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

CNL-15-147

July 14, 2015

10 CFR 50.90

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

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

Subject: **Responses to NRC Acceptance Review Questions for Watts Bar Nuclear Plant Unit 1 Essential Raw Cooling Water and Component Cooling System License Amendment Request (TAC No. MF6376)**

References:
1. Letter from TVA to NRC, "Watts Bar Nuclear Plant Unit 1 - Application to Revise Technical Specifications for Component Cooling Water and Essential Raw Cooling Water to Support Dual Unit Operation (TS-WBN-15-13)," dated June 17, 2015 [ML15170A474]
2. Email from NRC to TVA, "Preliminary Draft RAIs Associated with Proposed WBN 1 ERCW and CCS Technical Specifications LAR," dated July 2, 2015
3. Letter from NRC to TVA, "Watts Bar Nuclear Plant, Unit 1 - Supplemental Information Needed for Acceptance of Requested Licensing Action Regarding Application to Add Technical Specifications to Support Dual-Unit Operations (TAC No. MF6376)," dated July 9, 2015 [ML15187A403]

By letter dated June 17, 2015, Tennessee Valley Authority (TVA) submitted a request for a change to Facility Operating License No. NPF-90 for Watts Bar Nuclear Plant (WBN) Unit 1 (Reference 1). The proposed change would create new Technical Specifications (TS) 3.7.16, "Component Cooling System (CCS) - Shutdown," and TS 3.7.17, "Essential Raw Cooling Water (ERCW) System - Shutdown," to support dual unit operation of WBN Units 1 and 2. In addition, changes were proposed to TS 5.7.2.18, "Safety Function Determination Program," and LCO 3.0.6 Bases to adopt TSTF-273-A. By email dated July 2, 2015, the Nuclear Regulatory Commission (NRC) provided requests for additional information (RAI) on the proposed WBN Unit 1 license amendment (Reference 2).

By letter dated July 9, 2015, the NRC requested supplemental information associated with the proposed WBN Unit 1 license amendment (Reference 3).

Enclosure 1 provides the TVA responses to the Reference 3 supplemental information requests. As a result of the TVA response to NRC Acceptance Review Question 1, proposed TS 3.7.16, TS 3.7.17, and the associated Bases have been revised. The proposed changes to TS 5.7.2.18 and LCO 3.0.6 Bases are being withdrawn from the license amendment request. Attachment 1 to Enclosure 1 provides the updated versions of WBN Unit 1 TS 3.7.16 and Bases. Attachment 2 to Enclosure 1 provides the updated versions of WBN Unit 1 TS 3.7.17 and Bases.

Enclosure 2 provides the TVA responses to the Reference 2 RAIs.

Consistent with the standards set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) 50.92(c), TVA has determined that the response, as provided in this letter, does not affect the no significant hazards considerations associated with the proposed license amendment to add TS 3.7.16 and TS 3.7.17 previously provided in Reference 1. TVA has further determined that the proposed amendment still qualifies for a categorical exclusion from environmental review pursuant to the provisions of 10 CFR 51.22(c)(9). However, the no significant hazards considerations associated with the proposed license amendment to revise TS 5.7.2.18 is no longer required, as this change is being withdrawn from the license amendment request. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosures to the Tennessee Department of Environment and Conservation.

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

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 14th day of July 2015.

Respectfully,

J. W. Shea Digitally signed by J. W. Shea
DN: cn=J. W. Shea, o=Tennessee Valley Authority, ou=Nuclear Licensing, email=jwshea@tva.gov, c=US
Date: 2015.07.14 21:39:13 -04'00'

J. W. Shea
Vice President, Nuclear Licensing

Enclosures

cc: See Page 3

Enclosures:

1. Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request
2. Responses to NRC RAIs for WBN Unit 1 ERCW and CCS License Amendment Request

cc (w/Enclosures):

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

ENCLOSURE 1

Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request

Background

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

The TVA responses to the NRC's request for supplemental information are provided below.

NRC Acceptance Review Question 1

Proposed CCS TS 3.7.16 and ERCW System TS 3.7.17 include APPLICABILITY NOTE b, which states that the limiting conditions for operation (LCOs) are not applicable "When complying with Required Actions to be in MODE 5." The only justification provided in the submittal for this MODE APPLICABILITY exclusion is stated in the proposed Bases for these Technical Specifications (TSs), which refer to proposed additions to LCO 3.0.6 Bases consistent with Technical Specifications Task Force (TSTF) Traveler TSTF-273-A. TSTF-273-A clarifies the Safety Function Determination Program (SFDP) process by specifying that assuming a single failure or loss of electrical power when performing an analysis is not required. To adopt a TSTF change the licensee must state that the reasoning for the change applies for its facility and specifically how it applies to the plant-specific licensing basis.

The submittal did not provide justification for the inclusion of APPLICABILITY NOTE b. Also, the relationship of the proposed TSTF-273-A changes to the proposed CCS and ERCW TSs was not articulated.

The staff needs this information to understand the application of the proposed exception and SFDP clarification to the interpretation of the proposed CCS and ERCW TSs. For example, the staff postulated a scenario in which the MODE APPLICABILITY NOTE b exception may result in the inability to complete required actions of other TSs. Specifically, TS 3.8.1 (AC [alternating current] Sources – Operating), ACTION G, requires in the event of a loss of offsite power with loss of an onsite emergency power train that Unit 1 be in Mode 5 in 37 hours. The licensee has acknowledged that in the event that this postulated scenario occurs shortly following a unit shutdown it may be incapable of completing this required action in the specified time period without ensuring the availability of the additional CCS and ERCW pumps that the proposed TSs would make available; however, the MODE APPLICABILITY NOTE b exception appears to exclude requiring the availability of these pumps in the event of a TS-required shutdown.

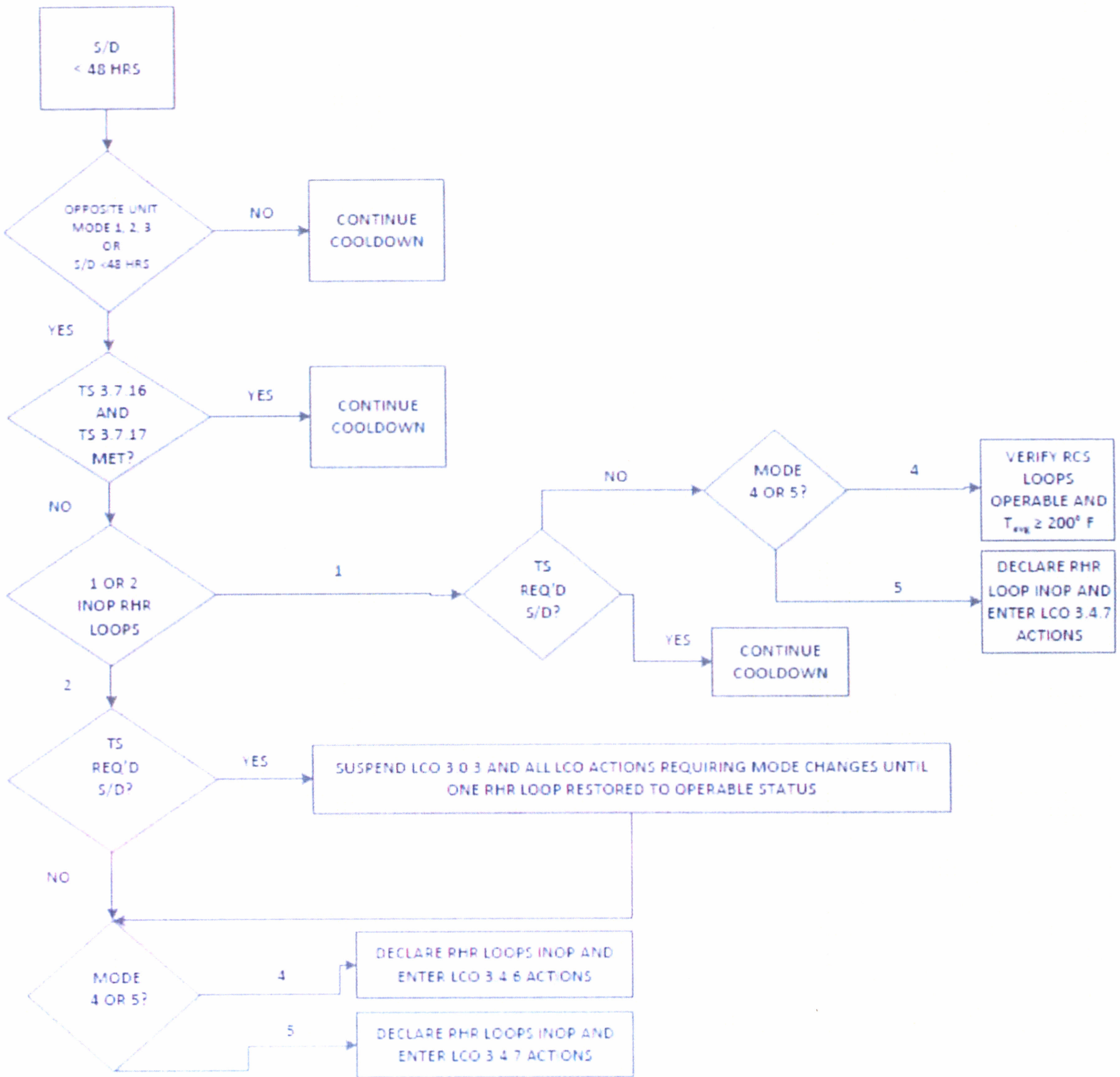
Provide information to justify and explain the inclusion of APPLICABILTY NOTE b in the proposed TSs 3.7.16 and 3.7.17. Also, clearly articulate the relationship of the proposed adoption of TSTF-273-A changes to the proposed CCS and ERCW TSs. All known scenarios similar to that of TS 3.8.1 discussed above should be identified and discussed.

TVA Response

ENCLOSURE 1

Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request

The Applicability statements of TS 3.7.16 and TS 3.7.17, as submitted in Reference 1, have been revised by removing the exception of "When complying with Required Actions to be in MODE 5." In order to help determine the Required Actions to address the differences in the requirements relative to a TS-required shutdown and operation in Mode 4 or 5, the decision tree below was developed.



Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request

The proposed changes to TS 3.7.16 and TS 3.7.17 (and associated Bases) are provided in Attachments 1 and 2 to this enclosure, respectively. With these changes to TS 3.7.16 and TS 3.7.17 and the withdrawal of the proposed changes to TS 5.7.2.18 and LCO 3.0.6 Bases, Attachments 1 and 2 to this enclosure entirely replace Attachments 1, 2, 3 and 4 to Enclosure 1 provided in TVA letter dated June 17, 2015 (Reference 1).

The Applicability statements for TS 3.7.16 and TS 3.7.17 have been revised with the addition of a new Note b to recognize that the additional CCS and ERCW System requirements are not required, if either unit has been shutdown for greater than 48 hours.

TS 3.7.16 Condition A and TS 3.7.17 Condition A provide the Required Actions for an inoperable CCS or ERCW train, respectively, when complying with Required Actions to be in Mode 5. In this condition, adequate capability exists to cool down both units or cool down one unit while mitigating a loss of coolant accident in the other unit. Therefore, consistent with Required Action B.1 of LCO 3.4.6, "RCS Loops - MODE 4," TS 3.7.16 and TS 3.7.17, Required Action A.1 requires the unit to be placed in Mode 5 in 24 hours.

The new proposed Condition B provides Required Actions for one inoperable CCS/ERCW train when not complying with Required Actions to be in Mode 5. These Required Actions maintain the unit in Mode 4 with decay heat removal provided by two operable reactor coolant system (RCS) loops with one RCS loop in operation. Maintaining the unit in Mode 4 provides conditions for additional methods of decay heat removal and minimizes the likelihood of a situation where the decay heat and residual heat of the unit may exceed the capability of the available residual heat removal (RHR) loop, resulting in the possibility of an unintentional Mode change.

Condition C provides actions in Mode 4 when two CCS / ERCW trains are inoperable. Required Action C.1 requires immediate action be taken to restore one of the CCS / ERCW trains to an operable status, as no RHR train is available to support the heat removal function. This action is consistent with LCO 3.4.6, "RCS Loops - MODE 4," Required Action B.1 for the Condition of one required RHR loop inoperable and no RCS loops OPERABLE. Required Action C.1 is modified by two Notes. Note 1 indicates that all required Mode changes or power reductions are suspended until one CCS / ERCW train is restored to an operable status. In this case, LCO 3.0.3 is not applicable because it could force the plant into a less safe condition. Note 2 indicates that the applicable Conditions and Required Actions of LCO 3.4.6 be entered for RHR loops made inoperable by the inoperable CCS / ERCW trains. This is an exception to LCO 3.0.6 and ensures the proper actions are taken for these components.

Condition D provides actions in Mode 5 when two CCS / ERCW trains are inoperable. Required Action D.1 requires immediate action be taken to restore one of the CCS/ERCW trains to an operable status, as no RHR train is available to support the heat removal function. This action is consistent with the Conditions and Required Actions of LCO 3.4.7, "RCS Loops - Mode 5, Loops Filled," for RHR loops made inoperable by CCS / ERCW. Although the current TS do not provide explicit Required Actions for an inoperable CCS / ERCW train in Mode 5, the inability of a non-TS support system to enable the TS supported system to perform its safety function results in the inoperability of the TS supported system. Therefore, the TS 3.7.16 and TS 3.7.17 Required Actions for inoperable CCS / ERCW trains in Mode 5 are the same as the current TS Required Actions for inoperable required RHR loops.

The proposed TS changes made to TS 5.7.2.18 and LCO 3.0.6 Bases per NRC-approved TSTF-273-A are not required and are being withdrawn from this license amendment request.

NRC Acceptance Review Question 2

The licensee's letter dated January 22, 2015 (ADAMS Accession Number ML15187A403), stated that there are two events where a unit may need to be returned to Mode 3 from Mode 4 or Mode 5, without all the conditions for a mode change required by the TS being satisfied. The descriptions of the proposed CCS and ERCW TSs in TVA's letter dated June 17, 2015, address one of the events, but do not address the other event, described in TVA's January 22 letter as:

> *"A simultaneous or near simultaneous shutdown of both units occurs. The units are being cooled down. The units may be in Mode 4 or Mode 5, a loss of offsite power occurs, and simultaneously there is the loss of an emergency power train."*

Provide discussion of this second event in the proposed change.

TVA Response

The simultaneous or near simultaneous shutdown of both units is similar to, but less demanding than the case of a single unit shutdown with reliance on RHR for cooling, concurrent with a postulated loss of coolant accident (LOCA) on the other unit. For the LOCA case, there are two key assumptions relative to heat removal requirements. The first assumes that the non-accident unit is placed on RHR as early as possible. Secondly, the accident unit is assumed to have been operating at 100 percent power after equilibrium decay heat is achieved. These two assumptions maximize the decay heat required to be removed by CCS and ERCW. In addition, the LOCA requires ERCW flow to the containment spray heat exchanger. This is a flow load on ERCW that does not exist in a dual unit non-accident shutdown case.

For a dual unit shutdown, the most limiting case is when the units are assumed to trip simultaneously. The initial cooldown of the units will be performed using auxiliary feedwater to remove decay and sensible heat from the RCS. Using the same assumptions that were used for the non-accident unit described above, RHR was placed in service at the earliest opportunity. However, it will be several hours (approximately 7 hours) before this can occur. Thus, the total decay heat that CCS and ERCW must remove is lower than in the LOCA case. As noted above for the non-accident shutdown, containment spray is not used. Therefore, the demands on ERCW are lower. The flow requirements are reduced to the point that the third ERCW pump is not required.

When the assumptions include a loss of offsite power and the loss of Train A power, two CCS pumps need to be aligned to the CCS Train B header and in operation when RHR is in service on both units and both units have been shutdown for less than 48 hours.

TVA agrees that the submittal did not provide much discussion of the non-accident case because the LOCA plus shutdown case is more limiting. There is discussion on pages E1-10 and E1-11 of the license amendment with respect to required ERCW pumps.

Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request

NRC Acceptance Review Question 3

The licensee stated that Unit 1 could be maintained in Mode 3 or Mode 4 with decay heat being removed through the steam generators for at least 48 hours as one of the options for managing a unit shutdown. Using the steam generators in some scenarios, including a loss of offsite power, would require operation of Auxiliary Feed Water (AFW) for up to 48 hours; however, the Condensate Storage Tank (CST) lacks sufficient inventory to support operation of AFW for 48 hours. Final Safety Analysis Report (FSAR) Section 9.2.6.1 states, "The ERCW system pool quality feedwater will be used during an extreme emergency when safety is the prime consideration and steam generator cleanliness is of secondary importance."

Address the use of available and approved clean water sources, ERCW, and the CST in accordance with the approved licensing basis. The submittal should address whether ERCW would be added to the non-accident unit's steam generators for events other than those described in FSAR 9.2.6.3. Also address a dual-unit shutdown and cooldown to Mode 5, for instance as required by LCO 3.0.3, and the available water sources that are credited for use, including reference to approved procedures that implement these water sources for steam generator cooldown methods.

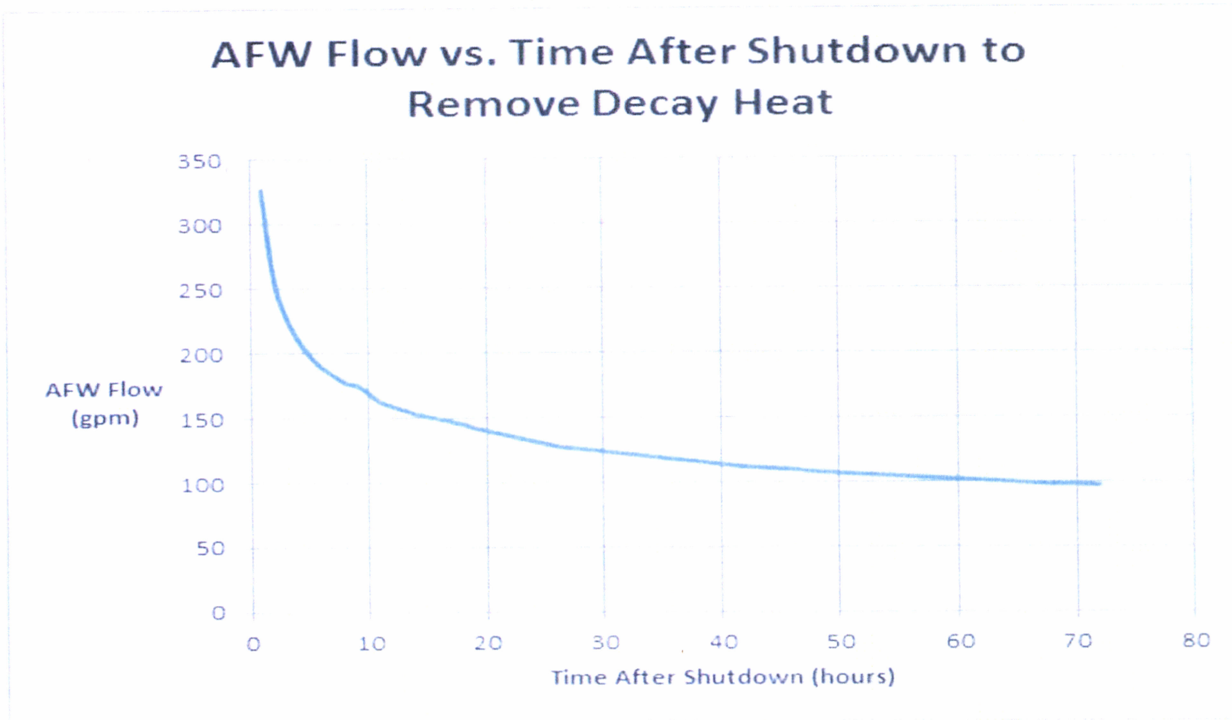
TVA Response

The safety-related water supply for AFW is ERCW. The AFW suction source automatically switches from the CST to ERCW when a low pressure condition exists in the AFW pump suction piping from the CST. The switchover to ERCW will occur whenever AFW is in service to assure heat removal through the steam generators if the low pressure condition exists. This assures the safety function of decay heat removal is accomplished.

There is adequate clean water to support a unit being maintained on AFW for 48 hours. The capacity of each of the two CSTs is 395,000 gallons and the normal maximum volume in the CSTs is approximately 385,000 gallons. Review of operational data for the past five years shows that the WBN Unit 1 CST has been maintained at approximately 330,000 gallons. Because AFW is not the only system that uses CST water, a standpipe is provided in the tank to assure that a minimum of 200,000 gallons of water is available for the sole use of AFW. Thus, the site maintains approximately 130,000 gallons of water in the CST above the TS limit. Normal make-up to the CST comes from the Demineralized Water Storage (DWST) Tank and the Make-up Water Treatment Plant (MWTP). The DWST tank has a capacity of 500,000 gallons and the level has historically been maintained between 65 and 90 percent full. There have been instances, including one earlier this year, where WBN Unit 1 was maintained in Mode 3 for more than two days using the DWST and the MWTP. WBN recently added the Auxiliary Feedwater Storage Tank (AFWST) as part of the FLEX mitigating strategies. This tank has a capacity of 500,000 gallons and is an immediately available source of clean water. The tank was designed to be seismically robust and to withstand the effects of tornados. The AFWST supply piping is normally isolated by air operated valves (AOVs) from the Unit 1 and Unit 2 condensate piping that supply the suction for the AFW pumps. The AOVs open on a low pressure signal from the upstream condensate piping, a loss of AC power, or a loss of control air. Water can be transferred from the DWST to the AFWST using hoses and pumps that are

maintained by the FLEX program if power cannot be provided to the DWST booster pumps. The two CSTs have a cross tie that when opened provides an additional approximately 330,000 gallons of clean water for the case of a LOCA on one unit and the other unit being shutdown.

