Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-15-181

September 3, 2015

10 CFR 50.90

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

Watts Bar Nuclear Plant, Unit 1
Facility Operating License No. NFP-90
NRC Docket No. 50-390

Subject: **Revision to Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling System License Amendment Request, Including Proposed Changes to Auxiliary Feedwater Pump Suction Transfer Instrumentation and Reactor Coolant System Loops - Mode 4**

References:

1. Letter from TVA to NRC, "Watts Bar Nuclear Plant Unit 1 - Application to Revise Technical Specifications for Component Cooling Water and Essential Raw Cooling Water to Support Dual Unit Operation (TS-WBN-15-13)," dated June 17, 2015 [ML15170A474]

2. Email from NRC to TVA, "Preliminary Draft RAIs Associated with Proposed WBN 1 ERCW and CCS Technical Specifications LAR," dated July 2, 2015

3. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Unit 1 - Supplemental Information Needed for Acceptance of Requested Licensing Action Regarding Application to Add Technical Specifications to Support Dual-Unit Operations (TAC No. MF6376)," dated July 9, 2015 [ML15187A403]

4. Letter from TVA to NRC, "Responses to NRC Acceptance Review Questions for Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling Water System License Amendment Request (TAC No. MF6376)," dated July 14, 2015 [ML15197A357]

5. Letter from TVA to NRC, "Responses to NRC Audit Review Questions for Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling Water System License Amendment Request," dated August 28, 2015 [ML15243A044]

By letter dated June 17, 2015, Tennessee Valley Authority (TVA) submitted a request for a change to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant (WBN) Unit 1 (Reference 1). The proposed change would create new Technical Specifications (TS) 3.7.16, "Component Cooling System (CCS) - Shutdown," and TS 3.7.17, "Essential Raw Cooling Water (ERCW) System - Shutdown," to support dual unit operation of WBN Units 1 and 2. By email dated July 2, 2015, the Nuclear Regulatory Commission (NRC) provided requests for additional information (RAI) on the proposed WBN Unit 1 license amendment (Reference 2). By letter dated July 9, 2015, the NRC requested supplemental information associated with the proposed WBN Unit 1 license amendment (Reference 3). By letter dated July 14, 2015 (Reference 4), TVA submitted the requested supplemental information and responses to the NRC acceptance review questions, including proposed changes to TS 3.7.16 and TS 3.7.17.

Following submittal of the requested supplemental information and responses to the NRC RAIs, the NRC indicated that sufficient information was provided by TVA to support the NRC review of the proposed license amendment request (LAR). However, to facilitate a more efficient and timely interaction between the NRC and TVA, the NRC decided to perform an audit of the proposed LAR in the NRC White Flint offices located in Rockville, MD during the periods of July 27 to July 31, 2015, August 3 to August 7, 2015, and August 25 to August 28, 2015. During the audit, the NRC asked numerous review questions related to the license amendment request.

By letter dated August 28, 2015 (Reference 5) TVA submitted responses to the NRC Audit Review questions. Within the TVA response to NRC Audit Review Question BOP-9, a proposal was made to change TS 3.7.16, TS 3.7.17, and the associated Bases to reflect an expanded applicability for these specifications. The TVA response to NRC Audit Review Question BOP-10 provided a proposal to revise the Technical Requirements Manual by including a new Technical Requirement (TR) for the Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low instrumentation. Upon further evaluation of this proposed new TR, TVA has determined that the requirement for the Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low instrumentation more appropriately belongs in TS. Lastly, to reflect the analysis assumption that the decay heat associated with a shutdown unit is removed by the Reactor Coolant System loops for the initial 7 hours after shutdown, changes are proposed to TS 3.4.6, "RCS Loops - MODE 4."

Enclosure 1 to this letter provides a background discussion and the proposed changes to TS 3.7.16, TS 3.7.17, and associated Bases. Attachment 1 to the enclosure provides the markups of WBN Unit 1 TS 3.7.16 and Bases, indicating the proposed changes. Attachment 2 to the enclosure provides the markups of WBN Unit 1 TS 3.7.17 and Bases, indicating the proposed changes. Attachments 3 and 4 to the enclosure provide the clean-typed versions of WBN Unit 1 TS 3.7.16, TS 3.7.17, and associated Bases, respectively, with the proposed changes incorporated.

Consistent with the standards set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.92(c), TVA has determined that the response, as provided in this letter, does not affect the no significant hazards considerations associated with the proposed license amendment to add TS 3.7.16 and TS 3.7.17 previously provided in Reference 1. TVA has further determined that the proposed amendment still qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9).

Enclosure 2 provides a description and technical evaluation of the proposed changes to TS 3.3.2 and TS 3.4.6, a regulatory evaluation, and a discussion of environmental considerations. Attachment 1 to Enclosure 2 provides the mark up for TS 3.3.2 and TS 3.4.6. Attachment 2 to Enclosure 2 provides the mark up for the TS 3.3.2 and TS 3.4.6 Bases. Attachment 3 to Enclosure 2 provides the clean-typed copy of TS 3.3.2 and TS 3.4.6, with the proposed changes incorporated. Attachment 4 to Enclosure 2 provides the clean-typed copy of the TS 3.3.2 and TS 3.4.6 Bases, with the proposed changes incorporated.

TVA requests approval of the proposed License Amendment by November 6, 2015, to support dual unit operation of WBN Unit 1 and Unit 2. The License Amendment will be implemented prior to startup of WBN Unit 2.

TVA has determined that there are no significant hazards considerations associated with the proposed changes to TS 3.3.2 and TS 3.4.6 and that the change qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9).

The WBN Plant Operations Review Committee and the TVA Nuclear Safety Review Board have reviewed the proposed changes and determined that operation of WBN Unit 1 in accordance with the proposed changes will not endanger the health and safety of the public.

Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosures to the Tennessee Department of Environment and Conservation.

There are no new regulatory commitments associated with this letter. Please direct any questions concerning this matter to Gordon Arent at (423) 365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 3rd day of September 2015.

Respectfully,

J. W. Shea

Digitally signed by J. W. Shea
DN: cn=J. W. Shea, o=Tennessee Valley Authority, ou=Nuclear Licensing, email=jwshea@tva.gov, c=US
Date: 2015.09.03 21:26:16 -04'00'

J. W. Shea
Vice President, Nuclear Licensing

Enclosures:

1. Revisions to WBN Unit 1 ERCW and CCS License Amendment Request
2. Evaluation of Proposed Changes

cc (Enclosures):

U.S. Nuclear Regulatory Commission, Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant, Unit 1
NRC Project Manager - Watts Bar Nuclear Plant, Unit 1
Director - Division of Radiological Health – Tennessee State Department of Environment and Conservation

ENCLOSURE 1

Revisions to WBN Unit 1 ERCW and CCS License Amendment Request

Background

By letter dated June 17, 2015, Tennessee Valley Authority (TVA) submitted a request for a change to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant (WBN) Unit 1 (Reference 1). The proposed change would create new Technical Specifications (TS) 3.7.16, "Component Cooling System (CCS) - Shutdown," and TS 3.7.17, "Essential Raw Cooling Water (ERCW) System - Shutdown," to support dual unit operation of WBN Units 1 and 2. By email dated July 2, 2015, the Nuclear Regulatory Commission (NRC) provided requests for additional information (RAI) on the proposed WBN Unit 1 license amendment (Reference 2). By letter dated July 9, 2015, the NRC requested supplemental information associated with the proposed WBN Unit 1 license amendment (Reference 3). By letter dated July 14, 2015 (Reference 4), TVA submitted the requested supplemental information and responses to the NRC acceptance review questions, including proposed changes to TS 3.7.16 and TS 3.7.17.

Following submittal of the requested supplemental information and responses to the NRC RAIs, the NRC indicated that sufficient information was provided by TVA to support the NRC review of the proposed license amendment request (LAR). However, to facilitate a more efficient and timely interaction between the NRC and TVA, the NRC decided to perform an audit of the proposed LAR in the NRC White Flint offices located in Rockville, MD during the weeks of July 27 to July 31, 2015, August 3 to August 7, 2015, and August 25 to August 28, 2015. During the audit, the NRC asked numerous review questions related to the LAR.

By letter dated August 28, 2015 (Reference 5) TVA submitted responses to the NRC Audit Review questions. The TVA response to NRC Audit Review Question BOP - 9 proposed a change to the Applicability Notes of TS 3.7.16 and TS 3.7.17. The response to BOP - 9, as provided in Reference 5, is provided below:

NRC Audit Review Question BOP - 9

> *Describe the ERCW and CCS analysis as it pertains to a LOCA in one unit while in MODE 4 and a controlled shutdown of the other Unit as it enters MODE 4 or 5.*

TVA Response

> *When the opposite unit has been shutdown for a period of time, the additional CCS and ERCW pump requirements of LCO 3.7.16 and LCO 3.7.17 are not required to ensure adequate decay heat removal by the RHR System. However, there may be some scenarios when the opposite unit has been shutdown for greater than 48 hours that the heat removal capacity of the RHR System is insufficient without the CCS and ERCW System requirements of LCO 3.7.16 and LCO 3.7.17 being applicable.*
>
> *Therefore, TVA will remove Applicability Note b, so that the Applicability of LCO 3.7.16 and LCO 3.7.17 in Modes 4 and 5 is dependent on whether the associated unit has been shutdown for less than 48 hours.*

ENCLOSURE 1

Revisions to WBN Unit 1 ERCW and CCS License Amendment Request

This response supersedes the response provided to Acceptance Review Question #2 provided in TVA letter dated July 14, 2015.

The following events are required to be supported by the CCS and ERCW configurations proposed in TS 3.7.16 and TS 3.7.17.

The CCS shall be designed to remove heat from potentially or normally radioactive heat loads during any mode of normal operation, and incidents of moderate frequency. In addition, the CCS shall be designed to remove heat from the RHR HXs and various pump seal and/or lube oil coolers during infrequent incidents, and limiting faults. The CCS is required to mitigate the consequences of Design Basis Events (DBEs). The required DBEs and associated safety functions for the CCS are in WB-DC-40-64.

<u>EVENTS IN WB-DC-40-64 THAT CREDIT CCS</u>
Fire
Operating Basis Earthquake
Safe Shutdown Earthquake
Tornado
Combustible Gases Inside Containment
Control Room Evacuation
Internally Generated Missiles
General High Energy Line Break
Heavy Load Drop
Small Break LOCA
Large Break LOCA
Steam Generator Tube Rupture
Rupture of a Control Rod Drive Mechanism Housing
Waste Gas Decay Tank Rupture
Fuel Handling Accident
Loss of External Electrical Load and/or Turbine Trip
Loss of Offsite Power
Main Steam Line Break
Main Feedwater Line Rupture Event
Accidental Depressurization of Main Steam System
Loss of Normal Feedwater
Excess Heat Removal Due to Feedwater System Malfunction
Moderate Energy Line Break
Partial Loss of Forced Reactor Coolant Flow
Single Reactor Coolant Pump Locked Rotor or Shaft Break
Complete Loss of Forced Reactor Coolant Flow
Excessive Load Increase Incident
Accidental Depressurization of The Reactor Coolant System
Inadvertent Safety Injection Operation - Power Operation
Uncontrolled RCCA Bank Withdrawal From a Subcritical or Hot Zero Power Condition
Uncontrolled RCCA Bank Withdrawal At Power
Single RCCA Withdrawal At Full Power

RCCA Misalignment
Uncontrolled Boron Dilution
Improper Fuel Assembly Loading
Anticipated Transient Without Scram
Failure of Nonsafety-Related Control Systems as an Initiating Event
Minor Secondary System Pipe Breaks
Loss of All AC Power (Station Blackout)
Loss of RHR During Mid-Loop Operations

The ERCW System is required to mitigate the consequences of plant Design Basis Events described in WB-DC-40-64. It performs a Primary Safety Function by providing cooling and makeup for essential safety-related plant equipment and components in response to adverse plant operating conditions which impose safety-related performance requirements on the systems being served.

EVENTS IN WB-DC-40-64 THAT CREDIT ERCW
Fire
Design Basis Flood
Operating Basis Earthquake
Safe Shutdown Earthquake
Tornado
Combustible Gases Inside Containment
Control Room Evacuation
Internally Generated Missiles
General High Energy Line Break
Heavy Load Drop
Small Break LOCA
Large Break LOCA
Steam Generator Tube Rupture
Rupture of a Control Rod Drive Mechanism Housing
Waste Gas Decay Tank Rupture
Fuel Handling Accident
Loss of External Electrical Load and/or Turbine Trip
Loss of Offsite Power
Main Steam Line Break
Main Feedwater Line Rupture Event
Accidental Depressurization of Main Steam System
Loss of Normal Feedwater
Excess Heat Removal Due to Feedwater System Malfunction
Moderate Energy Line Break
Partial Loss of Forced Reactor Coolant Flow
Single Reactor Coolant Pump Locked Rotor or Shaft Break
Complete Loss of Forced Reactor Coolant Flow
Excessive Load Increase Incident
Accidental Depressurization of the Reactor Coolant System
Inadvertent Safety Injection Operation - Power Operation

ENCLOSURE 1

Revisions to WBN Unit 1 ERCW and CCS License Amendment Request

Uncontrolled RCCA Bank Withdrawal From a Subcritical or Hot Zero Power Condition
Uncontrolled RCCA Bank Withdrawal at Power
Single RCCA Withdrawal at Full Power
RCCA Misalignment
Uncontrolled Boron Dilution
Improper Fuel Assembly Loading
Anticipated Transient Without Scram
Failure of Nonsafety-Related Control Systems as an Initiating Event
Minor Secondary System Pipe Breaks
Loss of All AC Power (Station Blackout)
Loss of RHR During Mid-Loop Operations

The attachments to this enclosure provide the proposed changes to TS 3.7.16, TS 3.7.17, and the associated Bases.

References

1. Letter from TVA to NRC, "Watts Bar Nuclear Plant Unit 1 - Application to Revise Technical Specifications for Component Cooling Water and Essential Raw Cooling Water to Support Dual Unit Operation (TS-WBN-15-13)," dated June 17, 2015 [ML15170A474]

2. Email from NRC to TVA, "Preliminary Draft RAIs Associated with Proposed WBN 1 ERCW and CCS Technical Specifications LAR," dated July 2, 2015

3. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Unit 1 - Supplemental Information Needed for Acceptance of Requested Licensing Action Regarding Application to Add Technical Specifications to Support Dual Unit Operations (TAC No. MF6376)," dated July 9, 2015 [ML15187A403]

4. Letter from TVA to NRC, "Responses to NRC Acceptance Review Questions for Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling Water System License Amendment Request (TAC No. MF6376)," dated July 14, 2015 [ML15197A357]

5. Letter from TVA to NRC, "Responses to NRC Audit Review Questions for Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling Water System License Amendment Request," dated August 28, 2015 [ML15243A044]

ENCLOSURE 1

Revisions to WBN Unit 1 ERCW and CCS License Amendment Request

ATTACHMENTS

Attachment 1 - WBN Unit 1 TS 3.7.16 and Bases Markups

Attachment 2 - WBN Unit 1 TS 3.7.17 and Bases Markups

Attachment 3 - WBN Unit 1 TS 3.7.16 and Bases, Clean-typed

Attachment 4 - WBN Unit 1 TS 3.7.17 and Bases, Clean-typed

ENCLOSURE 1

ATTACHMENT 1

WBN Unit 1 TS 3.7.16 and Bases Markups

3.7 PLANT SYSTEMS

3.7.16 Component Cooling System (CCS) - Shutdown

LCO 3.7.16 Two CCS trains shall be OPERABLE with one pump powered from Train A and aligned to the Train A header, and two pumps powered from Train B and aligned to the Train B header.

APPLICABILITY: MODES 4 and 5.

