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

CNL-15-121

June 17, 2015

10 CFR 50.36(a)

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

Watts Bar Nuclear Plant, Unit 2
Construction Permit No. CPPR-92
NRC Docket No. 50-391

Subject: **Watts Bar Nuclear Plant Unit 2 - Shutdown Technical Specifications for Component Cooling System and Essential Raw Cooling Water System to Support Dual Unit Operation**

References:

1. Letter from TVA to NRC, "Watts Bar Nuclear Plant, Unit 2 - Technical Specification Section 3.0 and 3.10.1," dated January 22, 2015 [ADAMS Accession No. ML15023A187]

2. Letter from TVA to NRC, "Watts Bar Nuclear Plant - Unit 2 - Final Safety Analysis Report, Amendment 113," dated February 23, 2015 [ADAMS Accession No. ML15069A533]

3. Letter from TVA to NRC, "Watts Bar Nuclear Plant Unit 2 – Submittal of Developmental Revision I of the Unit 2 Technical Specification & Technical Specification Bases and Developmental Revision D of the Unit 2 Technical Requirements Manual and Technical Requirements Manual Bases," dated June 16, 2014 [ADAMS Accession No. ML14169A525

In Reference 1, Tennessee Valley Authority (TVA) submitted a proposed Special Operation Technical Specification (TS) to permit a unit being shutdown to continue to comply with TS when a loss of coolant accident occurs on the other unit. The proposed change was to allow the non-accident unit to return to hot standby (safe shutdown for Watts Bar Nuclear Plant (WBN)) without all Mode Applicability statements being met. Based on discussions with the Nuclear Regulatory Commission (NRC) staff, TVA is withdrawing the Reference 1 TS change. Instead, new TSs for the Component Cooling System (CCS) and the Essential Raw Cooling Water (ERCW) System will define the support needed in the first 48 hours after a unit shutdown, assuming a loss of offsite power and the loss of one train of on-site power.

This letter provides an update to WBN Unit 2 Final Safety Analysis Report (FSAR), Amendment 113, and Developmental Revision I TS and TS Bases. The proposed change would (1) revise FSAR Sections 6.3, 8.3, 9.2.1, and 9.2.2; (2) add new TS 3.7.16, "Component Cooling System (CCS) - Shutdown," and TS 3.7.17, "Essential Raw Cooling Water (ERCW) System - Shutdown," to reflect the increased heat loads on the CCS and the ERCW System that are associated with dual unit operation; and (3) revise TS 5.7.2.18, "Safety Function Determination Program," and the Bases for LCO 3.0.6, "LCO Applicability," consistent with Technical Specification Task Force (TSTF) Traveler TSTF-273-A, Revision 2, regarding loss of power and determination of loss of safety function. These changes have not been the subject of a prior submittal.

Amendment 113 of the WBN Unit 2 FSAR was submitted to the NRC in Reference 2. Developmental Revision I of the WBN Unit 2 TS and TS Bases was submitted to the NRC in Reference 3.

The enclosure provides the rationale for the change. Attachments 1 and 2 provide the proposed new TS 3.7.16 and TS 3.7.17 and associated Bases. Attachments 3 and 4 provide marked-up and clean-typed versions of the proposed changes to TS 5.7.2.18 and the LCO 3.0.6 Bases. Attachment 5 provides the proposed FSAR changes reflecting the increased heat loads on the CCS and the ERCW System that are associated with dual unit operation.

The FSAR changes reflecting the ERCW and CCS alignments required for dual unit operation will be incorporated in FSAR Amendment 114. The changes to add TS 3.7.16 and TS 3.7.17, and the revisions to TS 5.7.2.18 and LCO 3.0.6 Bases will be incorporated in Developmental Revision J of the WBN Unit 2 TS and TS Bases.

There are no new commitments associated with this submittal. Please address any questions regarding this request to Gordon Arent at 423-365-2004.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 17th day of June, 2015.

Respectfully,

J. W. Shea
Vice President, Nuclear Licensing

Enclosure

cc: See Page 3

Enclosure: Watts Bar Nuclear Plant, Unit 2, New Technical Specifications to Support Plant Licensing Basis for Component Cooling System and Essential Raw Cooling Water System

cc (Enclosure):

U.S. Nuclear Regulatory Commission, Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant, Unit 2
NRC Project Manager - Watts Bar Nuclear Plant, Unit 2

ENCLOSURE

EVALUATION OF PROPOSED CHANGES

1.0 SUMMARY DESCRIPTION

A revision is being made to the Watts Bar Nuclear Plant (WBN) Unit 2 Technical Specifications (TS) and TS Bases and to Final Safety Analysis Report (FSAR) to allow operation in accordance with the plant design bases as described in Chapter 9 of the WBN Unit 2 FSAR. In addition, a revision is being made to TS and TS Bases consistent with Technical Specification Task Force (TSTF) Traveler TSTF-273-A, Revision 2, regarding loss of power and determination of loss of safety function.

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 2 TS and TS Bases for CCS and ERCW to support operability of the Residual Heat Removal (RHR) System during the first 48 hours of a Unit 2 shutdown. Decay heat removal by the RHR System is supported by CCS and ERCW.

2.1 Proposed Changes

2.1.1 Component Cooling Water System and Essential Raw Cooling Water System

New TS 3.7.16, “Component Cooling System (CCS) - Shutdown,” is proposed to require two trains of CCS (Train A and Train B) with two Train B CCS pumps to be operable and aligned to the B Train CCS header for the first 48 hours after shutdown, when not complying with TS Required Actions to place the unit in Mode 5. This alignment will support the simultaneous cooldown of both units in the event of a loss of offsite power (LOOP) concurrent with the loss of both Train A or both Train B 6.9 kV shutdown boards.

New TS 3.7.17, “Essential Raw Cooling Water (ERCW) System - Shutdown,” is proposed to require two operable ERCW trains (Train A and Train B) with two operable ERCW pumps per Unit 2 6.9 kV shutdown board. With Unit 2 shutdown less than 48 hours, a third ERCW pump per train must be operable that has the capability to be aligned to its respective Unit 2 6.9 kV shutdown board.

The existing TS 3.7.7, “Component Cooling System (CCS),” and TS 3.7.8, “Essential Raw Cooling Water (ERCW) System,” remain applicable, and are supplemented by the proposed TS 3.7.16 and TS 3.7.17 during the first 48 hours of a shutdown of Unit 2.

2.1.2 TSTF-273-A, Revision 2, Safety Function Determination Program Clarifications

Changes are proposed to limiting condition for operation (LCO) Bases 3.0.6 to provide a clarification of “appropriate LCO for loss of function” and to clarify the requirements in TS 5.7.2.18, “Safety Function Determination Program (SFDP),” that consideration does not have to be made for a loss of power in determining loss of safety function. The proposed changes are taken verbatim from the Technical Specification Task Force (TSTF) Traveler TSTF-273-A, Revision 2, to NUREG-1431, “Standard Technical Specifications, Westinghouse Plants.”

3.0 BACKGROUND

In June 1982, the Nuclear Regulatory Commission (NRC) staff issued a safety evaluation report (Reference 1), regarding TVA's application for licenses to operate WBN Units 1 and 2. When TVA delayed the construction of Unit 2, detailed reviews of the ERCW System and CCS did not need to consider dual unit operation and compliance with GDC 5.

TVA informed the NRC of the plan to reactivate the construction of Unit 2 in 2007 (Reference 2) and subsequently submitted Final Safety Analysis Report (FSAR) amendments reflecting the proposed dual unit operation at the WBN site. In Reference 3, the NRC issued a request for additional information (RAI) with respect to the design and heat removal capability of ERCW and CCS including compliance to GDC 5. TVA responded with the requested information in December 2010 (Reference 4). In the response, TVA stated that the existing eight ERCW pumps would e replaced with new pumps before the dual unit flow balance was performed and that the system had sufficient capacity to supply the normal and accident flows for dual unit operation. TVA provided additional information in support of the NRC review in a letter dated April 13, 2011 (Reference 5). The Reference 5 letter provided information on the heat removal capability of ERCW and CCS, including the heat loads and the flow rates required to remove the specified heat loads. Specific information was provided on the time needed to bring the non-accident unit to cold shutdown assuming a loss of coolant accident (LOCA) on the other unit in conjunction with a LOOP and a single failure of Train A or Train B power. The response also stated that the safe shutdown condition for WBN is Hot Standby.

The NRC documented their review of the ERCW System and CCS for dual unit operation in Supplemental Safety Evaluation Report (SSER) 23 (Reference 6), issued in July 2011. There were two open items related to the design of the ERCW System. Open Item 90 stated that the NRC should verify the dual unit flow balance confirms that the ERCW pumps meet the specified performance requirements including flows that establish conformance with GDC 5. The NRC concluded that the information provided in the two RAI responses (References 4 and 5) established that the ERCW System design met GDC 5. Open Item 91 required TVA to incorporate the information provided in the RAI responses in the FSAR.

In SSER 23, the NRC concluded that the CCS System met GDC 5 requirements based on the information provided in Reference 5. There were no SSER open items related to CCS.

The NRC also reviewed the ultimate heat sink (UHS) for WBN as a shared system. The SSER stated the following: “The NRC staff considers the ability to bring the non-accident unit to cold shutdown within 72 hours to meet ‘the orderly shutdown and cooldown’ requirement of GDC 5. Since the minimum available flow from the Tennessee River is well in excess of the ERCW flow requirement, the staff considers the UHS able to meet the requirements of GDC 5. TVA should clarify FSAR Section 9.2.5 to add the capability of the UHS to bring the non-accident unit to cold shutdown within 72 hours. This is Open Item 66 (Appendix HH)."

TVA provided updated information with respect to the ERCW System and CCS and the heat removal rates in FSAR Amendments 105, 106, 107, 110, and 112, including information requested by the NRC in SSER Open Item 91. The information requested by the NRC in SSER Open Item 66 on the UHS was provided in Unit 2 FSAR Amendment 105. Supplemental Safety Evaluation Report 27 was published in January 2015 (Reference 7), in which the staff closed SSER Open Items 66 and 91.

On June 12, 2014, TVA submitted a response (Reference 8) to an informal RAI from the NRC concerning the alignment of pumps and heat exchangers in ERCW and CCS during dual unit operation for combinations of design basis events and accidents, and shutdown of the non-accident unit. This response provided additional detail on the alignments that the plant would be in for specific combinations of accidents, transients, and plant modes of operation, as requested by the NRC. The response stated that for a limiting event of a LOCA on Unit 1, with Unit 2 on RHR cooling within 48 hours of shutdown and assuming a LOOP and a single failure of a loss of a power train, that Unit 2 may return to Mode 3 from Mode 4 or 5.

In subsequent discussions between the NRC and TVA, it was noted that a unit ascending in operational modes (e.g., to Mode 3 from Mode 4 or 5) with a LOOP and/or a loss of a power train would be an action prohibited by TS. To address this issue, TVA is proposing a TS change to require two CCS pumps powered from Train B and aligned to the Train B CCS header before the unit transfers decay heat removal from the steam generators to the RHR System, such that if a LOOP or a loss of a power train occurs, the unit can continue to be cooled down and not ascend in operational modes. If the required CCS Train B pump realignment cannot be supported, the unit must remain on steam generator cooling for at least 48 hours after shutdown. A second change requires that, with Unit 2 shutdown less than 48 hours, a third ERCW pump per train must be available that can be aligned to its respective Unit 2 6.9 kV shutdown boards (i.e., 6.9 kV Shutdown Board 2A-A or 2B-B).

4.0 TECHNICAL EVALUATION

4.1 Component Cooling Water and Essential Raw Cooling Water

4.1.1 System Description

<u>Residual Heat Removal System</u>

The Unit 2 RHR System consists of two heat exchangers, two pumps, and the associated piping, valves, and instrumentation necessary for operational control. The inlet line to the RHR System is connected to the hot leg of one reactor coolant loop, while the return lines are connected to the hot and cold legs of each of the reactor coolant loops. Those return lines are also the Emergency Core Cooling System (ECCS) low head injection lines.

During RHR System operation, reactor coolant flows from the Reactor Coolant System (RCS) to the RHR pumps, through the tube side of the RHR heat exchangers, and back to the RCS. The heat is transferred to CCS water circulating through the shell side of the RHR heat exchangers.

The RCS cooldown rate is manually controlled by regulating the reactor coolant flow through the tube side of the RHR heat exchangers. A common line containing a flow control valve bypasses both RHR heat exchangers and is used together with each RHR heat exchanger discharge valve to control return flow to the RCS. With both RHR trains in operation, the RHR System is designed to reduce RCS temperature from 350°F to 140°F within 16 hours. With one RHR System train in operation, the RHR System is designed to reduce RCS temperature from 350°F to cold shutdown (200°F) in 32 hours. The RHR System is normally placed in service four hours after reactor shutdown when the RCS is less than or equal to 350°F. The design heat load is based on the decay heat fraction that exists 20 hours after shutdown following an extended period of full power operation. The heat load handled by the RHR System during cooldown includes decay heat, residual component material heat, and reactor coolant pump (RCP) heat.

The RHR System functions in conjunction with the high head portion of the ECCS to provide injection of borated water from the refueling water storage tank (RWST) into the RCS cold legs during the injection phase following a LOCA.

In its capacity as the low head portion of the ECCS, the RHR System provides long term recirculation capability for core cooling following the injection phase of the LOCA. This function is accomplished by aligning the RHR System to take fluid from the containment sump, cool it by circulation through the RHR heat exchangers, and supply it directly to the core, as well as via the centrifugal charging pumps in the Chemical Volume Control System (CVCS) and the safety injection (SI) pumps in the Safety Injection System (SIS).

The Unit 2 Train A and B RHR pumps are powered from 6.9 kV Shutdown Boards 2A-A and 2B-B, respectively. The Unit 1 Train A and B RHR pumps are powered from 6.9 kV Shutdown Boards 1A-A and 1B-B, respectively.

<u>Component Cooling System</u>

The CCS is designed for operation during all phases of plant operation and shutdown. The system serves to remove residual and decay heat from the RCS via the RHR System during plant cool down; cool the spent fuel pool water and the letdown flow of the CVCS; provide cooling to dissipate waste heat from various plant components; and provide cooling for Engineered Safety Feature (ESF) loads after an accident.

The CCS serves as an intermediate loop between the RHR System, CVCS, spent fuel pool cooling system, and the ERCW System. Heat from these systems and other systems described in FSAR Section 9.2.2.1 is transferred by the CCS through the CCS heat exchangers to the ERCW system, which is the heat sink for these heat loads. The intermediate loop provides a double barrier to reduce the possibility of leakage of radioactive water to the environment.

The CCS design is based on a maximum ERCW inlet temperature of 85°F. The ERCW supply from the river is designed to be available under all conditions. The design temperature places no undue limitations on normal plant operation; however, it affects the time required for plant cooldown and the number of CCS heat exchangers in use during the various plant operations.

The CCS is required for post-accident removal of heat from the reactor. Thus, the CCS is designed such that no single active failure can interrupt cooling water to both ESF trains. One ESF train is capable of providing sufficient heat removal capability for maintaining safe shutdown.

The CCS consists of five pumps, three heat exchangers, three headers, and other associated pumps, valves, piping and instrumentation serving both units. CCS is a supporting system to other safe shutdown systems. Two redundant trains per unit are available. For each unit in the normal operation alignment, Train A consists of two CCS pumps and the associated valves, piping, instrumentation and a heat exchanger (Heat Exchanger A for Unit 1 and Heat Exchanger B for Unit 2). Train B is common for both units and consists of one CCS pump and the associated valves, piping, instrumentation and Heat Exchanger C.

Each unit has a CCS pump (1A-A for Unit 1 and 2A-A for Unit 2) that is aligned to the respective unit's Train A header and receives electrical power from Train A. Each unit has another CCS pump (1B-B for Unit 1 and 2B-B for Unit 2) that can be aligned to the respective unit's Train B header and receives electrical power from Train B. These pumps (1B-B and 2B-B) are normally aligned to the Train A piping system for their respective unit. The C-S pump, which normally receives Train B electrical power while serving as the common Train B CCS pump, is capable of being powered from Train A.

