDMS. OR B.2 Reduce THERMAL POWER to less than or equal to 50% RTP.	4 hours 8 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One demand position indicator per bank inoperable for one or more banks.	C.1.1	Verify by administrative means all ARPIs for the affected banks are OPERABLE.	Once per 8 hours
	AND		
	C.1.2	Verify the most withdrawn rod and the least withdrawn rod of the affected banks are less than or equal to 12 steps apart.	Once per 8 hours
	OR		
	C.2	Reduce THERMAL POWER to less than or equal to 50% RTP.	8 hours
D. Required Action and associated Completion Time not met	D.1	Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

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

Attachment 2 to
Enclosure 2

Retyped Version of

Developmental Revision D WBN Unit 2 TS

Section 3.1.8, Rod Position Indication

<u>Technical Specification Pages</u>

3.1-15
3.1-16
3.1-17

3.1 REACTIVITY CONTROL SYSTEMS

3.1.8 Rod Position Indication

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

APPLICABILITY: MODES 1 and 2

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
----------------NOTE----------------- Rod position monitoring by Required Actions A.2.1 and A.2.2 may only be applied to one inoperable RPI and shall only be allowed: (1) until the end of the current cycle, or (2) until an entry into MODE 5 of sufficient duration, whichever occurs first, when the repair of the inoperable RPI can safely be performed. Required Actions A.2.1, A.2.2 and A.2.3 shall not be allowed after the plant has been in MODE 5 or other plant condition, for a sufficient period of time, in which the repair of the inoperable RPI could have safely been performed. ---	A.1 Verify the position of the rods with inoperable position indicators indirectly by using the PDMS.	Once per 8 hours
	<u>OR</u>	
	A.2.1 Verify the position of the rod with the inoperable position indicator indirectly by using the PDMS.	8 hours <u>AND</u> Once every 31 days thereafter <u>AND</u> 8 hours, if rod control system parameters indicate unintended movement
A. One RPI per group inoperable for one or more groups.	<u>AND</u>	
		(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.2.2 Review the parameters of the rod control system for indications of unintended rod movement for the rod with an inoperable position indicator. AND A.2.3 Verify the position of the rod with an inoperable position indicator indirectly by using the PDMS. OR A.3 Reduce THERMAL POWER to less than or equal to 50% RTP.	16 hours AND Once per 8 hours thereafter 8 hours, if the rod with an inoperable position indicator is moved greater than 12 steps. AND Prior to increasing THERMAL POWER above 50% RTP and within 8 hours of reaching 100% RTP 8 hours
B. One or more rods with inoperable position indicators have been moved in excess of 24 steps in one direction since the last determination of the rod's position.	B.1 Verify the position of the rods with inoperable position indicators indirectly by using the PDMS. OR B.2 Reduce THERMAL POWER to less than or equal to 50% RTP.	4 hours 8 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One demand position indicator per bank inoperable for one or more banks.	C.1.1	Verify by administrative means all RPIs for the affected banks are OPERABLE.	Once per 8 hours
	AND		
	C.1.2	Verify the most withdrawn rod and the least withdrawn rod of the affected banks are less than or equal to 12 steps apart.	Once per 8 hours
	OR		
	C.2	Reduce THERMAL POWER to less than or equal to 50% RTP.	8 hours
D. Required Action and associated Completion Time not met	D.1	Be in MODE 3.	6 hours

SURVEILLANCE REQUIREMENTS

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

Attachment 3 to
Enclosure 2

Mark-up of

Developmental WBN Unit 2 TS Bases

Section 3.1.8, Rod Position Indication

to Create Revision D

Technical Specification Bases Pages

B 3.1-25
B 3.1-48
B 3.1-49
B 3.1-50
B 3.1-51
B 3.1-52
B 3.1-53
B 3.1-54

BASES

BACKGROUND (continued)

a bank of RCCAs consists of two groups that are moved in a staggered fashion, but always within one step of each other. There are four control banks and four shutdown banks.