----------NOTE----------

This LCO is not applicable ~~for either of the following conditions:~~

~~a. Mmore than 48 hours after Unit 1 entry into MODE 3 from MODE 1 or 2.~~

~~b. Unit 2 defueled or in MODE 4 or 5 more than 48 hours after entry into MODE 3 from MODE 1 or 2.~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CCS train inoperable in MODE 4. AND Complying with Required Actions to be in MODE 5.	A.1 Be in MODE 5.	24 hours
B. One CCS train inoperable in MODE 4 for reasons other than Condition A.	B.1 Verify two OPERABLE reactor coolant system (RCS) loops and one RCS loop in operation. AND B.2 Verify T_{avg} > 200ºF.	Once per 12 hours Once per 12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two CCS trains inoperable in MODE 4.	C.1 ----------NOTES---------- 1. LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one CCS train is restored to an OPERABLE status. 2. Enter Conditions and Required Actions of LCO 3.4.6, “RCS Loops - MODE 4,” for residual heat removal (RHR) loops made inoperable by CCS. ---------- Initiate action to restore one CCS train to OPERABLE status.	Immediately
D. One or more CCS train(s) inoperable in MODE 5.	D.1 ----------NOTE---------- Enter applicable Conditions and Required Actions of LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," for RHR loops made inoperable by CCS. ---------- Initiate action to restore CCS train(s) to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.16.1	Verify correct breaker alignment and indicated power available to the required pump(s) that is not in operation.	12 hours
SR 3.7.16.2	Verify two CCS pumps are aligned to CCS Train B.	12 hours

B 3.7 PLANT SYSTEMS

B 3.7.16 Component Cooling System (CCS) - Shutdown

BASES

BACKGROUND

The general description of the Component Cooling System (CCS) is provided in TS Bases 3.7.7, "Component Cooling System." The CCS has a Unit 1 Train A header supplied by CCS Pump 1A-A cooled through CCS Heat Exchanger (HX) A. Unit 2 has a separate Train A header containing HX B supplied by CCS Pump 2A-A. The Train B header is shared by Unit 1 and Unit 2 and contains HX C. Flow through the Train B header is normally supplied by CCS Pump C-S. CCS Pump 1B-B can be aligned to supply the Train B header, but it is normally aligned to the Unit 1 Train A header. Similarly, CSS Pump 2B-B can supply cooling water to the Train B header, but is normally aligned to the Unit 2 Train A header. The following describes the functions and requirements within the first 48 hours after shut down, when the Residual Heat Removal (RHR) System is being used for residual and decay heat removal.

During a normal shutdown, decay heat removal is via the reactor coolant system (RCS) loops until sometime after the unit has been cooled down to RHR entry conditions (T_{cold} < 350ºF). Therefore, as LCO 3.7.16 becomes Applicable (entry into Mode 4) the RCS loops are still OPERABLE. Entry into MODES 4 and 5 can place high heat loads onto the RHR System, CCS and the Essential Raw Cooling Water System (ERCW) when shutdown cooling is established. Residual and decay heat from the Reactor Coolant System (RCS) is transferred to CCS via the RHR HX. Heat from the CCS is transferred to the ERCW System via the CCS HXs. The CCS and ERCW systems are common between the two operating units.

During the first 48 hours after reactor shutdown, the heat loads are at sufficiently high levels that the normal pump requirement of LCO 3.7.7 for one CCS pump on the Train B header may not be sufficient to support shut down cooling of Unit 1, concurrent with either a nearly simultaneous shutdown of Unit 2 or a design basis loss of coolant accident (LOCA) on Unit 2, with loss of offsite power and a single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A.

In either scenario, CCS Pump C-S would normally be the only pump supplying the Train B header and the Train B header would be supplying both the Unit 1 RHR Train B HX and the Unit 2 RHR Train B HX. During the Unit 2 LOCA scenario, the Unit 2 RHR Train B HX would be cooling the recirculating Emergency Core Cooling System (ECCS) water from the containment sump.

(continued)

BASES

BACKGROUND (continued)

To assure that there would be adequate CCS flow to both units' RHR Train B HXs, prior to placing RHR in service for Unit 1, either CCS Pump 1B-B or 2B-B would be aligned to the CCS Train B header.

With two CCS pumps on the Train B header, CCS will supply at least 5000 gpm to the Unit 2 RHR Train B HX and 5000 gpm to the Unit 1 RHR Train B HX.

The alignment of either CCS Pump 1B-B or 2B-B to the CCS Train B header before entry into MODE 4 places both units in an alignment that supports LOCA heat removal requirements and allows the other unit to proceed to cold shutdown. Having the CCS pumps realigned while a unit is being shut down with steam generators available for heat removal, precludes the need for manual action outside of the main control room to align CCS should a LOCA occur. If a LOCA occurs with the concurrent loss of the Train A 6.9 kV shutdown boards, CCS Pump 1B-B or 2B-B will be started from the main control room, if the pump is not already in operation. Both CCS pumps must be running before the RHR pump suction is transferred from the refueling water storage tank (RWST) to the containment sump to ensure adequate cooling is maintained. If a LOCA occurs, the C-S pump automatically starts on a safety injection (SI) actuation from either unit. The CCS pump control circuits are designed such that, if a pump is running and a loss of power occurs, the pump will be automatically reloaded on the DG. With this alignment, two CCS pumps will be available if a LOCA occurs on one unit when the other unit is being shut down.

Alternatively, the unit being shut down can remain on steam generator cooling for 48 hours before RHR is placed in service. If a LOCA occurred on the other unit, CCS would only be removing heat from one RHR HX. A single CCS pump and CCS HX provides the required heat removal capability.

After ~~either~~ the unit has been shut down for greater than 48 hours, a single CCS pump on Train B provides adequate flow to both the Unit 1 and the Unit 2 RHR Train B HXs.

If the single failure were the loss of Train B power, the normal CCS alignment is acceptable, because CCS Pump 1A-A supplies the Unit 1 RHR Train A HX and CCS Pump 2A-A supplies the Unit 2 RHR Train A HX. CCS Pump 1A-A does not provide heat removal for Unit 2.

Additional information on the design and operation of the system, along with a list of the components served, is presented in the FSAR, Section 9.2.2 (Ref. 1). The principal safety related function of the CCS is the removal of heat from the reactor via the RHR System. This may be

(continued)

BASES

BACKGROUND (continued)

during a normal or post accident cool down and shut down. The Unit 1 CCS Train A header is not used to support Unit 2 operation.

APPLICABLE SAFETY ANALYSES

The CCS functions to cool the unit from RHR entry conditions in MODE 4 (T_{cold} < 350°F), to MODE 5 (T_{cold} < 200°F), during normal operations. The time required to cool from 350°F to 200°F is a function of the number of CCS and RHR trains operating. One CCS train is sufficient to remove heat during subsequent operations with T_{cold} < 200°F. This assumes a maximum ERCW inlet temperature of 85°F occurring simultaneously with the maximum heat loads on the system.

The design basis of the CCS is for one CCS train to remove the post LOCA heat load from the containment sump during the recirculation phase, with a maximum CCS HX outlet temperature of 110°F (Ref. 2). The ECCS LOCA analysis and containment LOCA analysis each model the maximum and minimum performance of the CCS, respectively. The normal maximum HX outlet temperature of the CCS is 95°F, and, during unit cooldown to MODE 5 (T_{cold} < 200°F), a maximum HX outlet temperature of 110°F is assumed. The CCS design based on these values, bounds the post accident conditions such that the sump fluid will not increase in temperature after alignment of the RHR HXs during the recirculation phase following a LOCA, and provides a gradual reduction in the temperature of this fluid as it is supplied to the RCS by the ECCS pumps.

The CCS is designed to perform its function with a single failure of any active component, assuming a loss of offsite power.

CCS - Shutdown satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO

The CCS trains are independent of each other to the degree that each has separate controls and power supplies and the operation of one does not depend on the other. During a unit shut down, one CCS train is required to provide the minimum heat removal capability assumed in the safety analysis for the systems to which it supplies cooling water. To ensure this requirement is met, two trains of CCS must be OPERABLE. At least one CCS train will operate assuming the worst case single active failure occurs coincident with a loss of offsite power.

This LCO provides CCS train OPERABILITY requirements beyond the requirements of LCO 3.7.7 during the first 48 hours after reactor shut down, when the heat loads are at sufficiently high levels that the normal pump requirement of one CCS pump on the Train B header may not be sufficient to support shutdown cooling of Unit 1, concurrent with a nearly simultaneous shutdown of Unit 2 or a LOCA on Unit 2, a loss of offsite power, and single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A.

Because CCS Train B supports heat removal from Unit 1 and Unit 2, when Unit 1 has been shutdown ≤ 48 hours and the RHR System is relied on for heat removal, the following is required for CCS OPERABILITY:

a. Train A is OPERABLE when CCS Pump 1A-A is available and aligned to the CCS Train A header.

b. Train B is OPERABLE when two CCS pumps are available and aligned to the CCS Train B header using any combination of CCS Pumps 1B-B, 2B-B, and C-S.

c. The associated piping, valves, HXs, and instrumentation and controls required to perform the safety related function are OPERABLE.

Because Unit 1 is shutdown and on RHR cooling, no automatic actuations are required as a DBA on Unit 1, such as a LOCA, does not have to be mitigated.

APPLICABILITY

Prior to aligning the RHR System for RCS heat removal in MODE 4, an additional CCS pump must be powered from and aligned to the CCS Train B header to ensure adequate heat removal capability.

The Applicability is modified by a Note stating the LCO does not apply after the initial 48 hours after ~~either~~ the unit enters MODE 3 from MODE 1 or MODE 2. Following extended operation in MODE 1, the heat loads are at sufficiently high levels that the normal pump requirement of LCO 3.7.7

(continued)

BASES

APPLICABILITY (continued)

for one CCS pump on the Train B header may not be sufficient to support shutdown cooling of Unit 1, concurrent with a near simultaneous shutdown of Unit 2 or a design basis LOCA on Unit 2, with loss of offsite power and a single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A. However, after the initial 48 hours following shutdown of ~~either~~ the unit, the heat removal capability of both units is within the capabilities of the CCS without the need for an additional CCS pump aligned to the CCS Train B header.

ACTIONS

A.1

In MODE 4, if one CCS train is inoperable, and the unit is required to be placed in MODE 5 to comply with Required Actions, action must be taken to place the unit in MODE 5 within 24 hours. When the Required Actions of an LCO direct the unit to be placed in MODE 5, either a loss of safety function has occurred or the Required Action and Completion Time for restoring a safety-related component has not been met. Therefore, it is prudent to place the unit in a condition of lower energy with a lower potential for a postulated event. In this Condition, the remaining OPERABLE CCS train is adequate to perform the heat removal function. The 24 hour Completion Time is consistent with LCO 3.4.6, "RCS Loops - MODE 4," Required Action B.1 for the Condition of one required RHR loop inoperable and no RCS loops OPERABLE.

B.1 and B.2

In MODE 4, if one CCS train is inoperable, and the unit is not required to be placed in MODE 5 to comply with Required Actions, actions are taken to verify LCO 3.4.6 is being met with two OPERABLE RCS loops with one loop in operation, and that the unit remains in MODE 4 (T_{avg} > 200ºF). These actions indicate the preference to maintain the unit in a condition with multiple methods of decay heat removal available, i.e., maintain the unit in MODE 4 with two RCS loops operable in addition to the remaining OPERABLE RHR loop. This action precludes entry into the LCO 3.4.6 Actions, as LCO 3.4.6 is met with two OPERABLE RCS loops and one RCS loop in operation. This Action is conservative to the Required Actions of LCO 3.4.6 when there are two OPERABLE RCS loops.

Maintaining the unit in MODE 4 ~~provides conditions for~~with additional methods of decay heat removal available~~and~~ minimizes the likelihood of a situation where the decay heat and residual heat of the unit exceeds the capability of the available RHR loop resulting in the possibility of an unintentional MODE change. The Frequency of once per 12 hours ensures that the systems being relied on for heat removal are operating properly and are maintaining the unit in MODE 4. The 12 hour Frequency

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

is reasonable, considering the low probability of a change in system operation during this time period.

If the Required Actions and Completion Times of Condition B are not met, no actions are specified. Therefore, LCO 3.0.3 applies, requiring the unit to be placed in MODE 5 in 37 hours. With one CCS train inoperable and Required Actions require the unit to be placed in MODE 5, Condition A applies, requiring the unit to be placed in MODE 5 in 24 hours. This Action is consistent with the Required Actions of LCO 3.4.6 Condition B (no OPERABLE RCS loops and one inoperable RHR loop).

C.1

In MODE 4, if two CCS trains are inoperable, immediate action must be taken to restore one of the CCS trains to an OPERABLE status, as no CCS train is available to support the heat removal function. Required Action C.1 is consistent with LCO 3.4.6, "RCS Loops - MODE 4," Required Action ~~B~~D.1 for the Condition of ~~one~~ required RCS or RHR loops inoperable and no required RCS or RHR loop~~s OPERABLE~~ in operation.

Required Action C.1 is modified by two Notes. Note 1 indicates that all required MODE changes or power reductions are suspended until one CCS train is restored to OPERABLE status. In this case, LCO 3.0.3 is not applicable because it could force the plant into a less safe condition. Note 2 indicates that the applicable Conditions and Required Actions of LCO 3.4.6 be entered for RHR loops made inoperable by the inoperable CCS trains. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

D.1

Required Action D.1 is modified by a Note indicating that the applicable Conditions and Required Actions of LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," be entered for RHR loops made inoperable by one or more inoperable CCS train(s). This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

In MODE 5, if one or more CCS train(s) is inoperable, action must be initiated immediately to restore the CCS train(s) to an OPERABLE status to restore heat removal paths. The immediate Completion Time reflects the importance of maintaining the capability of heat removal.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.7.16.1

Verification that each required CCS pump that is not in operation is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain heat removal. Verification is performed by verifying proper breaker alignment and power available to the CCS pump(s). The 12 hour Frequency is based on engineering judgment.

SR 3.7.16.2

This SR verifies that two of the three CCS pumps that are powered from Train B are aligned to the Train B header. Verification of the correct physical alignment assures that adequate CCS flow can be provided to both the Unit 1 and Unit 2 RHR Train B HXs, if required. The 12 hour Frequency is based on engineering judgment, is consistent with procedural controls governing valve alignment, and ensures correct valve positions.

REFERENCES

1. Watts Bar FSAR, Section 9.2.2, “Component Cooling System.”

2. Watts Bar Component Cooling System Description, N3-70-4002.

ENCLOSURE 1

ATTACHMENT 2

WBN Unit 1 TS 3.7.17 and Bases Markups

3.7 PLANT SYSTEMS

3.7.17 Essential Raw Cooling Water (ERCW) System - Shutdown

LCO 3.7.17 Two ERCW trains shall be OPERABLE as follows:

a. Three ERCW pumps aligned to Train A, including two pumps capable of being powered from 6.9 kV Shutdown Board 1A-A, and

b. Three ERCW pumps aligned to Train B, including two pumps capable of being powered from 6.9 kV Shutdown Board 1B-B.

APPLICABILITY: MODES 4 and 5.

----------NOTE----------

This LCO is not applicable ~~for either of the following conditions:~~

~~a. M~~more than 48 hours after ~~Unit 1~~ entry into MODE 3 from MODE 1 or 2.

~~b. Unit 2 defueled or in MODE 4 or 5 more than 48 hours after entry into MODE 3 from MODE 1 or 2.~~

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ERCW train inoperable in MODE 4. <u>AND</u> Complying with Required Actions to be in MODE 5.	A.1 Be in MODE 5.	24 hours
B. One ERCW train inoperable in MODE 4 for reasons other than Condition A.	B.1 Verify two OPERABLE reactor coolant system (RCS) loops and one RCS loop in operation. <u>AND</u> B.2 Verify T_{avg} > 200ºF.	Once per 12 hours Once per 12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two ERCW trains inoperable in MODE 4.	C.1 ----------NOTES---------- 1. LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one ERCW train is restored to an OPERABLE status. 2. Enter Conditions and Required Actions of LCO 3.4.6, “RCS Loops - MODE 4,” for residual heat removal (RHR) loops made inoperable by ERCW. ---------- Initiate action to restore one ERCW train to OPERABLE status.	Immediately
D. One or more ERCW train(s) inoperable in MODE 5.	D.1 ----------NOTE---------- Enter applicable Conditions and Required Actions of LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," for RHR loops made inoperable by ERCW. ---------- Initiate action to restore ERCW train(s) to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.17.1	Verify correct breaker alignment and indicated power available to the required pump(s) that is not in operation.	12 hours

B 3.7 PLANT SYSTEMS

B 3.7.17 Essential Raw Cooling Water (ERCW) System

BASES

BACKGROUND

The general description of ERCW is provided in TS Bases 3.7.8, "Essential Raw Cooling Water (ERCW) System." The descriptions of Applicable Safety Analyses, LCOs, Applicability, ACTIONS and Surveillance Requirements for applicable MODES are also described in TS Bases 3.7.8. The following discussion applies to the specific Applicability in TS 3.7.17 during the first 48 hours after shut down when the Residual Heat Removal (RHR) System is being used for residual and decay heat removal. The ERCW System provides a heat sink for the removal of process and operating heat from safety related components during a design basis accident (DBA) or transient. During normal operation, and a normal shutdown, the ERCW System also provides this function for various safety related and non-safety related components. The major post-accident heat load on the ERCW System is the Component Cooling System (CCS) heat exchangers (HXs), which are used to cool RHR and the containment spray HXs. The major heat load on the ERCW System when a unit is shut down on RHR is the CCS HX associated with the train(s) of RHR in service.