During normal full power operation, with all CCS equipment available, CCS pumps 1A-A and 1B-B and Heat Exchanger A are aligned to Unit 1, ESF Train 1A and miscellaneous equipment. CCS pumps 2A-A and 2B-B and Heat Exchanger B are aligned to Unit 2, ESF Train 2A and miscellaneous equipment. CCS pump C-S and Heat Exchanger C are aligned to both Unit 1 ESF Train 1B and Unit 2 ESF Train 2B equipment.

CCS pump 1B-B or CCS pump 2B-B can serve as a replacement or supplement for CCS Pump C-S. CCS pumps 1B-B and 2B-B, when normally aligned, provide backup to the Train A CCS pumps during normal operation to support RCP seal cooling. A specific alignment is proposed using CCS pump 1B-B or 2B-B to address the unlikely scenario of a LOCA occurring on Unit 1 when Unit 2 has been shut down less than 48 hours and is being cooled by the RHR System. The new alignment is described in Section 4.1.2 below.

<u>Essential Raw Cooling Water System</u>

The ERCW System is a safety-related system providing essential auxiliary support functions to the ESF equipment of the plant. The system is designed to supply cooling water to safety and non-safety related equipment. Provisions are made to ensure a continuous flow of cooling water to those systems and components necessary for plant safety either during normal operation or under accident conditions. Sufficient redundancy of piping and components is provided to ensure that cooling is maintained to vital loads at all times.

The ERCW System has eight pumps (four pumps per train). The major heat exchangers cooled by ERCW are the three CCS heat exchangers and four containment spray heat exchangers. Because an accident on both units is not assumed, only two containment spray heat exchangers would be in service at one time. For this submittal, because the loss of a power train is the condition being addressed, only one containment spray heat exchanger would be in service. Sufficient redundancy, separation and independence of piping and components are provided to ensure that cooling is maintained to vital loads at all times despite the occurrence of a random single active failure. A single active failure would not remove more than one supply train per unit (i.e., either headers 1A and 2A or headers 1B and 2B will always remain in service). The ERCW System is sufficiently independent, so that a single active failure of any one component in one train will not preclude safe plant operations of either unit. The safety-related portion of the ERCW System is designed such that total loss of either train, or a LOOP and the loss of an entire plant shutdown power train, will not prevent safe shutdown of either unit under any credible condition. The major heat load on the ERCW System during normal operation, including a unit shut down, is from the CCS heat exchangers. The highest normal operation ERCW System heat load occurs when one or both units are being shut down as RCS decay heat is being removed from the RHR heat exchangers supplied by CCS. If a unit experiences a LOCA, the major heat loads on the ERCW System are the CCS and containment spray heat exchangers associated with the accident unit and the normal heat loads from the other unit.

Table 1 shows the normal RHR System, CCS, and ERCW System pump power alignments to specific 6.9 kV shutdown boards and diesel generators (DGs).

Table 1			
Pump/Power Alignment			
Unit 1		Unit 2	
DG 1A-A	DG 1B-B	DG 2A-A	DG 2B-B
6.9 kV SB 1A-A	6.9 kV SB 1B-B	6.9 kV SB 2A-A	6.9 kV SB 2B-B
RHR Pump 1A-A	RHR Pump 1B-B	RHR Pump 2A-A	RHR Pump 2B-B
CCS Pump 1A-A CCS Pump C-S (alt)	CCS Pump 1B-B	CCS Pump 2A-A	CCS Pump 2B-B CCS Pump C-S (nor)
ERCW Pump A-A ERCW Pump C-A	ERCW Pump E-B ERCW Pump G-B	ERCW Pump B-A ERCW Pump D-A	ERCW Pump F-B ERCW Pump H-B

SB - shutdown board

4.1.2 Postulated GDC 5 Event

New TS 3.7.16 and TS 3.7.17 are being proposed to address a specific low probability of occurrence plant condition associated with CCS and ERCW heat removal capability. The proposed change is being made to address an initial plant condition of Unit 2 being in a shutdown condition for less than 48 hours and either in Mode 4 or Mode 5 with

Unit 1 in Mode 1, 2, or 3 when a LOCA on Unit 1 is assumed to occur. The following discussion provides an example of the limiting case for the above scenario.

The assumption is that Unit 2 has been shut down for less than 48 hours and is in Mode 4 or Mode 5 with cooldown proceeding on the RHR System after extended power operation. A LOCA is assumed to occur on Unit 1, also during an extended period of operation. Concurrent with the LOCA, offsite power is assumed to be lost, and a single failure occurs that results in the loss of an entire train of Class 1E alternating current (AC) power. Therefore, only two 6.9 kV shutdown boards, one associated with each unit, are assumed to be energized and are being powered by the associated DGs.

If the single active failure is the loss of Train B power, RHR Pump 2A-A would be running and circulating RCS water through the Unit 2 Train A RHR heat exchanger. Decay heat removal from Unit 2 would be provided by CCS Pump 2A-A via CCS Heat Exchanger A. ERCW flow to CCS Heat Exchanger A would be provided by two of the four Train A ERCW pumps. Heat removal to the UHS from Unit 1, the LOCA unit, would not begin until switch over from ECCS injection with water provided by the RWST to recirculation from the containment sump. When Unit 1 RHR suction is automatically transferred to the sump, CCS pump 1A-A would provide water to the Unit 1 Train A RHR heat exchanger, with the decay heat removed via CCS Heat Exchanger B. CCS Heat Exchangers A and B are on the same ERCW header and are supplied cooling water by the same ERCW pumps. One of the ERCW pumps is powered by DG 1A-A and the other ERCW pump is powered by DG 2A-A. A short time later, the Unit 1 Train A containment spray pump would be realigned to the containment sump and ERCW flow would be established to the shell side of the Unit 1 Train A containment spray heat exchanger. Because there are two operable CCS pumps supplying CCS heat exchangers being cooled by ERCW, a minimum of 5000 gallons per minute (gpm) of CCS flow could be supplied to the Unit 2 RHR heat exchanger and 5000 gpm could be supplied to the Unit 1 RHR heat exchanger. The normal CCS alignment provides sufficient decay heat removal so that both units may proceed to cold shutdown.

When the assumed single active failure is the loss of Train A power, RHR Pump 2B-B would be circulating RCS water through the Unit 2 Train B RHR heat exchanger. Decay heat removal from Unit 2 is normally provided by CCS Pump C-S using CCS Heat Exchanger C. Heat removal to the UHS from Unit 1, the LOCA unit, would not begin until switch over from ECCS injection using the RWST to recirculation from the containment sump. When Unit 1 RHR suction is automatically transferred to the sump, CCS Pump C-S would provide water to the Unit 1 Train B RHR heat exchanger with the decay heat removed via CCS Heat Exchanger C. Therefore, heat removal from both unit RHR heat exchangers would come from a single CCS pump and heat exchanger. As described in TVA's letter to the NRC on June 12, 2014 (Reference 8), this scenario places too high a demand on CCS, if Unit 2 has not been shutdown for at least 48 hours.

There are two approaches to address the situation. The first approach is to realign CCS Pump 1B-B or 2B-B from the A header to the B header before Unit 2 is cooled down to Mode 4 or Mode 5 within the first 48 hours after shut down. With two CCS pumps on the B header, CCS will supply at least 5000 gpm to the Unit 2 B Train RHR heat exchanger and 5000 gpm to the Unit 1 B Train RHR heat exchanger. When there are two CCS pumps on the B Train CCS header, Unit 2 would not need to return to Mode 3, should a

LOCA occur on Unit 1, and cool down to Mode 5 can continue or be maintained. The second approach is to maintain Unit 2 in Mode 3 or Mode 4 with decay heat being removed through the steam generators for at least 48 hours.

The alignment of either CCS Pump 1B-B or 2B-B to the B Train CCS 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 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 RWST to the containment sump to ensure adequate cooling is maintained. Should a LOCA occur, the C-S pump automatically starts on an 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 should a LOCA occur on one unit when the other unit is being shut down. Once 48 hours has passed since the unit shut down, the requirement to have two pumps aligned to the B CCS header is no longer required to provide sufficient heat removal capability.

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 heat exchanger. A single CCS pump and CCS heat exchanger provides the required heat removal capability.

Once 48 hours has passed after a unit shutdown, the CCS Pump C-S, CCS Heat Exchanger C, and two ERCW pumps provide sufficient heat removal capability that the shutdown unit cooldown can continue and the required heat load from the other unit can be removed assuming a LOCA has occurred, consistent with the safety analysis.

The ERCW System design was based on requiring two ERCW pumps to handle the cooling loads to the UHS for shutting down both units during either normal operation or in the event of a LOCA and the shut down of the non-accident unit. It has been determined, for the specific set of scenarios in this evaluation, that three ERCW pumps will be required if a cool down of the non-accident unit using RHR occurs within the first 48 hours after a shutdown. If Unit 2 has been shut down and is on RHR cooling and a LOCA occurs on Unit 1 concurrent with a LOOP, the total ERCW flow required is approximately 21,850 gpm, assuming Train A power is lost, and approximately 22,400 gpm, assuming Train B power is lost. When Train A power is lost, ERCW is cooling CCS Heat Exchanger C and the Unit 1 Train B containment spray heat exchanger. If the assumed single failure is Train B power, ERCW is cooling CCS Heat Exchangers A and B and the Unit 1 Train A containment spray heat exchanger. The higher heat loads associated with continuing the cool down of the unit that has been shut down for less than 48 hours, combined with the heat removal requirements of the safety analysis for the DBA LOCA via RHR and containment spray, necessitates the use of three ERCW pumps during the initial 48 hour time period. Once Unit 2 has been shut down for 48 hours or more, the total ERCW heat removal and thus, flow requirements, drop below the flowrate provided by two ERCW pumps.

Revised FSAR Sections 9.2.1 and 9.2.2 describing ERCW and CCS, respectively, (Attachment 5) have been updated to include revised two and three pump flow rates and heat removal values consistent with the revised containment analyses and the results of the dual unit flow balance testing.

The plant is designed such that only one ERCW pump is loaded on each 6.9 kV shutdown board and respective DG. However, each 6.9 kV shutdown board and respective DG has sufficient capacity to power two ERCW pumps. During the postulated scenario, Unit 2 is not in an accident. Therefore, the SI pumps and containment spray pumps will not be running and will not be loaded on the Unit 2 DGs. The Unit 2 motor-driven Auxiliary Feedwater (AFW) pumps are not assumed to be running as a result of the event, because Unit 2 is being cooled by RHR. As can be seen in Table 2, the horsepower requirements for one ERCW pump is less than any two of the other three pumps (AFW, containment spray, and SI). Table 3 provides the large motor horsepower loads on each DG for the combinations of a LOCA on one unit with the other unit cooled by RHR, concurrent with a single failure of either Train A or Train B power. Similarly, the total long term steady state DG loading for each combination is provided in Table 3. The load on the DG associated with the unit in shutdown assumes two ERCW pumps and two CCS pumps are being powered, and is lower than the load capability for a DG during a LOCA. Therefore, the DG capacity, as reviewed by the NRC in SSER 23 (Reference 6), is not challenged and remains bounding. Attachment 5 provides an update to FSAR Section 8.3 to denote the addition of the ERCW pump interlock bypass switch and that three ERCW pumps are required for the scenario discussed in this submittal.

The requirement to have two ERCW pumps running on one DG is required for the scenario of a LOCA on one unit and the other unit cooled by RHR within 48 hours of shutdown. The single failure of a loss of a train of power must also occur to require two ERCW pumps to be loaded on a single DG. Other single failures including the loss of a DG or a 6.9 kV shutdown board will not require two ERCW pumps to be loaded on a single DG. For dual unit shutdown cases without a LOCA, two ERCW pumps provide adequate heat removal irrespective of the single failure assumed, because no flow is required to a containment spray heat exchanger.

The ERCW System controls prevent the automatic loading of two ERCW pumps on a single DG. For each of the pairs of ERCW pumps powered from a 6.9 kV shutdown board, a pump selector switch allows the operations staff to choose which of the two pumps to have in service during normal operation. If one ERCW pump is in operation and powered by a DG, there is a second interlock that prevents the second ERCW pump from starting on that DG. These interlocks prevent the DG from being overloaded should an SI signal occur with the associated loading of the ECCS pumps on the DG.

Interlock bypass switches for the ERCW pumps are being added to each 6.9 kV shutdown board. These switches allow the operations staff to start a second ERCW pump on a DG, if necessary. The interlock bypass switches on the Unit 2 6.9 kV shutdown boards would be activated only in the event of a LOCA on Unit 1, concurrent with a LOOP and a single failure that results in the loss of both 6.9 kV shutdown boards on a power train. The only other scenario requiring two ERCW pumps to be loaded on one DG is for a 10CFR50 Appendix R fire. This requires manual operator action that is performed outside of the main control room. The 6.9 kV shutdown boards are located in close proximity to the main control room. A mission dose calculation has been prepared for this action, should it be required when either unit is experiencing a LOCA. The action is required to be performed within approximately 40 minutes from event initiation, when the containment spray pump suction is being transferred from the RWST to the containment sump. The action has been determined to be feasible because the location for the action is close to the main control room, there is adequate time to perform the action, the calculated mission dose is well within the 10 CFR 50, Appendix A, GDC 19 limits, the action will be procedurally controlled, and the environmental factors are acceptable. The activation of the interlock bypass switch does not cause the second ERCW pump to start. The second pump would be started from the main control room.

A design change notice has been issued to install the ERCW pump interlock bypass switches. The design change process also requires revision of the ERCW System Description to include the interlock switches and their post-accident use. When the system description is revised, the design process will also generate or revise the plant procedures that are impacted by the change. Similarly, a design change notice has been issued to revise the CCS design criteria to describe the alignment of a second Train B CCS pump to the CCS Train B header.

Attachment 5 provides a revision to FSAR Section 6.3, “Emergency Core Cooling Systems.” Table 6.3-3 provides the steps taken when the ECCS and containment spray pump suctions are realigned from the RWST to the containment sump. The table also includes the actions taken to provide CCS flow to the RHR heat exchangers and ERCW flow to the CCS and containment spray heat exchangers. The valve actuations, both opening and closing, required for RHR realignment occur automatically. Providing CCS flow to the RHR heat exchanger requires opening valves from the main control room. These actions are unchanged by this proposed amendment request. When there is a LOCA on one unit when the other unit is on RHR cooling but has been shut down for less than 48 hours, concurrent with a LOOP and the loss of Train A power, the operator may need to start the second CCS pump aligned to the CCS Train B header. If CCS Pump 1B-B is the second pump aligned to the B header, and CCS Pump C-S is in service, a main control room operator would need to start the pump. If CCS Pump 2B-B is in service and the CCS Pump C-S is in standby or in the other possible alignments of CCS pumps on the CCS Train B header, operator action would not be required to have two pumps running.

Table 2 - Brake Horsepower	
Pump	Normal / LOCA Brake Horsepower (HP) Calculated
AFW (motor-driven)	600/300
Containment Spray	596
RHR	370/440
SI	460
Centrifugal Charging	532/695
ERCW	805/805
CCS	360/378

Table 3
Summary of Steady-State DG Loading with 3 ERCW Pumps (>20 mins)

Pumps	U1 LOCA / U2 Shutdown / Loss of Train A				U2 LOCA / U1 Shutdown / Loss of Train A				U1 LOCA / U2 Shutdown / Loss of Train B				U2 LOCA / U1 Shutdown / Loss of Train B			
DG	1A	2A	1B	2B	1A	2A	1B	2B	1A	2A	1B	2B	1A	2A	1B	2B
ERCW			805	1610			1610	805	805	1610			1610	805		
CCS			378	720			378	720	378	378			378	378		
AFW (motor-driven)			300					300	300					300		
Containment Spray			596					596	596					596		
Centrifugal Charging			695	532			532	695	695	532			532	695		
SI			460					460	460					460		
RHR			440	370			370	440	440	370			370	440		
Total / Large Motor Load (HP)			3674	3232			2890	4016	3674	2890			2890	3674		
Pressurizer Heaters (kW)				500			500			500			500			
Total DG Loading (kW)			3983	4015			3941	4096	4065	3927			3981	3950		
kVA			4592	4514			4462	4687	4673	4401			4513	4529		

Note: Refer to Table 1 for CCS and ERCW pump power alignments.