The shutdown banks are maintained either in the fully inserted or fully withdrawn position. The control banks are moved in an overlap pattern, using the following withdrawal sequence: When control bank A reaches a predetermined height in the core, control bank B begins to move out with control bank A. Control bank A stops at the position of maximum withdrawal, and control bank B continues to move out. When control bank B reaches a predetermined height, control bank C begins to move out with control bank B. This sequence continues until control banks A, B, and C are at the fully withdrawn position, and control bank D is approximately halfway withdrawn. The insertion sequence is the opposite of the withdrawal sequence. The control rods are arranged in a radially symmetric pattern, so that control bank motion does not introduce radial asymmetries in the core power distributions.

The axial position of shutdown rods and control rods is indicated by two separate and independent systems, which are the Bank Demand Position Indication System (commonly called group step counters) and the ~~Analog~~ Rod Position Indication (ARPI) System.

The Bank Demand Position Indication System counts the pulses from the rod control system that moves the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Bank Demand Position Indication System is considered highly precise (± 1 step or ± 5/8 inch). If a rod does not move one step for each demand pulse, the step counter will still count the pulse and incorrectly reflect the position of the rod.

The ARPI System provides an accurate indication of actual control rod position, but at a lower precision than the step counters. This system is based on inductive analog signals from a series of coils spaced along a hollow tube with a center to center distance of 3.75 inches, which is six steps. The normal indication accuracy of the ARPI System is ± 6 steps (± 3.75 inches), and the maximum uncertainty is ± 12 steps (± 7.5 inches). With an indicated deviation of 12 steps between the group step counter and ARPI, the maximum deviation between actual rod position and the demand position could be 24 steps, or 15 inches.

(continued)

BASES

BACKGROUND (continued)

The axial position of shutdown rods and control rods are determined by two separate and independent systems: the Bank Demand Position Indication System (commonly called group step counters) and the ~~Analog~~ Rod Position Indication (ARPI) System.

The Bank Demand Position Indication System counts the pulses from the Rod Control System that move the rods. There is one step counter for each group of rods. Individual rods in a group all receive the same signal to move and should, therefore, all be at the same position indicated by the group step counter for that group. The Bank Demand Position Indication System is considered highly precise (± 1 step or ± 5/8 inch). If a rod does not move one step for each demand pulse, the step counter will still count the pulse and incorrectly reflect the position of the rod.

The ARPI System provides an accurate indication of actual control rod position, but at a lower precision than the step counters. This system is based on inductive analog signals from a series of coils spaced along a hollow tube with a center-to-center distance of 3.75 inches, which is 6 steps. The normal indication accuracy of the ARPI System is ± 6 steps (± 3.75 inches), and the maximum uncertainty is ± 12 steps (± 7.5 inches). With an indicated deviation of 12 steps between the group step counter and ARPI, the maximum deviation between actual rod position and the demand position could be 24 steps, or 15 inches.

APPLICABLE SAFETY ANALYSES

Control and shutdown rod position accuracy is essential during power operation. Power peaking, ejected rod worth, or SDM limits may be violated in the event of a Design Basis Accident (Ref. 2 through 12), with control or shutdown rods operating outside their limits undetected. Therefore, the acceptance criteria for rod position indication is that rod positions must be known with sufficient accuracy in order to verify the core is operating within the group sequence, overlap, design peaking limits, ejected rod worth, and with minimum SDM (LCO 3.1.6, "Shutdown Bank Insertion Limits," and LCO 3.1.7, "Control Bank Insertion Limits"). The rod positions must also be known in order to verify the alignment limits are preserved (LCO 3.1.5, "Rod Group Alignment Limits"). Control rod positions are continuously monitored to provide operators with information that ensures the plant is operating within the bounds of the accident analysis assumptions.

The control rod position indicator channels satisfy Criterion 2 of the NRC Policy Statement. The control rod position indicators monitor control rod position, which is an initial condition of the accident.

(continued)

BASES (continued)

LCO

LCO 3.1.8 specifies that the ARPI System and the Bank Demand Position Indication System be OPERABLE for all control rods. For the control rod position indicators to be OPERABLE requires meeting the SR of the LCO and the following:

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

b. For the ARPI System there are no failed coils; and

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

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

A deviation of less than the allowable limit, given in LCO 3.1.5, in position indication for a single control rod, ensures high confidence that the position uncertainty of the corresponding control rod group is within the assumed values used in the analysis (that specified control rod group insertion limits).