During a normal shutdown, decay heat removal is via the reactor coolant system (RCS) loops until sometime after the unit has been cooled down to RHR entry conditions (T_{cold} < 350ºF). Therefore, as LCO 3.7.17 becomes Applicable (entry into Mode 4) the RCS loops are still OPERABLE. After the RHR System is aligned as the principle method of decay heat removal, the heat loads on the ERCW System are increased. Normally, two ERCW pumps are sufficient to handle the cooling needs for maintaining one unit in normal operation while mitigating a DBA on the other unit. However, in the unlikely event of a loss of coolant accident (LOCA) on Unit 2 with a concurrent loss of offsite power and a single failure that results in the loss of both Train A or both Train B 6.9 kV shutdown boards while Unit 1 is on RHR shutdown cooling and has been shutdown for less than 48 hours, three ERCW pumps may be required.

This LCO controls the availability of ERCW pumps necessary to support mitigation of a LOCA on Unit 2 when Unit 1 has been shut down for ≤ 48 hours and is utilizing RHR for heat removal.

Additional information about the design and operation of the ERCW System, along with a list of the components served, is presented in the FSAR, Section 9.2.1 (Ref. 1).

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

The design basis of the ERCW System is for one ERCW train, in conjunction with the CCS and a 100% capacity Containment Spray System and RHR, to remove core decay heat following a design basis LOCA as discussed in the FSAR, Section 9.2.1 (Ref. 1). This prevents the containment sump fluid from increasing in temperature during the recirculation phase following a LOCA and provides for a gradual reduction in the temperature of this fluid as it is supplied to the Reactor Coolant System (RCS) by the Emergency Core Cooling System (ECCS) pumps. The ERCW System is designed to perform its function with a single failure of any active component, assuming a loss of offsite power.

The ERCW System, in conjunction with the CCS, also cools the unit, as discussed in the FSAR, Section 5.5.7 (Ref. 2) from RHR entry conditions to MODE 5 during normal and post accident operations. The time required to enter MODE 5 is a function of the number of CCS and RHR System trains that are operating. One ERCW train is sufficient to remove heat during subsequent operations in MODES 5 and 6. This assumes a maximum ERCW inlet temperature of 85ºF occurring simultaneously with maximum heat loads on the system. In the first 48 hours after the shutdown of Unit 1 assuming a DBA LOCA on Unit 2 with the loss of offsite power and the concurrent loss of two 6.9 kV shutdown boards on the same power train as a single failure. Three ERCW pumps are required to provide the heat removal capacity assumed in the safety analysis for Unit 2 while continuing the cooldown of Unit 1.

ERCW - Shutdown satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO provides ERCW train OPERABILITY requirements beyond the requirements of LCO 3.7.8 during the first 48 hours after reactor shutdown, when the heat loads are at sufficiently high levels that the normal pump requirement of two ERCW pumps on one train may not be sufficient to support shutdown cooling of Unit 1, concurrent with a LOCA on Unit 2, an assumed loss of offsite power, and a single failure that affects both 6.9 kV shutdown boards in one power train.

Two ERCW trains are required to be OPERABLE to provide the required redundancy to ensure that the system functions to support a cooldown to MODE 5.

An ERCW train is considered OPERABLE during the first 48 hours after shutdown when:

a. Two pumps per train, aligned to separate shutdown boards, are OPERABLE; and

(continued)

BASES

LCO (continued)

b. One additional Train A pump and one additional Train B pump are capable of being aligned to their respective Unit 1 6.9 kV shutdown board (1A-A and 1B-B) and manually placed in service.

APPLICABILITY

Prior to aligning the RHR System for RCS heat removal in MODE 4, one additional ERCW pump must be capable of being powered by its respective Unit 1 6.9 kV shutdown board (1A-A and 1B-B) and manually placed in service to ensure adequate heat removal capability.

The Applicability is modified by a Note stating the LCO does not apply after the initial 48 hours after ~~either~~ the unit enters MODE 3 from MODE 1 or MODE 2. Following extended operation in MODE 1, the heat loads are at sufficiently high levels that the normal pump requirement of LCO 3.7.8 for two ERCW pumps may not be sufficient to support shutdown cooling of Unit 1, concurrent with a design basis LOCA on Unit 2 with loss of offsite power and a single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A. However, after the initial 48 hours following shutdown of ~~either~~ the unit, the heat removal capability of both units is within the capabilities of the ERCW System without the need for an additional ERCW pump in each train.

ACTIONS

A.1

In MODE 4, if one ERCW train is inoperable, and the unit is required to be placed in MODE 5 to comply with Required Actions, action must be taken to place the unit in MODE 5 within 24 hours. When the Required Actions of an LCO direct the unit to be placed in MODE 5, either a loss of safety function has occurred or the Required Action and Completion Time for restoring a safety-related component has not been met. Therefore, it is prudent to place the unit in a condition of lower energy with a lower potential for a postulated event. In this Condition, the remaining OPERABLE ERCW train is adequate to perform the heat removal function. The 24 hour Completion Time is consistent with LCO 3.4.6, “RCS Loops - MODE 4,” Required Action B.1 for the Condition of one required RHR loop inoperable and no RCS loops OPERABLE.

B.1 and B.2

In MODE 4, if one ERCW train is inoperable, and the unit is not required to be placed in MODE 5 to comply with Required Actions, actions are taken to verify LCO 3.4.6 is being met with two OPERABLE RCS loops with one loop in operation, and that the unit remains in MODE 4 (T_{avg} > 200ºF). These actions indicate the preference to maintain the unit

(continued)

BASES

ACTIONS

B.1 (continued)

in a condition with multiple methods of decay heat removal available, i.e., maintain the unit in MODE 4 with two RCS loops operable in addition to the remaining OPERABLE RHR loop. This action precludes entry into the LCO 3.4.6 Actions, as LCO 3.4.6 is met with two OPERABLE RCS loops and one RCS loop in operation. This Action is conservative to the Required Actions of LCO 3.4.6 when there are two OPERABLE RCS loops.

Maintaining the unit in MODE 4 ~~provides conditions for~~with additional methods of decay heat removal ~~and~~ available minimizes the likelihood of a situation where the decay heat and residual heat of the unit exceeds the capability of the available RHR loop resulting in the possibility of an unintentional MODE change. The Frequency of once per 12 hours ensures that the systems being relied on for heat removal are operating properly and are maintaining the unit in MODE 4. The 12 hour Frequency is reasonable, considering the low probability of a change in system operation during this time period.

If the Required Actions and Completion Times of Condition B are not met, no actions are specified. Therefore, LCO 3.0.3 applies, requiring the unit to be placed in MODE 5 in 37 hours. With one ERCW train inoperable and Required Actions require the unit to be placed in MODE 5, Condition A applies, requiring the unit to be placed in MODE 5 in 24 hours. This Action is consistent with the Required Actions of LCO 3.4.6 Condition B (no OPERABLE RCS loops and one inoperable RHR loop).

Although LCO 3.7.17 provides requirements in addition to those of LCO 3.7.8, the additional requirements of LCO 3.7.17 are not required for DG OPERABILITY. There is sufficient flow to the DGs from ERCW without a third ERCW in each train to support DG OPERABILITY. Although the requirement of LCO 3.7.17 may not be met (i.e., a third pump capable of being aligned to each ERCW Train) the requirement of LCO 3.7.8 is still met. If the requirement of LCO 3.7.8 is not met, the Actions of LCO 3.7.8 include the requirement to enter the Conditions and Required Actions of LCO 3.8.1 for DGs made inoperable by ERCW.

C.1

In MODE 4, if two ERCW trains are inoperable, immediate action must be taken to restore one of the ERCW trains to an OPERABLE status, as no ERCW train is available to support the heat removal function. Required Action C.1 is consistent with LCO 3.4.6, “RCS Loops - MODE 4,”

(continued)

BASES

ACTIONS

C.1 (continued)

Required Action ~~B~~D.1 for the Condition of ~~one~~ required RCS or RHR loops inoperable and no RCS or RHR loop~~s OPERABLE~~ in operation.

Required Action C.1 is modified by two Notes. Note 1 indicates that all required MODE changes or power reductions are suspended until one ERCW train is restored to OPERABLE status. In this case, LCO 3.0.3 is not applicable because it could force the plant into a less safe condition. Note 2 indicates that the applicable Conditions and Required Actions of LCO 3.4.6 be entered for RHR loops made inoperable by the inoperable ERCW trains. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

D.1

Required Action D.1 is modified by a Note indicating that the applicable Conditions and Required Actions of LCO 3.4.7, “RCS Loops - MODE 5, Loops Filled,” be entered for RHR loops made inoperable by one or more inoperable ERCW train(s). This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

In MODE 5, if one or more ERCW train(s) is inoperable, action must be initiated immediately to restore the ERCW train(s) to an OPERABLE status to restore heat removal paths. The immediate Completion Time reflects the importance of maintaining the capability of heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.7.17.1

Verifying the availability of the ERCW pumps provides assurance that adequate ERCW flow is provided for heat removal. Verification that each required ERCW pump that is not in operation is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal. Verification is performed by verifying proper breaker alignment and power available to the ERCW pump(s). The ERCW pump Interlock Bypass Switches do not need to be in ‘Bypass’ in order to meet this SR. The associated ERCW pump Interlock Bypass Switch is positioned by procedure when the third ERCW pump in the respective train is required to be started. The 12 hour Frequency is based on engineering judgment.

REFERENCES

1. Watts Bar FSAR, Section 9.2.1, "Essential Raw Cooling Water."

2. Watts Bar FSAR, Section 5.5.7, "Residual Heat Removal System."

ENCLOSURE 1

ATTACHMENT 3

WBN Unit 1 TS 3.7.16 and Bases, Clean-typed

3.7 PLANT SYSTEMS

3.7.16 Component Cooling System (CCS) - Shutdown

LCO 3.7.16 Two CCS trains shall be OPERABLE with one pump powered from Train A and aligned to the Train A header, and two pumps powered from Train B and aligned to the Train B header.

APPLICABILITY: MODES 4 and 5.

----------NOTE----------
This LCO is not applicable more than 48 hours after entry into MODE 3 from MODE 1 or 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CCS train inoperable in MODE 4. <u>AND</u> Complying with Required Actions to be in MODE 5.	A.1 Be in MODE 5.	24 hours
B. One CCS train inoperable in MODE 4 for reasons other than Condition A.	B.1 Verify two OPERABLE reactor coolant system (RCS) loops and one RCS loop in operation. <u>AND</u> B.2 Verify T_{avg} > 200ºF.	Once per 12 hours Once per 12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two CCS trains inoperable in MODE 4.	C.1 ----------NOTES---------- 1. LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one CCS train is restored to an OPERABLE status. 2. Enter Conditions and Required Actions of LCO 3.4.6, “RCS Loops - MODE 4,” for residual heat removal (RHR) loops made inoperable by CCS. ---------- Initiate action to restore one CCS train to OPERABLE status.	Immediately
D. One or more CCS train(s) inoperable in MODE 5.	D.1 ----------NOTE---------- Enter applicable Conditions and Required Actions of LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," for RHR loops made inoperable by CCS. ---------- Initiate action to restore CCS train(s) to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.16.1	Verify correct breaker alignment and indicated power available to the required pump(s) that is not in operation.	12 hours
SR 3.7.16.2	Verify two CCS pumps are aligned to CCS Train B.	12 hours

B 3.7 PLANT SYSTEMS

B 3.7.16 Component Cooling System (CCS) - Shutdown

BASES

BACKGROUND

The general description of the Component Cooling System (CCS) is provided in TS Bases 3.7.7, "Component Cooling System." The CCS has a Unit 1 Train A header supplied by CCS Pump 1A-A cooled through CCS Heat Exchanger (HX) A. Unit 2 has a separate Train A header containing HX B supplied by CCS Pump 2A-A. The Train B header is shared by Unit 1 and Unit 2 and contains HX C. Flow through the Train B header is normally supplied by CCS Pump C-S. CCS Pump 1B-B can be aligned to supply the Train B header, but it is normally aligned to the Unit 1 Train A header. Similarly, CSS Pump 2B-B can supply cooling water to the Train B header, but is normally aligned to the Unit 2 Train A header. The following describes the functions and requirements within the first 48 hours after shut down, when the Residual Heat Removal (RHR) System is being used for residual and decay heat removal.

During a normal shutdown, decay heat removal is via the reactor coolant system (RCS) loops until sometime after the unit has been cooled down to RHR entry conditions (T_{cold} < 350ºF). Therefore, as LCO 3.7.16 becomes Applicable (entry into Mode 4) the RCS loops are still OPERABLE. Entry into MODES 4 and 5 can place high heat loads onto the RHR System, CCS and the Essential Raw Cooling Water System (ERCW) when shutdown cooling is established. Residual and decay heat from the Reactor Coolant System (RCS) is transferred to CCS via the RHR HX. Heat from the CCS is transferred to the ERCW System via the CCS HXs. The CCS and ERCW systems are common between the two operating units.

During the first 48 hours after reactor shutdown, the heat loads are at sufficiently high levels that the normal pump requirement of LCO 3.7.7 for one CCS pump on the Train B header may not be sufficient to support shut down cooling of Unit 1, concurrent with either a nearly simultaneous shutdown of Unit 2 or a design basis loss of coolant accident (LOCA) on Unit 2, with loss of offsite power and a single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A.

In either scenario, CCS Pump C-S would normally be the only pump supplying the Train B header and the Train B header would be supplying both the Unit 1 RHR Train B HX and the Unit 2 RHR Train B HX. During the Unit 2 LOCA scenario, the Unit 2 RHR Train B HX would be cooling the recirculating Emergency Core Cooling System (ECCS) water from the containment sump.

(continued)

BASES

BACKGROUND (continued)

To assure that there would be adequate CCS flow to both units' RHR Train B HXs, prior to placing RHR in service for Unit 1, either CCS Pump 1B-B or 2B-B would be aligned to the CCS Train B header.

With two CCS pumps on the Train B header, CCS will supply at least 5000 gpm to the Unit 2 RHR Train B HX and 5000 gpm to the Unit 1 RHR Train B HX.

The alignment of either CCS Pump 1B-B or 2B-B to the CCS Train B header before entry into MODE 4 places both units in an alignment that supports LOCA heat removal requirements and allows the other unit to proceed to cold shutdown. Having the CCS pumps realigned while a unit is being shut down with steam generators available for heat removal, precludes the need for manual action outside of the main control room to align CCS should a LOCA occur. If a LOCA occurs with the concurrent loss of the Train A 6.9 kV shutdown boards, CCS Pump 1B-B or 2B-B will be started from the main control room, if the pump is not already in operation. Both CCS pumps must be running before the RHR pump suction is transferred from the refueling water storage tank (RWST) to the containment sump to ensure adequate cooling is maintained. If a LOCA occurs, the C-S pump automatically starts on a safety injection (SI) actuation from either unit. The CCS pump control circuits are designed such that, if a pump is running and a loss of power occurs, the pump will be automatically reloaded on the DG. With this alignment, two CCS pumps will be available if a LOCA occurs on one unit when the other unit is being shut down.

Alternatively, the unit being shut down can remain on steam generator cooling for 48 hours before RHR is placed in service. If a LOCA occurred on the other unit, CCS would only be removing heat from one RHR HX. A single CCS pump and CCS HX provides the required heat removal capability.