The design basis requires 410 gpm of AFW flow to remove the decay and sensible heat from the RCS at the time of a reactor trip. The actual demand on AFW drops substantially in the first hours after the reactor trip, as shown in the figure below.



General Operating Instruction, GOI-6, the unit cooldown procedure, provides the actions to maintain steam generator cooling. System Operating Instruction, SOI-59.01, "Demineralized Water System," provides the guidance for maintaining water to the CSTs. Adequate clean water sources are available to support maintaining a unit on AFW in excess of 48 hours. Alternate makeup to the AFWST is controlled by FLEX Support Instruction, FSI-6, "Alternate AFWST Makeup" and Maintenance Instruction, MI-360.020, "FLEX - Water Transfer Pump Makeup to Auxiliary Feedwater Supply Tank."

In conclusion, there are several large sources of clean water that can be used to support maintaining WBN Unit 1 on steam generator cooling for 48 hours or longer without transferring AFW pump suction to ERCW. Notwithstanding that, the FSAR is clear that ERCW is the safety grade water supply to AFW. If clean water is not available or clean water is available but cannot be supplied to the steam generators for required decay heat removal, ERCW will be used.

Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request

NRC Acceptance Review Question 4

Information needed by the U.S. Nuclear Regulatory Commission staff to begin its review of the Tennessee Valley Authority's (the licensee) request to add technical specifications to support dual-unit operations related to containment considerations is described below.

> *In the June 17, 2015, submittal, the licensee committed to provide a revised containment pressure analysis by separate correspondence to reflect the dual-unit Essential Raw Cooling Water (ERCW) system flowrate to the Component Cooling System (CCS) heat exchangers. Please provide quantitative information regarding the impact of changes resulting from dual-unit operation of the ERCW and CCS systems, including the changes proposed to ensure compliance with General Design Criterion 5, on containment performance for both Unit 1 and Unit 2.*
>
> *The information provided for both units should include the results of containment pressure, temperature, and sump temperature responses, and net positive suction head analysis. These analyses should include corrections for errors in the WCAP-10325-P-A loss of coolant accident (LOCA) mass and energy (M&E) release methodology reported in Nuclear Safety Advisory Letters (NSALs)-06-6, -11-5, and -14-2.*
>
> *Additionally, the NRC staff is aware of Westinghouse's InfoGram IG-14-1, dated November 5, 2014, which states that the LOCA containment M&E release analysis methodology was found to use a reactor coolant system (RCS) stainless steel volumetric heat capacity value lower than the American Society of Mechanical Engineers (ASME) values. The staff has received information which indicates that the impact on the LOCA peak containment pressure in the current licensing basis would be significant if the analysis included the ASME values for the RCS metal volumetric heat capacity. Therefore, the information provided in response to this request should include use of the ASME values for the RCS metal volumetric heat capacity.*
>
> *The analysis for Unit 1 should also provide information consistent with the licensee's December 17, 2014, response to Request for Additional Information (RAI) regarding Watts Bar Unit 2 FSAR, Amendment 112, Chapter 6, RAI Number SCVB-RAI-3 (ADAMS Accession Number ML14352A248). In addition, consistent with Watts Bar Unit 2, please revisit the initial containment temperatures stated in assumption number (10) in Section 6.2.1.3.3 of the Watts Bar Unit 1 FSAR, and revise the containment analysis for conservatism based on the maximum containment air temperatures specified in TS 3.6.5.*

TVA Response

TVA will provide a revised containment LOCA pressure analysis with updated FSAR Section 6.2.1, "Containment Functional Design," for WBN Unit 2 and revised Technical Specification Surveillance Requirements (SR) 3.6.11.2 and 3.6.11.3 related to ice weight by August 14, 2015. The WBN Unit 2 FSAR analysis as described in Amendment 113 had incorporated the three Westinghouse Nuclear Safety Advisory Letters (NSALs) 06-6, 11-5, and 14-2, as well as initial containment compartment temperatures. The analysis to be submitted on August 14, 2015 will include the changes to heat exchanger heat removal rates to account for a

case with loss of Train A power and sharing of the CCS Train B heat exchanger between units, as well as changes to the specific heat values for RCS metal mass to address the issue identified in Westinghouse Infogram 14-1. The impacts on equipment qualification and issues related to sump water temperature will be addressed in the submittal.

The WBN Unit 1 containment LOCA analysis is being reanalyzed using WCOBRA/TRAC to generate the mass and energy (M&E) releases. The containment response will be calculated using LOTIC 1. The LOTIC 1 analysis will incorporate the changes to heat exchanger heat removal based on the dual unit sharing of Component Cooling System Train B. The WCOBRA/TRAC analysis for WBN will conform to all the applicable limiting conditions described in the NRC Safety Evaluation Report (SER) for WCOBRA/TRAC. Two specific issues that will be included in the WBN M&Es are: 1) the specific heat values for the RCS metal mass will be equal to or higher than the ASME values, and 2) PAD4 plus fuel thermal conductivity degradation will be explicitly accounted for. Based on information currently contained in the WCOBRA/TRAC topical report, it is known that the current containment response in the WBN Updated FSAR is conservative and that the current TS SRs 3.6.11.2 and 3.6.11.3 regarding total ice bed and per basket ice weights are acceptable and do not have to be increased. A revised WBN Unit 1 containment analysis that addresses the NSALs, initial containment compartment temperature, RCS metal specific heat values, and heat exchanger performance will be completed by September 18, 2015.

<u>NRC Acceptance Review Question 5</u>

TVA's June 17, 2015, submittal, identified several manual operator actions associated with the proposed change.

1. *Provide a description of the operator actions being added, changed, or deleted.*

2. *Provide a description of changes, additions or deletions to procedures in addition to those listed on page E1-12, if any (e.g., LOCA, fire).*

3. *Provide a description of changes, additions, or deletions to training or to the plant-specific simulator.*

4. *Identify any changes, additions or deletions to instrumentation, controls, alarms, annunciators, and Safety Parameter Display System.*

5. *Provide a description of the validation of the feasibility and reliability of added or changed operator actions, including time required vs. time available.*

6. *Identify any applicable precedents or other operating experience.*

<u>TVA Response</u>

1. *Provide a description of the operator actions being added, changed, or deleted.*

   One operator action outside of the main control room is being added. This action is for an

Assistant Unit Operator (AUO) to go to the appropriate 6.9 kilovolt (kV) shutdown board room and actuate a single switch (ERCW pump interlock bypass switch) as described on page E1-11 of the license amendment request.

Depending on the system alignments prior to the event and the electrical train that is lost as a part of the event, three possible actions that may be performed by a main control room operator have been added.

a. In the event of a loss of offsite power and the loss of Train A onsite power, a second CCS pump must be started if two are not already running. If CCS pump 2B-B was the second pump aligned to the CCS Train B header and it was not running, the operator would be required to start the pump. If CCS pump 2B-B was running or CCS pump 1B-B was the second pump aligned to the B header, no operator action would be required.

b. In the event of a loss of offsite power and the loss of either Train A or Train B power, a main control room operator would place the motor driven auxiliary feedwater pump powered from the shutdown board on which the second ERCW pump was to be started in pull-to-lock to ensure that it was not running and would not start.

c. In the event of a loss of offsite power and the loss of either Train A or Train B power, a main control room operator would start a second ERCW pump.

No other operator actions are associated with this license amendment request. The alignment of CCS pump 1B-B or 2B-B to CCS Train B header is not a manual action because the alignment takes place before the LOCA occurs.

2. *Provide a description of changes, additions or deletions to procedures in addition to those listed on page E1-12, if any (e.g., LOCA, fire).*

   a. Emergency Procedure E-0, "Reactor Trip or Safety Injection," contains an action to verify CCS pumps 1A-A, 1B-B, and C-S are running. The step will be modified to verify that CCS pump 2B-B is running if the pump is being used as the second pump on the B Train CCS header.

   b. Emergency Procedure ES-1.3, "Transfer to Containment Sump" is the procedure where actions are taken by the main control room operator to start the ERCW pumps and to place the AFW pump in pull-to-lock will most likely be located. Because the actions to start a second ERCW pump and place the AFW pump in pull-to-lock occur on the non-accident unit shutdown board, these steps could be placed in an abnormal operating instruction associated with the loss of a 6.9 kV shutdown board. The final decision about what procedures will be affected by this license amendment request is part of the impact review that occurs once the submittal is approved.

   c. No changes to fire procedures are associated with this license amendment request. The operation of two ERCW pumps on one diesel for some fire scenarios has been

addressed in the fire protection report. This report is undergoing a separate review by the NRC. This submittal does not change the fire protection report.

3. *Provide a description of changes, additions, or deletions to training or to the plant-specific simulator.*

   a. The operating training program has been revised as part of the WBN Unit 2 licensing process to address both unit differences and operation with both units in operation. The procedures being revised by this amendment request are part of the operator training program and the training program is regularly updated when the procedures are revised. A design change has been issued to prepare and implement this license amendment. Similar to the discussion on procedures above, training has been identified as being impacted by this submittal. Updates to the training program to incorporate the necessary information is part of the TVA design change process.

   b. The simulator programming will need to be updated to allow a second ERCW pump to be started when the interlock bypass has been activated. An annunciator window will illuminate showing that the interlock bypass has been activated.

4. *Identify any changes, additions or deletions to instrumentation, controls, alarms, annunciators, and Safety Parameter Display System.*

   An interlock bypass switch for ERCW pumps will be installed as described above and in the license amendment request. An annunciator window will be added in the main control room to show when an interlock bypass switch has been activated.

5. *Provide a description of the validation of the feasibility and reliability of added or changed operator actions, including time required vs. time available.*

   a. The action to start a second Train B CCS pump must occur before the unit in an accident transfers RHR suction from the refueling water storage tank (RWST) to the containment sump. The single failure that necessitates the action also causes the loss of one of the two trains of Emergency Core Cooling System (ECCS) equipment. For this case, the operator has approximately 20 minutes to start the CCS pump. Starting the pump is a single switch manipulation on the control board. The time required is thus very short and the time available is 20 minutes. The action is procedurally controlled and taken in an environmentally controlled area by a licensed operator trained in the action. Thus the action is feasible. In addition, this is not a new action. As noted above, Emergency Operating Instruction E-0 already requires the control room operators to ensure the required CCS pumps are running.

b. The action to start a second ERCW pump must occur before the containment spray pump suction is transferred from the RWST to the containment sump. The operator has approximately 40 minutes before the containment spray pump suction must be transferred. There are three actions that must be accomplished. An AUO is dispatched from the main control room to activate the interlock bypass switch. Preliminary walkdowns have shown that this action can be accomplished in approximately 215 seconds. This time includes the transit time from the Main Control Room to the most distant shutdown board room and operating the interlock bypass switch. There is more than 100 percent margin in the required time, the action is proceduralized, and personnel will be trained on the action. In addition, the action is the same type of action that AUOs currently are required to perform in the 6.9 kV shutdown board rooms. Thus this action is feasible. More details on this action outside of the control building are provided in response 6 below. The other actions are two switch manipulations from a control panel in the main control room. The time required for a reactor operator on the control board to manipulate a switch is very short. These actions are identical in form to actions that operators are taking within this time period. The actions are procedurally controlled and taken in an environmentally controlled area by a licensed operator trained in the actions. Thus the actions are feasible.

c. Preliminary walkdowns of the actions outside of the main control room support that these actions can be performed within required time limits without adverse impact. The procedure development process requires that a formal validation of the set of actions be conducted following installation of plant design changes.

6. *Identify any applicable precedents or other operating experience.*

There is substantial operating experience for these types of actions. For the action outside of containment, a specific WBN example is emergency procedure E-0, which requires an AUO to be dispatched to open breakers on the 480 V reactor vent boards. These boards are on an elevation above the 6.9 kV shutdown boards and are thus farther from the main control room and more actions are required since four breakers are to be opened versus actuating one switch. There are numerous steps in emergency procedure E-0 and in emergency procedure ES-1.3 that currently require the operator to start and stop ERCW and CCS pumps during the events of interest in this submittal. These are routine actions that occur both during normal operation and during accidents and transients.

<u>NRC Acceptance Review Question 6</u>

Provide information regarding the basis for the statement on page E1-11 that the mission dose is within the General Design Criterion 19 criteria, including:

- *Plant layout drawings depicting access and egress routes.*
- *Maximum anticipated accident dose rates.*
- *Maximum mission dose for the operator performing this manual action.*

ENCLOSURE 1

Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request

The level of detail should be consistent with the response provided to Final Safety Analysis Report Chapter 12 Request for Additional Information Number 6 in support of the Unit 2 operating license review.

TVA Response

Bullet 1: Plant layout drawings depicting access and egress routes.

The plant layout drawing below depicts the four "Performance Paths" from the main control room to the shutdown board room for manipulating each of the ERCW pump interlock bypass switches. The "Mission Dose Path" depicts the route upon which the mission dose is based.

Bullet 2: Maximum anticipated accident dose rates.

The table below indicates the dose rates (rem/hr) inside and outside of the auxiliary building secondary containment enclosure (ABSCE). All of the dose rates along the "Mission Dose Path" for performance of the subject manual action are outside of the ABSCE.

Mission Area Dose Rates (rem/hr)					
	Outside ABSCE	Inside ABSCE			
	(All Elevations)	El. 713	El. 737	El. 757	All Stairways
Inhalation	6.053E+01	6.228E+01	6.228E+01	6.228E+01	6.228E+01
Beta	1.220E+00	2.703E+00	2.703E+00	2.703E+00	2.703E+00
Gamma	2.132E+00	1.088E+00	1.385E+00	1.344E-01	1.385E+00

Bullet 3: Maximum mission dose for the operator performing this manual action.

Calculation of the mission dose for the operator performing the manual action includes occupancy, ingress/egress, and mission doses for the entire accident duration.

a) One operator dressed in anti-contamination clothing will leave the main control room at El. 755 and ascend the short stairway to room 757.0-A5.
   Walking Distance: 22.5 ft + 2 ft
   Time: 15 sec + 4 sec = 19 sec

b) Proceed through door A143 and walk north across room 757.0-A2 to close to T line wall. Turn to east and continue to the farthest 6.9 kV shutdown board, located at A12 line.
   Walking Distance: 203 ft
   Time: 136 sec

c) Switch operating time to one of 6.9 kV shutdown boards.
   Time: 60 sec

d) Travel back from the farthest 6.9 kV shutdown board to door A143, and into room 757.0-A5.
   Walking Distance: 203 ft
   Time: 136 sec

e) Descend the short stairway from El. 757.0 to the main control room El. 755.0.
   Walking Distance: 2 ft + 22.5 ft
   Time: 4 sec + 15 sec = 19 sec

Total mission time = 370 seconds

As indicated below, mission dose for the manual action is well within the 10 CFR 50, Appendix A, General Design Criterion 19 limits of 5 rem whole body, 30 rem beta (skin), and 30 rem thyroid (inhalation) with or without a respirator.

Step # / Description	Stay Time (sec)		Dose Rate (rem/hr)	Dose (rem) No Respirator	Dose (rem) with Respirator (PF=10000)	
a) From Control Rom to room 757.0-A5	19	Thyroid	6.053E+01	3.195E-01	3.195E-05	Outside ABSCE (757)
		Skin	1.220E+00	6.439E-03	6.439E-03	
		Whole Body	2.132E+00	1.125E-02	1.125E-02	
b) From room 757.0-A5 to 6.9 KV board	136	Thyroid	6.053E+01	2.287E+00	2.287E-04	Outside ABSCE (757)
		Skin	1.220E+00	4.609E-02	4.609E-02	
		Whole Body	2.132E+00	8.054E-02	8.054E-02	
c) Switch operating time	60	Thyroid	6.053E+01	1.009E+00	1.009E-04	Outside ABSCE (757)
		Skin	1.220E+00	2.033E-02	2.033E-02	
		Whole Body	2.132E+00	3.553E-02	3.553E-02	
d) From 6.9 KV board to room 757.0-A5	136	Thyroid	6.053E+01	2.287E+00	2.287E-04	Outside ABSCE (757)
		Skin	1.220E+00	4.609E-02	4.609E-02	
		Whole Body	2.132E+00	8.054E-02	8.054E-02	
e) From room 757.0-A5 to Control Room	19	Thyroid	6.053E+01	3.195E-01	3.195E-05	Outside ABSCE (757)
		Skin	1.220E+00	6.439E-03	6.439E-03	
		Whole Body	2.132E+00	1.125E-02	1.125E-02	
			Total Thyroid	6.22E+00	6.22E-04	
			Total Skin	1.25E-01	1.25E-01	
			Total Whole Body	2.19E-01	2.19E-01	

REFERENCES

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

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

ENCLOSURE 1

Responses to NRC Acceptance Review Questions Associated with WBN Unit 1 ERCW and CCS License Amendment Request

ATTACHMENTS

Attachment 1 - WBN Unit 1 TS 3.7.16 and Bases

Attachment 2 - WBN Unit 1 TS 3.7.17 and Bases

ENCLOSURE 1

ATTACHMENT 1

WBN Unit 1 TS 3.7.16 and Bases

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

ACTIONS

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

(continued)

ACTIONS (continued)

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

SURVEILLANCE REQUIREMENTS

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

B 3.7 PLANT SYSTEMS

B 3.7.16 Component Cooling System (CCS) - Shutdown

BASES

BACKGROUND

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

Entry into MODES 4 and 5 can place high heat loads onto the RHR System, CCS and the Essential Raw Cooling Water System (ERCW) when shutdown cooling is established. Residual and decay heat from the Reactor Coolant System (RCS) is transferred to CCS via the RHR HX. Heat from the CCS is transferred to the ERCW System via the CCS HXs. The CCS and ERCW systems are common between the two operating units.

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

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

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

(continued)

BASES (continued)

BACKGROUND (continued)

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

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

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

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

APPLICABLE SAFETY ANALYSES

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

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

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

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

(continued)

BASES (continued)

LCO

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

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

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

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

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

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

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

APPLICABILITY

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

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

(continued)

APPLICABILITY (continued)

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

ACTIONS

A.1

In MODE 4, if one CCS train is inoperable, and the unit is required to be placed in MODE 5 to comply with Required Actions, action must be taken to place the unit in MODE 5 within 24 hours. In this Condition, the remaining OPERABLE CCS train is adequate to perform the heat removal function. The 24 hour Completion Time is consistent with LCO 3.4.6, "RCS Loops - MODE 4," Required Action B.1 for the Condition of one required RHR loop inoperable and no RCS loops OPERABLE.

B.1 and B.2

In MODE 4, if one CCS train is inoperable, and the unit is not required to be placed in MODE 5 to comply with Required Actions, actions are taken to verify LCO 3.4.6 is being met with two OPERABLE RCS loops with one loop in operation, and that the unit remains in MODE 4 (T_{avg} > 200°F). Maintaining the unit in MODE 4 provides conditions for additional methods of decay heat removal and minimizes the likelihood of a situation where the decay heat and residual heat of the unit exceeds the capability of the available RHR loop resulting in the possibility of an unintentional MODE change. The Frequency of once per 12 hours ensures that the systems being relied on for heat removal are operating properly and are maintaining the unit in MODE 4. The 12 hour Frequency is reasonable, considering the low probability of a change in system operation during this time period.

C.1

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

(continued)

BASES

ACTIONS

C.1 (continued)

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

D.1

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

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

SURVEILLANCE REQUIREMENTS

SR 3.7.16.1

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

SR 3.7.16.2

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

(continued)

BASES

REFERENCES	1.	Watts Bar FSAR, Section 9.2.2, "Component Cooling System."
	2.	Watts Bar Component Cooling System Description, N3-70-4002.

ENCLOSURE 1

ATTACHMENT 2

WBN Unit 1 TS 3.7.17 and Bases

3.7 PLANT SYSTEMS

3.7.17 Essential Raw Cooling Water (ERCW) System - Shutdown

LCO 3.7.17 Two ERCW trains shall be OPERABLE as follows:

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

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

APPLICABILITY: MODES 4 and 5.

--NOTE--

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

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

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

ACTIONS

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

(continued)

ACTIONS (continued)

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

SURVEILLANCE REQUIREMENTS

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

B 3.7 PLANT SYSTEMS

B 3.7.17 Essential Raw Cooling Water (ERCW) System

BASES

BACKGROUND

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

Normally, two ERCW pumps are sufficient to handle the cooling needs for maintaining one unit in normal operation while mitigating a DBA on the other unit. However, in the unlikely event of a loss of coolant accident (LOCA) on Unit 2 with a concurrent loss of offsite power and a single failure that results in the loss of both Train A or both Train B 6.9 kV shutdown boards while Unit 1 is on RHR shutdown cooling and has been shutdown for less than 48 hours, three ERCW pumps may be required.

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

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

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

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

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

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

LCO

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

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

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

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

(continued)

BASES

LCO (continued)

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

APPLICABILITY

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

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

ACTIONS

A.1

In MODE 4, if one ERCW train is inoperable, and the unit is required to be placed in MODE 5 to comply with Required Actions, action must be taken to place the unit in MODE 5 within 24 hours. In this Condition, the remaining OPERABLE ERCW train is adequate to perform the heat removal function. The 24 hour Completion Time is consistent with LCO 3.4.6, "RCS Loops - MODE 4," Required Action B.1 for the Condition of one required RHR loop inoperable and no RCS loops OPERABLE.