4.2 TSTF-273-A, Revision 2

The proposed changes are based on TSTF-273, Revision 2, “SFDP Clarifications.” TSTF-273 changes the limiting condition for operation (LCO) 3.0.6 Bases to provide a clarification of “appropriate LCO for loss of function” and clarifies the requirements in TS 5.7.2.18, “Safety Function Determination Program (SFDP),” so that consideration does not have to be made for a loss of power in determining loss of function. Specifically, the following changes are proposed:

Add discussion to LCO 3.0.6 Bases to clarify when a support system’s TS action requirements provide sufficient remedial measures, so that entry into a supported system’s action requirements is not required, even though the inoperable support system would prevent the supported system from performing its safety function.

Revise the first sentence of the second paragraph of TS 5.7.2.18 by adding the language indicated in bold type face below:

> A loss of safety function exists when, assuming no concurrent single failure, **no concurrent loss of offsite power, or no concurrent loss of onsite diesel generator(s),** a safety function assumed in the accident analysis cannot be performed.

Revise the third paragraph of TS 5.7.2.18 by adding the sentence indicated in bold type face below:

> The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered. **When a loss of safety function is caused by the inoperability of a single Technical Specification support system, the appropriate Conditions and Required Actions to enter are those of the support system.**

Improved Standard Technical Specification (ISTS) LCO 3.0.2 and Unit 2 TS LCO 3.0.2 both require performing applicable required actions upon discovery that the associated LCO is not met. The ISTS and Unit 2 TS definitions of operability both require necessary support systems to be operable in order to consider the supported system operable. Therefore, per LCO 3.0.2 and the definition of operability, when a necessary specified support system is inoperable, the systems it supports are also inoperable and the licensee would be required to implement the applicable required actions of the supported system specifications, as well as those of the support system specification.

However, when a specified support system is inoperable, the ISTS and the Unit 2 TS usually specify sufficient required actions in the support system specification, so that implementation of supported system specification required actions is unnecessary to ensure safety. Because of this, the ISTS and Unit 2 TS contain a general exception to LCO 3.0.2, and do not require entering conditions and required actions of supported system specifications when a specified support system is inoperable (unless otherwise stated in the support system specification). This general exception to LCO 3.0.2 is contained in LCO 3.0.6, which states:

> *When a supported system LCO is not met solely due to a support system LCO not being met, the Conditions and Required Actions associated with this supported system are not required to be entered. Only the support system LCO ACTIONS are required to be entered. This is an exception to LCO 3.0.2 for the supported system. In this event, additional evaluations and limitations may be required in accordance with Specification 5.7.2.18, "Safety Function Determination Program (SFDP)." If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.*
>
> *When a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.*

The required actions for specified support systems, though adequate when no other safety systems are inoperable, usually do not consider the possibility that other specified safety systems (both support and supported) in the redundant train are inoperable. If a system in one train is already inoperable when a support system in the opposite train becomes inoperable, a loss of function condition may exist. Accordingly, LCO 3.0.6 requires an evaluation for this condition in accordance with the SFDP whenever a support system LCO is not met.

TSTF-273 clarified the application of LCO 3.0.6 in the event a certain kind of LCO is not met. Some support systems in TS, such as the RWST and the UHS, lack redundancy and support both trains of several safety systems. Not meeting such LCOs would render the supported systems incapable of fully performing their specified safety functions. In this situation, the SFDP and LCO 3.0.6 could be incorrectly interpreted as requiring implementation of the applicable required actions of all affected supported system specifications. However, in this condition, the intent of LCO 3.0.6 is to only require implementation of the applicable required actions of the support system specification. This is appropriate because the specified action requirements for these kinds of support systems adequately account for the reduced capability of the associated supported systems to perform their specified safety functions. TSTF-273 accomplished this clarification of LCO 3.0.6 with the previously described changes to the Bases for LCO 3.0.6 and TS 5.7.2.18. This clarification of the intent of LCO 3.0.6 is acceptable, because implementing the action requirements for such support systems provides an adequate assurance of safety, which is at least equivalent to that provided by the action requirements for the affected supported systems, and avoids the additional complication of initiating entry into multiple specifications for the inoperability of a single specified support system component.

TSTF-273 also clarified the application of LCO 3.0.6 and TS 5.7.2.18 in the event the AC sources LCO is not met. The required actions for an inoperable offsite or onsite AC source includes checking for a loss of function condition, and specifies appropriate actions to take should a loss of function condition exist. These actions are adequate to address loss of function conditions involving AC sources. Therefore, in such cases, the LCO 3.0.6 check for loss of function is redundant and unnecessary. However, as written, Unit 2 TS 5.7.2.18 can be interpreted as requiring this check even though it is redundant. To preclude this interpretation, TSTF-273 changed TS 5.7.2.18 for the SFDP, as described previously, to explicitly exclude the assumption of a concurrent inoperable AC source from the loss of function definition. This change only clarifies the intent of the existing requirements of the SFDP and LCO 3.0.6. Therefore, it is an administrative change and is acceptable.

There are no differences between the proposed change and the approved traveler and there are no differences between the plant specific justification and the approved traveler justification.

5.0 CONCLUSIONS

The design of the CCS and ERCW System conform to the requirements of GDC 5 for shared safety systems. The new TS 3.7.16, “Component Cooling System (CCS) - Shutdown,” and new TS 3.7.17, “Essential Raw Cooling Water (ERCW) System - Shutdown,” establish alignments for CCS and ERCW that, when Unit 2 has been shut down for 48 hours or less, is on RHR cooling, and the steam generators are not available for decay heat removal, ensure that the unit cool down to Mode 5 can continue, while mitigating a LOCA on Unit 1. The CCS and ERCW Shutdown TS provide the alignments necessary to support a dual unit cool down considering the limiting design basis assumptions for availability of offsite power and postulated single failures consistent with the safety analysis.

6.0 REFERENCES

1. NUREG-0847, “Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Units 1 and 2,” dated June 1982. [ADAMS Accession No. ML072060490]

2. Letter from TVA to NRC, “Watts Bar Nuclear Plant (WBN) - Unit 2 - Reactivation of Construction Activities,” dated August 3, 2007. [ADAMS Accession No. ML072190047]

3. Letter from NRC to TVA, “Watts Bar Nuclear Plant, Unit 2 - Request for Additional Information Regarding Final Safety Analysis Report Amendment Related to Section 9.2 (TAC No. ME4074),” dated September 17, 2010. [ADAMS Accession No. ML102510313]

4. Letter from TVA to NRC, “Watts Bar Nuclear Plant (WBN) Unit 2 - Final Safety Analysis Report (FSAR) - Response to Requests for Additional Information,” dated December 10, 2010. [ADAMS Accession No. ML103480708]

5. Letter from TVA to NRC, “Watts Bar Nuclear Plant (WBN) Unit 2 - Final Safety Analysis Report (FSAR) - Response to Requests for Additional Information (RAIs) Related to FSAR Sections 9.2.1 and 9.2.2,” dated April 13, 2011. [ADAMS Accession No. ML11104A059]

6. NUREG-0847 Supplement 23, “Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant Unit 2,” dated July 2011.

7. NUREG-0847 Supplement 27, “Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant Unit 2,” dated January 2015.

8. Letter from TVA to NRC, “Watts Bar Nuclear Plant, Unit 2 - Request for Additional Information Regarding Final Safety Analysis Report Amendment Related to Section 9.2, Component Cooling System,” dated June 12, 2014.

ENCLOSURE

WATTS BAR NUCLEAR PLANT, UNIT 2

New Technical Specifications to Support Plant Licensing Basis for Component Cooling System and Essential Raw Cooling Water System

ATTACHMENTS

Attachment 1 - WBN Unit 2 TS and TS Bases 3.7.16 CCS-Shutdown

Attachment 2 - WBN Unit 2 TS and TS Bases 3.7.17 ERCW-Shutdown

Attachment 3 - WBN Unit 2 LCO 3.0.6 Bases and TS 5.7.2.18 Safety Function Determination Program, Mark-ups

Attachment 4 - WBN Unit 2 LCO 3.0.6 Bases and TS 5.7.2.18 Safety Function Determination Program, Clean-typed

Attachment 5 - WBN Unit 2 FSAR Changes

ENCLOSURE

ATTACHMENT 1

WBN Unit 2 TS and TS Bases 3.7.16 CCS-Shutdown

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. More than 48 hours after entry into MODE 3 from MODE 1 or 2.
b. When complying with Required Actions to be in MODE 5.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One CCS train inoperable in MODE 4.	A.1 Verify two OPERABLE reactor coolant system (RCS) loops and one RCS loop in operation. <u>AND</u> A.2 Verify T_{avg} > 200ºF.	Once per 12 hours Once per 12 hours
B. One CCS train inoperable in MODE 5.	B.1 Initiate action to restore CCS train 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

BASES

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.

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 2, concurrent with a design basis loss of coolant accident (LOCA) on Unit 1 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 this scenario, CCS Pump C-S would normally be the only pump supplying the Train B header. The Train B header would be supplying both the Unit 1 RHR Train B HX and the Unit 2 RHR Train B HX cooling the recirculating Emergency Core Cooling System (ECCS) water from the containment sump.

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

(continued)

BACKGROUND (continued)

After Unit 2 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 during a normal or post accident cool down and shut down.

The Unit 1 CCS Train A header is not used or required to support Unit 2 operation.

APPLICABLE SAFETY ANALYSES

The CCS functions to cool the unit from RHR entry conditions (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 2, concurrent with a LOCA on Unit 1, 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 2 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 2A-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 2 is shutdown and on RHR cooling, no automatic actuations are required as a DBA on Unit 2, 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

(continued)

BASES

APPLICABILITY (continued)

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 shutdown cooling of Unit 2, concurrent with a design basis LOCA on Unit 1 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 unit shutdown, 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.

Additionally, per LCO 3.0.6 Bases, when operation is being restricted in accordance with ACTIONS of the support system, any resulting temporary loss of redundancy or single failure protection is taken into account. Therefore, postulating the loss of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A is not required when complying with the Required Actions to be in MODE 5, and the requirements for an additional CCS pump aligned to the CCS Train B header is not necessary.

ACTIONS

A.1 and A.2

When one CCS train is inoperable, the associated RHR loop is also inoperable, and redundancy for decay heat removal is lost. In the event the other RHR loop becomes inoperable, the RHR System would be incapable of maintaining the unit in MODE 4. Therefore, in MODE 4, if one CCS train is inoperable, the requirements of LCO 3.4.6, “RCS Loops - MODE 4,” must be met using two OPERABLE reactor coolant system (RCS) loops with one RCS loop in operation to ensure adequate heat removal to maintain the unit in MODE 4.

B.1

In MODE 5, if one CCS train is inoperable, action must be initiated immediately to restore the CCS train to an OPERABLE status to restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for heat removal.

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.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)	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, WBN2-70-4002.

ENCLOSURE

ATTACHMENT 2

WBN Unit 2 TS and TS Bases 3.7.17 ERCW-Shutdown

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 2A-A, and

b. Three ERCW pumps aligned to Train B, including two pumps capable of being powered from 6.9 kV Shutdown Board 2B-B.

APPLICABILITY: MODES 4 and 5.

--NOTE--

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

a. More than 48 hours after entry into MODE 3 from MODE 1 or 2.

b. When complying with Required Actions to be in MODE 5.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ERCW train inoperable in MODE 4.	A.1 Verify two OPERABLE reactor coolant system (RCS) loops and one RCS loop in operation. <u>AND</u> A.2 Verify T_{avg} > 200ºF.	Once per 12 hours Once per 12 hours
B. One ERCW train inoperable in MODE 5.	B.1 Initiate action to restore ERCW train 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 Surveillances 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 hour after a shutdown when the Residual Heat Removal (RHR) System is being used for 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, which are used to cool RHR and the containment spray heat exchangers. The major heat load on the ERCW System when a unit is shut down on RHR is the CCS heat exchanger associated with the train(s) of RHR in service.

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 1 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 2 in on RHR shutdown cooling and has been shut down 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 1 when Unit 2 has been shut down for less than or equal to 48 hours and is utilizing RHR for heat removal.

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

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 the 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 for this evolution 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 85° F occurring simultaneously with maximum heat loads on the system. In the first 48 hours after the shutdown of Unit 2 assuming a DBA LOCA on Unit 1 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 1 while continuing the cooldown of Unit 2.

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 2, concurrent with a LOCA on Unit 1, 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, aligned to separate shutdown boards, are OPERABLE; and

(continued)

LCO (continued)

b. One additional Train A pump and one additional Train B pump are capable of being aligned to their respective Unit 2 6.9 kV shutdown board (2A-A and 2B-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 2 6.9 kV shutdown board (2A-A and 2B-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 2, concurrent with a design basis LOCA on Unit 1 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 unit shutdown, 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.

Additionally, per LCO 3.0.6 Bases, when operation is being restricted in accordance with ACTIONS of the support system, any resulting temporary loss of redundancy or single failure protection is taken into account. Therefore, postulating the loss of Train A power to 6.9 kV Shutdown Boards 1A-A and 2A-A is not required when complying with the Required Actions to be in MODE 5, and the requirements for an additional ERCW pump in each train is not necessary.

ACTIONS

A.1 and A.2

When one ERCW train is inoperable, the associated RHR loop is also inoperable, and redundancy for decay heat removal is lost. In the event the other RHR loop becomes inoperable, the RHR System would be incapable of maintaining the unit in MODE 4. Therefore, in MODE 4, if one ERCW train is inoperable, the requirements of LCO 3.4.6, “RCS Loops - MODE 4,” must be met using two OPERABLE reactor coolant system (RCS) loops with one RCS loop in operation to ensure adequate heat removal to maintain the unit in MODE 4. In addition, in order to ensure the RCS loops remain the principle method of heat removal, T_{avg} is verified to be > 200ºF once per 12 hours. If the unit were allowed to enter MODE 5 (T_{avg} ≤ 200ºF) using RHR cooling and a LOCA occurred on Unit 1, the heat removal capacity of the remaining RHR loop may not be sufficient to maintain the unit in MODE 5, assuming a single failure.

(continued)

ACTIONS (continued)

B.1

In MODE 5, if one ERCW train is inoperable, action must be initiated immediately to restore the ERCW train to an OPERABLE status to restore redundant heat removal paths. The immediate Completion Time reflects the importance of maintaining the availability of two paths for 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 and is consistent with the procedural controls governing pump alignment.

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

ATTACHMENT 3

WBN Unit 2 LCO 3.0.6 Bases and TS 5.7.2.18, Safety Function Determination Program, Mark-ups

5.7 Procedures, Programs, and Manuals

5.7.2.16 Diesel Fuel Oil Testing Program (continued)

b. Other properties for ASTM 2D fuel oil are within limits within 31 days following sampling and addition to the 7 day storage tanks; and

c. Total particulate concentration of the fuel oil in each of the four interconnected tanks which constitute a 7 day storage tank is ≤ 10 mg/l when tested every 31 days in accordance with ASTM D-2276, Method A-2 or A-3.

5.7.2.17 (removed from Technical Specifications)

5.7.2.18 Safety Function Determination Program (SFDP)

This program ensures loss of safety function is detected and appropriate actions taken. Upon entry into LCO 3.0.6, an evaluation shall be made to determine if loss of safety function exists. Additionally, other appropriate actions may be taken as a result of the support system inoperability and corresponding exception to entering supported system Condition and Required Actions. This program implements the requirements of LCO 3.0.6. The SFDP shall contain the following:

a. Provisions for cross train checks to ensure a loss of the capability to perform the safety function assumed in the accident analysis does not go undetected;

b. Provisions for ensuring the plant is maintained in a safe condition if a loss of function condition exists;

c. Provisions to ensure that an inoperable supported system's Completion Time is not inappropriately extended as a result of multiple support system inoperabilities; and

d. Other appropriate limitations and remedial or compensatory actions.