After the unit has been shut down for greater than 48 hours, a single CCS pump on Train B provides adequate flow to both the Unit 1 and the Unit 2 RHR Train B HXs.

If the single failure were the loss of Train B power, the normal CCS alignment is acceptable, because CCS Pump 1A-A supplies the Unit 1 RHR Train A HX and CCS Pump 2A-A supplies the Unit 2 RHR Train A HX. CCS Pump 1A-A does not provide heat removal for Unit 2.

Additional information on the design and operation of the system, along with a list of the components served, is presented in the FSAR, Section 9.2.2 (Ref. 1). The principal safety related function of the CCS is the removal of heat from the reactor via the RHR System. This may be

(continued)

BASES

BACKGROUND (continued)

during a normal or post accident cool down and shut down. The Unit 1 CCS Train A header is not used to support Unit 2 operation.

APPLICABLE SAFETY ANALYSES

The CCS functions to cool the unit from RHR entry conditions in MODE 4 (T_{cold} < 350°F), to MODE 5 (T_{cold} < 200°F), during normal operations. The time required to cool from 350°F to 200°F is a function of the number of CCS and RHR trains operating. One CCS train is sufficient to remove heat during subsequent operations with T_{cold} < 200°F. This assumes a maximum ERCW inlet temperature of 85°F occurring simultaneously with the maximum heat loads on the system.

The design basis of the CCS is for one CCS train to remove the post LOCA heat load from the containment sump during the recirculation phase, with a maximum CCS HX outlet temperature of 110°F (Ref. 2). The ECCS LOCA analysis and containment LOCA analysis each model the maximum and minimum performance of the CCS, respectively. The normal maximum HX outlet temperature of the CCS is 95°F, and, during unit cooldown to MODE 5 (T_{cold} < 200°F), a maximum HX outlet temperature of 110°F is assumed. The CCS design based on these values, bounds the post accident conditions such that the sump fluid will not increase in temperature after alignment of the RHR HXs during the recirculation phase following a LOCA, and provides a gradual reduction in the temperature of this fluid as it is supplied to the RCS by the ECCS pumps.

The CCS is designed to perform its function with a single failure of any active component, assuming a loss of offsite power.

CCS - Shutdown satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO

The CCS trains are independent of each other to the degree that each has separate controls and power supplies and the operation of one does not depend on the other. During a unit shut down, one CCS train is required to provide the minimum heat removal capability assumed in the safety analysis for the systems to which it supplies cooling water. To ensure this requirement is met, two trains of CCS must be OPERABLE. At least one CCS train will operate assuming the worst case single active failure occurs coincident with a loss of offsite power.

This LCO provides CCS train OPERABILITY requirements beyond the requirements of LCO 3.7.7 during the first 48 hours after reactor shut down, when the heat loads are at sufficiently high levels that the normal pump requirement of one CCS pump on the Train B header may not be sufficient to support shutdown cooling of Unit 1, concurrent with a nearly simultaneous shutdown of Unit 2 or a LOCA on Unit 2, a loss of offsite power, and single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A.

Because CCS Train B supports heat removal from Unit 1 and Unit 2, when Unit 1 has been shutdown ≤ 48 hours and the RHR System is relied on for heat removal, the following is required for CCS OPERABILITY:

d. Train A is OPERABLE when CCS Pump 1A-A is available and aligned to the CCS Train A header.

e. Train B is OPERABLE when two CCS pumps are available and aligned to the CCS Train B header using any combination of CCS Pumps 1B-B, 2B-B, and C-S.

f. The associated piping, valves, HXs, and instrumentation and controls required to perform the safety related function are OPERABLE.

Because Unit 1 is shutdown and on RHR cooling, no automatic actuations are required as a DBA on Unit 1, such as a LOCA, does not have to be mitigated.

APPLICABILITY

Prior to aligning the RHR System for RCS heat removal in MODE 4, an additional CCS pump must be powered from and aligned to the CCS Train B header to ensure adequate heat removal capability.

The Applicability is modified by a Note stating the LCO does not apply after the initial 48 hours after the unit enters MODE 3 from MODE 1 or MODE 2. Following extended operation in MODE 1, the heat loads are at sufficiently high levels that the normal pump requirement of LCO 3.7.7

(continued)

BASES

APPLICABILITY (continued)

for one CCS pump on the Train B header may not be sufficient to support shutdown cooling of Unit 1, concurrent with a near simultaneous shutdown of Unit 2 or a design basis LOCA on Unit 2, with loss of offsite power and a single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A. However, after the initial 48 hours following shutdown of the unit, the heat removal capability of both units is within the capabilities of the CCS without the need for an additional CCS pump aligned to the CCS Train B header.

ACTIONS

A.1

In MODE 4, if one CCS train is inoperable, and the unit is required to be placed in MODE 5 to comply with Required Actions, action must be taken to place the unit in MODE 5 within 24 hours. When the Required Actions of an LCO direct the unit to be placed in MODE 5, either a loss of safety function has occurred or the Required Action and Completion Time for restoring a safety-related component has not been met. Therefore, it is prudent to place the unit in a condition of lower energy with a lower potential for a postulated event. In this Condition, the remaining OPERABLE CCS train is adequate to perform the heat removal function. The 24 hour Completion Time is consistent with LCO 3.4.6, “RCS Loops - MODE 4,” Required Action B.1 for the Condition of one required RHR loop inoperable and no RCS loops OPERABLE.

B.1 and B.2

In MODE 4, if one CCS train is inoperable, and the unit is not required to be placed in MODE 5 to comply with Required Actions, actions are taken to verify LCO 3.4.6 is being met with two OPERABLE RCS loops with one loop in operation, and that the unit remains in MODE 4 (T_{avg} > 200ºF). These actions indicate the preference to maintain the unit in a condition with multiple methods of decay heat removal available, i.e., maintain the unit in MODE 4 with two RCS loops operable in addition to the remaining OPERABLE RHR loop. This action precludes entry into the LCO 3.4.6 Actions, as LCO 3.4.6 is met with two OPERABLE RCS loops and one RCS loop in operation. This Action is conservative to the Required Actions of LCO 3.4.6 when there are two OPERABLE RCS loops.

Maintaining the unit in MODE 4 with additional methods of decay heat removal available minimizes the likelihood of a situation where the decay heat and residual heat of the unit exceeds the capability of the available RHR loop resulting in the possibility of an unintentional MODE change. The Frequency of once per 12 hours ensures that the systems being relied on for heat removal are operating properly and are maintaining the unit in MODE 4. The 12 hour Frequency

(continued)

BASES

ACTIONS

B.1 (continued)

is reasonable, considering the low probability of a change in system operation during this time period.

If the Required Actions and Completion Times of Condition B are not met, no actions are specified. Therefore, LCO 3.0.3 applies, requiring the unit to be placed in MODE 5 in 37 hours. With one CCS train inoperable and Required Actions require the unit to be placed in MODE 5, Condition A applies, requiring the unit to be placed in MODE 5 in 24 hours. This Action is consistent with the Required Actions of LCO 3.4.6 Condition B (no OPERABLE RCS loops and one inoperable RHR loop).

C.1

In MODE 4, if two CCS trains are inoperable, immediate action must be taken to restore one of the CCS trains to an OPERABLE status, as no CCS train is available to support the heat removal function. Required Action C.1 is consistent with LCO 3.4.6, “RCS Loops - MODE 4,” Required Action D.1 for the Condition of required RCS or RHR loops inoperable and no required RCS or RHR loop in operation.

Required Action C.1 is modified by two Notes. Note 1 indicates that all required MODE changes or power reductions are suspended until one CCS train is restored to OPERABLE status. In this case, LCO 3.0.3 is not applicable because it could force the plant into a less safe condition. Note 2 indicates that the applicable Conditions and Required Actions of LCO 3.4.6 be entered for RHR loops made inoperable by the inoperable CCS trains. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

D.1

Required Action D.1 is modified by a Note indicating that the applicable Conditions and Required Actions of LCO 3.4.7, “RCS Loops - MODE 5, Loops Filled,” be entered for RHR loops made inoperable by one or more inoperable CCS train(s). This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

In MODE 5, if one or more CCS train(s) is inoperable, action must be initiated immediately to restore the CCS train(s) to an OPERABLE status to restore heat removal paths. The immediate Completion Time reflects the importance of maintaining the capability of heat removal.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.7.16.1

Verification that each required CCS pump that is not in operation is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain heat removal. Verification is performed by verifying proper breaker alignment and power available to the CCS pump(s). The 12 hour Frequency is based on engineering judgment.

SR 3.7.16.2

This SR verifies that two of the three CCS pumps that are powered from Train B are aligned to the Train B header. Verification of the correct physical alignment assures that adequate CCS flow can be provided to both the Unit 1 and Unit 2 RHR Train B HXs, if required. The 12 hour Frequency is based on engineering judgment, is consistent with procedural controls governing valve alignment, and ensures correct valve positions.

REFERENCES

1. Watts Bar FSAR, Section 9.2.2, “Component Cooling System.”

2. Watts Bar Component Cooling System Description, N3-70-4002.

ENCLOSURE 1

ATTACHMENT 4

WBN Unit 1 TS 3.7.17 and Bases, Clean-typed

3.7 PLANT SYSTEMS

3.7.17 Essential Raw Cooling Water (ERCW) System - Shutdown

LCO 3.7.17 Two ERCW trains shall be OPERABLE as follows:

a. Three ERCW pumps aligned to Train A, including two pumps capable of being powered from 6.9 kV Shutdown Board 1A-A, and

b. Three ERCW pumps aligned to Train B, including two pumps capable of being powered from 6.9 kV Shutdown Board 1B-B.

APPLICABILITY: MODES 4 and 5.

----------NOTE----------
This LCO is not applicable more than 48 hours after entry into MODE 3 from MODE 1 or 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ERCW train inoperable in MODE 4. <u>AND</u> Complying with Required Actions to be in MODE 5.	A.1 Be in MODE 5.	24 hours
B. One ERCW train inoperable in MODE 4 for reasons other than Condition A.	B.1 Verify two OPERABLE reactor coolant system (RCS) loops and one RCS loop in operation. <u>AND</u> B.2 Verify T_{avg} > 200ºF.	Once per 12 hours Once per 12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Two ERCW trains inoperable in MODE 4.	C.1 ----------NOTES---------- 1. LCO 3.0.3 and all other LCO Required Actions requiring MODE changes are suspended until one ERCW train is restored to an OPERABLE status. 2. Enter Conditions and Required Actions of LCO 3.4.6, “RCS Loops - MODE 4,” for residual heat removal (RHR) loops made inoperable by ERCW. ---------- Initiate action to restore one ERCW train to OPERABLE status.	Immediately
D. One or more ERCW train(s) inoperable in MODE 5.	D.1 ----------NOTE---------- Enter applicable Conditions and Required Actions of LCO 3.4.7, "RCS Loops - MODE 5, Loops Filled," for RHR loops made inoperable by ERCW. ---------- Initiate action to restore ERCW train(s) to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.17.1	Verify correct breaker alignment and indicated power available to the required pump(s) that is not in operation.	12 hours

B 3.7 PLANT SYSTEMS

B 3.7.17 Essential Raw Cooling Water (ERCW) System

BASES

BACKGROUND

The general description of ERCW is provided in TS Bases 3.7.8, "Essential Raw Cooling Water (ERCW) System." The descriptions of Applicable Safety Analyses, LCOs, Applicability, ACTIONS and Surveillance Requirements for applicable MODES are also described in TS Bases 3.7.8. The following discussion applies to the specific Applicability in TS 3.7.17 during the first 48 hours after shut down when the Residual Heat Removal (RHR) System is being used for residual and decay heat removal. The ERCW System provides a heat sink for the removal of process and operating heat from safety related components during a design basis accident (DBA) or transient. During normal operation, and a normal shutdown, the ERCW System also provides this function for various safety related and non-safety related components. The major post-accident heat load on the ERCW System is the Component Cooling System (CCS) heat exchangers (HXs), which are used to cool RHR and the containment spray HXs. The major heat load on the ERCW System when a unit is shut down on RHR is the CCS HX associated with the train(s) of RHR in service.

During a normal shutdown, decay heat removal is via the reactor coolant system (RCS) loops until sometime after the unit has been cooled down to RHR entry conditions (T_{cold} < 350ºF). Therefore, as LCO 3.7.17 becomes Applicable (entry into Mode 4) the RCS loops are still OPERABLE. After the RHR System is aligned as the principle method of decay heat removal, the heat loads on the ERCW System are increased. Normally, two ERCW pumps are sufficient to handle the cooling needs for maintaining one unit in normal operation while mitigating a DBA on the other unit. However, in the unlikely event of a loss of coolant accident (LOCA) on Unit 2 with a concurrent loss of offsite power and a single failure that results in the loss of both Train A or both Train B 6.9 kV shutdown boards while Unit 1 is on RHR shutdown cooling and has been shutdown for less than 48 hours, three ERCW pumps may be required.

This LCO controls the availability of ERCW pumps necessary to support mitigation of a LOCA on Unit 2 when Unit 1 has been shut down for ≤ 48 hours and is utilizing RHR for heat removal.

Additional information about the design and operation of the ERCW System, along with a list of the components served, is presented in the FSAR, Section 9.2.1 (Ref. 1).

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

The design basis of the ERCW System is for one ERCW train, in conjunction with the CCS and a 100% capacity Containment Spray System and RHR, to remove core decay heat following a design basis LOCA as discussed in the FSAR, Section 9.2.1 (Ref. 1). This prevents the containment sump fluid from increasing in temperature during the recirculation phase following a LOCA and provides for a gradual reduction in the temperature of this fluid as it is supplied to the Reactor Coolant System (RCS) by the Emergency Core Cooling System (ECCS) pumps. The ERCW System is designed to perform its function with a single failure of any active component, assuming a loss of offsite power.

The ERCW System, in conjunction with the CCS, also cools the unit, as discussed in the FSAR, Section 5.5.7 (Ref. 2) from RHR entry conditions to MODE 5 during normal and post accident operations. The time required to enter MODE 5 is a function of the number of CCS and RHR System trains that are operating. One ERCW train is sufficient to remove heat during subsequent operations in MODES 5 and 6. This assumes a maximum ERCW inlet temperature of 85ºF occurring simultaneously with maximum heat loads on the system. In the first 48 hours after the shutdown of Unit 1 assuming a DBA LOCA on Unit 2 with the loss of offsite power and the concurrent loss of two 6.9 kV shutdown boards on the same power train as a single failure. Three ERCW pumps are required to provide the heat removal capacity assumed in the safety analysis for Unit 2 while continuing the cooldown of Unit 1.

ERCW - Shutdown satisfies Criterion 4 of 10 CFR 50.36(c)(2)(ii).

LCO

This LCO provides ERCW train OPERABILITY requirements beyond the requirements of LCO 3.7.8 during the first 48 hours after reactor shutdown, when the heat loads are at sufficiently high levels that the normal pump requirement of two ERCW pumps on one train may not be sufficient to support shutdown cooling of Unit 1, concurrent with a LOCA on Unit 2, an assumed loss of offsite power, and a single failure that affects both 6.9 kV shutdown boards in one power train.

Two ERCW trains are required to be OPERABLE to provide the required redundancy to ensure that the system functions to support a cooldown to MODE 5.

An ERCW train is considered OPERABLE during the first 48 hours after shutdown when:

a. Two pumps per train, aligned to separate shutdown boards, are OPERABLE; and

(continued)

BASES

LCO (continued)

b. One additional Train A pump and one additional Train B pump are capable of being aligned to their respective Unit 1 6.9 kV shutdown board (1A-A and 1B-B) and manually placed in service.

APPLICABILITY

Prior to aligning the RHR System for RCS heat removal in MODE 4, one additional ERCW pump must be capable of being powered by its respective Unit 1 6.9 kV shutdown board (1A-A and 1B-B) and manually placed in service to ensure adequate heat removal capability.

The Applicability is modified by a Note stating the LCO does not apply after the initial 48 hours after the unit enters MODE 3 from MODE 1 or MODE 2. Following extended operation in MODE 1, the heat loads are at sufficiently high levels that the normal pump requirement of LCO 3.7.8 for two ERCW pumps may not be sufficient to support shutdown cooling of Unit 1, concurrent with a design basis LOCA on Unit 2 with loss of offsite power and a single failure of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A. However, after the initial 48 hours following shutdown of the unit, the heat removal capability of both units is within the capabilities of the ERCW System without the need for an additional ERCW pump in each train.