B.1 and B.2

In MODE 4, if one ERCW train is inoperable, and the unit is not required to be placed in MODE 5 to comply with Required Actions, actions are taken to verify LCO 3.4.6 is being met with two OPERABLE RCS loops with one loop in operation, and that the unit remains in MODE 4 (T_{avg} > 200°F). Maintaining the unit in MODE 4 provides conditions for additional methods of decay heat removal and minimizes the likelihood of a situation where the decay heat and residual heat of the unit exceeds the capability of the available RHR loop resulting in the possibility of an unintentional MODE change. The Frequency of once per 12 hours ensures that the systems being relied on for heat removal are operating properly and are

(continued)

BASES

ACTIONS

B.1 (continued)

maintaining the unit in MODE 4. The 12 hour Frequency is reasonable, considering the low probability of a change in system operation during this time period.

C.1

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

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

D.1

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

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

SURVEILLANCE REQUIREMENTS

SR 3.7.17.1

Verifying the availability of the ERCW pumps provides assurance that adequate ERCW flow is provided for heat removal. Verification that each required ERCW pump that is not in operation is OPERABLE ensures that an additional pump can be placed in operation, if needed, to maintain decay heat removal. Verification is performed by verifying proper breaker alignment and power available to the ERCW pump(s). The ERCW pump

(continued)

BASES

SURVEILLANCE REQUIREMENTS	SR 3.7.17.1 (continued) Interlock Bypass Switches do not need to be in 'Bypass' in order to meet this SR. The associated ERCW pump Interlock Bypass Switch is positioned by procedure when the third ERCW pump in the respective train is required to be started. The 12 hour Frequency is based on engineering judgment.
REFERENCES	1. Watts Bar FSAR, Section 9.2.1, "Essential Raw Cooling Water." 2. Watts Bar FSAR, Section 5.5.7, "Residual Heat Removal System."

ENCLOSURE 2

Responses to NRC RAIs for WBN Unit 1
ERCW and CCS License Amendment Request

Background

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

The TVA responses to the NRC RAIs provided in Reference 2 are provided below.

NRC RAI Question 1) a.i.

1) Because of the added pumping power of CCS and ERCW, provide new flows as follows:
   a. Initial Conditions: LOCA [loss of coolant accident] on Unit 2; Unit 1 at 100%, loss of offsite power (LOOP), and loss of Train A electrical power.
      i. Identify required minimum flow to perform safety-related (SR) function for each load cooled by ERCW and CCS in Unit 1 and Unit 2.

TVA Response

For clarification, the following assumptions are also made with regard to the above scenario:

1. Unit 1 is operating at 100% power prior to the Unit 2 LOCA (also from 100% power).
2. The LOOP / loss of Train A accompanying Unit 2 LOCA will trip Unit 1.
3. Unit 1 is able to remain in Mode 3 (being cooled by steam generators) for at least 48 hours.
4. Two ERCW Train B pumps and one CCS Train B pump (aligned to CCS HX C) are available.

The applicable MULTIFLOW case is Unit 1 Cold Shutdown and Unit 2 LOCA with LOOP. For ERCW, this case is identified in calculation MDQ00006720080341, Revision 19, Appendix 11, Table A11.5 (Enclosure 2, Attachment 1). For CCS, this case is identified in calculation MDQ00007020090200, Revision 9, Appendix 10, Case 7E (Enclosure 2, Attachment 2). Resultant flows in both calculations are identified in their respective calculation appendices.

Calculation MDQ00006720080341, Appendix 11, is with the ERCW discharging to the cooling tower (Enclosure 2, Attachment 1). If the discharge is through the hydraulic gradient discharge structure, then refer to Appendix 14 (Enclosure 2, Attachment 3).

ENCLOSURE 2

Responses to NRC RAIs for WBN Unit 1
ERCW and CCS License Amendment Request

NRC RAI Question 1) a.ii.

> ii. *Identify actual flow to each of the loads with only Train B ERCW (i.e. 2 pumps) and Train B of CCS available because of the loss of Train A electrical power.*

TVA Response

The attachments identified in response to Question 1) a.i contain both the required minimum and expected actual flows (determined from Multiflow as benchmarked from flow balance testing).

NRC RAI Question 1) a.iii.

> iii. *Describe operator actions and timing of operation required to achieve the required/actual flows.*

TVA Response

The operator will perform the following actions to establish CCS flow:

1. The operator will set CCS flow to RHR HX 2B-B as > 5000 gpm by controlling valve 2-FCV-70-153 from the main control room (MCR). This is performed as part of the emergency core cooling system (ECCS) switchover sequence as described in Final Safety Analysis Report (FSAR) Section 6.3.2.2 and Table 6.3-3 (approximately 20 minutes, minimum).

The operator will perform the following actions to establish ERCW flow. These actions are performed prior to establishing Containment Spray switchover to recirculation (approximately 40 minutes, minimum) as described in FSAR Section 6.3.2.2 and Table 6.3-3:

1. The operator will set ERCW flow to CCS HX C as > 7125 gpm by controlling valve 0-FCV-67-152.
2. The operator will also open the ERCW supply to Containment Spray HX 2B-B by opening valves 2-FCV-67-123 and 2-FCV-67-124.

NRC RAI Question 1) b.i.

> b. *Initial Conditions: LOCA on Unit 2; Unit 1 just entered Mode 4 in minimum time allowed by procedure (i.e. maximum decay heat), LOOP, and loss of Train A electrical power.*
>
>   i. *Identify required minimum flow to perform SR function for each load cooled by ERCW and CCS in Unit 1 and Unit 2.*

TVA Response

CLARIFICATION: The below responses are based on just entering Mode 4 with RHR shutdown cooling only without assistance by RCS loop cooling via the steam generators. This is a conservative assumption as all residual heat will be placed on the RHR heat exchangers and thus the CCS and ERCW systems.

The ERCW minimum required and expected actual flows are provided in calculation MDQ00006720080341, Appendix 17, Case 1300 (Enclosure 2, Attachment 4). This case considers flow through the hydraulic gradient discharge structure whereas the first case (question 1) a.i.) considered flow to either the cooling tower basin or to hydraulic gradient discharge structure.

The CCS minimum required and expected actual flows are provided in calculation MDQ00007020090200, Appendix 11, Cases 8C and 8D (Enclosure 2, Attachment 5).

NRC RAI Question 1) b.ii.

> ii. *Identify actual flow to each of the loads with only Train B ERCW (i.e. 3 pumps) and Train B of CCS (2 pumps) available because of the loss of Train A electrical power.*

TVA Response

The attachments identified in response to Question 1) b.i contain both the required minimum and expected actual flows (determined from Multiflow as benchmarked from flow balance testing).

NRC RAI Question 1) b.iii.

> iii. *Describe operator actions and timing of operation required to achieve the required/actual flow.*

TVA Response

The operator will perform the following actions to establish CCS flow:

1. The operator will verify CCS flow to RHR HX 1B-B as > 5000 gpm by controlling valve 1-FCV-70-153 from the MCR. This would be an "immediate" action (TS 3.4.6) to restore RHR shutdown cooling after the LOOP and would be performed prior to re-starting the RHR pump (RHR pump does not automatically sequence on during a LOOP).
2. The operator will verify that two CCS pumps are running on CCS Train B. If not, the operator would start the second CCS pump prior to starting the ECCS switchover sequence as described in FSAR Section 6.3.2.2 and Table 6.3-3 (approximately 20 minutes, minimum).

3. The operator will set CCS flow to RHR HX 2B-B as > 5000 gpm by controlling valve 2-FCV-70-153 from the MCR. This is performed as part of the ECCS switchover sequence as described in FSAR Section 6.3.2.2 and Table 6.3-3 (approximately 20 minutes, minimum).

The operator will perform the following actions to establish ERCW flow. All actions are required to be completed prior to establishing containment spray switchover to recirculation (approximately 40 minutes, minimum) as described in FSAR Section 6.3.2.2 and Table 6.3-3:

1. The operator will stop the motor-driven auxiliary feedwater (MDAFW) pump 1B-B and place it in pull-to-lock from the MCR.
2. The operator will travel to the "B" train 6.9 kV shutdown board room and defeat the ERCW pump interlock bypass for shutdown board 1B-B.
3. The operator will start the non-running ERCW pump tied to 6.9 kV shutdown board 1B-B from the MCR.
4. The operator will set ERCW flow to CCS HX C as > 9200 gpm by controlling valves 0-FCV-67-152 and 0-FCV-67-144.
5. The operator will open the ERCW supply to Containment Spray HX 2B-B by opening valves 2-FCV-67-123 and 2-FCV-67-124.

NRC RAI Question 1) b.iv.

iv. *Discuss the flow and differential pressure across the C CCW HX on both the tube side and shell side from the 3 Train B ERCW pumps and the 2 CCS pumps before and after ERCW flow is initiated to the containment spray (CS) HXs. Specify whether tube and shell flows and differential pressures across the C CCS HX are acceptable and why.*

TVA Response

The CCS HXs are designed for various operating cases per CCS HX datasheet, provided in vendor document WBN-VTD-O015-0020 (Enclosure 2, Attachment 6). The highest pressure drop and highest flow are for the tube side (ERCW) with 8,000,000 lb/hr (approximately 16,000 gpm) at 6.4 psi and for the shell side (CCS) with 6,000,000 lb/hr (approximately 12,000 gpm) at 19.7 psi. The ERCW and CCS models are constructed based on the flow and pressure drop identified in WBN-VTD-O015-0020 and if one value was exceeded then the other value would also be exceeded.

The following data is from the models established for ERCW and CCS that are identified in the data files for the respective calculation, but may not be specifically identified in the respective calculation.

	Unit 1 Normal/ Unit 2 LOCA	Unit 1 Hot Shutdown/ Unit 2 LOCA
CCS HX C ERCW Flow (gpm)	7390	9432
CCS HX C ERCW Pressure Drop (psi)	1.4	2.3
CCS HX C CCS Flow (gpm)	8,146	11,204
CCS HX C CCS Pressure Drop (psi)	9.2	17.4

The model flow and pressure drop are less than the design of the CCS HX and are therefore acceptable.

NRC RAI Question 1) b.v.

v. Discuss flow and differential pressure across the ERCW strainers and traveling screens when 3 ERCW pumps per train are operating. Address whether flows and differential pressures across the strainers and screens are acceptable and why.

TVA Response

For comparison, the following flow data is extracted from the models discussed in 1) a.i. and 1) b.i.

	Unit 1 Normal/ Unit 2 LOCA	Unit 1 Hot Shutdown/ Unit 2 LOCA
Flow Through ERCW Strainer 1B-B (gpm)	11,462	13,366
Flow Through ERCW Strainer 2B-B (gpm)	9,878	11,407
Total ERCW Flow (gpm)	21,340	24,773

The ERCW Multiflow model conservatively uses a fouled strainer pressure drop for all cases. During normal operation, the strainers are periodically and automatically back flushed, removing debris that has accumulated. During an accident scenario, the strainers are continuously back flushed and the actual strainer pressure is approximately that of a clean strainer. A fouled strainer pressure drop is the maximum pressure drop during any mode of operation and bounds the accident scenarios.

The ERCW Multiflow model calculates the strainer pressure drop based on the flow using the fouled strainer pressure drop input into the model. The increased flow between the cases is based on a fouled strainer which is the maximum strainer pressure drop experienced due to the automatic back flush feature. The ERCW strainers are 24-inch size. Per vendor document WBN-VTD-K143-0020, the ERCW strainers can handle flows up to 33,000 gpm which is well above the required ERCW flow.

Traveling screen effectiveness is not impacted by the change of two ERCW pumps to three ERCW pumps during an accident with LOOP event. Design criteria WB-DC-20-20 requires one traveling screen to have sufficient capacity to pass the required amount of water, although two traveling screens are available per train. Calculation EPMRCP052992 evaluates flow through one traveling screen during accident conditions and concludes that one screen can pass the required flow with loss of a train based on TVA guidance and industry standard practice. This conclusion is valid for three ERCW pumps or two ERCW pumps in operation. The traveling screen is acceptable for the higher ERCW flow produced from three ERCW pumps.

The increase in flow across the traveling screens does result in higher pressure drop and less available submergence or NPSHa for the screen wash pumps. Calculation EPMWUC072489 documents that sufficient margin exists to ensure that available submergence and NPSHa are acceptable.

NRC RAI Question 2)

The MODE 5 REQUIRED ACTIONS of proposed TS 3.7.16 and TS 3.7.17 do not appear to provide any remedial actions to place the non-accident unit in any safer status in the event of an inoperable CS [CCS] or ERCW train. Provide additional justification for the action proposed and discuss any alternative actions available to place the unit in a safer status in the event of an inoperable CCS or ERCW train.

TVA Response

The changes made to the TS 3.7.16 and TS 3.7.17 Required Actions provide actions to address the loss of redundancy, similar to the Required Actions of TS 3.7.7, "Component Cooling System," and TS 3.7.8, "Essential Raw Cooling Water." See the revised TS 3.7.16 and TS 3.7.17 in Enclosure 1, Attachments 1 and 2, respectively.

NRC RAI Question 3)

Please provide explanation for the reference to the 10CFR50 Appendix R fire scenario and the need for two ERCW pumps on one DG identified on page E1-11.

TVA Response

WBN Unit 1 repair procedure MI-0.047, Section 6.3 for the Train A pumps installs a jumper to bypass the relay contact for fire scenarios when additional ERCW flow is required. The interlock bypass switches will perform a similar function as the existing Unit 1 repair procedure. These switches will be used to support Dual Unit Appendix R requirements where Dual Unit Appendix R flow calculations have shown the need for three ERCW pumps running to place both units in a safe shutdown condition. In fire zones where Train A is unavailable, this will require starting two pumps from the same diesel generator backed Train B board. Note that no fire event results in the reverse situation for Train B unavailable.

The new interlock bypass switches will allow this similar function to be performed in a timely manner for safe shutdown. For dual unit operation, the interlock bypass switches allow Manual Operator Actions (MOAs) instead of a repair procedure for Appendix R events and thus the repair procedure will no longer be required. The new plant configuration is described in Sections VI and VII of the Dual Unit Fire Protection Report, previously submitted to the NRC on June 24, 2015 (Reference 3).

NRC RAI Question 4)

The staff noted the following statement in the APPLICABILITY section of the proposed TS 3.7.16 Bases "... any resulting temporary loss of redundancy or single failure protection is taken into account..." This statement appears to be an interpretation of the TS, not a bases (reason) for the specification. Per 10CFR50.36(a)(1) "... bases or reasons for such specifications ..." are to be included "... but shall not become part of the specifications." Please either remove this statement or provide additional justification for its inclusion in the TS bases.

TVA Response

The statement provided in the TS 3.7.16 Bases is not required for understanding of the TS and has been removed from the Bases.

REFERENCES

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

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

3. Letter from TVA to NRC, "Watts Bar Nuclear Plant (WBN) Unit 2 - Transmittal of Unit 1/Unit 2 As-Constructed Fire Protection Report (TAC No. ME3091)," dated June 24, 2015.

ENCLOSURE 2

Responses to NRC RAIs for WBN Unit 1 ERCW and CCS License Amendment Request

ATTACHMENTS

ENCLOSURE 2

Attachment 1

ERCW Flow Model -

U1 Cold Shutdown, U2 LOOP / LOCA

Table A11.5: Test Data for ERCW pumps / Cvs

Component	Unit		Req'd	Normal / Normal Case 200	Case 200 Margin	U1 CS / U2 LOCA LoTA Case 300	Case 300 Margin	U1 LOCA / U2 CS LoTA Case 500	Case 500 Marging	U1 HS / U2 SU Case 700	Case 700 Margin
692' RC 1B-B	1	PEN1B1.7 → PENRMDIS.1	12.0	40.5	238%	30.3	153%	27.8	132%	40.9	241%
692' RC 2B-B	1 & 2	PEN2B1D.2 → AC2BDIS.13	12.0	29.6	147%	19.6	63%	22.7	89%	29.6	147%
713' RC 1B-B	1	PEN1B2.7 → PENRMDIS.3	11.0	27.8	153%	21.0	91%	19.4	76%	27.9	154%
713' RC 2B-B	1 & 2	2B109 → 2B110	11.0	28.0	155%	18.0	64%	20.9	90%	28.1	155%
737' RC 1B-B	1	PEN1B3.7 → PENRMDIS.3	12.0	33.2	177%	25.5	113%	22.9	91%	33.2	177%
737' RC 2B-B	1 & 2	2B119 → 2B110	12.0	20.3	69%	13.6	13%	15.6	30%	26.7	123%
ACAS AfterC B	0	ACACBBDIS.5 → ACACBBDIS.6	2.0	3.1	55%	2.2	10%	2.2	10%	2.4	20%
ACAS Cylind B	0	ACACBBDIS.2 → ACACBBDIS.3	1.5	3.7	147%	1.9	27%	2.2	47%	3.8	153%
BATP/AFWP RC B-B	0	BA2BDIS.4 → AC2BDIS.4	60.0	110.5	84%	71.9	20%	84.7	41%	113.4	89%
CCP RC 1B-B	1	CCP1B.7 → CCP1B.9	25.0	40.6	62%	30.8	23%	28.3	13%	40.7	63%
CCP RC 2B-B	2	CCPRC7 → CCPRC8	25.0	46.7	87%	32.0	28%	37.5	50%	47.1	88%
CCS Hx C-B (152)	0	18 → 19	7,125.0	0.0	Special	7,390.4	4%	8,578.7	20%	0.0	Special
CCS Hx C-B (144)	0	109B → 109C		6,672.4	11%	0.0	NIS	0.0	NIS	6,000.0	0%
CCS HX C-B Dummy	0	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CCS HX C-B Dummy	0	NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CCS/AFWP RC B-B	0	CCSAFW1B.16 → CCSAFW1B.17	102.0	155.0	52%	118.6	16%	109.0	7%	157.1	54%
CRDMC 1B-B	1	10H1 → 10J1	124.0	182.1	47%	127.9	NRqd	N/A	NRqd	180.1	45%
CRDMC 1D-B	1	CRDD1 → CRDD2	124.0	229.1	85%	171.2	NRqd	N/A	NRqd	229.2	85%
CRDMC 2B-B	2	2.10H1 → 2.10J1	124.0	128.4	4%	N/A	NRqd	175.4	Broken	194.0	56%
CRDMC 2D-B	2	2.CRDD1→ 2.CRDD2	124.0	140.1	13%	N/A	NRqd	178.9	Broken	149.1	20%
CSP RC 1B-B	1	68F9 → 68F11	28.0	0.0	NRqd	29.9	NRqd	48.5	73%	0.0	NRqd
CSP RC 2B-B	2	CSPRC9 → CSPRC11	28.0	0.0	NRqd	40.1	43%	46.6	NRqd	27.2	NRqd
CSS Hx 1B-B	1	13.1 → 28.1	5,200.0	0.0	NRqd	0.0	NRqd	6,581.5	27%	0.0	NRqd
CSS Hx 2B-B	2	CS2B01 → CS2B03	5,200.0	0.0	NRqd	5,478.1	5%	0.0	NRqd	0.0	NRqd
EBR RC B-B	0	57B.1 → 57C.1	300.0	449.5	50%	342.0	14%	314.3	5%	455.9	52%
EDG 1B1-B	0	DG1BB.4 → DG1BB.6	650.0	934.0	44%	742.6	14%	727.2	12%	0.0	NRqd
EDG 1B2-B	0	DG1BB.2 → DG1BB.5	650.0	968.9	49%	761.6	17%	746.0	15%	0.0	NRqd
EDG 2B1-B	0	DG2BB.4 → DG2BB.6	650.0	0.0	NRqd	757.6	17%	741.9	14%	0.0	NRqd
EDG 2B2-B	0	DG2BB.2 → DG2BB.5	650.0	0.0	NRqd	759.1	17%	770.8	19%	0.0	NRqd
EGTS RC B-B	0	EGT2BDIS.4 → EGT2BDIS.5	10.0	20.8	108%	13.9	39%	16.3	63%	0.0	NRqd
LCC 1B-B	1	10D1 → 10E1	306.0	425.5	39%	293.3	-4%	N/A	NRqd	434.0	42%
LCC 1D-B	1	LCVCD1 → LCVCD2	306.0	415.8	36%	301.7	-1%	N/A	NRqd	413.9	35%
LCC 2B-B	2	2.10D1 → 2.10E1	306.0	431.7	41%	N/A	NRqd	349.5	14%	471.8	54%
LCC 2D-B	2	2.LCVCD1 → 2.LCVCD2	306.0	424.5	39%	N/A	NRqd	358.0	17%	415.9	36%
MCR RC B-B	0	15.8 → 15.10	240.0	421.8	76%	326.8	36%	308.2	28%	423.6	77%
PC RC 1B-B	1	PCC1B.7 → PCC1B.9	15.0	41.8	179%	31.6	111%	29.4	96%	41.8	179%
PC RC 2B-B	2	2B124 → 2B125	15.0	26.3	75%	17.0	13%	19.7	31%	26.8	79%
RBIR RC1B-B	1	IR1B.10 → 11.1C	30.0	52.7	76%	33.2	11%	39.0	30%	49.9	66%
RBIR RC 2B-B	2	IRWC2B04 → 11C (IRWC2B02 → IRWC2B03)	30.0	52.6	75%	105.7	Broken	107.3	Broken	56.7	89%
RCP MAC 1-2-B	1	10V1 → 10S1 (10I1 → 10Z1)	110.0	122.8	12%	636.7	Broken	N/A	NRqd	124.0	13%
RCP MAC 1-4-B	1	RCP4.8 → LCVCDDIS1 (RCP4.1 → RCP4.2)	110.0	131.3	19%	458.2	Broken	N/A	NRqd	133.6	21%
RCP MAC 2-2-B	2	2.10V1 → 2.10S1 (2.10I1 → 2.10Z1)	110.0	118.8	8%	N/A	NRqd	99.4	NRqd	115.0	5%
RCP MAC 2-4-B	2	2.RCP4.8 → 2.LCVCDDIS1 (2.RCP4.1 → 2.RCP4.2)	110.0	115.7	5%	N/A	NRqd	102.9	NRqd	122.9	12%