(continued)

5.7 Procedures, Programs, and Manuals

5.7.2.18 Safety Function Determination Program (SFDP) (continued)

A loss of safety function exists when, assuming no concurrent single failure, no concurrent loss of offsite power, or no concurrent loss of onsite diesel generator(s), a safety function assumed in the accident analysis cannot be performed. For the purpose of this program, a loss of safety function may exist when a support system is inoperable, and:

a. A required system redundant to the system(s) supported by the inoperable support system is also inoperable; or

b. A required system redundant to the system(s) in turn supported by the inoperable supported system is also inoperable; or

c. A required system redundant to the support system(s) for the supported systems (a) and (b) above is also inoperable.

The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered. When a loss of safety function is caused by the inoperability of a single Technical Specification support system, the appropriate Conditions and Required Actions to enter are those of the support system.

5.7.2.19 Containment Leakage Rate Testing Program

A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50 Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide (RG) 1.163, “Performance-Based Containment Leak-Test Program,” dated September 1995.

The peak calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 15.0 psig.

The maximum allowable containment leakage rate, L_a, at P_a, is 0.25% of the primary containment air weight per day.

(continued)

LCO 3.0.5

LCO 3.0.5 establishes the allowance for restoring equipment to service under administrative controls when it has been removed from service or declared inoperable to comply with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 (e.g., to not comply with the applicable Required Action(s)) to allow the performance of SRs to demonstrate:

a. The OPERABILITY of the equipment being returned to service; or

b. The OPERABILITY of other equipment.

The administrative controls ensure the time the equipment is returned to service in conflict with the requirements of the ACTIONS is limited to the time absolutely necessary to perform the allowed SRs. This Specification does not provide time to perform any other preventive or corrective maintenance.

An example of demonstrating the OPERABILITY of the equipment being returned to service is reopening a containment isolation valve that has been closed to comply with Required Actions and must be reopened to perform the SRs.

An example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to prevent the trip function from occurring during the performance of an SR on another channel in the other trip system. A similar example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to permit the logic to function and indicate the appropriate response during the performance of an SR on another channel in the same trip system.

LCO 3.0.6

LCO 3.0.6 establishes an exception to LCO 3.0.2 for support systems that have an LCO specified in the Technical Specifications (TS). This exception is provided because LCO 3.0.2 would require that the Conditions and Required Actions of the associated inoperable supported system LCO be entered solely due to the inoperability of the support system. This exception is justified because the actions that are required to ensure the unit is maintained in a safe condition are specified in the support system LCO's Required Actions. These Required Actions may include entering the supported system's Conditions and Required Actions or may specify other Required Actions.

(continued)

LCO 3.0.6 (continued)

When a support system is inoperable and there is an LCO specified for it in the TS, the supported system(s) are required to be declared inoperable if determined to be inoperable as a result of the support system inoperability. However, it is not necessary to enter into the supported systems' Conditions and Required Actions unless directed to do so by the support system's Required Actions. The potential confusion and inconsistency of requirements related to the entry into multiple support and supported systems' LCOs' Conditions and Required Actions are eliminated by providing all the actions that are necessary to ensure the unit is maintained in a safe condition in the support system's Required Actions.

However, there are instances where a support system's Required Action may either direct a supported system to be declared inoperable or direct entry into Conditions and Required Actions for the supported system. This may occur immediately or after some specified delay to perform some other Required Action. Regardless of whether it is immediate or after some delay, when a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

Specification 5.7.2.18, "Safety Function Determination Program (SFDP)," ensures loss of safety function is detected and appropriate actions are taken. Upon entry into LCO 3.0.6, an evaluation shall be made to determine if loss of safety function exists. Additionally, other limitations, remedial actions, or compensatory actions may be identified as a result of the support system inoperability and corresponding exception to entering supported system Conditions and Required Actions. The SFDP implements the requirements of LCO 3.0.6.

Cross train checks to identify a loss of safety function for those support systems that support multiple and redundant safety systems are required. The cross train check verifies that the supported systems of the redundant OPERABLE support system are OPERABLE, thereby ensuring safety function is retained. If this evaluation determines that a loss of safety function exists, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

<u>This loss of safety function does not require the assumption of additional single failures or loss of offsite power. Since operation is being restricted in accordance with the ACTIONS of the support system, any resulting temporary loss of redundancy or single failure protection is taken into</u>

(continued)

LCO 3.0.6 (continued)

account. Similarly, the ACTIONS for inoperable offsite circuit(s) and inoperable diesel generator(s) provide the necessary restriction for cross train inoperabilities. This explicit cross train verification for inoperable AC electrical power sources also acknowledges that supported system(s) are not declared inoperable solely as a result of inoperability of a normal or emergency electrical power source (refer to the definition of OPERABILITY).

When a loss of safety function is determined to exist, and the SFDP requires entry into the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists, consideration must be given to the specific type of function affected. Where a loss of function is solely due to a single Technical Specification support system (e.g., loss of automatic start due to inoperable instrumentation, or loss of pump suction source due to low tank level) the appropriate LCO is the LCO for the support system. The ACTIONS for a support system LCO adequately addresses the inoperabilities of that system without reliance on entering its supported system LCO. When the loss of function is the result of multiple support systems, the appropriate LCO is the LCO for the supported system.

LCO 3.0.7

There are certain special tests and operations required to be performed at various times over the life of the plant. These special tests and operations are necessary to demonstrate select plant performance characteristics, to perform special maintenance activities, and to perform special evolutions.

Test Exception LCOs 3.1.9 and 3.1.10 allow specified Technical Specification (TS) requirements to be changed to permit performances of these special tests and operations, which otherwise could not be performed if required to comply with the requirements of these TS. Unless otherwise specified, all the other TS requirements remain unchanged. This will ensure all appropriate requirements of the MODE or other specified condition not directly associated with or required to be changed to perform the special test or operation will remain in effect.

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

ENCLOSURE

ATTACHMENT 4

WBN Unit 2 LCO 3.0.6 Bases and TS 5.7.2.18, Safety Function Determination Program, Clean-typed

5.7 Procedures, Programs, and Manuals

5.7.2.16 Diesel Fuel Oil Testing Program (continued)

b. Other properties for ASTM 2D fuel oil are within limits within 31 days following sampling and addition to the 7 day storage tanks; and

c. Total particulate concentration of the fuel oil in each of the four interconnected tanks which constitute a 7 day storage tank is ≤ 10 mg/l when tested every 31 days in accordance with ASTM D-2276, Method A-2 or A-3.

5.7.2.17 (removed from Technical Specifications)

5.7.2.18 Safety Function Determination Program (SFDP)

This program ensures loss of safety function is detected and appropriate actions taken. Upon entry into LCO 3.0.6, an evaluation shall be made to determine if loss of safety function exists. Additionally, other appropriate actions may be taken as a result of the support system inoperability and corresponding exception to entering supported system Condition and Required Actions. This program implements the requirements of LCO 3.0.6. The SFDP shall contain the following:

a. Provisions for cross train checks to ensure a loss of the capability to perform the safety function assumed in the accident analysis does not go undetected;

b. Provisions for ensuring the plant is maintained in a safe condition if a loss of function condition exists;

c. Provisions to ensure that an inoperable supported system's Completion Time is not inappropriately extended as a result of multiple support system inoperabilities; and

d. Other appropriate limitations and remedial or compensatory actions.

(continued)

5.7 Procedures, Programs, and Manuals

5.7.2.18 Safety Function Determination Program (SFDP) (continued)

A loss of safety function exists when, assuming no concurrent single failure, no concurrent loss of offsite power, or no concurrent loss of onsite diesel generator(s), a safety function assumed in the accident analysis cannot be performed. For the purpose of this program, a loss of safety function may exist when a support system is inoperable, and:

a. A required system redundant to the system(s) supported by the inoperable support system is also inoperable; or

b. A required system redundant to the system(s) in turn supported by the inoperable supported system is also inoperable; or

c. A required system redundant to the support system(s) for the supported systems (a) and (b) above is also inoperable.

The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered. When a loss of safety function is caused by the inoperability of a single Technical Specification support system, the appropriate Conditions and Required Actions to enter are those of the support system.

5.7.2.19 Containment Leakage Rate Testing Program

A program shall be established to implement the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50 Appendix J, Option B, as modified by approved exemptions. This program shall be in accordance with the guidelines contained in Regulatory Guide (RG) 1.163, “Performance-Based Containment Leak-Test Program,” dated September 1995.

The peak calculated containment internal pressure for the design basis loss of coolant accident, P_a, is 15.0 psig.

The maximum allowable containment leakage rate, L_a, at P_a, is 0.25% of the primary containment air weight per day.

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LCO 3.0.5

LCO 3.0.5 establishes the allowance for restoring equipment to service under administrative controls when it has been removed from service or declared inoperable to comply with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 (e.g., to not comply with the applicable Required Action(s)) to allow the performance of SRs to demonstrate:

a. The OPERABILITY of the equipment being returned to service; or

b. The OPERABILITY of other equipment.

The administrative controls ensure the time the equipment is returned to service in conflict with the requirements of the ACTIONS is limited to the time absolutely necessary to perform the allowed SRs. This Specification does not provide time to perform any other preventive or corrective maintenance.

An example of demonstrating the OPERABILITY of the equipment being returned to service is reopening a containment isolation valve that has been closed to comply with Required Actions and must be reopened to perform the SRs.

An example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to prevent the trip function from occurring during the performance of an SR on another channel in the other trip system. A similar example of demonstrating the OPERABILITY of other equipment is taking an inoperable channel or trip system out of the tripped condition to permit the logic to function and indicate the appropriate response during the performance of an SR on another channel in the same trip system.

LCO 3.0.6

LCO 3.0.6 establishes an exception to LCO 3.0.2 for support systems that have an LCO specified in the Technical Specifications (TS). This exception is provided because LCO 3.0.2 would require that the Conditions and Required Actions of the associated inoperable supported system LCO be entered solely due to the inoperability of the support system. This exception is justified because the actions that are required to ensure the unit is maintained in a safe condition are specified in the support system LCO's Required Actions. These Required Actions may include entering the supported system's Conditions and Required Actions or may specify other Required Actions.

(continued)

LCO 3.0.6 (continued)

When a support system is inoperable and there is an LCO specified for it in the TS, the supported system(s) are required to be declared inoperable if determined to be inoperable as a result of the support system inoperability. However, it is not necessary to enter into the supported systems' Conditions and Required Actions unless directed to do so by the support system's Required Actions. The potential confusion and inconsistency of requirements related to the entry into multiple support and supported systems' LCOs' Conditions and Required Actions are eliminated by providing all the actions that are necessary to ensure the unit is maintained in a safe condition in the support system's Required Actions.

However, there are instances where a support system's Required Action may either direct a supported system to be declared inoperable or direct entry into Conditions and Required Actions for the supported system. This may occur immediately or after some specified delay to perform some other Required Action. Regardless of whether it is immediate or after some delay, when a support system's Required Action directs a supported system to be declared inoperable or directs entry into Conditions and Required Actions for a supported system, the applicable Conditions and Required Actions shall be entered in accordance with LCO 3.0.2.

Specification 5.7.2.18, "Safety Function Determination Program (SFDP)," ensures loss of safety function is detected and appropriate actions are taken. Upon entry into LCO 3.0.6, an evaluation shall be made to determine if loss of safety function exists. Additionally, other limitations, remedial actions, or compensatory actions may be identified as a result of the support system inoperability and corresponding exception to entering supported system Conditions and Required Actions. The SFDP implements the requirements of LCO 3.0.6.

Cross train checks to identify a loss of safety function for those support systems that support multiple and redundant safety systems are required. The cross train check verifies that the supported systems of the redundant OPERABLE support system are OPERABLE, thereby ensuring safety function is retained. If this evaluation determines that a loss of safety function exists, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered.

This loss of safety function does not require the assumption of additional single failures or loss of offsite power. Since operation is being restricted in accordance with the ACTIONS of the support system, any resulting temporary loss of redundancy or single failure protection is taken into

(continued)

LCO 3.0.6 (continued)

account. Similarly, the ACTIONS for inoperable offsite circuit(s) and inoperable diesel generator(s) provide the necessary restriction for cross train inoperabilities. This explicit cross train verification for inoperable AC electrical power sources also acknowledges that supported system(s) are not declared inoperable solely as a result of inoperability of a normal or emergency electrical power source (refer to the definition of OPERABILITY).

When a loss of safety function is determined to exist, and the SFDP requires entry into the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists, consideration must be given to the specific type of function affected. Where a loss of function is solely due to a single Technical Specification support system (e.g., loss of automatic start due to inoperable instrumentation, or loss of pump suction source due to low tank level) the appropriate LCO is the LCO for the support system. The ACTIONS for a support system LCO adequately addresses the inoperabilities of that system without reliance on entering its supported system LCO. When the loss of function is the result of multiple support systems, the appropriate LCO is the LCO for the supported system.

LCO 3.0.7

There are certain special tests and operations required to be performed at various times over the life of the plant. These special tests and operations are necessary to demonstrate select plant performance characteristics, to perform special maintenance activities, and to perform special evolutions.

Test Exception LCOs 3.1.9 and 3.1.10 allow specified Technical Specification (TS) requirements to be changed to permit performances of these special tests and operations, which otherwise could not be performed if required to comply with the requirements of these TS. Unless otherwise specified, all the other TS requirements remain unchanged. This will ensure all appropriate requirements of the MODE or other specified condition not directly associated with or required to be changed to perform the special test or operation will remain in effect. The Applicability of a Test Exception LCO represents a condition not necessarily in compliance with the normal requirements of the TS. Compliance with Test Exception LCOs is optional. A special operation may be performed either under the provisions of the appropriate Test Exception LCO or under the other applicable TS requirements. If it is desired to perform the special operation under the provisions of the Test Exception LCO, the requirements of the Test Exception LCO shall be followed.

ENCLOSURE

ATTACHMENT 5

WBN Unit 2 FSAR Changes

The net positive suction head for the safety injection pumps and the centrifugal charging pumps is evaluated for both the injection and recirculation modes of operation for the design basis accident. The end of the injection mode of operation gives the limiting net positive suction head available. The net positive suction head available is determined from the elevation head and vapor pressure of the water in the RWST, which is at atmospheric pressure, and the pressure drop in the suction piping from the tank to the pumps. At the end of the injection mode when suction from the RWST is terminated, adequate net positive suction head is supplied from the containment sump by the booster action of the low head pumps. The net positive suction head evaluation is based on all pumps operating at the maximum design flow rates. The head-capacity curve for the safety injection pumps is given in Figure 6.3-3. The head-capacity curve for the charging pumps is given in Figure 6.3-4. Available NPSH parameters are given in Table 6.3-12.

6.3.2.15 Control of Motor-Operated Isolation Valves

The cold leg accumulator (CLA) valves are opened and their power removed prior to RCS pressure exceeding 1000 psig. This action assures that the CLAs are available for all plant operating conditions in which passive CLA discharge is required for accident mitigation. Power is removed by opening a shunt trip breaker, allowing the control circuit and indication to remain functional. The interlock for the CLA accumulator discharge valves to open upon receipt of the safety injection or P-11 signal remains from the original design, but this control function is obviated by removal of power and is no longer required for the accumulators to perform their safety function. A main control room alarm is actuated if any of the CLA valves are not fully open and the RCS pressure is above the P-11 permissive setpoint. A further discussion of these valves is given in Section 6.3.5.5.

6.3.2.16 Motor-Operated Valves and Controls

Certain remotely operated valves for the injection mode which are under manual control (i.e., critical valves normally in the ready position not requiring an SIS signal) have an audible alarm which is sounded in the main control room if a valve is not in the ready position for injection.

Replace with "to support"

6.3.2.17 Manual Actions

No manual actions are required during the injection phase. The only actions required by the operator for proper ECCS operation following injection are those required to realign the system for cold leg recirculation and, approximately 3 hours after event initiation, its hot leg recirculation mode of operation.

Replace with "during"

6.3.2.18 Process Instrumentation

Process instrumentation available to the operator in the control room to assist in assessing post LOCA conditions are tabulated in Section 7.5.

Incorporate the insert from the following page

Table 6.3-3 Sequence Of Change-Over Operation, Injection To Recirculation (Page 1 of 2)

The following automatic phase of switchover from the injection to the recirculation mode is initiated when the RWST is at low level and the containment sump level has risen to its level switch actuation point. (Westinghouse flow diagram valve numbers are shown in brackets.) The component cooling water isolation valve to each RHR heat exchanger (FCV 70-153, -156) is opened during this switchover or immediately thereafter.