ACTIONS

A.1

In MODE 4, if one ERCW train is inoperable, and the unit is required to be placed in MODE 5 to comply with Required Actions, action must be taken to place the unit in MODE 5 within 24 hours. When the Required Actions of an LCO direct the unit to be placed in MODE 5, either a loss of safety function has occurred or the Required Action and Completion Time for restoring a safety-related component has not been met. Therefore, it is prudent to place the unit in a condition of lower energy with a lower potential for a postulated event. In this Condition, the remaining OPERABLE ERCW train is adequate to perform the heat removal function. The 24 hour Completion Time is consistent with LCO 3.4.6, “RCS Loops - MODE 4,” Required Action B.1 for the Condition of one required RHR loop inoperable and no RCS loops OPERABLE.

B.1 and B.2

In MODE 4, if one ERCW train is inoperable, and the unit is not required to be placed in MODE 5 to comply with Required Actions, actions are taken to verify LCO 3.4.6 is being met with two OPERABLE RCS loops with one loop in operation, and that the unit remains in MODE 4 (T_{avg} > 200ºF). These actions indicate the preference to maintain the unit

(continued)

BASES

ACTIONS

B.1 (continued)

in a condition with multiple methods of decay heat removal available, i.e., maintain the unit in MODE 4 with two RCS loops operable in addition to the remaining OPERABLE RHR loop. This action precludes entry into the LCO 3.4.6 Actions, as LCO 3.4.6 is met with two OPERABLE RCS loops and one RCS loop in operation. This Action is conservative to the Required Actions of LCO 3.4.6 when there are two OPERABLE RCS loops.

Maintaining the unit in MODE 4 with additional methods of decay heat removal available minimizes the likelihood of a situation where the decay heat and residual heat of the unit exceeds the capability of the available RHR loop resulting in the possibility of an unintentional MODE change. The Frequency of once per 12 hours ensures that the systems being relied on for heat removal are operating properly and are maintaining the unit in MODE 4. The 12 hour Frequency is reasonable, considering the low probability of a change in system operation during this time period.

If the Required Actions and Completion Times of Condition B are not met, no actions are specified. Therefore, LCO 3.0.3 applies, requiring the unit to be placed in MODE 5 in 37 hours. With one ERCW train inoperable and Required Actions require the unit to be placed in MODE 5, Condition A applies, requiring the unit to be placed in MODE 5 in 24 hours. This Action is consistent with the Required Actions of LCO 3.4.6 Condition B (no OPERABLE RCS loops and one inoperable RHR loop).

Although LCO 3.7.17 provides requirements in addition to those of LCO 3.7.8, the additional requirements of LCO 3.7.17 are not required for DG OPERABILITY. There is sufficient flow to the DGs from ERCW without a third ERCW in each train to support DG OPERABILITY. Although the requirement of LCO 3.7.17 may not be met (i.e., a third pump capable of being aligned to each ERCW Train) the requirement of LCO 3.7.8 is still met. If the requirement of LCO 3.7.8 is not met, the Actions of LCO 3.7.8 include the requirement to enter the Conditions and Required Actions of LCO 3.8.1 for DGs made inoperable by ERCW.

C.1

In MODE 4, if two ERCW trains are inoperable, immediate action must be taken to restore one of the ERCW trains to an OPERABLE status, as no ERCW train is available to support the heat removal function. Required Action C.1 is consistent with LCO 3.4.6, “RCS Loops - MODE 4,”

(continued)

BASES

ACTIONS

C.1 (continued)

Required Action D.1 for the Condition of required RCS or RHR loops inoperable and no RCS or RHR loop in operation.

Required Action C.1 is modified by two Notes. Note 1 indicates that all required MODE changes or power reductions are suspended until one ERCW train is restored to OPERABLE status. In this case, LCO 3.0.3 is not applicable because it could force the plant into a less safe condition. Note 2 indicates that the applicable Conditions and Required Actions of LCO 3.4.6 be entered for RHR loops made inoperable by the inoperable ERCW trains. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

D.1

Required Action D.1 is modified by a Note indicating that the applicable Conditions and Required Actions of LCO 3.4.7, “RCS Loops - MODE 5, Loops Filled,” be entered for RHR loops made inoperable by one or more inoperable ERCW train(s). This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

In MODE 5, if one or more ERCW train(s) is inoperable, action must be initiated immediately to restore the ERCW train(s) to an OPERABLE status to restore heat removal paths. The immediate Completion Time reflects the importance of maintaining the capability of heat removal.

SURVEILLANCE REQUIREMENTS

SR 3.7.17.1

Verifying the availability of the ERCW pumps provides assurance that adequate ERCW flow is provided for heat removal. Verification that each required ERCW pump that is not in operation is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal. Verification is performed by verifying proper breaker alignment and power available to the ERCW pump(s). The ERCW pump Interlock Bypass Switches do not need to be in ‘Bypass’ in order to meet this SR. The associated ERCW pump Interlock Bypass Switch is positioned by procedure when the third ERCW pump in the respective train is required to be started. The 12 hour Frequency is based on engineering judgment.

REFERENCES

1. Watts Bar FSAR, Section 9.2.1, "Essential Raw Cooling Water."

2. Watts Bar FSAR, Section 5.5.7, "Residual Heat Removal System."

ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT
UNIT 1

EVALUATION OF PROPOSED CHANGES

Subject: **Request for License Amendments – Technical Specification 3.3.2 and Technical Specification 3.4.6**

ATTACHMENTS

1.0 SUMMARY DESCRIPTION

Pursuant to Title 10 of the Code of Federal Regulations (CFR) §50.90, the Tennessee Valley Authority (TVA) is submitting a request for a change to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant (WBN) Unit 1. The proposed change affects Technical Specification (TS) 3.3.2, Table 3.3.2-1, "Engineered Safety Feature Actuation System (ESFAS) Instrumentation," Function 6.f, "Auxiliary Feedwater Pumps Train A and B Suction Transfer on Suction Pressure - Low," by adding 'MODE 4 when relying on the steam generators for heat removal' to the Applicability. In addition, a change is being proposed to LCO 3.4.6, "RCS Loops - MODE 4," to require two Reactor Coolant System (RCS) loops to be operable and for the unit to be maintained in Mode 4 for the initial seven hours after entry into Mode 3 from Mode 1 or Mode 2.

The proposed change is required to support dual unit operation of WBN Unit 1 (Unit 1) and WBN Unit 2 (Unit 2).

2.0 DETAILED DESCRIPTION

10 CFR Part 50 Appendix A, General Design Criterion (GDC) 5, "Sharing of structures, systems and components," provides high level requirements for safety systems that are shared by multiple nuclear units on a single site. The Essential Raw Cooling Water System (ERCW) and the Component Cooling Water System (CCS) at WBN are shared safety systems that meet the requirements of GDC 5. In support of dual unit operation and meeting the GDC 5 requirement for mitigating an accident in one unit and the orderly shutdown and cooldown of the other unit, TVA is providing changes to the Unit 1 TS and TS Bases for the auxiliary feedwater pump suction transfer to ERCW instrumentation and to the RCS loops requirement in Mode 4.

2.1 Proposed Changes

A description of the proposed TS changes are provided below. The specific changes to the WBN Unit 1 TS are indicated in the markups provided in Attachment 1 to this enclosure. The specific changes to the WBN Unit 1 TS Bases (For Information Only) are indicated in the markups provided in Attachment 2 to this enclosure. The clean-typed pages of the WBN Unit 1 TS and Bases are provided in Attachments 3 and 4 to this enclosure, respectively.

2.1.1 LCO 3.3.2, Table 3.3.2-1, Function 6.f - New Applicability

A change to the Limiting Condition for Operation (LCO) Applicability for ESFAS instrumentation Function 6.f, "Auxiliary Feedwater Pumps Train A and B Suction Transfer on Suction Pressure - Low," is being proposed. In addition to this Function being required operable in Modes 1, 2 and 3, Mode 4 when the steam generators are being relied on for heat removal is being added to the Applicability. As a result of this change in Applicability, the applicable Condition to enter for an inoperable channel of Auxiliary Feedwater (AFW) Pumps Train A and B Suction Transfer on Suction Pressure - Low is being changed from Condition F to Condition B. Currently, Condition F requires an inoperable channel to be restored to an operable status in 48 hours or the unit placed in Mode 3 in an additional 6 hours (54 hours total) and Mode 4 in an additional 6 hours (60 hours total). Condition B will require an inoperable channel to be restored to an operable status in 48 hours or the unit placed in Mode 3 in an additional 6 hours

(54 hours total) and Mode 5 in an additional 30 hours (84 hours total). Therefore, application of Condition B will result in removing the unit from the new Mode of Applicability, if an inoperable auxiliary feedwater pump suction transfer on suction pressure - low channel is not restored to an operable status in 48 hours.

2.1.2 LCO 3.4.6 - New LCO Notes 2 and 3, Conditions A and D, SR 3.4.6.1, and SR 3.4.6.2

A change is being proposed to LCO 3.4.6, “RCS Loops - Mode 4,” with the addition of LCO Notes 2 and 3. Note 2 will require for the initial seven hours after entry into Mode 3 from Mode 1 or Mode 2 that the requirement for two loops be met with two RCS loops with one RCS loop in operation when the rod control system is not capable of rod withdrawal. When the rod control system is capable of rod withdrawal, Note 2 requires that the requirement for two loops be met with two RCS loops with two RCS loops in operation. Note 3 will require that the average reactor coolant temperature be maintained greater than 200ºF for the initial seven hours after entry into Mode 3 from Mode 1 or Mode 2. As a result of these changes in the LCO requirement, conforming changes are required to the wording of Condition A, Required Action D.3, and SR 3.4.6.2.

In addition to Condition A being entered with only one RCS loop operable when two RHR loops are inoperable, it will also require entry if only one RCS loop is operable and it has been less than seven hours since entry into Mode 3 from Mode 1 or Mode 2. In this Condition, action is required to be initiated immediately to restore a second required RCS or RHR loop to an operable status. Required Actions A.1 and D.3 are being changed by specifying that the loop being restored to an operable status has to be a “required” loop. In other words, an RCS loop or an RHR loop, depending on what is required by the LCO, including appropriate application of the LCO Notes. Similarly, SR- 3.4.6.2 is being changed by specifying the loop being verified in operation when the rod control system is not capable of rod withdrawal is the “required” RCS loop or RHR loop, depending on what is required by the LCO, including appropriate application of the LCO Notes.

An unrelated change to SR 3.4.6.1 is also being proposed to correct a grammatical error, where the plurality of the word “loop” did not match the number of loops specified.

3.0 BACKGROUND

By letter dated June 17, 2015, TVA submitted a request for a change to Facility Operating License No. NPF-90 for WBN Unit 1 (Reference 1). The proposed change would create new Technical Specifications (TS) 3.7.16, “Component Cooling System (CCS) - Shutdown,” and TS 3.7.17, “Essential Raw Cooling Water (ERCW) System - Shutdown,” to support dual unit operation of WBN Units 1 and 2. By email dated July 2, 2015, the Nuclear Regulatory Commission (NRC) provided requests for additional information (RAI) on the proposed WBN Unit 1 license amendment (Reference 2). By letter dated July 9, 2015, the NRC requested supplemental information associated with the proposed WBN Unit 1 license amendment (Reference 3). By letter dated July 14, 2015 (Reference 4), TVA submitted the requested supplemental information and responses to the NRC acceptance review questions, including proposed changes to TS 3.7.16 and TS 3.7.17.

Following submittal of the requested supplemental information and responses to the NRC RAIs, the NRC indicated that sufficient information was provided by TVA to support the NRC review of the proposed license amendment request (LAR). However, to facilitate a more efficient and timely interaction between the NRC and TVA, the NRC decided to perform an audit of the proposed LAR in the NRC White Flint offices located in Rockville, MD during the weeks of July 27 to July 31, 2015, August 3 to August 7, 2015, and August 25 to August 28, 2015. During the audit, the NRC asked numerous review questions related to the license amendment request.

By letter dated August 28, 2015 (Reference 5) TVA submitted responses to the NRC Audit Review questions. The TVA response to NRC Audit Review Question BOP - 10 proposed a new Technical Requirement (TR) be added to the Technical Requirements Manual (TRM) to address the requirement for the AFW pump suction transfer on suction pressure - low instrumentation to be operable in Mode 4, when relying on steam generators for heat removal.

Subsequent to the above response, TVA has re-evaluated the proposed TRM specification and has determined that the change to the applicability for the AFW pump suction transfer on suction pressure - low instrumentation would be more appropriately reflected in TS 3.3.2. Lastly, changes are proposed to LCO 3.4.6 to reflect the analysis assumption that the decay heat associated with a shutdown unit is removed by RCS loops for the initial seven hours after shutdown.

4.0 TECHNICAL EVALUATION

4.1 System Description

Reactor Coolant System

In Mode 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary side coolant or the component cooling water via the residual heat removal (RHR) heat exchangers. The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid. The reactor coolant is circulated through four RCS loops connected in parallel to the reactor vessel, each loop containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and to prevent boric acid stratification.

In Mode 4, with the reactor trip breakers open and the rods not capable of withdrawal, either RCPs or RHR loops can be used to provide forced circulation. The intent in this case is to provide forced flow from at least one RCP or one RHR loop for decay heat removal and transport. The flow provided by one RCP loop or RHR loop is adequate for decay heat removal. The other intent is to require that two paths be available to provide redundancy for decay heat removal. With the reactor trip breakers closed and the rods capable of withdrawal, two RCPs must be OPERABLE and in operation to provide forced circulation.

During the first seven hours after a unit shutdown, the decay heat and latent heat of the RCS may not be within the capability of the RHR System. Therefore, it is assumed that

the RCS is operable and in operation to ensure adequate heat removal until the heat load is within the capability of the RHR System.

Auxiliary Feedwater (AFW) System

The AFW System removes RCS heat by assuring the required supply of water to the SGs, when the Main Feedwater (MFW) System is not available and the RCS is above the operational pressure and temperature limits of the RHR System. The AFW System shall meet this safety function assuming a single active component failure in conjunction with a design basis event (DBE) and concurrent loss of offsite power (LOOP).

The AFW System consists of two motor driven (MD) AFW pumps and one steam turbine driven (TD) pump configured into three trains. Each MD pump provides 410 gpm of AFW flow, and the TD pump provides 720 gpm to the steam generators, as assumed in the accident analysis. The pumps are equipped with independent recirculation lines to prevent pump operation against a closed system. Each MD AFW pump is powered from an independent Class 1E power supply and feeds two steam generators. The TD AFW pump receives steam from one of two main steam lines upstream of the main steam isolation valves. Each of the steam feed lines will supply 100% of the requirements of the TD AFW pump.

The turbine driven AFW pump supplies a common header capable of feeding all steam generators. In Mode 4, one pump at full flow is sufficient to remove decay heat and cool the unit to residual heat removal (RHR) entry conditions.

The AFW pumps take suction from the condensate storage tank (CST) and pump to the steam generator secondary side via separate connections to the MFW bypass line piping. The steam generators function as a heat sink for the RCS from core decay heat and latent heat. The RCS heat load is dissipated by releasing steam to the atmosphere from the steam generators via the main steam safety valves or atmospheric dump valves. If the main condenser is available, and the main steam isolation valves are open, the preferred means of heat removal is to discharge steam to the condenser by the non-safety grade path of the steam dump valves. The condensed steam is returned to the CST by the condenser level control valves and recirculating the condensate back to the CST.

AFW System Supply Sources

The normal source of water for the AFW System is the non-safety related CST. The safety grade water supply to the AFW pumps is the Essential Raw Cooling Water System (ERCW). The water in the CST has been treated to be a clean water supply while ERCW is raw water taken from the Tennessee River. The ERCW piping that connects to the AFW pump suction piping is normally isolated by automatic valves such that clean water is supplied to the steam generators during normal plant operation. Instrumentation is provided that will automatically open the ERCW valves to the AFW pump suction in the event of low pressure in the AFW pump suction piping. This design assures that a source of water to permit decay heat removal from the steam generators is available if the water supply from the non-safety grade CST is not available.