Table A11.5: Test Data for ERCW pumps / Cvs

Component	Unit	Link	Req'd	Normal / Normal Case 200	Case 200 Margin	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin	U1 LOCA / U2 CS LoTB Case 600	Case 600 Margin	U1 HS / U2 SU Case 700	Case 700 Margin	
692' RC 1A-A	1	66D2 → 66G2	12.0	25.5	113%	18.4	53%	15.3	28%	22.5	88%	R13
692' RC 2A-A	1 & 2	66D.4 → 66G.4	12.0	24.1	101%	12.4	3%	16.6	38%	19.5	63%	
713' RC 1A-A	1	67E2 → 67G2	11.0	22.2	102%	16.0	45%	14.2	29%	18.9	72%	
713' RC 2A-A	1 & 2	67E4 → 67G6	11.0	24.8	125%	12.6	15%	17.6	60%	20.4	85%	
737' RC 1A-A	1	67S2 → 67G2	12.0	33.0	175%	23.7	98%	20.3	69%	29.5	146%	
737' RC 2A-A	1 & 2	67S4 → 67G6	10.0	23.3	133%	11.2	12%	13.2	32%	15.3	53%	
ACAS AfterC A	0	54R1 → 54Q1	1.5	1.6	7%	1.7	13%	1.6	7%	1.7	13%	
ACAS Cylind A	0	54R → 54Q	2.0	3.0	50%	2.3	15%	2.1	5%	2.7	35%	
BATP/AFWP RC A-A	0	54O2 → 54P.2	60.0	116.3	94%	63.5	6%	77.5	29%	91.9	53%	
CCP RC 1A-A	1	58D1 → 58D.2	25.0	40.4	62%	29.6	18%	29.2	17%	41.1	64%	
CCP RC 2A-A	2	58E.2 → 58F2	25.0	49.2	97%	29.3	17%	33.7	35%	39.0	56%	
CCS Hx A-A (146)	1	103D → 19	5,050.0	0.0	Isolated	5,272.8	4%	5,201.6	18%	5,894.4	2%	
CCS Hx A-A (143)	1	103 → 103B		3,339.3	1%	0.0	Isolated	0.0	Isolated	863.9		
CCS Hx B-A (146)	2	106 → 107	5,050.0	0.0	Isolated	4,400.0	0%	5,386.1	7%	7,061.7	6%	
CCS Hx B-A (143)	2	106A → 106B		3,376.6	2%	0.0	Isolated	0.0	Isolated	0.0	Isolated	
CCS/AFWP RC A-A	0	56T5 → 55F	102.0	158.1	55%	125.1	23%	121.8	19%	169.4	66%	
CRDMC 1A-A	1	50H → 50J	124.0	208.9	68%	142.5	NRqd	N/A	NRqd	188.4	52%	
CRDMC 1C-A	1	CRDC1 → CRDC2	124.0	0.0	NIS	119.8	NRqd	N/A	NRqd	151.9	23%	
CRDMC 2A-A	2	2.50H → 2.50J	124.0	163.8	32%	N/A	NRqd	156.1	Broken	125.8	1%	
CRDMC 2C-A	2	2.CRDC1→ 2.CRDC2	124.0	155.4	25%	N/A	NRqd	135.9	Broken	115.7	-7%	
CSP RC 1A-A	1	65M2 → 65N2	28.0	0.0	NRqd	3.0	NRqd	35.0	25%	0.0	NRqd	
CSP RC 2A-A	2	65M.6 → 65N4	28.0	0.0	NRqd	31.3	12%	33.7	NRqd	23.3	NRqd	
CSS Hx 1A-A	1	53 → 53A	5,200.0	0.0	NRqd	0.0	NRqd	5,580.9	7%	0.0	NRqd	
CSS Hx 2A-A	2	53.2 → CS2A01	5,200.0	0.0	NRqd	5,344.7	3%	0.0	NRqd	0.0	NRqd	
EBR RC A-A	0	57B → 55H	300.0	410.1	37%	320.4	7%	301.9	1%	420.1	40%	
EDG 1A1-A	0	48E1 → 48F	650.0	1,048.6	61%	789.3	21%	735.8	13%	0.0	NRqd	
EDG 1A2-A	0	48B1 → 48F1	650.0	1,033.9	59%	788.0	21%	745.8	15%	0.0	NRqd	
EDG 2A1-A	0	48C1 → 48P	650.0	0.0	NRqd	741.1	14%	704.8	8%	0.0	NRqd	
EDG 2A2-A	0	48M → 48C3	650.0	0.0	NRqd	755.0	16%	717.7	10%	0.0	NRqd	
EGTS RC A-A	0	54X2 → 54Y2	10.0	29.1	191%	18.1	81%	20.5	105%	0.0	NRqd	
LCC 1A-A	1	50D → 50E	306.0	440.2	44%	303.6	-1%	N/A	NRqd	399.2	30%	
LCC 1C-A	1	LCVCC1 → LCVCC2	306.0	424.7	39%	291.3	-5%	N/A	NRqd	371.7	21%	
LCC 2A-A	2	2.50D → 2.50E	306.0	498.6	63%	N/A	NRqd	326.6	7%	378.8	24%	
LCC 2C-A	2	2.LCVCC1 → 2.LCVCC2	306.0	512.5	67%	N/A	NRqd	320.2	5%	381.0	25%	
MCR RC A-A	0	55C → 55D	240.0	434.5	81%	400.4	67%	251.9	5%	340.8	42%	
PC RC 1A-A	1	67M2 → 67N2	15.0	30.1	101%	21.7	45%	18.9	26%	26.7	78%	
PC RC 2A-A	2	67M.6 → 67M.8	15.0	34.4	129%	18.0	20%	20.8	39%	24.4	63%	
RBIR RC 1A-A	1	51.1E → 51.1C	30.0	47.6	59%	37.6	25%	35.7	19%	48.6	62%	
RBIR RC 2A-A	2	IRWC2A04 → IRWC2A05 (IRWC2A02 → IRWC2A03)	30.0	54.1	80%	98.5	Broken	111.4	Broken	44.7	49%	
RCP MAC 1-1-A	1	50V → 50S (50I → 50Z)	110.0	119.6	9%	489.3	Broken	0.0	NRqd	109.7	0%	
RCP MAC 1-3-A	1	RCP3.8 → LCVCDIS1 (RCP3.1 → RCP3.2)	110.0	117.1	6%	442.3	Broken	N/A	NRqd	105.6	-4%	
RCP MAC 2-1-A	2	2.50V → 2.50S (2.50I → 2.50Z)	110.0	187.0	70%	N/A	NRqd	128.1	NRqd	146.6	33%	
RCP MAC 2-3-A	2	2.RCP3.8 → 2.LCVCCDIS1 (2.RCP3.1 → 2.RCP3.2)	110.0	178.7	62%	N/A	NRqd	119.6	NRqd	136.1	24%	

This Page Replaced by Revision 013.

Table A11.5: Test Data for ERCW pumps / Cvs

Component	Unit		Req'd	Normal / Normal Case 200	Case 200 Margin	U1 CS / U2 LOCA LoTA Case 300	Case 300 Margin	U1 LOCA / U2 CS LoTA Case 500	Case 500 Marging	U1 HS / U2 SU Case 700	Case 700 Margin
RCP RC 1C-B	1	RCP1C.13 → 68D8	12.0	16.7	39%	12.8	NRqd	11.8	-2%	17.0	42%
RHRP RC 1B-B	1	68G16 → 68G17	19.0	42.0	121%	31.7	67%	28.9	52%	42.8	125%
RHRP RC 2B-B	2	RHRPRC9 → RHRPRC9.1	19.0	32.7	72%	21.0	11%	27.0	42%	36.3	91%
SDBR RC B-B	0	SDBRB2 → 27	560.0	696.4	24%	641.7	15%	746.5	33%	893.1	59%
SFPP/TBBP RC B-B	0	SFPTBB7 → SFPTBB9	29.0	42.8	48%	33.6	16%	30.9	7%	43.6	50%
SIP RC 1B-B	1	SIS1B.9 → 68E10	22.0	0.0	NRqd	23.6	NRqd	38.9	77%	0.0	NRqd
SIP RC 2B-B	2	SISPRC8 → SISPRC9	22.0	0.0	NRqd	28.4	29%	22.8	NRqd	0.0	NRqd
Strainer 1B-B	0	4BO → 4BO1	450.0	0.0	NRqd	450.0	0%	450.0	0%	0.0	Special
Strainer 2B-B	0	4AO → 4AO1	450.0	0.0	NRqd	450.0	0%	450.0	0%	0.0	Special
UCC 1B-B	1	12O1 → 12L1 (12E1 → 12F1)	23.0	24.4	6%	46.9	Broken	0.0	NRqd	24.9	8%
UCC 1D-B	1	UCVC1D.10 → 12Y1 (UCVC1D.3 → UCVC1D.4)	23.0	25.7	12%	45.7	Broken	0.0	NRqd	26.2	14%
UCC 2B-B	2	2.12O1 → 2.12L1 (2.12E1 → 2.12F1)	23.0	33.4	45%	0.0	NRqd	60.0	Broken	32.1	40%
UCC 2D-B	2	2.UCVC1D.10 → 2.12Y1 (2.UCVC1D.3 → 2.UCVC1D.4)	23.0	29.7	29%	0.0	NRqd	54.3	Broken	30.3	32%
Broke 1-1054B-B		10A1 → 10B1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Broke 1-1054D-B		10A1 → 10B2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Broke 2-1054B-B		2.10A1 → 2.10B1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Broke 2-1054D-B		2.10A1 → 2.10B2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Scrn Wsh P 2B-B	0	BP30 → BP32	10.0	11.5	15%	9.8	-2%	9.1	-9%	12.4	24%
Scrn Wsh P 1B-B	0	BP30 → BP34	10.0	11.3	13%	9.6	-4%	8.9	-11%	12.1	21%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	54.0	0%	54.0	0%	50.1	-7%	54.0	0%
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	54.0	0%	54.0	0%	50.2	-7%	54.0	0%
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	54.0	0%	54.0	0%	49.4	-9%	54.0	0%
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	136.6	42%	112.4	17%	108.7	13%	127.6	33%
SAC B Header		68M1 → 68M2	N/A	0.0	N/A	274.4	N/A	258.4	N/A	0.0	N/A
SPLY CNTMT COOLERS		2.10B1.1 → 2.10B1.2	N/A	679.0	N/A	N/A	N/A	624.4	N/A	780.7	N/A
SPLY CNTMT COOLERS		2.LCVCDSUP1 → 2.LCVCDSUP2	N/A	680.3	N/A	N/A	N/A	639.8	N/A	687.9	N/A
SPLY CNTMT COOLERS		10B1.1 → 10B1.2	N/A	730.5	N/A	1,057.9	N/A	N/A	N/A	738.0	N/A
SPLY CNTMT COOLERS		LCVCDSUP1 → LCVCDSUP2	N/A	776.3	N/A	931.1	N/A	N/A	N/A	776.7	N/A

Table A11.5: Test Data for ERCW pumps / Cvs

Component	Unit	Link	Req'd	Normal / Normal Case 200	Case 200 Margin	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin	U1 LOCA / U2 CS LoTB Case 600	Case 600 Margin	U1 HS / U2 SU Case 700	Case 700 Margin
RCP RC Dummy		NA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RHRP RC 1A-A	1	65S6 → 65S8	19.0	29.9	57%	24.5	29%	21.7	14%	30.8	62%
RHRP RC 2A-A	2	65S12 → 65S14	19.0	37.4	97%	19.9	5%	24.8	31%	29.3	54%
SDBR RC A-A	0	55A3 → 55E	560.0	696.2	24%	653.3	17%	610.1	9%	838.2	50%
SFPP/TBBP RC A-A	0	54J → 54K1	29.0	47.7	64%	36.7	27%	34.2	18%	46.9	62%
SIP RC 1A-A	1	65F2 → 65G2	22.0	0.0	NRqd	24.6	NRqd	27.3	24%	0.0	NRqd
SIP RC 2A-A	2	65F6 → 65G8	22.0	0.0	NRqd	25.2	15%	26.8	NRqd	0.0	NRqd
Strainer 1A-A	0	44AO → 44AO1	450.0	0.0	NRqd	450.0	0%	450.0	0%	0.0	NRqd
Strainer 2A-A	0	44BO → 44BO2	450.0	0.0	NRqd	450.0	0%	450.0	0%	0.0	NRqd
UCC 1A-A	1	52O → 52L (52E → 52F)	23.0	42.2	83%	51.8	Broken	0.0	NRqd	38.2	66%
UCC 1C-A	1	UCVC1C.10 → 52Y (UCVC1C.3 → UCVC1C.4)	23.0	43.9	91%	83.5	Broken	0.0	NRqd	41.5	80%
UCC 2A-A	2	2.52O → 2.52L (2.52E → 2.52F)	23.0	63.3	175%	0.0	NRqd	61.2	Broken	45.9	100%
UCC 2C-A	2	2.UCVC1C.10 → 2.52Y (2.UCVC1C.3 → 2.UCVC1C.4)	23.0	33.9	47%	0.0	NRqd	74.8	Broken	43.4	89%
Broke 2-1054A-A		2.50A → 2.50B3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Broke 2-1054C-A		2.50A → 2.50B5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Broke 1-1054A-A		50A → 50B3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Broke 1-1054C-A		50A → 50B5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Scrn Wsh P 1A-A	0	AP25 → AP27	10.0	14.6	46%	11.8	18%	11.8	18%	14.2	42%
Scrn Wsh P 2A-A	0	AP25 → AP29	10.0	10.6	6%	8.5	-15%	8.5	-15%	10.3	3%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	54.0	0%	54.0	0%	53.0	-2%	54.0	0%
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	54.0	0%	54.0	0%	53.1	-2%	54.0	0%
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	54.0	0%	54.0	0%	52.4	-3%	54.0	0%
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	136.6	42%	103.7	8%	100.4	4%	127.6	33%
SAC A Header		59 → 59A	N/A	298.6	N/A	265.7	N/A	259.0	N/A	289.6	N/A
SPLY CNTMT COOLERS		2.LCVCCSUP1 → 2.LCVCCSUP2	N/A	846.7	N/A	N/A	N/A	575.7	N/A	632.9	N/A
SPLY CNTMT COOLERS		2.50B1 → 2.50B2	N/A	849.2	N/A	N/A	N/A	610.8	N/A	651.1	N/A
SPLY CNTMT COOLERS		50B1 → 50B2	N/A	768.8	N/A	935.4	N/A	N/A	N/A	697.3	N/A
SPLY CNTMT COOLERS		LCVCCSUP1 → LCVCCSUP2	N/A	541.7	N/A	853.3	N/A	N/A	N/A	629.2	N/A

R13

- Greater than 30% flow margin
- Between 20% and 30% flow margin
- Between 10% and 20% flow margin
- Between 0% and 10% flow margin
- Less than 0% flow margin

Notes:
1. Cases 300, 400, 500, 600 consider loss of downstream dam and broken coolers.
2. All cases consider 93% pumps.

ENCLOSURE 2

Attachment 2

CCS Flow Model -

U1 Cold Shutdown, U2 LOOP / LOCA

Appendix 10
CCS Flow Balance Test Results for Dual Unit Operation
Table 1

Component	Train	Link	Req'd	Case 7K/E - Unit 1 CS/2 LOCA, C-S, Train B				Case 7K/E - Unit 1 CS/2 LOCA, 2B-B, Train B					
				Test Flow (gpm)	Cv	Flow @ 90%P (gpm)	Margin	Test Flow (gpm)	Cv	Flow @ 90%P (gpm)	Margin	Flow @ 90%P (gpm)	Margin
Cent Chr Pump 1B-B	B	189 → 190	28.0	34.31	N/A	32.8	17%	34.04	N/A	33.0	18%	32.4	16%
CCP 1B-B Lube Cooler	2A	271B → 269	20.0	22.53	4.90	21.5	8%	22.54	4.89	21.9	9%	21.5	8%
CCP 1B-B Gear Cooler	2A	272 → 273	8.0	11.76	2.67	11.2	40%	11.48	2.58	11.1	39%	10.9	36%
Cent Chr Pump 2B-B	B	U2189 → U2190	28.0	32.33	N/A	31.0	11%	32.09	N/A	31.1	11%	30.6	9%
CCP 2B-B Lube Cooler	2A	U2271B → U2269	20.0	22.24	5.14	21.3	7%	22.23	5.11	21.6	8%	21.2	6%
CCP 2B-B Gear Cooler	2A	U2272 → U2273	8.0	10.09	2.36	9.7	21%	9.85	2.28	9.5	19%	9.4	18%
CS Pump Oil HX 1B-B	B	203 → 204	2.0	6.90	1.34	6.6	230%	6.71	1.30	6.5	225%	6.4	220%
CS Pump Oil HX 2B-B	B	U2203 → U2204	2.0	6.84	1.41	6.6	230%	6.72	1.38	6.5	225%	6.4	220%
Radiation Monitor 0-RE-90-123	B	180C → 180D 210B → 210A	6.0	0.88	N/A	6.1	2%	0.89	N/A	6.1	2%	6.1	2%
RHR HX 1B-B	B	206 → 207	2,725.0	2844.60	563.83	3000.0	10%	2835.68	561.68	2753.2	1.03%	2920.0	7%
RHR HX 2B-B	B	U2206 → U2207	5,000.0	5251.91	2253.00	5000.0	0%	5178.04	2079.2	5109.1	2.18%	5000.0	0%
RHR Pmp Seal Water 1B-B	B	199 → 200	10.0	13.82	2.83	13.2	32%	13.80	2.83	13.4	34%	13.2	32%
RHR Pmp Seal Water 2B-B	B	U2199 → U2200	10.0	12.71	2.75	12.2	22%	12.67	2.73	12.3	23%	12.1	21%
SI Pump 1B-B	B	194 → 195	15.0	20.78	4.11	19.8	32%	20.17	3.96	19.6	31%	19.2	28%
SI Pump 2B-B	B	U2194 → U2195	15.0	18.52	3.93	17.8	19%	18.11	3.81	17.6	17%	17.3	15%

Component	Train	Link	Req'd	Case 7L/F - Unit 1 LOCA/2 CS, C-S, Train B				Case 7L/F - Unit 1 LOCA/2 CS, 2B-B, Train B					
				Test Flow (gpm)	Cv	Flow @ 90%P (gpm)	Margin	Test Flow (gpm)	Cv	Flow @ 90%P (gpm)	Margin	Flow @ 90%P (gpm)	Margin
Cent Chr Pump 1B-B	B	189 → 190	28.0	35.53	N/A	34.8	24%	31.10	N/A	30.3	8%	30.6	9%
CCP 1B-B Lube Cooler	2A	271B → 269	20.0	24.38	5.41	23.9	20%	20.32	4.24	19.8	-1%	20.0	0%
CCP 1B-B Gear Cooler	2A	272 → 273	8.0	11.19	2.53	11.0	38%	10.70	2.31	10.5	31%	10.5	31%
Cent Chr Pump 2B-B	B	U2189 → U2190	28.0	32.78	N/A	32.1	15%	32.71	N/A	31.9	14%	32.2	15%
CCP 2B-B Lube Cooler	2A	U2271B → U2269	20.0	22.89	4.82	22.4	12%	22.62	4.81	22.1	11%	22.3	12%
CCP 2B-B Gear Cooler	2A	U2272 → U2273	8.0	9.89	2.09	9.7	21%	10.09	2.16	9.8	23%	9.9	24%
CS Pump Oil HX 1B-B	B	203 → 204	2.0	6.46	1.24	6.4	220%	6.51	1.26	6.4	220%	6.4	220%
CS Pump Oil HX 2B-B	B	U2203 → U2204	2.0	6.92	1.32	6.8	240%	6.90	1.32	6.7	235%	6.8	240%
Radiation Monitor 0-RE-90-123	B	180C → 180D 210B → 210A	6.0	0.90	N/A	6.1	2%	0.88	N/A	6.1	2%	6.1	2%
RHR HX 1B-B	B	206 → 207	5,000.0	5115.50	1671.3	5000.0	0%	5088.00	1683.2	4966.0	-0.68%	5000.0	0%
RHR HX 2B-B	B	U2206 → U2207	2,725.0	2874.67	549.8	2820.0	3%	2848.15	548.38	2792.9	2.49%	2725.0	0%
RHR Pmp Seal Water 1B-B	B	199 → 200	10.0	13.22	2.66	13.0	30%	12.79	2.57	12.5	25%	12.6	26%
RHR Pmp Seal Water 2B-B	B	U2199 → U2200	10.0	13.02	2.59	12.8	28%	13.10	2.63	12.8	28%	12.9	29%
SI Pump 1B-B	B	194 → 195	15.0	19.27	3.74	18.9	26%	19.40	3.80	18.9	26%	19.1	27%
SI Pump 2B-B	B	U2194 → U2195	15.0	18.69	3.64	18.3	22%	18.38	3.60	18.0	20%	18.1	21%

Notes:
1. Test flows are nominal values minus instrument inaccuracy.
2. Margin is the percent difference between the "Req'd" flow and "Flow @ XX%P (gpm)".