1. The valves that admit suction from the containment sump to the RHR pumps (FCV 63-72 & 73) open while the RHR pumps continue to run. [8811A and B]
2. The valves that were open and permitting suction for the RHR pumps to be taken from the RWST (FCV 74-3 & -21) start to close when the valves in Step 1 start to open. [8700A and B]

The manual operations below are accomplished following the automatic switchover phase.

1. Verify completion of the automatic valve realignments above. If an RHR pump has failed to switchover to the sump, stop that pump.
2. Verify SIP flow to the RCS (e.g., large break case) and close the three safety injection pump miniflow valves (FCV 63-3, -4, -175). [8811, 8920, 8813]
3. Close the two valves in the crossover line downstream of the RHR heat exchangers (FCV 74-33, -35). [8716A and B]
4. Open the two parallel valves in the common suction line between the charging pump suction and the safety injection pump suction (FCV 63-6, -7). [8807A and B] Ensure FCV-63-177 is open [8924].
5. Open the valve in the line from the train A RHR pump discharge to the charging pump suction (FCV 63-8) and the valve in the line from the train B RHR pump discharge to the safety injection pump suction (FCV 63-11). [8804A and B]
6. Reset the SIS actuation signal and close the two parallel valves in the line from the RWST to the charging pump suction (FCV 62-135, -136). [LCV-112D and E] Place corresponding valve handswitches in A-Auto.
7. Close the valve in the line from the RWST to the safety injection pump suction (FCV 63-5). [8806]
8. Restore power and close the valve in the common line from the RWST to both RHR pumps (FCV 63-1). [8812]

Upon reaching the RWST low-low level setpoint, as indicated on the qualified PAM indicator channels, the operator shall realign the containment spray system. The following steps are required for the realignment of the containment spray system from the injection to the recirculation mode.

First, reset containment spray actuation signal.

Delete

1. Stop both containment spray pumps ("pull to lock in stop" to preclude the possibility of pump restart while realigning suction valves).
2. Close the spray pump/RWST isolation valve at the suction of each containment spray pump (FCV 72-22 and -21). [9017A and B]
3. Open the essential raw cooling water isolation valves to each containment spray heat exchanger (FCV 67-125, -126, -123, -124).
4. Open the sump isolation valve at the suction of each containment spray pump (FCV 72-44 and -45) after the valves in Step 2 have completed their travel. [9020A and B]

Insert the following into the previous page

The following steps are performed while the ECCS is in the injection mode in preparation for the recirculation mode:

1 Prepare ERCW for recirculation mode by:

   a. Position the "CCS HX A OUTLET ERCW FLOW CNTL" valve (1-FCV-67-146) to Position A or B (as appropriate)
   b. Close the "CCS HX A OUTLET ERCW FLOW CNTL BYP" valve (1-FCV-67-143)
   c. Position the "CCS HX B OUTLET ERCW FLOW CNTL" valve (2-FCV-67-146) to Position A or B (as appropriate)
   d. Close the "CCS HX B OUTLET ERCW FLOW CNTL BYP" valve (2-FCV-67-143)
   e. Position the "CCS HX C OUTLET ERCW FLOW CNT" valve (0-FCV-67-152) to Position A or B (as appropriate)
   f. Close the "CCS HX C OUTLET ERCW FLOW CNTL BYP" valve (0-FCV-67-144)
   g. Open the "CNTMT SPRAY HX 1(2)A INLET" (1(2)-FCV-67-125) and "CNTMT SPRAY HX 1(2)A RETURN" (1(2)-FCV-67-126) valves
   h. Open the "CNTMT SPRAY HX 1(2)B INLET" (1(2)-FCV-67-123) and "CNTMT SPRAY HX 1(2)B RETURN" (1(2)-FCV-67-124) valves
   i. Bypass ERCW Pump Lockout for ERCW pumps powered by diesel generators associated with the non-accident unit.
   j. Ensure two ERCW pumps are running on each train.
   k. If available, start a third ERCW pump on each train.

Replace with Insert A

2. Prepare CCS for recirculation mode by:

   a. Ensure RHR HX 1(2)A OUTLET 1(2)-FCV-70-156 valve(s) are open.
   b. Ensure RHR HX 1(2)B OUTLET 1(2)-FCV-70-153 valve is throttled to 5,000 gpm on Accident Unit.
   c. If the non-accident is using RHR, while maintaining at least 5,000 gpm CCS flow to the RHR HX on the Accident Unit, ensure the Non-Accident Unit RHR HX 1(2)B OUTLET 1(2)-FCV-70-153 valve is throttled to approximately 2,725 gpm (or whatever is achievable).
   d. Start all available CCS pumps.
   e. For a LOCA on Unit 1 Only, if both CCS pumps 1A-A and 1B-B (aligned to CCS Header 1A) are not running, close SFP HEAT EXCHANGER A CCS SUPPLY (0-FCV-70-197)

INSERT A

2. Prepare CCS for recirculation mode by:

   a. Start all available CCS pumps.

   b. Ensure RHR HX 1(2)A OUTLET 1(2)-FCV-70-156 valve(s) are open.

   c. Ensure RHR HX 1(2)B OUTLET 1(2)-FCV-70-153 valve is throttled to 5,000 gpm on Accident Unit.

   d1. If the non-accident is using RHR and with only one (1) CCS pump supplying CCS HX C, while maintaining at least 5,000 gpm CCS flow to the RHR HX on the Accident Unit, ensure the Non-Accident Unit RHR HX 1(2)B OUTLET 1(2)-FCV-70-153 valve is throttled to approximately 2,725 gpm (or whatever is achievable).

   d2. If the non-accident is using RHR and with two (2) CCS pumps supplying CCS HX C, while maintaining at least 5,000 gpm CCS flow to the RHR HX on the Accident Unit, ensure the Non-Accident Unit RHR HX 1(2)B OUTLET 1(2)-FCV-70-153 valve is throttled to approximately 5,000 gpm.

   e. For a LOCA on Unit 1 Only, if both CCS pumps 1A-A and 1B-B (aligned to CCS Header 1A) are not running, close SFP HEAT EXCHANGER A CCS SUPPLY (0-FCV-70-197) because it is large enough to enable early detection and low enough to prevent excessive damage before fault clearing by the feeder breaker.

The diesel generator is 6900V, 3-phase, wye-connected with the neutral grounded through a relatively high ohmic resistance to keep ground fault currents to a low level. The maximum ground fault current available from the diesel generator is approximately 8 amperes. Ground faults are detected by a voltage relay across the neutral grounding resistor. Grounds cause an alarm but do not cause any breaker operation.

The Class 1E 480V systems are supplied through Δ-Δ transformers that are not grounded. This permits minimum disturbance to service continuity. Ground detectors are provided on each 480V load center to indicate the presence of a grounded-phase conductor. No ground fault relaying was required since there would be only a very small current flowing to a single-line-to-ground fault. A ground fault on more than one phase is a line-to-line fault and will trip the feeder breakers of the faulted circuits.

Sharing of the AC Distribution Systems and Standby Power Supplies

The onsite ac power distribution system for Watts Bar Nuclear Plant is divided into two divisions or trains in each unit (A and B). Each power train is made up of a 6900V switchgear (6900V shutdown board), 480V power transformers and switchgear, and 480V motor control centers. Each power train, through its 6900V shutdown board, has power connections to a unit generator, both offsite power circuits, and a dedicated diesel generator. Except for the offsite (preferred) power supplies, there are no ac power connections between the onsite power trains within a unit or between the two units.

with one exception:

Safety systems that are shared between the two Watts Bar units are discussed in Section 3.1.2 under Criterion 5 (GDC-5) - Compliance. Therefore, there are electric motors powered by the onsite distribution system of one unit that drive safety-related machinery (i.e. essential raw cooling water pumps, component cooling system pumps) required for safe shutdown of the other unit. For example, the ERCW system is arranged in two headers (trains) each serving certain components in each unit (see Section 9.2.1.2). There are eight ERCW pumps arranged electrically so that two pumps are fed from each shutdown board (1A-A, 1B-B, 2A-A, 2B-B). Only one pump per board can be automatically loaded on a DGU at any one time. The pumps supplied from the 'A' boards pump into the 'A' train header and likewise the 'B' pumps. The minimum combined safety requirements for one 'accident' unit and one 'non-accident' unit are met by only two pumps on one header (train).

If one unit is on RHR cooling and has been shutdown for not more than 48 hours, and a LOCA occurs on the other unit with a concurrent loss of offsite power, the loss of one train as a single failure would require that three ERCW pumps be powered from the remaining train to provide the required heat removal. Therefore control features are provided to allow the manual loading of a second ERCW pump on each diesel generator when a unit is in a shutdown condition.

8.3.1.2 Analysis

8.3.1.2.1 Standby AC Power S

The standby ac power s ... forth in GDC 17 and 18. The d ... 1.9 R3 and IEEE Std 308-1971 ... ements.

(1) Containment spray heat exchangers 1A, 1B, 2A, and 2B are supplied from ERCW headers 1A, 1B, 2A and 2B, respectively.

(2) The normal supply for both Train A diesel generators is from header 1A, although a backup source from header 2B is also provided. The normal supply for both Train B diesel generators is from header 1B with a backup supply from header 2A.

(3) The normal supply for component cooling heat exchangers A, B, and C is from ERCW header 2A, 2A, and 2B, respectively. However, interconnections between headers 1B and 2A, and between 1A and 2B have been incorporated to permit alternate supplies.

(4) Each header provides ERCW to its corresponding Main Control Room and Control Building electrical board room air-conditioning chillers, the Auxiliary Building ventilation coolers for ESF equipment, the containment ventilation coolers, the RCP motor coolers, the CRDM vent coolers, and the containment instrument room air conditioning water chillers (i.e., header 1A and 2A supply Train A equipment header 1B and 2B supply Train B equipment, etc.).

Insert "air"

(5) Headers 1A and 1B provide a normal and backup source of cooling water for the station air compressors. For the auxiliary control air compressors there is one compressor on header 1A and one on header 2B.

(6) Under flood conditions, the ERCW system provides water to the spent fuel pool heat exchangers, reactor coolant pump thermal barrier, ice machine refrigeration condensers, and under certain conditions, residual heat removal heat exchangers and sample system heat exchangers (refer to Section 2.4.14) using spool piece inter-ties.

(7) In the event of a need to supply ERCW to the auxiliary feedwater system, when the normal supply of water is not available from the condensate storage tank, discharge headers A and B automatically provide an emergency water supply to the motor-driven auxiliary feedwater pumps of the same train assignment as the header and to each unit's turbine driven auxiliary feedwater pump.

(8) Connections are available in the A-train ERCW supply and return headers for the lower compartment coolers that will allow chilled water from a non-safety related chiller to be used to provide additional cooling of the Reactor Building during outages.

(9) Two RCP motor coolers are supplied from ERCW Header 1A for Unit 1, 2A for Unit 2; and two are supplied from ERCW Header 1B for Unit 1 and 2B for Unit 2.

The supply headers are arranged and fitted with isolation valves such that a critical crack in either header can be isolated to ensure uninterrupted operation of the other

Replace with: "Due to diesel generator capacity limits, an interlock prevents more than one ERCW pump from being automatically loaded onto any given diesel generator. Under certain scenarios when a diesel generator has excess capacity, this interlock may be manually bypassed and a second ERCW pump may be manually loaded onto the diesel generator."

header. The operation of two pumps on the same plant train is sufficient to supply all cooling water requirements for the two-unit plant for unit cooldown, refueling or post-accident operation, and two pumps per plant train will operate during the hypothetical combined accident and loss of normal power if all four diesel generators are in operation. In an accident the safety injection signal automatically starts two pumps on each plant train, thus providing full redundancy.

Insert "normally"

Pump motors, traveling screen motors, screen wash pump motors, and backwashing strainer motors are supplied with power from normal and emergency sources, thereby ensuring a continuous flow of cooling water under all conditions. There are two independent power trains with two emergency diesel generators for each train, four of the eight ERCW pumps are assigned to Train A and four to Train B. Each diesel generator is aligned to supply power to either of two specific ERCW pumps; the generator capacity is such that only one pump per generator can be loaded automatically. Two traveling screens, two screen wash pumps, and two strainers are assigned to the power train corresponding to that of the ERCW pumps which this equipment serves. The motor-operated valves in the ERCW system are generally supplied with emergency power from the train of diesel generators which corresponds to the pump supplying the header in which the valve is located.

Replace with: "However, minimum combined safety requirements for the two units are met by only two ERCW pumps on the same plant train. There is one exception to this; see the discussion on compliance with GDC 5 later in this section."

The component cooling system (CCS) heat exchanger discharge by-pass valves incorporate special trim to suppress cavitation. Flow is directed through the by-pass lines at low and intermediate heat exchanger flow rates by opening the by-pass line and closing the main 24-inch motor-operated butterfly valve at the heat exchanger outlet. For conditions which require flow rates beyond the capacity of the anti-cavitation valve, the 24-inch butterfly valve is opened and the anti-cavitation valve closed. To minimize cavitation of the butterfly valves, a multi-holed orifice is located in each of the two CCS heat exchanger vertical discharge headers to increase the back pressure at the valves.

9.2.1.3 Safety Evaluation

The ERCW system is designed to prevent any postulated failure from curtailing normal plant operation or limiting the ability of the engineered safety features to perform their functions in the event of natural disasters or plant accidents. Sufficient pump capacity is provided for design cooling water flows under all conditions and the system is arranged in such a way that even a complete header loss can be isolated in a manner that does not jeopardize plant safety.

The ERCW system has eight pumps (four pumps per train). However, minimum combined safety requirements for one 'accident' unit and one 'non–accident' unit, or two 'non-accident' units, are met by only two pumps on the same plant train. Sufficient redundancy, separation and independence of piping and components are provided to ensure that cooling is maintained to vital loads at all times despite the occurrence of a random single failure. A single active failure will not remove more than one supply train per unit (i.e., either headers 1A and 2A or headers 1B and 2B will always remain in service). The ERCW system is sufficiently independent so that a single active failure of any one component in one train will not preclude safe plant operations in either unit. A failure modes and effects analysis is presented in Table 9.2-2.

Replace with: "A safety injection actuation signal in either unit or a loss of offsite power signal causes valve FCV-67-152 to automatically open to assure ERCW flow from header 2B. Depending on the event, the operator will then close FCV-67-144 and place FCV-67-152 in either Position A or B, as appropriate."

The safety-related portion of the ERCW system is designed such that total loss of either train, or the loss of offsite power and an entire plant shutdown power train will not prevent safe shutdown of either unit under any credible condition.

CCS Heat Exchanger C, which is shared between the two units, serves the train B engineered safety features for both units. During normal operation, the ERCW flow path to this heat exchanger will be through anti-cavitation bypass valve, FCV-67-144. A safety injection actuation signal in either unit or loss of offsite power signal causes valve FCV-67-152 to automatically open to assure ERCW flow from header 2B. Once the flow is established the operator determines which valve to close manually.

The Train A safeguards are capable of meeting the safety requirements independently of the Train B safeguards equipment. During a LOCA, it may be necessary to reduce flow to the component cooling heat exchanger prior to admitting flow to the containment spray heat exchanger. The earliest that this action is required is 15 minutes.

Under extreme flood conditions, the ERCW system provides a heat sink for required cooling systems, except the high pressure fire protection system water is used for steam generator feedwater for reactor cooling. The ERCW system is designed to continue operation during the postflood situation in which the loss of the downstream dam has also been assumed.

The ERCW system is designed to furnish a continuous supply of cooling water under normal conditions, as well as under the following extreme circumstances:

Replace with: "The Train A safeguards are capable of meeting the safety requirements independently of the Train B safeguards equipment. Depending on the event, the operator will place the 1(2)-FCV-67-146 valves in either Position A or B, as appropriate, then close the 1(2)-FCV-67-143 valves. The earliest that this action is required is 15 minutes. If minor adjustments in ERCW flow are required, the 1(2)-FCV-67-143 valve positions may be adjusted.