The ERCW System is the engineered safety feature (ESF) source of water to the AFW System. Safety-related valves normally isolate ERCW from the AFW pump suction so

that water is preferentially drawn from a unit's CST. The valves automatically open on low pressure in the AFW suction piping to assure that cooling water continues to be supplied to the steam generators in the event that the CST is depleted or if the initial event damaged the non-safety related CST such that it was no longer a viable water source.

Automatic Switchover to ERCW Supply

A low pressure signal in the AFW pump suction line protects the AFW pumps against a loss of the normal supply of water for the pumps, the CST. Three pressure switches are located on each MD AFW pump suction line from the CST. A low pressure signal sensed by two of the three switches on a line will cause the emergency supply of water for the respective pumps to be aligned. ERCW (safety grade) is then lined up to supply the AFW pumps to ensure an adequate supply of water for the AFW System to maintain at least one of the SGs as the heat sink for reactor decay heat and sensible heat removal.

4.2 Current Licensing Basis for Decay Heat Removal

Currently, LCO 3.3.2, Table 3.3.2-1, Function 6.f, requires that the automatic AFW pump suction switchover instrumentation be operable in Modes 1, 2, and 3. The TS Bases for Function 6.f states that automatic switching of the AFW suction to ERCW is not required in Mode 4. The justification for not requiring the automatic AFW pump suction logic was the time available to the operators for taking corrective actions due to lower decay heat and that the RHR System may be in operation.

Currently in Mode 4, LCO 3.4.6 requires any combination of two RCS loops and RHR loops be operable with one loop in operation when the rod control system is not capable of rod withdrawal. When the rod control system is capable of rod withdrawal, two RCS loops are required to be operable with both RCS loops in operation.

4.3 Proposed TS 3.3.2 and TS 3.4.6 Changes

LCO 3.7.5, "Auxiliary Feedwater (SFW) System," requires AFW to be operable in Modes 1, 2, and 3 and in Mode 4 when SGs are being relied on for heat removal. Because ERCW is the safety related water supply for the AFW pumps, the instrumentation associated with switching the AFW pump suction path from the CST to ERCW should also be required to be operable to support operability of AFW. Therefore, it is proposed that the Applicability of LCO 3.3.2, Table 3.3.2-1, Function 6.f be changed to include Mode 4 when the SGs are relied on for decay heat removal.

To reflect the extended Applicability of Function 6.f, it is also proposed that LCO 3.3.2, Table 3.3.2-1, Function 6.f also be revised to refer to Condition B instead of Condition F. This change will require that if an inoperable channel of AFW pump suction switchover instrumentation has not been restored to an operable status in 48 hours, that the unit be placed in Mode 3 in an additional 6 hours (54 hours total) and in Mode 5 within an additional 30 hours (84 hours total). However, as described in the Bases, once the RHR System is aligned for decay heat removal so that the steam generators are not relied on for heat removal, the plant is in a Mode in which the LCO no longer applies. Therefore, per LCO 3.0.2, completion of the Required Action to place the unit in Mode 5 is not required.

To ensure adequate heat removal capability for the initial seven hours after a unit shutdown, a change is being proposed to LCO 3.4.6, “RCS Loops - Mode 4,” by adding LCO Notes 2 and 3. Note 2 will require for the initial seven hours after entry into Mode 3 from Mode 1 or Mode 2 that the requirement for two loops be met with two RCS loops with one RCS loop in operation when the rod control system is not capable of rod withdrawal. When the rod control system is capable of rod withdrawal, Note 2 requires that the requirement for two loops be met with two RCS loops with two RCS loops in operation. Note 3 will require that the average reactor coolant temperature be maintained greater than 200ºF for the initial seven hours after entry into Mode 3 from Mode 1 or Mode 2. As a result of these changes in the LCO requirement, conforming changes are required to the wording of Condition A, Required Action D.3, and SR 3.4.6.2.

In addition to Condition A being entered with only one RCS loop operable when two RHR loops are inoperable, it will also require entry if only one RCS loop is operable and it has been less than seven hours since entry into Mode 3 from Mode 1 or Mode 2. In this Condition, action is required to be initiated immediately to restore a second required RCS or RHR loop to an operable status. Required Actions A.1 and D.3 are being changed by specifying that the loop being restored to an operable status has to be a “required” loop. In other words, an RCS loop or an RHR loop, depending on what is required by the LCO, including appropriate application of the LCO Notes. Similarly, SR 3.4.6.2 is being changed by specifying the loop being verified in operation when the rod control system is not capable of rod withdrawal is the “required” RCS loop or RHR loop, depending on what is required by the LCO, including appropriate application of the LCO Notes.

An unrelated change to SR 3.4.6.1 is also being proposed to correct a grammatical error, where the plurality of the word “loop” did not match the number of loops specified.

5.0 REGULATORY EVALUATION

5.1 Applicable Regulatory Requirements and Criteria

The RHR System is designed to remove heat from the core and reduce the temperature of the RCS during the second phase of plant cooldown. During the first phase of cooldown, the temperature of the RCS is reduced by transferring heat from the RCS to the steam and power conversion system through the steam generators.

As described in NUREG-0800, Standard Review Plan 10.4.9, “Auxiliary Feedwater System (PWR)” AFW normally operates during startup, hot standby and shutdown as the feedwater system for WBN Unit 1. With a Seismic Category I water source (ERCW), it also functions as an emergency system for heat removal from the primary system when the main feedwater system is not available for emergency conditions including small-break loss-of-coolant accident (LOCA) cases. The system operates over a time period sufficient either to hold the plant at hot standby for several hours or to cool down the primary system, at a rate not exceeding limits specified in technical specifications, to temperature and pressure levels at which the RHR System can operate.

The proposed changes described in this TS amendment request enhances the ability of the WBN to meet this requirement. The proposed change does not alter the capability of

AFW to remove residual heat from the RCS. The change does provide additional assurance that ERCW may be supplied to the AFW pump suction, without requiring operator action while the unit is in MODE 4 and relying on steam generators for residual heat removal. The RCS and AFW System continue to comply with the following regulations.

- 10 CFR 50, Appendix A, GDC 34, “Residual heat removal,” specifies that fission product decay heat and residual heat are removed at a rate such that fuel design limits and the reactor coolant pressure boundary limits are maintained, and the system safety function is maintained assuming a loss of offsite power and a single failure.

- 10 CFR 50, Appendix A, GDC 44, “Cooling water,” specifies that a cooling water system is provided that transfers heat from structures, systems, and components important to safety to an ultimate heat sink. The system shall have suitable redundancy that the safety function can be accomplished assuming a loss of either offsite or on-site power but not both simultaneously assuming a single failure.

5.2 Precedent

TVA did not identify any applicable regulatory precedence with respect to the changes proposed in this license amendment request for AFW pump suction switchover instrumentation or for the RCS loop requirements during the initial seven hours after a unit shutdown.

5.3 Significant Hazards Consideration

Tennessee Valley Authority (TVA) proposes to revise the current licensing basis of Facility Operating License No. NFP-90 for the Watts Bar Nuclear Plant (WBN) Unit 1 by revising the WBN Unit 1 Technical Specifications (TS) 3.3.2, “Engineered Safety Feature Actuation System (ESFAS) Instrumentation,” Table 3.3.2-1, Function 6.f, “Auxiliary Feedwater Pumps Train A and B Suction Transfer on Suction Pressure - Low,” by extending the Applicability to include Mode 4 when relying on steam generators for heat removal. Additionally, changes are proposed to TS 3.4.6, “RCS Loops - MODE 4,” to require the Reactor Coolant System (RCS) loops to be operable for the initial seven hours after entering Mode 3 from Mode 1 or Mode 2. The proposed changes support the anticipated dual unit operation of WBN Units 1 and 2, as well as compliance with the 10 CFR 50, Appendix A, General Design Criterion 5 requirements of mitigating an accident in one unit and the orderly shutdown and cooldown of the other unit.

TVA has concluded that the changes to TS 3.3.2 and TS 3.4.6 do not involve a significant hazards consideration. This conclusion is based on an evaluation in accordance with 10 CFR 50.91(a)(1) of the three standards set forth in 10 CFR 50.92, “Issuance of amendment,” as discussed below:

1. *Does the proposed amendment involve a significant increase in the probability or consequence of an accident previously evaluated?*

   Response: No.

   The proposed change to require the Reactor Coolant System (RCS) loops to be operable for the initial seven hours after shutdown and for the automatic switching of the auxiliary feedwater (AFW) pumps suction from the condensate storage tank (CST) to the Essential Raw Cooling Water (ERCW) System to be operable in Mode 4 when relying on steam generators for heat removal does not increase the probability or consequences of an accident that has been previously evaluated at WBN. The RCS loops are currently required to be operable to remove decay heat until plant conditions allow the Residual Heat Removal (RHR) System to be placed in service. Specifying that the RCS loops are required to be operable for the initial seven hours after shutdown is consistent with the heat load assumptions at the specified time after shutdown described in the Updated Final Safety Analysis Report (UFSAR). The suction piping to the AFW pumps from either the CST or ERCW is not an initiator of any analyzed accident. The equipment supported by AFW and ERCW as described in the UFSAR has not been changed.

   The structures, systems, and components (SSCs) credited to mitigate the consequences of postulated design basis accidents remain capable of performing their design basis function. The change requiring the RCS loops to be operable for the initial seven hours after shutdown does not affect heat removal capability. It ensures the RHR System is not solely relied on for decay heat removal before the decay heat load is within the capability of the RHR System. The change requiring the pressure switches in the AFW pump suction piping to remain in service in Mode 4 when steam generators are relied on to remove heat from the RCS does not affect heat removal capability. It retains the same automatic action required by the instruments in Modes 1, 2, and 3, consistent with the TS Applicability requirements for the AFW System.

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

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

   Response: No.

   The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The proposed change does not introduce any new modes of plant operation, change the design function of any SSC, or change the mode of operation of any SSC. There are no new equipment failure modes or malfunctions created as the affected SSCs continue to operate in the same manner as previously evaluated. Additionally, accident initiators remain as described in the UFSAR and no new accident initiators are postulated as a result of requiring the RCS loops to be operable for a specified duration after plant shutdown or by extending the Mode of Applicability of the AFW pump suction swap over from the CST to ERCW.

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

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

Response: No.

The proposed change does not result in any changes to plant equipment functions, including setpoints and actuations. The proposed change does not alter limiting safety system settings or safety limits specified in the TS for these instruments. The proposed change ensures the decay heat load of the plant is within the capability of the RHR System prior to allowing sole use of the RHR loops for decay heat removal. In addition, the proposed change ensures the same automatic action to align ERCW as a supply source to AFW that occurs in Modes 1, 2, and 3 will remain available in Mode 4 when relying on the steam generators for decay heat removal. Thus, the proposed change does not reduce the margin of safety.

Therefore, since there is no adverse impact of this change on the safety analysis, there is no significant reduction in the margin of safety of the plant.

Based on the above, TVA concludes that the proposed amendment 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.

5.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation 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 to the health and safety of the public.

6.0 ENVIRONMENTAL CONSIDERATION

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 effluents 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.

7.0 REFERENCES

1. Letter from TVA to NRC, “Watts Bar Nuclear Plant Unit 1 - Application to Revise Technical Specifications for Component Cooling Water and Essential Raw Cooling Water to Support Dual Unit Operation (TS-WBN-15-13),” dated June 17, 2015 [ML15170A474]

2. Email from NRC to TVA, “Preliminary Draft RAIs Associated with Proposed WBN 1 ERCW and CCS Technical Specifications LAR,” dated July 2, 2015

3. Letter from NRC to TVA, “Watts Bar Nuclear Plant, Unit 1 - Supplemental Information Needed for Acceptance of Requested Licensing Action Regarding Application to Add Technical Specifications to Support Dual Unit Operations (TAC No. MF6376),” dated July 9, 2015 [ML15187A403]

4. Letter from TVA to NRC, “Responses to NRC Acceptance Review Questions for Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling Water System License Amendment Request (TAC No. MF6376),” dated July 14, 2015 [ML15197A357]

5. Letter from TVA to NRC, “Responses to NRC Audit Review Questions for Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling Water System License Amendment Request,” dated August 28, 2015 [ML15243A044]

ENCLOSURE 2

ATTACHMENT 1

WBN Unit 1 TS 3.3.2 and TS 3.4.6 Markups

WBN Unit 1 TS 3.3.2 Markups

Table 3.3.2-1 (page 5 of 7)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
6. Auxiliary Feedwater (continued)						
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
d. Loss of Offsite Power	1, 2 ,3	4 per bus	F	Refer to Function 4 of Table 3.3.5-1 for SRs and Allowable Values		
e.. Trip of all Turbine Driven Main Feedwater Pumps	1[(i)], 2[(j)]	1 per pump	J	SR 3.3.2.8 SR 3.3.2.9 SR 3.3.2.10	≥ 48 psig	50 psig
f. Auxiliary Feedwater Pumps Train A and B Suction Transfer on Suction Pressure - Low	1, 2, 3, 4[(k)]	3	~~F~~B	SR 3.3.2.6 SR 3.3.2.9 SR 3.3.2.10	A) ≥ 0.5 psig B) ≥ 1.33 psig	A) 1.2 psig B) 2.0 psig
7. Automatic Switchover to Containment Sump						
a. Automatic Actuation Logic and Actuation Relays	1, 2, 3, 4	2 trains	C	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5	NA	NA

(continued)

(i) Entry into Condition J may be suspended for up to 4 hours when placing the second Turbine Driven Main Feedwater (TDMFW) Pump in service or removing one of two TDMFW pumps from service.

(j) When one or more Turbine Driven Feedwater Pump(s) are supplying feedwater to steam generators.

(k) When steam generators are relied on for heat removal.

WBN Unit 1 TS 3.4.6 Markups

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.6 RCS Loops - MODE 4

LCO 3.4.6 Two loops shall be OPERABLE, and consist of either:

a. Any combination of RCS loops and residual heat removal (RHR) loops, and one loop shall be in operation, when the rod control system is not capable of rod withdrawal; or

b. Two RCS loops, and both loops shall be in operation, when the rod control system is capable of rod withdrawal.

----------NOTES----------

1. No RCP shall be started with any RCS cold leg temperature ≤ 350ºF unless the secondary side water temperature of each steam generator (SG) is ≤ 50°F above each of the RCS cold leg temperatures.

2. For the initial 7 hours after entry into MODE 3 from MODE 1 or MODE 2, two loops shall consist of:

   a. Two RCS loops with one loop in operation when the rod control system is not capable of rod withdrawal; or

   b. Two RCS loops with both loops in operation when the rod control system is capable of rod withdrawal.

3. Average reactor coolant temperature shall be maintained > 200ºF for the initial 7 hours after entry into MODE 3 from MODE 1 or MODE 2.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Only one RCS loop OPERABLE. AND Two RHR loops inoperable. OR Less than 7 hours since entry into MODE 3 from MODE 1 or MODE 2.	A.1	Initiate action to restore a second required RCS or RHR loop to OPERABLE status.	Immediately
B. One required RHR loop inoperable. AND No RCS loops OPERABLE.	B.1	Be in MODE 5.	24 hours
C. One required RCS loop not in operation, and reactor trip breakers closed and Rod Control System capable of rod withdrawal.	C.1	Restore required RCS loop to operation.	1 hour
	OR		
	C.2	De-energize all control rod drive mechanisms (CRDMs).	1 hour
D. Required RCS or RHR loops inoperable. OR No required RCS or RHR loop in operation.	D.1	De-energize all CRDMs.	Immediately
	AND		
	D.2	Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	AND		
	D.3	Initiate action to restore one required loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify two RCS loops are in operation when the rod control system is capable of rod withdrawal.	12 hours
SR 3.4.6.2	Verify one required RHR or RCS loop is in operation when the rod control system is not capable of rod withdrawal.	12 hours
SR 3.4.6.3	Verify SG secondary side water levels are greater than or equal to 32% narrow range for required RCS loops.	12 hours
SR 3.4.6.4	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	7 days

ENCLOSURE 2

ATTACHMENT 2

WBN Unit 1 TS 3.3.2 and TS 3.4.6 Bases Markups (For Information Only)

WBN Unit 1 TS 3.3.2 Bases Markups

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

f. Auxiliary Feedwater - Pump Suction Transfer on Suction Pressure - Low

A low pressure signal in the AFW pump suction line protects the AFW pumps against a loss of the normal supply of water for the pumps, the CST. Three pressure switches are located on each motor driven AFW pump suction line from the CST. A low pressure signal sensed by two switches of a set will cause the emergency supply of water for the respective pumps to be aligned. ERCW (safety grade) is then lined up to supply the AFW pumps to ensure an adequate supply of water for the AFW System to maintain at least one of the SGs as the heat sink for reactor decay heat and sensible heat removal.