ENCLOSURE 2

Attachment 3

ERCW Flow Model with Discharge Through

Hydraulic Gradient Discharge Structure

Table A14.1: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTA Case 300	Case 300 Margin	U1 LOCA / U2 CS LoTA Case 600	Case 600 Marging
692' RC 1B-B	1	PEN1B1.7 → PENRMDIS.1	12.0	29.8	148%	28.0	133%
692' RC 2B-B	1 & 2	PEN2B1D.2 → AC2BDIS.13	12.0	19.3	61%	22.8	90%
713' RC 1B-B	1	PEN1B2.7 → PENRMDIS.3	11.0	20.6	87%	19.5	77%
713' RC 2B-B	1 & 2	2B109 → 2B110	11.0	17.7	61%	20.9	90%
737' RC 1B-B	1	PEN1B3.7 → PENRMDIS.3	12.0	25.0	108%	23.0	92%
737' RC 2B-B	1 & 2	2B119 → 2B110	12.0	13.4	12%	15.7	31%
ACAS AfterC B	0	ACACBBDIS.5 → ACACBBDIS.6	2.0	2.2	10%	2.2	10%
ACAS Cylind B	0	ACACBBDIS.2 → ACACBBDIS.3	1.5	1.8	20%	2.2	47%
BATP/AFWP RC B-B	0	BA2BDIS.4 → AC2BDIS.4	60.0	70.6	18%	85.1	42%
CCP RC 1B-B	1	CCP1B.7 → CCP1B.9	25.0	30.2	21%	28.4	14%
CCP RC 2B-B	2	CCPRC7 → CCPRC8	25.0	31.5	26%	37.7	51%
CCS Hx C-B (152)	0	18 → 19	7,125.0	7,263.0	2%	8,610.5	21%
CCS Hx C-B (144)	0	109B → 109C		0.0	NIS	0.0	NIS
CCS HX C-B Dummy	0	NA	N/A	N/A	N/A	N/A	N/A
CCS HX C-B Dummy	0	NA	N/A	N/A	N/A	N/A	N/A
CCS/AFWP RC B-B	0	CCSAFW1B.16 → CCSAFW1B.17	102.0	116.6	14%	109.4	7%
CRDMC 1B-B	1	10H1 → 10J1	124.0	124.9	NRqd	N/A	NRqd
CRDMC 1D-B	1	CRDD1 → CRDD2	124.0	167.6	NRqd	N/A	NRqd
CRDMC 2B-B	2	2.10H1 → 2.10J1	124.0	N/A	NRqd	174.6	Broken
CRDMC 2D-B	2	2.CRDD1→ 2.CRDD2	124.0	N/A	NRqd	178.1	Broken
CSP RC 1B-B	1	68F9 → 68F11	28.0	29.4	NRqd	48.6	74%
CSP RC 2B-B	2	CSPRC9 → CSPRC11	28.0	39.4	41%	46.8	NRqd
CSS Hx 1B-B	1	13.1 → 28.1	5,200.0	0.0	NRqd	6,605.6	27%
CSS Hx 2B-B	2	CS2B01 → CS2B03	5,200.0	5,383.5	4%	0.0	NRqd
EBR RC B-B	0	57B.1 → 57C.1	300.0	336.0	12%	315.5	5%
EDG 1B1-B	0	DG1BB.4 → DG1BB.6	650.0	729.3	12%	729.9	12%
EDG 1B2-B	0	DG1BB.2 → DG1BB.5	650.0	748.2	15%	748.8	15%
EDG 2B1-B	0	DG2BB.4 → DG2BB.6	650.0	744.0	14%	744.6	15%
EDG 2B2-B	0	DG2BB.2 → DG2BB.5	650.0	745.7	15%	773.6	19%
EGTS RC B-B	0	EGT2BDIS.4 → EGT2BDIS.5	10.0	13.7	37%	16.3	63%
LCC 1B-B	1	10D1 → 10E1	306.0	288.3	-6%	N/A	NRqd
LCC 1D-B	1	LCVCD1 → LCVCD2	306.0	295.4	-3%	N/A	NRqd
LCC 2B-B	2	2.10D1 → 2.10E1	306.0	N/A	NRqd	351.0	15%
LCC 2D-B	2	2.LCVCD1 → 2.LCVCD2	306.0	N/A	NRqd	359.5	17%

Table A14.1: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin	U1 LOCA / U2 CS LoTB Case 600	Case 600 Margin
692' RC 1A-A	1	66D2 → 66G2	12.0	18.1	51%	15.0	25%
692' RC 2A-A	1 & 2	66D.4 → 66G.4	12.0	12.0	0%	16.1	34%
713' RC 1A-A	1	67E2 → 67G2	11.0	15.7	43%	13.9	26%
713' RC 2A-A	1 & 2	67E4 → 67G6	11.0	12.2	11%	17.1	55%
737' RC 1A-A	1	67S2 → 67G2	12.0	23.3	94%	19.9	66%
737' RC 2A-A	1 & 2	67S4 → 67G6	10.0	10.8	8%	12.8	28%
ACAS AfterC A	0	54R1 → 54Q1	1.5	1.7	13%	1.5	0%
ACAS Cylind A	0	54R → 54Q	2.0	2.2	10%	2.0	0%
BATP/AFWP RC A-A	0	54O2 → 54P.2	60.0	61.1	2%	75.2	25%
CCP RC 1A-A	1	58D1 → 58D.2	25.0	29.1	16%	28.7	15%
CCP RC 2A-A	2	58E.2 → 58F2	25.0	28.2	13%	32.8	31%
CCS Hx A-A (146)	1	103D → 19	5,050.0	5,672.2	12%	5,456.4	24%
CCS Hx A-A (143)	1	103 → 103B		0.0	Isolated	0.0	Isolated
CCS Hx B-A (146)	2	106 → 107	5,050.0	4,168.1	-5%	5,189.7	3%
CCS Hx B-A (143)	2	106A → 106B		0.0	Isolated	0.0	Isolated
CCS/AFWP RC A-A	0	56T5 → 55F	102.0	122.6	20%	119.4	17%
CRDMC 1A-A	1	50H → 50J	124.0	139.3	NRqd	N/A	NRqd
CRDMC 1C-A	1	CRDC1 → CRDC2	124.0	117.2	NRqd	N/A	NRqd
CRDMC 2A-A	2	2.50H → 2.50J	124.0	N/A	NRqd	157.4	Broken
CRDMC 2C-A	2	2.CRDC1→ 2.CRDC2	124.0	N/A	NRqd	137.0	Broken
CSP RC 1A-A	1	65M2 → 65N2	28.0	30.7	NRqd	34.4	23%
CSP RC 2A-A	2	65M.6 → 65N4	28.0	34.2	22%	32.8	NRqd
CSS Hx 1A-A	1	53 → 53A	5,200.0	0.0	NRqd	5,480.5	5%
CSS Hx 2A-A	2	53.2 → CS2A01	5,200.0	5,146.2	-1%	0.0	NRqd
EBR RC A-A	0	57B → 55H	300.0	314.3	5%	296.3	-1%
EDG 1A1-A	0	48E1 → 48F	650.0	773.6	19%	721.8	11%
EDG 1A2-A	0	48B1 → 48F1	650.0	772.8	19%	731.9	13%
EDG 2A1-A	0	48C1 → 48P	650.0	726.6	12%	691.5	6%
EDG 2A2-A	0	48M → 48C3	650.0	740.4	14%	704.3	8%
EGTS RC A-A	0	54X2 → 54Y2	10.0	17.4	74%	19.9	99%
LCC 1A-A	1	50D → 50E	306.0	296.8	-3%	N/A	NRqd
LCC 1C-A	1	LCVCC1 → LCVCC2	306.0	284.9	-7%	N/A	NRqd
LCC 2A-A	2	2.50D → 2.50E	306.0	N/A	NRqd	317.9	4%
LCC 2C-A	2	2.LCVCC1 → 2.LCVCC2	306.0	N/A	NRqd	311.7	2%

Table A14.1: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTA Case 300	Case 300 Margin	U1 LOCA / U2 CS LoTA Case 500	Case 500 Marging
MCR RC B-B	0	15.8 → 15.10	240.0	321.2	⇧ 34%	309.3	⇗ 29%
PC RC 1B-B	1	PCC1B.7 → PCC1B.9	15.0	31.0	⬆ 107%	29.5	⇧ 97%
PC RC 2B-B	2	2B124 → 2B125	15.0	16.7	⇨ 11%	19.8	⬆ 32%
RBIR RC1B-B	1	IR1B.10 → 11.1C	30.0	32.6	⇘ 9%	39.1	⇧ 30%
RBIR RC 2B-B	2	IRWC2B04 → 11C (IRWC2B02 → IRWC2B03)	30.0	107.7	Broken	106.9	Broken
RCP MAC 1-2-B	1	10V1 → 10S1 (10I1 → 10Z1)	110.0	646.4	Broken	N/A	NRqd
RCP MAC 1-4-B	1	RCP4.8 → LCVCDDIS1 (RCP4.1 → RCP4.2)	110.0	464.7	Broken	N/A	NRqd
RCP MAC 2-2-B	2	2.10V1 → 2.10S1 (2.10I1 → 2.10Z1)	110.0	N/A	NRqd	99.8	NRqd
RCP MAC 2-4-B	2	2.RCP4.8 → 2.LCVCDDIS1 (2.RCP4.1 → 2.RCP4.2)	110.0	N/A	NRqd	103.3	NRqd
RCP RC 1C-B	1	RCP1C.13 → 68D8	12.0	12.5	NRqd	11.9	⬇ -1%
RHRP RC 1B-B	1	68G16 → 68G17	19.0	31.1	⇧ 64%	29.0	⬆ 53%
RHRP RC 2B-B	2	RHRPRC9 → RHRPRC9.1	19.0	20.6	⇘ 8%	27.1	⇧ 43%
SDBR RC B-B	0	SDBRB2 → 27	560.0	630.6	⇨ 13%	749.3	⬆ 34%
SFPP/TBBP RC B-B	0	SFPTBB7 → SFPTBB9	29.0	33.0	⇨ 14%	31.0	⇘ 7%
SIP RC 1B-B	1	SIS1B.9 → 68E10	22.0	23.1	NRqd	39.1	⇧ 78%
SIP RC 2B-B	2	SISPRC8 → SISPRC9	22.0	27.9	⇗ 27%	22.9	NRqd
Strainer 1B-B	0	4BO → 4BO1	450.0	450.0	⇘ 0%	450.0	✔ 0%
Strainer 2B-B	0	4AO → 4AO1	450.0	450.0	⇘ 0%	450.0	⬆ 0%
UCC 1B-B	1	12O1 → 12L1 (12E1 → 12F1)	23.0	46.8	Broken	0.0	NRqd
UCC 1D-B	1	UCVC1D.10 → 12Y1 (UCVC1D.3 → UCVC1D.4)	23.0	45.6	Broken	0.0	NRqd
UCC 2B-B	2	2.12O1 → 2.12L1 (2.12E1 → 2.12F1)	23.0	0.0	NRqd	59.3	Broken
UCC 2D-B	2	2.UCVC1D.10 → 2.12Y1 (2.UCVC1D.3 → 2.UCVC1D.4)	23.0	0.0	NRqd	53.7	Broken
Broke 1-1054B-B		10A1 → 10B1	N/A	N/A	N/A	N/A	N/A
Broke 1-1054D-B		10A1 → 10B2	N/A	N/A	N/A	N/A	N/A
Broke 2-1054B-B		2.10A1 → 2.10B1	N/A	N/A	N/A	N/A	N/A
Broke 2-1054D-B		2.10A1 → 2.10B2	N/A	N/A	N/A	N/A	N/A
Scrn Wsh P 2B-B	0	BP30 → BP32	10.0	9.9	⬇ -1%	9.1	⬇ -9%
Scrn Wsh P 1B-B	0	BP30 → BP34	10.0	9.7	⬇ -3%	8.9	⬇ -11%

Table A14.1: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin	U1 LOCA / U2 CS LoTB Case 600	Case 600 Margin
MCR RC A-A	0	55C → 55D	240.0	393.0	⇧ 64%	247.4	⇘ 3%
PC RC 1A-A	1	67M2 → 67N2	15.0	21.2	⇧ 41%	18.5	⇗ 23%
PC RC 2A-A	2	67M.6 → 67M.8	15.0	17.3	⇨ 15%	20.2	⬆ 35%
RBIR RC 1A-A	1	51.1E → 51.1C	30.0	36.9	⇗ 23%	35.1	⇨ 17%
RBIR RC 2A-A	2	IRWC2A04 → IRWC2A05 (IRWC2A02 → IRWC2A03)	30.0	99.3	Broken	112.1	Broken
RCP MAC 1-1-A	1	50V → 50S (50I → 50Z)	110.0	494.6	Broken	0.0	NRqd
RCP MAC 1-3-A	1	RCP3.8 → LCVCDIS1 (RCP3.1 → RCP3.2)	110.0	447.0	Broken	N/A	NRqd
RCP MAC 2-1-A	2	2.50V → 2.50S (2.50I → 2.50Z)	110.0	N/A	NRqd	124.8	NRqd
RCP MAC 2-3-A	2	2.RCP3.8 → 2.LCVCCDIS1 (2.RCP3.1 → 2.RCP3.2)	110.0	N/A	NRqd	116.5	NRqd
RCP RC Dummy		NA	N/A	N/A	N/A	N/A	N/A
RHRP RC 1A-A	1	65S6 → 65S8	19.0	24.1	⇗ 27%	21.3	⇨ 12%
RHRP RC 2A-A	2	65S12 → 65S14	19.0	19.1	⇘ 1%	24.0	⇗ 26%
SDBR RC A-A	0	55A3 → 55E	560.0	641.2	⇨ 15%	599.1	⇘ 7%
SFPP/TBBP RC A-A	0	54J → 54K1	29.0	36.0	⇗ 24%	33.5	⇨ 16%
SIP RC 1A-A	1	65F2 → 65G2	22.0	24.1	NRqd	26.8	⇗ 22%
SIP RC 2A-A	2	65F6 → 65G8	22.0	24.3	⇨ 10%	26.0	NRqd
Strainer 1A-A	0	44AO → 44AO1	450.0	450.0	⇘ 0%	450.0	⇘ 0%
Strainer 2A-A	0	44BO → 44BO2	450.0	450.0	⇘ 0%	450.0	⇘ 0%
UCC 1A-A	1	52O → 52L (52E → 52F)	23.0	51.1	Broken	0.0	NRqd
UCC 1C-A	1	UCVC1C.10 → 52Y (UCVC1C.3 → UCVC1C.4)	23.0	83.1	Broken	0.0	NRqd
UCC 2A-A	2	2.52O → 2.52L (2.52E → 2.52F)	23.0	0.0	NRqd	59.7	Broken
UCC 2C-A	2	2.UCVC1C.10 → 2.52Y (2.UCVC1C.3 → 2.UCVC1C.4)	23.0	0.0	NRqd	74.1	Broken
Broke 2-1054A-A		2.50A → 2.50B3	N/A	N/A	N/A	N/A	N/A
Broke 2-1054C-A		2.50A → 2.50B5	N/A	N/A	N/A	N/A	N/A
Broke 1-1054A-A		50A → 50B3	N/A	N/A	N/A	N/A	N/A
Broke 1-1054C-A		50A → 50B5	N/A	N/A	N/A	N/A	N/A
Scrn Wsh P 1A-A	0	AP25 → AP27	10.0	11.8	⇨ 18%	11.8	⇨ 18%
Scrn Wsh P 2A-A	0	AP25 → AP29	10.0	8.5	⬇ -15%	8.5	⬇ -15%

This Page Added by Revision 016.

Table A14.1: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTA Case 300	Case 300 Margin	U1 LOCA / U2 CS LoTA Case 500	Case 500 Marging
SAC AfterC A	0	SACA.1 → SACA.3	54.0	54.0	0%	49.8	-8%
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	54.0	0%	50.0	-7%
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	54.0	0%	49.2	-9%
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	113.7	18%	108.2	12%
SAC B Header		68M1 → 68M2	N/A	275.7	N/A	257.2	N/A
SPLY CNTMT COOLERS		2.10B1.1 → 2.10B1.2	N/A	N/A	N/A	625.3	N/A
SPLY CNTMT COOLERS		2.LCVCDSUP1 → 2.LCVCDSUP2	N/A	N/A	N/A	640.8	N/A
SPLY CNTMT COOLERS		10B1.1 → 10B1.2	N/A	1,057.5	N/A	N/A	N/A
SPLY CNTMT COOLERS		LCVCDSUP1 → LCVCDSUP2	N/A	927.7	N/A	N/A	N/A

Table A14.1: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin	U1 LOCA / U2 CS LoTB Case 600	Case 600 Margin
SAC AfterC A	0	SACA.1 → SACA.3	54.0	54.0	0%	53.6	-1%
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	54.0	0%	53.7	-1%
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	54.0	0%	53.0	-2%
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	104.6	9%	101.6	6%
SAC A Header		59 → 59A	N/A	266.6	N/A	262.0	N/A
SPLY CNTMT COOLERS		2.LCVCCSUP1 → 2.LCVCCSUP2	N/A	N/A	N/A	565.2	N/A
SPLY CNTMT COOLERS		2.50B1 → 2.50B2	N/A	N/A	N/A	600.1	N/A
SPLY CNTMT COOLERS		50B1 → 50B2	N/A	930.7	N/A	N/A	N/A
SPLY CNTMT COOLERS		LCVCCSUP1 → LCVCCSUP2	N/A	849.0	N/A	N/A	N/A

- Greater than 30% flow margin
- Between 20% and 30% flow margin
- Between 10% and 20% flow margin
- Between 0% and 10% flow margin
- Less than 0% flow margin

Notes:

1. Cases 300, 400, 500, 600 consider loss of downstream dam and broken coolers.
2. All cases consider 93% pumps.

Table A14.2: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin	U1 LOCA / U2 CS LoTB Case 600	Case 600 Margin
692' RC 1A-A	1	66D2 → 66G2	12.0	18.4	53%	15.3	28%
692' RC 2A-A	1 & 2	66D.4 → 66G.4	12.0	12.0	0%	16.2	35%
713' RC 1A-A	1	67E2 → 67G2	11.0	16.0	45%	14.2	29%
713' RC 2A-A	1 & 2	67E4 → 67G6	11.0	12.2	11%	17.1	55%
737' RC 1A-A	1	67S2 → 67G2	12.0	23.7	98%	20.4	70%
737' RC 2A-A	1 & 2	67S4 → 67G6	10.0	10.8	8%	12.8	28%
ACAS AfterC A	0	54R1 → 54Q1	1.5	1.7	13%	1.6	7%
ACAS Cylind A	0	54R → 54Q	2.0	2.2	10%	2.1	5%
BATP/AFWP RC A-A	0	54O2 → 54P.2	60.0	61.3	2%	75.4	26%
CCP RC 1A-A	1	58D1 → 58D.2	25.0	29.6	18%	29.3	17%
CCP RC 2A-A	2	58E.2 → 58F2	25.0	28.3	13%	32.8	31%
CCS Hx A-A (146)	1	103D → 19	5,050.0	5,688.2	13%	5,470.2	24%
CCS Hx A-A (143)	1	103 → 103B		0.0	Isolated	0.0	Isolated
CCS Hx B-A (146)	2	106 → 107	5,050.0	4,179.2	-5%	5,201.8	3%
CCS Hx B-A (143)	2	106A → 106B		0.0	Isolated	0.0	Isolated
CCS/AFWP RC A-A	0	56T5 → 55F	102.0	124.9	22%	121.9	20%
CRDMC 1A-A	1	50H → 50J	124.0	139.9	NRqd	N/A	NRqd
CRDMC 1C-A	1	CRDC1 → CRDC2	124.0	117.7	NRqd	N/A	NRqd
CRDMC 2A-A	2	2.50H → 2.50J	124.0	N/A	NRqd	157.7	Broken
CRDMC 2C-A	2	2.CRDC1 → 2.CRDC2	124.0	N/A	NRqd	137.2	Broken
CSP RC 1A-A	1	65M2 → 65N2	28.0	31.2	NRqd	35.1	25%
CSP RC 2A-A	2	65M.6 → 65N4	28.0	34.3	23%	32.8	NRqd
CSS Hx 1A-A	1	53 → 53A	5,200.0	0.0	NRqd	5,512.3	6%
CSS Hx 2A-A	2	53.2 → CS2A01	5,200.0	5,160.2	-1%	0.0	NRqd
EBR RC A-A	0	57B → 55H	300.0	319.5	7%	302.0	1%
EDG 1A1-A	0	48E1 → 48F	650.0	777.1	20%	725.2	12%
EDG 1A2-A	0	48B1 → 48F1	650.0	776.2	19%	735.3	13%
EDG 2A1-A	0	48C1 → 48P	650.0	729.8	12%	694.8	7%
EDG 2A2-A	0	48M → 48C3	650.0	743.7	14%	707.6	9%
EGTS RC A-A	0	54X2 → 54Y2	10.0	17.5	75%	20.0	100%
LCC 1A-A	1	50D → 50E	306.0	298.2	-3%	N/A	NRqd
LCC 1C-A	1	LCVCC1 → LCVCC2	306.0	286.2	-6%	N/A	NRqd
LCC 2A-A	2	2.50D → 2.50E	306.0	N/A	NRqd	318.6	4%
LCC 2C-A	2	2.LCVCC1 → 2.LCVCC2	306.0	N/A	NRqd	312.5	2%
MCR RC A-A	0	55C → 55D	240.0	394.7	64%	248.7	4%
PC RC 1A-A	1	67M2 → 67N2	15.0	21.6	44%	18.9	26%
PC RC 2A-A	2	67M.6 → 67M.8	15.0	17.4	16%	20.2	35%
RBIR RC 1A-A	1	51.1E → 51.1C	30.0	37.1	24%	35.3	18%
RBIR RC 2A-A	2	IRWC2A04 → IRWC2A05 (IRWC2A02 → IRWC2A03)	30.0	99.5	Broken	112.3	Broken
RCP MAC 1-1-A	1	50V → 50S (50I → 50Z)	110.0	496.8	Broken	0.0	NRqd
RCP MAC 1-3-A	1	RCP3.8 → LCVCDIS1 (RCP3.1 → RCP3.2)	110.0	449.0	Broken	N/A	NRqd
RCP MAC 2-1-A	2	2.50V → 2.50S (2.50I → 2.50Z)	110.0	N/A	NRqd	125.1	NRqd
RCP MAC 2-3-A	2	2.RCP3.8 → 2.LCVCCDIS1 (2.RCP3.1 → 2.RCP3.2)	110.0	N/A	NRqd	116.8	NRqd

This Page Added by Revision 016.