(1) Tornado or other violent weather condition which might disrupt normal offsite power. The ERCW pumps are protected from tornadic winds and tornado-borne missiles, as described in Section 3.5, by a walled enclosure covered with a roof composed of structural steel wide-flanged I-beams. The walls and roof are designed to withstand the tornado wind loading and tornado-driven missile impact. In addition, the pumps on power train A are separated from those on train B by a wall on the pumping station deck. The traveling water screens and related screen wash pumps are also located within this protective structure. Yard piping (Class C) is protected by a minimum rock cover or concrete slabs where the minimum rock cover is not possible.

(2) The ERCW pumps, intake pumping station traveling screens and screenwash pumps, and associated piping and structures remain operable during and after a safe shutdown earthquake which might destroy non-seismic structures and equipment and the main river dams upstream and downstream of the site. The components required for operation are designed either to Seismic Category I or I(L) - pressure boundary integrity requirements. The pumping station is designed to maintain direct communication with the main river channel at minimum possible water level resulting from loss of the downstream dams.

(3) The design provides for the probable maximum flood with the coincident or subsequent loss of the upstream and/or downstream dams. To meet these conditions, the ERCW pumps, traveling screens, and screenwash pumps located in the intake pumping station are above the maximum possible flood level.

(4) In the event of blockage of the non-qualified, normal discharge path, the alternative discharge path would be functional. In this event, the discharge water would flow through the ERCW standpipes and out of the ERCW overflow box . The ERCW overflow box is located in Area 2 which is described in Section 2.4.2.3. The flow from the overflow box will drain along the road, then across the perimeter road, flow west through a swale and across the low point in the access road. If the normal discharge path is blocked, no change in valve alignment or operator action is necessary to activate the alternate path. The alternate path is seismically qualified up to and including the ERCW overflow box. If the alternate path was in use and the non-qualified piping became blocked, the discharge water would flow out of the overflow box and drain away from the plant. Even with the maximum flow out of the overflow box, the water would not build up to reach the elevation of any of the entrances to safety-related buildings.

Replace with "(1) During normal operations, the ERCW system can supply the highest flow / decay heat demand of one unit in Startup and the other in Hot Shutdown with a flow requirement of approximately 26,250 gpm and remove a heat demand of 241 MBtu/hr.

For purposes of maintenance to the cooling towers, a valve is provided in each of the normal discharge headers so that the ERCW flow can be terminated to the cooling towers and diverted to the holding pond via the alternate discharge path.

Cooling water is supplied in an open cycle cooling mode to the various heat exchangers served by the ERCW pumps during all modes of plant operation. With normal offsite power sources available, water is normally supplied to both units by operating up to two ERCW pumps per train. More than 2 pumps may be operated during pump changeover, etc. The ERCW system provides the required flow necessary to dissipate the heat loads imposed under the design basis operating mode combination, i.e., one unit in LOCA and the other unit in hot standby, based on a maximum river temperature. The ERCW system is also capable of supporting a cooldown of the non-accident unit in accordance with GDC 5. Maximum ERCW supply temperature is 85°F and is consistent with the recommendations in Regulatory Guide 1.27. Minimum river temperature is 35°F.

ERCW is a versatile system capable of providing sufficient flow and heat removal for a variety of conditions in each unit. As examples,

(1) during normal operations, the ERCW system can supply the highest flow demand of one unit in startup and the other in hot shutdown with a flow requirement of approximately 26,300 gpm and remove the highest heat removal demand of one unit in hot shutdown and the other unit in cold shutdown with a heat load of approximately 238,800 kBTU/hr.

Replace with: "(2) Under design basis accident conditions with offsite power available, the ERCW system can supply the highest flow / decay heat demand with one unit in Startup and the other in LOCA-Recirculation with a flow requirement of approximately 32,750 gpm and remove a heat demand of 446 MBtu/hr."

(2) under design basis accident conditions with offsite power available, the ERCW system can supply the highest flow demand of one unit in startup and the other in LOCA Recirculation with a flow requirement of approximately 32,700 gpm and remove the highest heat removal demand of one unit in cold shutdown and the other unit in LOCA Recirculation with a heat load of approximately 473,400 kBTU/hr.

Replace with "(3) Under design basis accident conditions with a LOOP coupled with a Loss of Train A, ERCW Train B can supply the highest flow / decay heat demand of one unit in Hot Shutdown and the other in LOCA-Recirculation with a flow requirement of approximately 21,850 gpm and remove a decay heat demand of 316 MBtu/hr."

(3) under design basis accident conditions with a LOOP coupled with a Loss of Train A, Train B of the ERCW system can supply the highest flow demand of one unit in either cold shutdown or refueling (equally demanding) and the other in LOCA Recirculation with a flow requirement of approximately 19,500 gpm and remove the highest heat removal demand of one unit in refueling and the other unit in LOCA Recirculation with a heat load of approximately 292,900 kBTU/hr.

Replace with "(4) Under design basis accident conditions with a LOOP coupled with a Loss of Train B, ERCW Train A can supply the highest flow / decay heat demand of one unit in Hot Shutdown and the other in LOCA-Recirculation with a flow requirement of approximately 22,400 gpm and remove a decay heat demand of 320 MBtu/hr."

(4) under design basis accident conditions with a LOOP coupled with a Loss of Train B, Train A of the ERCW system can supply the highest flow demand of one unit in either cold shutdown or refueling and the other in LOCA Recirculation with a flow requirement of approximately 20,500 gpm and remove the highest heat removal demand of one unit in cold shutdown and the other unit in LOCA Recirculation with a heat load of approximately 296,700 kBTU/hr.

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(2) Loss of

(3) Loss of

In addition, the ER
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Design basis safe
accident condition
maintained in its
The ERCW syster
in accordance wit

A calculation has
CCS capability to
shutdown. This ca
within 72 hours fr

Replace with: "GDC 5 Compliance: The ERCW system has eight pumps (four pumps per train). Normally, during Loss of Offsite Power (LOOP) events, only four pumps (two pumps per train) may be loaded onto the four diesel generators (one per diesel generator). When both trains of ERCW are available, the four ERCW pumps are able to supply all required loads for all design basis events to support both units. When various events occur with a LOOP, and combined with a complete loss of one train of emergency power, then only two ERCW pumps are normally available. The two ERCW pumps are able to support the accident unit, the non-accident unit and the SFP for all design basis events except as described below.

Typically, if an accident occurs on one unit, the second unit will be brought to Mode 3 (Hot Standby), which for Watts Bar is the defined “Safe Shutdown” mode of operation. The non-accident unit will be held in Mode 3 until the accident unit can be stabilized and the core decay heat in the non-accident is within the capability of the RHR system. Calculations demonstrate that two ERCW pumps are sufficient to cope with the accident unit and bring the non-accident unit to Cold Shutdown within 72 hours. There is one scenario where two ERCW pumps do not have sufficient capacity to cope with both the accident and non-accident units. This scenario is described as follows:

- The non-accident unit has been shutdown within the previous 48 hours and is being cooled by RHR - in either Mode 4 or Mode 5.
- The accident unit is in LOCA-Recirculation mode of operation
- LOOP
- Loss of one train of emergency power."

performed with CCS carrying all required loads on both the accident and (later in the event) the non-accident unit, including the Spent Fuel Pool. The Core Decay Heat used in the calculation is consistent with the decay heat used in the normal cooldown analysis. The analysis is conservative in that, once RHR is placed inservice,credit for decay heat removal by the Steam Generators / Auxiliary Feedwater System is no longer taken.

In order to preclude leakage of radioactivity from the containment, the supply lines to
the upper containment coolers are
valve and motor-operated valve. T
groups and the discharge lines are
valves operated on separate powe

Radiation detectors are installed in
downstream of the last equipment
detected in either ERCW discharg
isolated.

9.2.1.4 Tests and Inspections

All system components are hydros
industry code before station startu
accordance with Section III of the A
activities, the yard piping was oper
lining was applied as a replaceme
Code. Section XI defines a replac
service. Welds at pipe access poin
test, and vacuum box leak tested b
completion of cement-mortar lining
hydrostatic test requirements. The
the requirements of ASME Section
maintained until the total time at pre
the system to service and before f
performed in accordance with ASM

This alternative to visual examinati
testing was approved by NRC Insp
for ERCW piping having inaccessible welds.

Replace with:

"Under this scenario, a third ERCW pump is required. Diesel generator loading calculations indicate that the diesel generator associated with the non-accident unit has the capacity to support a second ERCW pump (~ 805 horsepower). Manual bypass switches on the shutdown boards allow the interlocks, which prevent more than one ERCW pump to be loaded onto a diesel generator, to be over-ridden. The third ERCW pump must be manually started prior to placing the accident unit in LOCA-Recirculation.

For these reasons, one of the following two GDC 5 related restrictions are imposed on the ERCW system following the shutdown of a unit:

1. A third ERCW pump must be available on each train of ERCW; or,
2. The shutdown unit must remain in Mode 3 for 48 hours prior to establishing RHR cooling.

Calculations indicate that there is sufficient ERCW capacity to maintain the SFP within its design basis temperatures for all scenarios. In certain cases, SFP cooling may be temporarily suspended while plant operators reconfigure plant systems to restore it."

9.2.1.5 Instrument Applications

9.2.1.5.1 General Description

ERCW instrumentation and controls (see Figures 9.2-10 through 9.2-14A) for equipment supplied for a particular ERCW main supply header are powered from the same electrical power source as the pumps which normally supply the water to that header. Therefore, loss of one power train would result in the loss of only the instrumentation and controls associated with that particular ERCW header. Motor-operated containment isolation valves are arranged and powered such that isolation

The CCS design pressure and temperature are 150 psig and 200°F, respectively, except as noted below:

Replace with

"Each unit has a CCS pump (1A-A for Unit 1 and 2A-A for Unit 2) which is aligned to that unit's Train A header and which receives electrical power from Train A. Each unit has another CCS pump (1B-B for Unit 1 and 2B-B for Unit 2) which are normally aligned to that unit's Train A header, but which receives electrical power from Train B. These pumps (1B-B and 2B-B) can be manually re-aligned to the common Train B piping system. CCS pump C-S, which normally receives Train B electrical power while serving as the common Train B CCS pump, is capable of being powered from a Train A source."

(i) The design pressure and temperature for piping from thermal barrier booster pumps (TBBPS) discharge to the first of redundant check valves in each thermal barrier supply line are 200 psig and 200°F, respectively.

(ii) From the first redundant check valve of each thermal barrier supply line to the outboard containment isolation valve on the thermal barrier return line, the design pressure and temperature are the same as the RCS design pressure and temperature which are 2485 psig and 650°F. This prevents overpressurization of this portion of the CCS piping in the event of thermal barrier leakage. A 3/4-inch check valve installed across the inboard containment isolation valve, incorporates a soft seat which is not designed for fluid temperatures above 300°F. In order for the temperature to exceed 300°F, reactor coolant must leak through the thermal barrier into the CCS. A thermal barrier tube rupture event will not degrade the soft seat since isolation would occur rapidly. In order to guard against leakage through the check valve, inspection and repair of the check valve seat will be performed whenever repairs for thermal barrier tube leakage are needed.

(iii) In order to maintain containment integrity during and after a LOCA, CCS piping between and including the containment isolation valves is designed for 250°F.

CCS is a supporting system to other safe shutdown systems. Two redundant trains per unit are available. For each unit, Train A consists of two available CCS pumps and the associated valves, piping, instrumentation and heat exchanger (Heat Exchanger A for Unit 1 and Heat Exchanger B for Unit 2). Train B is common for both units and consists of one CCS pump and the associated valves, piping, instrumentation and heat exchanger (Heat Exchanger C).

Each unit has a CCS pump (1A-A for Unit 1 and 2A-A for Unit 2) which is aligned to that unit's Train A header and which receives electrical power from Train A. Each unit has another CCS pump (1B-B for Unit 1 and 2B-B for Unit 2) which can be aligned to that unit's Train A header but which receives electrical power from Train B. These pumps (1B-B and 2B-B) are normally aligned to the Train A piping system for that unit but can be aligned to the common Train B piping system. The C-S pump, which normally receives Train B electrical power while serving as the common Train B CCS pump, is capable of being powered from a Train A power source.

During normal full power operation, with all CCS equipment available, CCS pumps 1A-A and 1B-B and Heat Exchanger A are aligned with Unit 1, Train 1A ESF and miscellaneous equipment. CCS pumps 2A-A and 2B-B and Heat Exchanger B are

Replace with: "Although normally aligned as described above, the CCS pumps can be manually re-aligned to meet various abnormal operational and maintenance requirements. Either Train B CCS pump can be re-aligned to CCS HX C to either replace or supplement CCS pump C-S. CCS pump C-S can be re-aligned to either CCS HX A or B to supplement the Train A CCS pump. For additional information, see the GDC 5 compliance discussion in Section 9.2.2.3."

aligned with Unit 2 Train 2A ESF and miscellaneous equipment. CCS pump C-S and Heat Exchanger C are aligned with both Unit 1, Train 1B and Unit 2, Train 2B.

CCS pump 1B-B can be used as additional capacity for Train 1A, as required, or as a replacement for CCS pumps 1A-A or C-S, if one should be out of service. CCS pump 2B-B can be used as additional capacity for Train 2A as required or as a replacement for CCS pumps 2A-A or C-S, if one should be out of service.

CCS Heat Exchanger C is subject to testing in accordance with Generic Letter 89-13, which requires cleaning and testing of the ERCW cooled CCS Heat Exchangers to verify the heat transfer capability. Since CCS Heat Exchanger C supports the operability of both CCS Trains 1B and 2B, without a dual unit outage, cleaning CCS Heat Exchanger C requires a Unit 1 refueling outage and CCS Heat Exchanger A is needed to support CCS Train 2B operability.

Specifically, Unit 1 shall be in an outage with no RHR cooling required (full core offload) and CCS Heat Exchanger A (aligned to ERCW Train 1B), CCS Pump 1B-B, and CCS Pump C-S shall be aligned to CCS Train 2B. These components ensure that Unit 2 maintains two operable independent CCS trains, thereby; ensuring that Unit 2 is capable of responding to any design basis event. In this cleaning alignment, CCS can support two trains of Spent Fuel Pool Cooling utilizing Spent Fuel Pool Cooling Heat Exchangers A and B and Spent Fuel Pool Cooling Pump C-S.

Train 1A and Train 2A equipment will provide all the cooling water necessary for the safe operation of Units 1 and 2, respectively. Train 1B/2B (common) supplies additional cooling capacity of both units during various operational modes. Train 1B/2B equipment has been sized to maintain plant safety in the event of Train A power loss.

Two surge tanks are located in the Auxiliary Building. Each surge tank is separated into two parts by a baffle, providing separate minimum surge volumes for each ESF cooling train.

Both units are served by two cooling system trains (A and B) serving ESF equipment, with train A also serving miscellaneous non-safety related components. Except for the RHR Hxs, excess letdown Hx, and PASS coolers (Unit 1 only), both trains of the safeguards equipment of both units served by the CCS are normally aligned and supplied with CCS water and will automatically continue to be supplied in a LOCA. In the event of an accident, nonsafety-related components are not required; therefore, CCS flow to these components may be manually isolated. The excess letdown heat exchanger is required only during startup and when normal letdown is lost, and is valved in at that time. Prior to switchover from injection to recirculation phase of safety injection it is necessary for the operator to open the CCS valves at the RHR heat exchangers of the accident unit in order to supply these heat exchangers with cooling water. This action is part of the switchover sequence specified in Section 6.3.2.2 and Table 6.3-3. The earliest time at which this operator action is required to be performed is 10 minutes. If an emergency power train is lost during an accident condition no

Replace with insert on next page

additional operator action on the CCS is required for plant safety except for the following cases:

(1) If the non-accident unit is utilizing RHR cooling it may be necessary to close the CCS supply to these heat exchangers. RHR cooling may be terminated when the non-accident unit is in RHR cooldown with the reactor coolant system not vented. If the reactor coolant system has been vented, RHR cooling of the non-accident unit will continue, but at a reduced rate.

(2) If Train A electric power is lost, CCS pump 1B-B will supply cooling water to SFPCS heat exchanger A via CCS header 1A and CCS heat exchanger A during two unit operation.