Since the detectors are located in an area not affected by HELBs or high radiation, they will not experience any adverse environmental conditions and the NTSP reflects only steady state instrument uncertainties.

This~~ese~~ Function~~s~~ must be OPERABLE in MODES 1, 2, ~~and~~ 3, and 4, when the steam generators are relied on to remove decay heat from the reactor, to ensure a safety grade supply of water for the AFW System to maintain the SGs as the heat sink for the reactor. This~~ese~~ Function~~s~~ does not have to be OPERABLE in MODES 5 and 6 because there is not enough heat being generated in the reactor to require the SGs as a heat sink.

(continued)

BASES

ACTIONS (continued)

When the number of inoperable channels in a trip function exceed those specified in one or other related Conditions associated with a trip function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 should be immediately entered if applicable in the current MODE of operation.

A.1

Condition A applies to all ESFAS protection functions.

Condition A addresses the situation where one or more channels or trains for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.2-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

B.1, B.2.1 and B.2.2

Condition B applies to manual initiation of:

- SI;
- Containment Spray;
- Phase A Isolation; and
- Phase B Isolation.

Condition B also applies to the Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low.

For the manual initiation Functions, t~~T~~his action addresses the train orientation of the SSPS for the functions listed above. For the AFW System pump suction transfer channels, this action recognizes that placing a failed channel in trip during operation is not necessarily a conservative action. Spurious trip of this function could align the AFW System to a source that is not immediately capable of supporting pump suction. If a channel or train is inoperable, 48 hours is allowed to return it to an OPERABLE status. Note that for containment spray and Phase B isolation, failure of one or both channels in one train renders the train inoperable. Condition B, therefore, encompasses both situations.

(continued)

BASES

ACTIONS

B.1, B.2.1 and B.2.2 (continued)

For the manual initiation Functions, ~~T~~the specified Completion Time is reasonable considering that there are two automatic actuation trains and another manual initiation train OPERABLE for each Function, and the low probability of an event occurring during this interval. For the AFW System pump suction transfer channels, the specified Completion Time is reasonable considering the nature of this Function, the available redundancy, and the low probability of an event occurring during this interval. If the channel or train cannot be restored to OPERABLE status, the plant must be placed in a MODE in which the LCO does not apply. This is done by placing the plant in at least MODE 3 within an additional 6 hours (54 hours total time) and in MODE 5 within an additional 30 hours (84 hours total time). The allowable Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. For the AFW System pump suction transfer channels, aligning the RHR System for decay heat removal, so that the steam generators are not relied on for heat removal, places the plant in a MODE in which the LCO no longer applies. Therefore, per LCO 3.0.2, completion of the Required Action to place the unit in MODE 5 is not required.

For the manual initiation Functions, ~~T~~the allowance of 48 hours is justified in Reference 7.

(continued)

BASES

ACTIONS (continued)

F.1, F.2.1, and F.2.2

Condition F applies to:

- Manual Initiation of Steam Line Isolation;
- Loss of Offsite Power;
- ~~Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low;~~ and
- P-4 Interlock.

For the Manual Initiation and the P-4 Interlock Functions, this action addresses the train orientation of the SSPS. For the Loss of Offsite Power Function, this action recognizes the lack of manual trip provision for a failed channel. ~~For the AFW System pump suction transfer channels, this action recognizes that placing a failed channel in trip during operation is not necessarily a conservative action. Spurious trip of this function could align the AFW System to a source that is not immediately capable of supporting pump suction.~~ If a train or channel is inoperable, 48 hours is allowed to return it to OPERABLE status. The specified Completion Time is reasonable considering the nature of these Functions, the available redundancy, and the low probability of an event occurring during this interval. If the Function cannot be returned to OPERABLE status, the plant must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power in an orderly manner and without challenging plant systems. In MODE 4, the plant does not have any analyzed transients or conditions that require the explicit use of the protection functions noted above.

(continued)

WBN Unit 1 TS 3.4.6 Bases Markups

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.6 RCS Loops - MODE 4

BASES

BACKGROUND

In MODE 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary side coolant or the component cooling water via the residual heat removal (RHR) heat exchangers (HXs). The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops connected in parallel to the reactor vessel, each loop containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and to prevent boric acid stratification.

In MODE 4, with the reactor trip breakers open and the rods not capable of withdrawal, either RCPs or RHR loops can be used to provide forced circulation. The intent in this case is to provide forced flow from at least one RCP or one RHR loop for decay heat removal and transport. The flow provided by one RCP loop or RHR loop is adequate for decay heat removal. The other intent is to require that two paths be available to provide redundancy for decay heat removal.

In MODE 4, with the reactor trip breakers closed and the rods capable of withdrawal, two RCPs must be OPERABLE and in operation to provide forced circulation.

During a normal shutdown, decay heat removal is via the RCS loops until sometime after the unit has been cooled down to RHR entry conditions (T_{cold} < 350ºF). Therefore, as LCO 3.4.6 becomes Applicable (entry into MODE 4) the RCS loops are still OPERABLE. Transitioning decay heat removal to the RHR System will place high heat loads on the RHR System, Component Cooling System (CCS), and the Essential Raw Cooling Water System (ERCW). Residual and decay heat from the RCS is transferred to CCS via the RHR HX. Heat from the CCS is transferred to the ERCW System via the CCS HXs. The CCS and ERCW systems are common between the two operating units.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

In MODE 4, with the reactor trip breakers open and the rods not capable of withdrawal, RCS circulation is considered in determination of the time available for mitigation of the accidental boron dilution event. The RCS and RHR loops provide this circulation.

Whenever the reactor trip breakers (RTBs) are in the closed position and the control rod drive mechanisms (CRDMs) are energized, an inadvertent rod withdrawal from subcritical, resulting in a power excursion, is possible. Such a transient could be caused by a malfunction of the rod control system. In addition, the possibility of a power excursion due to the ejection of an inserted control rod is possible with the breakers closed or open. Such a transient could be caused by the mechanical failure of a CRDM.

Therefore, in MODE 4 with RTBs in the closed position and Rod Control System capable of rod withdrawal, accidental control rod withdrawal from subcritical is postulated and requires at least two RCS loops to be OPERABLE and in operation to ensure that the accident analyses limits are met. For those conditions when the Rod Control System is not capable of rod withdrawal, any combination of two RCS or RHR loops are required to be OPERABLE, but only one loop is required to be in operation to meet decay heat removal requirements, except during the initial seven hours after unit shutdown, when the decay and latent heat load may exceed the heat removal capability of one RHR loop in operation.

During the initial seven hours after reactor shutdown, the heat loads are at sufficiently high levels that the requirement of LCO 3.4.6 for one RHR loop in operation may not be sufficient to mitigate a design basis accident on Unit 2 and preclude a heatup of Unit 1.

To assure that there would be adequate heat removal capability under all postulated conditions during the initial seven hours after unit shutdown, reliance on heat removal via RCS loops is required. After a unit has been shutdown for greater than seven hours, a single RHR loop in operation provides adequate heat removal capability.

RCS Loops - MODE 4 have been identified in the NRC Policy Statement as important contributors to risk reduction.

(continued)

BASES (continued)

LCO

The purpose of this LCO is to require that at least two loops be OPERABLE. In MODE 4 with the RTBs in the closed position and Rod Control System capable of rod withdrawal, two RCS loops must be OPERABLE and in operation. Two RCS loops are required to be in operation in MODE 4 with RTBs closed and Rod Control System capable of rod withdrawal due to the postulation of a power excursion because of an inadvertent control rod withdrawal. The required number of RCS loops in operation ensures that the Safety Limit criteria will be met for all of the postulated accidents.

With the RTBs in the open position, or the CRDMs de-energized, the Rod Control System is not capable of rod withdrawal; therefore, only one loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. In this case, the LCO allows the two loops that are required to be OPERABLE to consist of any combination of RCS loops and RHR loops. An additional loop is required to be OPERABLE to provide redundancy for heat removal.

~~The~~ Note 1 requires that the secondary side water temperature of each SG be ≤ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature less than or equal to 350ºF. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 2 requires two RCS loops to be OPERABLE during the initial seven hours after entry into MODE 3 from MODE 1 or MODE 2 until decay heat and latent heat are within the capacity of the RHR System.

Note 3 precludes entry into MODE 5 during the initial seven hours after entry into MODE 3 from MODE 2 or MODE 1. This ensures that heat removal capability via RCS loops is retained until decay heat and latent heat are within the capacity of the RHR System.

An OPERABLE RCS loop comprises an OPERABLE RCP and an OPERABLE SG, which has the minimum water level specified in SR 3.4.6.3.

Similarly for the RHR System, an OPERABLE RHR loop comprises an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RCPs and RHR pumps are OPERABLE if they are capable of being powered and are able to provide forced flow if required.

(continued)

BASES (continued)

APPLICABILITY

In MODE 4, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of either RCS or RHR provides sufficient circulation for these purposes. However, two loops consisting of any combination of RCS and RHR loops are required to be OPERABLE to meet single failure considerations.

Operation in other MODES is covered by:

LCO 3.4.4, “RCS Loops - MODES 1 and 2”;

LCO 3.4.5, “RCS Loops - MODE 3”;

LCO 3.4.7, “RCS Loops - MODE 5, Loops Filled”;

LCO 3.4.8, “RCS Loops - MODE 5, Loops Not Filled”;

LCO 3.9.5, “Residual Heat Removal (RHR) and Coolant Circulation - High Water Level” (MODE 6); and

LCO 3.9.6, “Residual Heat Removal (RHR) and Coolant Circulation – Low Water Level” (MODE 6).

ACTIONS

A.1

If only one RCS loop is OPERABLE and both RHR loops are inoperable, redundancy for heat removal is lost~~.~~, and ~~A~~action must be initiated to restore a second RCS or RHR loop to OPERABLE status. If only one RCS loop is OPERABLE and it has been less than seven hours since the unit has entered MODE 3 from MODE 1 or MODE 2, redundancy has been lost and action must be initiated to restore a second RCS loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1

If one required RHR loop is OPERABLE and in operation and there are no RCS loops OPERABLE, an inoperable RCS or RHR loop must be restored to OPERABLE status to provide a redundant means for decay heat removal.

If the parameters that are outside the limits cannot be restored, the plant must be brought to MODE 5 within 24 hours. Bringing the plant to MODE 5 is a conservative action with regard to decay heat removal. With only one required RHR loop OPERABLE, redundancy for decay heat removal is lost and, in the event of a loss of the remaining RHR loop, it would be safer to initiate that loss from MODE 5 (less than or equal to 200°F) rather than MODE 4 (200 to 350°F). The Completion Time of

(continued)

BASES

ACTIONS

B.1 (continued)

24 hours is a reasonable time, based on operating experience, to reach MODE 5 from MODE 4 in an orderly manner and without challenging plant systems.

C.1 and C.2

If one required RCS loop is not in operation, and the RTBs are closed and Rod Control System capable of rod withdrawal, the Required Action is either to restore the required RCS loop to operation or to de-energize all CRDMs by opening the RTBs or de-energizing the motor generator (MG) sets. When the RTBs are in the closed position and Rod Control System capable of rod withdrawal, it is postulated that a power excursion could occur in the event of an inadvertent control rod withdrawal. This mandates having the heat transfer capacity of two RCS loops in operation. If only one loop is in operation, the RTBs must be opened. The Completion Times of 1 hour to restore the required RCS loop to operation or de-energize all CRDMs is adequate to perform these operations in an orderly manner without exposing the unit to risk for an undue time period.

D.1, D.2 and D.3

If no loop is OPERABLE or in operation, all CRDMs must be de-energized by opening the RTBs or de-energizing the MG sets. All operations involving a reduction of RCS boron concentration must be suspended, and action to restore one required RCS or RHR loop to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. Opening the RTBs or de-energizing the MG sets removes the possibility of an inadvertent rod withdrawal. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that two RCS loops are in operation when the rod control system is capable of rod withdrawal. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.6.2

This SR requires verification every 12 hours that one required RCS or RHR loop is in operation when the rod control system is not capable of rod withdrawal. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

SR 3.4.6.3

SR 3.4.6.3 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is greater than or equal to 32% (value does not account for instrument error, Ref. 1). If the SG secondary side narrow range water level is less than 32%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The 12-hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.6.4

Verification that the required pump is OPERABLE ensures that an additional RCS or RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

1. Watts Bar Drawing 1-47W605-242, "Electrical Tech Spec Compliance Tables."

ENCLOSURE 2

ATTACHMENT 3

WBN Unit 1 TS 3.3.2 and TS 3.4.6, Clean-typed

WBN Unit 1 TS 3.3.2, Clean-typed

Table 3.3.2-1 (page 5 of 7)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
6. Auxiliary Feedwater (continued)						
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
d. Loss of Offsite Power	1, 2 ,3	4 per bus	F	Refer to Function 4 of Table 3.3.5-1 for SRs and Allowable Values		
e.. Trip of all Turbine Driven Main Feedwater Pumps	1[i], 2[j]	1 per pump	J	SR 3.3.2.8 SR 3.3.2.9 SR 3.3.2.10	≥ 48 psig	50 psig
f. Auxiliary Feedwater Pumps Train A and B Suction Transfer on Suction Pressure - Low	1, 2, 3, 4[k]	3	B	SR 3.3.2.6 SR 3.3.2.9 SR 3.3.2.10	A) ≥ 0.5 psig B) ≥ 1.33 psig	A) 1.2 psig B) 2.0 psig
7. Automatic Switchover to Containment Sump						
a. Automatic Actuation Logic and Actuation Relays	1, 2, 3, 4	2 trains	C	SR 3.3.2.2 SR 3.3.2.3 SR 3.3.2.5	NA	NA

(continued)

(i) Entry into Condition J may be suspended for up to 4 hours when placing the second Turbine Driven Main Feedwater (TDMFW) Pump in service or removing one of two TDMFW pumps from service.

(j) When one or more Turbine Driven Feedwater Pump(s) are supplying feedwater to steam generators.

(k) When steam generators are relied on for heat removal.

WBN Unit 1 TS 3.4.6, Clean-typed

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.6 RCS Loops - MODE 4

LCO 3.4.6 Two loops shall be OPERABLE, and consist of either:

c. Any combination of RCS loops and residual heat removal (RHR) loops, and one loop shall be in operation, when the rod control system is not capable of rod withdrawal; or

d. Two RCS loops, and both loops shall be in operation, when the rod control system is capable of rod withdrawal.

----------NOTES----------

1. No RCP shall be started with any RCS cold leg temperature ≤ 350ºF unless the secondary side water temperature of each steam generator (SG) is ≤ 50°F above each of the RCS cold leg temperatures.

2. For the initial 7 hours after entry into MODE 3 from MODE 1 or MODE 2, two loops shall consist of:

   a. Two RCS loops with one loop in operation when the rod control system is not capable of rod withdrawal; or

   b. Two RCS loops with both loops in operation when the rod control system is capable of rod withdrawal.

3. Average reactor coolant temperature shall be maintained > 200ºF for the initial 7 hours after entry into MODE 3 from MODE 1 or MODE 2.