These requirements ensure that control rod position indication during power operation and PHYSICS TESTS is accurate, and that design assumptions are not challenged. 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 ARPI and step counters are only applicable in MODES 1 and 2 (consistent with LCO 3.1.5, LCO 3.1.6, and LCO 3.1.7), because these are the only MODES in which power is generated, and the OPERABILITY and alignment of rods have the potential to affect the safety of the plant. In the shutdown MODES, the OPERABILITY of the shutdown and control banks has the potential to affect the required SDM, but this effect can be compensated for by an increase in the boron concentration of the Reactor Coolant System.

(continued)

ACTIONS

The ACTIONS table is modified by a Note indicating that a separate Condition entry is allowed for each inoperable rod position indicator per group and each demand position indicator per bank. This is acceptable because the Required Actions for each Condition provide appropriate compensatory actions for each inoperable position indicator.

A.1

When one ~~A~~RPI channel per group fails, the position of the rod can still be ~~determined~~ inferred indirectly by use of incore power distribution measurement information. Incore power distribution measurement information is obtained from an OPERABLE Power Distribution Monitoring System (PDMS) (Ref. 15). Based on experience, normal power operation does not require excessive movement of banks. If a bank has been significantly moved, the Required Action of B.1 or B.2 below is required. Therefore, verification of ~~RCCA~~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.

A.2.1, A.2.2

The control rod drive mechanism (a portion of the rod control system) consists of four separate subassemblies; 1) the pressure vessel, 2) the coil stack assembly, 3) the latch assembly, and 4) the drive rod assembly. The coil stack assembly contains three operating coils; 1) the stationary gripper coil, 2) the moveable gripper coil, and 3) the lift coil. In support of Actions A.2.1 and A.2.2, a Temporary Alteration (TA) to the configuration of the plant is implemented to provide instrumentation for the monitoring of the rod control system parameters in the Main Control Room. The TA creates a circuit that monitors the operation and timing of the lift coil and the stationary gripper coil. Additional details regarding the TA are provided in the FSAR (Ref. 14).

Required Actions A.2.1 and A.1 are essentially the same. Therefore, the discussion provided above for Required Action A.1 applies to Required Action A.2.1. The options provided by Required Actions A.2.1 and A.2.2 allow for continued operation in a situation where the component causing the ~~A~~RPI to be inoperable is inaccessible due to operating conditions (adverse radiological or temperature environment). In this situation, repair of the ~~A~~RPI cannot occur until the unit is in an operating MODE that allows access to the failed components.

(continued)

BASES

ACTIONS

A.2.1, A.2.2 (continued)

In addition to the initial 8 hour verification, Required Action A.2.1 also requires the following for the rod with the failed ARPI:

1. Verification of the position of the rod indirectly every 31 days using the PDMS.

2. Verification of the position of the rod indirectly using the PDMS within 8 hours of the performance of Required Action A.2.2 whenever there is an indication of unintended rod movement based on the parameters of the rod control system.

Required Action A.2.2 is in lieu of the verification of the position of the rod indirectly using the PDMS every 8 hours as required by Required Action A.1. Once the position of the rod with the failed ARPI is confirmed through the use of the PDMS in accordance with Required Action A.2.1, the parameters of the rod control system must be monitored until the failed ARPI is repaired. Should the review of the rod control system parameters indicate unintended movement of the rod, the position of the rod must be verified within 8 hours in accordance with Required Action A.2.1. Should there be unintended movement of the rod with the failed ARPI, an alarm will be received. Alarms will also be received if the rod steps in a direction other than what was demanded, and if the circuitry of the TA fails. Receipt of any alarm requires the verification of the position of the rod in accordance with Required Action A.2.1.

Required Actions A.2.1, A.2.2 and A.2.3 are modified by a note. The note clarifies that rod position monitoring by Required Actions A.2.1 and A.2.2 shall only be applied to one rod with an inoperable ARPI and shall only be allowed until the end of the current cycle. Further, Required Actions A.2.1, A.2.2 and A.2.3 shall not be allowed after the plant has been in MODE 5 or other plant condition, for a sufficient period of time, in which the repair of the inoperable ARPI(s) could have safely been performed.

(continued)

BASES

ACTIONS

A.2.1, A.2.2 (continued)

As indicated previously, the modifications required for the monitoring of the rod control system will be implemented as a TA. Implementation of the TA includes a review for the impact on plant procedures and training. This ensures that changes are initiated for key issues like the monitoring requirements in the control room, and operator training on the temporary equipment.