(3) During two unit operation, if Train B electrical power is lost, the SFPCS heat exchanger may be isolated. If isolated, later in the event, one of the SFPCS heat exchangers will be returned to service. The CCS pump C-S may be manually realigned to Train A power and valved into either CCS Train 1A or 2A to facilitate spent fuel pool cooling.

In the event of a design basis flood at WBN, the CCS pumps will be submerged since the maximum flood level will be above the CCS pumps. Since cooling must be maintained to certain CCS users during the flood, provisions have been made to interconnect the ERCW and CCS systems to supply ERCW to the following loads:

Replace above and on Page 9.2-15 with the following:

"If an emergency power train is lost during an accident condition, no additional operator action is required for plant safety except for the following cases:

(1) If Train A power is lost and if the non-accident unit is utilizing Train B RHR cooling, it will be necessary to adjust CCS flow to the non-accident unit RHR HX.

(2) If SFPCCS HX A is inservice and if a LOCA occurs on Unit 1 concurrent with a LOOP and Loss of Train B, it will be necessary to isolate CCS flow to SFPCCS HX A.

(3) If Train A power is lost, SFP cooling may be restored by using CCS pump 1B-B to supply CCS flow through CCS HX A and SFPCCS HX A. (Note: This also requires the re-alignment of ERCW header 1B to CCS HX A.)"

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Provisions have been provided to reestablish CCS flow to the reactor coolant pump thermal barrier following a Phase B isolation signal. This action will protect the integrity of the seals in the event of passive failure of the chemical and volume control system seal injection flow to the reactor coolant pump seals.

The CCS water is circulated through the shell side of the CCS heat exchangers to the components using the cooling water and then back to the CCS pump suction. The surge tank for each unit is separated into two sections by a baffle. Each section is tied into the pump suction lines from safeguard trains. This tank accommodates expansion and contraction of the system water due to temperature changes or leakage, and

9.2.2.3.7 Piping

Component coolin
connections excep
maintenance. CC
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9.2.2.4 Safety Evaluatior

The CCS is compr
and Heat Exchang
equipment. The U
miscellaneous equ
Unit 2 Train A hea
equipment and Un
capability to provic
equipment trains a
one train at any tim
combinations of m
normal cooldown r
WBN is the hot sta
the non-accident unit in accordance with GDC 5.

Replace with:

"CCS is a versatile system capable of providing sufficient flow and heat removal for a variety of conditions in each unit. As examples:

(1) During normal operation, the CCS can supply the highest flow demand of both units in Startup with a flow requirement of approximately 22,950 gpm and remove the highest heat removal demand of one unit in Hot Shutdown and the other unit in Cold Shutdown with a heat load of approximately 184 MBtu/hr.

(2) Under design basis accident conditions with offsite power available, the CCS can supply the highest flow demand of one unit in Startup and the other unit in LOCA-Recirculation a flow requirement of approximately 21,600 gpm and remove a heat demand of 143 MBtu/hr.

(3) Under design basis accident conditions with a LOOP coupled with a Loss of Train A, CCS Train B can supply the highest flow / decay heat demand of one unit in Hot Shutdown and the other in LOCA-Recirculation with a flow requirement of approximately 10,650 gpm and remove a decay heat demand of 145 MBtu/hr."

CCS is a versatile system capable of providing sufficient flow and heat removal for a variety of conditions in each unit. As examples,

(1) during normal operations, the CCS system can supply the highest flow demand of both units in startup with a flow requirement of approximately 22,900 gpm and remove the highest heat removal demand of one unit in hot shutdown and the other unit in cold shutdown with a heat load of approximately 192,100 kBTU/hr.

(2) under design basis accident conditions with offsite power available, the CCS system can supply the highest flow demand of Unit 2 in startup and Unit 1 in LOCA Recirculation with a flow requirement of approximately 21,600 gpm and remove the highest heat removal demand of Unit 2 in cold shutdown and Unit 1 in LOCA Recirculation with a heat load of approximately 154,500 kBTU/hr.

(3) under design basis accident conditions with a LOOP coupled with a Loss of Train A, Train B of the CCS system can supply the highest flow demand of one unit in either cold shutdown or initial refueling (equally demanding) and the other in LOCA Recirculation with a flow requirement of approximately 7,900 gpm and remove the highest heat removal demand of Unit 2 in either Cold Shutdown or Initial Refueling (equally demanding) and Unit 1 in LOCA Recirculation or Unit 1 in Initial Refueling and Unit 2 in LOCA Recirculation with a heat load of approximately 113,800 kBTU/hr.

Replace with: "(4) Under design basis accident conditions with a LOOP coupled with a Loss of Train B, CCS Train A can supply the highest flow / decay heat demand of one unit in Hot Shutdown and the other in LOCA- Recirculation with a flow requirement of approximately 15,550 gpm and remove a decay heat demand of 170 MBtu/hr."

(4) under design basis accident conditions with a LOOP coupled with a Loss of Train B, Train A of the CCS system can supply the highest flow demand of Unit 2 in either cold shutdown or initial refueling (equally demanding) and Unit 1 in LOCA Recirculation with a flow requirement of approximately 15,800 gpm and remove the highest heat removal demand of Unit 1 in cold shutdown and Unit 2 in LOCA Recirculation with a heat load of approximately 136,800 kBTU/hr.

Replace with: "GDC 5 Compliance: The CCS has five pumps (two for Train A, two for Train B and one swing pump). Diesel generator loading calculations accommodate a combined loading of three CCS pumps (one on one diesel generator, two on the other one). The normal alignment of CCS pumps is able to support the accident unit, the non-accident unit and the SFP for all design basis events except as described below.

Typically, if an accident occurs on one unit, the second unit will be brought to Mode 3 (Hot Standby), which for Watts Bar is the defined "Safe Shutdown" mode of operation. The non-accident unit will be held in Mode 3 until the accident unit can be stabilized and the core decay heat in the non-accident is within the capability of the RHR system. Calculations demonstrate that the normal CCS alignment is sufficient to cope with both the accident and non-accident units. All Loss of Train A scenarios required the re-alignment of a second CCS Train B pump to CCS HX C (to supplement CCS pump C-S) to bring the non-accident unit to Cold Shutdown within 72 hours. There is one Loss of Train A scenario where a second CCS Train B pump must be re-aligned to CCS HX C prior to entering the LOCA-Recirculation phase. This scenario is described as follows:

- The non-accident unit has been shutdown within the previous 48 hours and is being cooled by RHR - in either Mode 4 or Mode 5.
- The accident unit is in LOCA-Recirculation mode of operation
- LOOP
- Loss of Train A.

Under this scenario, two CCS pumps must supply CCS HX C. There will be an additional operator manual action (accomplished in the MCR) prior to establishing LOCA-Recirculation to either verify that the two CCS pumps aligned to CCS HX C are running (or start the second CCS pump).

For these reasons, one of the following two GDC 5 related restrictions are imposed on the CCS following the shutdown of a unit:

1. Re-align one of the two CCS Train B pumps to CCS HX C prior to establishing RHR cooling on the shutdown unit; or,
2. The shutdown unit must remain in Mode 3 for 48 hours prior to establishing RHR cooling.

Calculations indicate that there is sufficient CCS capacity to maintain the SFP within its design basis temperatures for all scenarios. In certain cases, SFP cooling may be temporarily suspended while plant operators reconfigure plant systems to restore it."

9.2.2.5 Leak

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 1 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
1.	ERCW Pumps A-A B-A C-A D-A E-B F-B G-B H-B	Operate.	Any one pump either fails to start or stops operating.	Electrical or mechanical failure.	Status lights 0-HS-67-28A, 32A, 36A, 40A, 47A, 51A, 55A, 59A, respectively, and low header pressure alarms in MCR.	None. Any two of four pumps on either Train A or Train B are capable of providing full ERCW flow.	None.	Insert: "Two ERCW pumps can only support the LOCA unit and the non-accident unit being cooled by RHR after it has been shutdown for 48 hours. During the first 48 hours, if the non-accident (shutdown) unit requires RHR cooling a third ERCW pump is required. For this case, the FMEA becomes three of four pumps on either Train A or B are capable of providing full ERCW flow."
2.	Screen Wash Pumps 1A-A 2A-A 1B-B 2B-B	Operate.	Any one either fails to start or stops operating.	Electrical or mechanical failure.	Status lights 1-HS-67-431A, 2-HS-67-437A, 1-HS-67-440A, 2-HS-67-447A, respectively.	None. Any one of the two screens for either Train A or Train B intakes is capable of screening full ERCW flow.	None.	

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 8 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
11 Cont	1-67-508A Cont	ERCW supply flow path from header 1A, backflow protection.	Fails to close on reverse flow.	Mechanical failures or stuck open.	No direct MCR indications available.	None: Reverse flow would only occur on loss of ERCW supply Header 1A, if the opposite ERCW supply header had been placed in service. The loss of 1A would be the single failure in which case failure of this valve need not be postulated. Header realignment would be implemented by abnormal operating procedures.	None.	

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 10 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
11 cont	1-67-513A Cont	Alternate ERCW supply flow path from header 2B, backflow protection	Fails to close on reverse flow	Mechanical failure or stuck open	No direct MCR indications available.	None, under normal plan operating conditions flow through this line is isolated by valve 1-FCV-067-0068-A. Therefore, the failure of the check valve to close has no affect on the system.	None	

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 12 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
12 Cont	2-67-508A Cont	ERCW supply flow path from header 1A, backflow protection.	Fails to close on reverse flow	Mechanical failures or stuck open	No direct MCR indications available.	None. Reverse flow would only occur on loss of ERCW supply Header 1A of the opposite ERCW supply Header 2B had been placed in service. The loss ~~of~~ Header 1A would be the single ~~failure~~ failure, in which case failure of this valve need not ~~be~~ postulated. Header realignment would be implemented by abnormal operating procedures.	None.	

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 16 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
13 Cont	1-67-508B Cont	ERCW supply flow path from header 1B backflow protection.	Fails to close on reverse flow	Mechanical failures or stuck open.	No direct MCR indications available. Header	None. Reverse flow would only occur on loss of ERCW supply Header 1B, if the opposite ERCW supply Header 2A had been placed in service. The loss of 1B would be the single failure in which case failure of this valve need not be postulated. Header realignment would be implemented by abnormal operating procedures.	None.	

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS
(Page 18 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
13 Cont	1-67-513B Cont	Alternate ERCW supply flow path from header 2A, backflow protection.	Fails to close on reverse flow	Mechanical failures or stuck open.	No direct MCR indications available.	None, under normal plant operating conditions flow through this line is isolated by valve 1-FCV-067-0065-B. Therefore, the failure of the check valve to close has no affect on the ERCW system.	None.	

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 29 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
25.	Strainer Backwash Valves 1-FCV-67-9A 2-FCV-67-9A 1-FCV-67-10A 2-FCV-67-10A	Cycle intermitently to provide ERCW flow to backwash strainer 1A-A, 2A-A, 1B-B, 2B-B, respectively.	Any one of four fails to operate correctly.	Electrical or mechanical failure.	High differential pressure alarms in MCR.	None. Respective strainer will clog reducing ERCW flow to Header 1A, 2A, 1B, 2B, respectively. Either one of two header sets of 1A and 2A or 1B and 2B alone can furnish full ERCW flow.	None.	
26.	Aux. Bldg. Supply Header Section Valves 1-FCV-67-81 1-FCV-67-82 2-FCV-67-81 2-FCV-67-82	ERCW supply flow path to Aux. Bldg. for headers 1A, 1B, 2A, 2B, respectively.	Any one of four fails closed.	Mechanical failure.	No direct MCR indication available. See remarks.	None. Interrupt ERCW supply to Aux. Bldg. via ~~respect ive~~ respective header. Either one of two header sets of 1A and 2A or 1B and 2B can furnish full ERCW flow.	None.	Administratively locked in open position with breaker open.

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 30 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
27.	Header 1B and 2A Section Valves 1-FCV-67-223 2-FCV-67-223	Both open to Supply CCS HX A from Header 2A.	Either FCV fails closed.	Mechanical failure.	High temperature alarm form 0-M-278.	Intertupts ERCW cooling to CCS HX A.	None, Train B CCS components, cooled by HX-C, provide backup for all safety-related loads.	~~Administratively locked open with breaker removed.~~
28.	CCS HX A Inlet B'fly 1-FCV-67-478	Remain open to supply CCS HX A from header 2A.	Fails closed.	Mechanical failure.	High temperature alarm form 0-M-278.	Interrupts ERCW cooling a CCS HX A. ERCW flow provided to redundant CCS HX C by Train B via Header 2B.	None. Train B CCS components, cooled by HX-C, provide backup for all safety-related loads.	Administratively locked in open position with breaker open.

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 33 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
32.	CCS HX C Outlet Bfly's and Bypass 0-FCV-67-152	Remain closed, or open to control flow through HX.	Either -152 or -144 does not operate properly.	Electrical or mechanical failure	Change in flow indication on 0-FI-67-226	None.	None.	CCS HX C is back-up for CCS HX A and B. A failure related to HX A or B precludes a second failure related to HX C.
	0-FCV-67-151	Remain Closed~~Opens to provide ERCW discharge to discharge Header A.~~	None. See remarks.	Not applicable.	Not applicable.	None.	None.	Valve -151 is locked closed with breaker removed.
	0-FCV-67-144	Same as for 0-FCV-67-152				None.	None.	

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Page 72 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
75.	Main Control Room A/C condensers A-A & B-B discharge temperature control valves. 0-TCV-67- ~~1051A~~ 1051-A 0-TCV-67-1053-B	Throttles ERCW flow to MCR A/C Condensers A-A & B-B	Either valve fails open or fails closed or fails to modulate.	Mechanical failure.	Local indication at MCR chiller skid on low refrigerant suction pressure or low compressor oil pressure. See Remark 1. Local indication at MCR chiller skid on high refrigerant pressure. See Remark 1. Possible local indication at MCR chiller skid dependent upon severity of condition. See Remark 2.	None for ERCW . For HVAC, loss of associated MCR chilled water train. Eventual shurdown of associated MCR AHUs upon switchover to redundant train. None for ERCW. For HVAC potential loss of associated MCR chilled water train.	None. Standby chilled water train is 100% rredundant.	1) MCR annunciation of MCR Air conditioning safety train switchover to standby HVAC/chilled water train due to eventual temperature increase in conditioned MCR spaces. (2) May behave similar to either fail open or fail closed.

Place remark 2 on separate line

Table 9.2-2 ESSENTIAL RAW COOLING WATER SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS
(Page 52 of 77)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
47.	Lower Containment Vent Clr 1A, 1C, 1B, 1D & 2A, 2C, 2B, 2D Supply Pressure Relief Cont Iso Valves 1-67-1054A 1-67-1054C 1-67-1054B 1-67-1054D 2-67-1054 A 2-67-1054 C 2-67-1054 B 2-67-1054 D	Close to provide backup containment isolation for valves 1&2-FCV-67-83, 91, 99, 107, respectively. See remarks.	Anyone of four (for the affected unit) fails to close.	Mechanical failure or stuck open.	No direct MCR indication available.	None. Respective containment isolation valve will fulfill isolation function.	None.	Primary function is thermal pressure relief of liquid trapped between isolation valves. Failure to open is not considered credible.

Replace Item 47 with Items 47A and 47B with insert on next page

Replace Item 47 with Items 47 A and 47B below into Table 9.2-2 on previous page.

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
47A	Lower Containment Vent Clrs 1A, 1C, 1B, 1D Supply Pressure Relief Cont Iso Valves 1-RFV-67-1060A 1-RFV-67-1060C 1-RFV-67-1060B 1-RFV-67-1060D	Close to provide backup containment isolation for valves 1-FCV-67-83, -91, -99 & -109 respectively. See remarks.	Any one of four fails to close	Mechanical Failure or stuck open	No direct MCR indication available	None. Respective containment isolation valve will fulfill isolation function.	None	Primary function is thermal pressure relief of liquid trapped between isolation valves. Failure to open is not considered credible.
			Any one of four fails to open	Mechanical Failure	None	Single Failure	If respective containment isolation valves close and are leak tight, a line failure could occur between the two isolation valves. See remarks.	Containment integrity is maintained because the break would occur between the two leak tight FCVs.
47B	Lower Containment Vent Clrs 2A, 2C, 2B, 2D Supply Pressure Relief Cont Iso Valves 2-CKV-67-1054A 2-CKV-67-1054C 2- CKV -67-1054B 2- CKV -67-1054D	Close to provide backup containment isolation for valves 2-FCV-67-83, -91, -99 & -109 respectively. See remarks.	Any one of four fails to close	Mechanical Failure or stuck open	No direct MCR indication available	None. Respective containment isolation valve will fulfill isolation function.	None	Primary function is thermal pressure relief of liquid trapped between isolation valves. Failure to open is not considered credible.