APPLICABILITY: MODE 4.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. Only one RCS loop OPERABLE. AND Two RHR loops inoperable. OR Less than 7 hours since entry into MODE 3 from MODE 1 or MODE 2.	A.1	Initiate action to restore a second required RCS or RHR loop to OPERABLE status.	Immediately
E. One required RHR loop inoperable. AND No RCS loops OPERABLE.	B.1	Be in MODE 5.	24 hours
F. One required RCS loop not in operation, and reactor trip breakers closed and Rod Control System capable of rod withdrawal.	C.1	Restore required RCS loop to operation.	1 hour
	OR		
	C.2	De-energize all control rod drive mechanisms (CRDMs).	1 hour
G. Required RCS or RHR loops inoperable. OR No required RCS or RHR loop in operation.	D.1	De-energize all CRDMs.	Immediately
	AND		
	D.2	Suspend all operations involving a reduction of RCS boron concentration.	Immediately
	AND		
	D.3	Initiate action to restore one required loop to OPERABLE status and operation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.6.1	Verify two RCS loops are in operation when the rod control system is capable of rod withdrawal.	12 hours
SR 3.4.6.2	Verify one required RHR or RCS loop is in operation when the rod control system is not capable of rod withdrawal.	12 hours
SR 3.4.6.3	Verify SG secondary side water levels are greater than or equal to 32% narrow range for required RCS loops.	12 hours
SR 3.4.6.4	Verify correct breaker alignment and indicated power are available to the required pump that is not in operation.	7 days

ENCLOSURE 2

ATTACHMENT 4

WBN Unit 1 TS 3.3.2 and TS 3.4.6 Bases, Clean-typed (For Information Only)

WBN Unit 1 TS 3.3.2 Bases, Clean-typed

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

f. Auxiliary Feedwater - Pump Suction Transfer on Suction Pressure - Low

A low pressure signal in the AFW pump suction line protects the AFW pumps against a loss of the normal supply of water for the pumps, the CST. Three pressure switches are located on each motor driven AFW pump suction line from the CST. A low pressure signal sensed by two switches of a set will cause the emergency supply of water for the respective pumps to be aligned. ERCW (safety grade) is then lined up to supply the AFW pumps to ensure an adequate supply of water for the AFW System to maintain at least one of the SGs as the heat sink for reactor decay heat and sensible heat removal.

Since the detectors are located in an area not affected by HELBs or high radiation, they will not experience any adverse environmental conditions and the NTSP reflects only steady state instrument uncertainties.

This Function must be OPERABLE in MODES 1, 2, 3, and 4, when the steam generators are relied on to remove decay heat from the reactor, to ensure a safety grade supply of water for the AFW System to maintain the SGs as the heat sink for the reactor. This Function does not have to be OPERABLE in MODES 5 and 6 because there is not enough heat being generated in the reactor to require the SGs as a heat sink.

(continued)

BASES

ACTIONS (continued)

When the number of inoperable channels in a trip function exceed those specified in one or other related Conditions associated with a trip function, then the unit is outside the safety analysis. Therefore, LCO 3.0.3 should be immediately entered if applicable in the current MODE of operation.

A.1

Condition A applies to all ESFAS protection functions.

Condition A addresses the situation where one or more channels or trains for one or more Functions are inoperable at the same time. The Required Action is to refer to Table 3.3.2-1 and to take the Required Actions for the protection functions affected. The Completion Times are those from the referenced Conditions and Required Actions.

B.1, B.2.1 and B.2.2

Condition B applies to manual initiation of:

- SI;
- Containment Spray;
- Phase A Isolation; and
- Phase B Isolation.

Condition B also applies to the Auxiliary Feedwater Pump Suction Transfer on Suction Pressure - Low.

For the manual initiation Functions, this action addresses the train orientation of the SSPS for the functions listed above. For the AFW System pump suction transfer channels, this action recognizes that placing a failed channel in trip during operation is not necessarily a conservative action. Spurious trip of this function could align the AFW System to a source that is not immediately capable of supporting pump suction. If a channel or train is inoperable, 48 hours is allowed to return it to an OPERABLE status. Note that for containment spray and Phase B isolation, failure of one or both channels in one train renders the train inoperable. Condition B, therefore, encompasses both situations.

(continued)

BASES

ACTIONS

B.1, B.2.1 and B.2.2 (continued)

For the manual initiation Functions, the specified Completion Time is reasonable considering that there are two automatic actuation trains and another manual initiation train OPERABLE for each Function, and the low probability of an event occurring during this interval. For the AFW System pump suction transfer channels, the specified Completion Time is reasonable considering the nature of this Function, the available redundancy, and the low probability of an event occurring during this interval. If the channel or train cannot be restored to OPERABLE status, the plant must be placed in a MODE in which the LCO does not apply. This is done by placing the plant in at least MODE 3 within an additional 6 hours (54 hours total time) and in MODE 5 within an additional 30 hours (84 hours total time). The allowable Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems. For the AFW System pump suction transfer channels, aligning the RHR System for decay heat removal, so that the steam generators are not relied on for heat removal, places the plant in a MODE in which the LCO no longer applies. Therefore, per LCO 3.0.2, completion of the Required Action to place the unit in MODE 5 is not required.

For the manual initiation Functions, the allowance of 48 hours is justified in Reference 7.

(continued)

BASES

ACTIONS (continued)

F.1, F.2.1, and F.2.2

Condition F applies to:

- Manual Initiation of Steam Line Isolation;
- Loss of Offsite Power; and
- P-4 Interlock.

For the Manual Initiation and the P-4 Interlock Functions, this action addresses the train orientation of the SSPS. For the Loss of Offsite Power Function, this action recognizes the lack of manual trip provision for a failed channel. If a train or channel is inoperable, 48 hours is allowed to return it to OPERABLE status. The specified Completion Time is reasonable considering the nature of these Functions, the available redundancy, and the low probability of an event occurring during this interval. If the Function cannot be returned to OPERABLE status, the plant must be placed in MODE 3 within the next 6 hours and MODE 4 within the following 6 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power in an orderly manner and without challenging plant systems. In MODE 4, the plant does not have any analyzed transients or conditions that require the explicit use of the protection functions noted above.

(continued)

WBN Unit 1 TS 3.4.6 Bases, Clean-typed

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.6 RCS Loops - MODE 4

BASES

BACKGROUND

In MODE 4, the primary function of the reactor coolant is the removal of decay heat and the transfer of this heat to either the steam generator (SG) secondary side coolant or the component cooling water via the residual heat removal (RHR) heat exchangers (HXs). The secondary function of the reactor coolant is to act as a carrier for soluble neutron poison, boric acid.

The reactor coolant is circulated through four RCS loops connected in parallel to the reactor vessel, each loop containing an SG, a reactor coolant pump (RCP), and appropriate flow, pressure, level, and temperature instrumentation for control, protection, and indication. The RCPs circulate the coolant through the reactor vessel and SGs at a sufficient rate to ensure proper heat transfer and to prevent boric acid stratification.

In MODE 4, with the reactor trip breakers open and the rods not capable of withdrawal, either RCPs or RHR loops can be used to provide forced circulation. The intent in this case is to provide forced flow from at least one RCP or one RHR loop for decay heat removal and transport. The flow provided by one RCP loop or RHR loop is adequate for decay heat removal. The other intent is to require that two paths be available to provide redundancy for decay heat removal.

In MODE 4, with the reactor trip breakers closed and the rods capable of withdrawal, two RCPs must be OPERABLE and in operation to provide forced circulation.

During a normal shutdown, decay heat removal is via the RCS loops until sometime after the unit has been cooled down to RHR entry conditions (T_{cold} < 350ºF). Therefore, as LCO 3.4.6 becomes Applicable (entry into MODE 4) the RCS loops are still OPERABLE. Transitioning decay heat removal to the RHR System will place high heat loads on the RHR System, Component Cooling System (CCS), and the Essential Raw Cooling Water System (ERCW). Residual and decay heat from the RCS is transferred to CCS via the RHR HX. Heat from the CCS is transferred to the ERCW System via the CCS HXs. The CCS and ERCW systems are common between the two operating units.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

In MODE 4, with the reactor trip breakers open and the rods not capable of withdrawal, RCS circulation is considered in determination of the time available for mitigation of the accidental boron dilution event. The RCS and RHR loops provide this circulation.

Whenever the reactor trip breakers (RTBs) are in the closed position and the control rod drive mechanisms (CRDMs) are energized, an inadvertent rod withdrawal from subcritical, resulting in a power excursion, is possible. Such a transient could be caused by a malfunction of the rod control system. In addition, the possibility of a power excursion due to the ejection of an inserted control rod is possible with the breakers closed or open. Such a transient could be caused by the mechanical failure of a CRDM.

Therefore, in MODE 4 with RTBs in the closed position and Rod Control System capable of rod withdrawal, accidental control rod withdrawal from subcritical is postulated and requires at least two RCS loops to be OPERABLE and in operation to ensure that the accident analyses limits are met. For those conditions when the Rod Control System is not capable of rod withdrawal, any combination of two RCS or RHR loops are required to be OPERABLE, but only one loop is required to be in operation to meet decay heat removal requirements, except during the initial seven hours after unit shutdown, when the decay and latent heat load may exceed the heat removal capability of one RHR loop in operation.

During the initial seven hours after reactor shutdown, the heat loads are at sufficiently high levels that the requirement of LCO 3.4.6 for one RHR loop in operation may not be sufficient to mitigate a design basis accident on Unit 2 and preclude a heatup of Unit 1.

To assure that there would be adequate heat removal capability under all postulated conditions during the initial seven hours after unit shutdown, reliance on heat removal via RCS loops is required. After a unit has been shutdown for greater than seven hours, a single RHR loop in operation provides adequate heat removal capability.

RCS Loops - MODE 4 have been identified in the NRC Policy Statement as important contributors to risk reduction.

(continued)

BASES (continued)

LCO

The purpose of this LCO is to require that at least two loops be OPERABLE. In MODE 4 with the RTBs in the closed position and Rod Control System capable of rod withdrawal, two RCS loops must be OPERABLE and in operation. Two RCS loops are required to be in operation in MODE 4 with RTBs closed and Rod Control System capable of rod withdrawal due to the postulation of a power excursion because of an inadvertent control rod withdrawal. The required number of RCS loops in operation ensures that the Safety Limit criteria will be met for all of the postulated accidents.

With the RTBs in the open position, or the CRDMs de-energized, the Rod Control System is not capable of rod withdrawal; therefore, only one loop in operation is necessary to ensure removal of decay heat from the core and homogenous boron concentration throughout the RCS. In this case, the LCO allows the two loops that are required to be OPERABLE to consist of any combination of RCS loops and RHR loops. An additional loop is required to be OPERABLE to provide redundancy for heat removal.

Note 1 requires that the secondary side water temperature of each SG be $\leq$ 50°F above each of the RCS cold leg temperatures before the start of an RCP with any RCS cold leg temperature less than or equal to 350ºF. This restraint is to prevent a low temperature overpressure event due to a thermal transient when an RCP is started.

Note 2 requires two RCS loops to be OPERABLE during the initial seven hours after entry into MODE 3 from MODE 1 or MODE 2 until decay heat and latent heat are within the capacity of the RHR System.

Note 3 precludes entry into MODE 5 during the initial seven hours after entry into MODE 3 from MODE 2 or MODE 1. This ensures that heat removal capability via RCS loops is retained until decay heat and latent heat are within the capacity of the RHR System.

An OPERABLE RCS loop comprises an OPERABLE RCP and an OPERABLE SG, which has the minimum water level specified in SR 3.4.6.3.

Similarly for the RHR System, an OPERABLE RHR loop comprises an OPERABLE RHR pump capable of providing forced flow to an OPERABLE RHR heat exchanger. RCPs and RHR pumps are OPERABLE if they are capable of being powered and are able to provide forced flow if required.

(continued)

BASES (continued)

APPLICABILITY

In MODE 4, this LCO ensures forced circulation of the reactor coolant to remove decay heat from the core and to provide proper boron mixing. One loop of either RCS or RHR provides sufficient circulation for these purposes. However, two loops consisting of any combination of RCS and RHR loops are required to be OPERABLE to meet single failure considerations.

Operation in other MODES is covered by:

LCO 3.4.4, “RCS Loops - MODES 1 and 2”;

LCO 3.4.5, “RCS Loops - MODE 3”;

LCO 3.4.7, “RCS Loops - MODE 5, Loops Filled”;

LCO 3.4.8, “RCS Loops - MODE 5, Loops Not Filled”;

LCO 3.9.5, “Residual Heat Removal (RHR) and Coolant Circulation - High Water Level” (MODE 6); and

LCO 3.9.6, “Residual Heat Removal (RHR) and Coolant Circulation – Low Water Level” (MODE 6).

ACTIONS

A.1

If only one RCS loop is OPERABLE and both RHR loops are inoperable, redundancy for heat removal is lost, and action must be initiated to restore a second RCS or RHR loop to OPERABLE status. If only one RCS loop is OPERABLE and it has been less than seven hours since the unit has entered MODE 3 from MODE 1 or MODE 2, redundancy has been lost and action must be initiated to restore a second RCS loop to OPERABLE status. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

B.1

If one required RHR loop is OPERABLE and in operation and there are no RCS loops OPERABLE, an inoperable RCS or RHR loop must be restored to OPERABLE status to provide a redundant means for decay heat removal.

If the parameters that are outside the limits cannot be restored, the plant must be brought to MODE 5 within 24 hours. Bringing the plant to MODE 5 is a conservative action with regard to decay heat removal. With only one required RHR loop OPERABLE, redundancy for decay heat removal is lost and, in the event of a loss of the remaining RHR loop, it would be safer to initiate that loss from MODE 5 (less than or equal to 200°F) rather than MODE 4 (200 to 350°F). The Completion Time of

(continued)

BASES

ACTIONS

B.1 (continued)

24 hours is a reasonable time, based on operating experience, to reach MODE 5 from MODE 4 in an orderly manner and without challenging plant systems.

C.1 and C.2

If one required RCS loop is not in operation, and the RTBs are closed and Rod Control System capable of rod withdrawal, the Required Action is either to restore the required RCS loop to operation or to de-energize all CRDMs by opening the RTBs or de-energizing the motor generator (MG) sets. When the RTBs are in the closed position and Rod Control System capable of rod withdrawal, it is postulated that a power excursion could occur in the event of an inadvertent control rod withdrawal. This mandates having the heat transfer capacity of two RCS loops in operation. If only one loop is in operation, the RTBs must be opened. The Completion Times of 1 hour to restore the required RCS loop to operation or de-energize all CRDMs is adequate to perform these operations in an orderly manner without exposing the unit to risk for an undue time period.

D.1, D.2 and D.3

If no loop is OPERABLE or in operation, all CRDMs must be de-energized by opening the RTBs or de-energizing the MG sets. All operations involving a reduction of RCS boron concentration must be suspended, and action to restore one required RCS or RHR loop to OPERABLE status and operation must be initiated. Boron dilution requires forced circulation for proper mixing, and the margin to criticality must not be reduced in this type of operation. Opening the RTBs or de-energizing the MG sets removes the possibility of an inadvertent rod withdrawal. The immediate Completion Times reflect the importance of maintaining operation for decay heat removal. The action to restore must be continued until one loop is restored to OPERABLE status and operation.

SURVEILLANCE REQUIREMENTS

SR 3.4.6.1

This SR requires verification every 12 hours that two RCS loops are in operation when the rod control system is capable of rod withdrawal. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.6.2

This SR requires verification every 12 hours that one required RCS or RHR loop is in operation when the rod control system is not capable of rod withdrawal. Verification includes flow rate, temperature, or pump status monitoring, which help ensure that forced flow is providing heat removal. The Frequency of 12 hours is sufficient considering other indications and alarms available to the operator in the control room to monitor RCS and RHR loop performance.

SR 3.4.6.3

SR 3.4.6.3 requires verification of SG OPERABILITY. SG OPERABILITY is verified by ensuring that the secondary side narrow range water level is greater than or equal to 32% (value does not account for instrument error, Ref. 1). If the SG secondary side narrow range water level is less than 32%, the tubes may become uncovered and the associated loop may not be capable of providing the heat sink necessary for removal of decay heat. The 12-hour Frequency is considered adequate in view of other indications available in the control room to alert the operator to the loss of SG level.

SR 3.4.6.4

Verification that the required pump is OPERABLE ensures that an additional RCS or RHR pump can be placed in operation, if needed, to maintain decay heat removal and reactor coolant circulation. Verification is performed by verifying proper breaker alignment and power available to the required pump. The Frequency of 7 days is considered reasonable in view of other administrative controls available and has been shown to be acceptable by operating experience.

REFERENCES

1. Watts Bar Drawing 1-47W605-242, "Electrical Tech Spec Compliance Tables."