A.2.3

Required Action A.2.3 addresses two contingency measures when the TA is utilized:

1. Verification of the position of the rod indirectly with the inoperable ARPI by use of the PDMS, whenever the rod is moved greater than 12 steps in one direction.

2. Operation of the unit when THERMAL POWER is less than or equal to 50% RTP.

For the first contingency, the rod group alignment limits of LCO 3.1.5 require that all shutdown and control rods be within 12 steps of their group step counter demand position. The limits on shutdown or control rod alignments ensure that the assumptions in the safety analysis will remain valid and that the assumed reactivity will be available to be inserted for a unit shutdown. Therefore, this conservative measure ensures LCO 3.1.5 is met whenever the rod with the inoperable ARPI is moved greater than 12 steps. For the second contingency, the reduction of THERMAL POWER to less than or equal to 50% RTP puts the core into a condition where rod position is not significantly affecting core peaking factors (Ref. 13). Consistent with LCO 3.0.4 and this action, unit startup and operation to less than or equal to 50% RTP may occur with one ARPI per group inoperable. However, prior to escalating THERMAL POWER above 50% RTP, the position of the rod with an inoperable ARPI must be verified indirectly by use of the PDMS. Once 100% RTP is achieved, the position of the rod must be re-verified indirectly within 8 hours by use of the PDMS. Monitoring of the rod control system parameters in accordance with Required Action A.2.2 for the rod with an inoperable ARPI may resume upon completion of the verification at 100% RTP.

(continued)

BASES

ACTIONS (continued)

A.3

Required Action A.3 applies whenever the TA is not utilized or the position of the rod with an inoperable RPI cannot be verified indirectly. The discussion for Required Action A.2.3 (above) clarified that a reduction of THERMAL POWER to less than or equal to 50% RTP puts the core into a condition where rod position is not significantly affecting core peaking factors (Ref. 13). The allowed Completion Time of 8 hours is reasonable, based on operating experience, for reducing power to less than or equal to 50% RTP from full power conditions without challenging plant systems and allowing for rod position determination by Required Action A.1 above. Consistent with LCO 3.0.4 and this action, unit startup and operation to less than or equal to 50% RTP may occur with one ~~A~~RPI per group inoperable. Thermal Power may be escalated to 100% RTP as long as Required Action A.1 is satisfied.

B.1 and B.2

These Required Actions clarify that when one or more rods with inoperable position indicators have been moved in excess of 24 steps in one direction, since the position was last determined, the Required Actions of A.1 and A.2 are still appropriate but must be initiated promptly under Required Action B.1 to begin verifying that these rods are still properly positioned, relative to their group positions.

If, within 4 hours, the rod positions have not been verified~~determined~~, THERMAL POWER must be reduced to less than or equal to 50% RTP within 8 hours to avoid undesirable power distributions that could result from continued operation at greater than 50% RTP, if one or more rods are misaligned by more than 24 steps. The allowed Completion Time of 4 hours provides an acceptable period of time to verify the rod positions.

C.1.1 and C.1.2

With one demand position indicator per bank inoperable, the rod positions can be determined by the ~~A~~RPI 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 less than or equal to 12 steps apart within the allowed Completion Time of once every 8 hours is adequate.

(continued)

BASES

ACTIONS (continued)

C.2

Reduction of THERMAL POWER to less than or equal to 50% RTP puts the core into a condition where rod position is not significantly affecting core peaking factor limits (Ref. 13). The allowed Completion Time of 8 hours provides an acceptable period of time to verify the rod positions per Required Actions C.1.1 and C.1.2 or reduce power to less than or equal to 50% RTP.

D.1

If the Required Actions cannot be completed within the associated Completion Time, the plant must be brought to a MODE in which the requirement does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours. The allowed Completion Time is reasonable, based on operating experience, for reaching the required MODE from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.1.8.1

Verification that the ~~A~~RPI agrees with the demand position within 12 steps ensures that the ~~A~~RPI is operating correctly.

The 18-month Frequency is based on the need to perform this Surveillance under the conditions that apply during a plant outage and the potential for unnecessary plant transients if the SR were performed with the reactor at power. Operating experience has shown these components usually pass the SR when performed at a Frequency of once every 18 months. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

(continued)