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Replace with "None. Isolation will be achieved by redundant valve 1-FCV-70-87 and 1-RFV-70-687."

Table 9.2-9 COMPONENT COOLING SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Continued) (Page 3 of 29)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
A-4	1-FCV-70-87	Containment Isolation Penetration No. X-50A	Fails to Close	Power Supply, Electrical, or Mechanical Failure	1-HS-70-87A status lights	Single failure	None, isolation will be achieved by redundant valve 1-FCV-70-90.	Containment integrity is maintained. Valve is normally closed.
2A-4	2-FCV-70-87	Containment Isolation Penetration No. X-50A	Fails to Close	Power Supply, Electrical, or Mechanical Failure	2-HS-70-87A status lights	Single failure	None, isolation will be achieved by redundant valve 2-FCV-70-90.	Containment integrity is maintained. Valve is normally closed.
A-5	1-FCV-70-90	Containment Isolation Penetration No. X-50A	Fails to Close	Power Supply, Electrical, or Mechanical Failure	1-HS-70-90A status lights	Single failure	None, isolation will be achieved by redundant valve 1-FCV-70-87.	Containment integrity is maintained
2A-5	2-FCV-70-90	Containment Isolation Penetration No. X-50A	Fails to Close	Power Supply, Electrical, or Mechanical Failure	2-HS-70-90A status lights	Single failure	None, isolation will be achieved by redundant valve 2-FCV-70-87.	Containment integrity is maintained
A-6	1-CKV-70-687	Containment Isolation Penetration No. X-50A	Fails to Close	Mechanical Failure	None	Single Failure	None, isolation will be achieved by redundant valve 1-FCV-70-90.	Containment integrity is maintained (See Note 1)
2A-6	2-CKV-70-687	Containment Isolation Penetration No. X-50A	Fails to Close	Mechanical Failure	None	Single Failure	None, isolation will be achieved by redundant valve 2-FCV-70-90.	Containment integrity is maintained (See Note 1)

Replace with new A-6 on next page.

Replace A-6 on previous page.

A-6	1-RFV-70-687	Containment Isolation Penetration No. X-50A	Fails to Close	Mechanical Failure	None	Single Failure	None. Isolation will be achieved by redundant valves 1-FCV-70-90 and 1-FCV-70-87.	Containment Integrity is maintained (See Note 1)
			Fails to Open	Mechanical Failure	None	Single Failure	If isolation valves 1-FCV-70-87 and 1-FCV-70-90 close and are leak tight, a line failure could occur between the two isolation valves. See Remarks.	Containment Integrity is maintained because the break would occur between the two leak tight FCVs.

Replace with "None. Isolation will be achieved by redundant valve 1-FCV-70-92 and 1-RFV-70-698."

Table 9.2-9 COMPONENT COOLING SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Continued) (Page 4 of 29)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
A-7	1-FCV-70-89	Containment Isolation Penetration No. X-29	Fails to Close	Power Supply, Electrical, or Mechanical Failure	1-HS-70-89A status lights	Single Failure	None, isolation will be achieved by redundant valve 1-FCV-70-92.	Containment integrity is maintained.
2A-7	2-FCV-70-89	Containment Isolation Penetration No. X-29	Fails to Close	Power Supply, Electrical, or Mechanical Failure	2-HS-70-89A status lights	Single Failure	None, isolation will be achieved by redundant valve 2-FCV-70-92.	Containment integrity is maintained.
A-8	1-FCV-70-92	Containment Isolation Penetration No. X-29	Fails to Close	Power Supply, Electrical, or Mechanical Failure	1-HS-70-92A status lights	Single Failure	None, isolation will be achieved by redundant valve 1-FCV-70-89 and manual isolation of a downstream valve. See Remarks.	The line inside containment upstream of 1–FCV–70-89 is not protected from a HELB. Thermal relief check valve 1-CKV-70-698 around 1–FCV–70-89 will allow backflow into containment. Action is required to manually isolate valve 1-ISV-70-700 down stream of 1-FCV-70-92.

Replace with:

"None. Isolation will be achieved by redundant valve 1-FCV-70-89."

Replace with:

"Containment Integrity is maintained."

Table 9.2-9 COMPONENT COOLING SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS (Continued)
(Page 5 of 29)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
2A-8	2-FCV-70-92	Containment Isolation Penetration No. X-29	Fails to Close	Power Supply, Electrical, or Mechanical Failure	2-HS-70-92A status lights	Single Failure	None, isolation will be achieved by redundant valve 2-FCV-70-89 and manual isolation of a downstream valve. See Remarks.	The line inside containment upstream of 2-FCV-70-89 is not protected from a HELB. Thermal relief check valve 2-CKV-70-698 around 2-FCV-70-89 will allow backflow into containment. Action is required to manually isolate valve 2-ISV-70-700 downstream of 2-FCV-70-92.
A-9	1-CKV-70-698	Containment Isolation Penetration No. X-29	Fails to Close	Mechanical Failure	None	Single Failure	None, isolation will be achieved by redundant valve 1-FCV-70-92.	Containment integrity is maintained (See Note 1).
2A-9	2-CKV-70-698	Containment Isolation Penetration No. X-29	Fails to Close	Mechanical Failure	None	Single Failure	None, isolation will be achieved by redundant valve 2-FCV-70-92.	Containment integrity is maintained (See Note 1).
A-10	1-FCV-70-100	Containment Isolation Penetration No. X-52	Fails to Close	Power Supply, Electrical, or Mechanical Failure	1-HS-70-100A status lights	Single Failure	None, isolation will be achieved by redundant valve 1-FCV-70-140.	Containment integrity is maintained.

Replace with new A-9 on next page.

Replace with:

"None. Isolation will be achieved by redundant valve 1-FCV-70-140 and 1-RFV-70-790.

Replace A-9 on previous page.

A-9	1-RFV-70-698	Containment Isolation Penetration No. X-29	Fails to Close	Mechanical Failure	None	Single Failure	None. Isolation will be achieved by redundant valves 1-FCV-70-89.	Containment Integrity is maintained (See Note 1)
			Fails to Open	Mechanical Failure	None	Single Failure	If isolation valves 1-FCV-70-89 and 1-FCV-70-92 close and are leak tight, a line failure could occur between the two isolation valves. See Remarks.	Containment Integrity is maintained because the break would occur between the two leak tight FCVs.

Table 9.2-9 COMPONENT COOLING SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS (Continued)
(Page 6 of 29)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
2A-10	2-FCV-70-100	Containment Isolation Penetration No. X-52	Fails to Close	Power Supply, Electrical, or Mechanical Failure	2-HS-70-100A status lights	Single Failure	None, isolation will be achieved by redundant valve 2-FCV-70-140.	Containment integrity is maintained.
A-11	1-FCV-70-140	Containment Isolation Penetration No. X-52	Fails to Close	Power Supply, Electrical, or Mechanical Failure	1-HS-70-140A status lights	Single Failure	None, isolation will be achieved by redundant valve 1-FCV-70-100 and manual isolation of an upstream valve. See Remarks.	The line inside containment downstream of 1–FCV–70-100 is not protected from a HELB. Thermal relief check valve 1-CKV-70-790 around 1–FCV–70-100 will allow flow to enter containment. Action is required to manually isolate valve 1-ISV-70-516 upstream of 1-FCV-70-140.

Replace with

"None. Isolation will be achieved by redundant valve 1-FCV-70-100."

Replace with

"Containment Integrity is maintained."

**Table 9.2-9 COMPONENT COOLING SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS (Continued)
(Page 7 of 29)**

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
2A-11	2-FCV-70-140	Containment Isolation Penetration No. X-52	Fails to Close	Power Supply, Electrical, or Mechanical Failure	2-HS-70-140A status lights	Single Failure	None, isolation will be achieved by redundant valve 2-FCV-70-100 and manual isolation of an upstream valve. See Remarks.	The line inside containment downstream of 2-FCV-70-100 is not protected from a HELB. Thermal relief check valve 2-CKV-70-790 around 2-FCV-70-100 will allow flow to enter containment. Action is required to manually isolate valve 2-ISV-70-516 upstream of 2-FCV-70-140.
A-12	1-CKV-70-790	Containment Isolation Penetration No. X-52	Fails to Close	Mechanical Failure	None	Single Failure	None, isolation will be achieved by redundant valve 1-FCV-70-140.	Containment integrity is maintained (See Note 1).
2A-12	2-CKV-70-790	Containment Isolation Penetration No. X-52	Fails to Close	Mechanical Failure	None	Single Failure	None, isolation will be achieved by redundant valve 2-FCV-70-140.	Containment integrity is maintained (See Note 1).

Replace with new
A-12 on next page.

Replace A-12 on previous page.

A-12	1-RFV-70-790	Containment Isolation Penetration No. X-52	Fails to Close	Mechanical Failure	None	Single Failure	None. Isolation will be achieved by redundant valves 1-FCV-70-100.	Containment Integrity is maintained (See Note 1)
			Fails to Open	Mechanical Failure	None	Single Failure	If isolation valves 1-FCV-70-100 and 1-FCV-70-140 close and are leak tight, a line failure could occur between the two isolation valves. See Remarks.	Containment Integrity is maintained because the break would occur between the two leak tight FCVs.

Table 9.2-9 COMPONENT COOLING SYSTEM FAILURE MODES AND EFFECTS ANALYSIS (Continued) (Page 10 of 29)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
A-16	1-RFV-70-835	Over pressure protection of low pressure piping of CCS supply to RCP Thermal Barrier HX	Fails Closed	Mechanical Failure	Flow transmitters 1–FT-70-95, –105, -115, –124, -81B, or –81E (any one or combination)	None, tube leakage or CVCS isolation valve failure constitutes the single failure (failure of this valve need not be considered).	None	If this valve failed open containment integrity is still ensured because leakage is into containment. If the valve failed closed and the system did overpressurize, again leakage is into containment. Leakage into containment would be limited by closure of either 1–FCV-70-133 or –134 and -87 (with 1-CKV-70-687) or –90.
			Fails Open			None, inleakage isolated by FCVs (see remarks).		

Replace with:

"If this valve failed open, containment integrity is still assured because leakage is into containment. If the valve failed closed and the system did over-pressurize, again leakage is into containment. Leakage into containment would be limited by closure of either 1-FCV-70-133 or -134 and -87 or -90."

**Table 9.2-9 COMPONENT COOLING SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS (Continued)
(Page 14 of 29)**

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
B-3	0-FCV-70-194	Supply water to Spent Fuel Pit HX B	Fails to Open	Power Supply, Electrical, or Mechanical Failure	0-HS-70-194A status lights or low flow alarm if stem or disc separation.	Supply to HX B is stopped	None, 0-FCV-70-197 will supply water to redundant Spent Fuel Pit HX A.	Safe shutdown function is achieved with one HX.
B-4	0-FCV-70-197	Supply water to Spent Fuel Pit HX A	Fails to Open	Power Supply, Electrical, or Mechanical Failure	0-HS-70-197A status lights or low flow alarm if stem or disc separation	Supply to HX A is stopped	None, 0-FCV-70-194 will supply water to redundant Spent Fuel Pit HX B.	Safe shutdown function is achieved with one HX.
C	**CCS PUMPS**							
C-1	CCS Pump 1A-A (1-PMP-70-46)	Supply water to Train 1A	Pump Fails to Operate	Power Supply, Electrical, or Mechanical Failure	1-HS-70-46A status lights low header pressure alarm	Flow from Pump 1A-A is lost	None, redundant CCS Pump 1B-B will start on low pressure.	Safe shutdown function is achieved from redundant pump.
C-2	CCS Pump 1B-B (1-PMP-70-38)	Supply water to Train 1A supply water to CCS Train 1B/2B as replacement for CCS pump C-S	Pump Fails to Operate	Power Supply, Electrical, or Mechanical Failure	1-HS-70-38A status lights low header pressure	Flow from Pump 1B-B is lost	None, redundant CCS Pump 1A-A will start on low pressure. None. Redundant CCS Trains 1A & 2A will continue to support CCS safety function (See Note 2)	Safe shutdown function is achieved from redundant pump. Safe shutdown function capability is available from CCS Trains 1A and 2A

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C-2	Pump 1B-B (1-PMP-70-38)	Supply water to Train 1A	Pump Fails to Operate	Power Supply, Electrical or Mechanical Failure	1-HS-70-38A status lights, low header pressure alarm	Flow from Pump 1B-B is lost	None. Redundant CCS Pump 1A-A will start on low pressure.	Safe shutdown function is achieved from redundant pump.
		Supply water to CCS Train 1B/2B as replacement or supplement for CCS pump C-S	Pump Fails to Operate	Power Supply, Electrical or Mechanical Failure	1-HS-70-38A status lights, low header pressure alarm	Flow from Pump 1B-B is lost	None. Redundant CCS Trains 1A & 2A will continue to support CCS safety function (See Note 2).	Safe shutdown function capability is available from CCS Trains 1A and 2A.

Replace with New 2C-3A on next page.

Table 9.2-9 COMPONENT COOLING SYSTEM
FAILURE MODES AND EFFECTS ANALYSIS (Continued)
(Page 15 of 29)

Item	Component	Function	Failure Mode	Potential Cause	Method of Detection	Effect on System	Effect on Plant	Remarks
C-3	CCS Pump C-S (0-PMP-70-51)	Supply water to Train 1B/2B	Pump Fails to Operate	Power Supply, Electrical, or Mechanical Failure	1-HS-70-51A status lights	Flow from Pump C-S is lost	None, redundant CCS Pump 1B-B or 2B-B can supply water to Train B.	Safe shutdown function is achieved from redundant pump.
2C-3A	Pump 2B-B (2-PMP-70-33)	Supply water to Train 2A supply water to CCS Train 1B/2B as replacement for CCS pump C-S	Pump Fails to Operate	Power Supply, Electrical, or Mechanical Failure	2-HS-70-33A status lights, low header pressure alarm	Flow from 2B–B is lost	None, redundant CCS Pump 2A-A will start on low pressure. None. Redundant CCS Trains 1A & 2A will continue to support CCS safety function (See Note 3)	Safe shutdown function is achieved from redundant pump. Safe shutdown function capability is available from CCS Trains 1A and 2A
2C-3B	Pump 2A-A (2-PMP-70-59)	Supply water to Train 2A	Pump Fails to Operate	Power Supply, Electrical, or Mechanical Failure	2-HS-70-59A status lights, low header pressure alarm	Flow from 2A–A is lost	None, redundant CCS Pump 2B-B will start on low pressure.	Safe shutdown function is achieved from redundant pump.
C-4	1-CKV-70-504A	Prevent backflow to CCS Pump 1A-A when pump is not operating	Fails to Close	Mechanical Failure	Low header pressure alarm	Train A header pressure may be low	None, manual isolation valve 1-ISV-70-505A will be closed. Pump 1B-B or C-S will continue to operate.	Safe shutdown function is not affected.

Replace 2C-3A on previous page.

2C-3A	Pump 2B-B (2-PMP-70-33)	Supply water to Train 2A	Pump Fails to Operate	Power Supply, Electrical or Mechanical Failure	1-HS-70-38A status lights, low header pressure alarm	Flow from Pump 1B-B is lost	None. Redundant CCS Pump 2A-A will start on low pressure.	Safe shutdown function is achieved from redundant pump.
		Supply water to CCS Train 1B/2B as replacement or supplement for CCS pump C-S	Pump Fails to Operate	Power Supply, Electrical or Mechanical Failure	2-HS-70-33A status lights low header pressure alarm	Flow from Pump 2B-B is lost	None. Redundant CCS Trains 1A & 2A will continue to support CCS safety function (See Note 2).	Safe shutdown function capability is available from CCS Trains 1A and 2A.

1-HS-70-33A