Table A14.2: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin	U1 LOCA / U2 CS LoTB Case 600	Case 600 Margin
RCP RC Dummy		NA	N/A	N/A	N/A	N/A	N/A
RHRP RC 1A-A	1	65S6 → 65S8	19.0	24.5	29%	21.7	14%
RHRP RC 2A-A	2	65S12 → 65S14	19.0	19.1	1%	24.1	27%
SDBR RC A-A	0	55A3 → 55E	560.0	644.0	15%	602.2	8%
SFPP/TBBP RC A-A	0	54J → 54K1	29.0	36.4	26%	34.0	17%
SIP RC 1A-A	1	65F2 → 65G2	22.0	24.6	NRqd	27.3	24%
SIP RC 2A-A	2	65F6 → 65G8	22.0	24.4	11%	26.1	NRqd
Strainer 1A-A	0	44AO → 44AO1	450.0	450.0	0%	450.0	0%
Strainer 2A-A	0	44BO → 44BO2	450.0	450.0	0%	450.0	0%
UCC 1A-A	1	52O → 52L (52E → 52F)	23.0	51.4	Broken	0.0	NRqd
UCC 1C-A	1	UCVC1C.10 → 52Y (UCVC1C.3 → UCVC1C.4)	23.0	83.8	Broken	0.0	NRqd
UCC 2A-A	2	2.52O → 2.52L (2.52E → 2.52F)	23.0	0.0	NRqd	59.9	Broken
UCC 2C-A	2	2.UCVC1C.10 → 2.52Y (2.UCVC1C.3 → 2.UCVC1C.4)	23.0	0.0	NRqd	74.5	Broken
Broke 2-1054A-A		2.50A → 2.50B3	N/A	N/A	N/A	N/A	N/A
Broke 2-1054C-A		2.50A → 2.50B5	N/A	N/A	N/A	N/A	N/A
Broke 1-1054A-A		50A → 50B3	N/A	N/A	N/A	N/A	N/A
Broke 1-1054C-A		50A → 50B5	N/A	N/A	N/A	N/A	N/A
Scrn Wsh P 1A-A	0	AP25 → AP27	10.0	11.9	19%	11.9	19%
Scrn Wsh P 2A-A	0	AP25 → AP29	10.0	8.6	-14%	8.6	-14%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	0.0	N/A	0.0	N/A
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	0.0	N/A	0.0	N/A
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	0.0	N/A	0.0	N/A
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	120.5	25%	113.7	18%
SAC A Header		59 → 59A	N/A	120.5	N/A	113.7	N/A
SPLY CNTMT COOLERS		2.LCVCCSUP1 → 2.LCVCCSUP2	N/A	N/A	N/A	566.4	N/A
SPLY CNTMT COOLERS		2.50B1 → 2.50B2	N/A	N/A	N/A	601.4	N/A
SPLY CNTMT COOLERS		50B1 → 50B2	N/A	934.9	N/A	N/A	N/A
SPLY CNTMT COOLERS		LCVCCSUP1 → LCVCCSUP2	N/A	852.9	N/A	N/A	N/A

- Greater than 30% flow margin
- Between 20% and 30% flow margin
- Between 10% and 20% flow margin
- Between 0% and 10% flow margin
- Less than 0% flow margin

Notes:

1. Cases 400 and 600 consider loss of downstream dam and broken coolers.
2. All cases consider 93% pumps.

Table A14.3: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin
692' RC 1A-A	1	66D2 → 66G2	12.0	18.9	⇧ 58%
692' RC 2A-A	1 & 2	66D.4 → 66G.4	12.0	12.5	⇘ 4%
713' RC 1A-A	1	67E2 → 67G2	11.0	16.4	⇧ 49%
713' RC 2A-A	1 & 2	67E4 → 67G6	11.0	12.7	⇨ 15%
737' RC 1A-A	1	67S2 → 67G2	12.0	24.4	⇧ 103%
737' RC 2A-A	1 & 2	67S4 → 67G6	10.0	11.3	⇨ 13%
ACAS AfterC A	0	54R1 → 54Q1	1.5	1.7	⇨ 13%
ACAS Cylind A	0	54R → 54Q	2.0	2.3	⇨ 15%
BATP/AFWP RC A-A	0	54O2 → 54P.2	60.0	63.9	⇘ 7%
CCP RC 1A-A	1	58D1 → 58D.2	25.0	30.4	⇗ 22%
CCP RC 2A-A	2	58E.2 → 58F2	25.0	29.4	⇨ 18%
CCS Hx A-A (146)	1	103D → 19	5,050.0	5,220.0	⇘ 3.37%
CCS Hx A-A (143)	1	103 → 103B		0.0	Isolated
CCS Hx B-A (146)	2	106 → 107	4,000.0	4,435.5	⇨ 11%
CCS Hx B-A (143)	2	106A → 106B		0.0	Isolated
CCS/AFWP RC A-A	0	56T5 → 55F	102.0	128.5	⇗ 26%
CRDMC 1A-A	1	50H → 50J	124.0	153.8	NRqd
CRDMC 1C-A	1	CRDC1 → CRDC2	124.0	127.6	NRqd
CRDMC 2A-A	2	2.50H → 2.50J	124.0	N/A	NRqd
CRDMC 2C-A	2	2.CRDC1→ 2.CRDC2	124.0	N/A	NRqd
CSP RC 1A-A	1	65M2 → 65N2	28.0	32.1	NRqd
CSP RC 2A-A	2	65M.6 → 65N4	28.0	35.8	⇗ 28%
CSS Hx 1A-A	1	53 → 53A	5,200.0	0.0	NRqd
CSS Hx 2A-A	2	53.2 → CS2A01	5,200.0	5,374.7	⇘ 3.36%
EBR RC A-A	0	57B → 55H	300.0	328.6	⇘ 10%
EDG 1A1-A	0	48E1 → 48F	650.0	799.8	⇗ 23%
EDG 1A2-A	0	48B1 → 48F1	650.0	798.3	⇗ 23%
EDG 2A1-A	0	48C1 → 48P	650.0	750.9	⇨ 16%
EDG 2A2-A	0	48M → 48C3	650.0	764.8	⇨ 18%
EGTS RC A-A	0	54X2 → 54Y2	10.0	18.2	⬆ 82%
LCC 1A-A	1	50D → 50E	306.0	329.5	⇘ 8%
LCC 1C-A	1	LCVCC1 → LCVCC2	306.0	312.6	⇘ 2%
LCC 2A-A	2	2.50D → 2.50E	306.0	N/A	NRqd
LCC 2C-A	2	2.LCVCC1 → 2.LCVCC2	306.0	N/A	NRqd
MCR RC A-A	0	55C → 55D	240.0	405.9	⬆ 69%
PC RC 1A-A	1	67M2 → 67N2	15.0	22.2	⇧ 48%
PC RC 2A-A	2	67M.6 → 67M.8	15.0	18.1	⇗ 21%
RBIR RC 1A-A	1	51.1E → 51.1C	30.0	38.1	⇗ 27%
RBIR RC 2A-A	2	IRWC2A04 → IRWC2A05 (IRWC2A02 → IRWC2A03)	30.0	101.7	Broken
RCP MAC 1-1-A	1	50V → 50S (50I → 50Z)	110.0	94.3	NRqd
RCP MAC 1-3-A	1	RCP3.8 → LCVCDIS1 (RCP3.1 → RCP3.2)	110.0	90.1	NRqd
RCP MAC 2-1-A	2	2.50V → 2.50S (2.50I → 2.50Z)	110.0	N/A	NRqd
RCP MAC 2-3-A	2	2.RCP3.8 → 2.LCVCCDIS1 (2.RCP3.1 → 2.RCP3.2)	110.0	N/A	NRqd

Table A14.3: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin
RCP RC Dummy		NA	N/A	N/A	N/A
RHRP RC 1A-A	1	65S6 → 65S8	19.0	25.2	33%
RHRP RC 2A-A	2	65S12 → 65S14	19.0	20.0	5%
SDBR RC A-A	0	55A3 → 55E	560.0	662.4	18%
SFPP/TBBP RC A-A	0	54J → 54K1	29.0	37.4	29%
SIP RC 1A-A	1	65F2 → 65G2	22.0	25.2	NRqd
SIP RC 2A-A	2	65F6 → 65G8	22.0	25.4	15%
Strainer 1A-A	0	44AO → 44AO1	450.0	450.0	0%
Strainer 2A-A	0	44BO → 44BO2	450.0	450.0	0%
UCC 1A-A	1	52O → 52L (52E → 52F)	23.0	53.2	Broken
UCC 1C-A	1	UCVC1C.10 → 52Y (UCVC1C.3 → UCVC1C.4)	23.0	87.7	Broken
UCC 2A-A	2	2.52O → 2.52L (2.52E → 2.52F)	23.0	0.0	NRqd
UCC 2C-A	2	2.UCVC1C.10 → 2.52Y (2.UCVC1C.3 → 2.UCVC1C.4)	23.0	0.0	NRqd
Broke 2-1054A-A		2.50A → 2.50B3	N/A	N/A	N/A
Broke 2-1054C-A		2.50A → 2.50B5	N/A	N/A	N/A
Broke 1-1054A-A		50A → 50B3	N/A	N/A	N/A
Broke 1-1054C-A		50A → 50B5	N/A	N/A	N/A
Scrn Wsh P 1A-A	0	AP25 → AP27	10.0	12.1	21%
Scrn Wsh P 2A-A	0	AP25 → AP29	10.0	8.8	-12%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	0.0	N/A
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	0.0	N/A
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	0.0	N/A
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	123.4	28%
SAC A Header		59 → 59A	N/A	123.4	N/A
SPLY CNTMT COOLERS		2.LCVCCSUP1 → 2.LCVCCSUP2	N/A	N/A	N/A
SPLY CNTMT COOLERS		2.50B1 → 2.50B2	N/A	N/A	N/A
SPLY CNTMT COOLERS		50B1 → 50B2	N/A	577.5	N/A
SPLY CNTMT COOLERS		LCVCCSUP1 → LCVCCSUP2	N/A	530.3	N/A

- Greater than 30% flow margin
- Between 20% and 30% flow margin
- Between 10% and 20% flow margin
- Between 0% and 10% flow margin
- Less than 0% flow margin

Notes:

1. Case 400 considers loss of downstream dam and broken coolers.
2. All cases consider 93% pumps.

Table A14.4: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin
692' RC 1A-A	1	66D2 → 66G2	12.0	18.5	⇧ 54%
692' RC 2A-A	1 & 2	66D.4 → 66G.4	12.0	12.3	⇘ 3%
713' RC 1A-A	1	67E2 → 67G2	11.0	16.1	⇧ 46%
713' RC 2A-A	1 & 2	67E4 → 67G6	11.0	12.5	⇨ 14%
737' RC 1A-A	1	67S2 → 67G2	12.0	23.8	⇧ 98%
737' RC 2A-A	1 & 2	67S4 → 67G6	10.0	11.1	⇨ 11%
ACAS AfterC A	0	54R1 → 54Q1	1.5	1.7	⇨ 13%
ACAS Cylind A	0	54R → 54Q	2.0	2.3	⇨ 15%
BATP/AFWP RC A-A	0	54O2 → 54P.2	60.0	63.0	⇘ 5%
CCP RC 1A-A	1	58D1 → 58D.2	25.0	29.8	⇨ 19%
CCP RC 2A-A	2	58E.2 → 58F2	25.0	29.0	⇨ 16%
CCS Hx A-A (146)	1	103D → 19	5,050.0	5,149.0	⇘1.96%
CCS Hx A-A (143)	1	103 → 103B		0.0	Isolated
CCS Hx B-A (146)	2	106 → 107	4,000.0	4,376.4	⇘ 9%
CCS Hx B-A (143)	2	106A → 106B		0.0	Isolated
CCS/AFWP RC A-A	0	56T5 → 55F	102.0	125.6	⇗ 23%
CRDMC 1A-A	1	50H → 50J	124.0	140.7	NRqd
CRDMC 1C-A	1	CRDC1 → CRDC2	124.0	118.4	NRqd
CRDMC 2A-A	2	2.50H → 2.50J	124.0	N/A	NRqd
CRDMC 2C-A	2	2.CRDC1→ 2.CRDC2	124.0	N/A	NRqd
CSP RC 1A-A	1	65M2 → 65N2	28.0	31.4	NRqd
CSP RC 2A-A	2	65M.6 → 65N4	28.0	35.3	⇗ 26%
CSS Hx 1A-A	1	53 → 53A	5,200.0	0.0	NRqd
CSS Hx 2A-A	2	53.2 → CS2A01	5,200.0	5,301.9	⇘1.96%
EBR RC A-A	0	57B → 55H	300.0	321.2	⇘ 7%
EDG 1A1-A	0	48E1 → 48F	650.0	782.0	⇗ 20%
EDG 1A2-A	0	48B1 → 48F1	650.0	780.9	⇗ 20%
EDG 2A1-A	0	48C1 → 48P	650.0	734.3	⇨ 13%
EDG 2A2-A	0	48M → 48C3	650.0	748.2	⇨ 15%
EGTS RC A-A	0	54X2 → 54Y2	10.0	18.0	⇧ 80%
LCC 1A-A	1	50D → 50E	306.0	299.8	⬇ -2%
LCC 1C-A	1	LCVCC1 → LCVCC2	306.0	287.8	⇩ -6%
LCC 2A-A	2	2.50D → 2.50E	306.0	N/A	NRqd
LCC 2C-A	2	2.LCVCC1 → 2.LCVCC2	306.0	N/A	NRqd
MCR RC A-A	0	55C → 55D	240.0	396.8	⇧ 65%
PC RC 1A-A	1	67M2 → 67N2	15.0	21.7	⇧ 45%
PC RC 2A-A	2	67M.6 → 67M.8	15.0	17.8	⇨ 19%
RBIR RC 1A-A	1	51.1E → 51.1C	30.0	37.3	⇗ 24%
RBIR RC 2A-A	2	IRWC2A04 → IRWC2A05 (IRWC2A02 → IRWC2A03)	30.0	100.8	Broken
RCP MAC 1-1-A	1	50V → 50S (50I → 50Z)	110.0	500.0	Broken
RCP MAC 1-3-A	1	RCP3.8 → LCVCDIS1 (RCP3.1 → RCP3.2)	110.0	451.8	Broken
RCP MAC 2-1-A	2	2.50V → 2.50S (2.50I → 2.50Z)	110.0	N/A	NRqd
RCP MAC 2-3-A	2	2.RCP3.8 → 2.LCVCCDIS1 (2.RCP3.1 → 2.RCP3.2)	110.0	N/A	NRqd

This Page Added by Revision 016.

(CCS HX B Reduced Required Flow and Throttled CCS HX A Valve)

Table A14.4: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin
RCP RC Dummy		NA	N/A	N/A	N/A
RHRP RC 1A-A	1	65S6 → 65S8	19.0	24.6	↗ 29%
RHRP RC 2A-A	2	65S12 → 65S14	19.0	19.7	↘ 4%
SDBR RC A-A	0	55A3 → 55E	560.0	647.4	→ 16%
SFPP/TBBP RC A-A	0	54J → 54K1	29.0	36.6	↗ 26%
SIP RC 1A-A	1	65F2 → 65G2	22.0	24.7	NRqd
SIP RC 2A-A	2	65F6 → 65G8	22.0	25.1	→ 14%
Strainer 1A-A	0	44AO → 44AO1	450.0	450.0	↘ 0%
Strainer 2A-A	0	44BO → 44BO2	450.0	450.0	↘ 0%
UCC 1A-A	1	52O → 52L (52E → 52F)	23.0	51.7	Broken
UCC 1C-A	1	UCVC1C.10 → 52Y (UCVC1C.3 → UCVC1C.4)	23.0	84.6	Broken
UCC 2A-A	2	2.52O → 2.52L (2.52E → 2.52F)	23.0	0.0	NRqd
UCC 2C-A	2	2.UCVC1C.10 → 2.52Y (2.UCVC1C.3 → 2.UCVC1C.4)	23.0	0.0	NRqd
Broke 2-1054A-A		2.50A → 2.50B3	N/A	N/A	N/A
Broke 2-1054C-A		2.50A → 2.50B5	N/A	N/A	N/A
Broke 1-1054A-A		50A → 50B3	N/A	N/A	N/A
Broke 1-1054C-A		50A → 50B5	N/A	N/A	N/A
Scrn Wsh P 1A-A	0	AP25 → AP27	10.0	12.0	↗ 20%
Scrn Wsh P 2A-A	0	AP25 → AP29	10.0	8.6	↓ -14%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	0.0	N/A
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	0.0	N/A
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	0.0	N/A
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	121.1	↗ 26%
SAC A Header		59 → 59A	N/A	121.1	N/A
SPLY CNTMT COOLERS		2.LCVCCSUP1 → 2.LCVCCSUP2	N/A	N/A	N/A
SPLY CNTMT COOLERS		2.50B1 → 2.50B2	N/A	N/A	N/A
SPLY CNTMT COOLERS		50B1 → 50B2	N/A	940.5	N/A
SPLY CNTMT COOLERS		LCVCCSUP1 → LCVCCSUP2	N/A	858.0	N/A

↑ Greater than 30% flow margin

↗ Between 20% and 30% flow margin

→ Between 10% and 20% flow margin

↘ Between 0% and 10% flow margin

↓ Less than 0% flow margin

Notes:

1. Case 400 considers loss of downstream dam and broken coolers.
2. All cases consider 93% pumps.

Table A14.5: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

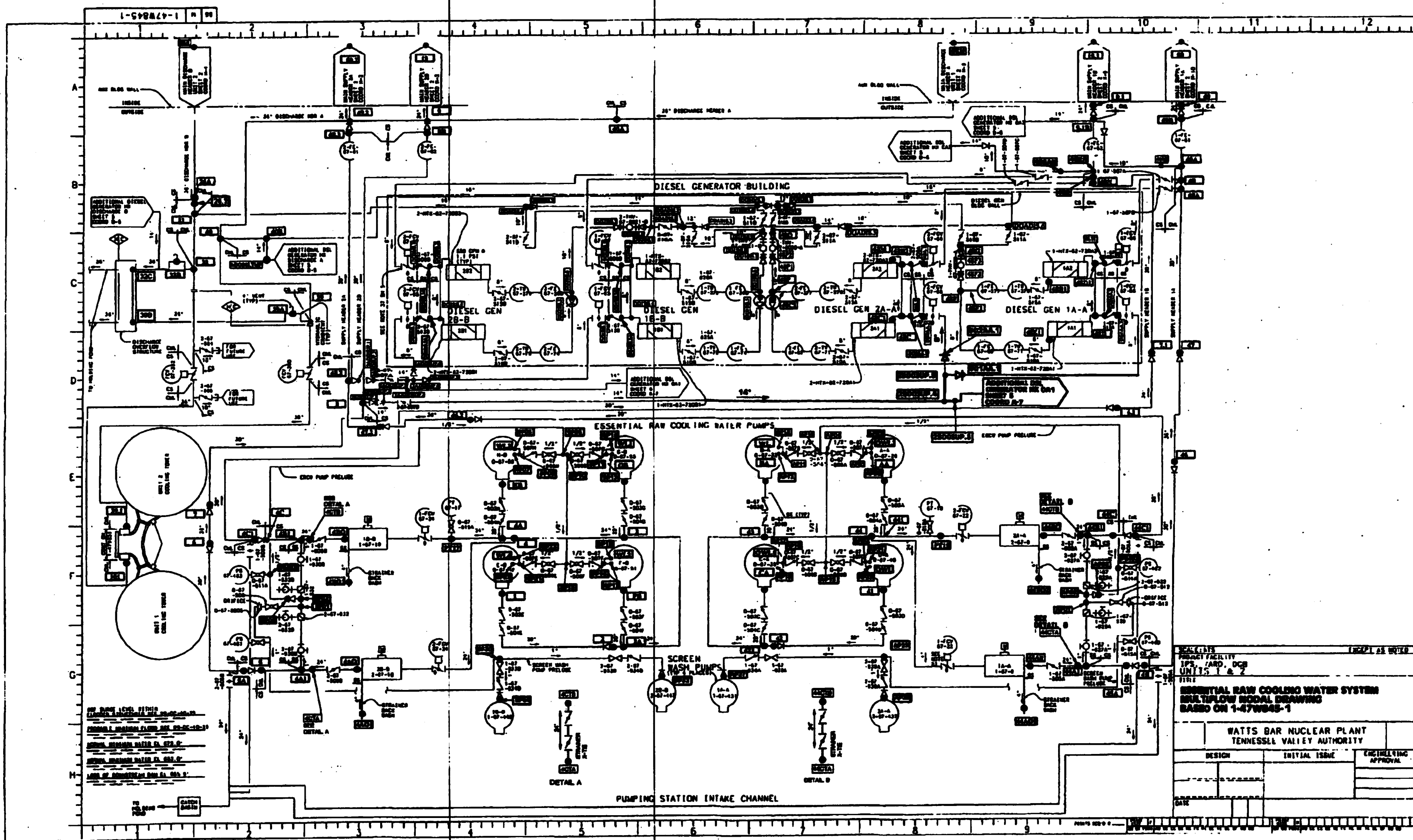
Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin
692' RC 1A-A	1	66D2 → 66G2	12.0	19.0	⇧ 58%
692' RC 2A-A	1 & 2	66D.4 → 66G.4	12.0	12.6	⇘ 5%
713' RC 1A-A	1	67E2 → 67G2	11.0	16.5	⇧ 50%
713' RC 2A-A	1 & 2	67E4 → 67G6	11.0	12.8	⇨ 16%
737' RC 1A-A	1	67S2 → 67G2	12.0	24.4	⇧ 103%
737' RC 2A-A	1 & 2	67S4 → 67G6	10.0	11.4	⇨ 14%
ACAS AfterC A	0	54R1 → 54Q1	1.5	1.7	⇨ 13%
ACAS Cylind A	0	54R → 54Q	2.0	2.3	⇨ 15%
BATP/AFWP RC A-A	0	54O2 → 54P.2	60.0	64.2	⇘ 7%
CCP RC 1A-A	1	58D1 → 58D.2	25.0	30.5	⇗ 22%
CCP RC 2A-A	2	58E.2 → 58F2	25.0	29.6	⇨ 18%
CCS Hx A-A (146)	1	103D → 19	5,050.0	5,132.0	⇘ 1.62%
CCS Hx A-A (143)	1	103 → 103B		0.0	Isolated
CCS Hx B-A (146)	2	106 → 107	4,400.0	4,471.8	⇘ 1.63%
CCS Hx B-A (143)	2	106A → 106B		0.0	Isolated
CCS/AFWP RC A-A	0	56T5 → 55F	102.0	128.8	⇗ 26%
CRDMC 1A-A	1	50H → 50J	124.0	154.1	NRqd
CRDMC 1C-A	1	CRDC1 → CRDC2	124.0	127.9	NRqd
CRDMC 2A-A	2	2.50H → 2.50J	124.0	N/A	NRqd
CRDMC 2C-A	2	2.CRDC1→ 2.CRDC2	124.0	N/A	NRqd
CSP RC 1A-A	1	65M2 → 65N2	28.0	32.2	NRqd
CSP RC 2A-A	2	65M.6 → 65N4	28.0	35.9	⇗ 28%
CSS Hx 1A-A	1	53 → 53A	5,200.0	0.0	NRqd
CSS Hx 2A-A	2	53.2 → CS2A01	5,200.0	5,402.9	⇘ 3.90%
EBR RC A-A	0	57B → 55H	300.0	329.3	⇘ 10%
EDG 1A1-A	0	48E1 → 48F	650.0	801.6	⇗ 23%
EDG 1A2-A	0	48B1 → 48F1	650.0	800.0	⇗ 23%
EDG 2A1-A	0	48C1 → 48P	650.0	752.6	⇨ 16%
EDG 2A2-A	0	48M → 48C3	650.0	766.5	⇨ 18%
EGTS RC A-A	0	54X2 → 54Y2	10.0	18.3	⇧ 83%
LCC 1A-A	1	50D → 50E	306.0	330.2	⇘ 8%
LCC 1C-A	1	LCVCC1 → LCVCC2	306.0	313.3	⇘ 2%
LCC 2A-A	2	2.50D → 2.50E	306.0	N/A	NRqd
LCC 2C-A	2	2.LCVCC1 → 2.LCVCC2	306.0	N/A	NRqd
MCR RC A-A	0	55C → 55D	240.0	406.8	⇧ 70%
PC RC 1A-A	1	67M2 → 67N2	15.0	22.3	⇧ 49%
PC RC 2A-A	2	67M.6 → 67M.8	15.0	18.2	⇗ 21%
RBIR RC 1A-A	1	51.1E → 51.1C	30.0	38.2	⇗ 27%
RBIR RC 2A-A	2	IRWC2A04 → IRWC2A05 (IRWC2A02 → IRWC2A03)	30.0	102.0	Broken
RCP MAC 1-1-A	1	50V → 50S (50I → 50Z)	110.0	94.5	NRqd
RCP MAC 1-3-A	1	RCP3.8 → LCVCDIS1 (RCP3.1 → RCP3.2)	110.0	90.3	NRqd
RCP MAC 2-1-A	2	2.50V → 2.50S (2.50I → 2.50Z)	110.0	N/A	NRqd
RCP MAC 2-3-A	2	2.RCP3.8 → 2.LCVCCDIS1 (2.RCP3.1 → 2.RCP3.2)	110.0	N/A	NRqd

Table A14.5: To Hydraulic Gradient Discharge Structure for ERCW pumps / Cvs

Component	Unit	Link	Req'd	U1 CS / U2 LOCA LoTB Case 400	Case 400 Margin
RCP RC Dummy		NA	N/A	N/A	N/A
RHRP RC 1A-A	1	65S6 → 65S8	19.0	25.3	⬆ 33%
RHRP RC 2A-A	2	65S12 → 65S14	19.0	20.1	⇘ 6%
SDBR RC A-A	0	55A3 → 55E	560.0	663.8	⇨ 19%
SFPP/TBBP RC A-A	0	54J → 54K1	29.0	37.5	⇗ 29%
SIP RC 1A-A	1	65F2 → 65G2	22.0	25.3	NRqd
SIP RC 2A-A	2	65F6 → 65G8	22.0	25.5	⇨ 16%
Strainer 1A-A	0	44AO → 44AO1	450.0	450.0	⇘ 0%
Strainer 2A-A	0	44BO → 44BO2	450.0	450.0	⇘ 0%
UCC 1A-A	1	52O → 52L (52E → 52F)	23.0	26.9	NRqd
UCC 1C-A	1	UCVC1C.10 → 52Y (UCVC1C.3 → UCVC1C.4)	23.0	20.8	NRqd
UCC 2A-A	2	2.52O → 2.52L (2.52E → 2.52F)	23.0	0.0	NRqd
UCC 2C-A	2	2.UCVC1C.10 → 2.52Y (2.UCVC1C.3 → 2.UCVC1C.4)	23.0	0.0	NRqd
Broke 2-1054A-A		2.50A → 2.50B3	N/A	N/A	N/A
Broke 2-1054C-A		2.50A → 2.50B5	N/A	N/A	N/A
Broke 1-1054A-A		50A → 50B3	N/A	N/A	N/A
Broke 1-1054C-A		50A → 50B5	N/A	N/A	N/A
Scrn Wsh P 1A-A	0	AP25 → AP27	10.0	12.2	⇗ 22%
Scrn Wsh P 2A-A	0	AP25 → AP29	10.0	8.8	⬇ -12%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	0.0	N/A
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	0.0	N/A
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	0.0	N/A
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	123.7	⇗ 28%
SAC A Header		59 → 59A	N/A	123.7	N/A
SPLY CNTMT COOLERS		2.LCVCCSUP1 → 2.LCVCCSUP2	N/A	N/A	N/A
SPLY CNTMT COOLERS		2.50B1 → 2.50B2	N/A	N/A	N/A
SPLY CNTMT COOLERS		50B1 → 50B2	N/A	578.8	N/A
SPLY CNTMT COOLERS		LCVCCSUP1 → LCVCCSUP2	N/A	531.5	N/A

⬆ Greater than 30% flow margin
⇗ Between 20% and 30% flow margin
⇨ Between 10% and 20% flow margin
⇘ Between 0% and 10% flow margin
⬇ Less than 0% flow margin

Notes:
1. Case 400 considers loss of downstream dam and broken coolers.
2. All cases consider 93% pumps.


DIESEL GENERATOR BUILDING
DIESEL GEN 2B-B
DIESEL GEN 1B-B
DIESEL GEN 2A-A
DIESEL GEN 1A-A
ESSENTIAL RAW COOLING WATER PUMPS
SCREEN WASH PUMPS
PUMPING STATION INTAKE CHANNEL
ESSENTIAL RAW COOLING WATER SYSTEM
MULTIFLOW NODAL DRAWING
BASED ON 1-47W845-1
WATTS BAR NUCLEAR PLANT
TENNESSEE VALLEY AUTHORITY

ENCLOSURE 2

Attachment 4

ERCW Flow Model Mode 4 - RHR Cooling

Appendix 17 – ERCW System Configuration for High Core Decay Heat and LOCA

1.0 Purpose:

The purpose of this Appendix is to evaluate the operational mode when a unit has high core decay heat and the other unit experiences a Loss of Cooling Accident (LOCA) during a Loss of Offsite Power (LOOP) and Loss of Train A (LoTA) or Loss of Train B (LoTB) which address GDC 5 requirements. The high core decay heat impacts the requirements of the Component Cooling System (CCS) heat exchangers. The evaluation considers limiting conditions with degraded pumps, broken coolers (as applicable), discharge through the Hydraulic Gradient Discharge Structure, and loss of downstream dam LODD (as applicable).

The following cases incorporate the flow balance test results and the associated files are stored at Filekeeper.

Case 1300: Unit 1·Hot Shutdown Modified (High Core Decay Heat), Unit 2 LOCA-RECIRC (LOOP and LoTB)
Case 1400: Unit 1·Hot Shutdown Modified (High Core Decay Heat), Unit 2 LOCA-RECIRC (LOOP and LoTA)
Case 1500: Unit 1 LOCA-RECIRC, Unit 2·Hot Shutdown Modified (High Core Decay Heat) (LOOP and LoTB)
Case 1600: Unit 1 LOCA-RECIRC, Unit 2·Hot Shutdown Modified (High Core Decay Heat) (LOOP and LoTA)

The hydraulic analyses presented in this Appendix were performed utilizing MULTIFLOW Version 1.21. MULTIFLOW is a TVA QA computer program that has been verified and validated in the TVA QA Record Software Verification and Validation Report. MULTIFLOW Version 1.21 is run off Windows NT Version 5.1 Service Pack 3.

2.0 Methodology / Approach:

The goal is to ensure all components served by ERCW receive their design basis flow during all modes of operation.

The limiting modes of ERCW operation selected for the flow balance are:

Unit 1 (for each train)	Unit 2 (for each train)
LOCA-Recirculation	Hot Shutdown Modified (HSm)
Hot Shutdown Modified (HSm)	LOCA-Recirculation

The modes of ERCW operation are described in Reference 1. Hot Shutdown Modified is the same as Hot Shutdown Case A in Section 6.5 of Reference 1. Hot Shutdown Modified is the same as Hot Shutdown except with the addition of Spent Fuel Pool cooling.

The general approach in developing flows during accident and degraded conditions is outlined below:

1. This Appendix uses the MULTIFLOW models established in Appendix 14 which contains the limiting conditions in item 2 below. Appendix 14 considers the operational mode combination of a unit in Cold Shutdown and the other in LOCA-Recirculation. Reference 1 shows the required components serviced by ERCW between Cold Shutdown and Hot Shutdown differs by Hot Shutdown additionally requiring the CRDM coolers. This changes the name for the MUTIFLOW model but does not change which components receive ERCW. Cold Shutdown case provides cooling to all containment components due to the inability to readily isolate the containment components and thus, the CRDM coolers are receiving flow which now becomes required if the CRDM coolers are not broken.

2. These cases were executed under limiting conditions, including:

   a. ERCW pumps (three (3) worst pumps in each train) performing at 93% of their factory acceptance test results (applicable to all cases); R19

   b. A lake level consistent with a "loss of downstream dam" event (applicable to cases 1300, 1400, 1500, and 1600); and,

   c. Non-seismically qualified components failed and spilling ERCW water, e.g., Unit 2 Instrument Room Chiller, Unit 1 & 2 Reactor Building Upper Compartment Coolers, Unit 2 CRDM Coolers, Unit 1 RCP Motor Air Coolers.

Table A17.2: High Core Decay Heat Load / Three ERCW pumps / CCS HX Adjusted

Component	Unit	Link	Req'd	U1 HSm / U2 LOCA LoTA Case 1300	Case 1300 Margin	U1 LOCA / U2 HSm LoTA Case 1500	Case 1500 Margin
692' RC 1B-B	1	PEN1B1.7 → PENRMDIS.1	12.0	31.7	164%	30.3	153%
692' RC 2B-B	1 & 2	PEN2B1D.2 → AC2BDIS.13	12.0	19.2	60%	22.3	86%
713' RC 1B-B	1	PEN1B2.7 → PENRMDIS.3	11.0	22.0	100%	21.2	93%
713' RC 2B-B	1 & 2	2B109 → 2B110	11.0	17.5	59%	20.5	86%
737' RC 1B-B	1	PEN1B3.7 → PENRMDIS.3	12.0	26.6	122%	25.1	109%
737' RC 2B-B	1 & 2	2B119 → 2B110	12.0	13.3	11%	15.4	28%
ACAS AfterC B	0	ACACBBDIS.5 → ACACBBDIS.6	2.0	2.2	10%	2.2	10%
ACAS Cylind B	0	ACACBBDIS.2 → ACACBBDIS.3	1.5	1.8	20%	2.2	47%
BATP/AFWP RC B-B	0	BA2BDIS.4 → AC2BDIS.4	60.0	70.2	17%	83.4	39%
CCP RC 1B-B	1	CCP1B.7 → CCP1B.9	25.0	32.2	29%	30.8	23%
CCP RC 2B-B	2	CCPRC7 → CCPRC8	25.0	31.3	25%	36.9	48%
CCS Hx C-B (152)	0	18 → 19	9,200.0	6,032.0	2.52%	5,838.6	29%
CCS Hx C-B (144)	0	109B → 109C		3,400.0		6,003.7	
CCS Hx A-A (146)	1	103D → 19	1,370.0	0.0	Isolated	0.0	Isolated
CCS Hx A-A (143)	1	103 → 103B		1,370.0	0%	1,370.0	0%
CCS/AFWP RC B-B	0	CCSAFW1B.16 → CCSAFW1B.17	102.0	124.0	22%	118.5	16%
CRDMC 1B-B	1	10H1 → 10J1	124.0	131.9	6%	N/A	NRqd
CRDMC 1D-B	1	CRDD1 → CRDD2	124.0	177.1	43%	N/A	NRqd
CRDMC 2B-B	2	2.10H1 → 2.10J1	124.0	N/A	NRqd	175.6	Broken
CRDMC 2D-B	2	2.CRDD1 → 2.CRDD2	124.0	N/A	NRqd	179.1	Broken
CSP RC 1B-B	1	68F9 → 68F11	28.0	31.3	NRqd	52.8	89%
CSP RC 2B-B	2	CSPRC9 → CSPRC11	28.0	39.1	40%	45.8	NRqd
CSS Hx 1B-B	1	13.1 → 28.1	5,200.0	0.0	NRqd	7,046.3	36%
CSS Hx 2B-B	2	CS2B01 → CS2B03	5,200.0	5,365.4	3.18%	0.0	NRqd
EBR RC B-B	0	57B.1 → 57C.1	300.0	357.3	19%	341.7	14%
EDG 1B1-B	0	DG1BB.4 → DG1BB.6	650.0	776.0	19%	792.7	22%
EDG 1B2-B	0	DG1BB.2 → DG1BB.5	650.0	795.3	22%	812.0	25%
EDG 2B1-B	0	DG2BB.4 → DG2BB.6	650.0	791.6	22%	806.8	24%
EDG 2B2-B	0	DG2BB.2 → DG2BB.5	650.0	792.6	22%	838.8	29%
EGTS RC B-B	0	EGT2BDIS.4 → EGT2BDIS.5	10.0	13.6	36%	16.0	60%
LCC 1B-B	1	10D1 → 10E1	306.0	302.4	-1%	N/A	NRqd
LCC 1D-B	1	LCVCD1 → LCVCD2	306.0	311.9	2%	N/A	NRqd

Table A17.2: High Core Decay Heat Load / Three ERCW pumps / CCS HX Adjusted

Component	Unit	Link	Req'd	U1 HSm / U2 LOCA LoTB Case 1400	Case 1400 Margin	U1 LOCA / U2 HSm LoTB Case 1600	Case 160 Margin
692' RC 1A-A	1	66D2 → 66G2	12.0	20.9	74%	17.4	45%
692' RC 2A-A	1 & 2	66D.4 → 66G.4	12.0	12.7	6%	17.2	43%
713' RC 1A-A	1	67E2 → 67G2	11.0	18.2	65%	16.1	46%
713' RC 2A-A	1 & 2	67E4 → 67G6	11.0	12.9	17%	18.2	65%
737' RC 1A-A	1	67S2 → 67G2	12.0	27.0	125%	23.1	93%
737' RC 2A-A	1 & 2	67S4 → 67G6	10.0	11.5	15%	13.6	36%
ACAS AfterC A	0	54R1 → 54Q1	1.5	1.9	27%	1.8	20%
ACAS Cylind A	0	54R → 54Q	2.0	2.6	30%	2.3	15%
BATP/AFWP RC A-A	0	54O2 → 54P.2	60.0	64.8	8%	80.1	34%
CCP RC 1A-A	1	58D1 → 58D.2	25.0	33.7	35%	33.1	32%
CCP RC 2A-A	2	58E.2 → 58F2	25.0	29.9	20%	34.9	40%
CCS Hx A-A (146)	1	103D → 19	7100 HSm 4000 LOCA	8,038.1	13%	5,709.0	43%
CCS Hx A-A (143)	1	103 → 103B		0.0		0.0	
CCS Hx B-A (146)	2	106 → 107	7100 HSm 4000 LOCA	3,982.8	12%	4,357.8	8%
CCS Hx B-A (143)	2	106A → 106B		500.0		3,290.7	
CCS/AFWP RC A-A	0	56T5 → 55F	102.0	142.6	40%	138.5	36%
CRDMC 1A-A	1	50H → 50J	124.0	159.1	28%	N/A	NRqd
CRDMC 1C-A	1	CRDC1 → CRDC2	124.0	133.8	8%	N/A	NRqd
CRDMC 2A-A	2	2.50H → 2.50J	124.0	N/A	NRqd	169.2	Broken
CRDMC 2C-A	2	2.CRDC1→ 2.CRDC2	124.0	N/A	NRqd	147.1	Broken
CSP RC 1A-A	1	65M2 → 65N2	28.0	35.5	NRqd	39.6	41%
CSP RC 2A-A	2	65M.6 → 65N4	28.0	36.3	30%	34.9	NRqd
CSS Hx 1A-A	1	53 → 53A	5,200.0	0.0	NRqd	6,237.6	20%
CSS Hx 2A-A	2	53.2 → CS2A01	5,200.0	5,476.2	5%	0.0	NRqd
EBR RC A-A	0	57B → 55H	300.0	363.2	21%	341.4	14%
EDG 1A1-A	0	48E1 → 48F	650.0	887.9	37%	828.0	27%
EDG 1A2-A	0	48B1 → 48F1	650.0	884.1	36%	837.0	29%
EDG 2A1-A	0	48C1 → 48P	650.0	832.9	28%	792.5	22%
EDG 2A2-A	0	48M → 48C3	650.0	847.0	30%	805.4	24%
EGTS RC A-A	0	54X2 → 54Y2	10.0	18.5	85%	21.2	112%
LCC 1A-A	1	50D → 50E	306.0	338.9	11%	N/A	NRqd
LCC 1C-A	1	LCVCC1 → LCVCC2	306.0	325.2	6%	N/A	NRqd

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Table A17.2: High Core Decay Heat Load / Three ERCW pumps / CCS HX Adjusted

Component	Unit	Link	Req'd	U1 HSm / U2 LOCA LoTA Case 1300	Case 1300 Margin	U1 LOCA / U2 HSm LoTA Case 1500	Case 1500 Margin
LCC 2B-B	2	2.10D1 → 2.10E1	306.0	N/A	NRqd	356.2	→ 16%
LCC 2D-B	2	2.LCVCD1 → 2.LCVCD2	306.0	N/A	NRqd	364.8	→ 19%
MCR RC B-B	0	15.8 → 15.10	240.0	338.5	↑ 41%	329.2	↑ 37%
PC RC 1B-B	1	PCC1B.7 → PCC1B.9	15.0	33.1	↑ 121%	32.0	↑ 113%
PC RC 2B-B	2	2B124 → 2B125	15.0	16.6	→ 11%	19.4	↗ 29%
RBIR RC1B-B	1	IR1B.10 → 11.1C	30.0	34.4	→ 15%	42.2	↑ 41%
RBIR RC 2B-B	2	IRWC2B04 → 11C (IRWC2B02 → IRWC2B03)	30.0	109.0	Broken	107.6	Broken
RCP MAC 1-2-B	1	10V1 → 10S1 (10I1 → 10Z1)	110.0	680.8	Broken	N/A	NRqd
RCP MAC 1-4-B	1	RCP4.8 → LCVCDDIS1 (RCP4.1 → RCP4.2)	110.0	489.0	Broken	N/A	NRqd
RCP MAC 2-2-B	2	2.10V1 → 2.10S1 (2.10I1 → 2.10Z1)	110.0	N/A	NRqd	101.3	NRqd
RCP MAC 2-4-B	2	2.RCP4.8 → 2.LCVCDDIS1 (2.RCP4.1 → 2.RCP4.2)	110.0	N/A	NRqd	104.8	NRqd
RCP RC 1C-B	1	RCP1C.13 → 68D8	12.0	13.3	NRqd	12.9	↘ 8%
RHRP RC 1B-B	1	68G16 → 68G17	19.0	33.1	↑ 74%	31.5	↑ 66%
RHRP RC 2B-B	2	RHRPRC9 → RHRPRC9.1	19.0	20.5	↘ 8%	26.5	↑ 39%
SDBR RC B-B	0	SDBRB2 → 27	560.0	623.9	→ 11%	728.5	↑ 30%
SFPP/TBBP RC B-B	0	SFPTBB7 → SFPTBB9	29.0	34.9	↗ 20%	33.4	→ 15%
SIP RC 1B-B	1	SIS1B.9 → 68E10	22.0	24.6	NRqd	42.4	↑ 93%
SIP RC 2B-B	2	SISPRC8 → SISPRC9	22.0	27.7	↗ 26%	22.5	NRqd
Strainer 1B-B	0	4BO → 4BO1	450.0	450.0	↘ 0%	450.0	↘ 0%
Strainer 2B-B	0	4AO → 4AO1	450.0	450.0	↘ 0%	450.0	↑ 0%
UCC 1B-B	1	12O1 → 12L1 (12E1 → 12F1)	23.0	50.3	Broken	0.0	NRqd
UCC 1D-B	1	UCVC1D.10 → 12Y1 (UCVC1D.3 → UCVC1D.4)	23.0	49.0	Broken	0.0	NRqd
UCC 2B-B	2	2.12O1 → 2.12L1 (2.12E1 → 2.12F1)	23.0	0.0	NRqd	59.0	Broken
UCC 2D-B	2	2.UCVC1D.10 → 2.12Y1 (2.UCVC1D.3 → 2.UCVC1D.4)	23.0	0.0	NRqd	53.5	Broken
Broke 1-1054B-B		10A1 → 10B1	N/A	N/A	N/A	N/A	N/A
Broke 1-1054D-B		10A1 → 10B2	N/A	N/A	N/A	N/A	N/A
Broke 2-1054B-B		2.10A1 → 2.10B1	N/A	N/A	N/A	N/A	N/A
Broke 2-1054D-B		2.10A1 → 2.10B2	N/A	N/A	N/A	N/A	N/A
Scrn Wsh P 2B-B	0	BP30 → BP32	10.0	10.7	↘ 7%	10.0	↘ 0%
Scrn Wsh P 1B-B	0	BP30 → BP34	10.0	10.4	↘ 4%	9.8	↓ -2%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	0.0	N/A	0.0	N/A

Table A17.2: High Core Decay Heat Load / Three ERCW pumps / CCS HX Adjusted

Component	Unit	Link	Req'd	U1 HSm / U2 LOCA LoTB Case 1400	Case 1400 Margin	U1 LOCA / U2 HSm LoTB Case 1600	Case 160(Margin
LCC 2A-A	2	2.50D → 2.50E	306.0	N/A	NRqd	344.7	→ 13%
LCC 2C-A	2	2.LCVCC1 → 2.LCVCC2	306.0	N/A	NRqd	338.0	→ 10%
MCR RC A-A	0	55C → 55D	240.0	448.8	↑ 87%	281.1	→ 17%
PC RC 1A-A	1	67M2 → 67N2	15.0	24.6	↑ 64%	21.4	↑ 43%
PC RC 2A-A	2	67M.6 → 67M.8	15.0	18.4	↗ 23%	21.5	↑ 43%
RBIR RC 1A-A	1	51.1E → 51.1C	30.0	42.2	↑ 41%	40.1	↑ 34%
RBIR RC 2A-A	2	IRWC2A04 → IRWC2A05 (IRWC2A02 → IRWC2A03)	30.0	104.9	Broken	119.9	Broken
RCP MAC 1-1-A	1	50V → 50S (50I → 50Z)	110.0	561.8	Broken	0.0	NRqd
RCP MAC 1-3-A	1	RCP3.8 → LCVCDIS1 (RCP3.1 → RCP3.2)	110.0	508.2	Broken	N/A	NRqd
RCP MAC 2-1-A	2	2.50V → 2.50S (2.50I → 2.50Z)	110.0	N/A	NRqd	135.3	NRqd
RCP MAC 2-3-A	2	2.RCP3.8 → 2.LCVCCDIS1 (2.RCP3.1 → 2.RCP3.2)	110.0	N/A	NRqd	126.3	NRqd
RCP RC Dummy		NA	N/A	N/A	N/A	N/A	N/A
RHRP RC 1A-A	1	65S6 → 65S8	19.0	27.9	↑ 47%	24.6	↗ 29%
RHRP RC 2A-A	2	65S12 → 65S14	19.0	20.3	↘ 7%	25.6	↑ 35%
SDBR RC A-A	0	55A3 → 55E	560.0	732.3	↑ 31%	680.9	↗ 22%
SFPP/TBBP RC A-A	0	54J → 54K1	29.0	41.4	↑ 43%	38.5	↑ 33%
SIP RC 1A-A	1	65F2 → 65G2	22.0	27.9	NRqd	30.9	↑ 40%
SIP RC 2A-A	2	65F6 → 65G8	22.0	25.8	→ 17%	27.7	NRqd
Strainer 1A-A	0	44AO → 44AO1	450.0	450.0	↘ 0%	450.0	↘ 0%
Strainer 2A-A	0	44BO → 44BO2	450.0	450.0	↘ 0%	450.0	↘ 0%
UCC 1A-A	1	52O → 52L (52E → 52F)	23.0	59.4	Broken	0.0	NRqd
UCC 1C-A	1	UCVC1C.10 → 52Y (UCVC1C.3 → UCVC1C.4)	23.0	101.0	Broken	0.0	NRqd
UCC 2A-A	2	2.52O → 2.52L (2.52E → 2.52F)	23.0	0.0	NRqd	64.5	Broken
UCC 2C-A	2	2.UCVC1C.10 → 2.52Y (2.UCVC1C.3 → 2.UCVC1C.4)	23.0	0.0	NRqd	85.9	Broken
Broke 2-1054A-A		2.50A → 2.50B3	N/A	N/A	N/A	N/A	N/A
Broke 2-1054C-A		2.50A → 2.50B5	N/A	N/A	N/A	N/A	N/A
Broke 1-1054A-A		50A → 50B3	N/A	N/A	N/A	N/A	N/A
Broke 1-1054C-A		50A → 50B5	N/A	N/A	N/A	N/A	N/A
Scrn Wsh P 1A-A	0	AP25 → AP27	10.0	13.5	↑ 35%	13.6	↑ 36%
Scrn Wsh P 2A-A	0	AP25 → AP29	10.0	9.8	↓ -2%	9.8	↓ -2%
SAC AfterC A	0	SACA.1 → SACA.3	54.0	0.0	N/A	0.0	N/A

This Page Replaced by Revision 019.

Table A17.2: High Core Decay Heat Load / Three ERCW pumps / CCS HX Adjusted

Component	Unit	Link	Req'd	U1 HSm / U2 LOCA LoTA Case 1300	Case 1300 Margin	U1 LOCA / U2 HSm LoTA Case 1500	Case 1500 Margin
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	0.0	N/A	0.0	N/A
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	0.0	N/A	0.0	N/A
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	134.5	⬆ 40%	128.7	⬆ 34%
SAC B Header		68M1 → 68M2	N/A	134.5	N/A	128.7	N/A
SPLY CNTMT COOLERS		2.10B1.1 → 2.10B1.2	N/A	N/A	N/A	633.1	N/A
SPLY CNTMT COOLERS		2.LCVCDSUP1 → 2.LCVCDSUP2	N/A	N/A	N/A	648.7	N/A
SPLY CNTMT COOLERS		10B1.1 → 10B1.2	N/A	1,115.1	N/A	N/A	N/A
SPLY CNTMT COOLERS		LCVCDSUP1 → LCVCDSUP2	N/A	977.9	N/A	N/A	N/A

Table A17.2: High Core Decay Heat Load / Three ERCW pumps / CCS HX Adjusted

Component	Unit	Link	Req'd	U1 HSm / U2 LOCA LoTB Case 1400	Case 1400 Margin	U1 LOCA / U2 HSm LoTB Case 1600	Case 1600 Margin
SAC Cylind A	0	SACA.2 → SACA.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC B	0	SACB.1 → SACB.22	54.0	0.0	N/A	0.0	N/A
SAC Cylind B	0	SACB.2 → SACB.4	N/A	N/A	N/A	N/A	N/A
SAC AfterC C	0	SACC.1 → SACC.22	54.0	0.0	N/A	0.0	N/A
SAC Cylind C	0	SACC.2 → SACC.4	N/A	N/A	N/A	N/A	N/A
SAC D	0	SACD.2 → SACC.24	96.3	133.7	⬆ 39%	126.1	⬆ 31%
SAC A Header		59 → 59A	N/A	133.7	N/A	126.1	N/A
SPLY CNTMT COOLERS		2.LCVCCSUP1 → 2.LCVCCSUP2	N/A	N/A	N/A	611.4	N/A
SPLY CNTMT COOLERS		2.50B1 → 2.50B2	N/A	N/A	N/A	649.2	N/A
SPLY CNTMT COOLERS		50B1 → 50B2	N/A	1,059.7	N/A	N/A	N/A
SPLY CNTMT COOLERS		LCVCCSUP1 → LCVCCSUP2	N/A	967.2	N/A	N/A	N/A

⬆ Greater than 30% flow margin
⬀ Between 20% and 30% flow margin
⇨ Between 10% and 20% flow margin
⬂ Between 0% and 10% flow margin
⬇ Less than 0% flow margin

Notes:
1. Cases 1300, 1400, 1500, 1600 consider loss of downstream dam and broken coolers.
2. All cases consider 93% pumps.

ENCLOSURE 2

Attachment 5

CCS Flow Model Mode 4 - RHR Cooling

Table A11.3: 90% Pumps / Train 1/2B							
Component	Train	Link	Req'd	Case 8C - Unit 1 HSm/Unit 2 LOCA, C-S, 2B-B, Train B Flow (gpm)	Case 8C - Train B, C-S, 2B-B, Margin	Case 8D - Unit 1 HSm/Unit 2 LOCA, 1B-B, 2B-B, Train B Flow (gpm)	Case 8D - Train B, 1B-B, 2B-B, Margin
Cent Chr Pump 1B-B	B	189 → 190	28.0	36.2	29%	35.6	27%
CCP 1B-B Lube Cooler	B	271B → 269	20.0	23.8	19%	23.6	18%
CCP 1B-B Gear Cooler	B	272 → 273	8.0	12.4	55%	12.0	50%
Cent Chr Pump 2B-B	B	U2189 → U2190	28.0	35.0	25%	34.5	23%
CCP 2B-B Lube Cooler	B	U2271B → U2269	20.0	24.1	21%	23.9	20%
CCP 2B-B Gear Cooler	B	U2272 → U2273	8.0	10.9	36%	10.6	33%
CS Pump Oil HX 1B-B	B	203 → 204	2.0	7.3	265%	7.0	250%
CS Pump Oil HX 2B-B	B	U2203 → U2204	2.0	7.4	270%	7.2	260%
Radiation Monitor 0-RE-90-123	B	180C → 180D 210B → 210A	6.0	6.0	0%	6.0	0%
RHR HX 1B-B	B	206 → 207	5,000.0	5361.4	7%	5333.4	7%
RHR HX 2B-B	B	U2206 → U2207	5,000.0	5680.1	14%	5653.2	13%
RHR Pmp Seal Water 1B-B	B	199 → 200	10.0	14.5	45%	14.4	44%
RHR Pmp Seal Water 2B-B	B	U2199 → U2200	10.0	13.8	38%	13.6	36%
SI Pump 1B-B	B	194 → 195	15.0	21.8	45%	21.0	40%
SI Pump 2B-B	B	U2194 → U2195	15.0	20.1	34%	19.4	29%

This page added by revision 009.

ENCLOSURE 2

Attachment 6

CCS Heat Exchanger Data Sheet

HEAT EXCHANGER DATA SHEET

SERVICE COMP. COOLER HX IDENT. ______ JOB T.V.A.

TYPE AEL SQ. FT. PER SHELL 37,700 SHELLS, IN SERIES/PARAL. One

SIZE 68-720 SQ. FT. PER UNIT 37,700 TEMA CLASS R

PERFORMANCE OF UNIT

OPERATION MODE	DESIGN COND. F		CONDITION-BASIC		CONDITION A	
HEAT EXCHANGED, BTU/HR	96.7 x 10^6 (Reqd.)		64.3 x 10^6 (Reqd.)		89.8 x 10^6 (Reqd.)	
(FACTOR) Δ T	12.5(1.0)(1.0)=12.5		(11.7)(1.0)(1.0) = 11.7		(11.8)(1.0)(1.0)=11.	
OVERALL COEF., CLEAN/SERVICE	207/491		206/487		221/581	
BTU x HR^{-1} x °F^{-1} x FT^{-2}	SHELL SIDE	TUBE SIDE	SHELL SIDE	TUBE SIDE	SHELL SIDE	TUBE SIDE
FLUID ENTERING	WATER	WATER	WATER	WATER	WATER	WATER
TOTAL FLUID, LB/HR	4,500,000	6,000,000	4,500,000	6,000,000	6,000,000	8,000,000
LIQUID, LB/HR	4,500,000	6,000,000	4,500,000	6,000,000	6,000,000	8,000,000
VAPOR, LB/HR						
NON-COND'S, LB/HR						
VAPOR'D OR CONDENSED						
TEMP, IN/OUT °F	116.5/95	85/101.1	109.3/95	85/95.7	110/95	85/96.2
SPECIFIC GRAVITY						
VISCOSITY (LIQUID), CP						
CONDUCTIVITY (LIQUID)	.3647	.3615	.3638	.3608	.3639	.3609
PASSES	1	1	1	1	1	1
VELOCITY, FT/SEC	2.21	3.62	2.21	3.62	2.95	4.83
PRESSURE AT INLET, PSI						
PRESSURE DROP, PSI	11.4	3.8	11.4	3.8	19.7	6.4
FOULING RESISTANCE	.0005	.002	.0005	.002	.0005	.002

CONSTRUCTION OF ONE SHELL

		SHELL SIDE	TUBE SIDE
PRESS., PSI — DESIGN/TEST		150/225	200/300
DESIGN TEMP °F		200	200
ASME CODE CLASS		SEC. III, Cl. 3	SEC. III, Cl. 3
CONNECTIONS (SIZE & FACING)	IN	24" x 150# WNRF	24" x 150# WNRF
	OUT	24" x 150# WNRF	24" x 150# WNRF
	OTHER	1" threaded cplg. vent & drain	1" threaded cplg. vent & drain
GASKET & JOINT STYLE		----	1/8" comp. asb.
CORR. ALLOWANCE		.125"	.125" on C.S.

TUBE TO T.S. JOINT Roller expanded IMPINGEMENT PLATE Yes

TUBES NO. 3200 O.D. .75 GUAGE 18 BWG LENGTH 60'

SHELL I.D. 68.0" O.D. 69.0" TUBE PITCH .9375" △ ☐

BAFFLES CROSS TYPE 11 SPACING 60.0" ; LONG TYPE NIL

WEIGHT - LBS. EMPTY 145,000 FULL 246,000 BUNDLE ______

PART	MATERIAL	THK.-IN.	PART	MATERIAL	THK.-IN.
TUBES	AL-6X SB-676 * (initials) 9-12-91	.049	T.S. - FIXED	SA516-70	3.0"
SHELL	SA516-70	.5	T.S. - FLOATING	--	--
SHELL COVER	--		CROSS BAFFLE	C.S.	.5
CHANNEL	SA516-70	.625	LONG BAFFLE	--	--
CHANNEL COVER	SA516-70	4.5	OTHER		

REMARKS (I) There are no tubes in windows
(II) Condition F governs the design

	NO	ISSUE	DATE	ENG	APP'D
JOSEPH OAT CORP. 2500 BROADWAY CAMDEN, N. J. 08104 — EST 1788 — * PER DCA'S: P00634-01-0 P00635-01-0	~~1~~	~~CLAY CERT~~	~~11/~~		

EAT EXHANGER DATA SHEET

SERVICE COMPONENT COOLER IDENT. ______ JOB ---
TYPE ______ SQ. FT. PER SHELL ______ SHELLS, IN SERIES/PARAL. ______
SIZE ______ SQ. FT. PER UNIT ______ TEMA CLASS ______

PERFORMANCE OF UNIT

OPERATION MODE	CONDITION B		CONDITION C		CONDITION D	
EXCHANGED, BTU/HR	52.9 x 10^6 (Reqd.)		147.6 x 10^6 (Reqd.)		59.9 x 10^6 (Reqd.)	
(FACTOR) Δ T	(11.4)(1.0)(1.0)=11.4		(28.9)(1.0)(1.0)=28.9		(11.6)(1.0)(1.0) 11.6	
OVERALL COEF., CLEAN/SERVICE	206/486		209/505		206/487	
BTU x HR^{-1} x $°F^{-1}$ x FT^{-2}	SHELL SIDE	TUBE SIDE	SHELL SIDE	TUBE SIDE	SHELL SIDE	TUBE SIDE
FLUID ENTERING	WATER	WATER	WATER	WATER	WATER	WATER
TOTAL FLUID, LB/HR	4,500,000	6,000,000	4,500,000	6,000,000	4,500,000	6,000,000
LIQUID, LB/HR	4,500,000	6,000,000	4,500,000	6,000,000	4,500,000	6,000,000
VAPOR, LB/HR						
NON-COND'S, LB/HR						
VAPOR'D OR CONDENSED						
TEMP, IN/OUT °F	106.8/95	85/93.8	142.9/110	85/109.6	108.3/95	85/95
SPECIFIC GRAVITY						
VISCOSITY (LIQUID), CP						
CONDUCTIVITY (LIQUID)						
PASSES	1	1	1	1	1	1
VELOCITY, FT/SEC	2.20	3.62	2.22	3.63	2.20	3.62
PRESSURE AT INLET, PSI						
PRESSURE DROP, PSI	11.4	3.80	11.2	3.7	11.4	3.80
FOULING RESISTANCE	.0005	.002	.0005	.002	.0005	.002

CONSTRUCTION OF ONE SHELL

		SHELL SIDE	TUBE SIDE
P__S., PSI — DESIGN/TEST			
DESIGN TEMP °F			
ASME CODE CLASS			
CONNECTIONS (SIZE & FACING)	IN		
	OUT		
	OTHER		
GASKET & JOINT STYLE			
CORR. ALLOWANCE			

TUBE TO T.S. JOINT ______ IMPINGEMENT PLATE ______
TUBES NO. ______ O. D. ______ GUAGE ______ LENGTH ______
SHELL I. D. ______ O. D. ______ TUBE PITCH ______ △ ☐
BAFFLES CROSS TYPE ______ SPACING ______ ; LONG TYPE ______
WEIGHT - LBS. EMPTY ______ FULL ______ BUNDLE ______

PART	MATERIAL	THK.-IN.	PART	MATERIAL	THK.-IN.
TUBES			T. S. - FIXED		
SHELL			T. S. - FLOATING		
SHELL COVER			CROSS BAFFLE		
CHANNEL			LONG BAFFLE		
CHANNEL COVER			OTHER		

REMARKS ______

JOSEPH OAT CORP.
2500 BROADWAY
CAMDEN, N. J. 08104
EST 1788

NO	ISSUE	DATE	ENG	APP'D

IEAT EXHANGER DATA SHEET

SERVICE ________ IDENT. ________ JOB ________

TYPE ________ SQ. FT. PER SHELL ________ SHELLS, IN SERIES/PARAL. ________

SIZE ________ SQ. FT. PER UNIT ________ TEMA CLASS ________

PERFORMANCE OF UNIT

OPERATION MODE	CONDITION E		CONDITION G			
[illegible] EXCHANGED, BTU/HR	37.9 x 10^6 (Reqd.)		69.9 x 10^6 (Reqd.)			
L[illegible] (FACTOR) Δ T	(9.5)(1.0)(1.0)=9.5		(12.7)(1.0)(1.0)=12.7			
OVERALL COEF., CLEAN/SERVICE	191/410		185/382			
BTU x HR^{-1} x $°F^{-1}$ x FT^{-2}	SHELL SIDE	TUBE SIDE	SHELL SIDE	TUBE SIDE	SHELL SIDE	TUBE SIDE
FLUID ENTERING	WATER	WATER	WATER	WATER		
TOTAL FLUID, LB/HR	4,500,000	4,000,000	3,000,000	4,000,000		
LIQUID, LB/HR	4,500,000	4,000,000	3,000,000	4,000,000		
VAPOR, LB/HR						
NON-COND'S, LB/HR						
VAPOR'D OR CONDENSED						
TEMP, IN/OUT °F	103.4/95	85/94.5	118.3/95	85/102.5		
SPECIFIC GRAVITY						
VISCOSITY (LIQUID), CP						
CONDUCTIVITY (LIQUID)						
PASSES	1	1	1	1		
VELOCITY, FT/SEC	2.20	2.41	1.46	2.42		
PRESSURE AT INLET, PSI						
PRESSURE DROP, PSI	11.40	1.80	5.2	1.8		
FOULING RESISTANCE	.0005	.002	.0005	.002		

CONSTRUCTION OF ONE SHELL

		SHELL SIDE	TUBE SIDE
P[illegible]., PSI — DESIGN/TEST			
DE[illegible]GN TEMP °F			
ASME CODE CLASS			
CONNECTIONS (SIZE & FACING)	IN		
	OUT		
	OTHER		
GASKET & JOINT STYLE			
CORR. ALLOWANCE			

TUBE TO T.S. JOINT ________ IMPINGEMENT PLATE ________

TUBES NO. ________ O. D. ________ GUAGE ________ LENGTH ________

SHELL I. D. ________ O. D. ________ TUBE PITCH ________ △ ▢

BAFFLES CROSS TYPE ________ SPACING ________ ; LONG TYPE ________

WEIGHT - LBS. EMPTY ________ FULL ________ BUNDLE ________

PART	MATERIAL	THK.-IN.	PART	MATERIAL	THK.-IN.
TUBES			T. S. - FIXED		
SHELL			T. S. - FLOATING		
SHELL COVER			CROSS BAFFLE		
CHANNEL			LONG BAFFLE		
CHANNEL COVER			OTHER		

REMARKS — — — — — — — — — — — — — —

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